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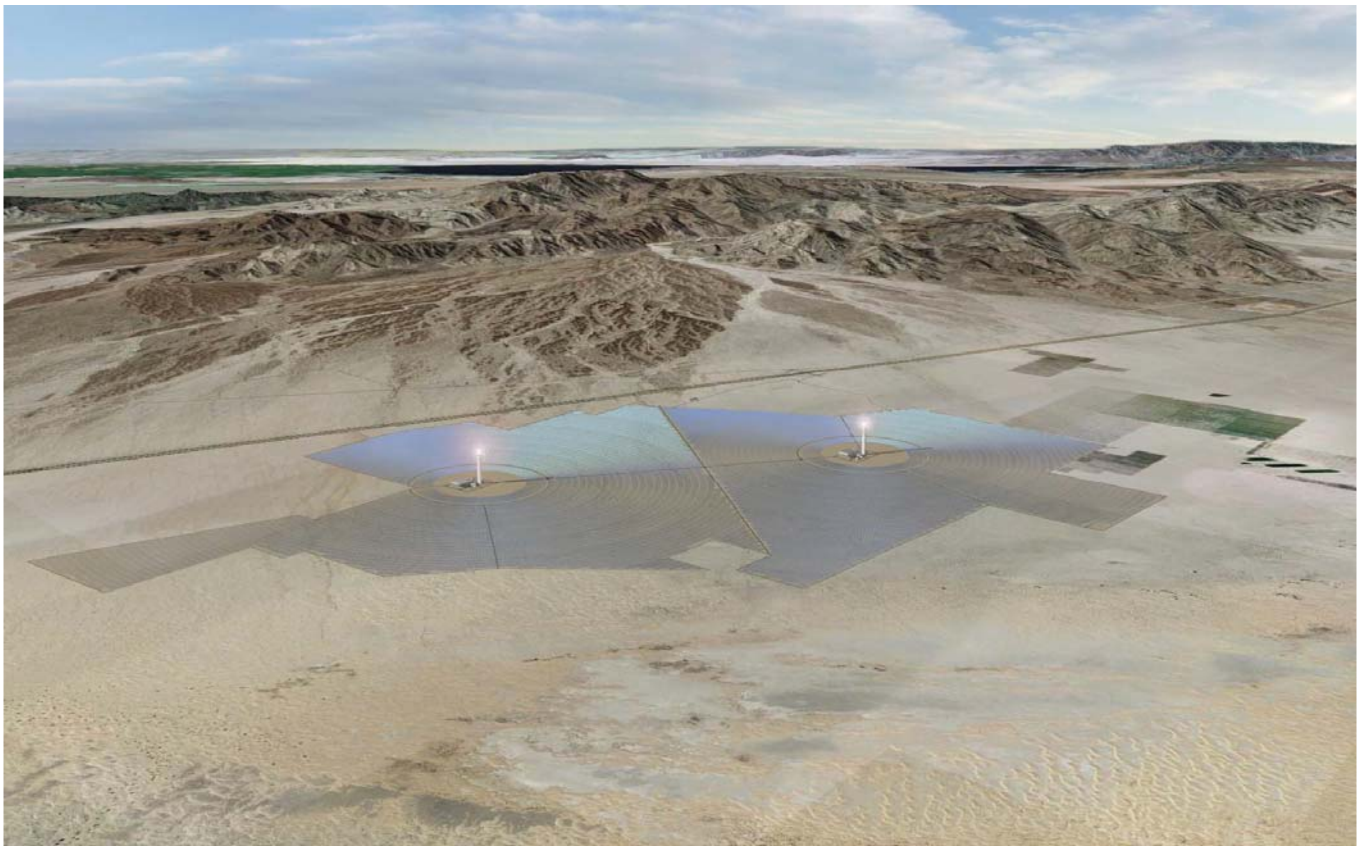
PALEN SOLAR ELECTRIC GENERATING SYSTEM

Final Staff Assessment for the Palen Solar Electric Generating System, Part A

Amendment to the Palen Solar Power Project



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PALEN SOLAR ELECTRIC GENERATING SYSTEM (09-AFC-7C)
FINAL STAFF ASSESSMENT – Part A

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INTRODUCTION

This Final Staff Assessment (FSA) Part A is being published by California Energy Commission (Energy Commission) staff for the proposed amendment to the Palen Solar Power Project (PSPP). The modified project, owned by Palen Solar Holdings, LLC (PSH), is now called Palen Solar Electric Generating System (PSEGS) and proposes to change the solar thermal power-generating technology of the approved project from parabolic trough technology to solar power tower technology.

This FSA Part A contains staff's independent, objective evaluation of PSH's Petition to Amend (09-AFC-7C) for all technical areas except cultural resources which will be provided in Part B, and air quality which will be provided in Part C after the South Coast Air Quality Management District completes its Preliminary Determination of Compliance (PDOC) with its rules and regulations. The staff analyses in the FSA are similar to those normally contained in an Environmental Impact Report (EIR) required by the California Environmental Quality Act (CEQA) except they also include an engineering assessment.

For an amendment for an existing power plant over which it has regulatory oversight, the Energy Commission is the lead state agency under CEQA. The Energy Commission's certified regulatory program provides the environmental analysis that satisfies CEQA requirements. In fulfilling this responsibility, Energy Commission staff provides an independent assessment of the amendment's engineering design, evaluates its potential effects on the environment and on public health and safety, and determines whether the project, if modified, would remain in conformance with all applicable local, state, and federal laws, ordinances, regulations and standards (LORS). Energy Commission staff also recommends any needed modifications to existing mitigation measures (known as conditions of certification) in the Energy Commission Final Decision and proposes additional conditions of certification to mitigate any significant adverse environmental effects of the proposed modifications.

For the ease of the reader, this FSA provides a description of the environmental setting of the entire project. However, because this is an amendment to an existing Energy Commission license, staff's analysis focuses on the technology change proposed for the PSEGS in the Petition to Amend. These specific changes are explained in detail in the **PROJECT DESCRIPTION** section. A summary of the PSEGS project is provided below.

This FSA is not the decision document for these proceedings, nor does it contain findings of the Energy Commission related to environmental impacts or the project's compliance with local, state, and federal LORS. This document will serve as staff's testimony in evidentiary hearings to be held by the assigned Committee. In the evidentiary hearings, the Committee will consider the testimony presented by staff, the applicant, and intervenors, and will also consider the comments and recommendations of governmental agencies, tribes, and the public prior to submitting its proposed decision (Presiding Member's Proposed Decision [PMPD]) to the full Commission.

Following a public hearing(s), the full Energy Commission will make a final decision on the proposed modifications.

PROPOSED PROJECT LOCATION AND DESCRIPTION

On December 17, 2012, the project owner filed a Petition to Amend with the Energy Commission requesting to modify the PSPP (http://www.energy.ca.gov/sitingcases/palen/compliance/). The PSPP, as licensed by the Energy Commission on December 15, 2010, is a 500-megawatt (MW) solar thermal power-generating facility utilizing parabolic trough technology. The project site is approximately 3,794 acres in size and is located approximately 0.25 mile north of Interstate 10, approximately 10 miles east of Desert Center and approximately halfway between the cities of Indio and Blythe, in Riverside County, California.

The modifications proposed in the 2012 Petition to Amend include replacing the parabolic trough solar collection system and associated heat transfer fluid with BrightSource's solar tower technology. Heliostats—elevated mirrors guided by a tracking system mounted on a pylon—focus the sun's rays on a solar receiver steam generator (SRSG) located atop a 750-foot tower near the center of each solar field to create steam to drive a turbine that generates electricity.

The modified project, the PSEGS, would be comprised of two adjacent solar fields and associated facilities with a total combined nominal output of approximately 500 MW. The project owner proposes to develop PSEGS in two operational phases. Each phase would consist of one solar field and power block with approximately 250 MW of generation capacity. Each solar field would have an array of approximately 85,000 heliostats for a total of 170,000 heliostats for the project. Each phase would also share common facilities, including an administration building, warehouse, evaporation ponds, maintenance complex with a meter/valve station for incoming natural gas service to the site, an on-site switchyard, and a single-circuit 230-kV generation tie-line to deliver power to the electricity grid. Other on-site facilities would include access and maintenance roads (either dirt, gravel, or paved), perimeter fencing, tortoise fencing, and other ancillary security facilities.

The PSEGS amendment does not propose to change the generating capacity of the PSPP, or the site access, or the interconnection point at the Red Bluff Substation, although there would be a slight re-routing of the generation tie-line near the western end of the route and around the newly constructed Red Bluff Substation. A new natural gas pipeline is also proposed.

PURPOSE AND NEED FOR AN AMENDMENT

PSH acquired the PSPP site in order to develop BrightSource's proprietary solar thermal tower technology on the site. This change in technology could not have been anticipated during the original permitting process because, at the time of the original licensing, the project was owned by Solar Millennium and was to use parabolic trough technology. The Energy Commission approved the change in ownership for the PSPP project on July 11, 2012.

U.S. BUREAU OF LAND MANAGEMENT COORDINATION

The PSEGS is proposed to be located entirely on public land managed by the Bureau of Land Management (BLM). A Record of Decision (ROD) and Right of Way (ROW) grant from BLM, in addition to an Energy Commission license, would be required before the proposed project could commence construction. During the PSPP proceeding in 2009 and 2010, Energy Commission staff and BLM staff worked closely together on the review and analysis of the PSPP. The Energy Commission and BLM staff issued a joint Draft Environmental Impact Statement/Staff Assessment (DEIS/SA) for the PSPP on March 18, 2010. The DEIS/SA contained the Energy Commission staff's and BLM's environmental, public health, and engineering evaluation of the PSPP.

During the original licensing case, the Energy Commission and BLM determined that they would develop and publish separate final documents. On May 13, 2011, the BLM Published a Notice Of Availability (NOA) of the Final Environmental Impact Statement for the PSPP in the Federal Register. BLM never made a final decision on the PSPP; therefore, neither a ROD nor a ROW grant was issued.

On February 8, 2013, the BLM received a Revised Plan of Development for the PSEGS from PSH. The BLM issued the PSEGS Plan Amendment/Draft Supplemental Environmental Impact Statement on July 27, 2013. If the project is approved by the BLM, the BLM will issue a ROD and a ROW grant for the PSEGS.

Currently, the project owner is preparing a draft Reclamation & Decommissioning Plan for the project and will submit the plan to BLM prior to the release of the Final EIS. This document, in conjunction with the **General Conditions** provided in this FSA, will outline the requirements for facility closure of PSEGS.

Although the Energy Commission and BLM are not publishing a joint document for the PSEGS, the Energy Commission and the BLM continue to share staff expertise, information, and documentation in order to promote intergovernmental coordination at the state, and federal levels.

CUMULATIVE IMPACTS

See **EXECUTIVE SUMMARY ATTACHMENT A** at end of the section.

ENVIRONMENTAL JUSTICE

Environmental justice communities are commonly identified as those where residents are predominantly minorities or low-income; where residents have been excluded from the environmental policy setting or decision-making process; where they are subject to a disproportionate impact from one or more environmental hazards; and where residents experience disparate implementation of environmental regulations, requirements, practices, and activities in their communities. Environmental justice efforts attempt to address the inequities of environmental protection in these communities.

An environmental justice analysis is composed of three parts:

1. identification of areas potentially affected by various emissions or impacts from a proposed project;

2. a determination of whether there is a significant population of minority persons or persons below the poverty level living in an area potentially affected by the proposed project; and

3. a determination of whether there may be a significant adverse impact on a population of minority persons or persons below the poverty level caused by the proposed project alone, or in combination with other existing and/or planned projects in the area.

CALIFORNIA RESOURCES AGENCY

California law defines environmental justice as "the fair treatment of people of all races, cultures and income with respect to the development, adoption, implementation, and enforcement of environmental laws, regulations, and policies" (Gov. Code §65040.12; Pub. Resources Code, §72000). All departments, boards, commissions, conservancies and special programs of the Resources Agency must consider environmental justice in their decision-making process if their actions have an impact on the environment, environmental laws, or policies. Such actions that require environmental justice consideration may include:

- adopting regulations;
- enforcing environmental laws or regulations;
- making discretionary decisions or taking actions that affect the environment;
- providing funding for activities affecting the environment; and
- interacting with the public on environmental issues.

DEMOGRAPHIC SCREENING ANALYSIS

For all siting cases, Energy Commission staff uses a demographic screening tool (Socioeconomic Figure 1) as part of its CEQA analysis. Based on 2010 census block data, Socioeconomic Figure 1 shows the percentage of the minority population within the six-mile buffer of the project site. The Council on Environmental Quality's *Environmental Justice: Guidance Under the National Environmental Policy Act*, dated December, 1997, defines minority individuals as members of the following groups: American Indian or Alaskan Native; Asian or Pacific Islander; Black, not of Hispanic origin; or Hispanic.

The *Final Guidance for Incorporating Environmental Justice Concerns in USEPA's National Environmental Policy Act (NEPA) Compliance Analysis*, dated April, 1998, considers a minority population to be present when the minority population of the potentially affected area is greater than 50 percent or when the minority population percentage is meaningfully greater than the minority population in the general population or other appropriate unit of geographic analysis. That guide also provides staff with information on outreach and public involvement.

SUMMARY OF ENVIRONMENTAL CONSEQUENCES AND MITIGATION

Below is a summary of environmental consequences and mitigation proposed in this FSA. This section also provides a summary of outstanding information that will be analyzed in the FSA.

Executive Summary - Table 1
Environmental and Engineering Assessment

	PSPP Decision	PSPP Decision	PSEGS Amendment	PSEGS Amendment
Technical Area	**Complies with LORS**	**Impacts Mitigated**	**Complies with LORS**	**Impacts Mitigated**
Air Quality/Greenhouse gases	Yes	Yes	To be provided in Part C	To be provided in Part C
Biological Resources	Yes	Yes	Yes	**Uncertain**
Cultural Resources	Yes	**No**	To be provided in Part B	To be provided in Part B
Hazardous Materials	Yes	Yes	Yes	Yes
Land Use	**No**	**No**	Yes	Yes
Noise and Vibration	Yes	Yes	Yes	Yes
Public Health	Yes	Yes	Yes	Yes
Socioeconomics	Yes	N/A	Yes	Yes
Soil and Water Resources	Yes	Yes	Yes	Yes
Traffic & Transportation	Yes	Yes	Yes	Yes
Transmission Line Safety/Nuisance	Yes	Yes	Yes	Yes
Visual Resources	Yes	**No**	**No**	**No**
Waste Management	Yes	Yes	Yes	Yes
Worker Safety and Fire Protection	Yes	Yes	Yes	Yes
Facility Design	Yes	Yes	Yes	Yes
Geology & Paleontology	Yes	Yes	Yes	Yes
Power Plant Efficiency	N/A	N/A	N/A	N/A
Power Plant Reliability	N/A	N/A	N/A	N/A
Transmission System Engineering	Yes	Yes	Yes	Yes
Alternatives	N/A	N/A	N/A	N/A

AIR QUALITY/GREENHOUSE GASES

Air Quality/Greenhouse Gases will be provided in Part C of the FSA. Part C will be published 30 days after staff receives the PDOC.

BIOLOGICAL RESOURCES

Staff finds that the PSEGS would have significant impacts to biological resources, impacting all of the Sonoran creosote bush scrub, sand dunes, desert washes and other native plant and wildlife communities within the PSEGS boundaries as well as along the natural gas line corridor and the proposed and approved generation tie-line corridor. The PSEGS project as proposed would leave the majority of the vegetation within heliostat fields intact, while adding roads and other improvements only where necessary for project development and operation. The PSEGS would eliminate the engineered channels of the approved PSPP and most of the natural drainage features will be maintained and any grading required will be designed to promote sheet flow where possible. However, staff is assuming a total loss of the function and value of the vegetation and habitats within the project site because perimeter fencing will exclude most terrestrial animals, and ongoing disturbance, noise, and other anthropogenic activities at the site may continue to degrade habitat functions within the project footprint. Wildlife and plants that are tolerant to disturbance may continue to occupy the site, however, staff does not consider leaving the vegetation on site a benefit to these species due to the ongoing risk of injury or mortality from construction equipment or operational work including mowing, maintenance, and washing of the heliostats.

The solar tower technology creates a new impact, solar flux. Flux is concentrated over the heliostat field, starting at the mirror face and increasing in intensity as the reflected sunlight concentrates at the top of the tower. Exposure to elevated flux may cause injury or death to various bird and bat species. Additionally, the heliostats may reflect the sky, creating a water-like mirage effect in the heliostat field for each tower. It is possible for birds to be attracted to the project site by this effect, and collide with mirrors. Mirror collision was also identified as a project impact of the PSPP project. The evaporation ponds and adjacent date-palm and jojoba agricultural operations may attract insects, bats, and birds, increasing their risk from collision or exposure to elevated levels of solar flux.

Staff finds that impacts to the sand transport corridor (critical habitat for the Mojave fringe-toed lizards and several special-status plants) would increase over the approved alternative configurations in the PSPP decision. Direct and indirect impacts to the sand transport corridor would occur. In comparison with the approved PSPP Reconfigured Alternative #3, the project would increase direct impacts to the sand transport corridor by 370 acres, and would increase indirect impacts to the sand transport corridor by 316 acres. Staff believes that implementation of Condition of Certification **BIO-20** would mitigate onsite direct impacts, as well as offsite indirect impacts.

A summary of biological resource impacts and mitigation proposed by staff is provided in **Executive Summary – Table 2.**

Executive Summary - Table 2
Summary of Biological Resources Impacts and Mitigation

Biological Resource	Impact/Mitigation
Sonoran Creosote Bush Scrub & Associated Wildlife Habitat	**Direct Impacts:** Permanent loss of 3,335[a] acres; fragmentation of adjacent wildlife habitat and native plant communities. **Indirect Impacts:** Disturbance (noise, lights, dust) to surrounding plant and animal communities; spread of non-native invasive plants; changes in drainage patterns downslope of project; erosion and sedimentation of disturbed soils. **Cumulative Impacts:** Contributes to cumulatively considerable loss of habitat, fragmentation, and indirect effects from past, present, and foreseeable future projects in the California Desert region of the NECO planning area. **Mitigation:** Off-site habitat acquisition and enhancement (**BIO-12**); implement impact avoidance and minimization measures (**BIO-8)** and weed control plan (**BIO-14**). **Impact Significance:** Direct and Indirect Impacts are Less than Significant with Mitigation; Cumulative Impacts are Less than Significant with Mitigation.
Stabilized and Partially Stabilized Dunes	**Direct Impacts:** Permanent loss of 187 acres of stabilized and partially stabilized dune habitat; potential accidental direct impacts to adjacent preserved habitat during construction and operation. **Indirect Impacts:** Disruption of sand transport corridor resulting in downwind impacts to sand dune habitat; introduction and spread of non-native invasive plants; erosion and sedimentation of disturbed soils; fragmentation and degradation of remaining habitat. **Cumulative Impacts:** Contributes substantially~~100%~~ to cumulative impacts~~loss~~ from future projects within Chuckwalla Valley and NECO planning area. **Mitigation:** Implement **BIO-20,** Sand Dune Community Impact Mitigation. **Impact Significance:** Direct and Indirect Impacts are Less than Significant with Mitigation; Cumulative Impacts are Less than Significant with Mitigation.
Waters of the State/ Sensitive Plant Communities	**Direct Impacts:** Permanent loss biological functions and values of 375.3[a] acres of state waters, including: • 206.5 [a] acres desert dry wash woodland • 168.2 [a] acres of unvegetated ephemeral dry wash **Indirect Impacts:** Indirect impacts to approximately 0.55 acres of state waters. Impacts include colonization of invasive weeds and erosion/sedimentation to downstream areas. **Cumulative Impacts:** Contributes to cumulative loss of habitat from future projects within the Chuckwalla Valley and NECO planning area. Indirect effects cumulatively considerable. **Mitigation:** Acquisition and enhancement of 788 acres of ephemeral desert washes, implementation of avoidance and minimization measures to protect state waters (**BIO-21**); implement weed management plan (**BIO-14**). **Impact Significance:** Direct and Indirect Impacts are Less than Significant with Mitigation; Cumulative Impacts are Less than Significant with Mitigation.

Biological Resource	Impact/Mitigation
Groundwater-dependent Plant Communities	**Direct Impacts:** None. The effects of pumping may take several-to-many years to appear, depending on the degree of separation in the confining layers between the shallow aquifer (supporting plants) and deep aquifers (where pumping will occur); see below. **Indirect and Cumulative Impacts:** Potential for significant adverse effects to groundwater-dependent plant ecosystems (GDEs) near Palen Dry Lake, including loss of habitat function and value for wildlife, reduced plant cover which increases wind erosion and affects air quality, increase in weedy species, impacts to special-status species inhabiting the GDEs. Even minor individual impacts to GDEs are considered cumulatively considerable. **Mitigation:** Monitoring groundwater-dependent plant communities near the project site (**BIO-23**) and implementation of remedial action and compensatory mitigation if adverse effects are detected (**BIO-24**). **BIO-7** BRMIMP ensures enforcement of all conditions of certification. **Impact Significance:** Direct and Indirect Impacts are Less than Significant with Mitigation Cumulative Impacts are Less than Significant with Mitigation.
Desert Tortoise	**Direct Impacts:** Potential take of individuals during operation and construction; permanent loss of 3,948[a] acres (including 228[a] acres of critical habitat) of low to moderate quality desert tortoise habitat and fragmentation of surrounding habitat. **Indirect Impacts:** Increased risk of predation from ravens, coyotes, feral dogs; disturbance from increased noise and lighting; introduction and spread of weeds; increased road kill hazard. **Cumulative Impacts:** Contributes to cumulative loss of low to moderate value desert tortoise habitat from future projects in NECO, based on USGS habitat model (Nussear et al. 2009). Impedes movement in the region. Impacts to higher quality habitat values less than cumulatively considerable. **Mitigation:** Implement avoidance and minimization measures (**BIO-6** through **BIO-11**) and acquire 4,860 acres of desert tortoise habitat (**BIO-12**). **Impact Significance:** Direct and Indirect Impacts are Less than Significant with Mitigation; Cumulative Impacts are Less than Significant with Mitigation.

Biological Resource	Impact/Mitigation
Mojave Fringe-toed Lizard	**Direct Impacts:** Mortality to individuals during construction and permanent loss of 1,480 acres of Mojave fringe-toed lizard habitat; increased road kill hazard from construction traffic; potential accidental direct impacts to adjacent preserved habitat during construction and operation, increased risk of disturbance or mortality from vegetation management activities. **Indirect Impacts:** Disruption of sand transport (25%-100%); introduction and spread of non-native invasive plants; erosion and sedimentation of disturbed soils; fragmentation and degradation of remaining habitat; increased road kill hazard from construction and operations traffic; harm from accidental spraying/drift of herbicides and dust suppression chemicals. **Cumulative Impacts:** Contributes substantially to cumulative loss of Mojave fringe-toed lizard habitat in the Chuckwalla Valley. Project's contribution to fragmentation and indirect impacts cumulatively considerable. **Mitigation:** Implement **BIO-20,** Mojave fringe-toed lizard compensation, and **BIO-8,** impact avoidance and minimization measures; **BIO-14** weed management plan. **Impact Significance:** Direct and Indirect Impacts are Less than Significant with Mitigation; Cumulative Impacts are Less than Significant with Mitigation.
Western Burrowing Owl	**Direct Impacts:** Permanent loss of breeding and foraging habitat for at least two pairs of resident burrowing owls; potential loss of eggs and young **Indirect Impacts:** Degradation and fragmentation of remaining adjacent habitat from edge effects; disturbance of nesting and foraging activities for nesting pairs near the plant site and linear facilities. Collisions with project features, glare, also collision, electrocution, glare, and exposure to elevated levels of solar flux. Increased road kill hazard from operations traffic and collision with mirrors; increased predation from ravens; disturbance of nesting activities from operations. **Cumulative Impacts:** Contributes to cumulative loss of habitat from future projects in the Chuckwalla Valley and NECO planning area. Indirect impacts also cumulatively considerable. **Mitigation:** Implement burrowing owl impact avoidance and mitigation measures, including a minimum acquisition of 78 acres of burrowing owl habitat (**BIO 18**). If additional breeding owls are detected additional compensatory mitigation will be required. Additionally, implement impact avoidance and minimization measures (**BIO-1** through **BIO-8**); pre-construction nest surveys (**BIO-15**); avian enhancement and conservation plan (**BIO-16a**), and avian and bat protection plans (**BIO-16b**). **Impact Significance:** Direct Impacts are Less than Significant with Mitigation; Indirect Impacts May Remain Significant After Mitigation; Cumulative Impacts May Remain Significant After Mitigation

Biological Resource	Impact/Mitigation
Golden Eagle/Bald Eagle	**Direct Impacts**: Loss of foraging habitat, potential mortality or disturbance during construction and operation, loss or fragmentation of habitat, displacement, and disruption of movement. **Indirect Impacts**: Collision, glare, electrocution, and death or injury from exposure to concentrated solar flux. Fragmentation of local population; introduction and spread of non-native invasive plants; increased risk of fire; and degradation of off-site springs or seeps. Weed abatement, mirror washing and maintenance. Glare or heat associated with the heliostats may also adversely affect bird's use of the site. **Cumulative Impacts:** The modified project would contribute to cumulative loss of foraging habitat (Sonoran creosote scrub and desert dry wash woodland) within a 140-mile radius of the project, and also would contribute to cumulatively considerable loss of habitat, fragmentation, and direct loss of these species from past, present, and foreseeable future projects within 140-mile radius of the modified project. Fragmentation and indirect impacts also would be cumulatively considerable. Mitigation: Off-site habitat acquisition and enhancement (**BIO-12** and **BIO-21**); pre-construction nest surveys (**BIO-15**); avian enhancement and conservation plan (**BIO-16a**), and avian and bat protection plans (**BIO-16b**). **Impact Significance:** Direct Impacts are Less than Significant with Mitigation; Indirect Impacts May Remain Significant After Mitigation; Cumulative Impacts May Remain Significant After Mitigation.
Special-status Avian Species	**Direct Impacts:** Permanent loss of breeding and foraging habitat, Sonoran creosote bush scrub and desert dry wash woodland); potential loss of eggs and young; disturbance of nesting and foraging activities for populations on and near the plant site and linear facilities; degradation and fragmentation of remaining adjacent habitat from edge effects; disturbance from operations. **Indirect Impacts:** Increased road kill hazard from operations traffic; increased predation from ravens; fragmentation of local population; introduction and spread of non-native invasive plants; increased risk of fire; degradation of off-site springs or seeps; weed abatement; mirror washing and maintenance; death or injury from exposure to concentrated solar flux; and glare or heat associated with the heliostats may adversely affect bird's use of the site. **Cumulative Impacts:** Contributes cumulative loss of habitat from future projects within NECO planning area desert dry wash woodland. Project's cumulative contribution to fragmentation, indirect impacts, and direct loss of special status and migratory birds from collisions and exposure to solar flux would be considerable. **Mitigation:** Implement impact avoidance and minimization measures (**BIO-1** through **BIO-8**); pre-construction nest surveys (**BIO-15**); avian protection plan (**BIO-16**) off-site habitat acquisition and enhancement (**BIO-12**). Pre-construction nest surveys (**BIO-15**); avian enhancement and conservation plan (**BIO-16a**), and avian and bat protection plans (**BIO-16b**). **Impact Significance:** Direct Impacts are Less than Significant with Mitigation; Indirect Impacts May Remain Significant After Mitigation; Cumulative Impacts May Remain Significant After Mitigation.

Biological Resource	Impact/Mitigation
Special Status Bats	**Direct Impacts**: No anticipated direct loss of maternity, day roosts, or hibernacula. Loss of foraging habitat. Bats that forage near the ground, such as the pallid bat, would also be subject to crushing or disturbance by vehicles driving at dusk, dawn, or during the night. Collision with facility structures, exposure to concentrated solar flux **Indirect Impacts**: the loss of foraging habitat due to type conversion, night time lighting that exposes bats to predation, and alteration in prey base. Degradation to groundwater dependent communities in the vicinity of the project site. **Cumulative Impacts**: Contributes to cumulatively considerable loss of habitat, fragmentation, and direct loss of these species from past, present, and foreseeable future projects in the Chuckwalla Valley. Mitigation: **BIO-1** through **BIO-8** requires avoidance and minimization measures during life of project, construction monitoring, worker training, fugitive dust control, fire prevention and weed management. pre-construction nest surveys (**BIO-15**); avian enhancement and conservation plan (**BIO-16a**), and avian and bat protection plans (**BIO-16b**). **BIO-23** requires monitoring to track the impacts of pumping to groundwater levels as they develop during the life of the project, and defines triggers for adaptive management to be implemented if data indicate impending adverse effects. **Impact Significance:** Direct and Indirect Impacts are Less than Significant with Mitigation; Cumulative Impacts are Less than Significant with Mitigation.
Desert Kit Fox & American Badger	**Direct Impacts:** Permanent loss of 3,899[a] acres of habitat; fragmentation and degradation of remaining habitat, loss of foraging grounds, crushing or entombing of animals during construction; increased risk of road kill hazard from construction traffic. **Indirect Impacts:** Disturbance from increased noise and lighting; introduction and spread of weeds; increased risk of road kill from operations traffic; increased risk of infection from Canine Distemper Virus (CDV) during passive relocation or hazing activities conducted in an area experiencing or adjacent to distemper cases, increased risk of disturbance or mortality from vegetation management activities. **Cumulative Impacts:** Contributes to cumulative loss of habitat from future projects within the NECO planning area. Project's contribution to fragmentation and indirect impacts also cumulatively considerable. **Mitigation:** Implementation of impact avoidance and minimization measures (**BIO-17**); off-site habitat acquisition and enhancement (**BIO-12**). **Impact Significance:** Direct and Indirect Impacts are Less than Significant with Mitigation; Cumulative Impacts are Less than Significant with Mitigation.

Biological Resource	Impact/Mitigation
Special Wildlife Management Areas	**Desert Wildlife Management Areas:** A portion of the proposed generation tie-line would be located in the Chuckwalla DWMA south of I-10. **Areas of Critical Environmental Concern:** None. **Wildlife Habitat Management Areas:** Contributes to the loss of Sonoran creosote scrub and desert dry wash woodland habitat from future projects within Palen-Ford WHMA. Project would not contribute to the loss of sand dune communities within the WHMA. Contributes to the loss to the DWMA Connectivity WHMA. No cumulative contribution to habitat loss in Big Maria Mountains WHMA. **Desert Tortoise Critical Habitat:** Approximately 228 acres of the southwestern corner of the project overlaps the northern boundary of the Chuckwalla Desert Tortoise Critical Habitat Area. **Mitigation:** Mitigate loss of critical habitat with acquisition and preservation of suitable desert tortoise at a 5:1 ratio (**BIO-12**). **Impact Significance:** Direct and Indirect Impacts are Less than Significant with Mitigation; Cumulative Impacts are Less than Significant with Mitigation.
Special-status Plants	**Direct Impacts:** – • Harwood's milk-vetch: Less-than-significant direct loss of approximately six in Project Disturbance Area; • Harwood's eriastrum: No direct impacts; • California ditaxis: Loss of 11 plants significant; • Ribbed cryptantha: abundant throughout the vicinity; less-than-significant direct effect; • New taxon of saltbush: No direct impacts. • Late-season plants: no direct impacts within approved PSPP project footprint. Potentially significant impacts to fall-blooming plants not detected during spring surveys along new PSEGS features, including modified generation tie-line corridor (Sonoran creosote bush scrub and dry desert wash woodland). **Indirect Impacts:** Minor to potentially significant indirect impacts to all plants in close proximity to site from introduction and spread of non-native invasive plants; increased risk of fire; altered drainage patterns downstream of site; erosion and sedimentation of disturbed soils; accidental chemical and herbicide drift; disruption of photosynthesis and other metabolic processes from dust; fragmentation of population and impaired gene flow and increased vulnerability to local extinctions, and accidental impacts to avoided plants during construction. **Cumulative Impacts:** Project's contribution to spread of weeds, fragmentation, altered hydrology, and risk of fire is cumulatively considerable, however these effects would be reduced through the implementation of staffs proposed conditions of certification. **Mitigation:** Implement impact avoidance and minimization measures (**BIO-8**); Avoidance and minimization measures (**subsection A, BIO-19**); conduct fall surveys (subs**ection B, BIO-19**) and mitigate according to thresholds in **BIO-19**); implement avoidance and compensation mitigation according to performance standards in subs**ection D, BIO-19**; implement weed management plan (**BIO-14**); implement worker training in fire prevention (**BIO-8**). **Impact Significance:** Direct and Indirect Impacts are Less than Significant with Mitigation; Cumulative Impacts are Less than Significant with Mitigation.

Staff finds that the PSEGS will comply with LORS, but is uncertain that mitigation for avian species will mitigate the potential impacts to less than significant.

CULTURAL RESOURCES

Cultural Resources will be published in Part B of the FSA. It is anticipated that Part B will be published the week of September 16, 2013.

HAZARDOUS MATERIALS

Staff proposed Hazardous Materials Management conditions of certification are slightly modified from the existing conditions of certification to account for the discontinuation of the project's use of heat transfer fluid (HTF) and propane, and the addition of natural gas and a gas pipeline.

Revised Condition of Certification **HAZ-2** ensures that local emergency response services are notified of the amounts and locations of hazardous materials at the facility and safety plans, existing Condition of Certification **HAZ-3** requires the development of a Safety Management Plan that addresses the delivery of all liquid hazardous materials during the construction, commissioning, and operation of the project would further reduce the risk of any accidental release not specifically addressed by the proposed spill prevention mitigation measures, and further prevent the mixing of incompatible materials that could result in the generation of toxic vapors. Revised Condition of Certification **HAZ-4** addresses the use of natural gas and prohibits its use to clear pipes. Site security during both the construction and operation phases is addressed in existing Condition of Certification **HAZ-5** and revised Condition of Certification **HAZ-6.**

Staff concludes that there is insignificant potential for a hazardous materials release to have an impact beyond the facility boundary, and therefore concludes there is also insignificant potential for significant impacts to the environment.

LAND USE

Staff concludes the modifications proposed for the PSEGS would not disrupt or divide an established community, or convert farmland to non-agricultural use or forest land to non-forest use. Staff has made minor clarifying edits to the single land use Condition of Certification from the Energy Commission PSPP Final Decision.

NOISE AND VIBRATION

Because construction and operational noise for PSEGS would be the same or less than for the PSPP, staff does not propose any changes to the noise and vibration Conditions of Certification.

PUBLIC HEALTH

According to the results of staff's health risk assessment, emissions from PSEGS would not contribute significantly to morbidity or mortality in any age or ethnic group residing in the project area. Only clarifying changes to **PUBLIC HEALTH-1** are proposed.

SOCIOECONOMICS

Staff concludes that the construction and operation of the PSEGS would not cause a significant adverse direct or indirect impact on the area's housing, schools, law enforcement services, or parks. The project would not directly or indirectly induce a substantial population growth or displacement of population, or induce substantial increases in demand for housing, parks, or law enforcement services. However, when considered cumulatively with the other proposed and approved projects, temporary lodging may be constrained in the local and regional study areas, thus contributing to a cumulative impact. PSEGS operations would not create a significant adverse socioeconomic cumulative impact on the area's housing, schools, law enforcement services, or parks.

Staff concludes the population in the six-mile project buffer does not constitute an environmental justice population as defined by *Environmental Justice: Guidance under the National Environmental Policy Act*, and would not trigger further scrutiny for purposes of an environmental justice analysis. Staff notes that the BLM July 2013 PSEGS Draft Supplemental Environmental Impact Statement used different demographic metrics and identified an environmental justice population, where Energy Commission staff did not. However, the BLM found no disproportionate adverse impacts from the PSEGS to the BLM-identified environmental justice population.

SOIL & WATER RESOURCES

Staff determined that construction, operation, non-operation and closure of the proposed PSEGS could potentially impact soil and water resources. The PSEGS would be located on an alluvial fan where flash flooding and mass erosion could impact the project. Project-related changes to the alluvial fan hydrology could result in impacts to adjacent land users. Five PSPP conditions of certification were deleted because of changes to the drainage design for the PSEGS. A Draft Drainage, Erosion, and Sedimentation Control Plan (DESCP) has been developed, by the project owner to mitigate the potential storm water and sediment project-related impacts by implementing Best Management Practices (BMPs) during construction and operations. A new condition of certification was also added for the PSEGS to address potential impacts from storm damage to the heliostats. Additional conditions are proposed to reduce damage and injury caused by potential flash flooding.

The PSEGS project would use less water during construction and operation than the PSPP, and the PSPP conditions of certification have been updated to reflect these changes. Changes to the conditions reduce the maximum limit of water usage and construction duration to match the PSEGS project description. The waste discharge requirements for wastewater disposal to lined evaporation ponds have also been revised to reflect the smaller ponds now needed for the reduced wastewater volume. The requirements for a Land Treatment Unit would also be removed since no heat transfer fluid requiring bioremediation would be used for PSEGS operation.

A summary of proposed modifications to the **Soil and Water Resources** Conditions of Certification is shown in **Executive Summary Table 3**.

Executive Summary Table 3
Summary of Proposed Modifications to Conditions of Certification

Condition of Certification	Proposed Modification(s) to Condition
SOIL&WATER-1	DRAINAGE EROSION AND SEDIMENTATION CONTROL PLAN (DESCP): Edit to items C and N.
SOIL&WATER-2	PROJECT GROUNDWATER WELLS, PRE-WELL INSTALLATION: No change.
SOIL&WATER-3	CONSTRUCTION AND OPERATION WATER USE: Reduce maximum limit of water usage and construction duration to match the project description.
SOIL&WATER-4	GROUNDWATER LEVEL MONITORING, MITIGATION AND REPORTING: No change.
SOIL&WATER-5	COMPENSATION FOR WELL IMPACTS: No change.
SOIL&WATER-6	WASTE DISCHARGE REQUIREMENTS: Delete a typo. Revise requirements specified in Appendix B, C, and D to match the modified project.
SOIL&WATER-7	SEPTIC SYSTEM AND LEACH FIELD REQUIREMENTS: No change.
SOIL&WATER-8	REVISED PROJECT DRAINAGE REPORT AND PLANS: Delete.
SOIL&WATER-9	DETAILED FLO-2D ANALYSIS: Delete.
SOIL&WATER-10	DRAINAGE CHANNEL DESIGN: Delete.
SOIL&WATER-11	CHANNEL EROSION PROTECTION: Delete.
SOIL&WATER-12	CHANNEL MAINTENANCE PROGRAM: Delete.
SOIL&WATER-13	CLOSURE PLAN: Text changed to match language in the GENERAL CONDITIONS section.
SOIL&WATER-14	MITIGATION OF IMPACTS TO THE PALO VERDE MESA GROUNDWATER BASIN: No change.
SOIL&WATER-15	GROUNDWATER PRODUCTION REPORTING: No change.
SOIL&WATER-16	GROUND SUBSIDENCE MONITORING AND ACTION PLAN: Change “applicant” to “project owner”.
SOIL&WATER-17	ESTIMATION OF SURFACE WATER IMPACTS: Edit to verification.
SOIL&WATER-18	GROUNDWATER QUALITY MONITORING AND REPORTING PLAN: Change “applicant” to “project owner”.
SOIL&WATER-19	NON-TRANSIENT, NON-COMMUNITY WATER SYSTEM: No change.
SOIL&WATER-20	STORM WATER DAMAGE MONITORING AND RESPONSE PLAN: New.

TRAFFIC & TRANSPORTATION

Staff concludes that with proposed changes to the conditions of certification that impacts to traffic level of service on Corn Springs Road and the Corn Springs Road and Interstate 10 (I-10) ramp intersections that traffic impacts would be less than significant.

Staff also determined that there is no risk for either photothermal or photochemical retinal damage to motorists, pilots or the general civilian population outside of the PSEGS site from either the heliostats or solar power tower solar receiver steam generators (SRSGs). However, without mitigation, direct solar reflections from the heliostats (DSRH) would cause drivers on I-10 to experience discomfort glint and glare, and potentially disability glint and glare. Implementation of proposed Condition of Certification **TRANS-7** requires a Heliostat Positioning and Monitoring Plan that would minimize the frequency of DSRH events during the testing, calibration and operational phases of the PSEGS, resulting in less than significant impacts to motorists and pilots.

Sustained glare from the solar power tower solar receiver steam generators (SRSGs) during nominal operating conditions (where luminance would be less than 1×10^6 candelas per meter squared [cd/m^2]) would not produce discomfort or disability glare that would interfere with motorists' or pilots' abilities to operate their vehicles and planes, respectively. However, at higher luminance levels, the SRSGs could produce discomfort or disability glare that would significantly impact drivers on I-10. To ensure that the SRSGs operate at acceptable luminance levels that would not impact the traveling public, staff has proposed Condition of Certification **TRANS-8** to require a solar power tower receiver luminance and monitoring plan. **TRANS-8** would provide procedures for the identification and mitigation of visual distraction, discomfort glare, or disability glare effects with the potential of causing significant impacts to motorists.

TRANSMISSION LINE SAFETY AND NUISANCE

Since the proposed PSEGS transmission line would be operated to minimize health, safety, and nuisance impacts and would be routed through an area with no residences in its immediate vicinity, staff considers the proposed design, maintenance, and construction plan as complying with the applicable LORS. Staff does not propose any changes to the PSPP conditions of certification for the proposed PSEGS modifications.

VISUAL RESOURCES

Energy Commission staff identified significant unmitigatable impacts in the Visual Resources technical area.

Staff concludes that the PSEGS would result in a substantial adverse impact to existing scenic resource values, as seen from several viewing areas and Key Observation Points in the project vicinity and Chuckwalla Valley area, including:

- Eastbound and westbound Interstate 10 (I-10), which is located immediately south of the project site and transmission line;
- State Route 177, to the west and northwest of the project site;
- Joshua Tree National Park to the west and northwest of the project site;
- Palen McCoy Wilderness to the northeast of the project site;
- Chuckwalla Mountains Wilderness to the south of the project site; and
- Corn Springs Road in the immediate vicinity of the project site.

Staff concludes that these visual impacts would be significant in terms of three of the four criteria of CEQA Appendix G, could not be mitigated to less than significant levels, and would thus result in significant and unavoidable impacts under CEQA. Staff also concludes that the project's contribution to significant cumulative visual effects would be cumulatively considerable when combined with the effects of other renewable and development projects along the I-10 corridor, within the Chuckwalla Valley, and within the California Desert Conservation Area as a whole.

In addition, staff concludes that the project would not be consistent with several applicable goals and policies of the Riverside County Integrated Plan. Staff proposes modification to the PSPP conditions of certification to minimize PSEGS impacts to the greatest feasible extent.

WASTE MANAGEMENT

Based on estimates provided by the project owner, disposal of non-hazardous PSEGS wastes would be approximately the same as the original project, and would not adversely impact Class III landfill capacity and disposal of project-related hazardous wastes would not adversely impact Class I landfill capacity.

Because the proposed amended project would employ the BrightSource power tower technology, which would eliminate parabolic trough technology and the need for HTF, staff is recommending the deletion of Waste Discharge Requirement stipulations for treatment of HTF-contaminated soils (**WASTE-8**). PSPP waste management Conditions of Certification Waste-1 through 7 will still apply and only editorial edits are proposed.

WORKER SAFETY AND FIRE PROTECTION

Staff has considered the position of Palen Solar Holdings LLC and the Riverside County Fire Department (RCFD) and all relevant information as well as past and current experience at other solar power plants in California and has determined that the modified project would cause a significant direct impact on local fire protection services, but not cause a significant cumulative impact. A direct impact is caused by the need to equip and train the fire department to respond to the specific unique hazards posed by solar tower technology which would be new to the county. No significant cumulative impact would occur because the construction and operation of this solar power plant is not likely to change the overall hazard profile of facilities requiring emergency response in the county, emergency events at this solar power plant are not likely to escalate within or beyond the power plant site, and emergencies are not likely to occur simultaneously with other facilities.

Therefore, staff is proposing mitigation to reduce the direct impact to less than significant by requiring payment to the RCFD for capital improvements and annual support (see proposed revised Condition of Certification **WORKER SAFETY-7**). Staff is also proposing a new condition (**WORKER SAFETY-10**) that would clarify the requirement for the project owner to submit plans for all fire detection and suppression systems to the RCFD and to pay the fire department’s usual and customary fee for those reviews and subsequent inspections.

And, in order to protect workers from potential exposure to Valley Fever, staff proposes a revision to an existing condition of certification, now numbered **WORKER SAFETY-8**, that would require enhanced dust control measures. Additionally, staff proposes **WORKER SAFETY-12**, which would require reporting of confirmed VF cases (along with heat stress incidences) to the Energy Commission staff.

Staff proposes a new condition of certification (**WORKER SAFETY-11)** that would require a Tower Access and Safety Plans, one for construction and one for commissioning and operations, be prepared and implemented to control access to the towers, address fire detection and suppression systems, and ensure that the emergency hoist systems and backup power supply for the elevators and hoists are in place. Lastly, staff deleted and revised various conditions that pertained to design features of the previously-approved Palen project.

With these modifications, staff believes the project would incorporate sufficient measures to ensure adequate levels of industrial safety and comply with applicable LORS. **WORKER SAFETY-8** (enhanced dust control measures) would minimize the potential impacts of Valley Fever, and would not significantly impact the provision of emergency services.

FACILITY DESIGN

Staff concludes that the design, construction, and eventual closure of the PSEGS and its linear facilities would comply with applicable engineering laws, ordinances, regulations, and standards. The proposed PSEGS modifications, as described in the Petition to Amend, would not change staff's analysis or the conditions of certification in the December 2010 Energy Commission Final Decision for the approved PSPP.

GEOLOGY AND PALEONTOLOGY

Staff believes that the potential is low for significant adverse impacts to the proposed project from geologic hazards during its design life. The potential for significant adverse impacts to potential geologic and mineralogic resources from the construction, operation, and closure of the proposed project is also low.

In areas where soils are exposed by conventional excavation operations, potential impacts to paleontologic resources would be mitigated through worker training and monitoring by qualified paleontologists, as required by the existing PSPP conditions. Existing studies indicate the soils beneath the solar field are likely to contain Pleistocene-age vertebrate fossils. Based on existing information, the proposed method of construction would create a significant impact to paleontological resources in the area where heliostat pylons are proposed. Staff has proposed conditions of certification to reduce the impacts to less than significant.

POWER PLANT EFFICIENCY

The PSEGS would use solar energy to generate a minimum 98 percent of its annual electrical energy production. Fossil fuel, in the form of natural gas, would be used only to reduce startup time and to keep the temperature of the steam generation system above freezing. Compared to the project's expected overall production rate of approximately 1,412,300 MWh (megawatt-hours) per year, and compared to a typical fossil fuel-fired power plant of equal capacity, the amount of the annual power production from fossil fuel is insignificant, at less than 2 percent.

The project would decrease reliance on fossil fuel and would increase renewable energy generation. It would not create significant adverse effects on fossil fuel energy supplies or resources, would not require additional sources of energy supply, and would not consume fossil fuel energy in a wasteful or inefficient manner. No efficiency standards apply to this project. Staff therefore concludes that this project would present no significant adverse impacts on fossil fuel energy resources.

The PSEGS, as proposed, would occupy approximately 7.6 acres per MW of capacity, which approximates that of other solar power technologies.

POWER PLANT RELIABILITY

Staff concludes that the PSEGS would be built and would operate in a manner consistent with industry norms for reliable operation. The project owner predicts an availability factor of between 92 and 98 percent for the modified project, which staff believes is achievable and comparable to that of the PSPP. No conditions of certification are proposed.

TRANSMISSION SYSTEM ENGINEERING

The proposed interconnection facilities, including the PSEGS 230-kV switchyard, generators, 230-kV overhead gen-tie line, and its termination at the new SCE Red Bluff substation, are acceptable and would comply with applicable LORS. No changes to the PSPP conditions of certification are proposed.

ALTERNATIVES

Staff reviewed the previous alternatives analysis for the licensed PSPP during the initial work to determine the scope of the analysis for the proposed modified project. The alternatives analysis for the PSPP retained three reconfigured alternatives, a reduced acreage alternative, and one off-site alternative for detailed analysis and comparison to the PSPP. Of the three reconfigured alternatives, the Commission Decision for the PSPP determined that Reconfigured Alternatives #2 and #3 would reduce impacts on Mojave fringe-toed lizard, sand dune habitat, and the sand transport corridor. Thus the Commission decision approved either Reconfigured Alternative #2 or #3 using the parabolic trough technology proposed for the PSPP and this has become the No-Project Alternative for the purposes of the PSEGS alternatives analysis.

For PSEGS staff has selected three project alternatives for full analysis and comparison to the proposed modified project:

- No-Project Alternative
- Solar Photovoltaic Alternative with Single-Axis Tracking Technology
- Reduced Acreage Alternative with Solar Power Tower (SPT) Technology

Staff concludes that constructing and operating Reconfigured Alternative #2 or #3 (i.e., the No-Project Alternative) would avoid or substantially reduce certain impacts on **Biological Resources**, **Cultural Resources**, **Paleontological Resources**, and **Visual Resources**.

If reducing or avoiding several direct and indirect environmental impacts is a critical factor, then either Reconfigured Alternative #2 or #3 would be environmentally superior to the proposed modified project.

For the Solar PV Alternative with Single-Axis Tracking Technology, staff concludes that this Alternative would avoid or substantially reduce several impacts on **Biological Resources**, **Cultural Resources**, **Traffic and Transportation**, and **Visual Resources**.

If reducing or avoiding several direct and indirect environmental impacts and improving the effectiveness of mitigation measures are the critical factors, then the Solar PV Alternative with Single-Axis Tracking Technology would be environmentally superior to the proposed modified project.

For the Reduced Acreage Alternative with SPT Technology, staff identifies several impacts on **Biological Resources** that would be "much less than PSEGS," and staff considers this to be the primary benefit of this alternative compared to the proposed modified project.

If lessening several impacts on biological resources is the critical factor, then the Reduced Acreage Alternative would be somewhat superior to the proposed modified project.

REFERENCES

OPR 2013—The Governor's Office of Planning and Research (OPR), CEQAnet Database. Accessed May, 2013. On-line http://www.ceqanet.ca.gov/

Riverside County 2013—Riverside County Planning Department. Accessed May, 2013. On-line http://www.tlma.co.riverside.ca.us/planning/

Solar Millennium2009a—Solar Millennium (TN 52939). Application for Certification for the Palen Solar Power Plant, Vols.1 & 2, dated August 24, 2009.

EXECUTIVE SUMMARY ATTACHMENT A

CUMULATIVE IMPACTS

Preparation of a cumulative impact analysis is required under CEQA. In the CEQA Guidelines, "a cumulative impact consists of an impact which is created as a result of the combination of the project evaluated in the EIR together with other projects causing related impacts" [14 Cal. Code Regs., §15130(a)(1)]. Cumulative impacts must be addressed if the incremental effect of a project, combined with the effects of other projects is "cumulatively considerable" [14 Cal. Code Regs., §15130(a)]. Such incremental effects are to be "viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects" [14 Cal. Code Regs., §15164(b)(1)]. Together, these projects comprise the cumulative scenario which forms the basis of the cumulative impact analysis.

CEQA also states that both the severity of impacts and the likelihood of their occurrence are to be reflected in the discussion, "but the discussion need not provide as great detail as is provided for the effects attributable to the project alone. The discussion of cumulative impacts shall be guided by standards of practicality and reasonableness, and shall focus on the cumulative impact to which the identified other projects contribute rather than the attributes of other projects which do not contribute to the cumulative impact" (14 Cal. Code Regs., §15130(b)).

DEFINITION OF THE CUMULATIVE PROJECT SCENARIO

Cumulative impacts analysis is intended to identify past, present, and probable future actions that are closely related either in time or location to the project being considered, and consider how they have harmed or may harm the environment. Most of the projects listed in the cumulative projects tables (**Executive Summary Attachment A – Tables 1, 2, and 3)** have, are, or will be required to undergo their own independent environmental reviews under CEQA. The cumulative project list was developed by staff in the fall of 2012 during the Rio Mesa Solar Electric Generating Facility AFC process and will be updated in the FSA.

Executive Summary Attachment A – Table 1
Existing Projects

OID	Project Name	Location	Ownership	Status	Project Description	Distance (Mile)	Feature
1	2012 Air Quality Management Plan	Orange, Los Angeles, Riverside, and San Bernardino Counties	South Coast Air Quality Management District	Lead agency approved the project on 12/12/2012, and will have significant impacts	The 2012 AQMP identifies control measures to be implemented by state, federal and local agencies to demonstrate that the region will attain the federal standard for particulate matter less than 2.5 microns in diameter (PM2.5) by the applicable target dates and provides Clean Air Act S182(e)(5) proposed implementation measures to assist in achieving the 8-hour ozone standard	0.00	Polygon
15	Blythe Energy Project	City of Blythe, north of I-10, 7 miles west of the CA/AZ border	Blythe Energy, LLC	Existing	520 MW combined-cycle natural gas-fired electric-generating facility. Project is connected to the Buick Substation owned by WAPA	30.78	Point
17	Blythe Energy Project Transmission Line	From the Blythe Energy Project to Julian Hinds Substation	Blythe Energy , LLC	Existing	Transmission line modifications including upgrades to Buck Substation, approximately 67.4 miles of new 230 kV transmission line between Buck Substation and Julian Hinds Substation, upgrades to the Julian Hinds Substation, installation of 6.7 miles of new 230 kV transmission line between Buck Substation and SCE's DPV 500 kV transmission line	1.92	Line
19	Blythe PV Project	Blythe	First Solar	Existing	21 MW solar photovoltaic project located on 200 acres	27.82	Polygon
28	Chuckwalla Valley State Prison	19025 Wiley's Well Rd., Blythe, CA	CA Dept. of Corrections & Rehabilitation	Existing	State prison providing long-term housing and services for male felons classified as medium and low-medium custody inmates jointly located on 1,720 acres of state owned property	19.95	Polygon

OID	Project Name	Location	Ownership	Status	Project Description	Distance (Mile)	Feature
43	Devers-Palo Verde No. 1 Transmission Line	From Palo Verde (Arizona) to Devers Substation	SCE	Existing	Existing 500 kV transmission line parallel to I-10 from Arizona to the SCE Devers Substation, near Palm Springs. DPV1 will loop into the approved Midpoint Substation, which will be located 10 miles southwest of Blythe	1.87	Line
49	Eagle Mountain Pumping Plant	Eagle Mountain Rd, west of Desert Center	Metropolitan Water District of Southern California	Existing	144-foot pumping plant that is part of the Metropolitan Water District of Southern California's facilities	21.36	Point
78	Interstate 10	Linear interstate highway running from Santa Barbara to Blythe	Caltrans	Existing	Interstate 10 is a major east-west route for trucks delivering goods to and from California. It is a four-lane divided highway in the project region	1.28	Line
81	Ironwood State Prison	19005 Wiley's Well Rd., Blythe, CA	CA Dept. of Corrections & Rehabilitation	Existing	ISP jointly occupied with Chuckwalla Valley State Prison 1,720 acres of state-owned property, of which ISP encompasses 640 acres. The prison complex occupies approximately 350 acres with the remaining acreage used for erosion control, drainage ditches, and catch basins	18.81	Polygon
84	Kaiser Mine	Eagle Mountain, north of Desert Center	Kaiser Ventures, Inc	Existing	Kaiser Street mined iron ore at Kaiser Mine in Eagle Mountain and provided much of the Pacific Coast steel in the 1950s. Mining project also included the Eagle Mountain Railroad, 51 miles long. Closed in 1980s	23.84	Point
121	Recreational Opportunities	Eastern Riverside County	BLM	Existing	BLM has numerous recreational opportunities on lands in eastern Riverside County along the I-10 corridor, including the Corn Spring's Campground, Wiley's Well Campground, Coon Hollow Campground, and Midland Long-Term Visitor Area	23.07	Point

OID	Project Name	Location	Ownership	Status	Project Description	Distance (Mile)	Feature
167	West-wide Section 368 Energy Corridors	Riverside County, parallel to DPV corridor	BLM, Department of Energy (DOE), U.S. Forest Service	Approved by BLM and U.S. Forest Service	Designation of corridors on federal land in the 11 western states, including California, for oil, gas, and hydrogen pipelines and electricity transmission and distribution facilities (energy corridors). One of the corridors runs along the southern portion of Riverside County	0	Polygon

Executive Summary Attachment A – Table 2
Foreseeable Projects in the Project Area

OID	Project Name	Location	Ownership	Status	Project Description	Distance (mile)	Feature
2	6th Street/CA Avenue/Maple Ave Sewer Line Extension Project	6th St and Xeni, Maple Ave and 1st St, CA Ave and 1st St, Beaumont	City of Beaumont	Negative declaration filed on 11/5/2012	Extension of an 8" sewer line	102.53	Point
3	ACI Residential Project	Citrus St and Cleveland Ave, Eastvale	City of Eastvale	Lead agency approved the project on 2/1/2013, and will not have significant impacts	Streambed Alteration Agreement, limited to the preparation of 38.1 acres of the 85.4 acre APN 152-040-034 for medium-density residential development	136.74	Point
4	Adoption of Rule 1406 Generation of ERCs for Paving Unpaved Public Roads	Various locations in Riverside County	Mojave Desert Air Quality Managemen t District	Lead agency approved the project on 2/11/2013, and will not have significant impacts	The objectives of this Project (rule adoption) are to codify existing District procedures, making their application federally enforceable, and to allow PM10 emission reductions generated by unpaved public road paving to be used as offsets for specifically identified permit applications subject to federal New Source Review requirements.	136.12	Point
5	Agua Caliente Indian Reservation	Knowles Property, eastern slope of the San Jacinto Mts. APN: 513-040-021-2	Bureau of Indian Affairs	Review period ends 6/5/2013	Land acquisition	81.63	Point
6	Agua Caliente PV	Between Yuma and Phoenix	First Solar	Under Construction	290 MW solar PV plant on 2,400 acres	110.87	Point

OID	Project Name	Location	Ownership	Status	Project Description	Distance (mile)	Feature
7	Annex 114, SIA 12-001, GPA 12-004, CZ12-002 & ZTA12-002	Unincorporated Temescal Valley, Riverside County	City of Corona	Mitigated negative declaration filed on 12/6/2012	Annexation 114 is an application of the City of Corona to annex the unincorporated area of Temescal Valley in Riverside County into the city. The Temescal Valley SOI is 15.58 square miles and entirely covers the city's southern sphere of influence	130.06	Point
8	Aqua Caliente Roadway and Drainage Improvements Project	Tahquitz Canyon Way and Hermosa Dr, Palm Springs	City of Palm Springs	Mitigated Negative Declaration filed 2/14/2013	Widening of Hermosa Drive (east half) between Tahquitz Canyon Way and Hermosa Drive to its full-width 40-foot-wide (curb to curb) collector street designation	76.54	Point
9	Beaumont Avenue Recharge Facility and Pipeline	Beaumont Ave and Brookside Ave, Beaumont	San Gorgonio Pass Water Agency	Notice of Preparation filed on 11/30/2012	The recharge facility is proposed to be located on a ~44 acre parcel and consists of a series of five tiered basins, separated by berms. The perimeter of the recharge facility is proposed to include raised embankments. The pipeline is proposed to extend from the recharge facility to the service connection facility. The pipeline will be 24-inches in diameter and will extend north from the recharge facility along Beaumont Avenue for ~5,600 linear feet and west along Orchard Street for ~1,400 feet	103.16	Point
10	Beaumont Distribution Center (City Project No. 12-PP-05, 12-RZ-02, and 12-GPA-01)	First St and Beaumont Ave, Beaumont	City of Beaumont	Notice of Preparation filed on 2/14/2013	The proposed Project entails the development of an approximately 38 acre site with an 803,600 square foot high cube distribution warehouse facility with a maximum building height of 50 feet.	102.77	Point

OID	Project Name	Location	Ownership	Status	Project Description	Distance (mile)	Feature
11	Bella Linda General Plan Amendment, Zone Change/Planned Development Overlay	Pechanga Parkway (west), Loma Linda (south), Temecula Lane (east), Temecula	City of Temecula	Draft EIR filed on 12/3/2012	The project is a two-phase residential development. Phase one will consist of 325 apartment units totaling 462,622 s.f. Phase two of the project will consist of creating lots for 49 senior single-family units. The project will feature a meandering trail along Loma Linda Road and Pechanga Parkway. An additional 0.91 acres of project area is located off-site immediately to the north of the project site	111.02	Point
12	Belle Terre Specific Plan	Washington St and Keller Rd, Riverside County	County of Riverside	Notice of preparation filed on 11/21/2012	The Project includes a split foundation Specific Plan that would allow for the development of up to 1,326 residential units and open space and/or recreational features	108.02	Point
13	Big Maria Vista Solar Project	North of I-10, 12 miles N/W Blythe	Bullfrog Green Energy	POD in to BLM	500 MW PV project on 2,684 acres	28.69	Polygon
16	Blythe Energy Project II	Near Blythe Airport	Blythe Energy	Approved	520 MW combined-cycle power plant located entirely within the Blythe Energy Project site boundary, located on 30 acres of a 76 acre site	30.82	Polygon
18	Blythe Mesa Solar I	Blythe	Renewable Resources Group	Under review	A planned 485 MW solar PV project on private land in Blythe	32.78	Point
20	Blythe Solar Power Generation Station 1	Blythe	Southwestern Solar Power	Approved	A planned 4.76 MW solar PV facility, including 69 PV panels that stand 50 feet tall and 72 feet ride	32.61	Point
21	Blythe Solar Power Project	North of I-10, north of Blythe Airport	Solar Millennium	Approved	1,000 MW solar trough facility on 7,540 acres	26.33	Polygon

OID	Project Name	Location	Ownership	Status	Project Description	Distance (mile)	Feature
22	Bundy Canyon Road and Orange Street Tentative Parcel Map No. 30522	Bundy Canyon Rd and Orange St, Wildomar	City of Wildomar	MND comment period ended 5/1/2013, with no updates as of 5/17/2013	The proposed project includes a TPM 30522 to subdivide two existing parcels, totaling approximately 10.3 acres, into seven parcels (numbered parcels 1-7) for future commercial development. Existing parcels include APN 367-100-026, which the proposed project would dedicate approximately 0.75 acres along both Bundy Canyon Road and Orange Street of the project site to the City of Wildomar for right-of-way necessary to accommodate access to/from the future commercial development.	119.02	Point
23	Bundy Canyon/Scott Road Improvement Project	Bundy Cyn Rd/Scott Rd from I-15 to I-215, Lake Elsinore	County of Riverside	Draft EIR submitted on 1/14/2013	The proposed project would widen and realign portions of a six mile segment of Bundy Canyon Road/Scott Road (from Cherry Street near I-15 on the west to Haun/Zelders Road near I-215 on the east) from its existing two lanes to a four lane cross-section	118.71	Point
24	Cactus Avenue PUD	Cactus Ave, Quincy, Brodiaea Ave, Moreno Valley	City of Moreno Valley	Mitigated negative declaration filed 12/13/2012	43.52 acres into 159 single family residential lots within a Planned Unit Development, modifying the zoning from Residential single family 10 (RS10), Residential 10 (R10) and Residential 15 (R15) multi-family to Residential 5 (R5) with lots ranging from 6,000 to 15,298 square feet	113.26	Point

OID	Project Name	Location	Ownership	Status	Project Description	Distance (mile)	Feature
25	Canyon Lake Hybrid Treatment Process-Phase I	Canyon Lake	City of Canyon Lake, CA	Expected start date of September 2013	The proposed Project consists of application of alum to Canyon Lake to remove nutrients that contribute to algal blooms. A wide-range of management options, ranging from oxygenation, aeration, mixing, and dredging to application of alum, Phoslock, and other nutrient binders have been considered.	118.84	Point
26	Chuckwalla Solar I	1 mile north of Desert Center	Chuckwalla Solar I	POD in to BLM	200 MW solar PV project on 4,083 acres	6.40	Polygon
27	Chuckwalla Valley Raceway	Desert Center Airport	Developer Matt Johnson	Approved by County of Riverside	5.8 mile racetrack located on 400 acres of land that used to belong to Riverside County and was used as the Desert Center Airport	8.12	Polygon
29	Circulation Element General Plan Amendment	Banning	City of Banning	Project approved 3/26/2013, will not have significant impacts	The City is proposing to amend the General Plan Circulation Element. The proposed General Plan Amendment (GPA) includes a change to the acceptable Level of Service (LOS) for roadway operating conditions from LOS C to LOS D.	99.43	Point
30	Coachella General Plan Update	Coachella	City of Coachella	Notice of Preparation filed 3/8/2013	The City of Coachella Comprehensive General Plan update encompasses future community development plans from now, until 2035. The General Plan will provide long term planning guidelines for the City's growing population and projected development.	55.27	Point

OID	Project Name	Location	Ownership	Status	Project Description	Distance (mile)	Feature
31	College of the Desert West Valley Campus Facilities Master Plan & Phase I Project	Indian Canyon Drive and Tramview Road, Palm Springs	Desert Community College District	Draft EIR Submitted 3/15/2013	West Valley Campus Facilities Master Plan and Phase 1 Project. Total planned development of 650,000 sf on 119+ acres. Also includes 30 on-campus dwelling units and 10,000 sf of campus related retail. Phase 1 development of 50,000 sf.	77.33	Point
32	Colorado River Substation Expansion	10 miles southwest of Blythe	SCE	Approved 7/2011	500/230kV substation, constructed in an area approximately 1000 ft by 1900 ft	35.72	Point
33	Corona Regional Medical Center Expansion	S. Main St and W. Eight St, Corona	City of Corona	Notice of Preparation filed 3/7/2013	Expansion and renovation of the 47-year-old Corona Regional Medical Center	136.05	Point
34	Crystal View Terrace/Green Orchard Place/Overlook Parkway Project	Crystal View Terrace/Green Orchard Place/Overloo k Parkway/Kingd om Dr/Victoria/Wa shington, Riverside	City of Riverside	Draft EIR filed on 12/3/2012	The Project includes four scenarios, each of which represents an alternative set of actions intended to help resolve potential vehicular circulation issues associated with the gates on Crystal View Terrace and Green Orchard Place; address the connection of Overlook Parkway easterly to Alessandro Boulevard; and potentially provide for a future connection to the SR-91	127.53	Point
35	Dawson Road Contractor's Storage Yard Plot Plan #2010-049	North of McLaughlin Rd, south of Ethanac Rd, west of Antelope Rd and east of Dawson Rd, Menifee	City of Menifee	Lead agency approved the project on 12/11/2012, and will not have significant impacts	5.01 acres of land which includes 5,000 s.f. of office and 10,000 s.f. of shop building; Construction of a 6,000 s.f. office building in proposed Parcel 2; Construction of a 10,000 s.f. shop	113.00	Point

OID	Project Name	Location	Ownership	Status	Project Description	Distance (mile)	Feature
36	Desert Center 50	Desert Center	US Solar Holdings	Under review	A planned 49.5 MW fixed flat panel photovoltaic solar power plant	7.95	Polygon
38	Desert Harvest Solar Project	6 miles north of Desert Center	EnXco	Final document submitted on 11/7/2012	Project would be a 150-megawatt solar photovoltaic facility sited on 1,208 acres of BLM-managed lands north of the community of Desert Center in Riverside County, CA. An associated 220-kilovolt generation-intertie transmission line would be sited within a 204-acre right-of-way on BLM-managed land and 52 acres of non-BLM managed land, which would extend from the solar facility site to the planned Red Bluff Substation.	11.78	Polygon
39	Desert Lily Soleil Project	6 miles north of Desert Center	EnXco	POD in to BLM	100 MW PV plant on 1,216 acres of BLM land	6.87	Polygon
40	Desert Quartzite	South of I-10, 8 miles southwest of Blythe	First Solar	POD in to BLM	600 MW solar PV project located on 7,724 acres, adjacent to DPV transmission line and SCE Colorado Substation	27.55	Polygon
41	Desert Southwest Transmission Line	118 miles primarily parallel to DPV	Imperial Irrigation District	Approved	118 mile 500 kV transmission line from a new substation/switching station near the Blythe Energy Project to the existing Devers Substation located approximately 10 miles north of Palm Springs	24.09	Line
42	Desert Sunlight Project	6 miles north of Desert Center	First Solar	Approved	550 MW PV project on 4,144 acres of BLM land, requiring a 12 mile transmission to the planned Red Bluff Substation	13.53	Polygon

OID	Project Name	Location	Ownership	Status	Project Description	Distance (mile)	Feature
44	Devers-Palo Verde No. 2 Transmission Line Project	From the Midpoint Substation to Devers Substation	SCE	CPUC petition to modify request to construct CA-only portion approved by CPUC 11/2009	New 500 kV transmission line parallel to the existing Devers-Palo Verde Transmission Line from Midpoint Substation, approximately 10 miles southeast of Blythe, to the SCE Devers Substation, near Palm Springs. The ROW for the 500 kV transmission line would be adjacent to existing DPV ROW	1.86	Line
45	District Community Education Support Complex	Church St at Polk St, Coachella	Coachella Valley Unified School District	Notice of Preparation filed 3/1/2013	The proposed project involves the demolition of the existing of District Community Education Support Complex and its reconstruction and expansion to consolidate all District administrative operations at the project site	53.98	Point
46	Eagle Canyon Dam and Debris Basin Project	Canyon Plaza Dr and E. Palm Canyon Dr, Riverside County	Riverside County Flood Control and Water Conservation	DWR approved the project on 1/31/2013, and will have significant impacts	Construction of a zoned earth embankment dam and reservoir and its appurtenant structures for flood control use	73.35	Point
48	Eagle Mountain Pumped Storage Project	Eagle Mountain iron ore mine, north of Desert Center	Eagle Crest Energy	FERC draft EIS published in 12/2010	1,300 MW pumped storage project on 2,200 acres of public and private land, designed to store off-peak energy to use during peak hours	19.54	Point
51	East County Detention Center	Existing Riverside County Jail, Indio	Riverside County	EIR filed, review period ends 6/4/2013	1,273 bed expansion of existing 353 bed detention center	58.15	Point
52	EIR No. 512, Specific Plan No. 376 (Thoroughbred Farm)	Bellgrave Ave and Wineville Ave, Riverside County	City of Jurupa Valley	Lead agency approved the project on 11/15/2012, and will have significant impacts	The proposed project includes approximately 42.6 acres of light industrial uses, 36.5 acres of business park uses, 11.5 acres of commercial/retail uses, and 7.6 acres of commercial/tourist uses. The project also includes approximately 10.0 acres of potential roads	135.45	Point

OID	Project Name	Location	Ownership	Status	Project Description	Distance (mile)	Feature
53	EnXco	North of Wiley's Well Rd, east of Genesis Solar Project	EnXco	POD in to BLM	300 MW solar PV project	17.21	Polygon
54	Expanded Gage Exchange Project	Kansas Ave, Spruce St, Chicago Ave, Iowa Ave, Watkins Dr, Blaine St, Riverside	City of Riverside	Ca Dept of Public Health approved the project on 11/30/2012, and states that the project will not have significant impacts	The City of Riverside proposes to install approximately 12,285 feet of 18-inch ductile iron pipe and booster station which will reduce the amount of imported Colorado River water, and will enable the City to increase the supply of irrigation water	123.79	Point
55	Fernando Child Care Center	Limonite Avenue and Wineville Avenue, Jurapa Valley	City of Jurupa Valley	Lead agency approved the project on 3/11/2013, and will not have significant impacts	Proposal to establish a day care center for up to 44 children and five (5) staff on 0.51 acre parcel.	131.21	Point
56	First Inland Logistics Center II	San Michele Rd, Perris Blvd, Nandina Ave, Moreno Valley	City of Moreno Valley	Notice of preparation filed on 12/4/2012	Review Per Lead Plot Plan PA12-0023 proposes 400,130 SF warehouse building on 17.3 acres at the southwest corner of San Michele Avenue and Perris Boulevard. A 8.4 acre portion of the site is an existing truck storage facility with the northern vacant 8.9 acres currently entitled with a truck storage facility	116.61	Point
57	Foothill Parkway Westerly Extension	Foothill Pkwy between Skyline Dr and Green River Rd, Corona	City of Corona	California Transportation Commission approved the project on 12/6/2012, and stated will have significant impacts.	The project will extend Foothill Parkway for approximately two miles by constructing a four-lane roadway with bicycle and pedestrian facilities from 600 feet west of Skyline Drive to Green River Road in the vicinity of Paseo Grande	138.71	Point

OID	Project Name	Location	Ownership	Status	Project Description	Distance (mile)	Feature
58	Four Commercial Projects	Blythe	Various	Approved	Four commercial projects have been approved by the Blythe Planning Department, including the Agate Road Boar & RV Storage, Riverway Ranch Specific Plan, Subway Restaurant and Motel, and Agate Senior Housing Development. Dates of construction are unknown at this time	36.48	Point
59	Fred Waring Drive Improvement Project	Fred Waring Drive, between Adams Street to Port Maria Rd, Riverside	Riverside County Transportation Commission	Lead agency approved the project on 3/6/2013, and will not have significant impacts	The project will widen Fred Waring Drive from four to six lanes for a distance of .65 miles, install a bike lane on the south side of the roadway and construct a raised median with left turn lanes between Adams Street and Port Maria Road	59.94	Point
60	General Plan Amendment No. 778, Change of Zone No. 7270, Tentative Tract Map No. 33248	S. of Indiana Avenue, E. of Lincoln Street in the Home Gardens Community of unincorporated Riverside County	County of Riverside	Mitigated negative declaration filed on 1/4/2013	The Change of Zone proposes to amend the zoning for the site from residential Agriculture- Two Acre Minimum (R-A-2) and areas with no previous zoning (previous Right of Way) to One Family Dwelling- 10,000 sf Minimum (R-1-10,000), Residential Agricultural Two Acre Minimum (R-A-2) and Open Area Combining Zone Residential Developments (R-5). The Tentative Track Map proposes a Schedule 'A' subdivision of 18 acres into 16 single family residential lots with a minimum lot size of 7200 sf and one (1) 6.73 acre lot for open space	132.27	Point

OID	Project Name	Location	Ownership	Status	Project Description	Distance (mile)	Feature
61	General Plan Update	Various locations in Calimesa	City of Calimesa	Notice of Preparation filed on 2/14/2013	The update will include the addition of new sustainability-related goals and policies, a review of existing goals and policies, and an overall streamlining of the existing General Plan	108.42	Point
62	General Plan Update	City-wide, La Quinta	City of La Quinta	Final document submitted on 12/6/2012	Update of the La Quinta General Plan, to encompass all mandated Elements, and add a Sustainable Community and an Economic Development Element. The Update will include modifications to the Land Use Map, but will not significantly change land use patterns in the City	62.32	Point
63	Genesis Solar Energy Project	North of I-10, 25 miles west of Blythe, 27 miles east of Desert Center	NextEra (FPL)	Approved, under construction	250 MW solar power project on 1,950 acres north of the Ford Dry Lake. 6 mile natural gas pipeline and 5.5 mile gen-tie line to the Blythe Energy Center to Julian Hindes Transmission Line	12.47	Polygon
64	Gestamp Asetym Solar	Northwest of Blythe	Gestamp Asetym Solar	EPA review	37 MW solar power plant	352.62	Point
65	Gilman Home Channel Lateral A, Stage 3 Project	Wilson Street, Williams Street, 4th Street, and 12th Street, Banning	Riverside County Flood Control and Water Conservation District	Lead agency approved the project on 2/6/2013, and will not have significant impacts	Flood control as part of the 100-year storm runoff plan	96.41	Point

OID	Project Name	Location	Ownership	Status	Project Description	Distance (mile)	Feature
66	Grading Environmental Assessment-EA42558	Northerly of Upper Valley Rd and easterly of Bautista Rd, unincorporated Riverside	County of Riverside	Mitigated negative declaration filed on 1/8/2013	EA No. 42558, is an application by Tricia Napolitano for an initial study for a grading permit (BGR120054) on APNs 573-040-001 and 573-040-002 project is located northerly of Upper Valley Road, easterly of Bautista Road, and westerly of Polliwog Road within unincorporated Riverside CA	86.06	Point
68	Grant for LCNG Fueling Facility	East Side of South Willow Street between West 14th Avenue, Blythe	Energy Commission	Lead agency approved the project on 1/9/2013, and will not have significant impacts	This grant agreement will fund a project by Blackhawk Logistics LLC to construct a publicly accessible liquefied natural gas station to fuel goods movement trucks along the I-10 connection between California and Arizona.	35.55	Point
69	Green Energy Express Transmission Line Project	Eagle Mountain Sub to So. California	Green Energy Express	Approved	70 mile double circuit 500 kV transmission line from Eagle Mt. Sub to So. California	1.88	Line
70	Green River Communication Site	82695 Doctor Carreon Blvd., Indio	US Army Corps of Engineers	Lead agency approved the project on 3/12/2013, and will have significant impacts	Relocation of an existing communication site	58.19	Point
71	Hwy 111 Beautification and Improvement Project	Hwy 111, Riverside County	California State Transportation Commission	Lead agency approved the project on 3/5/2013, and will not have significant impacts	The project will widen Highway 111 from four to six lanes for a distance of approximately 4 miles	65.94	Point
72	Hwy 86 Domestic Water Transmission Main Phase 2 and Pump Station	Avenue 80 and Hwy 86, Riverside and Imperial Counties	Coachella Valley Water District	Lead agency approved the project on 11/13/2012, and will not have significant impacts	The proposed 30-inch-diameter pipeline is approximately 7.2 miles long and will connect to an existing 30-inch-diameter pipeline located on the west side of Highway 86 at Avenue 74	52.60	Point

OID	Project Name	Location	Ownership	Status	Project Description	Distance (mile)	Feature
73	I-215/Newport Road Interchange Improvement Project	I-215 at Newport Rd, Menifee	Caltrans #8	Lead agency approved the project on 3/6/2013, and will not have significant impacts	Intersection improvements on I-215 at Newport Road in the city of Menifee	113.00	Point
74	Imperial Solar Energy Center West	El Centro	CSOLAR Development	ROW granted	250 MW solar facility located on 65 acres of BLM land	73.11	Polygon
75	Imperial Wind	Black Mountain, CA	Imperial Wind	Authorized	48-65 MW	46.87	Polygon
76	Indian Wells Tennis Garden	Washington St and Miles Ave, Indian Wells	City of Indian Wells	Lead agency approved the project on 2/21/2013, and will have significant impacts	The proposed project includes various renovations to the existing Indian Wells Tennis Garden and the expansion of tennis facilities to the east. Major components of the proposal include a second tennis stadium, signalized main entry, grassed and paved parking lots, onsite circulation and bus queuing areas, landscaped pedestrian corridors, shade canopies, new practice tennis courts, and driveway improvements.	63.00	Point
77	Intake Shell	Blythe	Shell	Under Construction	Reconstruction of a Shell facility located at Intake & Hobson Way	37.44	Point
79	Interstate 10/Jefferson St Interchange Improvement Project	Indio	Caltrans #8	Project start summer 2014, completion expected fall 2016	Hwy interchange improvements	60.63	Point

OID	Project Name	Location	Ownership	Status	Project Description	Distance (mile)	Feature
80	Interstate 10/Monterey Avenue Interchange Improvement Project	I-10 at Monterey Ave near the city of Thousand Palms	Cal Trans #8	Lead agency approved the project on 3/5/2013, and will not have significant impacts	Intersection improvements on I-10 at Monterey Avenue near the city of Thousand Palms	69.30	Point
82	Joshua Palmer Realignment	Joshua Palmer Way and Highland Springs Ave, Banning	City of Banning	Negative declaration filed on 11/19/2012	The Project is a realignment of Joshua Palmer Way to the north and west of its current location and which includes the construction of a new four way intersection including traffic signal improvements at Highland Springs Avenue approximately 340 feet south of West Ramsey Street	101.11	Point
83	Jurisdictional Delineation and Permits for Operations and Maintenance of Whitewater River Stormwater Channel and Coachella Valley Stormwater Channel	Various locations through Coachella Valley	Coachella Valley Water District	Lead agency approved the project on 2/21/2013, and will not have significant impacts	Operation and maintenance activities include mowing, mulching, grading, tree removal, disking, excavating, dredging, filling, armoring of banks, and water monitoring to allow the WWRSC/CVSC system to operate under optimal conditions per design	50.63	Line
85	La Paz Solar Tower	La Paz County, AZ	EnviroMission	Pre-construction	200 MW power station on 11.000 acres	60.63	Point
88	Longview Tank and Pipelines and Watson Booster Station and Pipelines	Longview Ln and Alerich St, Perris	Eastern Municipal Water District	Lead agency approved the project on 2/11/2013, and will not have significant impacts	EMWD proposes to construct a 5.63-million-gallon water storage tank and associated 24-inch diameter underground potable water transmission pipeline and booster pump	111.51	Point

OID	Project Name	Location	Ownership	Status	Project Description	Distance (mile)	Feature
89	March Business Center	Heacock St and Iris Ave, north of the Perris Valley Channel, Moreno Valley	City of Moreno Valley	Final document filed on 11/30/2012	Subdivision of a 75.05 acre portion of land into four separate parcels to include four individual industrial buildings totaling 1,484,407 sf within the I land use district	117.59	Point
90	McCoy Solar Energy Project	North of I-10, south of McCoy Wash, east of McCoy Mountains, Riverside County	McCoy Solar, LLC	Record of Decision signed on March 13, 2013	750 megawatt (MW) photovoltaic (PV) solar energy generating facility and related infrastructure in unincorporated Riverside County, CA. About 7,700 acres of BLM land and 470 acres of private land.	24.82	Polygon
91	McCoy Soleil Project	10 miles northwest of Blythe	EnXco	Plan of Development to Palm Springs BLM	300 MW solar power tower project located on 1,959 acres. Requires a 14 mile transmission line to proposed SCE Colorado Substation south of I-10	24.96	Polygon
92	Mid County Parkway Project	Corona	Riverside County Transportation Commission	Draft EIR filed 1/24/2013	Extended review per lead the RCTC, FHWA, and Caltrans are proposing a project to improve west-east transportation in western Riverside County between I-215 in the west and SR 79 in the east. This is a 16-mile transportation corridor traffic congestion relief project.	139.62	Point
93	Milpitas Wash	Chuckwalla Valley	John Deere Renewables	Authorized	Wind Farm	19.96	Polygon
94	Moreno Valley Field Station Specific Plan	Lasselle St and Brodiaea Ave, Moreno Valley	City of Moreno Valley	CDFW approved the project on 3/11/2013, stating the project will have significant impacts	CDFW is executing a Lake or Streambed Alteration Agreement (SAA#1600-202-0173-R6 [Revision 1]) pursuant to Section 1602 of the Fish and Game code to the project	115.90	Point
95	Mount Signal Solar Farm #1	Calexico	82LV 8ME	EA pending	600 MW solar PV project located on 1,440 acres	50.84	Point

OID	Project Name	Location	Ownership	Status	Project Description	Distance (mile)	Feature
96	MSP for Pyrite Creek Trunk Sewer Phase II, Sky Country Trunk Sewer, and Force Main to Riverside WWTP	Limonite Ave/Van Buren Blvd; Jurupa Rd/Van Buren Blvd; Wineville Ave/Limonite Ave, Jurapa Valley	Jurapa Community Services District	Mitigated negative declaration filed 2/7/2013	Replace existing sewer pipelines and install additional sewer lines and components as the need and demand arises in the District's service area	131.62	Point
99	Murrieta Creek Phase 2	Murrieta, Temecula, Wildomar, Riverside County	US Army Corps of Engineers	Supplemental EIR filed12/4/2012	The U.S. Army Corps of Engineers (Corps) proposes to construct various improvements to provide flood control, a multi-purpose trail, and higher quality riparian habitat along the existing Murrieta Creek Channel within the location described below	113.90	Point
100	Music Festival Plan	Monroe Street/49th Ave; Monroe/52nd Ave; Madison/50th Ave; Madison/52nd Ave, Indio	City of Indio	Approved by lead agency on 4/17/2013	The Major Music Festival Event Permit allows the applicant to hold Major Music Festival events on up to 5 weekends annually from 2014-2030 on a 601 acre site. The maximum daily attendance allowed is 75,000 persons for 2 of the permitted events and 99,000 for the other 3 events.	59.54	Point
103	Non-Potable Water Service Expansion in the Eastern Portion of the District (DPR 3657DP)	Limonite Ave/El Palomino Dr; Clay St/Van Buren Blvd; Mission Blvd/Pyrite St & Camino Rd, Jurapa Valley, Riverside	Jurapa Community Services District	Mitigated negative declaration filed 1/29/2013	New non-potable pipelines; Reuse of an existing 3 million gallon (MG) water reservoir; and New pump stations. There are eight reaches of potential non-potable pipelines. One reach of non-potable pipeline includes the reuse of an existing 3 MG water reservoir. Two reaches includes the potential for a new pump station	130.69	Point

OID	Project Name	Location	Ownership	Status	Project Description	Distance (mile)	Feature
104	North City Extended Specific Plan	N. of I-10 along the Varner Road Corridor, Cathedral City	Cathedral City	Notice of Preparation filed 1/28/2013	The North City Extended Specific Plan is a proposal to develop 568 acres of land featuring an estimated 235.94 acres of land	72.81	Point
105	Oak Creek Canyon Residential Project	Bundy Canyon Rd between Oak Canyon Dr and Sunset Ave, Wildomar	City of Wildomar	Project approved on 2/25/2013	A proposed subdivision of 151.23 acres into 315 lots (including a 3.5 acre commercial site - Lot L) for the development of 315 single family residential dwelling units with lot sizes ranging from 4,000 sf to 7,200 sf with private parks	118.15	Point
106	Ocotillo Sol	9 miles southwest of El Centro	SDG&E	NOI published	18 MW PV project on 115 acres	73.57	Polygon
107	Ocotillo Wind Energy Facility	5 miles west of Ocatillo	Ocotillo Express	ROW approved	115 MW wind facility located on 12,436 acres of BLM land	80.09	Polygon
108	Ogilby Solar	Chocolate Mountain	Pacific Solar Investments	Revised POD 8/26/11	1,500 MW Solar Thermal Trough	53.37	Polygon
109	Operation of New Well #17	Yucaipa	City of Yucaipa	Notice of Determination filed 1/29/2013	The South Mesa Water company proposed project included construction of Well No. 17, chlorination system, housing unit, appurtenant structures and chain link fence	107.89	Point
110	Optimus Logistics Center	Ramona Expressway and Webster Ave, Perris	City of Perris	Notice of preparation filed on 11/1/2012	The proposed project consist of a new high-cube warehouse development consisting of two buildings totaling 1.5 million square feet on two individual parcels totaling 73.76 acres separated by the new Patterson Avenue realignment	117.61	Point

OID	Project Name	Location	Ownership	Status	Project Description	Distance (mile)	Feature
112	PA08-0097 (Plot Plan), PA08-0098 (Zone Change), PA09-0022 (TPM 36207, & PA10-0017 (Code Amendment)	Fir/Eucalyptus Ave, Redlands Blvd, Moreno Valley	City of Moreno Valley	CDFW approved the project on 1/9/2013, stating the project will not have significant impacts	Streambed Alteration Agreement consisting of the construction of one 937,260-square foot warehouse distribution facility, with associated onsite parking, landscape, hardscape, screening and infrastructure improvements, and the construction of adjacent roadways	114.24	Point
113	Palo Verde Mesa Solar Project	N/W Of Blythe	Renewable Resources Group	NOP Filed	486 MW Solar	29.26	Polygon
114	Pelican 33-Acre Industrial Project	Markham St and Redlands Ave, Perris	City of Perris	Notice of Preparation filed 3/6/2013	The proposed Pelican 33-Acre Industrial Project involves the construction and operation of up to 600,000 gsf of light industrial warehouse uses	115.75	Point
115	Perris Middle School and Central Kitchen	Perris	Perris Union High School District	NOP filed, waiting for mitigated negative declaration to be filed	Construction and operation of a 95,000 sq ft middle school	115.19	Point
116	Pyrite Channel Bypass	Galena St and Pyrite St, Jurupa Valley	Riverside County Flood Control and Water Conservation	Lead agency approved the project on 11/30/2012, and will not have significant impacts	The proposed storm drain project consists of approximately 1700 lineal feet of reinforced concrete pipe that will convey minor flows from the District's existing concrete lined rectangular Jurupa Channel. Street improvements along Pyrite Street between Jurupa Road and Lone Trail will ensure that the storm drain system functions properly	131.14	Point
117	Quartzsite Solar Energy	10 miles north of Quartzsite	Solar Reserve	Draft EIS released	100MW, 653 foot tall power tower located on 1,500 acres of BLM land	57.14	Polygon

OID	Project Name	Location	Ownership	Status	Project Description	Distance (mile)	Feature
119	Ramona 49	Bridge Rd and Ramona Blvd, San Jacinto	City of San Jacinto	Lead agency approved the project on 2/11/2013, and will not have significant impacts	Second reading of Ordinance No. 12-13 for Change of Zone 1-11, adopting a zone change from the Residential Medium Density (RM) and Specific Plan (SP Getaway) Zoning Districts to the General Commercial (CG), Industrial Light (IL), Open Space (OSR), and Residential Medium High (RMH) Zoning Districts	107.34	Point
120	Ramona Creek Specific Plan (SP-12-001)	Florida Ave and Myers St, Hemut	City of Hemet	Notice of Preparation filed 2/22/2013	The Project is a Specific Plan to allow for development of the Project Site with a multiple-use commercial and residential community concentrated around open space amenities.	104.43	Point
122	Recycled Water Ponds Expansion and Optimization Project	Trumble Rd, Case Rd, Simpson Rd, Riverside	Eastern Municipal Water District	Lead agency approved the project on 3/20/2013, and will have significant impacts	EMWD is planning on the construction, operation and maintenance of additional recycled water storage facilities at its North Trumble Recycled Water Storage Ponds site.	111.50	Point
123	Recycled Water Program	River Road and the Santa Ana River	Western Riverside County Regional Wastewater Authority	Lead agency approved the project on 11/14/2012, and will have significant impacts	WRCRWA intends to provide recycled water to its member agencies for non-portable uses in accordance with the terms of its Resolution No. 97-38. The agencies utilizing the recycled water would provide for the ultimate use under their individual permits	116.90	Point

OID	Project Name	Location	Ownership	Status	Project Description	Distance (mile)	Feature
124	Rice Solar Energy Project	Rice Valley, Eastern Riverside County	Rice Solar Energy	Approved, construction date unknown at this time	150 MW solar power tower project with liquid salt storage. Project located on 1,410 acres and includes a power tower approximately 650 feet tall and 10 miles long interconnection with the WAPA Parker-Blythe transmission line	34.55	Polygon
126	Riverside County Regional Medical Center, Nursing and Allied Health Education Building Project	South of State Road 60 and East of I-215, at 26520 Cactus Avenue, Moreno Valley	Riverside County Economic Development Agency	Lead agency approved the project on 3/19/2013, and will not have significant impacts	Nursing and Allied Health Education Building (Education Building) as a three-story structure with approximately 34,749 square feet.	115.13	Point
127	RPT Centerpointe West Project	Frederick St and Cactus Ave, Moreno Valley	City of Moreno Valley	Final document filed on 11/16/2012	The proposed project consists of construction and operation of a warehouse facility with two individual warehouses of varying sizes and an expansion of an existing warehouse for a total of 1,281,000 sf on 56.2 acres	118.83	Point
128	San Gorgonio Pass Campus Master Plan	Westward Ave and Sunset Ave, Banning	Mt. San Jacinto Community College District	Draft EIR filed 1/22/2013	Buildings on the Campus are planned to total ~250,000 gross sf of laboratory, lecture, and other space including physical fitness facilities, library, and miscellaneous administrative office and support space. The total parking provided would be 2,203 spaces	99.30	Point

OID	Project Name	Location	Ownership	Status	Project Description	Distance (mile)	Feature
129	San Jacinto Master Drainage Plan Line C	Santa Fe St and Midway St, San Jacinto	Riverside County Flood Control and Water Conservation	Project approved on 4/4/2013, will not have significant impacts	The project will construct, operate and maintain Line C, Line C-5, C-4, and Line B underground storm drain facilities pursuant to the District's adopted San Jacinto Master Drainage Plan. The project includes relocation of existing utilities, repaving disturbed areas, and purchasing permanent and temporary construction easements on multiple properties	100.96	Point
130	San Jacinto Valley Master Drainage Plan and Amendment	San Jac. Riv to the N. Meridian St to the E, Florida Ave to the S, & Warren Rd to the W., San Jacinto	City of San Jacinto	Lead agency approved the project on 1/14/2013, and will have significant impacts	The project consists of the revision and consolidation of two existing and previously adopted Master Drainage Plans located in portions of the cities of San Jacinto and Hemet and unincorporated Riverside County, California.	98.96	Point
131	San Joaquin Rail Corridor 2035 Vision Project	Several counties within the San Joaquin Valley	Caltrans #7	Notice of Preparation filed on 11/13/2012	The proposed San Joaquin Rail Corridor (Corridor) Project infrastructure upgrades would generally be installed within the existing track rights-of-way, with limited rights-of-way acquisition if any, and would not change the existing land use of the rail corridor or the surrounding parcels	176.58	Line
132	Santa Ana River Bridge Seismic Retrofit	Near the intersection Wilderness and Jurupa Ave, east of Van Buren Ave, Riverside	Metropolitan Water District of Southern California	Lead agency approved the project on 3/12/2013, and will not have significant impacts	The Project proposes to provide seismic retrofit upgrades to the Santa Ana River bridge crossing to accommodate lateral displacement in the transverse direction of the bridge	130.02	Point

OID	Project Name	Location	Ownership	Status	Project Description	Distance (mile)	Feature
133	SCE Red Bluff Substation	South of I-10 at Desert Center	SCE	Approved	A proposed new 500/220 kV substation, 2 new parallel 500 kV transmission lines of about 2,500 to 3,500 feet each	5.80	Polygon
134	Sierra Bella Specific Plan/Annexation	Green River Rd beyond Calle Del Oro, Corona	City of Corona	Addendum to Specific Plan filed on 3/20/2013	Application to amend the Sierra Bella Specific Plan (SP04-001) by reducing the minimum lot size requirement for the LDR 1 (Low Density Residential, minimum lot size, 9,000 sf) and LDR 2 (Low Density Residential, minimum lot size, 14,000 sf) designation to 7,200 sf and 9,000 sf, respectively.	139.23	Point
136	Sol Orchard	Desert Center	Sol Orchard	Approved	A planned 1.5 MW fixed flat panel PV solar power plant north of I-10, east of SR-177, west of Desert Center Airport	107.01	Polygon
137	Starwood Solar 1	75 miles west of Phoenix	Lockheed Martin	Under Construction	290 MW concentrated solar power plant	119.10	Point
138	State Route 60/Potrero Boulevard New Interchange	Potrero Blvd, Beaumont	Cal Trans #8	Lead agency approved the project on 3/1/2013, and will not have significant impacts	The proposed SR-60/Potrero Blvd New Interchange project features construction of a new full access interchange and bridge overcrossing on SR-60 for Potrero Blvd	101.01	Point
139	State Route 79 Realignment Project	Domenigoni Pkwy, Hemet to Gilman Springs Rd, San Jacinto	Cal Trans #8	Draft EIR Submitted 2/8/2013	The realigned highway would be a limited access, four-lane expressway, with two travel lanes in each direction separated by a median. The alternatives evaluated in the DEIR are four Build alternatives, two Design Options, and a No Build Alternative	103.30	Point

OID	Project Name	Location	Ownership	Status	Project Description	Distance (mile)	Feature
140	State Route 91 Corridor Improvement Project	SR-91 and I-15, Anaheim, Corona, Riverside	Caltrans #8	Riverside County Transportation Commission approved the project on 11/14/2012, and will have significant impacts	The SR-91 CIP proposes capacity, operational, and safety improvements on SR-91 and I-15.	135.30	Point
141	Stratford Ranch Industrial Project	Redlands Ave and Perry St, Perris	City of Perris	Lead agency approved the project on 11/17/2012, and will have significant impacts	Development of a high-cube logistics warehouse site in two buildings totaling up to 1,725,411 square feet. Infrastructure improvements including 2.4 acres for dedication and construction of Redlands Avenue street frontage improvements. Improvements to the Perris Valley Strom Drain (PVSD) channel encompassing 45.7 net acres	115.95	Point
142	Temescal Canyon and Dawson Canyon Pipelines and Non-Potable Water Tank Project	Temescal Cyn Rd and Dawson Cyn Rd, Corona	Lee Lake Water District	Mitigated negative declaration filed on 12/19/2012	The LLWD proposes construction of a Non-Potable Water System, which includes the Temescal Canyon Pipeline, the Dawson Canyon Pipeline, and a 1.5 MG non-potable water tank in unincorporated Riverside County, CA	131.20	Point
143	Tentative Tract Numbers 30386 and 30387	California St, Bryant St, and Fremont St, Calimesa	City of Calimesa	Project approved by CDFW on 4/10/2013, will not have significant impacts	Construction of an approximate 210-unit senior housing subdivision on 72.23 acres of which 23.9 acres will remain open space.	107.11	Point

OID	Project Name	Location	Ownership	Status	Project Description	Distance (mile)	Feature
144	The Triangle Specific Plan (SP0-007-2452)	I-15, I-215, Murrieta Hot Springs Rd, Murrieta	City of Murrieta	Draft EIR Submitted 2/8/2013	The Triangle Specific Plan Project involves implementation of a mixed-use development consisting of approximately 1.77 million gsf within an open-air retail commercial district. Proposed uses include restaurant (125,258 gsf), commercial/retail (640,914 gsf), theater (74,660 gsf), office (779,082 gsf), and 220-room hotel (148,000 gsf)	113.16	Point
145	Three Residential Developments	Blythe	Various	Under Construction	3 residential development projects are under construction: River Estates at Hidden Beaches, The Chanslor Place, Mesa Bluffs. 125 single family homes are currently being built	35.53	Point
146	Trails of Eastvale Residential Development	Archibald Ave and 65th St, Eastvale	City of Eastvale	Mitigated negative declaration filed 2/4/2013	The proposed project consists of a General Plan Amendment from Light Industrial to Medium Density Residential, a Change of Zone from A-2-10 to PRD, and a Tentative Tract Map to subdivide a 50.48-acre site into 224 single family residential lots and 13.69-acres of parkland and open space	138.34	Point
147	Travertine Point Specific Plan	St. Rte 86, between 81st Ave and Coolidge Spring Rd, Riverside and Imperial County	County of Riverside	Lead agency approved the project on 1/15/2013, and will have significant impacts	The project proposes the construction of a total of 16,665 residential units and 5,029,500 square feet of non-residential development. This includes approximately 1,410 acres of TMDCI lands of which 647 acres are in Imperial County.	52.10	Point

OID	Project Name	Location	Ownership	Status	Project Description	Distance (mile)	Feature
148	Trumble Road Recycle Water Storage Expansion Project	Trumble Rd and Case Rd, Perris	Eastern Municipal Water District	Final document submitted 3/26/2013. Currently in comment period	EMWD is planning on the construction, operation and maintenance of additional recycled water storage facilities at its North Trumble Recycled Water Storage Ponds site	114.20	Point
149	Twelve Residential Developments	Blythe	Various	Approved or under construction	12 residential development projects have been approved by the Blythe Planning Department: Vista Palo Verde, Van Weelden, Sonora South, Ranchette Estates, Irvine Assets, Chanslor Village, St. Joseph's Investments, Edgewater Lane, The Chanslor Place Phase IV, Cottonwood Meadows, Palo Verde Oasis. A total of 1,005 single family residences are proposed	36.18	Point
150	Upper Valle de Los Caballos Recharge Basins	Temecula	Rancho California Water District	Lead agency approved the project on 3/14/2013, and will not have significant impacts	The project consists of infrastructure improvements to RCWD's existing Upper Valle de Los Caballos Recharge Basins	106.10	Point
151	Van Buren Commercial Center Project Site	Van Buren Blvd and Gamble Ave, Riverside	City of Riverside	Mitigated negative declaration filed on 11/20/2012	Mass grading on 4.55 acres, located at the southeast corner of Van Buren Blvd and Gamble Ave, in the Woodcrest neighborhood, City of Riverside	123.87	Point
152	Van Horn Youth Treatment & Education Center	County Farm Road and Harrison Street, Riverside	Riverside County Redevelop ment Agency	Lead agency approved the project on 3/12/2013, and will not have significant impacts	The proposed treatment and education center will be approximately 75,000 sf and comprise of a 10 bed assessment unit, a 20 bed transitional housing component, and four, 20-single cell living units (with the potential for a future 20 bed transitional housing component and a 20-single cell living unit with recreation areas for an additional 11,692 sf.	129.91	Point

OID	Project Name	Location	Ownership	Status	Project Description	Distance (mile)	Feature
153	Waite Street 1467 Zone Reservoir and Pipeline	Pointe Circle & Waite Street, Wildomar	Elsinore Valley Municipal Water District	Mitigated Negative Declaration filed 3/4/2013	The proposed Waite Street 1467 Zone Reservoir and Pipeline Project is located within the City of Wildomar in Riverside County	118.83	Point
154	Wake Rider Beach Resort	Grand Ave between Macy St and Serena, Lake Elsinore	City of Lake Elsinore	Mitigated negative declaration filed 12/13/2012	A commercial mixed use project, which consists of five buildings totaling 62,437 square feet, with associated on-site and off-site improvements, including hardscape and landscaping	124.89	Point
155	Water Reclamation Facility #2-Tertiary Filtration Project	E. Harrison St and Le Roy Dr, Corona	City of Corona	Addendum Note: Review Per Lead An EIR for the Groundwater Management Plan was adopted by the City Council of the City of Corona in 2012. The GWMP identified eight categories of management strategies and defined 25 specific management strategies for implementation of the GWMP, which are intended to facilitate a sustainable groundwater resource supply for the City. The PEIR (incorporated herein by this reference) analyzed the environmental impacts of the GWMP and imposed mitigation measures set forth in a Mitigation Monitoring and Reporting Program	The City wishes to ensure a long-term sustainable supply of groundwater resources and has therefore proposed its AB 3030-compliant Groundwater Management Plan (GWMP)	135.52	Point

OID	Project Name	Location	Ownership	Status	Project Description	Distance (mile)	Feature
156	Well Number 31 for Temescal Desalter	Buena Vista Avenue and Sixth Street, Corona	City of Corona	Project approved on 3/22/2013, and will not have significant impacts	Domestic water supply well (Well 31) to serve the City's potable water system. Well 31 will connect to the existing Temescal Desalter Well Collection Pipeline.	136.74	Point
157	Wenzlaff Elementary School Conversion	11625 West Drive, Desert Hot Springs	Palm Springs Unified School District	Review period ended 5/13/2013. No updates as of 5/17/2013	The existing buildings would be renovated and modernized to accommodate the new programs and students. Project and possibly an area for future ground-mounted solar panel integration. Other site improvements would include mechanical, electrical, and plumbing equipment and facility upgrades	77.15	Point
159	Wildomar 2014-2021 Housing Element Update and EIR	Wildomar	City of Wildomar	NOP for EIR filed, with review period ending 6/3/2013	Land use change and re-zoning of 25.96 acres of residential and business land	118.51	Point
160	Wileys Well Communication Tower	East of Wiley's Well Road just south of I-10	Riverside County	Final EIR	Expansion of Riverside County's fire and law enforcement agencies approximately 20 communication sites to provide voice and data transmission	18.86	Point
161	Wine County Infrastructure Sewer Project	Monte De Oro Road, Rancho California Road and Calle Contento Road, Temecula	Eastern Municipal Water District	Lead agency approved the project on 12/19/2012, and will not have significant impacts	45,200 lineal feet of sewer lines and two lift stations. The Wine Country Infrastructure Project would connect into EMWD's existing wastewater collection system on Butterfield Stage Road adjacent to the Roripaugh Ranch Development	108.92	Point

OID	Project Name	Location	Ownership	Status	Project Description	Distance (mile)	Feature
162	World Logistics Center Project	Redlands BLVD and Eucalyptus Ave, Moreno Valley	City of Moreno Valley	Draft EIR submitted 2/5/2013	The proposed World Logistics Center project (WLC) site covers 3,918 acres in eastern Moreno Valley. A General Plan Amendment is proposed to designate 2,635 acres for logistics warehousing including up to a maximum of 41.4 million sf of "Logistics Development" and 200,000 sf of warehousing-related uses classified as "Light Logistics"	113.14	Point
163	WR-34 Hydroelectric Power Generation Facility	Pujol Street, Temecula	Rancho California Water District	Construction expected to begin 8/15/2013, and expected to last 6 months	Construction of a hydroelectric power generation facility at the existing WR-34 Turnout Facility.	112.48	Point
164	Wyle Laboratories Inc-Norco Facility	Hillside Ave and Second St, Norco	Department of Toxic Substances Control	Negative declaration filed on 11/27/2012	DTSC is considering approval of a Draft Remedial Action Plan (RAP) to address volatile organic compounds (VOCs) in subsurface soil and groundwater at the former Wyle Laboratories site in Norco, CA	135.02	Point
165	Yuma Crude Oil Refinery	100 miles SW of Phoenix and 48 miles E of Yuma	Arizona Clean Fuels Yuma	Under review	Oil refinery on 1,400 acres	105.79	Point
166	Sol Orchard	Desert Center	Sol Orchard	Approved	A planned 1.5-MW fixed, flat-panel solar PV project north of I-10, east of SR-177, west of Desert Center Airport	107.01	Point

Executive Summary Attachment A – Table 3
Projects Submitted and On Hold

OID	Project Name	Location	Ownership	Status	Project Description	Distance (Mile)	Feature
67	Graham Pass Wind Project	Riverside County	Graham Pass Inc	Pending	175 MW Wind Project	14.60	Polygon
86	La Posa Solar Thermal	Stone Cabin, AZ	Pacific Solar Investments	Pending	2,000 MW Solar	60.04	Polygon
87	LH Renewables Riverside County Type II	Eagle Mountain, CA	LH Renewables	Pending	Unknown	17.71	Polygon
97	Mule Mountain III	Chuckwalla Valley	EnXco	Pending	200 MW Solar PV	22.04	Polygon
102	Nextlight Quartzsite	Quartzsite, AZ	Nextlight Renewable Power	Pending	50 MW CSP Trough	57.91	Polygon
111	Oro Valley Wind	Black Mountain, CA	Oro Valley Power	Pending	180 MW Wind Project	47.58	Polygon
135	Silverado Power I, II, III	West of SR-177, North of I-10	Silverado Power	On hold	3 solar PV projects with a 400 MW total capacity.	342.12	Point
158	Wildcat Quartzsite	Quartzsite, AZ	Wildcat Quartzsite Solar	Pending	800 MW CSP Tower	62.34	Polygon

Under CEQA, there are two acceptable and commonly used methodologies for establishing the cumulative impact setting or scenario: the “list approach” and the “projections approach.” The first approach would use a “list of past, present, and probable future projects producing related or cumulative impacts.” [14 Cal. Code Regs., §15130(b)(1)(A)]. The second approach is to use a “summary of projections contained in an adopted general plan or related planning document, or in a prior environmental document which has been adopted or certified, which described or evaluated regional or area wide conditions contributing to the cumulative impact.” [14 Cal. Code Regs., §15130(b)(1)(B)]. This FSA uses the “list approach” for purposes of state law to provide a tangible understanding and context for analyzing the potential cumulative effects of the proposed project.

In order to provide a basis for cumulative analysis for each discipline, this section provides information on other projects in both maps and tables. All projects used in the Cumulative Impacts Analysis for this FSA are provided in cumulative projects tables. **Executive Summary Attachment A – Figure 1,** presented at the end of this section, shows projects within 50 miles of the PSEGS site. However, within the desert region, the specific area of cumulative effect varies by resource. For this reason, each discipline has identified the geographic scope for the discipline’s analysis of cumulative impacts, which may exceed the 50-mile buffer shown in Figure 1.

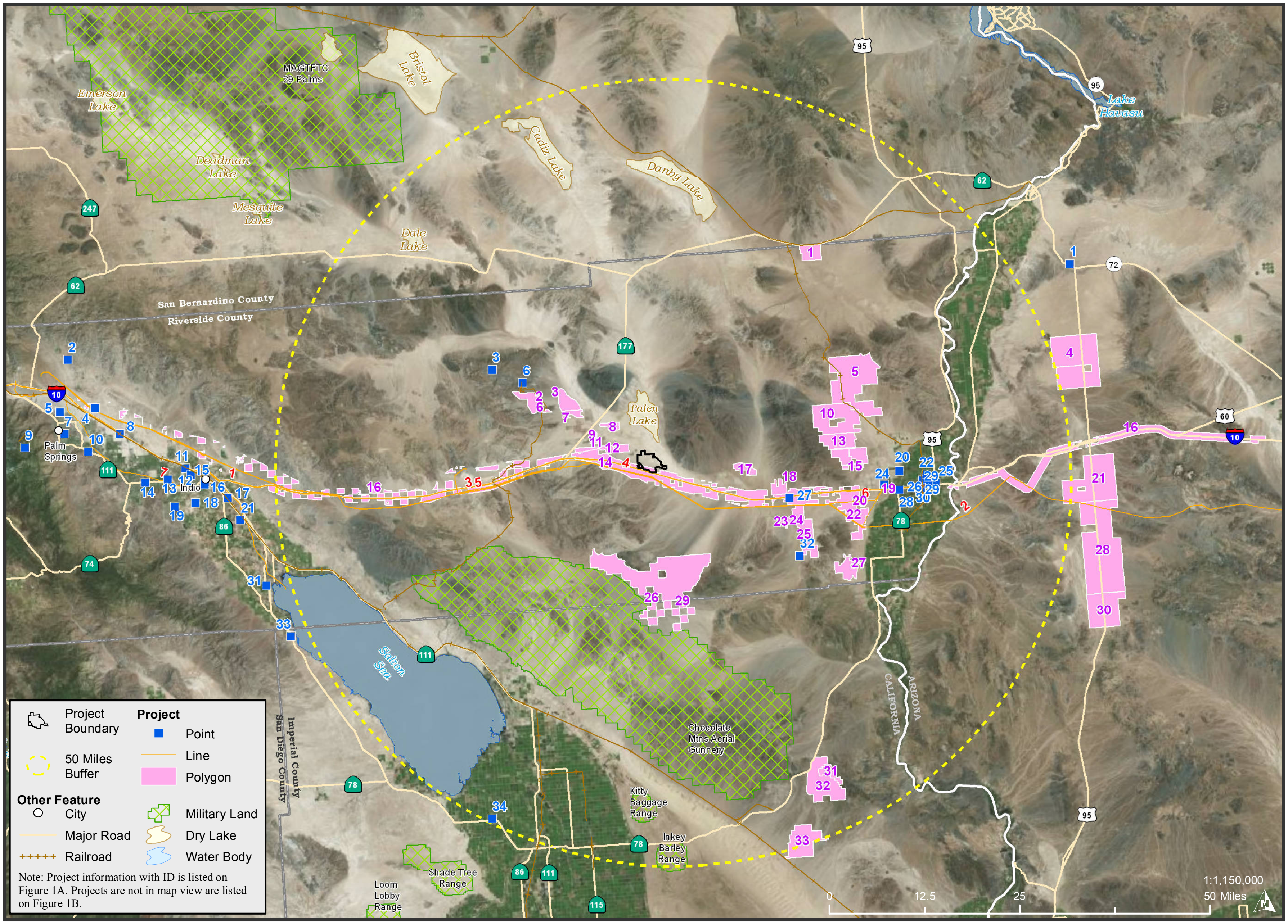
APPROACH TO CUMULATIVE IMPACT ANALYSIS

This FSA evaluates cumulative impacts within the analysis of each resource area, following these steps:

- Define the geographic scope of cumulative impact analysis for each discipline, based on the potential area within which impacts of the PSEGS could combine with those of other projects.
- Evaluate the effects of the PSEGS in combination with past and present (existing) projects within the area of geographic effect defined for each discipline.
- Evaluate the effects of the PSEGS with foreseeable future projects that occur within the area of geographic effect defined for each discipline. This section is divided into Foreseeable Future Projects and Foreseeable Renewable Projects in the California Desert for ease of the reader.

EXECUTIVE SUMMARY ATTACHMENT A - FIGURE 1

Palen Solar Electric Generating System - FSA Cumulative Impacts



CALIFORNIA ENERGY COMMISSION - SITING, TRANSMISSION AND ENVIRONMENTAL PROTECTION DIVISION

SOURCE: Microsoft Bing Aerial, BrightSource, OpenStreetMap - June 2013, Bureau of Land Management - June 2013

EXECUTIVE SUMMARY ATTACHMENT A - FIGURE 1A

Palen Solar Electric Generating System – FSA Cumulative Impacts (Projects within the map view)

POINT

LABEL ID	OID	PROJECT NAME	DISTANCE (MILE)
1	85	La Paz Solar Tower	60.63
2	157	Wenzlaff Elementary School Conversion	77.15
3	84	Kaiser Mine	23.84
4	104	North City Extended Specific Plan	72.81
5	31	College of the Desert West Valley Campus Facilities Master Plan & Phase I Project	77.33
6	48	Eagle Mountain Pumped Storage Project	19.54
7	8	Aqua Caliente Roadway and Drainage Improvements Project	76.54
8	80	Interstate 10/Monterey Avenue Interchange Improvement Project	69.30
9	5	Agua Caliente Indian Reservation	81.63
10	46	Eagle Canyon Dam and Debris Basin Project	73.35
11	79	Interstate 10/Jefferson St Interchange Improvement Project	60.63
12	59	Fred Waring Drive Improvement Project	59.94
13	76	Indian Wells Tennis Garden	63.00
14	71	Hwy 111 Beautification and Improvement Project	65.94
15	51	East County Detention Center	58.15
16	70	Green River Communication Site	58.19
17	30	Coachella General Plan Update	55.27
18	100	Music Festival Plan	59.54
19	62	General Plan Update	62.32
20	20	Blythe Solar Power Generation Station 1	32.61
21	45	District Community Education Support Complex	53.98
22	149	Twelve Residential Developments	36.18
23	32	Colorado River Substation Expansion	35.72
24	15	Blythe Energy Project	30.78
25	77	Intake Shell	37.44
26	58	Four Commercial Projects	36.48
27	160	Wileys Well Communication Tower	18.86
28	18	Blythe Mesa Solar I	32.78
29	68	Grant for LCNG Fueling Facility	35.55
30	145	Three Residential Developments	35.53
31	72	Hwy 86 Domestic Water Transmission Main Phase 2 and Pump Station	52.60
32	121	Recreational Opportunities	23.07
33	147	Travertine Point Specific Plan	52.10
34	95	Mount Signal Solar Farm #1	50.84

LINE

LABEL ID	OID	PROJECT NAME	DISTANCE (MILE)
1	78	Interstate 10	1.28
2	43	Devers-Palo Verde No. 1 Transmission Line	1.87
3	69	Green Energy Express Transmission Line Project	1.88
4	44	Devers-Palo Verde No. 2 Transmission Line Project	1.86
5	17	Blythe Energy Project Transmission Line	1.92
6	41	Desert Southwest Transmission Line	24.09
7	83	Jurisdictional Delineation and Permits for Operations and Maintenance of Whitewater River Stormwater Channel and Coachella Valley Stormwater Channel	50.63

EXECUTIVE SUMMARY ATTACHMENT A - FIGURE 1A (Continued)

POLYGON							
LABEL ID	OID	PROJECT NAME	DISTANCE (MILE)	LABEL ID	OID	PROJECT NAME	DISTANCE (MILE)
1	124	Rice Solar Energy Project	34.55	18	53	EnXco	17.21
2	87	LH Renewables Riverside County Type II	17.71	19	16	Blythe Energy Project II	30.82
3	42	Desert Sunlight Project	13.53	20	19	Blythe PV Project	27.82
4	117	Quartzsite Solar Energy	57.14	21	102	Nextlight Quartzsite	57.91
5	13	Big Maria Vista Solar Project	28.69	22	40	Desert Quartzite	27.55
6	49	Eagle Mountain Pumping Plant	15.56	23	81	Ironwood State Prison	18.81
7	38	Desert Harvest Solar Project	11.78	24	28	Chuckwalla Valley State Prison	19.95
8	39	Desert Lily Soleil Project	6.87	25	97	Mule Mountain III	22.04
9	27	Chuckwalla Valley Raceway	8.12	26	67	Graham Pass Wind Project	14.60
10	91	McCoy Soleil Project	24.96	27	113	Palo Verde Mesa Solar Project	29.26
11	36	Desert Center 50	7.95	28	86	La Posa Solar Thermal	60.04
12	26	Chuckwalla Solar I	6.40	29	93	Milpitas Wash	19.96
13	90	McCoy Solar Energy Project	24.82	30	158	Wildcat Quartzsite	62.34
14	133	SCE Red Bluff Substation	5.80	31	75	Imperial Wind	46.87
15	21	Blythe Solar Power Project	26.33	32	111	Oro Valley Wind	47.58
16	167	West-wide Section 368 Energy Corridors	0.00	33	108	Ogilby Solar	53.37
17	63	Genesis Solar Energy Project	12.47				

Note:
The distances from all the cumulative projects are calculated to the centroid of PSEGS. The distances between the line features of the cumulative projects are calculated by the shortest distance between the PSEGS centroid to the line features segments. The distances between the polygon features of the cumulative projects are calculated between the PSEGS centroid to the centroids of all the polygon features.

All distances are estimated.

EXECUTIVE SUMMARY ATTACHMENT A - FIGURE 1B

Palen Solar Electric Generating System – FSA Cumulative Impacts (Projects not in map view)

POINT							
ID	OID	PROJECT NAME	DISTANCE (MILE)	ID	OID	PROJECT NAME	DISTANCE (MILE)
1	2	6th Street/CA Avenue/Maple Ave Sewer Line Extension Project	102.53	23	60	General Plan Amendment No. 778, Change of Zone No. 7270, Tentative Tract Map No. 33248	132.27
2	3	ACI Residential Project	136.74	24	61	General Plan Update	108.42
3	4	Adoption of Rule 1406 Generation of ERCs for Paving Unpaved Public Roads	136.12	25	64	Gestamp Asetym Solar	352.62
4	6	Agua Caliente PV	110.87	26	65	Gilman Home Channel Lateral A, Stage 3 Project	96.41
5	7	Annex 114, SIA 12-001, GPA 12-004, CZ12-002 & ZTA12-002	130.06	27	66	Grading Environmental Assessment-EA42558	86.06
6	9	Beaumont Avenue Recharge Facility and Pipeline	103.16	28	73	I-215/Newport Road Interchange Improvement Project	113.00
7	10	Beaumont Distribution Center (City Project No. 12-PP-05, 12-RZ-02, and 12-GPA-01)	102.77	29	82	Joshua Palmer Realignment	101.11
8	11	Bella Linda General Plan Amendment, Zone Change/Planned Development Overlay	111.02	30	88	Longview Tank and Pipelines and Watson Booster Station and Pipelines	111.51
9	12	Belle Terre Specific Plan	108.02	31	89	March Business Center	117.59
10	22	Bundy Canyon Road and Orange Street Tentative Parcel Map No. 30522	119.02	32	94	Moreno Valley Field Station Specific Plan	115.90
11	23	Bundy Canyon/Scott Road Improvement Project	118.71	33	96	MSP for Pyrite Creek Trunk Sewer Phase II, Sky Country Trunk Sewer, and Force Main to Riverside WWTP	131.62
12	24	Cactus Avenue PUD	113.26	34	99	Murrieta Creek Phase 2	113.90
13	25	Canyon Lake Hybrid Treatment Process-Phase I	118.84	35	103	Non-Potable Water Service Expansion in the Eastern Portion of the District (DPR 3657DP)	130.69
14	29	Circulation Element General Plan Amendment	99.43	36	105	Oak Creek Canyon Residential Project	118.15
15	33	Corona Regional Medical Center Expansion	136.05	37	109	Operation of New Well #17	107.89
16	34	Crystal View Terrace/Green Orchard Place/Overlook Parkway Project	127.53	38	110	Optimus Logistics Center	117.61
17	35	Dawson Road Contractor's Storage Yard Plot Plan #2010-049	113.00	39	112	PA08-0097 (Plot Plan), PA08-0098 (Zone Change), PA09-0022 (TPM 36207, & PA10-0017 (Code Amendment)	114.24
18	52	EIR No. 512, Specific Plan No. 376 (Thoroughbred Farm)	135.45	40	114	Pelican 33-Acre Industrial Project	115.75
19	54	Expanded Gage Exchange Project	123.79	41	115	Perris Middle School and Central Kitchen	115.19
20	55	Fernando Child Care Center	131.21	42	116	Pyrite Channel Bypass	131.14
21	56	First Inland Logistics Center II	116.61	43	119	Ramona 49	107.34
22	57	Foothill Parkway Westerly Extension	138.71	44	120	Ramona Creek Specific Plan (SP-12-001)	104.43

EXECUTIVE SUMMARY ATTACHMENT A - FIGURE 1B (Continued)

POINT							
ID	**OID**	**PROJECT NAME**	**DISTANCE (MILE)**	**ID**	**OID**	**PROJECT NAME**	**DISTANCE (MILE)**
45	122	Recycled Water Ponds Expansion and Optimization Project	111.50	62	144	The Triangle Specific Plan (SP0-007-2452)	113.16
46	123	Recycled Water Program	116.90	63	146	Trails of Eastvale Residential Development	138.34
47	126	Riverside County Regional Medical Center, Nursing and Allied Health Education Building Project	115.13	64	148	Trumble Road Recycle Water Storage Expansion Project	114.20
48	127	RPT Centerpointe West Project	118.83	65	150	Upper Valle de Los Caballos Recharge Basins	106.10
49	128	San Gorgonio Pass Campus Master Plan	99.30	66	151	Van Buren Commercial Center Project Site	123.87
50	129	San Jacinto Master Drainage Plan Line C	100.96	67	152	Van Horn Youth Treatment & Education Center	129.91
51	130	San Jacinto Valley Master Drainage Plan and Amendment	98.96	68	153	Waite Street 1467 Zone Reservoir and Pipeline	118.83
52	132	Santa Ana River Bridge Seismic Retrofit	130.02	69	154	Wake Rider Beach Resort	124.89
53	134	Sierra Bella Specific Plan/Annexation	139.23	70	155	Water Reclamation Facility #2-Tertiary Filtration Project	135.52
54	135	Silverado Power I, II, III	342.12	71	156	Well Number 31 for Temescal Desalter	136.74
55	137	Starwood Solar 1	119.10	72	159	Wildomar 2014-2021 Housing Element Update and EIR	118.51
56	138	State Route 60/Potrero Boulevard New Interchange	101.01	73	161	Wine County Infrastructure Sewer Project	108.92
57	139	State Route 79 Realignment Project	103.30	74	162	World Logistics Center Project	113.14
58	140	State Route 91 Corridor Improvement Project	135.30	75	163	WR-34 Hydroelectric Power Generation Facility	112.48
59	141	Stratford Ranch Industrial Project	115.95	76	164	Wyle Laboratories Inc-Norco Facility	135.02
60	142	Temescal Canyon and Dawson Canyon Pipelines and Non-Potable Water Tank Project	131.20	77	165	Yuma Crude Oil Refinery	105.79
61	143	Tentative Tract Numbers 30386 and 30387	107.11	78	166	Sol Orchard Solar Farm Project	65.75

LINE							
ID	**OID**	**PROJECT NAME**	**DISTANCE (MILE)**	**ID**	**OID**	**PROJECT NAME**	**DISTANCE (MILE)**
1	92	Mid County Parkway Project	103.60	2	131	San Joaquin Rail Corridor 2035 Vision Project	176.58

EXECUTIVE SUMMARY ATTACHMENT A - FIGURE 1B (Continued)

POLYGON							
LABEL ID	OID	PROJECT NAME	DISTANCE (MILE)	ID	OID	PROJECT NAME	DISTANCE (MILE)
1	74	Imperial Solar Energy Center West	73.11	3	107	Ocotillo Wind Energy Facility	80.09
2	106	Ocotillo Sol	73.57	4	136	Sol Orchard	107.01

Note:
The distances from all the cumulative projects are calculated to the centroid of PSEGS. The distances between the line features of the cumulative projects are calculated by the shortest distance between the PSEGS centroid to the line features segments. The distances between the polygon features of the cumulative projects are calculated between the PSEGS centroid to the centroids of all the polygon features.

All distances are estimated.

INTRODUCTION

Testimony of Christine Stora

On December 17, 2012, Palen Solar Holdings, LLC (PSH), filed the petition with the California Energy Commission requesting to modify the Palen Solar Power Project (PSPP). The PSPP, as licensed by the Energy Commission on December 15, 2010 (Order No. 10-1215-19, the “Final Decision,” 09-AFC-7), was a 500-megawatt (MW) solar thermal power-generating facility utilizing parabolic trough technology. The PSPP encompassed approximately 4,366 acres located approximately one-quarter mile north of Interstate 10, approximately 10 miles east of Desert Center, and approximately halfway between the cities of Indio and Blythe, in Riverside County, California.

The modifications proposed in the petition include replacing the parabolic trough solar collection system with BrightSource’s solar tower technology. Heliostats—elevated mirrors guided by a tracking system mounted on a pylon—focus the sun’s rays on a solar receiver steam generator tower near the center of each solar field to create steam to drive a turbine that provides electricity.

In the petition, PSH also requested that the project name be changed from Palen Solar Power Project to Palen Solar Electric Generating System (PSEGS). In this document, the acronym, “PSPP,” refers to the approved project, and the acronym, “PSEGS,” refers to the proposed modified project.

AMENDMENT PROCESS

The purpose of the Energy Commission’s review process is to assess the impacts of the proposed PSEGS on environmental quality and public health and safety. The Energy Commission will evaluate the impacts caused by the proposed changes to the approved project and will determine if the PSEGS would remain in compliance with applicable laws, ordinances, regulations, and standards (LORS) (Title 20, Calif. Code of Regulations, section 1769).

The petition will be processed as an amendment to the PSPP Final Decision.

PURPOSE OF THIS REPORT

This Final Staff Assessment (FSA) is being published by the Energy Commission staff and is staff’s final independent analysis of the petition to amend the Palen Solar Power Project (PSPP). This FSA is a staff document. It is neither a Committee document, nor a draft Decision. The FSA describes the following:

- the proposed modified project (PSEGS);
- the updated existing environment from the original decision;
- whether the modified facilities can be constructed and operated safely and reliably in accordance with applicable LORS;
- the environmental consequences of the modified project in conjunction with other existing and known planned developments;

- the potential cumulative impacts of the modified project in conjunction with other existing and known planned developments;
- modified and/or new conditions of certification proposed by the project owner, staff, interested agencies, local organizations, tribes, and intervenors which may lessen or eliminate potential impacts of the PSEGS;
- modified and/or new conditions of certification under which the project should be construction and operated, if the modified project is certified; and,
- project alternatives.

The analyses contained in this FSA are based upon information from the: 1) Petition to Amend and Supplements to the Petition to Amend provided by the project owner, 2) responses to energy commission staff data requests, 3) supplementary information from local, state, and federal agencies, interested organizations and individuals, 4) existing documents and publications including the record from the approved PSPP, 5) independent research, 6) comments at public workshops, 7) comments received on the PSA and 8) other docketed communications. The analyses for most technical areas include discussions of proposed modifications to conditions of certification and new conditions of certification. Each condition of certification is followed by a proposed means of “verification.” All changes to conditions to certification in the original decision are shown in this document so the reader can easily identify the changes being made to the project license. Deleted text to the conditions of certification is shown as ~~strikethrough~~, new text is **bold and underlined**.

The FSA serves as staff’s testimony in evidentiary hearings to be held by the PSEGS Committee of two Commissioners who oversee this case. The Committee will hold evidentiary hearings and will consider the testimony presented by staff, the applicant, intervenors and the recommendations and comments provided by governmental agencies, tribes, and the public prior to proposing its recommended decision to the full Commission. Energy Commissioners will make a final decision on PSEGS, including findings, after the Committee’s publication of the Presiding Member’s Proposed Decision (PMPD).This FSA is intended to be a complete review of the modified project and in many cases relies on analysis that was prepared for the original PSPP. This information has been reviewed and updated to reflect current conditions and the setting that exists today. Although this document provides a full analysis of the project as a whole, this petition will be processed as an amendment to the PSPP Final Decision. Thus a Decision will only be made by the Energy Commission on the proposed changes to the existing PSPP certification.

ORGANIZATION OF THE FINAL STAFF ASSESSMENT

The sections in this FSA include an Executive Summary, Introduction, Project Description, and a Project Analysis. The Project Analysis contains an Environmental Assessment, Engineering Assessment, Alternatives and General Conditions. The Environmental Assessment contains the following chapters: 1) Air Quality (to be provided in Part C of this FSA); 2) Biological Resources; 3) Cultural Resources (to be provided in Part B of this FSA); 4) Hazardous Materials Management; 5) Land Use; 6) Noise and Vibration; 7) Public Health; 8) Socioeconomics; 9) Soil and Water Resources;

10) Traffic and Transportation; 11) Transmission Line Safety and Nuisance; 12) Visual Resources; 13) Waste Management; and 14) Worker Safety and Fire Protection. The Engineering Assessment contains the following sections: 15) Facility Design; 16) Geology and Paleontology; 17) Power Plant Efficiency; 18) Power Plant Reliability; and 19) Transmission System Engineering. The Environmental Assessment, Engineering Assessment and General Conditions are followed by a discussion of facility closure, project construction, and operation compliance monitoring plans and a list of staff that prepared this report.

All of the sections under the Environmental Assessment, Engineering Assessment, and the General Conditions sections include a discussion of: laws, ordinances, regulations and standards (LORS); the regional and site-specific setting; the modified project direct and cumulative impacts; proposed mitigation measures; conclusions and recommendations; and modified and/or new conditions of certification for both construction and operation (if applicable).

Part B (Cultural Resources) of the FSA is anticipated to be published the week of September 16th.

Part C (Air Quality) of the FSA will be published 30 days after staff receives the Preliminary Determination of Compliance (PDOC) from the South Coast Air Quality Management District (SCAQMD). Currently, staff has not received this permit.

AGENCY AUTHORITIES, RESPONSIBILITIES, AND COORDINATION

The Energy Commission has the exclusive authority to certify the construction, , operation and modification of thermal electric power plants 50 megawatts (MW) or larger within California. The Energy Commission certification is in lieu of any permit required by state, regional, or local agencies and by federal agencies to the extent permitted by federal law (Pub. Resources Code, § 25500 et. seq.). The Energy Commission must evaluate the impacts caused by the proposed changes to the approved project and will determine if the PSEGS would remain in compliance with applicable laws, ordinances, regulations, and standards (LORS) (Title 20, Calif. Code of Regulations, section 1769). However, the Energy Commission typically seeks comments from and works closely with other regulatory agencies that administer LORS that are applicable to the proposed project. The following paragraphs describe the agency coordination that has occurred throughout this amendment process.

Staff had multiple meetings with Native American Tribes, and staff coordinated with a number of other agencies including but not limited to U.S. National Park Service, U.S. Department of Defense, Caltrans, California Department of Public Health, California Department of Resources Recycling and Recovery (CalRecycle), California Division of Occupational Safety and Health (Cal-OHSA), California Office of Environmental Health Hazard Assessment (OEHHA), Colorado River Basin Regional Water Quality Control, South Coast Air Quality Management District, Riverside County, Riverside County Fire Department, Riverside County Sheriff’s Department, Riverside County Airport Land Use Commission, and the San Bernardino and Riverside Counties Building and Construction Trades Council. Additional information regarding tribal consultation and agency coordination is provided in the technical sections of this FSA.

U.S. BUREAU OF LAND MANAGEMENT (BLM)

The PSEGS is proposed to be located entirely on land managed by the Bureau of Land Management (BLM) and will require a Right of Way grant from BLM in addition to the certification from the Energy Commission. During the original PSPP proceeding in 2009 and 2010, Energy Commission staff and BLM staff worked closely together on the review and analysis of the project. The Energy Commission and BLM staff issued a joint Draft Environmental Impact Statement/Staff Assessment (DEIS/SA) for the Palen Solar Project on March 18, 2010. The DEIS/SA contained the Energy Commission staff's and BLM's environmental, public health and engineering evaluation of the proposed Palen Solar Project. On May 13, 2011, the BLM Published a Notice Of Availability (NOA) of the Final EIS for the Palen Solar Project in the Federal Register.

During the original licensing case, both the Energy Commission and BLM determined that they would develop and publish separate final documents. The Energy Commission released a Presiding Member's Proposed Decision on November 12, 2010 and approved the Application for Certification on December 15, 2010. BLM never made a final decision on the project and neither a Record of Decision (ROD) nor a Right of Way (ROW) grant was issued.

The BLM issued the PSEGS Plan Amendment/Draft Supplemental Environmental Impact Statement on July 27, 2013. If the project is approved by the BLM, the BLM will issue a ROD and ROW grant for the PSEGS.

Although the Energy Commission and BLM are not publishing a joint document, the Energy Commission and the BLM continue to share staff expertise, information and documentation to promote intergovernmental coordination at the local, state, and federal levels.

U.S. FISH AND WILDLIFE SERVICE (USFWS)

The U.S. Fish and Wildlife Service (USFWS) has jurisdiction to protect threatened and endangered species under the Endangered Species Act (ESA) [16 U.S.C. § 1531 et seq.] and the Migratory Bird Treaty Act [16 U.S.C. §§ 703-712]. Formal consultation with the USFWS under Section 7 of the ESA is required for any federal action that may adversely affect a federally-listed species. This consultation will be initiated through a request by the lead federal Agency – BLM – to initiate formal consultation and the submittal of a Biological Assessment (BA) which determines that the proposed project is likely to adversely affect a listed species. The BLM has received a biological opinion (BO) for the original PSPP project; however, the USFWS has requested that the BLM re-initiate consultation to address changes to the project design and footprint. The BLM has submitted a revised BA addressing these changes and has included the Yuma clapper rail, a federally listed bird that may be adversely affected by the project. Following review of the BA, the USFWS is expected to issue a Revised BO for the modified project, which will specify reasonable and prudent measures which must be implemented for the desert tortoise and Yuma clapper rail. The BLM will not issue a ROD until the final BO is issued; and therefore, the project owner may begin work on the site only after the BO is issued. Permit issuance may occur after the final Energy Commission Decision is released, however, all terms and conditions of the BO are to be incorporated by the project owner, pursuant to Condition of Certification BIO-7.

THE CALIFORNIA DEPARTMENT OF FISH AND WILDLIFE (CDFW)

The California Department of Fish and Wildlife (CDFW) has the authority to protect water resources of the State through regulation of modifications to streambeds. (Fish and Game Code, Section 1602). The Energy Commission, BLM, and the project owner have provided information to CDFW to assist in their determination of the impacts to streambeds, and their identification of permit and mitigation requirements. The project owner previously filed a Streambed Alteration Agreement with CDFW for the original PSPP project. The project owner has agreed to undertake surveys of the gas pipeline and transmission line alignments, and provide the CDFW an updated Application for Streambed Alteration Agreement for the modified project. The requirements of the Streambed Alteration Agreement will be included as a recommended Condition of Certification/Mitigation Measure.

CDFW also has the authority to regulate potential impacts to species that are protected under the California Endangered Species Act (CESA) [Fish and Game Code Sections 2050-2116]. The Energy Commission certification is in-lieu of streambed alteration agreement and incidental take permits for state-listed species usually granted by CDFW, and its Decision will incorporate the recommendations of the CDFW.

ENERGY COMMISSION'S PUBLIC ADVISER'S OFFICE

The Public Adviser advises the public on how to participate in the Energy Commission process, but does not represent members of the public. A representative of the Public Adviser's Office attended and presented information at the February 20, 2013 Informational Hearing and Site Visit. A representative also attended the workshops held on April 17, 2013, May 1, 2013, July 17, 2013, July 22, 2013, July 25, 2013 and July 26, 2013, and the Tribal Consultation Meeting held on March 22, 2013.

COMMENTS

Written comments received during the amendment process are addressed in the FSA in the technical sections they apply to. Below is a table summarizing the comments that were received during the PSA comment period.

Table 1- Agency, Intervenor, and Public Comments for PSEGS

Palen Solar Electric Generating System 09-AFC-7C																							
DATE	**DOCUMENT**	**Air Quality**	**Alternatives**	**Biological Resources**	**Cultural Resources**	**Efficiency**	**Facility Design**	**Geology and Paleontology**	**Hazardous Materials**	**Land Use**	**Noise and Vibration**	**Public Health**	**Reliability**	**Socioeconomics**	**Soil and Water Resources**	**Suggestions/Requests**	**Support of the Project**	**Traffic and Transportation**	**Trans Line Safety & Nuisance**	**Transmission System Design**	**Visual Resources**	**Waste Management**	**Worker Safety & Fire Protection**
1/21/2013	La Cuna de Aztlan Sacred Dites Protection Circle's Opposition to the Petition to amend for Palen Solar			X	X																		
2/6/2013	County of Riverside's Comment Letter																						X
3/15/2013	La Cuna de Aztlan Sacred Dites Protection Circle's Opposition to the Petition to amend for Palen Solar				X																		
3/26/2013	Agua Caliente Band Cahuilla Indians Letter re Invitation to Participate in CEC Tribal Consultation				X																		
3/29/2013	Center for Biological Diversity's Status Report		X	X	X											X							
3/29/2013	Basin and Range Watch Status Report No. 1			X																			
4/11/2013	Soboba Band of Luiseno Indians Cultural Resources Department Letter of Requests				X																		
4/24/2013	Veena Doijido - Public Comment			X						X					X								
5/1/2013	Email from Kevin Emmerich of Basin and Range Watch	X										X											
5/8/2013	Center for Biological Diversity's Second Status Report			X	X																		
5/8/2013	Intervenor Basin and Ranch Watch's Status Report Number Two	X	X	X								X									X		

Palen Solar Electric Generating System 09-AFC-7C																							
DATE	**DOCUMENT**	**Air Quality**	**Alternatives**	**Biological Resources**	**Cultural Resources**	**Efficiency**	**Facility Design**	**Geology and Paleontology**	**Hazardous Materials**	**Land Use**	**Noise and Vibration**	**Public Health**	**Reliability**	**Socioeconomics**	**Soil and Water Resources**	**Suggestions/Requests**	**Support of the Project**	**Traffic and Transportation**	**Trans Line Safety & Nuisance**	**Transmission System Design**	**Visual Resources**	**Waste Management**	**Worker Safety & Fire Protection**
5/21/2013	Center for Biological Diversity Status Report			X																			
7/1/2013	Park Ewing - Public Comment			X																			
7/11/2013	PSH's Initial Comments on PSA														X								
7/13/2013	USFWS Email, and sent from Palm Springs Fish and Wildlife Office			X																			
7/25/2013	Shaun Gonzales - Public Comment			X														X			X		
7/26/2013	Kenneth B. Waxlax - Public Comment				X												X						
7/29/2013	Center for Biological Diversity - Comments on Palen PSA			X											X								
7/29/2013	Colorado River Board of California- Comment on PSA			X											X								
7/29/2013	Tourism Ecnomics Commission/Morongo Basin Conservation Association	X		X										X									
7/29/2013	Colorado River Indian Tribes - Comments on PSA			X	X																X		
7/29/2013	Palen Solar Holdings Final Comments on the PSA	X		X	X				X						X			X					X
7/29/2013	Basin and Range Watch Comments on PSA		X	X	X			X													X		
7/30/2013	PSH's Supplemental Comments on the 07/26/13 Version of Condition of Certification BIO-17			X																			
7/30/2013	County of Riverside Comments on PSA			X	X				X	X				X				X			X	X	X

Palen Solar Electric Generating System 09-AFC-7C																							
DATE	**DOCUMENT**	**Air Quality**	**Alternatives**	**Biological Resources**	**Cultural Resources**	**Efficiency**	**Facility Design**	**Geology and Paleontology**	**Hazardous Materials**	**Land Use**	**Noise and Vibration**	**Public Health**	**Reliability**	**Socioeconomics**	**Soil and Water Resources**	**Suggestions/Requests**	**Support of the Project**	**Traffic and Transportation**	**Trans Line Safety & Nuisance**	**Transmission System Design**	**Visual Resources**	**Waste Management**	**Worker Safety & Fire Protection**
8/2/2013	Airport Land Use Commission's Comment on PSA																	X					
8/16/2013	County of Riverside Comments on Fire and Emergency Risk Assessment																						X
8/26/2013	Riverside County Waste Management Department																					X	
TOTALS		5	3	8	1	0	0	1	2	2	0	2	0	2	5	1	1	4	0	0	5	2	3

REFERENCES

CEC 2010b – California Energy Commission/A. Solomon (TN 58252). Revised Staff Assessment Part 1, dated September 1, 2010. Submitted to CEC/Docket Unit on September 1, 2010

CEC 2010c – California Energy Commission/A. Solomon (TN 58497). Revised Staff Assessment Part II, dated September 16, 2010. Submitted to CEC/Docket Unit September 16, 2010

CEC 2013a – California Energy Commission/C. Stora (TN 69756). CEC Staff's Data Request No. 1-18, dated March 1, 2013. Submitted to Applicant/Galati Blek LLP, Scott Galati on March 1, 2013

CEC 2013b – California Energy Commission/C. Stora (TN 70214). Status Update No. 1, dated April 4, 2013. Submitted to CEC/K. Douglas, D. Hochschild, R. Renaud on April 4, 2013

CEC 2013c – California Energy Commission/C. Stora (TN 70404). Data Request Set 2 (Nos. 19-39), dated April 19, 2013. Submitted to Scott Galati on April 19, 2013

CEC 2013d- California Energy Commission/C. Stora (TN 70824). Data Request Set 3 (Nos. 40-39), dated May 15, 2013. Submitted to Scott Galati on May 15, 2013

CEC 2013e – California Energy Commission/C. Stora (TN 70827). Status Update No. 2, dated May 15, 2013. Submitted to CEC/K. Douglas, D. Hochschild, Kenneth Celli on May 15, 2013

Palen 2012a – Palen Solar Holdings, LLC/Galati Blek, Scott Galati (TN 68910). Palen Solar Holdings LLC's Petition for Amendment, dated December 17, 2012. Submitted to CEC/C. Stora on December 18, 2012

PROJECT DESCRIPTION

Testimony of Christine Stora

PROJECT LOCATION

The project site is located approximately ¼ mile north of Interstate 10, approximately ten miles east of Desert Center and approximately halfway between the cities of Indio and Blythe, in Riverside County, California (See **Project Description Figure 1**). The Palen Solar Electric Generating System (PSEGS) would be in the same location as the Palen Solar Power Project (PSPP), but is reduced in size to approximately 3,794 acres, entirely on public land managed by the Bureau of Land Management (BLM) (Right-of-Way No. CACA-048810).

APPROVED PROJECT DESCRIPTION AND PROPOSED MODIFICATIONS

PALEN SOLAR POWER PROJECT APPROVED BY THE ENERGY COMMISSION ON DECEMBER 15, 2010

The 2010 Final Decision for the PSPP approved a solar thermal generating facility that would consist of two separate units of a 250-MW solar parabolic trough technology, with a total nominal capacity of 500 MW. With this technology, arrays of parabolic mirrors focus the sunlight on a receiver tube to create and collect heat energy. The receiver tube is located at the focal point of the trough's parabola. A heat transfer fluid (HTF) is heated to 750°F as it circulates through the receiver tubes. The HTF is then piped through a series of heat exchangers to generate high pressure steam. The steam is then fed to a traditional steam turbine generator where electricity is produced. Individual components of the PSPP included:

- Graded Solar Field & Power Block #1 (east);
- Graded Solar Field & Power Block #2 (west);
- Access road from Corn Springs Road;
- Warehouse/maintenance building, assembly hall, and laydown area;
- Telecommunications lines;
- Liquified petroleum gas (LPG) tank;
- Concrete batch plant;
- Fuel depot;
- On-site transmission facilities, including central internal switchyard;
- Single-circuit, 230-kV transmission line interconnecting to Southern California Edison's (SCE) Red Bluff Substation;
- Groundwater wells used for water supply;
- Four evaporation ponds for wastewater;

- Septic systems for sanitary wastewater; and
- Land treatment plots for remediating spills of Therminol HTF.

During the Energy Commission’s licensing process, technical staff concluded that the PSPP as originally proposed would result in unmitigable significant adverse impacts to biological resources associated with sand transport interference. Two other site configuration alternatives were submitted by the original applicant in an effort to accommodate staff’s and other biological agencies’ concerns. The alternative configurations (Reconfigured Alternatives 2 and 3) moved the project facilities westerly in order to prevent the project footprint from interfering with the area with the greatest sand transport potential. Reconfigured Alternative 2 incorporated into the project boundary 240 acres of private land near the southeast corner of the site, over which the PSPP owner did not have control. Reconfigured Alternative 3 did not incorporate private land. Because of the lack of ownership of the private land used in Reconfigured Alternative 2, the Energy Commission approved use of either Reconfigured Alternative 2 or Reconfigured Alternative 3. (See **Project Description Figures 2 and 3**)

PROPOSED MODIFICATIONS

The PSEGS proposal includes replacing the parabolic trough solar collection system and associated HTF with solar tower technology. The solar tower technology would create steam to run an electricity generator by using a field of 85,000 elevated mirrors known as heliostats—each approximately 12 feet tall, mounted on pylons and guided by a sun-tracking system to focus the sun’s rays on a solar receiver steam generator (SRSG) on top of a 750-foot solar tower located near the center of each solar field. Access to the site would be the same as the PPSP with an access road from Corn Springs Road. The project would continue to interconnect to the regional transmission grid at SCE’s Red Bluff Substation, which is currently under construction. The PSEGS would be comprised of two adjacent solar fields and associated facilities with a total combined nominal output of approximately 500 MW. PSH proposes to develop the PSEGS in two operational units, each consisting of one solar field, one tower, and a power block capable of producing approximately 250 MW of electricity. (See Project Description Figures 4, 5, 6, and 7).

Two natural gas-fired auxiliary boilers are proposed for each power block, for a total of four at the project. A startup boiler would be used during the morning startup cycle to assist the power generation equipment to reach operating temperature more quickly and for augmenting the solar operation when solar energy diminishes or during transient cloudy conditions. Each solar field also includes a night preservation boiler to provide steam to the gland systems of the steam turbine and boiler feedwater pump turbine to prevent air ingress overnight and during other shutdown periods when steam is not available from the SRSG. This boiler would also provide pegging steam to the generator during these shutdowns.

The two units would share common facilities, including an on-site switchyard, a single-circuit, 230-kV generation tie-line, and a common area containing an administration building, warehouse, evaporation ponds, maintenance complex, and a meter/valve station for incoming natural gas service to the site. Other on-site facilities would include access and maintenance roads (either dirt, gravel, or paved), perimeter fencing, tortoise fencing, and other ancillary security facilities.

The PSEGS footprint is smaller by 572 acres than the original footprint of the PSPP. While the PSPP included the use of a private parcel (of approximately 40 acres) located in the northeast portion of the site, the PSEGS would not include any development within this private parcel. The PSPP also had Energy Commission approval to develop the private parcels (approximately 240 acres) located in the southeastern portion of the site, if the project owner acquired the parcels. The PSEGS owner would not develop these private parcels.

The primary modifications to the PSPP are as follows:

- Two 250-MW power-generating units, each consisting of a dedicated field of approximately 85,000 heliostats, a 750-foot solar tower and receiver, and a power block;
- An approximately 15-acre common facilities area located in the southwestern corner of the site, with an administrative/warehouse building and two 2-acre evaporation ponds (reduced from four 2-acre evaporation ponds for the PSPP);
- An approximately 203-acre temporary construction laydown area located in the southwestern portion of the site immediately north of the common facilities area;
- Re-routing of the generation tie-line near the western end of the route and around the newly constructed Red Bluff Substation. The purpose of this re-routing is to align the PSEGS generation tie-line route immediately adjacent to the NextEra Desert Sunlight generation tie-line to minimize crossings over Interstate 10 and to ensure easy entry into the Red Bluff Substation nearest the PSEGS breaker position;
- Removal of the secondary emergency access road and the addition of two secondary access gates for emergency vehicles to enter the site;
- Re-routing of the redundant telecommunication line along the generation tie-line route;
- Natural gas delivery from a new extension of the existing Southern California Gas (SoCal Gas) distribution system to the project boundary;
- Reduction of the project footprint from 4,366 acres to 3,794 acres;
- Reduction of the amount of grading by 4.3 million cubic yards because the heliostat technology does not require an entirely flat surface;
- Reduction of the amount of water used by 99 acre-feet per year (AFY); and
- An increase in NOx emissions from the use of the auxiliary boilers.

COMMON FACILITIES AREA

A 15-acre common facilities area would be established on the southwestern corner of the site to accommodate an administration, warehouse, and maintenance complex; and an asphalt-paved visitor and employee parking area. The common facilities area also includes two 2-acre evaporation ponds. The administration complex would be served by power from the local 12.47-kV distribution system and by water from wells located in the common facilities area. The common facilities area would also be used for a temporary construction laydown area.

ACCESS ROADS AND DRIVE ZONES

Primary access to the site during both construction and operation would be a new 1,350-foot-long, 24-foot-wide, paved road entering from Corn Springs Road. The access road would be constructed from a point just north of the I-10 Corn Springs Road entrance/exit ramps east to the project site entrance, as described in the Final Decision. This road would include a 12-foot-wide, gravel-surfaced shoulder for truck staging, to preclude traffic interferences.

The PSEGS would contain internal roadway and utility corridors for each power-generating unit (comprised of the heliostat field, solar tower, and power block). Each unit would be accessible from a 20-foot-wide, paved or hardscaped access road running from the entrance of the PSEGS site to the power blocks, and then around the power block.

In addition to the paved or hardscaped access road to the power block of each unit, 12-foot-wide, unpaved roads would radiate out from each power block to provide access through the heliostat fields to a 12-foot-wide, unpaved perimeter road, running 5 feet inside of and parallel to the boundary fence. PSEGS personnel would use this road to monitor and maintain perimeter security and tortoise exclusion fencing. This road would be grubbed, bladed, and smoothed to facilitate safe use, with minimal grading where necessary to cross washes. Within each heliostat field, 10-foot-wide, dirt roads would be located concentrically around the power block to provide access to the heliostat mirrors for maintenance and cleaning. These concentric roads would be approximately 152 feet apart and would be grubbed to remove vegetation and smoothed.

LIGHTING

The lighting system would provide personnel with illumination for operation under normal conditions, for egress under emergency conditions, and emergency lighting to perform manual operations during an outage of the normal power source. The system also would provide 120-volt AC convenience outlets for portable lamps and tools. Exterior light fixtures would utilize technologies to reduce light pollution.

TEMPORARY CONSTRUCTION LAYDOWN AREA

The 203-acre temporary construction laydown area on the west side of the site would be used for equipment laydown, construction parking, construction trailers, a tire cleaning station, heliostat assembly, a temporary concrete batch plant, and other construction support facilities. The surface areas within the temporary construction area that are used frequently would be stabilized with a layer of crushed stone in areas subject to heavy daily traffic.

PROCESS DESCRIPTION

In each plant, one Rankine-cycle steam turbine would receive steam from the SRSG to generate electricity. The solar field and power generation equipment would start each morning after sunrise and would shut down (unless augmented by the auxiliary boiler) when insolation drops below the level required to keep the turbine on-line. Each plant would have two natural gas-fired auxiliary boilers that could also be used to extend daily power generation. However, on an annual basis, the natural gas used as a supplement to power generation would be limited to below 2 percent of the annual energy output of the PSEGS.

Each plant would use an air-cooled condenser (ACC) for the main steam cycle. A wet surface air cooler (WSAC) would be used for auxiliary equipment cooling. Raw water would be drawn daily from on-site wells located in each power block and in the common area adjacent to the administration building. Groundwater would be treated in on-site treatment systems and would be used for mirror washing, WSAC makeup, and process water makeup.

Each of the power blocks would be connected via underground electrical cables to the on-site switchyard in the northern area of the site. Each power block would also have a gas metering set. Permanent parking areas would be provided at each power block for operations and maintenance personnel.

POWER CYCLE

Solar energy is reflected by the heliostats onto the SRSG where the energy heats water into superheated steam. The steam is then routed to the steam turbine generator (STG) where the energy in the steam is converted to electrical energy.

Following expansion through the steam turbine, exhaust steam is directed to the air-cooled condenser. The ACC blows ambient air across a heat transfer surface area to cool and condense the steam. The condensed steam is collected in a condensate tank and returned to the SRSG via a series of feedwater heaters and pumps.

SOLAR FIELD

Each of the heliostat assemblies is composed of two mirrors, each approximately 12 feet high by 8.5 feet wide, with a total reflecting surface of 204.7 square feet. Each heliostat assembly is mounted on a single pylon along with a computer-programmed aiming-control system that directs the motion of the heliostat to track the movement of the sun. Pylon height may vary due to specific site conditions, but they are generally

6.23 feet tall. Communication between the heliostats and the operations center would be done via surface-mounted anchored cable or a wireless remote system.

GENERATING UNITS

The following in a condensate tank and provided to the feedwater circuit through a condensate pump. The ACC normally operates at a pressure of 3.25 inches of mercury absolute (approximately 1.6 psia).

NATURAL GAS BOILERS

Each unit would include two natural gas-fired boilers to assist with daily startup of the power generation equipment and to preserve energy in the steam cycle overnight. Each unit would contain the following boiler equipment:

- One 249-MMBtu/hr[1] packaged natural gas-fired auxiliary boiler for startup and cycle augmentation, capable of producing 185,000 pounds per hour (lb/hr) at 770°F and 650 psia;
- One 10-MMBtu/hr natural gas-fired, “night preservation” boiler to maintain system temperatures overnight, capable of producing 10,000 lb/hr at 500°F and 175 psia.

MAJOR ELECTRICAL EQUIPMENT AND SYSTEMS

The bulk of the electric power produced by the facility would be transmitted to the grid. Approximately 22 MW of electric power would be used on-site to power auxiliaries such as the ACC, pumps and fans, control systems, and general facility loads, including lighting, heating, and air conditioning. Some power would also be converted from alternating current (AC) to direct current (DC) and stored in batteries, which would be used as backup power for the plant control systems and essential uses. Emergency power would be provided by two diesel generator sets (one in each power block), each with 2,500-kW output capacity and one diesel generator set in the common area (with a 250-kW output capacity).

MIRROR WASHING

The majority of mirror washing activities are planned to be performed at night, with a small minority of the washing activities to be performed in the daytime during plant operation. Mirror washing will be performed by a mobile mirror washing machine. The mirror washing machine will travel along the ring roads and, in a stationary position, use a remote boom to access all heliostats within a 100-foot radius of its location.

When mirrors are washing during the daytime, the heliostats will be constrained in one of two ways:

1) Directional Orientation – Heliostats will be limited in terms of direction so that all heliostats remain facing, generally, toward the tower (and not toward the boundary of the project).

[1] = Million Metric British thermal units per hour

2) Elevation - Depending on its range and relative direction from the washing machine, each heliostat will be limited to a vertical position (like in sleep orientation) or a horizontal (wind stow) position.

NATURAL GAS SUPPLY

The PSPP did not include a natural gas supply pipeline, but rather was approved to use LPG for its auxiliary fuel. The PSEGS would use natural gas to fire its auxiliary and nighttime preservation boilers. The natural gas supply for PSEGS would be provided by SoCal Gas via a new pipeline that would extend southward from the site and interconnect with an existing SoCal Gas transmission pipeline located just south of I-10. The new gas pipeline, approximately 8 inches in diameter and 2,956 feet long, would be constructed within a previously-surveyed corridor as shown on applicant’s Figure 2.1-6, dated and docketed on March 15, 2013. SoCal Gas would construct, own, and operate the new gas pipeline as part of its extensive gas supply system.

WATER SUPPLY AND USE

Primary water uses consist of replacing boiler blowdown, providing supplemental cooling for plant auxiliary systems, and water for washing the heliostats to ensure they function at full performance. The Final Decision allowed the PSPP to use up to 1,917 AFY of water, from up to 10 groundwater wells, during construction (for a total of 5,750 acre-feet during the 39-month-long construction period) and 300 AFY during operation. The PSEGS would utilize the same number of groundwater wells, but would only use up to 400 acre-feet during construction (for a total of 1,130 acre-feet during the construction period) and up to 201 AFY during operation. The well water would be used for process make-up, mirror washing, and domestic uses.

Each unit would have a raw water tank with a capacity of 800,000 gallons. A portion of the raw water (200,000 gallons) is for plant use, while the majority would be reserved for fire water. The common area would also contain a combined service water/firewater tank with a capacity of 480,000 gallons. The water treatment plant would operate continuously in order to minimize water treatment system size and capital cost.

WATER REQUIREMENTS

A breakdown of the estimated average daily quantity of water required for PSEGS operation is presented in **Project Description Table 1**. The daily water requirements shown are estimated quantities based on PSEGS operating at full load.

Project Description Table 1
Average Daily Water Requirements (Both Units)

Use	Average Daily Use*		Annual Average Use
	gpm	gpd	AFY
Process Uses	63	90,873	102
Mirror Washing	44	63,408	71
Potable Water	2.1	2,995	3.4
Dust Suppression	15	21,802	24.4
Total	124	179,078	201

*Average Daily Use is based on annual operating hours of 3,500 hours/year
gpd = gallons per day
gpm = gallons per minute
AFY = acre-feet per year

PLANT COOLING SYSTEMS

The cycle heat rejection system for the main steam cycle would consist of an ACC system. The heat rejection system would receive exhaust steam from the low-pressure section of the steam turbine and feedwater heaters and condense it back to water for reuse. The condenser would remove heat from the condensing steam up to a maximum of 1,140 MMBtu/hr, depending on ambient temperature and plant load.

A WSAC would cool the generator, steam turbine generator lubrication oil, boiler feed pump lubricating oil, SRSG circulating water pumps, and other equipment requiring cooling. The WSAC would use reverse osmosis (RO) brine mixed with filtered well water for cooling. A 40 percent propylene glycol/60 percent demineralized water mixture would be used in the closed cooling water loop to provide freeze protection.

WASTE MANAGEMENT

Waste management is the process whereby all wastes produced at the project site are properly collected, treated (if necessary), and disposed of. Project wastes would consist primarily of non-hazardous solid and liquid wastes, with lesser amounts of hazardous wastes and universal wastes. The non-hazardous solid wastes would be construction and office wastes, as well as solid wastes from the water treatment system. The non-hazardous solid wastes would be trucked to a nearby Class II or III landfill. Non-hazardous liquid wastes would consist primarily of domestic sewage and wastewater streams such as RO system reject water, boiler blowdown, and auxiliary cooling tower blowdown. A septic tank and leach field system would be installed to manage domestic sewage. All other waste streams would be either recycled or sent to the evaporation ponds.

FIRE PROTECTION

The fire protection system would be designed in accordance with applicable regulations, standards and codes to protect personnel and limit property loss and plant downtime in the event of a fire. The primary source of fire protection water would be the service/firewater storage tank located at each power block and the firewater storage tank in the common area. An electric jockey pump and electric motor-driven main fire pump would be provided for the common area and for each power block to maintain the water pressure in the fire main at the level required to serve all fire-fighting systems. In addition, a back-up, 204-hp, diesel engine-driven fire pump would be provided for the common area and each power block to pressurize the fire loop if the power supply to the electric motor-driven main fire pump fails. A fire pump controller would be provided for each fire pump.

The fire pumps would discharge to a dedicated underground firewater loop piping system. Normally, the jockey pumps would maintain pressure in the firewater loop. Both the fire hydrants and the fixed-suppression systems would be supplied from the firewater loop. Fixed fire suppression systems would be installed at determined fire-risk areas, such as the transformers and turbine lube oil equipment. Sprinkler systems would also be installed in the administration complex buildings and fire pump enclosure as required by National Fire Protection Association (NFPA) and local code requirements. Handheld fire extinguishers of the appropriate size and rating would be located in accordance with NFPA 850 throughout the power block and common area. Generator step-up transformers and other oil-filled transformers would be contained and provided with a deluge system. On-site personnel would be trained in the use of fire protection equipment and would be the first responders to an incident.

The PSEGS is located such that it would fall under the jurisdiction of the Indio Office of the Riverside County Fire Department. Based on the requirements of Riverside County Ordinance No. 787.1, the piping system supplying the fire hydrants must be sized to convey a potential firewater flowrate of 5,000 gpm. Minimum firewater storage volume in each power block would be 600,000 gallons. Firewater would be supplied from a combined service water/firewater storage tank located at each power block. One electric primary and one diesel-fueled backup firewater pump, each with a capacity of 5,000 gpm, would deliver water to the fire protection piping network. Fire protection for the solar fields is not required since no combustible materials would be present in the solar field areas.

The common area fire protection system would be sized to comply with LORS and would consist of one electric primary pump and one diesel-fueled backup firewater pump. Firewater would be supplied from the combined service water/firewater storage tank with a storage volume of 480,000 gallons.

SUMMARY OF CONSTRUCTION ACTIVITIES AND METHODS OF THE PSEGS

The PSEGS would have an average construction workforce of 998 and a peak workforce of approximately 2,311. Construction is expected to take a little over two years. The PSEGS would require much less grading than the PSPP because the heliostat technology does not require an entirely flat surface.

The site fence will be installed concurrently with the desert tortoise's survey process. Project construction would commence with the building of site roads and the installation of temporary construction facilities, including office trailers, parking areas, material laydown areas, a concrete batch plant, and a heliostat assembly facility. The construction of each generating unit would begin with grading and construction of earthen berms around the power block areas to divert storm water, followed by the excavation and placement of foundations and other underground facilities. Superstructures and equipment would then be placed on the foundations. Major items include the 750-foot-tall solar power tower and SRSG, the STG pedestal and STG, and the ACC. Once the mechanical equipment is in place, construction would continue with the installation of the piping, electrical equipment, and cables necessary to connect and power the equipment. Upon completion of construction, the checkout, testing, startup, and commissioning of the various plant systems would begin, resulting in a fully operational generating unit.

After required grading in the heliostat fields, the heliostats would be installed in two steps. Initially, the support pylons would be installed using vibratory technology to insert the pylons into the ground (pre-augering prior to the installation of the pylon may be required). Depths would not be expected to be greater than 12 feet. The heliostat assembly (mirrors, support structure, and aiming system) would be mounted on the pylon. Pylons would be delivered to their locations by an all-terrain vehicle. Installation of the heliostat assemblies would be accomplished with a rough terrain crane.

The majority of the project site would maintain the original grades and natural drainage features; therefore, no additional storm drainage control is proposed. The stormwater management design for the I-10 freeway includes three drainage culverts to allow rain to flow from south to north underneath the freeway. To minimize wind and water erosion, open spaces would be preserved and left undisturbed, maintaining existing vegetation to the extent possible with respect to site topography and access requirements. If needed, stone filters and check dams would be strategically placed throughout the project site to provide areas for sediment deposition and to promote the sheet flow of stormwater prior to leaving the project site boundary. During construction, trenches would be excavated for the installation of electrical transmission system conductors and the on-site natural gas system. A typical trench would be 2–3 feet wide at the base and 3–6 feet deep. A few trenches may have widths and/or depths up to 12 feet.

SUMMARY OF PSEGS OPERATIONS

The proposed PSEGS would employ up to 100 full-time employees: 30 at Unit 1 (including mirror washing machine operators), 30 at Unit 2 (including mirror washing machine operators), and 40 at the administration complex. The facility would operate seven days a week. Heliostat washing will cover the entire solar field weekly.

A detailed operation and maintenance program has not yet been developed. The facility would be operated in one of the following modes:

- The facility would be operated at its maximum continuous output for as many hours per year as solar input allows, or as limited by contractual terms and conditions; or
- A full shutdown would occur if forced by equipment malfunction, transmission or gas line disconnect, or scheduled maintenance.

NON-OPERATION AND CLOSURE

Non-operation is time-limited and can encompass part or all of a facility. Non-operation can be a planned event, usually for minor equipment maintenance or repair, or unplanned, usually the result of unanticipated events or emergencies.

Closure is a facility shutdown with no intent to restart operation. It may also be the cumulative result of unsuccessful efforts to re-start over an increasingly lengthy period of non-operation, condemned by inadequate means and/or lack of a viable plan. Facility closures can occur due to a variety of factors, including, but not limited to, irreparable damage and/or functional or economic obsolescence. Please see the **GENERAL CONDITIONS** section of this FSA for specific non-operational and closure requirements.

REFERENCES

CEC 2010a – California Energy Commission/A. Solomon (TN 55988). Staff Assessment and Draft Environmental Impact Statement, dated March 19, 2010. Submitted to CEC/Docket Unit on March 19, 2010

CEC 2010b – California Energy Commission/A. Solomon (TN 58252). Revised Staff Assessment Part 1, dated September 1, 2010. Submitted to CEC/Docket Unit on September 1, 2010

CEC 2010c – California Energy Commission/A. Solomon (TN 58497). Revised Staff Assessment Part II, dated September 16, 2010. Submitted to CEC/Docket Unit September 16, 2010

GRENIER 2013a – Andrea, information received by e-mail from Andrea Grenier. (TN 70799), April 25, 2013.

GRENIER 2013b – Andrea, information received by e-mail from Andrea Grenier. (TN 70912), May 15, 2013.

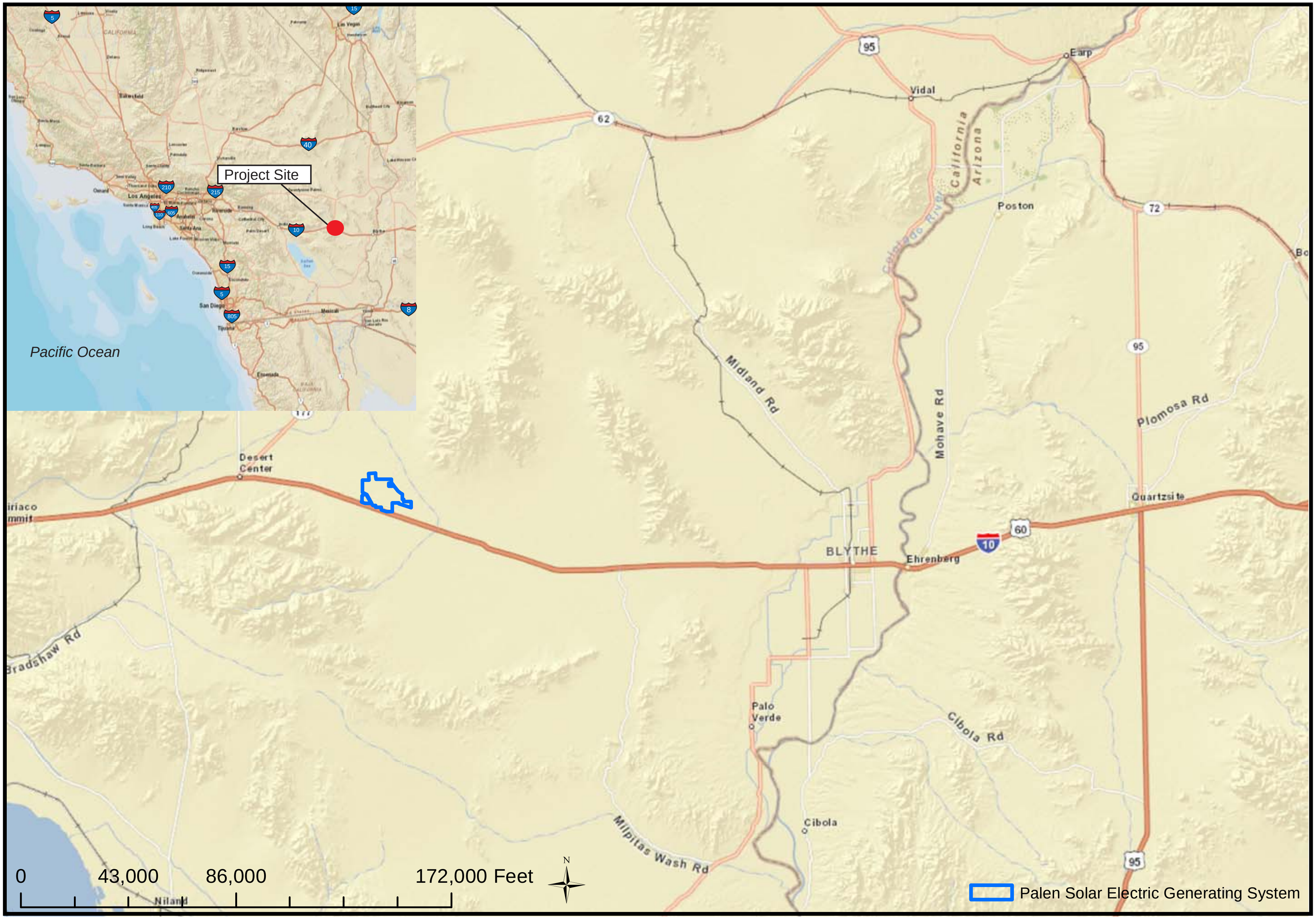
Palen 2012a – Palen Solar Holdings, LLC/Galati Blek, Scott Galati (TN 68910). Palen Solar Holdings LLC’s Petition for Amendment, dated December 17, 2012. Submitted to CEC/C. Stora on December 18, 2012

Palen 2013d – Palen Solar/Galati Blek LLP, Marie Fleming (TN 69931). Palen Solar’s Relocated Natural Gas Pipeline Drawing. Submitted to CEC/Docket Unit on March 15, 2013

Palen 2013cc-– Galati Blek/Scott Galati (TN 71280). Palen Solar Holdings, LLC’s Response to CEC Staff Data Request Set 3 (40-72), dated June 14, 2013. Submitted to CEC/C. Stora on June 14, 2013

PROJECT DESCRIPTION - FIGURE 1

Palen Solar Power Project - Site Vicinity Map

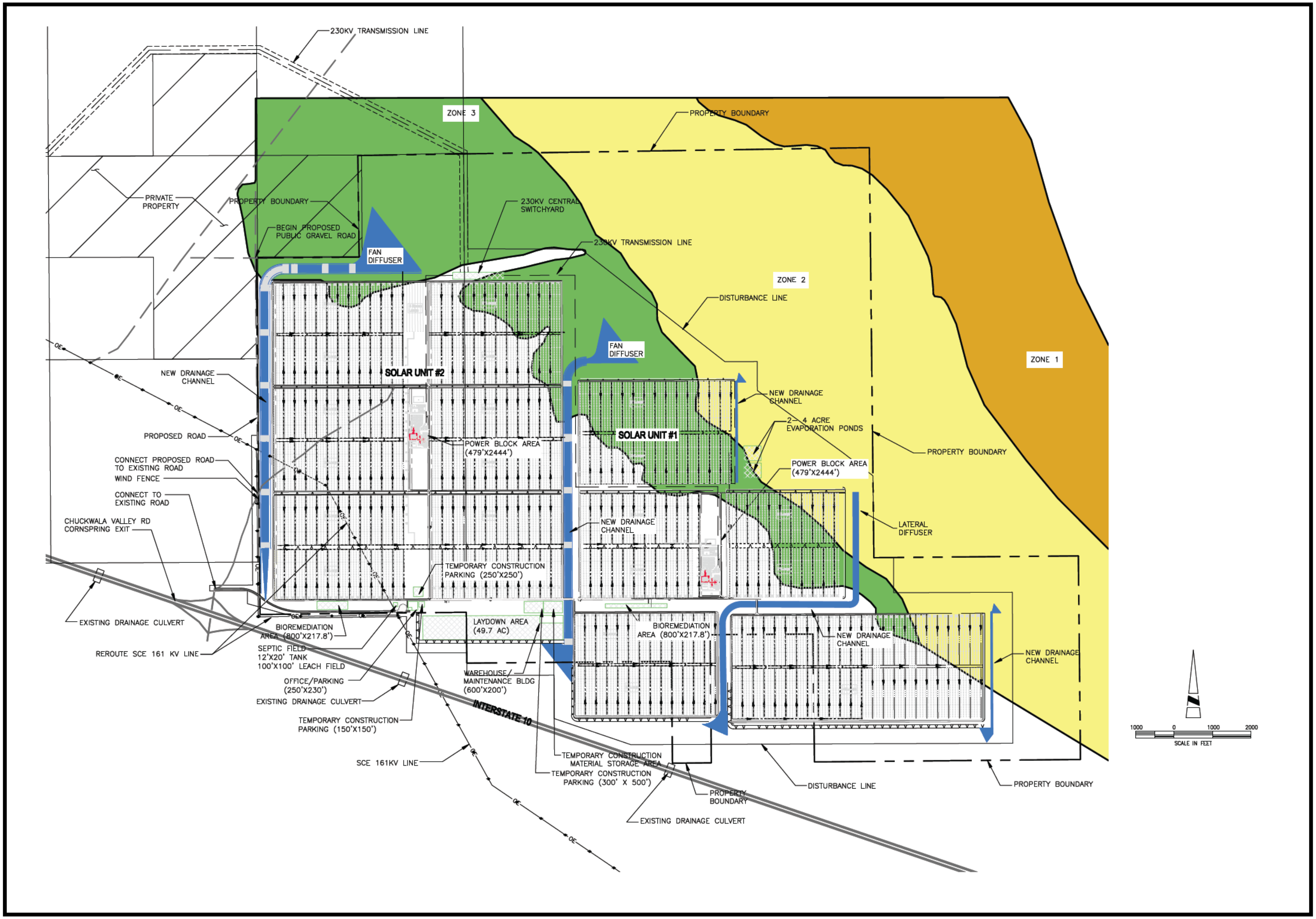


CALIFORNIA ENERGY COMMISSION - SITING, TRANSMISSION AND ENVIRONMENTAL PROTECTION DIVISION

SOURCE: 09 - AFC - 07, Site Vicinity Map - Figure 2.1-1

PROJECT DESCRIPTION - FIGURE 2

Palen Solar Power Project - Approved Project Reconfigured Alternative 2

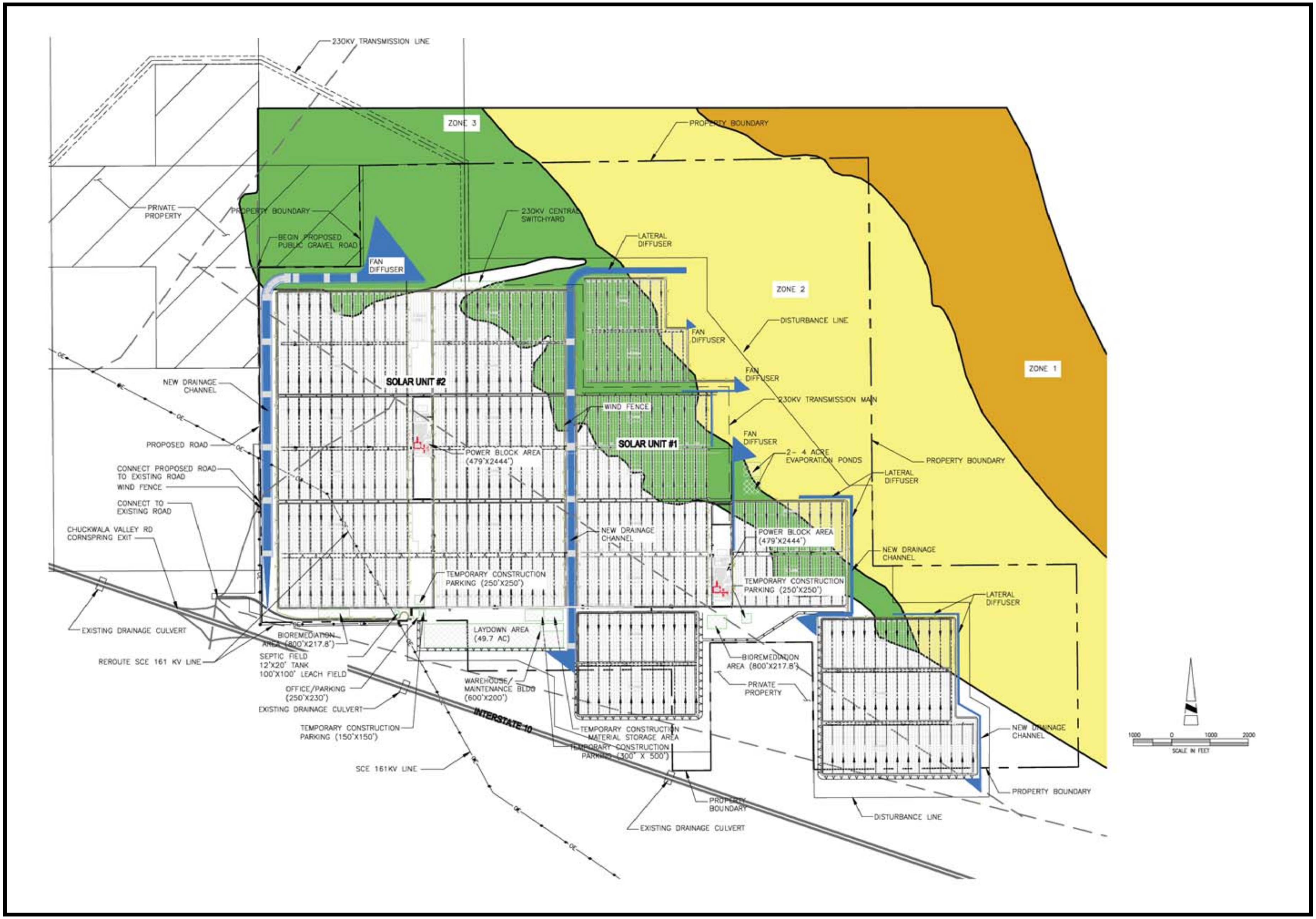


CALIFORNIA ENERGY COMMISSION - SITING, TRANSMISSION AND ENVIRONMENTAL PROTECTION DIVISION

SOURCE: 09 - AFC - 07, Revised Staff Assessment Part 1, Alternatives - Figure 1B

PROJECT DESCRIPTION - FIGURE 3

Palen Solar Power Project - Approved Project Reconfigured Alternative 3

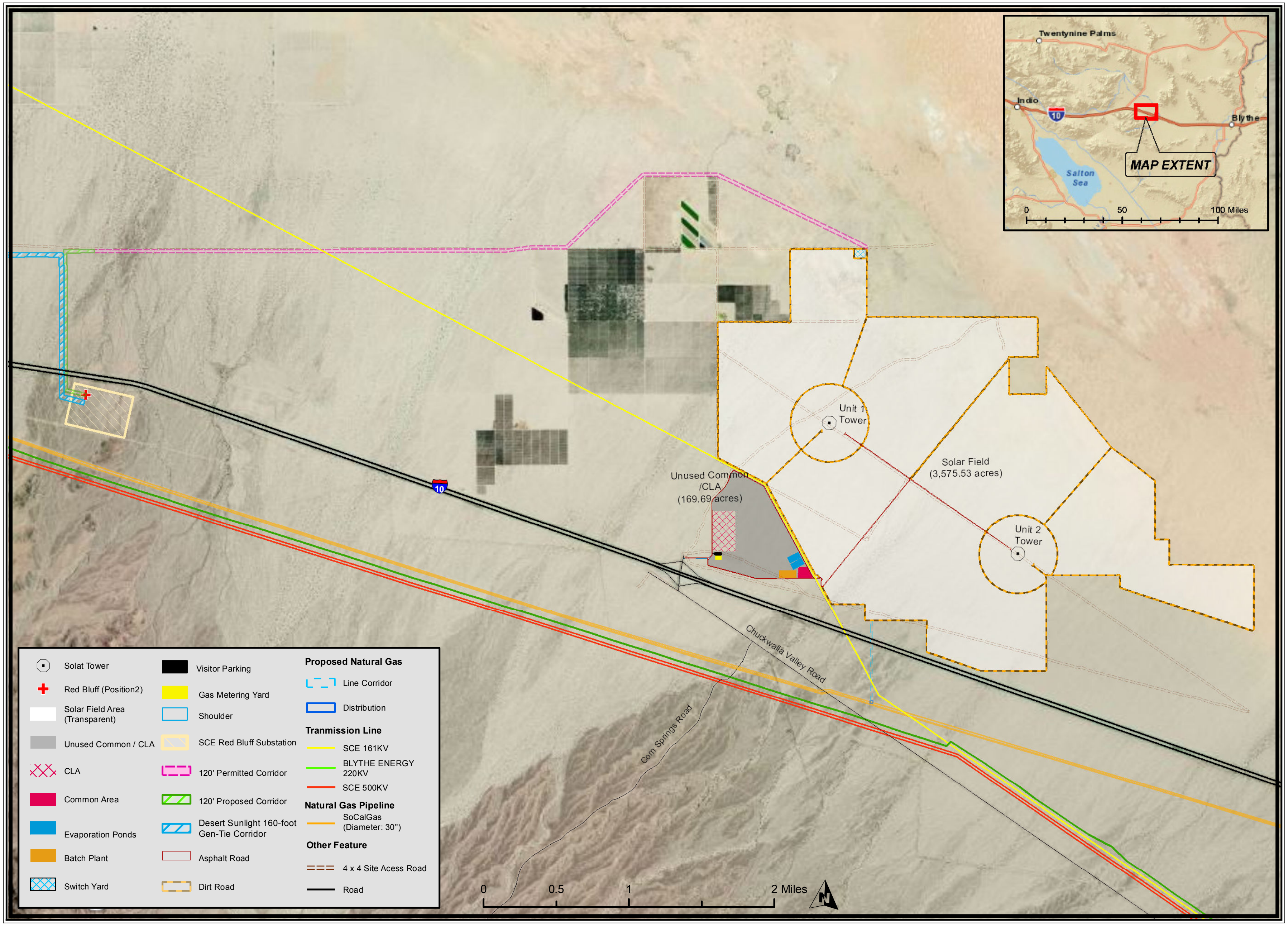


CALIFORNIA ENERGY COMMISSION - SITING, TRANSMISSION AND ENVIRONMENTAL PROTECTION DIVISION

SOURCE: 09 - AFC - 07, Revised Staff Assessment Part 1, Alternatives - Figure 1C

PROJECT DESCRIPTION - FIGURE 4

Palen Solar Power Project - Facility Boundary Map

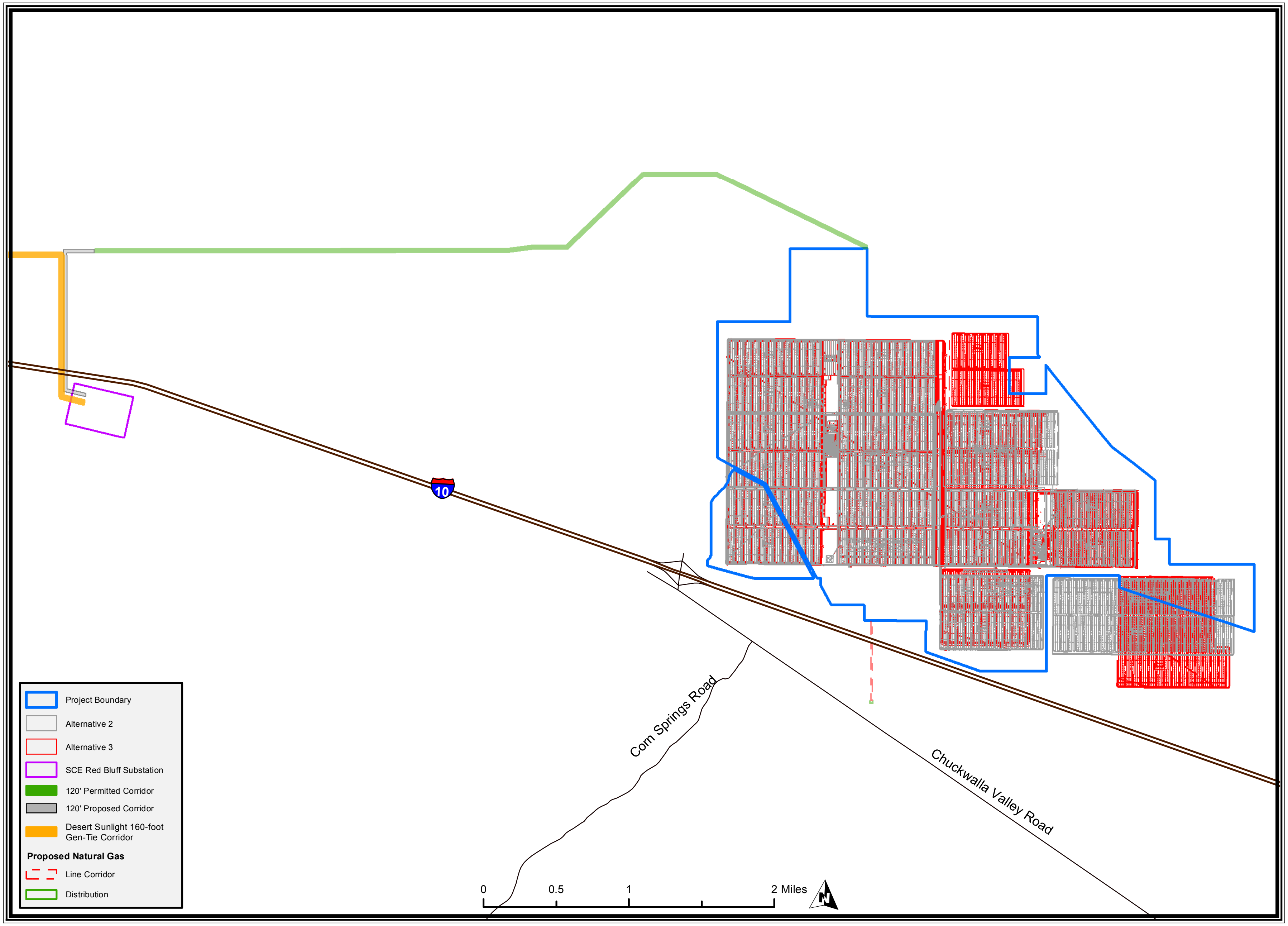


CALIFORNIA ENERGY COMMISSION, SITING, TRANSMISSION AND ENVIRONMENTAL PROTECTION DIVISION

SOURCE: 09 - AFC - 07 - Facility Boundary Map - Figure 2.1-3, BrightSource, OpenStreetMap 2013, BING Aerial

PROJECT DESCRIPTION - FIGURE 5

Palen Solar Power Project - Facility Overlay on Approved Project Reconfigured Alternatives 2 and 3 Footprint

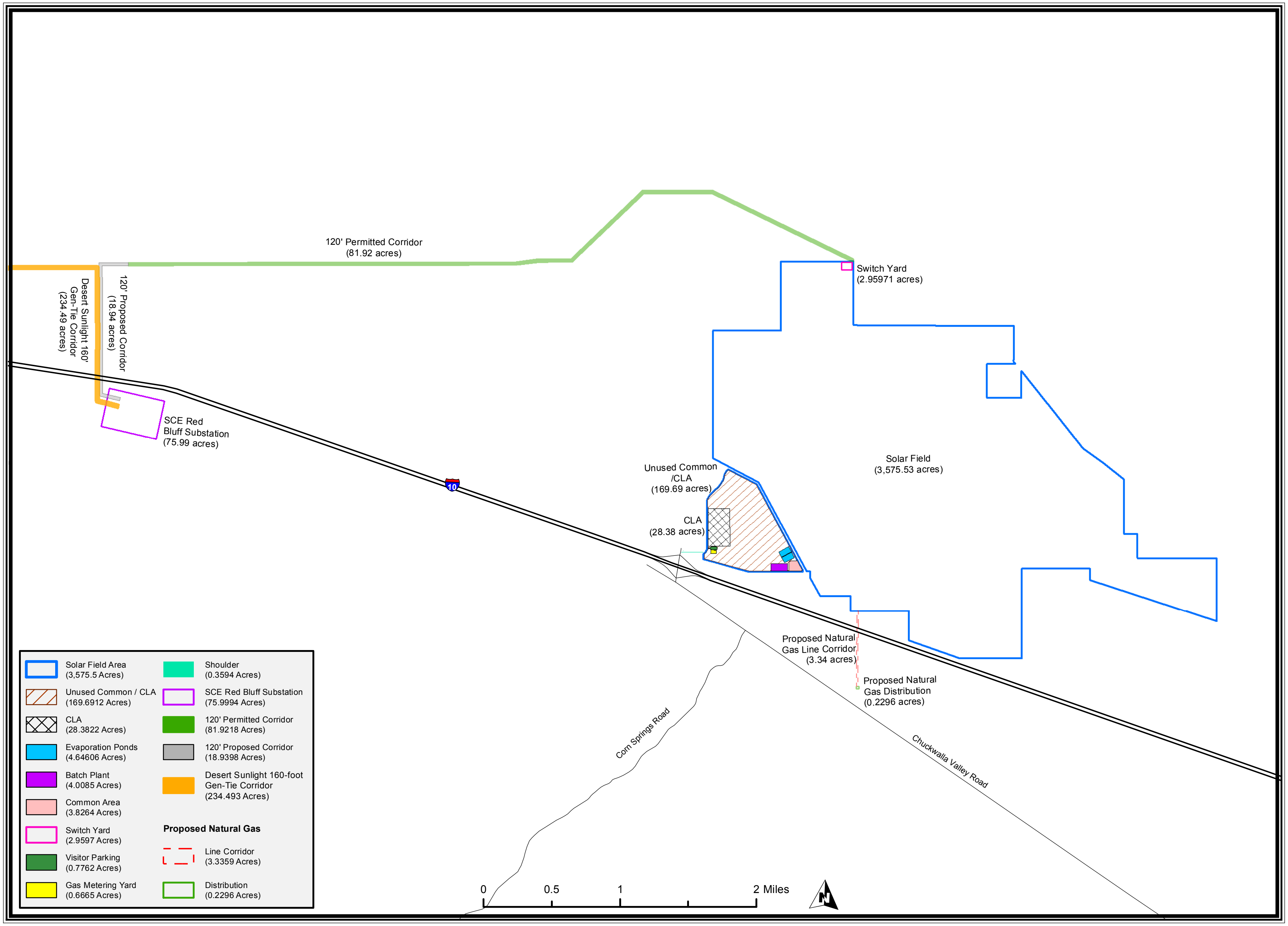


CALIFORNIA ENERGY COMMISSION, SITING, TRANSMISSION AND ENVIRONMENTAL PROTECTION DIVISION

SOURCE: 09 - AFC - 07 - Revised Staff Assessment Part 1, Alternatives Figure 1B & 1C, BrightSource, OpenStreetMap 2013

PROJECT DESCRIPTION - FIGURE 6

Palen Solar Power Project - Facility Acreage Estimates

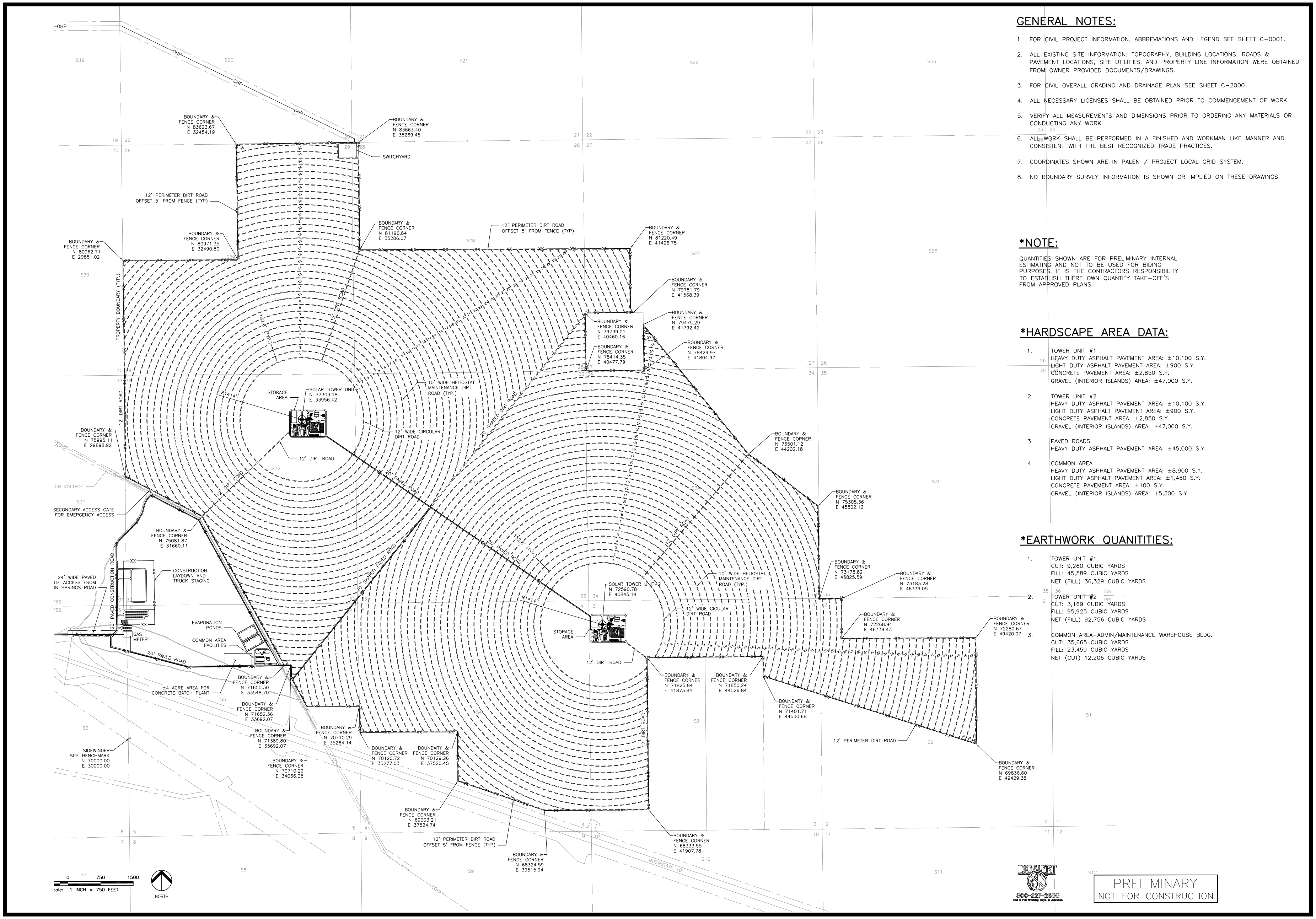


CALIFORNIA ENERGY COMMISSION, SITING, TRANSMISSION AND ENVIRONMENTAL PROTECTION DIVISION

SOURCE: 09 - AFC - 07 - Facility Acreage Estimates - Figure 2.1-4, BrightSource, OpenStreetMap 2013

PROJECT DESCRIPTION - FIGURE 7

Palen Solar Power Project - Solar Electric Generation Station



CALIFORNIA ENERGY COMMISSION - SITING, TRANSMISSION AND ENVIRONMENTAL PROTECTION DIVISION

SOURCE: 09 - AFC - 07, Civil Overall Site Plan - Figure 2.1-5

Environmental Assessment

AIR QUALITY

Jacquelyn Leyva Record

THIS SECTION WILL BE PROVIDED IN THE

FINAL STAFF ASSESSMENT – Part C

BIOLOGICAL RESOURCES

Testimony of Ann Crisp, Carol Watson, and Chris Huntley

SUMMARY OF CONCLUSIONS

OVERVIEW OF IMPACTS TO BIOLOGICAL RESOURCES:

The Palen Solar Electric Generating System (PSEGS project or modified project) would have significant impacts to biological resources, impacting all of the Sonoran creosote bush scrub, sand dunes, desert washes and other native plant and wildlife communities within the approximately 3,794-acre site as well as along the natural gas line corridor (3.56 acres) and proposed and approved generation tie-line corridor (100.86 acres). The PSEGS project as proposed would leave the majority of the vegetation within heliostat fields intact, while adding roads and other improvements only where necessary for project development and operation. The PSEGS would eliminate the engineered channels of the approved Palen Solar Power Project (PSPP or approved project) and most of the natural drainage features will be maintained and any grading required will be designed to promote sheet flow where possible. However, staff is assuming a total loss of the function and value of the vegetation and habitats within the project site because perimeter fencing will exclude most terrestrial animals, and ongoing disturbance, noise, and other anthropogenic activities at the site may continue to degrade habitat functions within the project footprint. Wildlife and plants that are tolerant to disturbance may continue to occupy the site, however, staff does not consider leaving the vegetation on site a benefit to these species due to the ongoing risk of injury or mortality from construction equipment or operational work including mowing, maintenance, and washing of the heliostats.

<u>Desert Tortoise Impacts</u>:

The PSEGS project site is located in an area that was surveyed for desert tortoise for the Commission approved PSPP project. Supplemental surveys for desert tortoise were conducted in 2013 for areas not previously covered by the PSPP project including the proposed natural gas line alignment.Most of the PSEGS site provides low to moderate quality habitat for desert tortoise. The PSEGS project would result in 3,897 acres of direct and 51.4 acres of indirect impacts to desert tortoise habitat. This would functionally remove access to approximately 3,948 acres of desert tortoise habitat, including 228 acres within the Chuckwalla Critical Habitat Unit.

Desert tortoise sign (i.e., burrows, pallets, and shell remains) were detected on the PSEGS project site; however no living animals were observed. Surveys conducted in 2010 identified seven tortoises (adult and juvenile) in the project area including four along the generation tie line and three tortoises south of I-10. These tortoises were detected in buffer areas that would not be subject to direct project disturbance. Based on estimates provided by the USFWS 2011 Biological Opinion (BO) for the PSPP (approved project), the site is expected to support from two to 12 adult/subadult tortoises, three to six juvenile tortoises, and approximately 35 eggs. Because these values are based on regional densities and animals detected in buffer areas, the projected number of desert tortoise that may occur on the site is expected to be lower than the estimates provided in this Final Staff Assessment (FSA).

Construction and operation of the PSEGS project will result in direct and indirect impacts to desert tortoise (federally and state listed as threatened). Implementation of the project would result in the permanent loss of desert tortoise habitat.

Construction and operation of the PSEGS project will constrain wildlife movement to some degree and fragment and degrade adjacent native plant and wildlife communities. The PSEGS project may promote the spread of invasive non-native plants and desert tortoise predators such as ravens.

Conditions of Certification **BIO-9** through **BIO-11** would require the protection of desert tortoise and other biological resources that occur in and near the project area and would minimize potential take of desert tortoise during project construction and operation. To offset the direct and indirect loss of 3,948 acres of desert tortoise habitat, Condition of Certification **BIO-12** which recommends habitat compensation at a 1:1 ratio for areas outside of critical habitat and a 5:1 ratio for disturbance to habitat in the Chuckwalla Critical Habitat Unit. These ratios are consistent with the Commission adopted mitigation requirements identified for the PSPP. The PSEGS project would require 4,860 acres of compensatory mitigation for desert tortoise. The project owner provided comments on the Preliminary Staff Assessment (PSA) which included revisions to Condition of Certification **BIO-12.** These revisions recommended an alternative mitigation strategy for desert tortoise compensation based on the retirement of grazing allotments. During a workshop conducted on July 24, 2013 the project owner provided further information on the proposed ratios and how this may benefit desert tortoise. On July 31, 2013 the project owner filed additional revisions to Condition **BIO-12** based on workshop discussions and recommended that up to 50 percent of the mitigation land requirement could be achieved through the retirement of grazing allotments. The project owner proposed mitigation ratios of 3:1 for areas outside of critical habitat and 15:1 ratios for habitat in the Chuckwalla Critical Habitat Unit. Staff considered the request for this change and acknowledges retirement of grazing allotments can benefit desert tortoise. However, after coordination with REAT group team members, staff does not recommend adopting the revised language for this FSA. The approach has merit, however staff is not convinced that the changes to the condition are warranted at this time. The current mitigation approach was considered and adopted by the Commission. The proposed changes are considerable; depart from the adopted mitigation strategy; have not been subject to public review; and the REAT agencies are not in full agreement on the efficacy of this approach or in full agreement if this change will ensure full mitigation.

Condition of Certification **BIO-13** requires implementation of a Raven Management and Monitoring Plan to address project-related increases in ravens, a desert tortoise predator, as well as define the requirements for the project owner to contribute funds to the USFWS regional raven management program.

In June, 2011, USFWS issued a BO for the licensed PSPP project (USFWS 2011b); however, the USFWS requested the BLM re-initiate consultation to address changes to the project design and footprint. The BLM has submitted a revised Biological Assessment (BA) addressing these changes and has included the Yuma clapper rail, a federally listed bird that may be adversely affected by the project. Following review of the BA, the USFWS is expected to issue a Revised BO for the modified project, which will specify reasonable and prudent measures which must be implemented for desert tortoise and Yuma clapper rail. The BLM will not issue a Record of Decision prior to receiving the approved BO.

Ephemeral Streams:

A total of 374.7 acres of state jurisdictional waters, a slight increase from PSPP's impacts to 312 acres were delineated on the project site. In June, 2013 the project owner provided an update of jurisdictional waters that occur on the modified linear facilities. In August 2013 the project owner provided a CDFW Lake or Streambed Alteration Agreement Amendment Notification package for staff's review in coorridnation with CDFW (Palen 2013aaa). Approximately 13.88 acres of state waters are present on the natural gas pipeline alignment. Thirty-two acres of ephemeral streams located downstream of the project will be indirectly impacted but to a limited degree because the project is not expected to substantially alter the hydrology to downstream drainages. The project owner will minimize obstructions of the natural surface drainage patterns where possible, but staff concluded the biological functions and values of the streams will be lost due to perimeter exclusion fencing, partial grading, road construction and maintenance, vegetation maintenance, herbicide spraying (if used), and human disturbance. Staff considers the direct, indirect, and cumulative impacts to ephemeral streams to be significant because they would result in a loss of the beneficial functions and values that these state waters provide to vegetation and wildlife.

Condition of Certification **BIO-21** would minimize and offset direct and indirect impacts to state waters to less-than-significant levels and would assure compliance with California Department of Fish and Wildlife (CDFW) codes that regulate impacts to these waters. **BIO-21** specifies acquisition of state waters within the Chuckwalla Valley basin, in the Palen watershed or adjacent watersheds, at a 1:1 ratio for unvegetated ephemeral dry wash and at a 3:1 ratio for desert dry wash woodland.

Impacts to Groundwater-Dependent Ecosystems:

The modified project would use less groundwater during both construction and operation than the PSPP project. Construction groundwater use is stated to be 1,130 acre-feet per year (AFY), a reduction from the original permitted project groundwater consumption of 1,917 AFY. Operational groundwater use is stated as 201 AFY, a reduction of nearly 100 AFY.

Two conditions, **BIO-23** and **BIO-24** were required for the original project. Condition of Certification **BIO-23** requires monitoring of groundwater levels and of groundwater-dependent vegetation within the area affected by groundwater pumping, and Condition of Certification **BIO-24** requires implementation of remedial action and compensatory mitigation if the monitoring reveals adverse effects. No new or additional impacts were identified in conjunction with the modified project, and therefore no new conditions, or edits to the existing conditions other than updates to dates and map references **BIO-23** or **BIO-24** are necessary. With implementation of these mitigation measures the PSEGS project impacts to groundwater-dependent plant communities would be reduced to less-than-significant levels.

Special-Status Plants:

Impacts to special-status plant species are similar to impacts identified for the PSPP project. No federal- or state-listed plant species were detected within the PSPP Project Disturbance Area, but three other species of special-status plants were detected within the disturbance area during the spring 2010 surveys for the PSPP: Harwood's milk-vetch, California ditaxis, and ribbed cryptantha. These species are located in the PSEGS Project Disturbance Area and would be similarly impacted by the PSEGS project. Fall 2010 botanical surveys were conducted in the PSPP project area; however no additional special-status plant species were detected. No additional special-status plants were detected during spring 2013 surveys for new areas of impact for the PSEGS project including the proposed generation tie-line and natural gas line corridor (Palen 2013jj).

Condition of Certification **BIO-19** describes measures for avoiding and minimizing effects to avoided occurrences of Harwood's milk-vetch, California ditaxis and other special-status plants occurring within 100 feet of the project boundary, and guidelines for minimizing direct effects along project linears. **BIO-19** also contains guidelines for conducting fall botanical surveys, triggers for mitigation, and detailed specifications and performance standards to ensure that any additional special-status plants that would have been missed during the previous spring surveys would be mitigated to a less-than-significant level. Fall 2010 surveys were completed for the PSPP: however, fall 2013 botanical surveys would be required for the new areas of impact for the PSEGS project including the proposed generation tie-line and natural gas line corridor.

Avian Impacts

Desert dry wash woodland, Sonoran creosote bush scrub and other habitat within the project area provides foraging, cover, and/or breeding habitat for a number of resident and migratory birds, including a number of special-status bird species potentially occurring at the site. Construction and operation of the proposed project or its alternatives could result in death or injury of these birds.

The solar tower technology creates a new impact, solar flux. Flux is concentrated over the heliostat field, as the mirrors reflect sunlight back to the solar receiver located near the top of each collector tower. Solar flux increases in intensity as reflected beams of light converge on one another. Under normal operating conditions, intensity of flux is highest at the towers. Exposure to elevated flux may cause injury or death. From an aerial perspective, heliostats may reflect the sky, creating a water-like mirage effect. It is possible for birds to be attracted to the project site by this effect, and collide with mirrors. Mirror collision was also identified as a project impact of the PSPP project. The evaporation ponds and adjacent date-palm and jojoba agricultural operations may attract insects, bats, and birds, increasing their risk from collision or exposure to elevated levels of solar flux. The following discussions group at-risk bird species in terms of state and federallaws. Because nesting birds are afforded legal protections as well, a separate discussion is provided for this group of birds. Please note that birds that nest on the site may also be discussed under the categories of Fully Protected Species, or Other Special Status Species.

Nesting Birds & Habitat Loss

The large-scale conversion of the site from relatively intact native habitat to an operating solar field has the potential to impact nesting birds. Conditions of Certification **BIO-1** through **BIO-8** requires a project biologist, and prescribe a variety of minimization measures and best management practices to protect nesting birds, control fugitive dust, reduce the potential for wildfires, require worker training to minimize disturbances, require biological monitoring and reporting of project disturbances, and compensate for habitat loss through the acquisition and management of offsite lands. Staff has recommended several modifications to **BIO-1** to **BIO-8**. These modifications include: 1) revised timing of submittals; 2) additional duties for the Designated Biologist; 3) additional requirements for the BRMIMP and WEAP; and 4) additional impact avoidance and minimization measures such as requiring the use of best vegetation management practices which will limit activities that may disrupt nesting and breeding of sensitive birds. Condition of Certification **BIO-14**, Weed Management, requires preparation and implementation of a Weed Management Plan to prevent the loss or ongoing degradation of habitat values, and includes measures to protect wildlife from weed management activities. Condition of Certification **BIO-15** requires surveys and avoidance measures to prevent destruction of active bird nests during construction and operations. Staff's proposed conditions of certification **BIO-16a and BIO-16b** (which would replace condition **BIO-16** in the PSPP Decision) provide for ongoing project monitoring, powerline retrofits, and implementation of a suite of habitat restoration and enhancement measures that would benefit nesting birds. Taken together, staff concludes that these conditions of certification would avoid or minimize potential take of nesting birds during project construction and would reduce impacts to their habitat to a level less than significant according to CEQA.

Fully Protected Avian Species (Bald and Golden Eagles, Yuma Clapper Rail)

Several fully protected species have a potential to be impacted by the project. Bald and Golden eagles are protected by the federal Bald and Golden Eagle Protection Act (BGEPA) and Migratory Bird Treaty Act (MBTA) and are fully protected under the California Fish and Game Code. Both bald and golden eagles are also BLM sensitive species. The list of species which may be present at the project site could include other fully protected species such American peregrine falcon, and Yuma clapper rail, among others. This list is not meant to be comprehensive, however, this discussion is generally applicable to any fully protected species.

There is no suitable bald or golden eagle nesting habitat on the proposed project site. The entire project site is suitable golden eagle foraging habitat year-around, and bald eagles may fly over the area or (rarely) forage on the site during winter or migration seasons. Conditions of Certification **BIO-1** through **BIO-8** would serve to mitigate many of the project's impacts to native vegetation and wildlife habitat, including eagle foraging habitat. Staff believes that all compensation land meeting the selection criteria as desert tortoise habitat (**BIO-12**) and desert dry wash habitat (**BIO-21**) also would serve as suitable eagle foraging habitat. Staff concludes that the project's impacts to eagles and their foraging habitat would be less than significant with implementation of these required conditions of certification.

Mortality or other take, such as sub-lethal injury caused by burning or blinding through exposure to elevated flux, would be significant under CEQA. Staff's recommended Conditions of Certification **BIO-1** through **BIO-8** would minimize adverse impacts to eagles and Conditions of Certification **BIO-16a and BIO-16b** provide for ongoing project monitoring and implementation of a suite of habitat restoration and enhancement measures that would benefit bald and golden eagles, including powerline retrofits, to mitigate and avoid potential electrocutions both on and offsite. Staff concludes that the take of a bald or golden eagle, should it occur, would be significant according to CEQA.

While the probability is uncertain, given that the site and surrounding areas are suitable bald and golden eagle foraging habitat, staff believes that operation of the PSEGS project could result in the take of bald or golden eagles, due either to collision with project facilities or to injury or mortality caused by flying through concentrated solar energy over the heliostat field. No mechanism is currently available to allow staff to quantify potential mortality for bald or golden eagles, or any other avian species. Because they are fully protected species, any take of bald or golden eagles is prohibited by law. The burden is on the project owner to avoid any such take.

Other Special Status Avian Species

Special status avian species includes federally and state listed threatened, endangered, or candidate species, or other species such as those considered to be sensitive by the BLM. The list of species of special status species which may be present at the project site includes more species than can be listed here, but would include Yuma clapper rail, gilded flicker, elf owl, osprey, ferruginous hawk, burrowing owl (discussed further below), Cooper's hawk, sharp-shinned hawk, northern harrier, prairie falcon, peregrine falcon, Swainson's hawk, Harris hawk, and short-eared owl. This list is not meant to be comprehensive, however, this discussion is generally applicable to any special status species.

These specially protected birds may be found in the region seasonally, especially during winter, or as year-around residents, and have the potential to be adversely affected by the project during operation. Operational impacts may include collision with heliostats or other project facilities and injury or mortality from exposure to solar flux, such as burning or blinding. Staff cannot quantify the potential risk of these effects; however, this impact is unavoidable, and staff believes these impacts would be significant under CEQA and may violate the California Endangered Species Act (CESA) and/or the Federal Endangered Species Act (ESA) depending on the species taken. Such take is also impermissible under the MBTA, which is applicable to native American birds.

Conditions of Certification **BIO-1** through **BIO-8** and **BIO-12** (Desert Tortoise Compensatory Mitigation), including staff's recommended modifications, would minimize project impacts to special status birds. In addition, staff's recommended Conditions of Certification **BIO-16a and BIO-16b** provide for ongoing project monitoring, powerline retrofits, and implementation of a suite of habitat restoration and enhancement measures that would benefit special status birds. Staff is unable to quantify the risk to each species of threatened or endangered bird that may be impacted by the site. However, the risk is predictable and unavoidable. Take of a special status bird, in the absence of appropriate permits (a federal Section 7 permit or a state 2081 permit) may be considered significant under CEQA. Effects to special status birds may be unmitigable.

Impacts to Burrowing Owl

Burrowing owls have been detected on the PSEGS site as recently as 2013. Construction and operation of the PSEGS would result in disturbance or habitat loss for this species. Approximately 18 observations of individual owls were made during spring avian surveys of the project site. Burrowing owls were detected on the modified linear facilities however active burrows were not observed. Potential direct impacts to burrowing owls would be mitigated by implementation of Condition of Certification **BIO-18**

Staff has proposed minor modifications to address the more recent recommendations included in the CDFW Staff Report of Burrowing Owl issued in 2012 after the PSPP was approved and also incorporated modifications requested by the project owner related to selection criteria for mitigation lands (Palen 2013a) This condition involves passive relocation of burrowing owls, as well as acquisition of 78 acres of off-site compensatory mitigation lands suitable for two pairs of burrowing owls for development of the PSEGS project site. This offset may be nested within Condition of Certification **BIO-12**, Desert Tortoise Compensatory Mitigation; given that selection criteria are met. Additional, off-site compensatory mitigation land may be required pending completion of pre-construction surveys if additional owls are identified on the project site. Indirect impacts to burrowing owl include collisions with project features, glare, also collision, electrocution, glare, and exposure to elevated levels of solar flux. Conditions of Certification **BIO-16a and BIO-16b** provide for ongoing project monitoring and implementation of a suite of habitat restoration and enhancement measures that would benefit burrowing owls, and implement adaptive management strategies based on results of project monitoring. However potential indirect impacts may remain significant after mitigation.

Special Status Bats

Documented roosting areas for several special-status bats, including caves and mines, are known to occur in mountains surrounding the project site. Bats have also been found roosting under bridges along Interstate 10. Bats may roost in large palm trees in adjacent commercial agriculture operations. Important foraging habitat is found over agricultural lands and desert wash woodland on-site and on lands to the east. No special-status bats are expected to roost on-site, but several species could forage or fly over the site en route between roosting areas in the Mule Mountains and agricultural lands located to the east. Conditions of Certification **BIO-1** through **BIO-8**, including staff's recommended modifications, would minimize or compensate for habitat loss, including offset for dry desert washes at a 3:1 ratio. Staff concludes that these measures would effectively mitigate habitat impacts for special-status bats. Bats may also experience flux and collision impacts as described above under **Avian Impacts.** Conditions of Certification **BIO-16a and BIO-16b** provide for ongoing project monitoring and implementation of a suite of habitat restoration and enhancement measures that would benefit bats, and recommends adaptive management strategies based on results of project monitoring. Staff has requested the project owner install acoustic bat detection systems (Anabat™ or Sonobat™) on the project site to collect further data on bat species that may be present (CEC 2013i). Data collected during this effort would be used to inform the Bird and Bat Conservation Strategy. Take of special status bats on the project site would be considered significant under CEQA, as it would violate CESA and/or FESA, depending on the species taken.

Impacts to Burrowing Mammals

Desert dry wash woodland, Sonoran creosote bush scrub and other habitat in the project area provides foraging, cover, and/or breeding habitat for American badgers and desert kit fox. Construction and operation of the project could result in death or injury of these species.

American badgers and desert kit fox occur throughout the project area, and construction activities could crush or entomb kit fox and American badger. Passive relocation would also potentially increase the risk of Canine Distemper Virus (CDV) transmission in desert kit fox if CDV is present in local area. Staff's proposed revised Condition of Certification **BIO-17,** requires development of an American Badger and Desert Kit Fox Mitigation and Monitoring Plan that includes, but is not limited to, procedures and impact avoidance measures for conducting pre-construction baseline surveys and avoidance measures to protect badgers and kit fox during construction and operation, as well as the option for the project owner to participate in the CDFW-led Proposed Desert Kit Fox Health Monitoring and Mitigation Program and would avoid or minimize this potential impact.

Impacts to Sand Dunes/Mojave Fringe-toed Lizards

The 2010 Final Decision approved two reconfigured alternatives (Reconfigured Alternative 2 and Reconfigured Alternative 3) that shifted the original proposed PSPP project partially out of the sand transport corridor, thus reducing interference with the sand transport corridor and reducing impacts to sand dune dependent species such as Mojave fringe-toed lizards and several special-status plants. The PSEGS project is located within the footprint of the approved PSPP footprint (Reconfigured Alternative 2 and Reconfigured Alternative 3) and would directly impact 267 acres of Zone II sand transport corridor, and 893 acres of Zone III sand transport corridor, for a total of 1,160 acres of direct impacts to sand transport zones II and III, based on the use of the Philip Williams and Associates (PWA) model. The PSEGS project would result in approximately 421 acres of indirect impacts to Zone II and Zone III (25-100% sand transport reduction). This impact would occur outside the project footprint on BLM lands downwind of the project (CEC 2013l). Indirect impacts would occur in areas that experience reduced sand transport in areas that lie outside the project footprint and are affected by varying degrees of sand flux reduction. This is an increase in impacts as compared to the PSPP project, and mainly attributable to an increase in sand shadow effects. The number of heliostat pylons and other project features also factor into the increase in impacts. Specifically, and acknowledging constraints in the accuracy of modeled results, this is an increase of 480 acres of direct effects to sand transport zones compared to Reconfigured Alternative 2. In comparison with Reconfigured Alternative #3, the project would increase direct impacts by 370 acres, and would increase indirect impacts by 316 acres. Implementation of Condition of Certification **BIO-20** would mitigate onsite direct impacts, as well as offsite indirect impacts.

The PSEGS project would directly affect 1,480 acres of Mojave fringe-toed lizard habitat. This includes direct impacts to 1,160 acres of habitat in sand transport zones II and III and 320 acres of other habitat identified as potential Mojave fringe-toed lizard habitat as part of the PSPP that includes stabilized and partially stabilized sand dunes, some wash habitat, and other areas within Sonoran creosote scrub bush habitat with appropriate soils as identified during the original PSPP project proceedings (Solar Millennium 2010m). The PSEGS project would have significant but mitigable impacts to Mojave fringe-toed lizards within the project footprint, and would indirectly affect Mojave fringe-toed lizard offsite and downwind of the project, due to projected deflation of the dunes, plant successional shifts, and other predictable events which would all degrade Mojave fringe-toed lizard habitat. Offsite indirect impacts to Mojave fringe-toed lizards would be cumulatively significant but mitigable. This is an increase in indirect impacts, compared to the approved PSPP (Reconfigured Alternatives 2 and 3).

The PSEGS project proposes leaving some vegetation onsite, while adding roads and other improvements only where necessary for project development and operation. In addition, the PSEGS will have asphaltic roads within the project site fence that were not present for the PSPP project. Additional asphaltic pavement onsite may lead to increased road kill of Mojave fringe-toed lizard and other reptiles or amphibians that may use the asphalt roads as thermoregulation sites. Implementation of vegetation management activities could also result death or injury of Mojave fringe-toed lizard. In addition, Mojave fringe toed lizard may be injured or killed by vehicles on unpaved roads as they are difficult to detect as they hide under loose sand.

Condition of Certification **BIO-20** requires acquisition, protection and enhancement of core populations of Mojave fringe-toed lizard habitat elsewhere in the Chuckwalla or Palen valleys. This compensatory mitigation would offset the impacts of the PSEGS project to less-than-significant levels. In addition, staff has modified **BIO-6** and **BIO-8** to address the potential for vehicle strikes of Mojave fringe-toed lizard when lizards are using asphaltic and unpaved roads within the PSEGS site to thermoregulate.

Temporarily Disturbed Areas

Avoidance and minimization measures for the restoration of temporarily disturbed areas previously described in the deleted **BIO-27** were incorporated into **BIO-8** (Impact Avoidance and Minimization Measures) and weed management measures previously described in **BIO-27** were incorporated into **BIO-14** (Weed Management Plan). Restoration and revegetation of the solar facility and other permanently disturbed areas upon closure is addressed separately in **BIO-22**.

Cumulative Effects

Construction and operation of the PSEGS, as proposed, would have cumulatively considerable impacts to many biological resources within the Chuckwalla Valley and the Northern and Eastern Colorado Desert Coordinated Management Plan (NECO) area. These include: desert washes; Mojave fringe-toed lizard; desert tortoise; movement and connectivity; special status birds such as bald and golden eagle, Swainson’s hawk, Leconte’s thrasher and burrowing owl; American badger and desert kit fox; the Chuckwalla Valley dune system, desert wash woodland, groundwater-dependent ecosystems and other natural communities, and special-status plants.

With the exception of avian species the projects contribution to significant cumulative effects to biological resources including desert washes and dune habitats would be minimized to a level less than cumulatively considerable with implementation of Conditions of Certification **BIO-1** through **BIO-29**.

Conditions of certification address impacts that might be individually minor but cumulatively considerable. These conditions include measures to minimize the spread of invasive non-native plants, habitat fragmentation, an increase in raven predation, increased roadkills, bird collisions and damaging exposure to elevated solar flux, increased disturbance from noise and lighting, fugitive dust, chemical drift, unauthorized off-road vehicle use of temporary access roads, altered surface drainage patterns, and accidental impacts during construction and operation.

Additional Information Staff Received from the Project Owner in Order to Complete the FSA

Staff received several submittals after publication of the PSA that included Palen Solar Holdings, LLC's Bat Habitat Assessment, dated July 22, 2013 (Palen 2013hh), Palen Solar Holdings, LLC's Spring 2013 Avian Survey Results, dated July 23, 2013 (Palen 2013ii), Supplemental Spring 2013 Biological Surveys (Palen 2013jj), Palen Solar Holdings, LLC's Final Sand Transport Study, dated July 23, 2013 (Palen 2013kk), Palen Solar Holdings, LLC's Response to CEC Staff Data Request Set 4 (73-89) (Palen 2013ss), PSH's Response to Staff's 8/2/13 Email Request - Additional Data Sheets and CNDDB Report Forms for Spring 2013 Supplemental Biological Resource Surveys, dated August 13, 2013 (2013zz), and the requested CDFW Lake or Streambed Alteration Agreement Amendment Notification package (Palen 2013aaa) and has incorporated information as appropriate.

INTRODUCTION

This section of the Final Staff Assessment (FSA) provides the California Energy Commission (Energy Commission) staff analysis of potential impacts to biological resources from the construction and operation of the Palen Solar Electric Generating System (PSEGS project, or modified project). This analysis describes the biological resources at the PSEGS project site (including ancillary facilities) and addresses potential impacts to special-status species, sensitive natural communities, and other significant biological resources. This section discusses the need for mitigation, evaluates the adequacy of mitigation proposed by the project owner, and specifies additional mitigation measures designed to reduce impacts. It also describes compliance with applicable laws, ordinances, regulations, and standards (LORS) and recommends staff's proposed conditions of certification. Changes from the Palen Solar Power Project (PSPP) (approved Reconfigured Alternative 2 and Alternative 3) to the PSEGS project have been evaluated to determine if the PSEGS would remain in compliance with LORS. Refer to **Biological Resources Figure 1**. Information contained in this document includes a detailed description of the existing biotic environment for all areas of the PSPP which are also part of the proposed PSEGS and new areas that are part of the PSEGS. The Revised Staff Assessment for the approved project provides the basis for this document and this FSA provides an analysis of potential new or revised impacts from the PSEGS project to biological resources and, where necessary, specifies new or modified mitigation measures (conditions of certification) to reduce potential impacts to less than significant levels.

The analysis for the Revised Staff Assessment for the approved PSPP project was based, in part, upon information from the following sources: the Application for Certification (AFC) (Solar Millennium 2009a), Supplement to the AFC (Solar Millennium 2009b), and additional information from the prior project owner (Solar Millennium) (Galati & Blek 2010i; Galati & Blek 2010j; AECOM 2010f; Solar Millennium 2010k; Solar Millennium 2010l); responses to staff data requests (AECOM 2010a, Palen 2010; Kenney 2010; Solar Millennium 2010m; AECOM 2010u); staff workshops held on December 9 and 18, 2009, January 7,10,14, and 25, 2010, and April 28 and 29, 2010; site visits by staff on October 7, 2009, November 3, 2009, April 8, 2010, and January 25, 2010; communications with representatives from the California Department of Fish and Wildlife (CDFW), the Bureau of Land Management (BLM), and the U.S. Fish and Wildlife Service (USFWS); and information contained within the Northern and Eastern Colorado Desert Coordinated Management Plan (NECO) (BLM CCD 2002). Additional analysis for the PSEGS is based, in part on information provided in the Palen Solar Holdings LLC's Petition for Amendment (Palen 2012a), two supplements to the Petition to Amend (Palen 2013a and Palen 2013c), responses to data requests, independent research and reconnaissance level surveys conducted by staff on April 9, 10, and 30, 2013. Information was also obtained through ongoing coordination with representatives of the USFWS, CDFW, and BLM. Workshops addressing biological resources for the project were conducted in April, May, and July of 2013.

CHANGES FROM PSPP REVISED STAFF ASSESSMENT

Information included in this FSA is based in part on the previously published PSPP Revised Staff Assessment (RSA) (CEC 2010c). The staff assessment has been revised where new data is available to reflect changes in the project design or footprint, or where new analysis is required to disclose impacts from the PSEGS project.

Changes from the PSPP RSA to this PSEGS FSA are summarized below:

New Project Features and Modifications: These changes are described below and staff has provided an analysis of new project features that could affect biological resources in this FSA:

Phasing of Construction: The project owner has proposed a phased plan for construction where Phase 1 will include construction of the generation tie-line, access road, common facilities area, common facilities, temporary construction laydown area, both power blocks including laydown area, and a portion of solar field 2. Phase 2 will include construction of the remainder of the facility (Palen 2013a). The gen-tie will be constructed during Phase 1; the natural gas line will be constructed during Phase 2 (Palen 2013jj). Mitigation measures would be similarly phased, with clearance surveys and translocation of desert tortoise and deposits of security for compensatory mitigation completed before each phase of construction as described in Condition of Certification **BIO-29.**

Red Bluff Substation: When the RSA for the PSPP was published the location of the substation had not yet been determined. Since then the site for the Southern California Edison's (SCE) Red Bluff Substation has been determined and the substation is currently under construction. The Red Bluff Substation is expected to be completed and operational in December 2013. Staff has removed the discussion of the impacts of substation construction that were included in the Project-Related Future Actions subsection of the Revised Staff Assessment (RSA) for the PSPP.

Spring 2013 Survey Results: The project owner has undertaken surveys of the natural gas line corridor and the previously-unsurveyed segment of the generation tie-line route (CEC 2013b and CEC 2013l). Surveys were conducted during the spring and summer of 2013, from March to July and staff has provided an analysis of impacts based upon the final impact calculations and relevant information from the project owner.

New and Revised Conditions of Certification: Staff has made revisions to several conditions of certification based on new information and analysis, as well as requests by the project owner (Supplement No.1 to Support PSH's Petition for Amendment, Palen 2013a). See **Biological Resources Table 11** for a summary of changes to conditions of certification.

New Terms and Definitions for General Conditions Compliance responsibilities carried out on recent large solar projects including Ivanpah, and Genesis have highlighted the need to revise and/or modify several general conditions. The modifications are minor in nature; however, the General Conditions contain several modified and/or refined definitions, terms, protocols, and new conditions of certification that are critical to effective compliance enforcement. A detailed description of the changes is provided in the **General Conditions** section of this Final Staff Assessment. The bulleted list below summarizes the revisions/modifications contained in the Compliance Plan:

- Definitions for specific terms utilized during compliance monitoring, including "Start of Construction", "Start of Commercial Operation", "Non-Operation and Closure", "Site Assessment and Pre-Construction Activities", and "Site Mobilization and Construction", among others;
- A new sub-section and expanded discussion of "Roles and Responsibilities", and new sections for "Pre-Construction and Pre-Operation Compliance Meeting", and "Energy Commission Record";
- New conditions of certification addressing "Non-Operation" and "Facility Closure Plans".

These new terms have been incorporated in this FSA and the Biological Resources conditions of certification.

METHODOLOGY AND THRESHOLDS FOR DETERMINING ENVIRONMENTAL CONSEQUENCES

The analysis of PSEGS project effects must comply with California Environmental Quality Act (CEQA). However, given the land jurisdiction of the U.S. Bureau of Land Management (BLM) the project will also be analyzed according to National Environmental Policy Act (NEPA) requirements through a separate process with the BLM. The BLM is the federal lead agency and has prepared a Supplemental Draft Environmental Impact Statement (EIS), which analyzed the PSEGS project. The BLM will issue a Final EIS following a 30 day public comment period followed by a Record of Decision (ROD) which is the final step for BLM in the EIS process. Although separate state and federal documents will be prepared and each agency will make a decision on the PSEGS project independently, Energy Commission and BLM staff have been sharing information. CEQA requires a list of criteria that are used to determine the significance of identified impacts. A significant impact is defined by CEQA as “a substantial, or potentially substantial, adverse change in any of the physical conditions within the area affected by the project” (Cal. Code Regs., tit. 14, § 15382).

Thresholds for determining CEQA significance in this section are based on Appendix G of the CEQA Guidelines (Cal. Code Regs., tit. 14, § 15000 et seq) and performance standards or thresholds identified by the Energy Commission staff. The determination of whether a project has a significant effect on biological resources is based on the best scientific and factual data that staff could review for the project. In this analysis the following impacts to biological resources are considered significant if the project would result in:

- a substantial adverse effect to plant species considered by the California Native Plant Society (CNPS), CDFW, or USFWS to be rare, threatened, or endangered in California or with strict habitat requirements and narrow distributions; a substantial impact to a sensitive natural community (i.e., a community that is especially diverse; regionally uncommon; or of special concern to local, state, and federal agencies);
- a substantial adverse effect to wildlife species that are federally-listed or state-listed or proposed to be listed; a substantial adverse effect to wildlife species of special concern to CDFW, candidates for state listing, or animals fully protected in California;
- substantial adverse effects on habitats that serve as breeding, foraging, nesting, or migrating grounds and are limited in availability or that serve as core habitats for regional plant and wildlife populations;
- substantially interferes with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites;
- a substantial adverse effect on important riparian habitats or wetlands and any other “Waters of the U.S.” or state jurisdictional waters; and
- conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan.

LAWS, ORDINANCES, REGULATIONS, AND STANDARDS

The project owner would need to comply with the following LORS during project construction and operation, as listed in **Biological Resources Table 1.** There are no new LORS since publication of the RSA that would affect the PSEGS project however the Desert Tortoise (Mojave Population) Recovery Plan (USFWS 2011a) was issued and replaces the Desert Tortoise (Mojave Population) Recovery Plan (USFWS 1994a) and Draft Revised Recovery Plan (USFWS 2008a). The update plan included revised recovery unit designations and builds upon the foundations of the 1994 plan to aid in the recovery of the desert tortoise. Notwithstanding changes to the 1994 plan; the revised recovery plan did not anticipate the extent to which the landscape of desert ecosystems in the Pacific Southwest might become modified as a result of the nation's renewable energy priorities (USFWS 2011a). The USFWS considers the revised recovery plan to be a living document and the recommendations identified in the plan have been considered in the evaluation of impacts to desert tortoise in this FSA.

Biological Resources Table 1
Laws, Ordinances, Regulations, and Standards (LORS)

Applicable LORS	Description
Federal	
Federal Endangered Species Act (Title 16, United States Code, section 1531 et seq., and Title 50, Code of Federal Regulations, part 17.1 et seq.)	Designates and protects federally threatened and endangered plants and animals and their critical habitats.
Clean Water Act (Title 33, United States Code, sections 1251 through 1376, and Code of Federal Regulations, part 30, section 330.5(a)(26))	Requires the permitting and monitoring of all discharges to surface water bodies. Section 404 requires a permit from the U.S. Army Corps of Engineers (USACE) for a discharge of dredged or fill materials into waters of the U.S., including wetlands. Section 401 requires a permit from a regional water quality control board (RWQCB) for the discharge of pollutants. By federal law, every applicant for a federal permit or license for an activity that may result in a discharge into a California water body, including wetlands, must request state certification that the proposed activity will not violate state and federal water quality standards.
Eagle Act (Title 50, Code of Federal Regulations, section 22.26)	Would authorize limited take of bald eagles (*Haliaeetus leucocephalus*) and golden eagles (*Aquila chrysaetos*) under the Eagle Act, where the taking is associated with, but not the purpose of activity, and cannot practicably be avoided.
Eagle Act (Title 50, Code of Federal Regulations, section 22.27)	Would provide for the intentional take of eagle nests where necessary to alleviate a safety hazard to people or eagles; necessary to ensure public health and safety; the nest prevents the use of a human-engineered structure; or the activity, or mitigation for the activity, will provide a net benefit to eagles. Only inactive nests would be allowed to be taken except in the case of safety emergencies.
Bald and Golden Eagle Protection Act (Title 16, United States Code section 668)	This law provides for the protection of the bald eagle and the golden eagle by prohibiting, except under certain specified conditions, the take, possession, and commerce of such birds. The 1972 amendments increased penalties for violating provisions of the Act or regulations issued pursuant thereto and strengthened other enforcement measures. Rewards are provided for information leading to arrest and conviction for violation of the Act.

Applicable LORS	Description
California Desert Conservation Area (CDCA) Plan	The California Desert Conservation Area (CDCA) Plan was established by Congress at the time of the passage of the Federal Land and Policy Management Act (FLPMA). The FLPMA outlines how the BLM will manage public lands. Congress specifically provided guidance for the management of the CDCA and directed the development of the 1980 CDCA Plan.
Northern and Eastern Colorado Desert Coordinated Management Plan (NECO)	A regional amendment to the CDCA Plan approved in 2002, NECO protects and conserves natural resources while simultaneously balancing human uses in the northern and eastern portion of the Colorado Desert.
Migratory Bird Treaty Act (Title 16, United States Code, sections 703 through 711)	Makes it unlawful to take or possess any migratory nongame bird (or any part of such migratory nongame bird) as designated in the Migratory Bird Treaty Act.
Executive Order 11312	Prevent and control invasive species.
Wild Free-Roaming Horse and Burro Act (Public Law 92-195)	Wild horses and burros are protected from capture, branding, harassment, and death, and managed with the intent to achieve and preserve the natural ecological balance on public lands.
Desert Tortoise (Mojave Population) Recovery Plan (USFWS 2011)	Describes a strategy for recovery and delisting of the desert tortoise.
State	
California Endangered Species Act of 1984 (Fish and Game Code, sections 2050 through 2098)	Protects California’s rare, threatened, and endangered species.
Protected furbearing mammals (California Code of Regulations, Title 14, section 460)	Fisher, marten, river otter, desert kit fox, and red fox may not be taken at any time.
California Code of Regulations (Title 14, sections 670.2 and 670.5)	Lists the plants and animals of California that are declared rare, threatened, or endangered.
Fully Protected Species (Fish and Game Code, sections 3511, 4700, 5050, and 5515)	Designates certain species as fully protected and prohibits the take of such species or their habitat unless for scientific purposes (see also California Code of Regulations Title 14, section 670.7).
Nest or Eggs (Fish and Game Code section 3503)	Protects California’s birds by making it unlawful to take, possess, or needlessly destroy the nest or eggs of any bird, except as otherwise provided by code or regulation.
Birds of Prey (Fish and Game Code section 3503.5	Unlawful to take, possess, or destroy any birds in the orders Falconiformes and Strigiformes or to take, possess, or destroy the nest or eggs of any such bird except as otherwise provided by code or regulation.
Migratory Birds (Fish and Game Code section 3513)	Protects California’s migratory birds by making it unlawful to take or possess any migratory nongame bird as designated in the Migratory Bird Treaty Act or any part of such migratory nongame birds except as otherwise provided by code or regulation.

Applicable LORS	Description
Nongame mammals (Fish and Game Code section 4150)	Makes it unlawful to take or possess any non-game mammal or parts thereof except as provided in the Fish and Game Code or in accordance with regulations adopted by the commission.
Significant Natural Areas (Fish and Game Code section 1930 and following)	Designates certain areas such as refuges, natural sloughs, riparian areas, and vernal pools as significant wildlife habitat.
California Environmental Quality Act (CEQA), CEQA Guidelines section 15380	CEQA defines rare species more broadly than the definitions for species listed under the state and federal endangered species acts. Under section 15830, species not protected through state or federal listing but nonetheless demonstrable as “endangered” or “rare” under CEQA should also receive consideration in environmental analyses. Included in this category are many plants considered rare by the California Native Plant Society (CNPS) and some animals on the CDFW’s Special Animals List.
Streambed Alteration Agreement (Fish and Game Code sections 1600 and following)	Regulates activities that may divert, obstruct, or change the natural flow or the bed, channel, or bank of any river, stream, or lake in California designated by CDFW in which there is at any time an existing fish or wildlife resource or from which these resources derive benefit. Impacts to vegetation and wildlife resulting from disturbances to waterways are also reviewed and regulated during the permitting process.
California Native Plant Protection Act of 1977 (Fish and Game Code section 1900 and following)	Designates state rare, threatened, and endangered plants.
California Desert Native Plants Act of 1981 (Food and Agricultural Code section 80001 and following and California Fish and Game Code sections 1925-1926)	Protects non-listed California desert native plants from unlawful harvesting on both public and private lands in Imperial, Inyo, Kern, Los Angeles, Mono, Riverside, San Bernardino, and San Diego Counties. Unless issued a valid permit, wood receipt, tag, and seal by the commissioner or sheriff, harvesting, transporting, selling, or possessing specific desert plants is prohibited.
Porter-Cologne Water Quality Control Act	Regulates discharges of waste and fill material to waters of the state, including “isolated” waters and wetlands.

Desert Renewable Energy Conservation Plan – Interim Planning

In addition to the federal, state, and local LORS summarized above, federal and state agencies are currently collaborating to establish joint policies and plans to expedite development of California’s utility scale renewable energy projects. On October 12, 2009, the State of California and the U.S. Department of Interior entered into a Memorandum of Understanding (MOU) on renewable energy, building on existing efforts by California and its federal partners to facilitate renewable energy development in the state. The MOU stems from California and Department of Interior energy policy directives, and California’s legislative mandate to reduce greenhouse gases to 1990 levels by 2020, and meet the goal of 33 percent of California’s electricity production from renewable energy sources by 2020.

The California-Department of Interior MOU expands on several MOUs issued in 2008 to establish the activities of the California Renewable Energy Action Team (REAT). The REAT was established with California Executive Order S-14-08 (issued November 18, 2008), to "*establish a more cohesive and integrated statewide strategy, including greater coordination and streamlining of the siting, permitting, and procurement processes for renewable generation*…"

The Energy Commission and CDFW are the primary state collaborators of the REAT agencies, operating under a November 18, 2008 MOU between the two agencies to create a "one-stop process" for permitting renewable energy projects under their joint permitting authority. The REAT agencies also include the BLM and the USFWS under a separate MOU signed in November 2008, which outlines the state and federal cooperation of the group. In October 2011, two MOUs were issued that outlined the participation and engagement of the REAT agencies and the Desert Renewable Energy Conservation Plan (DRECP) for participating agencies, one MOU was between CDFW, Energy Commission, BLM, USFWS and the California State Land Commission and one was between CDFW, Energy Commission, BLM, USFWS and the US Department of Defense.

The October 12, 2009 MOU between California and the Department of Interior reiterates several tasks of the REAT agencies provided for in S-14-08 and the Energy Commission–Fish and Game MOU (2009). The MOU between California and the Department of Interior MOU was amended and reissued on January 13, 2012. The primary change to the MOU included the inclusion of additional participating agencies including the California Public Utilities Commission (CPUC), the California State Lands Commission (CSLC), and the California Independent System Operator (CAISO). The updated MOU was based on SBX2 (2011). Modifications to the objectives of this MOU included an extension of the timeline to complete the draft DRECP from June 2012 to the second quarter 2013 but which is now targeted for the third quarter of 2013.

The REAT agencies' primary mission is to streamline and expedite the permitting processes for renewable energy projects in the Mojave and Colorado Desert ecoregions within the State of California, while conserving endangered species and natural communities at the ecosystem scale. To accomplish this goal the REAT agencies are developing a Desert Renewable Energy Conservation Plan (DRECP), a science-based process for reviewing, approving, and permitting renewable energy applications in California. Once the DRECP is complete, which was anticipated in late 2012 and now is anticipated in 2013, the plan will be a state Natural Communities Conservation Plan (NCCP) and a federal Habitat Conservation Plan (HCP) that will provide tools to expedite coordination of federal and state endangered species act permitting. Last year the Legislature gave the CDFW the authorization to allow take of the fully-protected golden eagle as a covered species in a NCCP. When the DRECP is completed, and if the DRECP includes the PSEGS site as expected, the take of golden eagles would be covered. The DRECP would also offer a unified framework for state and federal agencies to oversee mitigation actions, including land acquisitions, for listed species. Since 2010 when the approved project was licensed, major DRECP milestones reached include the release of the Description and Comparative Evaluation of Draft DRECP Alternatives for public review and comment in December 2012. The Draft DRECP is anticipated to be released for formal public review in October 2013.

The REAT agencies recognize that some renewable energy projects are scheduled to be approved prior to completion of the DRECP. Section 8.9 of the October 2009 Draft Planning Agreement for the DRECP <www.energy.ca.gov/2009publications/...2009.../REAT-1000-2009-034.PDF> provides explicit guidance for such interim projects, and directs the REAT agencies to ensure that permitting for these projects:

- be consistent with the preliminary conservation objectives for the DRECP;
- not compromise successful completion and implementation of the DRECP;
- facilitate Endangered Species Act, California Endangered Species Act, National Environmental Policy Act, and California Environmental Quality Act compliance; and
- not be unduly delayed during preparation of the DRECP.

REAT Account and SBX8 34

The REAT agencies signed a Memorandum of Agreement (MOA) with the National Fish and Wildlife Foundation (NFWF) in May 2010 to establish a REAT Account that may be used by project developers to deposit funding for specified mitigation for approved renewable energy projects in the Mojave and Colorado Desert region of southern California (the MOA is available at <www.energy.ca.gov/33by2020>). For each project using the REAT Account, an individual subaccount would be established for project specific tracking, compliance and accounting purposes. The subaccount would include a list of the specific mitigation actions, the cost, a timeframe for carrying out the actions, and identify which of the REAT agencies would be responsible for requiring and coordinating the mitigation actions. NFWF would manage the subaccount on behalf of the REAT agencies, and at their direction would disburse mitigation funding to satisfy mitigation requirements for impacts to biological resources. NFWF is a charitable non-profit corporation established in 1984 by the federal government to accept and administer funds to further the conservation and management of fish, wildlife, plants and other natural resources <hwww.nfwf.org>.

Senate Bill 1094, enacted in 2012, established criteria for selection of the entity that will hold endowments to fund the long-term management of mitigation lands for projects such as this one. The bill, codified at Gov. Codes § 65965-65968, limits the circumstances under which NFWF may hold project related endowments. SB 1094 prohibits state and local agencies from requiring that endowment funds be transferred to a preferred endowment holder, and CEC does not require that endowments be held or managed by NFWF.

Subject to SB 1094 and other applicable state and federal laws, project developers may elect to use the REAT Account, but use of that account will not change any of the requirements a project proponent must fulfill in order to comply with applicable State and Federal environmental laws governing the permitting of the projects. Renewable energy developers are not required to use the REAT Account to fulfill their obligations for securing compensation lands and are free to undertake mitigation on their own, except for the required contribution in **BIO-13** to the regional raven control program.

The SBX8 34 legislation that was signed into law by the Governor created a $10 million loan that provides for advanced mitigation habitat purchases. This advanced mitigation can be used by a qualifying solar renewable energy project to receive credit for implemented mitigation after a project proponent pays into the Renewable Energy Development Fee Trust Fund that was created by the SBX8 34 legislation (SBX8 34 Trust Fund). Funds in the NFWF-administered REAT Account and the SBX8 34 Trust Fund are similar in that renewable energy project proponents pay into accounts set up to receive project-specific mitigation funds, and a third party entity implements the mitigation actions. Condition of Certification **BIO-28** provides an opportunity for the project owner to fulfill their mitigation obligations by depositing funds into the SBX8 34 Trust Fund.

The REAT agencies have developed a total cost accounting method for calculating acquisition or conservation easement costs for mitigation lands, including costs associated with the purchase transaction, appraisal, escrow, and title insurance including mineral, oil, and gas rights (REAT 2010). The estimate also addresses costs of initial enhancement (e.g., signs, fencing, and boundary/property line surveys; or restoration actions such as removal of exotic species, roads), management for ongoing activities such as public access and enforcement; and monitoring the implementation, effectiveness, and compliance of conservation measures with the goals and objectives. For those projects using the REAT Account for implementing mitigation actions, the budget includes administration of contracts and reporting. These cost estimates are also used for purposes of establishing an appropriate security amount in conditions of certification.

PROPOSED MODIFIED PROJECT

Palen Solar Holdings, LLC (PSH) (referred to as the project owner in this document) propose to construct, own, and operate the Palen Solar Electric Generating System (PSEGS project or modified project). The approved Palen Solar Power Project (PSPP) was a concentrated solar thermal parabolic trough electric power generating facility with two adjacent, independent, and identical solar plants of 250-megawatt (MW) nominal capacity each, for a total nominal capacity of 500 MW. For the PSEGS, two adjacent solar fields producing 250 MW each are proposed for a combined nominal output of approximately 500 MW using BrightSource's solar tower technology. The PSEGS project site is located approximately ½- mile north of Interstate 10 (I-10), approximately 10 miles east of the small community of Desert Center, and less than 2 miles from the southern edge of Palen Dry Lake in an unincorporated area of eastern Riverside County, California.

The PSEGS site occurs at elevations ranging from 130 feet above mean sea level (MSL) along the eastern edge to 200 feet above MSL near the southwestern portion of the study area. The study area for the PSPP was approximately 13,715 acres, encompassing the 4,024-acre Project Disturbance Area (including the transmission Disturbance Area) for the PSPP. The study area for the PSPP included all areas that would have been required to be surveyed for the PSEGS per the Energy Commission's Siting Regulations (proposed project site plus 1 mile buffer and project linear features plus a 1,000 foot buffer) except for the slight re-routing of the generation tie-line near the western end of the route and around the Red Bluff Substation, currently under construction, which encompasses 18.9 acres (120-foot Proposed Corridor). The Natural Gas Line corridor has been relocated since the submittal of the Petition to Amend from a previously unsurveyed area and would instead be located within the study area for the PSPP (Palen 2013d). Refer to **Biological Resources Figure 2**. The PSEGS Project Site Disturbance Area (solar facility and common area) is smaller by 572 acres than the footprint of the PSPP Project Site Disturbance Area. The total Project Disturbance Area for PSEGS is approximately 3,898acres. The total Project Disturbance Area for the PSEGS includes the Transmission Line Disturbance Area (81.9 acres for the 120-foot Permitted Corridor and 18.9 acres for the 120-foot Proposed Corridor), the Natural Gasline Disturbance Area (3.5 acres), and the Project Site Disturbance Area (3,794 acres). New biological resource surveys of the PSEGS site were not required for areas of the project that were included in the license for the PSPP as the project owner holds a license to construct a power plant within the PSEGS footprint. Only new areas of the PSEGS project required additional biological resource surveys.

The project owner has applied for a revised right-of-way (ROW) grant for approximately 5,200 acres of open lands owned by the federal government and managed by the U.S. Bureau of Land Management (BLM) (BLM 2013a). The portion within the ROW that would support all project facilities and would be disturbed by the project is 3,896 acres, referred to as the Project Disturbance Area (BLM 2013).

A detailed description of the project is provided in the **PROJECT DESCRIPTION**. The following discusses key PSEGS project design elements as they relate to the potential effects on biological resources.

Proposed Modified Project Features

In the Petition to Amend the PSEGS project features were identified and changes from the PSPP were described. This section will describe the modified project features for the PSEGS and all project description changes from the PSPP. A discussion of the potential for impacts to biological resources and applicable biological conditions of certification that would reduce the adverse environmental effects to less-than-significant levels are discussed in this FSA under the “Assessment of Impacts” and “Discussion of Mitigation” subsections of this document. The project changes to the PSEGS discussed in this section include the following:

- Two 250-MW power-generating units, each consisting of a dedicated field of approximately 85,000 heliostats, a 750-foot solar tower and receiver, and a power block;
- An approximately 15-acre common facilities area located in the southwestern corner of the site, with an administrative/warehouse building and two 2-acre evaporation ponds (reduced from four 2-acre evaporation ponds for the PSPP);
- An approximately 203-acre temporary construction laydown area located in the southwestern portion of the site immediately north of the common facilities area.

- Re-routing of the generation tie-line near the western end of the route and around the newly constructed Red Bluff Substation, currently under construction; the purpose of this re-routing is to align the PSEGS generation tie-line route immediately adjacent to the NextEra Desert Sunlight generation tie-line to minimize crossings over Interstate 10 and to ensure easy entry into the Red Bluff Substation nearest the PSEGS breaker position;
- Natural gas delivery from a new extension of the existing Southern California Gas (SoCal Gas) distribution system to the project boundary;
- No need for relocation of the existing Southern California Edison 161-kv power line, and

Solar Power Tower Technology

For the PSEGS, two adjacent solar fields producing 250 MW each are proposed for a combined nominal output of approximately 500 MW using BrightSource's solar tower technology. The two adjacent solar fields would each consist of a power block and approximately 85,000 heliostats for heating a receiver on top of a 750 foot tall solar power tower. During construction, portions of the PSEGS site would be graded, including portions along the ephemeral washes. Grading is not intended to level the site, but rather to prepare the site for installation of the heliostats and ease future maintenance activities. As such, the drainages would remain, to the extent feasible, and natural drainage waters are expected to continue to flow in and through these ephemeral washes. Any grading required would be designed to maintain existing drainage pathways, where possible (Palen 2013e). Approximately 27 percent of the site will be completely developed and the rest of the site will be left largely intact. Disturbance-tolerant wildlife and birds will continue to inhabit and utilize the site throughout construction and operation, and ongoing vegetation management and operational activities such as mowing, vegetation removal, and mirror washing could continue to degrade remnant native habitat. Grading and mowing during construction, and continued vegetation control during operations, could affect ephemeral drainages both on and offsite, over the life of the project.

Modification of the Project's Generation-tie Line

The PSPP provided an analysis of two proposed 230-kV transmission line connection routes to two alternate Southern California Edison (SCE) Red Bluff substation sites. The 230/500-kV Red Bluff substation sites would be constructed, owned, operated, and maintained by SCE (Galati & Blek 2010i). SCE considered the construction of two substations sites (eastern and western) and two separate transmission lines (eastern and western) would have been required for each of the two sites. The Red Bluff substation and both alternate sites were described in further detail in the 'Reasonably Foreseeable Project' subsection of the PSPP Revised Staff Assessment (RSA) however since the Red Bluff substation is currently under construction this section has not been included in the PSEGS analysis. The final location of the SCE Red Bluff substation, which is currently under construction, would require the project owner to construct the eastern generation tie line (gen-tie) alignment. The discussion of the western gen-tie alignment has also not been included in this FSA.

Addition of Natural Gas Line

The PSPP did not include a natural gas supply pipeline, but rather was approved to use liquid petroleum gas for its auxiliary fuel. The PSEGS would use natural gas to fire its auxiliary and nighttime preservation boilers. The natural gas supply for PSEGS would be provided by SoCal Gas via a new pipeline that would extend southward from the site and interconnect with an existing SoCal Gas transmission pipeline located just south of I-10. The new gas pipeline, approximately eight inches in diameter and 2,956 feet long, would disturb an approximately 50 foot wide corridor that would be approximately 3,000 feet long and encompasses 3.3 acres. The proposed natural gas line distribution disturbance area encompasses approximately 0.23 acres.

Relocation of the Blythe Eagle Mountain 161kv Line

The existing 161-kV Eagle Mountain-Blythe power line which runs in a northwesterly direction across the southwest portion of the PSEGS site, would no longer require relocation for the PSEGS project as it would have for the PSPP project.

Emergency Access Gates

Due to site constraints increasing the difficulty of providing a secondary access road, **Worker Safety and Fire Protection** staff is instead requiring at least two emergency access gates, one each on the north fence line and south fence line. In the event of an emergency, if the main access road was blocked, all-terrain fire engines would be able to access the site through these gates. **Worker Safety and Fire Protection** staff is requiring that PSEGS “buy into” the Riverside County Fire Department’s all-terrain fire engines purchased by the Genesis Solar Energy Project by paying the Genesis project owners the PSEGS’ fair share of the cost of the purchase and maintenance of the fire engines. See the **Worker Safety and Fire Protection** section of this FSA for more details.

SETTING AND EXISTING CONDITIONS

REGIONAL SETTING

The PSEGS project would be located within the Northern and Eastern Colorado Desert Coordinated Management Plan (NECO) area; a region that includes most of the California portion of the Sonoran Desert ecosystem. Specifically, it is located at the southwestern side of Palen Dry Lake, between the Chuckwalla and Palen mountains in eastern Riverside County (DTPC 2006). The project site would be located within the central portion of Chuckwalla Valley, an area east of Palm Springs in the remote Colorado Desert, a subsection of the Sonoran Desert. The range of the Chuckwalla Valley is from 400 feet above mean sea level (MSL) at Ford Dry Lake to approximately 1,800 feet above MSL along some of the bajadas that occur west of Desert Center, California with the surrounding mountains rising to over 3,000 above MSL (Solar Millennium 2009a). Hydrologically, the study area occurs in the Colorado River Basin within the Chuckwalla Valley Drainage Basin. This is an internally drained basin and all surface water flows to Palen Dry Lake in the western portion of Chuckwalla Valley and Ford Dry Lake in the eastern section of Chuckwalla Valley.

The Sonoran Desert region of southeastern California has a uniquely ‘tropical’ warm desert climate influenced by the addition of monsoonal summer rains; a contrast to the dry summer Mediterranean climate that characterizes much of California. The unique position of the region contributes to the presence of a number of rare and endemic plants and vegetation communities specially adapted to this bi-modal rainfall pattern, and not found elsewhere in California. These include microphyll woodlands, palm oases, and a number of summer annuals that only germinate after a significant warm summer rain.

The Chuckwalla Valley is a region of active aeolian (wind-blown) sand migration and deposition but at a magnitude substantially less that it had experienced during dune aggradational events since the late Pleistocene. Nevertheless, aeolian processes play a major role in the creation and establishment of sand dune habitat in the Chuckwalla Valley and those within the project area. These habitats are essential to the existence of the Mojave fringe-toed lizard among many other dune habitat specialists. In general, major local sand migration corridors utilized in the past are currently utilized but the corridors have decreased in width since the late Pleistocene within the project area indicating that the aerial extent of aeolian activity in recent times is less than it once was during regional dune aggradational events (Solar Millennium 2010b, Geomorphic Aeolian and Ancient Lake Shoreline Report).

The dominant sand migration direction within the corridors is toward the east and south. Regional aeolian system studies indicate that the prevailing wind responsible for aeolian sand transport was from the northwest toward the southeast and locally controlled by topography (mountain ranges). Three aeolian sand migration corridors have been identified within the Chuckwalla Valley region including the following: The Dale Lake-Palen Dry Lake-Ford Dry Lake sand migration corridor; the Palen Valley-Palen Dry Lake sand migration corridor; and the Palen Pass-Palen-McCoy Valley sand migration corridor (Solar Millennium 2010b).

The PSEGS project and portions of the generation tie-in are located within designated wildlife habitat management areas (WHMA) or Desert Wildlife Habitat Management Area (DWMA). These include the Palen-Ford WHMA and DWMA Connectivity WHMA, and the Chuckwalla DWMA. Management emphasis for the Palen-Ford WHMA is on the management of the dunes and playas within the Palen-Ford dune system. Management emphasis for the DWMA Connectivity WHMA is on the geographic connectivity for desert tortoise for the conservation areas east of Desert Center (i.e., connectivity between the Chuckwalla DWMA and the wilderness area north of I-10). The Palen-McCoy Wilderness is approximately three miles to the northeast of the project and the Palen Dry Lake Area of Critical Environmental Concern (ACEC) borders the project site to the east.

Vegetation and Wildlife

Natural Communities

Seven natural communities occur within the study area for the PSEGS, a 13,715-acre area that encompassed the 4,024-acre Project Disturbance Area (including the Transmission Disturbance Area) for the PSPP, and a surrounding buffer area. These communities include: Sonoran creosote bush scrub, desert dry wash woodland (also known as “microphyll woodland”), unvegetated ephemeral streams, stabilized and partially stabilized desert dunes, active desert dunes, alkali desert sink scrub, and dry lake bed (Palen Dry Lake). Two other cover types occur in the study area: agriculture and developed. Refer to **Biological Resources Figure 3**. The Project Disturbance Area (including Transmission Line and Natural Gas Line Disturbance Area) for the modified project will include approximately 3,899 acres of disturbance to cover types. The Project Disturbance Area for the solar plant site only has been reduced by 572 acres from 4,366 acres to 3,794 acres. The Project Disturbance Area includes Sonoran creosote bush scrub, desert dry wash woodland, stabilized and partially stabilized sand dunes, and unvegetated ephemeral streams as well as minimal amounts of developed (Palen 2013f and 2013pp). Staff has provided an analysis of impacts of the PSEGS on natural communities based in part on information provided as part of the analysis for the approved PSPP project. Staff requested additional information for all new areas of the project including the natural gas line corridor and the unsurveyed segment of the generation tie-line. The project owner submitted preliminary information regarding vegetation community mapping and vegetation was re-mapped during Spring 2013 surveys to verify changes since the original mapping (Palen 2013f). Staff reviewed the final results of vegetation community mapping submitted by the project owner after the publication of the Preliminary Staff Assessment (PSA) and made minor updates to the PSEGS Project Disturbance Area acres included in **Biological Resources Table 2** (Palen 2013jj).

Three large desert washes of varying hydrologic capacity transverse the project site from the Chuckwalla Mountains, south of I-10, trending northeast under I-10 via bridges. Large collector ditches south of I-10 divert flows from the smaller streams into these three primary features. The upper portions of these three washes support more deeply incised channels with woody, riparian vegetation while dry, flashy washes located in the center of the project site support less vegetated, ephemeral washes. Areas of stabilized and partially stabilized desert dunes occur in the northeastern portion of the Project Disturbance Area in association with an active dune system with portions of desert sink scrub and lake bed farther north and east in the study area. Agriculture and disturbed areas occur in minimal amounts in the Project Disturbance Area and also occur within the 1-mile survey buffer area in the northwestern portion of the study area.

Five of the seven natural communities—desert dry wash woodland, active desert dunes, desert sink scrub, dry lake bed (playa) and stabilized and partially stabilized desert dunes—are considered rare natural communities by CDFW (CDFG 2010) and are also NECO-designated sensitive communities. Desert washes, including unvegetated ephemeral streams, are not a NECO or CNDDB community-type but are considered state jurisdictional waters (AECOM 2010a). These communities are discussed in more detail below. Vegetation communities in the study area were classified by Holland (Holland 1986) and then cross-referenced with *A Manual of California Vegetation* (Sawyer and Keeler-Wolf 1995), where appropriate. **Biological Resources Table 2** summarizes the acreage of natural communities that occurs within the study area (AECOM 2010a).

Biological Resources Table 2
Natural Communities and Cover Types

Natural Communities and Cover Type within the Biological Resources Study Area	PSEGS Project Disturbance Area[1]	PSPP Biological Resources Study Area[2]
Riparian		
Desert dry wash woodland	206	846
Unvegetated ephemeral dry wash	168	225
Subtotal Riparian	*374*	*1,071*
Upland		
Active desert dunes	0	684
Desert sink scrub	0	9
Dry lake bed	0	270
Sonoran creosote bush scrub	3335	10,845
Stabilized and partially stabilized desert dunes	186	910
Subtotal Upland	*3,522*	*12,718*
Other Cover Types		
Agricultural Land	0	833
Developed	2	149
Subtotal Other Cover Types	*2*	*982*
Total Acres	**3,899**	**14,771**

Source: Palen 2013pp(final acreages are rounded up)
1 – The Project Disturbance Area encompasses the disturbance resulting from the proposed construction of the PSEGS project including solar fields, transmission facilities, office and maintenance buildings, lay down area, bioremediation area, drainage channels, leach fields, and other components. It includes the impact acreage of the permitted gen-tie line for the Red Bluff Substation. These acreages include final data for the 18.9 acre proposed gen-tie line route included in the Final Comments on the Preliminary Staff Assessment (Palen 2013pp)
2 – The BRSA encompasses the Project Disturbance Area (area inside and outside the facility fence that will be disturbed by the project), the solar facility footprint area inside the facility fence including solar fields and other support structures and facilities, the transmission line route and buffer areas (1 mile for solar footprint, 1,000 feet for the transmission line) for the PSPP project. All features for the PSEGS except the proposed generation tie-line route are included in the PSPP Project Disturbance Area.

Sonoran Creosote Bush Scrub

Sonoran creosote bush scrub habitat characterizes the majority of the study area and intergrades with desert dry wash woodland along desert washes. This natural community is not designated as a sensitive community by BLM. CNDDB recognizes many rare associations of creosote bush scrub but none of these were found in the Project Disturbance Area. Areas of desert pavement occur in areas with a lower density of vegetation and cobbles ranging in size from one to three inches (Solar Millennium 2009a). Sonoran creosote bush scrub occurs on well-drained, secondary soils of slopes, fans, and valleys and is the basic creosote scrub habitat of the Colorado Desert (Holland 1986). Within the study area, this community is characterized by sandy soils with a shallow clay pan. Past disturbance of the study area by military training and agricultural practices has resulted in a high percentage of non-native invasive plant species, also referred to as noxious weeds, especially in the southern portion of the study area and consisting primarily of Sahara mustard (*Brassica tournefortii*), Mediterranean grass (*Schismus* sp.), and Russian thistle (*Salsola tragus*). Noxious weeds are discussed in the following section. The diversion of all the smaller washes by collector ditches south of I-10 may also contribute to the overall sparse cover and low diversity of the creosote bush scrub in the vicinity of the project.

Agriculture

There is no Holland or Sawyer and Keeler-Wolf natural community designation for this land cover type. CDFW characterizes farmed areas as cropland or more general categories of agriculture and urban/agriculture. Active and fallow agricultural fields occur within the buffer of the study area but not within the Project Disturbance Area. The majority of the lands mapped as agriculture within the study area are palm tree plantations. In fallow agricultural areas, ruderal vegetation is recolonizing previously farmed areas including exotic plant species interspersed with some native vegetation (Solar Millennium 2009a). Fallow and active agriculture fields provide habitat value to local and migratory wildlife in the form of food, cover, and shelter habitat, especially if fields are actively irrigated (Mayer and Laudenslayer 1988). Adjacent to the project site lies approximately 850 acres of palm and jojoba production, an extensive irrigation network, as well as two small man-made pools.

Developed

Developed areas consist of roadways (I-10 and Corn Springs Road) and cleared or highly disturbed land in the southern portion of the study area. A small structure, possibly a residential home, is located adjacent to the northwest corner of the Project Disturbance Area.

Dry Lake Bed

"Dry Lake Bed" corresponds with the CNDDB natural community "Playa" and incorporates the unvegetated lake bed sediments at the southern tip of Palen Dry Lake. This dry lake bed has a soft surface when wet and displays desiccation cracks once the surface dries. Dry lake beds are prone to periodic flooding with a high coefficient for swelling and contracting once dried. Palen Dry Lake is characterized as a "wet playa" since it supports significant groundwater discharge at the ground surface by evaporation (Solar Millennium 2009a). Palen Dry Lake bed is a closed, depressional basin with no natural or artificial outlet.

Noxious Weeds

Noxious weeds are species of non-native plants included on the weed lists of the California Department of Food and Agriculture (CDFA) (CDFA 2007), the California Invasive Plant Council (Cal-IPC), or those weeds of special concern identified by the Bureau of Land Management (BLM). They are of particular concern in wild lands because of their potential to degrade habitat and disrupt the ecological functions of an area (Cal-IPC 2006). Specifically, noxious weeds can alter habitat structure, increase fire frequency and intensity, decrease forage (including for special-status species, such as desert tortoise), exclude native plants, and decrease water availability for both plants and wildlife. Soil disturbance and gathering and channeling water create conditions favorable to the introduction of new noxious weeds or the spread of existing populations. Construction equipment, fill, aeolian processes and use of purchased mulch can act as vectors introducing noxious weeds into an area.

During the original project proceeding, preliminary weed data was gathered. Non-native species were recorded as a part of project surveys in 2009, and the project linear features were surveyed for the modified project in spring 2013, and a summary report has been provided (Palen 2013s). Additionally, the project owner docketed an updated weed management plan on May 28, 2013 (Palen 2013u), and performed surveys for weeds along the project linears.

Four[1] noxious weed species were observed within the study area: Sahara mustard, Russian thistle, salt cedar, and Mediterranean grass. Each of these species is identified on a list of the region's worst weeds compiled by the Low Desert Weed Management Area (NRCS 2005). Noxious weeds found in the study area are discussed further below.

Sahara mustard (*Brassica tournefortii*) was found in disturbed areas throughout Sonoran creosote bush scrub habitat (Solar Millennium 2009a, Appendix F). This species is of high concern; it is a BLM weed of special concern and Cal-IPC has declared this plant highly invasive (Cal-IPC 2006) and recommends that it should be eradicated whenever encountered. This species is associated with impacts to habitat for native wildlife as well as for native plants. It promotes the spread of fire by increasing fuel load and competes with native plants for moisture and nutrients. In addition, it increases cover and works to stabilize sand, thereby affecting wildlife species dependent on open sandy habitat (Brossard et al. 2000; Barrows and Allen 2007).

Russian thistle or tumbleweed (*Salsola* sp.) was found in several habitat types in the Project Disturbance Area, including dune, desert scrub, desert dry wash woodland, and Sonoran creosote bush scrub woodland (Solar Millennium 2009a, Appendix F). Although all invasive plants share the trait of being adapted to disturbed habitat, Russian thistle particularly tends to be restricted to roadway shoulders and other sites where the soil has been recently disturbed. However, once an area is disturbed this species competes readily and can affect native plant ecosystems and increase fire hazard (Orloff et al. 2008; Lovich 1999). Dune habitat is particularly vulnerable to non-native species, which can stabilize sand or block sand movement, and Russian thistle is considered an invasive species of primary concern in this habitat (CDFG 2007). There is a high potential that Russian thistle could become established in the construction area and this species should be eradicated if observed. Cal-IPC has determined that this plant has a limited invasiveness rating in California (Cal-IPC 2006) and the CDFA has given it a "C" rating.

Tamarisk or **salt cedar** (*Tamarix ramosissima*) is a riparian plant and is therefore restricted to habitats where there is perennial saturation such as springs and seeps, or runoff from poorly maintained water pipelines or well pumps. It was observed interspersed throughout desert dry wash woodland within the study area. Cal-IPC has declared this plant highly invasive (Cal-IPC 2006) and it is a CDFA "B" rated species.

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[1] *Fescue* sp. was also recorded, however *Festuca arundinacea*, the Cal-IPC "moderate" listed invasive species, is not expected in this area.

Salt cedar is associated with many ecological impacts including impacts to channel geomorphology, groundwater availability, plant species diversity, and fire frequency (Lovich 1999). Salt cedar can also affect sand dunes by blocking sand movement, a vital part of the natural function of these habitats (CDFG 2007).

Mediterranean grass (*Schismus arabicus, S. barbatus*) is prevalent throughout Sonoran creosote bush scrub within the study area. Mediterranean grass is an annual that reproduces by seed, and is widespread in arid and semi-arid California landscapes. This species competes effectively with native plants for nutrients and water and can provide cover that prevents native annuals from sprouting (VanDevender et al. 1997; Brossard et al. 2000) and contributes to dune stabilization (CDFG 2007). Fire, historically, was rare in the Colorado Desert. The presence of Mediterranean grass and other annual non-native grasses has provided a continuous and increased fuel load, influencing the extent, frequency, and intensity of fire in these ecosystems (Brooks and Pyke 2001; Brooks et al. 2004). BLM and other agencies recognize that because of the widespread distribution of Mediterranean grass, this species is not considered feasible to eradicate.

Sensitive Natural Communities and Waters of the State

Sensitive natural communities support unique or biologically important plant or wildlife species, or perform important ecological functions (e.g., bank stabilization or water filtration). These communities are usually locally and regionally scarce and therefore vulnerable to elimination. Sensitive natural communities in the desert region includes many wash-dependent communities, dune and playa habitats, and groundwater-dependent plant communities, such as mesquite groves, waters of the state, wetland and riparian habitats, and others that are of particular concern to BLM, CDFW, and other local, state, and federal agencies. The most current version of the Department's *List of California Terrestrial Natural Communities* indicates which natural communities are of special status given the current state of the California classification (CDFG 2010).

The following sensitive natural communities occur in or immediately adjacent to the project, and thus may be directly or indirectly affected:

- Desert dry wash woodland (waters of the state)
- Unvegetated ephemeral wash (waters of the state)
- Desert sink scrub (off-site)
- Active dunes (off-site)
- Playa/lake bed (off-site)
- Stabilized and partially stabilized dunes
- Mesquite Bosque (small stands)

Waters of the State

A total of 374.6 acres of state jurisdictional waters were documented on the PSEGS project disturbance area (Palen 2013y). Waters regulated by the U.S. Army Corps of Engineers (USACE) and U.S. Environmental Protection Agency (USEPA) do not occur on the project site. Correspondence from the USACE South Coast Branch determined that waters regulated by the USACE are not present on the project site (letter from

USACE). The project is located in a closed basin with no identifiable outlet and there is no direct hydrologic connection to any navigable waters.

This information was based on the November 25, 2009 formal jurisdictional delineation report submitted as part of the Lake and Streambed Alteration Agreement Notification application to CDFW for the approved PSPP (Galati & Blek 2009a) and a supplemental delineation conducted to address the new and altered linear facilities, including the natural gas pipeline and transmission line for the PSEGS (Palen 2013y). In August 2013 the project owner provided a CDFW Lake or Streambed Alteration Agreement Amendment Notification package (Palen 2013aaa). The delineations addressed waters (and/or wetlands) regulated under the federal Clean Water Act and/or streams and associated habitat regulated under the California Fish and Game Code. Refer to **Biological Resources Figure 4**. A total of 32 acres of jurisdictional state waters were documented downstream of the Project Disturbance Area to account for project design features of the PSPP that reduced or eliminated flow to these features post construction. The solar field for the PSEGS project would occur within the Disturbance Area of the approved PSPP project and would rely on the November 25, 2009 delineation. This report delineated all aquatic features, including desert washes which lack a continuous component of desert wash woodland but provide other wildlife habitat function and values. The delineation also included waters and wash-dependent vegetation downstream of the project footprint that would have been indirectly affected by the diversion of waters at the upstream side of the project into a perimeter stormwater conveyance channel. However, the PSEGS project requires less area and the project Disturbance Area would be reduced from 4,366 acres to 3,898 acres. In addition, the PSEGS project would not require the construction of manufactured channels within the solar field to control storm flows. The PSEGS project includes two linear facilities that were not analyzed for the approved PSPP project. This includes a natural gas pipeline and a relocation of the proposed generation tie-in to the Red Bluff substation, which is currently under construction.

Hydrology

The affected waters occur within the Chuckwalla-Palen hydrologic unit, or “watershed” of the Colorado River Hydrologic Basin Planning Area (Solar Millennium 2009a). The rainfall pattern is bimodal with a rainy season in summer and winter (December through March and July through September [commonly the wetter of the two]). Average annual rainfall for the project area is approximately 3.7 inches (NOAA 2009).

In arid fluvial systems, it is flash flood events (particularly the larger summer thunderstorms), combined with highly erosive soils of alluvial fans that most contribute to the conversion from single thread channels to a compound or anastomosing (braided) morphology. Because the ephemeral washes occurring within the disturbance area are subject to very wide fluctuations in discharges over a short period of time their channels can frequently change configuration to accommodate large variations in surface flow during storm events. As a result, arid fluvial systems usually exhibit long periods of little morphologic change interspersed with short-term dramatic changes in channel configuration. Therefore, arid stream geometry is more likely to be influenced strongly by a large event of low recurrence frequency (Lichvar et al. 2006).

Surface hydrology in the project area is influenced largely by stormwater runoff from the northeastern flank of the Chuckwalla Mountains, approximately 4 miles south, and south of I-10 (Galati & Blek 2010a). The main hydrologic feature in the watershed, and in the project area, is Corn Springs Wash, which is supported largely by precipitation but also in part by Corn Springs. The stream drains approximately 31 square miles of the Chuckwalla Mountains at higher elevations (Solar Millennium 2009a). Corn Springs Wash and all other desert washes in the watershed are ephemeral (flowing only in response to storm events). At the foot of the Chuckwalla Mountains, as Corn Springs Wash and other features empty onto the alluvial fan of more erosive, less consolidated soils, the stream system changes from single thread channel to compound, anastomosing channels with highly variable flow pathways. Compound channels are considered the most common channel types in arid regions and are characterized by low-flow meandering channels inset into a wider braided channel network (Lichvar et al. 2006). These channels are highly susceptible to widening and avulsions (i.e., rapid changes in channel position and/or channel relocation) during moderate to high discharges, reestablishing a low-flow channel during subsequent low flows (Lichvar and McColley 2008). This channel avulsion creates diverse physical features and habitats, supports a complex ecosystem, and sustains healthy stream function despite frequent and rapid changes in channel position (USACE 2007). With any compound/ anastomosing ephemeral stream system in arid regions, the riparian corridor may consist of streambanks lined with adapted riparian vegetation, unvegetated areas such as recently created swales and terraces (interfluves), or a mosaic of these types (Bendix and Hupp 2000).

Historic Hydrologic Alterations

When I-10 was constructed across the alluvial fan outlet of Corn Springs Wash over 40 years ago, it deprived the downstream reaches of all surface flows, interrupted natural channel formation and meandering nature of the alluvial fan flow path(s) that historically drained unimpeded from the Chuckwalla Mountains toward Palen Dry Lake, a playa lake (depressional desert sink) (Galati & Blek 2009a). A series of wing dikes were constructed just upstream (south) of the freeway, diverting the flows of numerous smaller channels into the three largest branches of Corn Springs Wash, which I-10 crosses with three short bridges. These dikes and bridges along I-10 concentrate the flows of dozens of small washes into three discrete discharge points. The westerly bridge near Corn Springs Road Interchange conveys flows from the main branch of Corn Springs Wash to the northwest corner of the site. The two other bridges convey flows to the center and east side of the project site respectively. The flat topography at the outlet of the culverts creates an initially incised watercourse that rapidly diminishes and eventually spreads out into numerous small, newly formed channels that abate fairly quickly. In general, alluvial fan channels become increasingly less defined as they flow down the fan (Vyverberg 2010), confinement is lost and the channels dissipate.

The elevated freeway permanently deprived flows of many of the channels that once crossed the project; many dead and declining ironwood trees are still evident and there is a marked decrease in the cover, vigor, diversity, and overall habitat function and value in the impaired reaches on the project. This observation is also supported by comparisons of current and historical aerial photography of the project site (before and after the diversions) (Galati & Blek 2010a).

Habitat Function and Value of State Waters

Desert dry washes play an integral role in the ecology of the watershed. The importance of ephemeral streams to wildlife in the desert is undisputed and well-documented in the literature, the sum of which represents decades of observations and surveys (Levick et al. 2008; Baxter 1988; Kirkpatrick et al. 2007; Kubick & Remsen 1977; Tomoff 1977; Daniels & Boyd 1979, and others). Ephemeral washes (both vegetated and unvegetated) provide unique habitat that is distinct from the surrounding uplands providing more continuous vegetation cover and microtopographic diversity than the surrounding uplands. Ephemeral and intermittent streams in the arid west provide important habitat for wildlife and are responsible for much of the biotic diversity (Levick et al. 2008). They have higher moisture content, and the topographic relief provides shade and cooler temperatures within the channel. In cases where the habitat is distinct in species composition, structure, or density, wash communities provide habitat values not available in the adjacent uplands. They provide movement corridors and seasonal access to water or moisture.

Both the wash-dependent and upland vegetation along desert washes drive food webs, provide seeds for regeneration, habitat for wildlife, access to water, and create cooler, more hospitable microclimatic conditions essential for a number of plant and animal species. Baxter (1988) noted that washes, because of their higher diversity plant communities, are probably important foraging locations for desert tortoise; in smaller washes, there is greater cover and diversity of spring annuals, providing important food sources. Researchers have noted the high diversity of herpetofauna in desert washes and many snakes and lizards preferentially use xeroriparian habitat because of its denser cover (*ibid.*). Kirkpatrick et al. (2007) noted that even dry, ephemeral washes have greater avian abundance and species richness than adjacent uplands. In a study of 66 plots on BLM lands in California, dry washes supported 1.5 times more breeding species and twice as many wintering species as the more common desert scrub (Kubick & Remsen 1977; Tomoff 1977; Daniels & Boyd 1979, and others).

The vegetation—whether dominated by woodland trees or shrubs and perennial herbs—contributes channel roughness that reduces the velocity of floodwaters, and provides organic matter for soil development and nutrient cycling. Functional services of these communities include moderating soil and air temperatures, stabilizing channel banks and interfluves, seed banking and trapping of silt and fine sediment favorable to the establishment of diverse floral and faunal species, and dissipating stream energy which aids in flood control (USEPA 2008).

During seasonal dry periods, plant species diversity levels along ephemeral stream channels are typically low. Following seasonal wet periods, however, diversity levels along some ephemeral stream channels can equal that along perennial stream channels (Lichvar and McColley 2008) with ephemeral desert annuals.

Because ephemeral and intermittent stream channels have a higher moisture content and more abundant vegetation than the surrounding areas, they are very important to wildlife. Frequently, these streams may retain the only available water in the area, with permanent pools interposed wherever hydrogeological conditions allow (USEPA 2008). The short duration and episodic flood pulses of surface and overbank flow is important as it allows some species to complete important life-history developmental stages. The habitat provided by desert streams contracts and expands dramatically in size due to the extreme variations in flow, which can range from high-discharge floods to periods when surface flow is absent. This spatial variation in habitat or ecosystem size is a fundamental, defining feature of these streams (Smith et al. 1995; USEPA 2008).

Within the survey area there was ample evidence of the presence of wildlife use of the ephemeral washes (e.g., tracks and scat) as a movement corridor (Solar Millennium 2010a). In addition to Sonoran creosote bush scrub, the desert dry wash woodland and unvegetated ephemeral dry wash communities within the survey area are considered suitable burrowing owl foraging and nesting habitat. Desert tortoises are often present in higher densities associated with drainages, swales, mountainous areas, and alluvial fans. Annual and perennial plant production is higher in these areas and is longer lasting. Ephemeral streams also contain rich assemblages of both invertebrates and macro-invertebrates (USEPA 2008).

Desert Dry Wash Woodland

Desert dry wash woodland is a sensitive natural community recognized by the CNDDB, BLM, and is also designated as state waters by CDFW (CDFG 2003, BLM CDD 2002). This community is described by Holland as an open to densely covered, drought-deciduous, microphyll (small-leaved) riparian scrub woodland. These habitats are often supported by braided wash channels that change patterns and flow directions following every surface flow event (Holland 1986).This natural community occupies the major washes that traverse the Project Disturbance Area and is dominated by an open tree layer of ironwood (*Olneya tesota*), blue palo verde (*Parkinsonia florida*), honey mesquite (*Prosopis glandulosa*), and smoke tree (*Psorothamnus spinosus*) with an understory of big galleta grass (*Pleuraphis rigida*), desert starvine (*Brandegea bigelovii*) and intermixed with creosote scrub (*Larrea tridentata*) and Russian thistle (*Salsola tragus*) (Solar Millennium 2009a, AECOM 2010a). Desert dry wash woodland is most developed in the primary wash near I-10 where channel development is most pronounced and water supply more abundant. As the washes become shallower and eventually abate into the landscape further northward from I-10 within the Project Disturbance Area, desert dry wash woodland is eventually replaced by washes of mixed creosote and big bush galleta grass, and other upland and wash-dependent species. Outside of the major washes, desert dry wash woodland appears to be declining overall within the Project Disturbance Area as hydrological diversions upstream (collector ditches and the construction and placement of I-10) in the early 1960s interrupted natural flow paths that have reduced water flows either through obstruction and/or redistribution from the Corn Springs Wash (AECOM 2010a). This community type is present along portions of the proposed natural gas pipeline and in discrete areas of the generation tie-in north of the Red Bluff sub-station.

Desert dry wash woodland habitat was surveyed for wildlife use during December 2009 and various signs of coyote (*Canis latrans*), fox (either kit fox or gray fox), burro deer (*Odocoileus hemionus eremicus*), and bobcat (*Lynx rufus*) were observed. This habitat provides value to various species of wildlife in the form as food, cover, dispersal, and refuge habitat (AECOM 2010a). Surveys of the natural gas pipeline conducted in 2013 detected or observed sign for a variety of wildlife including burro deer, desert kit fox, and burrowing owl (Palen 2013jj). Desert dry wash woodland also provides habitat for species such as desert tortoise, American badger, and loggerhead shrike and many other common and special-status species.

Other Ephemeral Desert Washes

In the project area, there are numerous smaller streams, which lack a continuous cover of desert dry wash woodland and consist largely of small compound channels. These are also recognized as regulated state waters. These smaller streams are subject to frequent channel avulsion and highly variable flow pathways contained within broad floodplains. Vegetative cover consists largely of mixed upland and wash-dependent shrubs and herbs and very widely scattered, small-statured, individual ironwood trees. These ephemeral streams provide movement corridors for small and large mammals and provide a seasonal water source not available in the surrounding dry uplands. Even smaller washes have been shown to support a higher density of spring and summer annuals than the surrounding uplands and thus provide important habitat value. Wildlife use of the site as a movement corridor is described in detail in the prior project owner's Data Responses (Solar Millennium 2010a and Palen 2013jj). Special-status species likely to benefit from ephemeral desert washes include desert tortoise.

Desert Sink Scrub

Desert sink scrub is considered sensitive by the CNDDB (CDFG 2003) and BLM (BLM CDD 2002). Desert sink scrub occurs below 4,000 feet in elevation and often exhibits poorly drained soils, a high water table with salt crust at the surface, and widely spaced shrubs (Holland 1986). This community occupies the salt clay pan and sandy areas around Palen Dry Lake in the northeastern portion of the study area. Dominant and indicator plants of this community include four-wing saltbush (*Atriplex canescens*), allscale saltbush (*Atriplex polycarpa*), bush seepweed (*Suaeda moquinii*), Arizona honeysweet (*Tidestromia oblongifolia*), western sea purslane (*Sesuvium ventricosum*), and Russian thistle. Desert sink scrub was not mapped within the Project Disturbance Area (AECOM 2010a).

Stabilized and Partially Stabilized Desert Dunes

Stabilized and partially stabilized desert dunes are considered sensitive by the CNDDB (CDFG 2010) and the BLM (BLM CDD 2002). These dune systems are described as accumulations in the desert which are stabilized or partially stabilized by evergreen and/or deciduous shrubs and scattered, low grasses. These dunes typically occur lower than active dune systems and retain water just below the sand surface which allows deep-rooted, perennial vegetation to survive during longer drought periods (Holland 1986).

Desert sand dunes are unique insular habitats that support sand obligate plants, mammals, reptiles and insects, including some that are restricted to sand dunes. Desert sand dunes are very limited in their distribution in California, comprising less than 7 percent of California's desert, and are threatened by disturbance such as intensive recreational use and other development (Luckenbach and Bury 1983). The disjunct distribution and limited nature of sand dunes in California's deserts mean that they often function as habitat islands, with the resident biota showing distinctive adaptations to their sand dune environments. Sand dunes in the American west support a number of endemic species which are unique, sensitive to disturbance, and at high risk of extinction (Van Dam and Van Dam 2008).

In the project area stabilized and partially stabilized desert dunes occupy the margins of Palen Dry Lake and extends into the PSEGS Project Disturbance Area. Dominant plants within the study area of this community include mesquite, dye bush (*Psorothamnus emoryi*), and desert milk-vetch (*Astragalus aridus*). The dunes within the study area are an important habitat type for the Mojave fringe-toed lizard, Harwood's milk-vetch, Harwood's phlox (a BLM Sensitive plant species), western burrowing owl, American badger, desert kit fox, as well as a variety of common plant and wildlife species (AECOM 2010a). A potentially new taxon of four-wing saltbush (*Atriplex canescens ssp.)* has been documented on the dunes just outside the Project Disturbance Area (Andre pers. comm., LaDoux pers. comm.) and other special-status plants and plant communities have been documented on the southern portion of Palen Dry Lake, including jack-ass clover (*Wislizenia refracta* ssp.) and mesquite bosque (Silverman pers. comm). The vegetation mapping provided in the Response to Staff Data Requests Set 1 (Palen 2013f) depicts the stabilized and partially stabilized desert dunes as a few discrete patches within the northern and eastern portion of the PSEGS Project Disturbance Area, totaling 187 acres.

Active Desert Dunes

Active desert dunes are considered sensitive by the CNDDB (CDFG 2010) and the BLM (BLM CDD 2002). This community is characterized by mostly unvegetated drifted sand dunes and sand fields of five feet or less in height. Dominant and indicator plants within the study area for this community include desert twinbugs (*Dicoria canescens*), creosote bush, birdcage evening primrose (*Oenothera deltoides*), and Russian thistle. The active desert dunes are in the northeastern portion of the study area and northeast of Palen Dry Lake. Despite the presence of Russian thistle, the active desert dunes within the study area provide habitat values to many species of plants and wildlife since there was little sign of human activity on the low-lying dunes (AECOM 2010a).

Active desert dunes only occur in the buffer area, northeast of the PSEGS project boundaries within the most active part of the wind transport corridor; no active desert dunes occur within the Project Disturbance Area.

Groundwater-Dependent Vegetation Communities

Information presented herein was generated during the original proceedings for the PSPP project; no further surveys or data collection was determined to be necessary as part of analysis of the modified project. Groundwater-dependent ecosystems (GDEs) are an important component of biological diversity in the California desert region. Because they are rare or limited in distribution, they often support rare or special-status plants and animals. All GDEs depend upon groundwater for all or part of their survival. Characteristic GDEs of the California desert region include playas or dry lakes, seeps and springs, mesquite woodlands (mesquite "bosques"), microphyll woodland or desert dry wash woodland, palm oases, alkali sink scrubs, alkali meadows, alkali desert scrub, and spring mounds. Groundwater may also be a vital component of the base flows of rivers and streams, and wetlands (Howard & Merrifield 2010).

In the desert region, phreatophytes, or deep-rooted plant species that obtain water from a permanent ground supply or from the water table, are largely restricted to areas of high groundwater availability, such as larger desert washes, the fringe zone around ephemeral or dry lakes (Sawyer et al. 2009), dune areas, and alluvial riverine systems (Smith et al 1998). They are also found around seeps and springs, such as fan palm oases (*Washingtonia*). Several leguminous trees form extensive riparian woodlands, such as mesquite (*Prosopis*), ironwood (*Olneya*), and palo verde (*Cercidium*), and there are a number of halophytic shrubs that are indicative of shallow saline groundwater, including seep-weed (*Suaeda*), greasewood (*Sarcobatus*), iodine bush (*Allenrolfea*), and some saltbush species (*Atriplex canescens, A. spinifera*) (ibid). Other desert shrubs such as sagebrush (*Artemisia*) and rabbitbrush (*Chrysothamnus*) facultatively exploit groundwater (ibid). Cheesebush (*Hymenochlea*), a common desert wash shrub, is also included on some lists of desert phreatophytes.

The distinction between phreatophytes depending on groundwater or exploiting surface water or soil moisture is complicated in areas where groundwater levels are not shallow. However, groundwater elevation contour mapping by Steinemann (1989) suggests that groundwater levels around Palen Lake are within the known rooting depths for most of the phreatophytes documented within the zone potentially affected by the project wells, including:

- mesquite woodlands (Solar Millennium 2009a, Appendix F; Sawyer 2009; Evens & Hartman 2007; Silverman pers. comm);
- alkali sink scrubs (Solar Millennium 2009a), dune communities along the margins of the playa (Solar Millennium 2009a, Silverman pers. comm.);
- and ironwood-palo verde woodlands (Evens & Hartman 2007, BLM CDD 2002).

Documented examples around Palen Dry Lake were also confirmed during staff site visits or through aerial photo interpretation. Groundwater levels drop to over 100 feet at Ford Dry Lake and are even deeper in other portions of the valley (Worley-Parsons 2009). Desert phreatophytes are legendary for their deep-rooting (Barbour et al. 2007). Mesquite, for example, typically root to depths of 40 feet but have been documented to root as deep as 150 feet (Steinberg 2001) to over 250 feet in one example at a mine shaft (Sosebee and Wan 1989).

The potentially groundwater-dependent plant communities found or documented to occur within the area that would be affected by groundwater pumping (Solar Millennium 2010l) are described below, including their importance to wildlife and special-status species known to occur in these areas. All of these natural communities are recognized as rare or sensitive by either CDFW (CDFG 2010) or BLM (or both).

Mesquite Bosque and Microphyll Woodlands

Shrubby “bosques” (groves) of honey mesquite occur around the open, unvegetated playa along the northwest and southwest margins of Palen Dry Lake (Evans and Hartman 2007) on small coppice dunes (vegetated sand mounds) (Solar Millennium 2009a, Appendix F).

Mesquite bosques are a rare and sensitive community recognized by BLM and the CNDDB (CDFG 2003). They occur in areas with access to permanent and stable groundwater. When available, mesquite will exploit sources of deep water by growing a taproot. Mesquite can also persist on sites that have little or no ground water by growing lengthy shallow lateral roots. In some parts of their range they are considered “facultative phreatophytes” that function as phreatophytes if unlimited water is available, but are capable of surviving on sites with limited soil water. In California, however, they are very rare outside of washes or areas with available groundwater (Steinberg 2001). They also occur as a decumbent or running bush found on coppice dunes. These adaptations allow honey mesquite to retain most leaves in all but the most severe droughts (Ansley et al. 2004).

The fruit of honey mesquite is valuable forage for wildlife; it is quite predictable, even in drought years, annually providing an abundant and nutritious food source for numerous wildlife species upon ripening in summer (Steinberg 2001). The fruit's pericarp is high in sugars and the seeds contain large amounts of protein. Where they occur, honey mesquite seeds form an important part of the diet of mice, kangaroo rats, ground squirrels, quail, black-tailed jackrabbit, mule deer, and many other wildlife. Mesquite flowers are eaten by numerous bird species. Quail and many other birds eat mesquite buds and flowers in the spring and seeds during the fall and winter. Western honey mesquite communities often attract large numbers of birds that feed on the mistletoe fruit.

Other known phreatophytic woodlands in the project area include the native trees associated with desert wash dry woodland in the Sonoran Desert region: ironwood, palo verde, smoke tree, and cat’s claw (*Acacia greggii =syn. Senegalia greggii*); the invasive exotic salt cedar (also known as “tamarisk”). These microphyllous trees occur largely along desert washes but they can also be observed singly or in small stands outside of the stream channels on the valley floor or across the upper bajadas on very small channels. The best examples are found on the largest desert washes. The importance of these desert riparian ecosystems to wildlife is described above under “Desert Dry Wash Woodland”.

Bush Seepweed and Other Alkali Sink Scrubs

Other known phreatophytes observed in the project vicinity (Evens & Hartman 2007) include succulent chenopod scrubs dominated by bush seepweed, which forms pure stands or co-occur with four-wing saltbush (*Atriplex canescens*) over large areas around the margins of Palen Dry Lake. Bush seepweed is a characteristic component of alkali sinks, a low-growing, grayish, succulent phreatophyte (Barbour et al. 2007) occupying fine-textured, often poorly drained, saline-alkaline soils on or around the playa margins. It is a ‘facultative’ wetland plant meaning that it can occur in wetlands or non-wetlands, and it is recognized as a phreatophyte, rooting at depths of several meters to access groundwater (Patten et al. 2007).

In the project area, bush seepweed-dominant chenopod scrubs occur in the northern portion of the project area and around Palen Dry Lake, predominantly in sand drifts over playa. This has also been confirmed in detailed surveys, mapping, and classification conducted by CNPS for the BLM NECO plan (Evens & Hartman 2007). Other sink scrubs documented in the project vicinity around Palen Dry Lake include facultative wetland scrubs of iodine bush (*Allenrolfea californica*) and communities dominated by the special-status plant jackass clover (*Wislizenii refracta* ssp. *refracta*) (Evens & Hartman 2007). These communities often occur on the margins of dry lake beds in the Colorado, Sonoran, Mojave, and Great Basin deserts typically below 4,000 feet in elevation (Holland 1986). Chenopod scrub provides habitat value to many species of common and special-status plants, mammals, and reptiles as dispersal, foraging, and cover habitats especially in association with other upland and desert wash communities. Special-status species documented in the scrubs at the northeast portion of the project area include Mojave fringe-toed lizard. Other observed wildlife or known associates include zebra-tailed lizard and kangaroo rat. Alkaline sink scrubs in the vicinity are also associated with the rare Abram's spurge, which is documented from less than five viable occurrences statewide, including an occurrence at Ford Dry Lake in similar habitats.

Sand Dune Transport System

This subsection provides a brief explanation of wind transport of sand relative to the creation, preservation, and destruction of sand dunes in the project area. **BIOLOGICAL RESOURCES APPENDIX A**, provides a more detailed explanation, as does the Geomorphic Evaluation for Reconfigured Alternatives 2 and 3 (Kenney 2010), the Preliminary Sand Transport Summary included in Response to CEC Data Request Set 2 (Palen 2013r), the Final Sand Transport Study (Palen 2013kk) and Supplement No. 1 (Palen 2013bbb) and staff's Geomorphic Assessment of Sand Transport for the Modified Project (Palen Solar Electric Generating System) (CEC 2013v).

The PSEGS (proposed modified project) footprint covers several different land units that vary along a southwest to northeast gradient in the degree of aeolian sand transport they experience. The least sandy land unit is within the PSEGS's western solar field which is almost entirely a stable, coarse gravel alluvial fan surface (referred to as Zone IV in Solar Millennium 2010b). Refer to **Biological Resources Figure 5a.** The sand dunes in the southern and western sector of the PSEGS site are a mixture of degraded vegetated dunes with thin coarse sand, and patches of alluvial gravel lag and desert varnish. This surface has been formed primarily by deposition of sand and gravel from alluvial fans (fluvial action) over hundreds of thousands of years, overlain with patches of vegetated sand dunes that formed from wind action during periods of greater sand availability. The sand dunes on the mid fan have subsequently degraded due to wind erosion and deflation (sand is being removed by the wind but not replaced). Deflation of the relict dunes is leaving behind the more resistant alluvial deposits as a protective lag of gravel. In many places the lag has formed desert varnish (a black coloration on the exposed surface of gravel particles). The presence of desert varnish suggests that parts of this surface have been stable and exposed in its current condition for many hundreds to thousands of years. There is little available sand for either transport to dunes down wind, and the sand that is present is coarse (1–2 millimeter (mm)) with abundant fine gravel (2 mm and larger). The vegetation cover is largely sparse creosote bushes and degraded dunes, with ironwood trees in the larger washes.

Northeast is a more active wind-blown sand area with relatively shallow sand deposits (Zone III) on the lower alluvial fan. This is an area of shallow vegetated sand dunes with a transition from creosote bushes to grasses. The dunes are in relative equilibrium – losses of sand due to wind erosion are matched by deposition of sand from upwind. Refer to **Biological Resources Figure 5a.**

At the northeastern portion of the PSEGS project site within the lower alluvial fan is an area of deeper and more active vegetated sand dunes (Zone II). Refer to **Biological Resources Figure 5a.** This area is characterized by hummocky vegetated dunes with greater topographic expression than the zone to the west, implying that they are more actively supplied by sand. This zone lies within the Palen Dry Lake–Chuckwalla sand transport corridor, a regionally significant geomorphic feature that provides sand build and supports sand dune habitat. This sand corridor stretches down the Chuckwalla Valley to Blythe and the Colorado River.

The most active area of sand transport is Zone I, northeast of the PSEGS project boundary. Two sand transport corridors come together just to the east of the PSEGS project: the Palen Valley corridor which runs from north to south along the eastern edge of the project and the Palen Dry Lake–Chuckwalla Valley corridor which runs northwest to southeast through the northeastern half of the project.

Special-Status Species

Special-status species are plant and wildlife species that have been afforded special recognition by federal, state, or local resource agencies or organizations. Listed and special-status species are of relatively limited distribution and typically require unique habitat conditions. Special-status species are defined as meeting one or more of the following criteria:

1. Listed as threatened or endangered or candidates for future listing as threatened or endangered under CESA or FESA;

2. Protected under other regulations (e.g. Migratory Bird Treaty Act);

3. Listed as fully protected or species of special concern by CDFW;

4. A plant species considered by the CNPS to be “rare, threatened, or endangered in California” (California Rare Plant Ranks (CRPR) List 1A, 1B, 2A and 2B) as well as CRPR List 3 and 4[2] plant species;

5. A plant listed as rare under the California Native Plant Protection Act[3];

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[2] List 3 plants may be analyzed under CEQA §15380 if sufficient information is available to assess potential impacts to such plants. Factors such as regional rarity vs. statewide rarity should be considered in determining whether cumulative impacts to a RPR 4 plant are significant even if individual project impacts are not. RPR 3 and 4 may be considered regionally significant if, e.g., the occurrence is located at the periphery of the species' range, or exhibits unusual morphology, or occurs in an unusual habitat/substrate. For these reasons, RPR List 3 and 4 plants should be included in the field surveys. RPR 3 and 4 plants are also included in the California Natural Diversity Database’s (CNDDB) Special Plants, Bryophytes, and Lichens List. [Refer to the current online published list available at: http://www.dfg.ca.gov/biogeodata.] Data on RPR 3 and 4 plants should be submitted to CNDDB. Such data aids in determining or revising priority ranking (CDFG 2009).

6. Considered a locally significant species, that is, a species that is not rare from a statewide perspective but is rare or uncommon in a local context such as within a county or region or is so designated in local or regional plans, policies, or ordinances; or

7. Any other species receiving consideration during environmental review under CEQA.

The BLM designates Sensitive species as those requiring special management considerations to promote their conservation and reduce the likelihood and need for future listing under ESA. BLM Sensitive species include all Federal Candidate and Federally Delisted species which were so designated within the last 5 years, and CNPS List 1B species that occur on BLM lands. For the purposes of this analysis, Energy Commission staff considers all BLM Sensitive species as special-status species.

Biological Resources Table 3 lists all special-status species evaluated during the analysis that are known to occur or could potentially occur in the project area and vicinity. Special-status species detected or considered possible or likely to occur based on known occurrences in the vicinity and suitable habitat present within the project area are discussed in more detail below. Special-status species observed during the field surveys conducted in 2009 and 2010 as well as staff site visits in 2013 are indicated by **bold-face type** (Solar Millennium 2009a, AECOM 2010a, Palen 2013m). Staff received the final results of biological resource surveys conducted in spring 2013 including a list of all species observed on the modified linear facilities during surveys and no updates to the table were required (Palen 2013jj).

Biological Resources Table 3
Special-Status Species Known to or With Potential to Occur in the Palen Solar Electric Generating System Biological Resources Study Area

PLANTS		
Common Name	**Scientific Name**	**Status State/Fed/CNPS/BLM/ Global Rank/State Rank**
Chaparral sand verbena	*Abronia villosa var. aurita*	__/__/1B.1/Sensitive/G5T3T4/S2
Angel trumpets	*Acleisanthes longiflora*	__/__/2.3/__/G5/S1
Desert sand parsley	*Ammoselinum giganteum*	__/__/2.3/__/G2G3/SH
Small-flowered androstephium	*Androstephium breviflorum*	__/__/2.2/__/G5/S2S3
Harwood's milk-vetch	***Astragalus insularis var. harwoodii***	**__/__/2.2/__/G5T3/S2**
Coachella Valley milk-vetch	***Astragalus lentiginosus var. coachellae***	**__/FE/1B.2./Sensitive/G5T2/S2**
California ayenia	***Ayenia compacta***	**SE/__/2.3/__/G4/S3?**
Pink fairy duster	*Calliandra eriophylla*	__/__/2.3/__/G5/S2S3
Sand evening-primrose	*Camissonia arenaria*	__/__/2.2/__/G4?/S2
Crucifixion thorn	*Castela emoryi*	__/__/2.3/__/G3/S2S3

[3] As defined by the California Native Plant Protection Act, a plant is rare when, although not presently threatened with extinction, the species, subspecies, or variety is found in such small numbers throughout its range that it may be endangered if its environment worsens (Fish and Game Code §1901) (CDFG 2009).

PLANTS		
Common Name	**Scientific Name**	**Status State/Fed/CNPS/BLM/ Global Rank/State Rank**
Abram's spurge	*Chamaesyce abramsiana*	__/__/2.2/__/G4/S2S3
Arizona spurge	*Chamaesyce arizonica*	SR/__/2.3/__/G5/S2
Flat-seeded spurge	***Chamaesyce platysperma***	**__/__/1B.2/ Sensitive/G3/S1**
Las Animas colubrina	*Colubrina californica*	__/__/2.3/__/G4/S2S3.3
Spiny abrojo/Bitter snakeweed	*Condalia globosa var. pubescens*	__/__/4.2/__/G5T3T4/S3.2
Foxtail cactus	*Coryphantha alversonii*	__/__/4.3/__/G3/S3.2
Ribbed cryptantha	***Cryptantha costata***	**__/__/4.3/__/G4G5/S3.3**
Winged cryptantha	*Cryptantha holoptera*	__/__/4.3/__/G3G4/S3?
Wiggins' cholla	*Cylindropuntia wigginsii (syn=Opuntia wigginsii)*	__/__/3.3/__/G3?Q/S1
Utah vining milkweed	*Cynanchum utahense*	__/__/4.2/__/G4/S3.2
Glandular ditaxis	*Ditaxis claryana*	__/__/2.2/__/G4G5/S1
California ditaxis	***Ditaxis serrata var. californica***	**__/__/3.2/__/G5T2T3/S2**
Cottontop cactus	***Echinocactus polycephalus var. polycephalus***	**__/__/__/__/__/__**
Harwood's eriastrum	***Eriastrum harwoodii***	**__/__/1B.2/ Sensitive/G2/S3**
Morning-glory heliotrope	*Heliotropium convolvulaceum*	**__/__/__/__/__/__**
California satintail	*Imperata brevifolia*	__/__/2.1__/G2/S2.1
Pink velvet mallow	*Horsfordia alata*	__/__/4.3/__/G4/S3.3
Bitter hymenoxys	*Hymenoxys odorata*	__/__/2.1/__/G5/S2
Spearleaf	*Matelea parvifolia*	__/__/2.3/__/G5?/S2.2
Darlington'sblazing star	*Mentzelia puberula*	__/__/2.2/__/G4/S2
Slender woolly-heads	*Nemacaulis denudata var. gracilis*	__/__/2.2/__/G3G4T3?/S2
Lobed ground cherry	*Physalis lobata*	__/__/2.3/__/G5/S2
Desert portulaca	*Portulaca halimoides*	__/__/4.2/__/G5/S3
Desert unicorn plant	*Proboscidea althaeifolia*	__/__/4.3/__/G5/S3.3
Orocopia sage	***Salvia greatae***	**__/__/1B.3./Sensitive/G2/S 2**
Desert spikemoss	*Selaginella eremophila*	__/__/2.2./__/G4/S2.2?
Cove's cassia	*Senna covesii*	__/__/2.2/__/G5?/S2
Mesquite nest straw	*Stylocline sonorensis*	__/__/1A/__/G3G5/SX
Dwarf germander	*Teucrium cubense ssp. depressum*	__/__/2.2/__/G4G5T3T4/S2
Jackass clover	*Wislizenia refracta ssp. refracta*	__/__/2.2/__/G5T5?/S1
Palmer's jackass clover	*Wislizenia refracta ssp. palmeri*	__/__/2.2/ __/G5T2T4/S1
"Palen Lake atriplex"[4]	***Atriplex* sp. nov. J. Andre (*Atriplex canescens* ssp?)**	**__/_ / _/Sensitive/__/__**

[4] Proposed new taxon (Andre, pers. comm.). BLM may consider proposed new taxa as BLM Sensitive (Lund, pers. comm.)

WILDLIFE		
Common Name	**Scientific Name**	**Status State/Federal/BLM**
Reptiles/Amphibians		
Desert tortoise	***Gopherus agassizii***	**ST/FT/__**
Couch's spadefoot toad	***Scaphiopus couchii***	**CSC/__/Sensitive**
Mojave fringe-toed lizard	***Uma scoparia***	**CSC//Sensitive**
Birdsstaff has provided expanded avian and bat species lists**		
Eared grebe**±	*Podiceps nigricollis*	__/__/__
Black vulture	*Coragyps atratus*	__/__/__
Turkey vulture**	*Cathartes aura*	__/__/__
Northern harrier	*Circus cyaneus*	SSC/__/__
Swainson's hawk**	***Buteo swainsoni***	**ST/__/__**
Ferruginous hawk**	*Buteo regalis*	WL/BCC/S
Red-tailed hawk**	*Buteo jamaicensis*	_/__/__
Golden eagle	***Aquila chrysaetos***	**FP/BCC/S**
Bald eagle	***Haliaeetus leucocephalus***	**SSC, FP/ BCC /S**
American kestrel**	*Falco sparvius*	__/__/__
Prairie falcon**	*Falco mexicanus*	WL/BCC/__
American peregrine falcon	*Falco peregrinus anatum*	FP/BCC/__
Gambel's quail**	*Callipepla gambelii*	_/__/__
Yuma clapper rail	**Rallus longirostris yumanensis**	**FP, T/E/__**
Vaux's swift	*Chaetura vauxi*	SSC/__/__
Killdeer**	*Charadrius vociferus*	_/__/__
Mountain plover	***Charadrius montanus***	**SSC/BCC/S**
White-winged dove**	*Zenaida asiatica*	__/__/__
Mourning dove**	*Zenaida macroura*	__/__/__
Greater roadrunner**	*Geococcyx californianus*	__/__/__
Barn owl**	*Tyto alba*	__/__/__
Western burrowing owl	***Athene cunicularia hypugaea***	**SSC/BCC/S**
Short-eared owl	*Asio flammeus*	SSC/__/__
Lesser nighthawk**	*Chordeiles acutipennis*	__/__/__
Great horned owl	*Bubo virginianus*	__/__/__
Long-eared owl	*Asio otus*	SSC/__/__
Short-eared owl	*Asio flammeus*	SSC/__/__
White-throated swift**	*Aeronautes saxatalis*	__/__/__
Costa's hummingbird**	*Calypte anna*	__/__/__
Say's phoebe**	*Sayornis saya*	__/__/__
Gilded flicker	***Colaptes chrysoides***	**SE/BCC/__**
Gila woodpecker	***Melanerpes uropygialis***	**SE/BCC/S**
Ash-throated flycatcher**	*Myiarchus cinerascens*	__/__/__
Vermilion flycatcher	*Pyrocephalus rubinus*	SSC/__/__
Western kingbird**	*Tyrannus verticalis*	__/__/__
Yellow warbler	*Dendroica petechia sonorana*	SSC/BCC/__
Yellow-breasted chat	*Icteria virens*	SSC/__/__
Loggerhead shrike**	*Lanius ludovicianus*	SSC/BCC/__

WILDLIFE		
Common Name	**Scientific Name**	**Status State/Federal/BLM**
Common raven**	*Corvus corax*	__/__/__
California horned lark	*Eremophila alpestris actia*	WL/__/__
Northern rough-winged swallow**	*Stelgidopteryx serripenis*	__/__/__
Barn swallow**	*Hirundo rustica*	__/__/__
Cliff swallow**	*Petrochelidon pyrrhonota*	__/__/__
Purple martin	*Progne subis*	SSC/__/__
Verdin**	*Auriparus flaviceps*	__/__/__
Bewick's wren**	*Thryomanes bewickii*	__/__/__
Black-tailed gnatcatcher**	*Polioptila melanura*	__/__/__
Bendire's thrasher	*Toxostoma bendirei*	SSC/BCC/S
Crissal thrasher	*Toxostoma crissale*	SSC/__/__
Le Conte's thrasher	*Toxostoma lecontei*	WL/BCC/S
Orange-crowned warbler**	*Vermivora celata*	__/__/__
Nashville warbler**	*Vermivora ruficapilla*	__/__/__
Black-throated gray warbler**	*Dendroica nigrescens*	__/__/__
Yellow-rumped warbler**	*Dendroica coronata*	__/__/__
Chipping sparrow**	*Spizella passerina*	__/__/__
Brewer's sparrow**	*Spizella breweri*	__/BCC/__
Lark sparrow**	*Chondestes grammacus*	__/__/__
White-crowned sparrow**	*Zonotrichia leucophrys*	__/__/__
House finch**	*Carpodacus mexicanus*	__/__/__
Mammals		
Pallid bat	*Antrozous pallidus*	CSC/__ / Sensitive
Townsend's big-eared bat	*Corynorhinus townsendii*	CSC/__/ Sensitive
Small-footed myotis	*Myotis ciliolabrum*	__/__/SSSensitive
Western yellow bat	*Lasiurus xanthinus*	SSC/__/SSSensitive
Western mastiff bat	*Eumops perotis californicus*	CSC/__/ Sensitive
California leaf-nosed bat	*Macrotus californicus*	CSC/__/ Sensitive
Yuma myotis	*Myotis yumanensis*	__/__/ Sensitive
Colorado Valley woodrat	*Neotoma albigula venusta*	__/__/__
Burro	*Equus asinus*	__/____/__/__
Burro deer	***Odocoileus hemionus eremicus***	__/__/__
Nelson's bighorn sheep	*Ovis canadensis nelson*	__/__/ Sensitive
Yuma mountain lion	*Puma concolor browni*	CSC/__/__

WILDLIFE		
Common Name	**Scientific Name**	**Status State/Federal/BLM**
American badger	***Taxidea taxus***	**CSC/__/__**
Desert kit fox	***Vulpes macrotis arsipus***	**__/__/__**
Insects		
Riverside cuckoo wasp	Hedychridium argenteum	__/__/ Sensitive
Casey's June beetle	**Dinacoma caseyi**	**__/E/__**
California mellitid bee	Melitta californica	**__/__/__**
Bradley's cuckoo wasp	Ceratochrysis bradleyi	**__/__/__**
Desert cuckoo wasp	Ceratochrysis longimala	**__/__/__**
Senile tiger beetle	Cicindela senilis frosti	**__/__/__**
Greenest tiger beetle	Cicindela tranquebarica viridissima	**__/__/__**

Sources: CNDDB 2013

**These species were observed by staff at the Palen Solar Energy Generating System Project site during site visits performed April 9 and 10, 2013.

±These species were observed by staff immediately adjacent to the Palen site within ponds located in the agricultural areas.

Status Codes:

Federal FE = Federally listed endangered: species in danger of extinction throughout a significant portion of its range
FT = Federally listed, threatened: species likely to become endangered within the foreseeable future
BCC: Fish and Wildlife Service: Birds of Conservation Concern: identifies migratory and non-migratory bird species (beyond those already designated as federally threatened or endangered) that represent highest conservation priorities <www.fws.gov/migratorybirds/reports/BCC2002.pdf>

State CSC = California Species of Special Concern: species of concern to CDFW because of declining population levels, limited ranges, and/or continuing threats have made them vulnerable to extinction.
CFP = California Fully Protected
SE = State listed as endangered
ST = State listed as threatened
SR = State listed as rare
WL = State watch list

California Rare Plant Rank
List 1A = Plants Presumed Extirpated in California and Either Rare or Extinct Elsewhere
List 1B = Rare, threatened, or endangered in California and elsewhere
List 2A = Plants Presumed Extirpated in California, But More Common Elsewhere

List 2B = Rare, threatened, or endangered in California but more common elsewhere
List 3 = Plants which need more information
List 4 = Limited distribution – a watch list
0.1-Seriously threatened in California (over 80% of occurrences threatened / high degree and immediacy of threat)
0.2-Moderately threatened in California (20-80% occurrences threatened / moderate degree and immediacy of threat)
0.3-Not very threatened in California (<20% of occurrences threatened / low degree and immediacy of threat or no current threats known)

Bureau of Land Management
BLM Sensitive = Species requiring special management consideration to promote their conservation and reduce the likelihood and need for future listing under the ESA. BLM Sensitive species also include all Federal Candidate species and Federal Delisted species which were so designated within the last 5 years and CNPS List 1B plant species that occur on BLM lands. http://www.blm.gov/style/medialib/blm/wo/Information_Resources_Management/policy/blm_manual.Par.43545.File.dat/6840.pdf.

Global Rank/State Rank

Global rank (G-rank) and State rank (S-rank) is a reflection of the overall condition of an element throughout its global (or State) range. Subspecies are denoted by a T-Rank; multiple rankings indicate a range of values. State rank (S-rank) is assigned much the same way as the global rank, except state ranks in California often also contain a threat designation attached to the S-rank. An H-rank indicates that all sites are historical
G1 or S1 = Critically imperiled; Less than 6 viable element occurrences (EOs) OR less than 1,000 individuals
G2 or S2 = Imperiled; 6-20 EOs OR 1,000-3,000 individuals
G3 or S3 = Rare, uncommon or threatened, but not immediately imperiled; 21-100 EOs OR 3,000-10,000 individuals
G4 or S4 = Not rare and apparently secure, but with cause for long-term concern; this rank is clearly lower than G3 but factors exist to cause some concern; i.e., there is some threat, or somewhat narrow habitat.
G5 or S5= Demonstrably widespread, abundant, and secure.

Threat Rank
.1 = very threatened
.2 = threatened
.3 = no current threats known

Special-Status Plant Species

As shown in **Biological Resources Table 3,** several special-status plant species have the potential to occur within the study area. Four of these were observed within the study area: Harwood's milk-vetch, Harwood's eriastrum, California ditaxis, and ribbed cryptantha. Utah vining milkweed was observed outside the study area to the east and was documented in Solar Millennium's (prior project owner) July 2010 spring survey report (Solar Millennium 2010m). A potential new taxon of saltbush was reported and documented in the dunes just north of the project boundary (Andre, pers. comm.), and was mapped in the prior project owner's preliminary spring 2010 survey report (AECOM 2010d). It has no official status or recognition at this time; however, the BLM State Botanist has indicated that potential new taxa may be treated as BLM Sensitive species (Lund, pers. comm.), and thus it is included here as a special-status species. Of the six species observed during the surveys, only the Harwood's milk-vetch, California ditaxis, and ribbed cryptantha occur within the Project Disturbance Area. Refer to **Biological Resources Figure 6**.

Several additional species were included in staff's analysis for the PSPP because they are documented or reported to occur within Chuckwalla Valley in similar habitats, or along washes in the surrounding foothills; however, they were not observed in the study area during the spring 2009 or 2010 surveys (AECOM 2010d, Solar Millennium 2009a, Solar Millennium 2010k, Solar Millennium 2010l): Jack-ass clover, Palmer's jackass clover, mesquite nest straw, dwarf germander, Abram's spurge, glandular ditaxis, desert unicorn plant, winged cryptantha, and Las Animas colubrina. Another rare species, morning-glory heliotrope, has been observed in the Chuckwalla Valley and Palo Verde mesa, but this new range extension from the Arizona flora has no status yet in California (Silverman, pers. comm.).

For the PSPP, staff considered that, at a minimum, the following late-blooming special-status plants had some potential to occur based on suitable habitat and known occurrences within the Sonoran Desert region of California: Abram's spurge, flat-seeded spurge, lobed ground cherry, and glandular ditaxis. Surveys for late-season special-status plants were completed in fall 2010. Fall 2010 botanical surveys were conducted in the PSPP project area, which included all areas within one mile of the approved project site, on October 11, 2010 through October 15, 2010. Summer/fall annual plant species were detected in bloom and/or fruit within and in the vicinity of the project, confirming that late season surveys were being conducted at the appropriate time, but no special-status plant species were detected in the PSPP project area during the October 2010 surveys. Surveys would also be required to locate these late-blooming special-status plants identified as potentially occurring and any other late-blooming special-status plants. Surveys have not been completed for late-season special-status plants along the along the modified generation tie-line route and new gas pipeline corridor. The botanical survey report for the fall 2013 surveys is expected in November 2013.

The special-status plants found in the study area during the 2009-2010 spring surveys for the PSPP and the 2013 spring surveys for PSEGS are described below, followed by a discussion of the late-season special-status plants that may be detected during the fall 2013 surveys for PSEGS, or that are considered to have some potential for occurrence in the study area based on the presence of suitable habitat and known occurrences in the region. Staff requested additional information for all new areas of the PSEGS including the natural gas line corridor and the unsurveyed segment of the generation tie-line corridor. The project owner submitted final survey reports regarding rare plant surveys conducted in March 2013 for the PSEGS that included a complete floristic inventory for the spring 2013 surveys and no additional special-status plants were found (Palen 2013jj).

In order to better define and categorize rarity in California's flora, the CNPS Rare Plant Program and Rare Plant Program Committee developed the new California Rare Plant Ranks (CRPR) 2A and CRPR 2B in 2010 (CNPS 2010). These new categories, in addition to the initial categories, are described as follows:

- List 1A are plants presumed extirpated in California and either rare or extinct elsewhere
- List 1B are rare, threatened, or endangered in California and elsewhere
- List 2A are plants presumed extirpated in California, but more common elsewhere
- List 2B are rare, threatened, or endangered in California but more common elsewhere
- List 3 are plants which need more information
- List 4 are limited distribution or a watch list
- 0.1-Seriously threatened in California (over 80% of occurrences threatened / high degree and immediacy of threat)
- 0.2-Moderately threatened in California (20-80% occurrences threatened / moderate degree and immediacy of threat)
    - 0.3-Not very threatened in California (<20% of occurrences threatened / low degree and immediacy of threat or no current

Harwood's Milk-vetch

Harwood's milk-vetch is a California Rare Plant Rank (RPR) 2B.2 species, meaning that it is moderately threatened in California, but more common elsewhere. It is also a covered species under the NECO Plan. It is an annual herb that mainly occurs in Sonoran desert scrub habitat throughout the Colorado Desert (BLM CDD 2002). This subspecies is found in desert dunes and sandy or gravelly areas throughout the Mojave and Sonoran deserts covering portions of Imperial, Riverside, and San Diego counties (CNPS 2009). Historic and recent collections include Ogilby Road in Imperial County and three locales west of Blythe, the Pinto Basin, and Chuckwalla Basin in Riverside County. Harwood's milk-vetch has also been reported from Baja California, Sonora Mexico, and portions of Yuma County, Arizona (Reiser 1994). There are several CNDDB records for this species within the project vicinity (CNDDB 2010).

For the PSPP, staff reviewed the occurrence data in the Consortium of California Herbaria and detected 3 new occurrences that were not in the CNDDB. All of these are historical occurrences. Of the total 46 occurrences in California (CNDDB plus new additional occurrences), 9 of these are protected under Park Service or State Park ownership. A total of 11 records are historical records. Sixteen of these occurrences have documented threats including development, OHV, agriculture, transmission lines, road maintenance, and trash dumping.

A total of 146 Harwood's milk-vetch plants were documented in the study area during the 2009 and 2010 surveys for the PSPP (Solar Millennium 2010k). Only four of these occurrences occur within the Project Disturbance Area for the PSEGS totaling 6 plants (5 in solar field and 1 in generation tie-line corridor). Many new occurrences were documented in Chuckwalla Valley and the Palo Verde mesa during the 2010 surveys for the Blythe Solar Power Project (Solar Millennium 2010k) and the Genesis Solar Energy Project (Solar Millennium 2010k) study areas. This species was not observed during March 2013 surveys for the PSEGS along the proposed generation tie-line or the natural gasline route.

Ribbed Cryptantha

Ribbed cryptantha is a RPR 4.3 species, meaning that it has limited distribution in California, but it is not very threatened in California. It typically occurs in loose friable soils in the eastern Mojave and Sonoran deserts in Imperial, Riverside, San Diego, and San Bernardino counties and into Arizona and south to Baja California, Mexico (CNPS 2009). It commonly occurs in stabilized and partially stabilized desert dunes and sandy areas of Sonoran and Mojavean desert creosote bush scrub. There are 116 records of this species from several locations throughout Riverside, Imperial, San Diego, and Imperial counties in the Consortium of California Herbaria database; the nearest collection is from the Palen Valley approximately three miles east of the Desert Center Airport (CCH 2010).

CDFW protocols for botanical surveys specify: *"Factors such as regional rarity vs. statewide rarity should be considered in determining whether cumulative impacts to a List 4 plant are significant even if individual project impacts are not. CNPS List 3 and 4 may be considered regionally significant if, e.g., the occurrence is located at the periphery of the species' range, or exhibits unusual morphology, or occurs in an unusual habitat/substrate. For these reasons, CNPS List 3 and 4 plants should be included in the field surveys."* (CDFG 2009). The protocols also recommend that cumulative impacts should be considered in the assessment of impacts to RPR 4 plants.

A large local population of this RPR watch list (RPR 4.3) species was found during the 2010 surveys for the PSPP for this and other projects in the vicinity (Solar Millennium 2010k, TTEC 2010m, AECOM 2010v). None of the surveyors have reported that the occurrences exhibit a local or regional significance. Plant estimates of this species were made using sub-sampling methods and an estimate of 8,903 plants per acre was used. Approximately 285 acres and 1,309 acres of occupied ribbed cryptantha acreage were estimated within the PSPP Project Disturbance Area and buffer area, respectively (Solar Millennium 2010m, Table 3). In Data Request Set 4 staff requested that the project owner provide an impacts analysis similar to the impact analysis provided for the PSPP for this species and all other special-status plant species that includes an estimate of the acres of impact or number of individuals in the PSEGS Project Disturbance Area. Plant estimates for this species occupied approximately 15.9 acres in the solar field area totaling approximately 141,558 plants (Palen 2013ss). This species was not observed during March 2013 surveys for the PSEGS along the proposed generation tie-line or the natural gasline route.

Harwood's Eriastrum

Harwood's eriastrum, also known as Harwood's phlox, or Harwood's woollystar, is a BLM Sensitive spring annual currently known from only 14 documented locations worldwide. It is RPR 1B.2 species, which indicates it is rare, threatened, or endangered throughout its range. It is a California endemic with a global range restricted to San Diego, Riverside, and San Bernardino counties, typically in dunes associated with the margins around dry lakes such as Dale, Cadiz, and Soda lakes. Recently, surveys conducted in spring of 2010 for the Blythe Solar Power Project located this plant primarily in the sandy areas south of I-10, where 2,134 plants were located and mapped (AECOM 2010v). All of these plants were identified in the general vicinity of the Southern California Edison Colorado River Substation. Staff considers all stabilized and partially stabilized dunes to be suitable habitats for this species in the study area.

For the PSPP, staff reviewed the occurrence data in the Consortium of California Herbaria and detected 2 new occurrences that were not in the CNDDB. Both of these are historical records from 1939 and 1958. Of the total of 14 occurrences in California (12 CNDDB plus two additional historic records), three of these are protected under Park Service or State Park ownership. A total of three records are historical records. Four of these occurrences have documented threats, including OHV use and non-native plant impacts.

This species was not observed during 2009 field surveys for the PSPP; however, a total of 23 Harwood's eriastrum plants were observed in the partially stabilized dunes in the northeast corner of the study area during spring 2010 field surveys for the PSPP (Palen 2013ss). No Harwood's eriastrum were found within the Project Disturbance Area for the PSPP and this species does not occur in the PSEGS Project Disturbance Area. This species was not observed during March 2013 surveys for the PSEGS along the proposed generation tie-line or the natural gasline route.

Utah Vining Milkweed

This twining perennial occurs in sandy or gravelly soils in Mojavean and Sonoran desert scrub habitats or washes from approximately 500 feet to 4,300 feet in elevation (CNPS 2009). The distribution of this species covers San Diego, Imperial, Riverside, and San Bernardino counties and portions of Arizona, Nevada, and Utah.

Until recently discovered growing on the Palo Verde Mesa (AECOM 2010v), it was believed that the project was outside of the range of Utah vining milkweed. As a RPR List 4.2, it is not tracked in CNDDB but there are 58 records of this species from the Consortium of California Herbaria database primarily from San Bernardino and San Diego counties; there is one record from the Big Maria Mountains from wash and stabilized dune habitat at approximately 1,200 feet elevation (CCH 2010). This species was not found during 2009 field surveys; however, this plant was observed incidentally at a single location outside of the study area, east of Palen Lake. No Utah vining milkweed plants were observed within the Project Disturbance Area or buffer area during 2009 or 2010 field surveys for the PSPP (Solar Millennium 2010m, Figure 7). This species was not observed during March 2013 surveys for the PSEGS along the proposed generation tie-line or the natural gasline route.

California Ditaxis

California ditaxis is a RPR 3.2 species (a review list), meaning that its taxonomic status is questionable and more information is needed. It may be a glabrous variety of the common *Ditaxis neomexicana* but appears to be a rare variety of the common species. Its occurrences in California are fairly endangered (CNPS 2009). This species occupies Sonoran desert scrub habitat, and prefers sandy washes and alluvial fans of the foothills and lower desert slopes, from 100 to 3,000 feet above mean sea level. Reports of this species are known from San Bernardino, Riverside, Imperial, and San Diego counties, and Sonora, Mexico (CNPS 2009). There are 17 records from the CNDDB (2010) primarily from Riverside County.

For the PSPP, staff reviewed the occurrence data in the Consortium of California Herbaria and detected four new occurrences that were not in the CNDDB. Three of these are historical records from between 1921 and 1952; however, one more recent occurrence was found at Anza-Borrego Desert State Park near Starfish Cove Canyon. Of the total 21 occurrences in California (CNDDB plus new additional occurrences), two of these are protected under Park Service ownership. A total of four records are historical records. Five of these occurrences have documented threats, including, OHV use, road grading, and construction of a new power line.

A total of 22 plants were documented in the study area during the 2010 surveys for the PSPP; half of these (11) occur within the PSPP Project Disturbance Area along the gen-tie line (Solar Millennium 2010m, Table 3). These 11 plants are also in the PSEGS Project Disturbance Area along the generation tie line corridor. This species was not observed during March 2013 surveys for the PSEGS along the proposed modified generation tie-line or the natural gasline route.

Atriplex sp. nov

A potentially new taxon of saltbush (*Atriplex*) was discovered on the saline playa margins of Palen Dry Lake last year by a botanist with the U.C. Reserve System (Andre and La Doux, pers. comm.). It resembles the common four-wing saltbush (*Atriplex canescens*), a common plant of dunes which has very linear leaves, but the new taxon has obovate leaves that distinguish it from all *Atriplex canescens* and its subspecies (Andre, pers. comm.). Solar Millennium's botanical consultant tentatively treated it as a variety of the common four-wing saltbush. Although plasticity in fruit and vegetative characters hinders description and identification, many of the subspecies of four-wing saltbush have been demonstrated to differ in ploidy level and chemical constituents and thus their biological validities are confirmed, including *Atriplex canescsens* ssp. *linearis* (Sanderson & Stutz 1994).

The undescribed *Atriplex* was first collected in 2005 at the "dry lake" just northeast of the Interstate 15 and Highway 95 junction approx 35 miles east and northeast of Las Vegas, Nevada. The first voucher/observation of it in California was at Palen Lake 2009. There is also potential for it to occur along the I-8 corridor in Imperial County. Although it is distinct from the common *Atriplex canescens* in its obovate leaves, it would be easy to overlook the new taxon where they co-occur, even by experienced botanists. The new taxon is more confined to subsaline or saline playa margins, though not necessarily so. Andre (pers. comm.) indicated that it may also have been observed in the Ford Dry

Lake area (unconfirmed) and it has been observed in other saline (but non-playa) habitats on remnants of the lower Colorado River flood plain.

Several plants of four wing saltbush were found within in the buffer area, northeast of the PSPP project site during spring 2010 field surveys for the PSPP (Solar Millennium 2010m, Figure 7). This species has been observed in other saline (but non-playa) habitats on remnants of the lower Colorado River flood plain (Andre, Silverman, pers. comm.). This species was not observed during March 2013 surveys for the PSEGS along the proposed generation tie-line or the natural gasline corridor.

Desert Unicorn Plant

Desert unicorn plant is a RPR 4.3 plant species, meaning it has limited distribution, but is not very threatened in California. This is a covered species under the NECO Plan. This is a low-growing, perennial species that occurs in sandy washes within Sonoran desert scrub habitats in San Bernardino, Imperial, Riverside, and San Diego counties of California. There are 13 records known from the NECO planning area in Milipitas Wash, Chuckwalla Valley, and Chemehuevi Valley (BLM CDD 2002). The blooming period for this species is from May to August (CNPS 2009). It is a late-season bloomer but it has large and distinctive seed pods that can be detected during routine spring surveys. It has a fleshy root system that can remain dormant in dry years. As a RPR 4.3, it is not tracked in CNDDB but there are 36 records in the Consortium of California Herbaria, several of which are from the Chuckwalla Mountains and Desert Center area, including the project area (CCH 2010). This species was not observed during spring 2009 or 2010 field surveys performed for the PSPP; however this plant has been identified in the project region for other solar projects (AECOM 2009d, 2009a and b). This species was not observed during March 2013 surveys for the PSEGS along the proposed generation tie-line or the natural gasline. Although surveys were not conducted during the blooming period it can be detected during routine spring survey so no additional surveys are required to confirm if this species is present.

Abram's Spurge

Abram's spurge is a late-season, ephemeral annual that responds to summer monsoonal rains but dries quickly and cannot be detected during routine spring surveys. It is a RPR 2B.2 species meaning it is moderately threatened in California but more common elsewhere (CNPS 2009). Habitat consists of sandy flats in creosote bush scrub habitat from approximately 600 to 2,700 feet above mean sea level. This summer annual occurs in halophytic (saline-alkaline) scrub flats, playas, and along inlets and floodplains of playas and always seems to prefer the lower floodplain ecotone but can also extend higher up in the floodplain drainages (Silverman, pers. comm.). Based on fourteen Consortium of California Herbaria database records for this species, habitats in Riverside, San Diego, and Imperial counties consist of sandy soil habitats often along dry lake margins, whereas documented occurrences in San Bernardino County occur on coarser, possibly sandy loams. Abram's spurge occurs from San Bernardino County to Imperial and eastern San Diego counties to Arizona, Nevada, Mexico, and Baja California (GSEP 2009a, b). The CNDDB (CNDDB 2010) lists 15 occurrences of this plant within the Riverside, Imperial, San Bernardino, and San Diego counties in California, east through Nevada to Arizona, and as far south as Baja California, Mexico. Of the total of 15 occurrences in California, seven of these are protected under Park

Service, CDFW, or State Park ownership. A total of four records are historical records and one of these occurrences has documented threats which include grazing. A recent 2000 CNDDB record is from a location near the project site; approximately 0.5 mile east of Ford Dry Lake on Gasline Road just south of I-10, and reported as a "substantial population" (CNDDB 2010).

During workshops the project owner discussed that a request for a Rare Plant Status Review has been submitted to California Native Plant Society (CNPS) for Abram's spurge currently a RPR Rank 2 Plant, as their biologist reports it is so abundant along the I-10 corridor that it warrants a review. In order for a Rank 2 species to be downgraded to a lower rank by CNPS it must have more than 50 occurrences that must be ranked "excellent" or "good" by the CNDDB, currently only 33 of its 86 occurrences are ranked "excellent" or "good" (Sims, per comm., 2013). Moreover, 40 are ranked "fair" or "poor" and 1 is confirmed extirpated (Sims, per comm., 2013). These ranks are based on the site quality and viability of the occurrence, and are one of the only things CNDDB have to go off in attempts to understand the long-term viability of the plants at each occurrence (Sims, per comm., 2013). In addition to threats to known populations from solar development along I-10, there are other threats noted for this species, including development, agriculture, weeds, grazing, and more.

The blooming period is identified by CNPS as September through November (CNPS 2009). Since the project site occurs in the Chuckwalla Valley of the Sonoran Desert, an area known for bi-modal rain patterns and late summer/fall rains, this species typically only blooms during summer or fall months following monsoonal rains (>+/- 0.10 inch) (Silverman pers. comm.). On average, August receives the most rainfall, although rainfall is also received during winter months of December, January, and February. Regional botanical experts have concluded that this, and other summer annuals, may be missed if surveys are only conducted within the mid-March through mid-April window, and that a full inventory at multiple temporal windows are necessary in order to capture all appropriate growing conditions (typically following 12 to 18 mm rain events) (CEC 2009a).

This species was not identified during fall 2010 botanical surveys for the PSPP. This species was not observed during March 2013 surveys for the PSEGS along the proposed generation tie-line or the natural gasline but surveys were not conducted during a time of year adequate for detecting this species; late season surveys will occur in fall 2013 and the survey report is expected in November 2013, as per Condition of Certification **BIO-19**.

Flat-seeded Spurge

Flat-seeded spurge is a RPR 1B.2 species meaning it is rare, threatened, or endangered in California and elsewhere; fairly endangered in California. It is a BLM Sensitive species. This species occurs in desert dunes and Sonoran desert scrub habitat types, in sandy places or shifting dunes, at elevations from approximately 200 to 300 feet. Some experts speculate that the species may be a "waif" in California, or a species that is not naturalizing, and note that it is more common in Arizona and Mexico (CNDDB 2010) but overall little is known or can be concluded (LaDoux pers. comm.). This ephemeral summer annual blooms February through September (CNPS 2009). There are four CNDDB records of this species for the entire state of California, only one of which is from Riverside County; the closest occurrences are approximately 50 miles away.

For the PSPP, staff reviewed the occurrence data in the Consortium of California Herbaria and detected 1 new occurrence that were not in the CNDDB. This occurrence is a historical record from 1933. Of the total five occurrences in California (CNDDB plus new additional occurrences), one of these are protected under State Park ownership. A total of three records are historical records and none of these occurrences have documented threats.

This species was not observed during spring 2009 or 2010 botanical surveys for the PSPP. Although there are no documented nearby occurrences, the project occurs within its range, suitable habitat is present, and as an ephemeral summer annual it may be under-surveyed and its potential to occur cannot be dismissed (LaDoux pers. comm.). This species was not observed during March 2013 surveys for the PSEGS along the proposed generation tie-line or the natural gasline route. This is a RPR 1B.2 species meaning that is it rare, threatened, or endangered in California, but more common elsewhere, fairly endangered in California. It is a CNDDB state rank S1. This plant species grows from sea level to approximately 1,400 feet above mean sea level in Mojavean and Sonoran desert scrub habitat, in the sandy soils of dry washes and rocky hillsides. Glandular ditaxis (an annual or short-lived perennial) blooms from October through March (CNPS 2009); while it can be detected during spring surveys; it is easier to detect in fall following the start of the rainy season (Silverman pers. comm.).

For the PSPP, staff reviewed the occurrence data in the Consortium of California Herbaria and detected 3 new occurrences that were not in the CNDDB. All of these are historical records from 1932. Of the total 21 occurrences (CNDDB plus new additional occurrences), one of these is protected on under CDFW land ownership. A total of six records are historical occurrences. One of these has documented threats, including land development, and is likely extirpated. This species was not observed during spring 2009 or 2010 botanical surveys performed for the PSPP or during March 2013 surveys for the PSEGS along the proposed generation tie-line or the natural gasline route.

Lobed Ground Cherry

Lobed ground cherry is a late season perennial that blooms September to January. It is a RPR 2B.3 species, meaning that is rare, threatened, or endangered in California, but more common elsewhere and not very threatened in California. This species occurs in Mojavean desert scrub on decomposed granite soils, playas, and alkaline dry lake beds. This species occurs from approximately 1,500 feet to 2,400 feet above mean sea level. There are six records from the Consortium of California Herbaria database, all from San Bernardino County (CCH 2010).

For the PSPP, staff reviewed the occurrence data in the Consortium of California Herbaria and detected two new occurrences that were not in the CNDDB. Both of these are more recent occurrences, including one from Joshua Tree National Monument and one in the eastern Mojave Desert. Of the total six occurrences in California (CNDDB plus new additional occurrences), none of these are protected under Park Service or other agency land ownership. None of these are historical records and none of these occurrences have documented threats. This species was not observed during fall 2010 botanical surveys performed for the PSPP. This species was not observed during March 2013 surveys for the PSEGS along the proposed generation tie-line or the natural gasline but surveys were not conducted during a time of year adequate for detecting this species; late season surveys will occur in fall 2013 and the survey report is expected in November 2013.

Dwarf Germander

Dwarf germander is a RPR 2B.2 meaning that is it rare, threatened, or endangered in California, but more common elsewhere, fairly endangered in California. It is a CNDDB state rank 2. This species occurs in desert dune, playa margins, and Sonoran desert scrub habitats from approximately 100 feet to 1,200 feet. This species typically blooms from March to May but may also bloom from September through November. This species typically occurs in sandy soils and wash habitats and is known from fewer than 10 occurrences in California (CNPS 2009).

For the PSPP, staff reviewed the occurrence data in the Consortium of California Herbaria and detected 2 new occurrences that were not in the CNDDB. Both of these are historic records from 1905 and 1949. Of the total seven occurrences in California (CNDDB plus new additional occurrences), one occurs in a BLM Desert Wildlife Management Area. A total of three records are historical records and none of these occurrences have documented threats. This species was not observed during spring 2009 or 2010 botanical surveys performed for the PSPP. This species was not observed during March 2013 surveys for the PSEGS along the proposed generation tie-line or the natural gasline route.

Palmer's Jackass Clover

Palmer's jackass clover is a new addition since 2010 to the CNPS inventory and is a RPR 2B.2 (CDFW 2013X).It is a perennial herb that occupies sandy washes, and Sonoran desert scrub habitat from sea level to 650 feet. There are no CNDDB records for this species (CNDDB 2010). Staff reviewed the occurrence data in the Consortium of California Herbaria and detected seven occurrences that were not in the CNDDB. Four of these are historical records from between 1937 and 1952; however, two more recent occurrences were found in the Chocolate-Chuckwalla Mountains region, one southeast of Palen Dry Lake and one near the Palen Sand Dunes. No information on land ownership or documents of threats is available from the Consortium of California Herbaria. This species was not observed during spring 2009 or 2010 botanical surveys performed for the PSPP. This species was not observed during March 2013 surveys for the PSEGS along the proposed generation tie-line or the natural gasline route

Jackass Clover

This is a RPR 2B.2 species and considered rare, threatened, or endangered in California, but more common elsewhere, fairly endangered in California. Jackass-clover inhabits desert dunes Mojavean desert scrub, playas, or Sonoran desert scrub. This species is commonly associated with sandy washes, roadsides, or alkaline flats, of elevations from 425 to 2,630 feet.

For the PSPP, staff reviewed the occurrence data in the Consortium of California Herbaria and detected 2 new occurrences that were not in the CNDDB. One of these occurrences is a historical record from 1937; however one more recent occurrence was found at the Junction I-5 and Stockdale Highway west of Bakersfield. Of the total 9 occurrences in California (CNDDB plus new additional occurrences), three of these are protected under Park Service ownership. A total of three records are historical records. One of these occurrences has documented threats, including development. Jackass clover was also documented at several locations from the northern to southern end of Palen Lake in dune habitats during a detailed vegetation mapping and classification project conducted by CNPS Vegetation Program for BLM (Evens & Hartman 2007). This species was not observed during spring 2009 or 2010 botanical surveys performed for the PSPP. This species was not observed during March 2013 surveys for the PSEGS along the proposed generation tie-line or the natural gasline route.

Winged Cryptantha

This RPR 4.3 species is a spring-blooming annual that occurs in Mojavean and Sonoran desert scrub habitats from 300 feet to approximately 5,000 feet above mean sea level. This species blooms from March through April (CNPS 2009). Winged cryptantha is found in Mojavean and Sonoran deserts within California, Arizona, and Nevada. There are 79 records of this species in the Consortium of California Herbaria database from Riverside, Imperial, San Bernardino, and San Diego counties (CCH 2010). This species has low to moderate potential to occur at the project site. There are no CNDDB records for this species for the entire state of California (CNDDB 2010). This species was not observed during spring 2009 or 2010 botanical surveys performed for the PSPP but was observed near the proposed Colorado Substation at the southeastern end of Chuckwalla Valley, south of I-10 (Solar Millennium 2010l). This species was not observed during March 2013 surveys for the PSEGS along the proposed generation tie-line or the natural gasline route.

Las Animas Colubrina

Las Animas colubrina is a RPR 2B.3 species indicating it is not very threatened in California and more common elsewhere (CNPS 2009). This is a covered species under the NECO Plan. It is an evergreen to semi-evergreen shrub that occurs in Mojavean and Sonoran desert scrub (creosote bush series) and occurs at elevations from approximately 30 to 3,000 feet. It primarily occurs in dry canyons or headwater reaches of desert washes with gravelly, sandy soils. The distribution of this species includes San Diego, Imperial, and Riverside counties; portions of Arizona; Baja California; and Sonora, Mexico. This species has been reported from isolated desert locales in Joshua Tree National Monument, the Eagle Mountains, and Chuckwalla Mountains (Reiser 1994). There are approximately 27 occurrences primarily from the Chocolate Mountains area (BLM CCD 2002). This species typically blooms from April through June.

For the PSPP, staff reviewed the occurrence data in the Consortium of California Herbaria and detected 12 new occurrences that were not in the CNDDB. Of these eight are historical records from between 1930 and 1966; however four of these are more recent occurrences found in the Sonoran (Colorado) Desert, including several occurrences in the mountains and foothills surrounding Chuckwalla Valley (CCH 2010). Of the total 36 records in California (CNDDB plus new additional occurrences), six of these are protected under Park Service, State Park, or BLM DWMA land ownership. A total of 11 records are historical records. None of these occurrences have documented threats. This species was not identified during spring 2009 or 2010 botanical surveys performed for the PSPP; however this plant has been identified in the project region during surveys performed for other solar projects (AECOM 2009d, GSEP 2009a and b). This species was not observed during March 2013 surveys for the PSEGS along the proposed generation tie-line or the natural gasline route.

Special-status Wildlife Species

Biological Resources Table 4, below, was generated for analysis of the PSPP project, and provides a summary of special-status plants and animals also considered in this assessment. Some of these species were originally considered to have a lower potential for occurrence at the Project site than the species discussed above because the general or micro-habitats known to support them were not found at the site, and/or there are no known occurrences in the Project vicinity.

In consideration of potential effects from the PSEGS project, conclusions regarding the potential for several of the wildlife species to occur at the site have changed, particularly with respect to avifauna. These changes are due to several factors. Each species' habitat needs and behavioral traits were considered and evaluated with respect to the modified project's footprint, profile, and operating characteristics. In several instances, the modified project has introduced a previously unidentified risk to the species which requires further analysis, and for other species such as Swainson's hawk, ongoing surveys have detected additional species at the site or general vicinity. The species list has been updated to indicate that species that have the potential to occur are marked in ~~strikeout~~ in **Table 4**, and are included in **Biological Resources Table 3**.

Bats

The project owner's biologists conducted a habitat suitability survey for bat species and recorded any potential roosting locations or potential sign (guano piles, staining on trees, etc.). To determine how bats may be using the PSPP site and surrounding area the prior project owner's (Solar Millennium) biologist conducted a one-day survey to look for bat sign (i.e., roosting locations, guano piles, staining on trees, etc.) in December 2009. Species specific habitat requirements were considered when conducting bat habitat reconnaissance surveys. In order to assess potential bat use of the PSPP and surrounding area, biologists searched portions of large washes both within, and adjacent to the PSPP within the project buffer. This involved walking slowing up and down some of the main washes searching trees, rock crevices, and other potential locations for bats, bat sign and potential roosting locations. During surveys performed in summer of 2013, freeway underpasses were also searched for bats or bat sign (Palen 2013aaa). As stated in this report, "Three freeway underpasses within one mile of the modified gen-tie were inspected for bats, accumulations of insect carcasses, and bat guano (Figure 3); the underpasses in the vicinity of the gas line had been previously surveyed for PSPP (AECOM 2010c) and were not resurveyed. Only two of the three underpasses had marginal habitat, where washes had been directed under the freeway. However, the slick concrete walls and pillars provided only marginal to negligible roosting opportunities. The third underpass was a completely boxed-in cement culvert. Not surprisingly, no bat sign was seen in any of these underpasses. A fourth underpass, approximately 0.7 miles west of the modified gen-tie was not surveyed."

Desert dry wash (microphyll) woodland areas have been documented as important habitat to several bat species (Brown 2010). Primary suitable roosting habitat for bats within the proposed project site and larger project area includes washes with large trees within the southern portions of the project site in the central wash, and around the transmission line (that connects the Facility Footprint to the substation south of I-10) and substation, and within tall palms located in the adjacent agricultural areas. Large washes with riparian vegetation meander through the southern portion of the buffer around the transmission line and substation south of I-10. Some large trees are located within the southern portion of the central wash in the project site. Large trees with exfoliating bark, tree cavities, rock crevices, bridges, and other locations may provide suitable roosting habitat for a variety of bat species within the project site and buffer area. Any large trees with cavities or rock crevices with potential for bats were observed for any potential bat sign. Staff's Data Requests #45 and #46 requested the project owner install at least three acoustic bat sensing devices on the project site from May 1, 2013, through October 1, 2013 (CEC 2013i). Staff has yet to receive this information; however, it will be incorporated into the BBCS. The project owner has supplied a bat habitat assessment performed over four days in May, 2013 (Palen 2013hh), and using this methodology, detected three species of bats on the project site: pallid bat, canyon bat, and Mexican freetail bat. The report further states that while not detected, the California leaf-nosed bat, Townsend's big-eared bat, hoary bat, Western yellow bat, Western mastiff bat, and Pocketed free-tailed bat may also occur onsite.

California leaf-nosed bat

This bat may occur in the general vicinity of the project site, and there is a potential for this species to forage within the modified project site. Desert dry wash woodland vegetation attracts foraging bats due to increased insect concentration. This is especially true for California leaf-nosed bats that feed on large arthropods which they glean off of foliage. This bat feeds off a variety of insects, such as moths, butterflies, dragonflies, and beetles (Adams, 2003). This species roosts in caves, mines, abandoned buildings, etc. (Brown 2005, Piaggio 2005). Roosts for California leaf-nosed bats have been identified in existing mines in the Eagle and Coxcomb Mountains. During the warmer months, California leaf-nosed bats night roost in ironwood trees between foraging bouts. This species has not been detected onsite.

Pallid bat

The closest known historical location of pallid and western mastiff bats based on the CNDDB search is approximately 4.3 miles southwest of the project site near Corn Springs. Only the pallid bat was identified by the project owner's biologists as potentially roosting within the project site and buffer. The pallid bat may roost in rocky outcrops, cliffs, mines, caves, trees, exfoliating bark, tree cavities, bridges, and man-made structures (Rambaldini 2005). The pallid bat is historically known to occur in the Chuckwalla Mountains, as reported in a Biological Resources Technical Report (AECOM 2009a). Roosts for pallid bats have been identified in existing mines in the Eagle and Coxcomb Mountains. This bat feeds by gleaning insects and even scorpions off the ground, or off of vegetation, and is known for "walking" on the ground using both legs and wing bones. Pallid bats may migrate into or out of the site during various times of the year, although they generally do not migrate long distances between summer and winter sites (Rambaldini 2005). This species has been detected onsite during habitat assessments (Palen 2013hh).

Western mastiff bat

The western mastiff bat lacks suitable roosting habitat (large rock formations with cliffs and exfoliating rock) within the project and buffer, but may occur in the general vicinity and there is a potential for this species to forage within the modified project site and buffer (Siders 2005). The western mastiff bat is historically known to occur in the Chuckwalla Mountains Biological Resources Technical Report (AECOM 2009a). It is also known from CNDDB records near Corn Springs. These bats feed primarily by echolocation, and their diet consists primarily of moths (Lepidoptera), but also includes crickets and katydids. Unlike most North American bats, they do not undergo either migration or prolonged hibernation, but are periodically active all winter. This species has not been detected onsite.

Cave myotis

The cave myotis has a limited potential to roost within the project area due to the presence of two bridges along Corn Springs Road. The cave myotis is known to occasionally roost in crevices in bridges (Peckham 2005). These species were not detected during the CNDDB search of the project area, but are known from locations in similar habitat around Blythe, California. Therefore this bat species has the potential to forage within the project area. This species will roost in caves, mines, or buildings. Foraging is accomplished by echolocation; small moths make up the largest portion of the diet although small beetles, weevils, and antlions are also eaten. Colonies hibernate from mid October until April.

During surveys performed in 2009, a bat was detected roosting between large wood structural components underneath a bridge on Corn Springs Road, near the substation south of I-10, but identification was not possible. Based on features observed, the individual was likely a Myotis species. Since the individual could not be identified to species, it was not possible to confirm if it was a species of special concern.

Western yellow bat

This species - relative to most of our locally occurring bats - is still poorly understood and its occurrence and ecology only recently described. The species was discovered in southern California in 1945 (Pierson and Rainey, 1998) and its continuing expansion is typically linked to the distribution of exotic palms (Williams, O’Farrell, and Riddle, 2006). However, the distribution of the species may also be associated with that of yucca plants (Higginbotham, Dixon, and Ammerman, 2000). The first known occurrence of the western yellow bat in the United States was from Palm Springs, California, in November 1945 (Constantine 1946). They were not found again in the U.S. until 1960 when two yellow bats were found roosting in dead palm fronds while trees were being trimmed at the University of Arizona in Tucson (Cockrum 1961). Locally, the species is known from the Palm Springs area as well as the Lower Colorado River including the vicinity of Blythe.

There are oases in the Desert Center area near Lake Tamarisk that have the potential to support western yellow bat. These may or may not be sufficiently close to support use of the project area by this species. Approximately 850 acres of agricultural development (jojoba and palm farms) occur immediately adjacent to the project. Associated with these farms are two private pools, approximately 2 acres or less in size. The relatively short plantation palms are not expected to support use by this species; however larger palms may provide habitat and the area could support foraging by the species if the trees support appropriate insect fauna. Irrigation at the plantation is expected to provide an important water source to many species and may attract and support a host of insects. Foraging is typically associated with water features and may occur across a variety of habitat, from desert scrub to riparian areas. Foraging has been observed over swimming pools, lawns, and orchards. It is unknown if some individuals or populations migrate and it is likely this species does not hibernate. This species has not been detected onsite.

Desert Tortoise

The desert tortoise was state-listed in California as threatened on August 3, 1989. The Mojave population was federally listed as threatened on April 2 1990. Critical habitat for this species was designated on February 8, 1994. The desert tortoise is a large slow growing herbivorous reptile that is well adapted to a variable and often harsh desert environment (USFWS 2011b). In the United States the desert tortoise's range includes portions of the Mojave and Sonoran desert regions of southern California, southern Nevada, southwestern Utah, and western Arizona. In Mexico, the species is found throughout most of Sonora and into portions of Sinaloa. Based on genetic differences there are two recognized populations of desert tortoise in the United States; these are the Mojave and Sonoran populations (USFWS 2011b). Recently, genetic data suggest these groups are unique species. Although the species often look similar, the differentiation between the Mojave and Sonoran assemblages of the desert tortoise are supported via multiple forms of evidence, including morphology, ecology, and genetics (Weinstein and Berry 1987; Lamb et al. 1989; Lamb and Lydehard 1994; Berry et al. 2002; Van Devender 2002a; 2002b; Murphy et al. 2007). The Mojave population includes those animals living north and west of the Colorado River in the Mojave Desert of California, Nevada, Arizona, southwestern Utah, and in the Colorado Desert in California (a division of the Sonoran Desert). Desert tortoises are adapted to living in a highly variable and often harsh desert environment. They spend much of their lives in burrows, even during their seasons of activity, which generally coincides with the greatest annual forage availability. In late winter or early spring, they emerge from over-wintering burrows and typically remain active through fall. Activity does decrease in summer, but tortoises often emerge after summer rain storms to drink (Henen et al. 1998). Desert tortoises in the project region are active during the late summer months often in response to seasonal rainfall. Because up to 30 percent of the annual precipitation falls in response to summer monsoons; the region supports two distinct annual floras on which tortoises can feed (USFWS 2011a).

During activity periods, desert tortoises eat a wide variety of herbaceous vegetation, particularly grasses and the flowers of annual plants (Berry 1974; Luckenbach 1982; Esque 1994). During periods of inactivity, they reduce their metabolism and water loss and consume very little food. Adult desert tortoises lose water at such a slow rate that they can survive for more than a year without access to free water of any kind and can apparently tolerate large imbalances in their water and energy budgets (Nagy and Medica 1986; Peterson 1996a, b; Henen et al. 1998).

The size of desert tortoise home ranges varies with respect to location and year (Berry 1986a) and also serves as an indicator of resource availability and opportunity for reproduction and social interactions (O'Connor *et al.* 1994). Females have long-term home ranges that may be as little or less than half that of the average male, which can range to up to 200 acres (Burge 1977; Berry 1986a; Duda *et al*. 1999; Harless *et al*. 2009). Core areas used within larger home ranges of desert tortoise depend on the number of burrows used within those areas (Harless *et al*. 2009). Thus, an individual home range is best viewed as a network of burrows, connected by somewhat linear corridors, which the desert tortoise visits serially through the year (O'Connor et al 1994). Over its lifetime, each desert tortoise may use more than 1.5 square miles of habitat and may make periodic forays of more than 7 miles at a time (Berry 1986a).

Tortoises are long-lived and grow slowly, requiring 13 to 20 years to reach sexual maturity, and have low reproductive rates during a long period of reproductive potential (Turner et al. 1984a; Bury 1987; Germano 1994). Mating occurs both during spring and fall (Black 1976; Rostal *et al.* 1994), and the number of eggs as well as the number of clutches (set of eggs laid at a single time) that a female desert tortoise can produce in a season is dependent on a variety of factors including environment, habitat, availability of forage and drinking water, and physiological condition (Turner et al. 1986, 1987; Henen 1997; McLuckie and Fridell 2002). Egg-laying occurs primarily from April to July (Rostal et al. 1994; USFWS 1994a); the female typically lays 2-14 eggs (average 5-6) eggs in an earthen chamber excavated near the mouth of a burrow or under a bush (Woodbury and Hardy 1948; USFWS 1994a). The eggs typically hatch 90 to 120 days later, between August and October. The success rate of clutches has proven difficult to measure, but predation, while highly variable (Bjurlin and Bissonette 2004), appears to play an important role in clutch failure (Germano 1994).

The majority of threats to the desert tortoise and its habitat are associated with human land uses. Many of the threats identified in the 1994 and 2011 Recovery Plans, which formed the basis for listing the species as threatened, continue to affect the tortoise today (USFWS 2011b). Some of the threats identified at the time of listing include urbanization, upper respiratory tract disease and possibly other diseases, predation by common ravens and domestic and feral dogs, unauthorized off-road vehicle activity, authorized vehicular activity, illegal collecting, mortality on paved roads, vandalism, drought, livestock grazing, feral burros, non-native plants, changes to natural fire regimes, and environmental contaminants (USFWS 1994a).

Even though a wide range of threats are known to affect desert tortoises and their habitat, very little is known about their demographic impacts on tortoise populations or the relative contributions each threat makes to tortoise mortality (Boarman 2002a). Extensive research shows that all of these threats can directly kill or indirectly affect tortoises; research has also clarified many mechanisms by which these threats act on individuals. While current research results can lead to predictions about how local tortoise abundance should be affected by the presence of threats, quantitative estimates of the magnitude of these threats, or of their relative importance, have not yet been developed. Thus, the Draft Revised Recovery Plan focuses on expanding the knowledge of individual threats and places emphasis on understanding their multiple and combined effects on tortoise populations (USFWS 2008a).

The original *Desert Tortoise (Mojave Population) Recovery Plan* identified six recovery units (Upper Virgin River, Northeastern Mojave, Eastern Mojave, Eastern Colorado, Northern Colorado, and Western Mojave) and recommended the establishment of 14 Desert Wildlife Management Areas (DWMAs) throughout the recovery units (USFWS 1994a). Since 1994, greater insight into patterns of both ecological and genetic variation within the Mojave desert tortoise population has been gained. Based on this information the USFWS 2011 *Desert Tortoise (Mojave Population) Recovery Plan* identifies revised recovery unit boundaries and identified five recovery units for the Mojave population of desert tortoise. These include the Upper Virgin River; Northeastern Mojave; Eastern Mojave; Western Mojave; and Colorado Desert. Although the Recovery Unit designation does not provide special legal protection, the USFWS defines recovery units as special units that are geographically identifiable and are essential to the recovery of the entire listed population; that is recovery units are individually necessary to conserve the genetic, behavioral, morphological, and ecological diversity necessary for long-term sustainability of the entire listed population (USFWS 2011a).

The PSEGS project is located in the Colorado Desert Recovery Unit. This recovery unit combines the 1994 Eastern Colorado and Northern Colorado recovery units, as well as a portion of the Eastern Mojave Recovery Unit in Piute and Fenner valleys (USFWS, 2012). Desert tortoise in this recovery unit are found primarily in “well-developed washes, desert pavements, piedmonts, and rocky slopes characterized by relatively species-rich succulent scrub, creosote bush scrub, and blue palo verde-ironwood-smoke tree communities” (USFWS 1994a). Habitat within this recovery unit has been described as being in excellent condition despite declines in tortoise densities over the past several decades; disturbance was estimated at less than 1.3 percent throughout the recovery unit (USFWS 2005). The highest desert tortoise densities within this recovery unit occur in Chemehuevi and Ward valleys (approximately 60 miles north of the project); on the Chuckwalla Bench within the Chuckwalla DWMA and associated Critical Habitat Unit (CHU); and in Joshua Tree National Park (approximately 40 miles northwest of the project). Desert tortoise densities at the Chuckwalla Bench in 1992 were estimated between 22 and 49 adults per square kilometer (approximately 57–127 adults per square mile) but have shown declining trends (Berry 1997; Tracey et al. 2004).

Density estimates from range-wide sampling over the past decade have resulted in general estimates of desert tortoise density for the entire Eastern Colorado Recovery Unit of approximately 5.9 animals per square kilometer, with estimates of 3.7 per square kilometer on BLM-managed lands (USFWS 2010c). Generally the data suggest the species may still be in decline across most of its range.

Protocol-level surveys of the project site and linear facilities for the PSPP project were conducted between March 17 and May 22, 2009 (study area except substation) and October 24 to 25, 2009 (substation site and buffer). Post certification clearance surveys were conducted on portions of the site in 2010. Survey results conducted in 2009 detected 17 burrows (Class 3–5), 15 tortoise pallets (Class 4 or 5), and 19 tortoise shell remains (Class 5) in the project area (AECOM 2010a). Pallets are shallow excavations or non-covered depressions used by desert tortoise. Surveys conducted in 2010 identified seven tortoises (adult and juvenile) in the project area including four along the generation tie line and three tortoises south of I-10, the latter being outside of the Project Disturbance Area and buffer area. Only one tortoise was detected in the Project Disturbance Area along the gen-tie line for the PSPP project (Solar Millennium 2010k, Table 1 and Figure 1). Living desert tortoises were not detected on the proposed solar field. Refer to **Biological Resources Figure 7**.

To address changes to the project footprint (e.g., the linear facilities) for the PSEGS project protocol surveys for desert tortoise were conducted from 7 to 30 April 2013. Desert tortoises were not detected during these surveys (Palen 2013m). Two desert tortoise burrows showing sign of recent occupation were detected on the generation tie-in south of I-10 and a possible burrow was noted in a survey buffer north of the freeway (Palen 2013m Table 3, Figure 1). Surveys for desert tortoise were not conducted in the Project Disturbance Area (i.e., the solar field) for the PSEGS project in 2013.

Desert tortoises were not detected on the PSPP project site although this species is known to occur in the project region. Desert tortoise sign is present on the project site and along portions of the modified linear facilities. Additional observations of desert tortoise from project buffers are included in the Revised Desert Tortoise Technical Report (Galati & Blek 2010b, Revised Desert Tortoise Technical Report). In addition, for the PSPP project resource agency staff located a possible desert tortoise burrow near the bridge associated with the large wash that flows into the center of the Project Disturbance Area (LaPre, pers. comm.). Based on surveys of the project site and available data for the region the site is expected to support a relatively low number of desert tortoise.

To support the preparation of the Biological Opinion (BO) for the approved PSPP project, the USFWS developed assumptions in an effort to estimate the number of desert tortoises that may occur in the Project Disturbance Area. The estimates of desert tortoise density predicted by the USFWS was based on desert tortoises found in the buffer transects of the generation tie-in (Palen 2013m). Using this information the FWS concluded that two subadult or adult tortoises occupy the project (USFWS 2011b). Regional population estimates were used to further extrapolate the number of animals that may occur and using this data the USFWS concluded that approximately 2-12 adult tortoises may occupy the site. This data was used to estimate the number of juvenile tortoises and eggs that may occur on the project site. Because desert tortoises were not detected in 2013; surveys conducted by the project owner of the modified linear facilities do not provide any information that would alter this analysis.

Habitat in the Project Disturbance Area north of I-10 (including the Chuckwalla CHU) supports lower quality desert tortoise habitat and the only moderate quality habitat within the Project Disturbance Area occurs south of I-10 (Galati & Blek 2010b, Revised Desert Tortoise Technical Report, Solar Millennium 2010m, Table 5). Staff agrees with the project owners assessment that higher value habitat is found south of I-10 corresponding with higher elevation alluvial fan plant communities, less historic disturbance, and connectivity to lands supporting desert tortoise. However, staff has concluded that, aside from developed areas and sand dunes, the entire Project Disturbance Area contains suitable habitat for this species.

Critical Habitat

The PSEGS project area overlaps with a portion of the Chuckwalla Desert Tortoise Critical Habitat Unit (Chuckwalla CHU).

Mojave Fringe-toed Lizard

The Mojave fringe-toed lizard is endemic to southern California and a small area of western Arizona, where it is restricted to aeolian sand habitats in the deserts of Los Angeles, Riverside, and San Bernardino counties in California and La Paz County in Arizona (Hollingsworth and Beaman 1999; Stebbins 1985). Nearly all records for this species are associated with present-day and historical drainages and associated sand dune complexes of the Mojave and Amargosa rivers (Norris, 1958).

The distribution of Mojave fringe-toed lizards is naturally fragmented because of its obligate habitat specificity to loose sand, a patchy habitat type (Murphy et al. 2007). Many local populations of this species are quite small, with small patches of sand supporting small populations of lizards. This fragmented pattern of distribution leaves the species vulnerable to local extirpations from additional habitat disturbance and fragmentation (Murphy et al. 2007). The loose, wind-blown sand habitat, upon which the species is dependent, is a fragile ecosystem requiring protection against both direct and indirect disturbances (Weaver, 1981; Barrows, 1996). Environmental changes that stabilize sand, affect sand sources, or block sand movement corridors will also affect this species (Turner et al. 1984; Jennings and Hayes 1994). Additional threats to this species include habitat loss or damage from urban development, OHV use, and agriculture. Aside from the direct loss of land, development can also increase predators, such as the common raven, to occupied habitat.

Murphy et al. (2006) identified two maternal lineages of this species; the northern lineage is associated with the Amargosa River drainage system, and the southern with the Mojave River drainage system, Bristol Trough, Clark’s Pass (including Palen Lake and Pinto Wash), and the Colorado River sand transport systems.

The Mojave fringe-toed lizard is found in arid, sandy, sparsely vegetated habitats and is associated with creosote scrub throughout much of its range (Norris 1958; Jennings and Hayes 1994). This species is totally restricted to habitats of fine, loose, aeolian sand, typically with sand grain size no coarser than 0.375 mm in diameter (Turner et al. 1984; Jennings and Hayes 1994; Stebbins 1944). It burrows in the sand for both cover from predators and protection from undesirable temperatures (Stebbins 1944), though it will also seek shelter in rodent burrows. They are primarily insectivorous, but also eat plant food including leaves, seeds, and buds (Stebbins 1944).

Mojave fringe-toed lizards normally hibernate from November to February, emerging from hibernation sites from March to April. The breeding season is April to July, and adult Mojave fringe-toed lizards reach sexual maturity two summers after hatching. Females deposit 2-5 eggs in sandy hills or hummocks May through July (Mayhew 1964, Jennings and Hayes 1994). From April to May, while temperatures are relatively cool, this species is active during mid-day; from May to September, they are active in mornings and late afternoon, but seek cover during the hottest parts of the day. Common predators of the Mojave fringe-toed lizard include burrowing owls, leopard lizards, badgers, loggerhead shrikes, roadrunners, various snakes, and coyotes (Jennings and Hayes 1994).

Nearly half of the Project Disturbance Area for the PSPP (1,503 for Reconfigured Alternative 2 and 1,542 acres for Reconfigured Alternative 3) contained suitable Mojave fringe-toed lizard habitat, including in stabilized and partially stabilized sand dunes, some wash habitat, and other areas within Sonoran creosote scrub bush habitat with appropriate soils (Solar Millennium 2009a-AFC Volume II, Appendix F). For the PSEGS, 1,480 acres of the Project Disturbance Area contains suitable Mojave fringe-toed lizard habitat as defined above. Numerous Mojave fringe-toed lizards were found in the northeastern half of the study area during Spring 2009 and 2010 surveys, including 105 within the PSPP Reconfigured Alternative 2 Project Disturbance Area and 91 within the PSPP Reconfigured Alternative 3 Project Disturbance Area (Solar Millennium 2009a-AFC Volume II, Appendix F; Figure 11). An additional 62 Mojave fringe-toed lizards were observed within the buffer area based on preliminary spring 2010 survey results (Solar Millennium 2010k, Table 3). Refer to **Biological Resources Figure 5a and 5b**. A total of 95 Mojave fringe-toed lizard observations from 2009 and 2010 surveys occur within the PSEGS Project Disturbance Area. This species or its sign was not reported to be observed during spring 2013 surveys for the PSEGS along the proposed generation tie-line or the natural gasline route.

Couch's Spadefoot Toad

This species lives in a variety of plant communities, including desert dry wash woodland, creosote bush scrub, and alkali sink scrub. They require habitat with substrate capable of sustaining temporary pools for breeding, and loose enough to permit burial in subterranean burrows (Jennings and Hayes 1994, BLM CDD 2002). Breeding habitat includes temporary impoundments at the base of dunes as well as road or railroad embankments, temporary pools in washes or channels, pools that form at the downstream end of culverts, and playas (Morey 2005; Morey, pers. comm.; Mayhew 1965). Natural scour sites in washes with breeding toads (included in Dimmitt 1977) had washed down to a hardpan, which enabled ponding (Dimmitt, pers. comm.). The majority of known Couch's spadefoot toad breeding ponds are artificial, though this may be because of the difficulty of locating natural ponds within the limited amount of time ponds may retain water. Couch's spadefoot toads consume termites, beetles, ants, grasshoppers, solpugids, scorpions, and centipedes.

This species is dormant from 8–10 months of the year, emerging from burrows at the onset of warm summer rains. Emergence appears to be triggered by the low frequency sound caused by falling rain, low-frequency sound created by off-highway vehicles, and construction vehicles (Dimmitt, pers. comm.). These sounds may trigger emergence, and result in emergence in poor environmental conditions (Jennings and Hayes 1994).

At the time the PSPP was permitted, the closest known record for this species was a very old record: an individual in a breeding pond in a borrow pit near the east end of Chuckwalla Road, south of I-10 (about 15 miles east of the project site) (Dimmitt 1977). Based on these and other records the project site was considered west of the range for this species (NECO, Jennings and Hayes (1994)), although other information indicated the Palen Mountains and surrounding bajadas could support marginal populations (Dimmitt 1977). Couch's spadefoot toads require substrate capable of sustaining ponding for at least nine days (Morey 2005). Staff reviewed aerials of the project area and were unable to identify any areas of obvious ponding, and determined that there was limited potential for breeding habitat at the project site. Because there was uncertainty regarding adult dispersal (Dimmitt, pers. comm.) and existence of offsite breeding ponds (such as the Palen Lake area) within adult dispersal distance, staff ultimately concluded that spadefoot toads could occur on the PSEGS site.

In August 2012 several spadefoot toads were found on the Genesis Solar Energy Project site, following a storm event. The toads were located both in and adjacent an engineered concrete lined drainage channel with standing water, and captured and released offsite at the Ford Dry Lake. In addition, in May of 2012, a desiccated specimen was found adjacent an access road at the Genesis project site (AECOM 2012). This toad was found on bare ground with evidence of recent ponding, located in a low area between creosote shrubs. The Genesis Solar Energy Project is located approximately 10 miles east of the proposed project site, just north of the I-10. In 2013, the project owner surveyed low areas of potential ponding and washes, and did not find any ponded areas (Palen 2013zz).

Western Burrowing Owl

The western burrowing owl inhabits arid lands throughout much of the western United States and southern interior of western Canada (Haug et al. 1993) and is typically a year-round resident in much of California (Gervais et al. 2008).

Burrowing owls are unique among the North American owls in that they nest and roost in abandoned burrows, especially those created by California ground squirrels, kit fox, desert tortoise, and other wildlife. Burrowing owls have a strong affinity for previously occupied nesting and wintering habitats. They often return to burrows used in previous years, especially if they were successful at reproducing there in previous years (Gervais et al. 2008). The southern California breeding season (defined as from pair bonding to fledging) generally occurs from February to August with peak breeding activity from April through July (Haug et al. 1993).

Burrowing owls are rare in the undisturbed desert areas of the eastern and southeastern portion of California (Small 1994). By the 1940s', burrowing owls had become scarce in many portions of the desert southwest as a result of shooting and elimination of ground squirrel burrows (Grinnell and Miller 1944). Limited data suggest that they are decreasing in some areas, but may be stable or increasing in others (Klute et al. 2003). Surveys in California in 1986-91 found population decreases of 23-52 percent in the number of breeding groups and 12-27 percent in the number of breeding pairs of owls (DeSante et al. 1997). In addition, in a 2003 report by the U.S. Fish and Wildlife Service, breeding burrowing owls were thought to be largely extirpated during the last 10-15 years from multiple areas in California, including Napa, Marin, San Francisco, Santa Cruz, and Ventura counties, coastal San Luis Obispo county and the Coachella Valley (http://burrowingowlconservation.org/PR12-09-2010.html).

In the Colorado Desert, western burrowing owls generally occur at low densities in scattered populations, but they can be found in much higher densities near agricultural lands where rodent and insect prey tend to be more abundant, including along the lower Colorado River (Gervais et al. 2008). Western burrowing owls tend to be opportunistic feeders. Large arthropods, mainly beetles and grasshoppers, comprise a large portion of their diet. Small mammals, especially mice and voles (*Microtus, Peromyscus,* and *Mus* spp.), are also important food items for this species. Other prey animals include reptiles and amphibians, young cottontail rabbits, bats, and birds, such as sparrows and horned larks. Consumption of insects increases during the breeding season (Haug et al. 1993).

Threats to burrowing owls include habitat modification and destruction of ground squirrel burrows. Other threats include pesticide accumulation, burrow destruction from farming practices and canal and road maintenance, roadside shooting, and direct mortality from squirrel poisons (BLM CDD 2002; Gervais et al. 2008).

Phase I through III protocol-level surveys for portions of the Project Disturbance Area (except the substation) were conducted in spring and summer 2009 for the approved PSPP project. A habitat assessment was completed for this site in fall 2009. Part of the northern end of the Project Disturbance Area is densely covered in Sahara mustard; other than this area, the entire Project Disturbance Area is suitable western burrowing owl habitat. Two pairs with juveniles and four active burrows with sign were identified during 2009 protocol surveys (Solar Millennium 2009b, Appendix F, Attachment J). Survey results from 2010 indicate that a total of four burrowing owls with active burrows have been observed within the Project Disturbance Area, to date (Solar Millennium 2010m, Table 6). Refer to **Biological Resources Figure 8**. During golden eagle surveys in the winter of 2013, approximately ten observations of burrowing owl were recorded (Palen 2013m). Burrowing owls were observed 18 times during avian point count surveys conducted between April 8 and May 5, 2013 (Palen 2013ii). Fifteen of these observations were of birds in or immediately adjacent to the agricultural lands that border the site, where a nesting burrow was documented (ibid). The other three observations were scattered across the site (*ibid*.). Based on the type of surveys conducted it is not possible to fully establish the exact number of birds that may be using the site or their breeding status. Some of the observations are likely multiple recordation of the same bird. While the nesting status of these birds was not documented it suggests that the site is used by burrowing owls and breeding birds may be present. It is also possible that some of the birds may be migrants. Phase III surveys conducted in 2013 detected one burrowing owl on the transmission line alignment north of the Red Bluff substation and one burrowing owl north of I-10 on the natural gas pipeline right of way. These birds were observed in buffer areas and active burrows were not detected.

Golden Eagle

Golden eagles are typically year-round residents throughout most of their western United States range. They breed from late January through August with peak activity March through July (Kochert et al. 2002). Migratory patterns are usually fairly local in California where adults are relatively sedentary, but dispersing juveniles sometimes migrate south in the fall. This species is generally considered to be more common in southern California than in the northern part of the state (USFWS 2008).

Habitat for this species typically includes rolling foothills, mountain areas, and deserts. Golden eagles need open terrain for hunting and prefer grasslands, deserts, savanna, and early successional stages of forest and shrub habitats. Golden eagles primarily prey on lagomorphs and rodents but will also take other mammals, birds, reptiles, and some carrion (Kochert et al. 2002). This species prefers to nest in rugged, open habitats with canyons and escarpments, with overhanging ledges and cliffs and large trees used as cover.

The status of golden eagle populations in the United States is not well known, although there are indications that populations may be in decline (USFWS 2009b, Kochert et al. 2002). Accidental death from collision with man-made structures, electrocution, gunshot, and poisoning are the leading causes of mortality for this species, and loss and degradation of habitat from agriculture, development, and wildfire continues to put pressure on golden eagle populations (Kochert et al. 2002; USFWS 2009b).

In spring 2010, golden eagle helicopter surveys were conducted to cover the area within a 10-mile radius from the PPSP boundaries as well as three other proposed solar projects (Solar Millennium 2010u, TTEC 2010a). The surveys covered eleven mountain ranges between and around Blythe and Desert Center (TTEC 2010a) and were conducted following the USFWS's February 2010 Interim Golden Eagle Inventory and Monitoring Protocols (Pagel et al. 2010). The surveys found two active golden eagle nests within one territory, approximately 7 miles southwest of the PSEGS project site in the Chuckwalla Mountains. Additionally, three inactive nests were located approximately six miles southwest of the site in the Chuckwalla Mountains; two of these nests were associated with the territory discussed above, the other is likely associated with a territory located further south of the PSEGS project site (Solar Millennium 2010u).

Surveys for golden eagle were also conducted for the Desert Harvest Solar Project, located roughly ten miles to the west of the PSEGS project. These surveys detected eight golden eagle nests, all located on power poles (Aspen 2012). Most of the nests were located south of the I-10 freeway. Additional survey efforts are ongoing for the PSEGS project. From January to February 2013, fresh carcasses and camera stations were placed on the site and within a ten mile buffer area surrounding the project site. A single subadult eagle made repeat visits to a bait station located northeast of the project site, in the Palen Mountains. Additionally, the project owner conducted ground and helicopter surveys for golden eagle in April, 2013 (Palen 2013x). Helicopter surveys for nests were performed within a 10-mile radius of the project, along the Palen Mountains and the Chuckwalla Mountains: the Coxcomb Mountains were surveyed from the ground. Known locations of nests were surveyed, and three potential nests of golden eagles were noted in the Chuckwalla Mountains. Further helicopter studies are scheduled to occur in early August, 2013 (TN 200106) and staff will incorporate that information into the Bird and Bat Conservation Strategy, along with the below information, as it is generated. No eagles were observed during spring 2013 avian surveys (Palen 2013x). Staff's Data Request 3 (#42) provided the project owner further guidance in collecting data on eagle populations in the area, and requested information pertaining to territory and home range size, migration, movements of "floaters," or juvenile unpaired eagles lacking established territories, and meta-population dynamics of the species (CEC 2013i).

Loggerhead Shrike

Loggerhead shrikes are uncommon residents throughout most of the southern portion of their range, including southern California. In southern California they are generally much more common in interior desert regions than along the coast (Humple 2008). Loggerhead shrikes initiate their breeding season in February and may continue with raising a second brood as late as July; they often re-nest if their first nest fails or to raise a second brood (Yosef 1996).

This species can be found within lowland, open habitat types, including creosote scrub and other desert habitats, sage scrub, non-native grasslands, chaparral, riparian, croplands, and areas characterized by open scattered trees and shrubs. Fences, posts, or other potential perches are typically present. In general, loggerhead shrikes prey upon large insects, small birds, amphibians, reptiles, and small rodents over open ground within areas of short vegetation, usually impaling prey on thorns, wire barbs, or sharp twigs to cache for later feeding (Yosef 1996). Loss of habitat to agriculture, development, and invasive species is a major threat; this species has shown a significant decline in the Sonoran Desert (Humple 2008).

The entire Project Disturbance Area contains suitable habitat for loggerhead shrike. This species, including an adult with fledglings, was observed on the project site during spring 2010 surveys (Solar Millennium 2010k), and also during golden eagle surveys in the winter of 2013 (Palen 2013x and 2013k), and was one of the most-commonly sighted birds during bird use studies in spring 2013 (Palen 2013ii).

Le Conte's Thrasher

In California, Le Conte's thrasher is a resident in the San Joaquin Valley and the Mojave and Colorado deserts. It occurs in desert flats, washes and alluvial fans with sandy and/or alkaline soil and scattered shrubs. It rarely occurs in monotypic creosote scrub habitat, because creosote bush is unable to support a nest, or in massive Sonoran Desert woodlands (Prescott 2005). Preferred nest substrate includes thorny shrubs and small desert trees. Breeding activity occurs from January to early June, with a peak from mid-March to mid-April (BLM CDD 2002). Le Conte's thrashers forage for food by digging and probing in the soil. They eat arthropods, small lizards and snakes, and seeds and fruit; the bulk of their diet consists of beetles, caterpillars, scorpions, and spiders.

This species was observed during project surveys, including avian surveys conducted over a period of four weeks in the spring of 2009, and again in spring 2013 (Palen 2013ii). Because the Sonoran creosote scrub bush in this area is fairly monotypic, suitable habitat for this species in the Project Disturbance Area is confined to of the 148 acres of desert dry wash woodland. The closest CNDDB record for this species is about 3 miles south of the project site (CNDDB 2010).

California horned lark

The California horned lark is found throughout California except the north coast, and is less common in mountainous areas. This species prefers open areas that are barren or with short vegetation including deserts, brushy flats, and agricultural areas. Eggs are laid March to early June, and this species frequently lays a second clutch.

The project site contains suitable habitat for this species, especially in creosote bush scrub. This species was observed frequently in the Project Disturbance Area during surveys conducted for the PSPP project, as well as during golden eagle surveys in the winter of 2013 (Palen 2013k), and spring of 2013 (Palen 2013ii). There are numerous CNDDB (2010) records for this species in western Riverside County.

Prairie Falcon

The prairie falcon inhabits dry environments in the North American west from southern Canada to central Mexico. It is found in open habitat from annual grasslands to alpine meadows at all elevations up to 10,990 feet, but is associated primarily with perennial grasslands, savannahs, rangeland, some agricultural fields, and desert scrub areas. They require cliffs or bluffs for nesting though will sometimes nest in trees, on power line structures, on buildings, or inside caves or stone quarries. Ground squirrels and horned larks are the primary food source, but prairie falcon will also prey on lizards, other small birds, and small rodents.

Prairie falcons were observed several times during project surveys both as flyovers and perched in the Project Disturbance Area. The entire Project Disturbance Area (4,024 acres) contains suitable foraging habitat for this species. The project site does not contain suitable nesting habitat, although adjacent mountains may. There are numerous CNDDB (2010) records in the region for this species, including eight records from Little Maria Mountains to the northeast (1977) and the Chuckwalla Mountains to the southwest (1978). During golden eagle Phase 2 nest surveys performed jointly for neighboring proposed energy projects, a pair of prairie falcons was documented to be nesting on the same cliff on which the golden eagle nest was located in the Palen Mountains (TTEC 2010a). Staff observed this species at the PSEGS project site during site visits performed April 9 and 10, 2013, and the project owner documented the presence of this species during spring 2013 (Palen 2013ii).

Elf owl

The elf owl is listed as endangered under CESA. The project site is near the western margin of its geographic range, though nesting has been documented near Corn Springs (Garret and Dunn 1981). Elf owls are more common and widely distributed outside of California and probably have never been common in California due to limited geographic range and generally marginal habitat. Riparian woodland in the Colorado River Valley, the elf owl's primary habitat in California, has declined and been degraded due to agricultural land use conversion and invasion by tamarisk (Gould 1987). The elf owl is also listed as a Bird of Conservation Concern (BCC) by USFWS. It is migratory, spending winters in Mexico and southward. It arrives in California by March, and its breeding period extends from April to mid-July (Gould 1987).

The elf owl is a secondary cavity nester (it nests in cavities of trees and cacti, generally in disused woodpecker nests). Its nesting habitat is closely correlated with nesting habitat of woodpeckers, including Gila woodpecker (Hardy et al. 1999; Johnsgard 2002). In Arizona, both elf owl and Gila woodpecker are best known for nesting in saguaro cacti. However, both species also nest in numerous trees, particularly riparian woodland trees such as cottonwood and willow. With one exception (below) all elf owl reports in California have been in these riparian trees, generally along the Colorado River. Farther east in their range, both species also nest in mesquite (an upland microphyll species). Gila woodpeckers nest in blue palo verde and elf owls have been documented nesting in blue palo verde near Wiley's Well by Robert McKernan (Director, San Bernardino County Museum; SBCM 2012a). The blue palo verde – ironwood woodland habitat on the site may provide suitable (albeit probably marginal) habitat for nesting elf owls.

Elf owls are primarily active nocturnally. Because of this, diurnal SBC surveys are not sufficient to determine their status on the project site. To address this, the project owner has conducted three rounds of nocturnal, focused Elf Owl call playback surveys in Desert Dry Wash and palm plantation habitats during the months of May and June, 2013, without detecting any Elf Owls (Palen 2013ii). As stated in Spring 2013 Avian Survey Results "The complete methods and results for these surveys will be reported in the Bloom Biological, Inc. (BBI) forthcoming Summer Avian Bird Report (see Section 5.0 "Future Surveys"). Additionally, habitat and nest cavity surveys designed specifically to address the suitability of habitat on site for Elf Owls and Gila Woodpeckers were conducted during early July (see Section 5.0) and will be detailed in BBI's Summer report." Staff will incorporate this information into the project's BBCS plan.

Gila Woodpecker

The Gila woodpecker is listed as endangered under CESA but has no status under the federal ESA. It is identified as a bird species of conservation concern by the USFWS. Its geographic range is generally in southern Arizona and southward into Baja California and western mainland Mexico. It occupies this range year around (i.e., it is not migratory). In California, the Gila woodpecker is known from riparian forests along the Colorado River and from desert wash woodlands in Imperial County. It excavates cavity nests in large riparian trees such as cottonwoods and (in upland habitats) saguaro cacti, and feeds largely on insects, mistletoe berries, and cactus fruits. Its primary habitat is cottonwood-willow riparian woodland, but it also uses thickets of other desert trees (e.g., desert ironwood), as well as upland habitats, especially outside the breeding season. Desert ironwood is generally too dense for nest excavation. Where Gila woodpeckers occur in dry desert wash woodlands, they reportedly excavate cavity nests in large blue palo verde trees rather than ironwood. In suburban habitats, they nest in ornamental trees including athel (*Tamarix aphylla*), eucalyptus, and palms. Availability of suitable nesting trees is apparently a limiting factor in breeding habitat suitability.

The project owner had three experienced biologists search for and record the species and location information for any special status species at all times while on the project site. As stated in the project owner's Spring 2013 Avian Survey Results (Palen 2013ii)," including while walking transects between SBC survey stations and, of course, during periods of surveying at SBC stations. In general, the project site does not possess a large amount of high quality habitat for breeding woodpeckers of any species, as evidenced by the low number of woodpeckers detected during Spring surveys. No other woodpecker species was observed, and no active or inactive woodpecker cavities were discovered on site during the course of Spring surveys, although no systematic searches for such cavities were conducted during this period." The report further states that "habitat and nest cavity surveys designed specifically to address the suitability of habitat on site for Elf Owls and Gila Woodpeckers were conducted during early July (see Section 5.0) and will be detailed in BBI's Summer report." Staff will incorporate this information into the project's BBCS plan.

American Badger

American badgers were once fairly widespread throughout open grassland habitats of California. Badgers are an uncommon permanent resident with a wide distribution across California, except from the North Coast area. American badger is a resident species and is most abundant in the drier open stages of most shrub, forest, and herbaceous habitats with friable soils. Badgers are generally associated with treeless regions, prairies, parklands, and cold desert areas (Zeiner et al. 1990). Badgers inhabit burrows and often predate and forage on other small mammal burrows as evidenced by claw marks along the edges of existing burrows. Most of the CNDDB records from the Palo Verde Valley area of Riverside County are prior to 1960 and the closest is located approximately 12 miles southeast of the project site, northwest of Palo Verde (CNDDB 2010).

American badger sign was found during spring 2009 and spring 2010 field surveys for the PSPP; burrow predation evidence by badgers was found throughout the Project Disturbance Area habitats and study area. Surveyors observed 5 badger dens and over 10 wildlife burrows showing evidence of predation by badgers (Solar Millennium 2009b). During spring 2010 surveys for the PSPP, one American badger den was found in the Project Disturbance Area and two were found in the buffer area (Solar Millennium 2010k, Table 3). In addition, a badger skull was observed within the study area, south of I-10 (Solar Millennium 2009b). The PSEGS project footprint would impact fewer known American badger burrows detected in 2009-2010 however since badgers use multiple burrows within their home range impacts to this species would be similar to the PSPP. This species or its sign was not reported to be observed during spring 2013 surveys for the PSEGS along the proposed generation tie-line or the natural gasline route. (Palen 2013jj) The entire Project Disturbance Area is considered suitable habitat for badgers.

Desert Kit Fox

Desert kit fox is an uncommon to rare permanent resident of arid regions of the southern portion of California. Kit fox occur in annual grasslands, or grassy open, arid stages of vegetation dominated by scattered herbaceous species. Kit fox occur in association with their prey base which is primarily cottontail rabbits, ground squirrels, kangaroo rats and various species of insects, lizards, or birds (Zeiner et al. 1990). Title 14, California Code of Regulations section 460 stipulates that desert kit fox may not be taken at any time. Protection provided by kit fox dens for use as shelter, escape, cover, and reproduction is vital to the survival of the species. Desert kit fox burrows, complexes and scat were observed throughout the study area within desert wash and upland scrub habitats during spring 2009. Approximately 71 kit fox burrows and burrow complexes were recorded within the study area during 2009 field surveys, most of which occur in the Project Disturbance Area (Solar Millennium 2009a). Kit fox scat was observed within the transmission line disturbance area in fall 2009 and a kit fox burrow was observed in spring 2009 (Solar Millennium 2009b). During spring 2010 field surveys, two kit fox complexes were found in the Project Disturbance Area and four burrow complexes were found in the buffer area (Solar Millennium 2010k). The PSEGS project footprint would impact fewer known desert kit fox burrows detected in 2009-2010 however since kit fox use multiple burrows within their home range impacts to this species would be similar to the PSPP. No kit fox dens were observed during spring 2013 surveys for the PSEGS along the proposed generation tie-line and the natural gasline route however sign (e.g. digs and scat) of this species was reported to be observed during the surveys (Palen 2013jj). The entire Project Disturbance Area is suitable habitat for desert kit fox.

Nelson's Bighorn Sheep

Nelson's bighorn sheep includes bighorns from the Transverse Ranges through most of the desert mountain ranges of California, Nevada, and northern Arizona to Utah. Essential habitat for bighorn sheep includes steep, rocky slopes of desert mountains, termed "escape terrain." Their agility on steep rocky terrain is an adaptation used to escape predators such as coyotes, eagles, and cougars (Wehausen 1992). Surface water is another element of desert bighorn habitat considered essential to population health. Male and female bighorn sheep inhabiting desert ecosystems can survive without consuming surface water (Krausman et al. 1985) and males appear to drink infrequently in many situations; however, there are no known large populations of bighorn sheep in the desert region that lack access to surface water. In the spring, when annual plants are available, bighorn tend to disperse downhill to bajadas and alluvial fans to forage. Desert bighorn have a long lambing season that can begin in December and end in June in the Mojave Desert, and a small percentage of births commonly occur in summer, as well (Wehausen 1992).

Over the past 140 years, bighorn sheep have suffered considerable population declines throughout their range and metapopulations have been fragmented by roads and other barriers with a resulting decline in genetic diversity (Bleich et al. 1996, Epps et al. 2005). Disease, sometimes brought about by contacts with domestic sheep, drought and predation, interacting with other anthropogenic factors may also have contributed to declines in bighorn sheep populations (Wehausen 2005). Loss of surface water sources may also diminish the viability of existing populations (Wehausen 2005).

Two metapopulations of bighorn sheep occur within the NECO planning area, the Southern Mojave and Sonoran. Within these metapopulations, there are smaller, isolated subpopulations of bighorn sheep, known as demes, and there are nine demes occurring in the Sonoran metapopulation (BLM CDD 2002). Bighorn sheep metapopulations have been fragmented by highways, roads, railroads, and aqueducts primarily by the construction of Interstate 10 (I-10) and Interstate 40 which are major barriers to bighorn sheep movements. Transportation corridors of Highways 66, 62, 177, 95, and 78, the AT&SF Railroad (parallel to Old Highway 66) and the Eagle Mountain Railroad (scheduled for reactivation) inhibit bighorn sheep movements between demes. Nevertheless, bighorn sheep are known to cross these and other linear features such as transmission lines and fences.

The PSEGS site is located south of occupied range in Bighorn Sheep Wildlife Habitat Management Areas (WHMAs) in the Palen, Granite, and Coxcomb mountains (BLM CDD 2002). Recent surveys also suggest bighorn sheep may occur in the Little Maria Mountains, farther northeast of the project area (Wehausen 2009). CNDDB records for this species from the project area indicate that bighorn sheep disperse through these mountain ranges typically whenever forage and water conditions permit.

No sign or evidence of Nelson’s bighorn sheep were found during field surveys performed within the study area; however, bighorn sheep have been documented in the Chuckwalla Mountains southwest of the project site and the Palen, Granite, Coxcomb, Eagle mountain ranges among other ranges to the north, west, and east. Six rams were observed in the Coxcomb Mountains during Phase 2 golden eagle surveys performed jointly for various energy projects during 2010 (Tetra Tech 2010a). This species or its sign was not observed during spring 2013 surveys for the PSEGS along the proposed generation tie-line or the natural gasline route (Palen 2013jj). The project area does not occur in a known movement corridor as identified in the NECO. All vegetation communities within the study area are considered suitable for bighorn sheep.

Burro Deer

Burro deer is a subspecies of mule deer (*Odocoileus hemionus*) found in the Colorado Desert of southern California. This species is found in the Colorado region of the Sonoran Desert near the Colorado River and within desert dry wash woodland communities. Some burro deer are resident along the Colorado River, but a significant portion move into desert areas in response to water and forage. During the hot summers, water is critical, and burro deer concentrate along the Colorado River or the Coachella Canal where water developments have been installed and where microphyll woodland is dense and provides good forage and cover. With late summer thundershowers and cooler temperatures, deer move away from the Colorado River and Coachella Canal and then up the larger washes into mountains or wash complexes in the foothills (BLM CDD 2002).

During spring 2009 and December 2009 field surveys for the PSPP, deer scat and tracks were observed in rocky substrate and deep washes including the western, central, and eastern desert washes that transect the project site. Deer sign was found within the washes and 150-foot-wide box culverts that convey the washes underneath I-10 via (Solar Millennium 2009a, AECOM 2009a). Burro deer use the culvert associated with the western-most project area wash to access a water source at a nearby orchard. Other species sign observed in these washes include coyote, cottontail rabbit (*Sylvilagus audubonii*), bobcat, badger, and kit fox. During spring 2013 field surveys for the PSEGS, deer scat and tracks were observed in arboreal washes east of the modified gen-tie, both adjacent to the I-10 and one set of deer tracks was also observed in the buffer for the natural gas pipeline, south of the I-10 (Palen 2013jj). The entire project site supports suitable habitat for burro deer.

SPECIAL STATUS INSECTS

Desert ecosystems are known to support a broad group of invertebrate life. As in all ecosystems, invertebrates play a crucial role in a number of biological processes. Insects serve as the primary or secondary food source for a variety of bird, reptile, and mammal predators; act as important pollination agents for plant species; they act as efficient components in controlling pest populations; and supporting the naturally occurring maintenance of an area by consuming detritus and contributing to necessary soil nutrients. The project site likely supports a wide variety of common and non-native invertebrates. Some of the orders identified in the project area included Hemiptera (true bugs), Coleoptera (beetles), and Diptera (flies). Various insects were observed on the project site by staff during surveys conducted to verify and document biological resources. A review of the CNDDB by staff resulted in a list of several special status insects known from the area, including the federally endangered Casey's June beetle.

Conservation Challenges California's Action Plan states that within the Mojave Desert Region, 29 invertebrate taxa are included on the CDFW's Special Animals List, including 19 arthropod taxa and 10 mollusk taxa. Of these, 22 are endemic to the Mojave Desert Region, and six other taxa found here are endemic to California but not restricted to this region (CDFG 2007a). Staff believes the adjacent agricultural operation and concomitant water supply likely attracts and supports a variety of insect species. Other species may migrate over the project site and general area at various times of the year, or stopover at the project site and general area during migration. Little data on migration routes is available, and it is unclear which, if any, special status species might be present at or over the project site and general vicinity during migratory movements.

Biological Resources Table 4, below, was generated for analysis of the PSPP project, and provides a summary of special-status plants and animals also considered in this assessment. Some of these species were originally considered to have a lower potential for occurrence at the Project site than the species discussed above because the general or micro-habitats known to support them were not found at the site, and/or there are no known occurrences in the Project vicinity.

In consideration of potential effects from the PSEGS project, conclusions regarding the potential for several of the wildlife species to occur at the site have changed, particularly with respect to avifauna. These changes are due to several factors. Each species' habitat needs and behavioral traits were considered and evaluated with respect to the modified project's footprint, profile, and operating characteristics. In several instances, the modified project has introduced a previously unidentified risk to the species which requires further analysis, and for other species such as Swainson's hawk, ongoing surveys have detected additional species at the site or general vicinity. The species list has been updated to indicate that species that have the potential to occur are marked in ~~strikeout~~ in **Table 4**, and are included in **Biological Resources Table 3**.

Biological Resources Table 4
Special-Status Species with Low to Moderate Potential to Occur at the Project Site

Species	Habitat Requirements and Geographic Range	Potential to Occur or Presence On Site
Plants		
Angel trumpets *Acleisanthes longiflora*	This species occurs in Sonoran desert scrub habitats on carbonate soils from approximately 200 to 300 feet above MSL. There are two records from the Consortium of California Herbaria from the Colorado Desert, Palo Verde area (CCH 2010).	This species has a low potential to occur since the elevation range of the project site is appropriate for this species although the study area does not support carbonate/limestone derived soils in mountainous areas.
Argus blazing star *Mentzelia puberula*	This plant species occurs in desert scrub and desert woodlands with limestone and granitic slopes above 2,000 feet in elevation. Based on 13 Consortium of California Herbaria database records for this species, this species has been collected from Riverside, San Bernardino, and Imperial counties from the Little and Big Maria Mountains in Riverside County.	This species is not expected to occur in the study area due to lack of limestone and granitic slopes which are soil types preferred by this species that are absent from the study area. The project site is located at approximately 130 to 200 feet above MSL which is well below the typical elevation where this species typically occurs.
Arizona spurge *Chamaesyce arizonica*	This species occupies sandy, Sonoran desert scrub habitat areas and has been reported from Imperial, Riverside, and San Diego Counties and portions of Arizona and Baja California (CNPS 2009) from approximately 150 feet to 1,200 feet above MSL. There are seven database records from the Consortium of California Herbaria primarily from San Diego County but also Riverside and Imperial counties often from sandy areas and transition areas between chaparral and desert habitats. The record from Riverside County is near Palm Springs from Andreas Canyon (CCH 2010).	Arizona spurge has a low potential to occur within the study area due to the presence of suitable habitat and appropriate elevation range of the project site.
Bitter hymenoxys *Hymenoxys odorata*	Bitter hymenoxys grows riparian scrub and Sonoran desert scrub habitats from 150 feet to 500 feet above MSL. This plant species blooms from February through November (CNPS 2009). There are five CNDDB records for this species for the entire state of California, two of which occur in Riverside County; the nearest CNDDB occurrence is a historical record approximately 5 miles southeast of the project area from sandy slope, low bottom lands and overflow flats (CNDDB 2010).	This species was not found during spring 2009-2010 or 2013 field surveys. This species has a potential to occur within desert dry wash woodland, unvegetated washes, and Sonoran creosote bush scrub habitats within the project area.

Species	Habitat Requirements and Geographic Range	Potential to Occur or Presence On Site
Bitter snakeweed *Condalia globosa* var. *pubescens*	Also referred to by the common name, spiny abrojo. Bitter snakeweed occurs in Sonoran desert scrub from approximately 400 feet to 3,000 feet above MSL. Bitter snakeweed blooms from March through May (CNPS 2009). Based on 35 records from the Consortium of California Herbaria database, all records are from Imperial County except one from Riverside County, a record from 1,900 feet in elevation from a relatively flat alluvial fan from Chuckwalla Bench (CCH 2010). There are no CNDDB records for this species in California (CNDDB 2010).	This species was not observed during spring 2009-2010 or 2013 field surveys. The project site occurs below the elevation where this species typically occurs.
California ayenia *Ayenia compacta*	This species occurs in Mojavean and Sonoran desert scrub habitats from approximately 500 to 3,300 feet above MSL. This species blooms from March through April. There are 29 records from the Consortium of California Herbaria database from the Anza-Borrego area alone, one from Riverside County from a sandy wash in the Santa Rosa Mountains off Martinez Canyon (CCH 2010). The nearest CNDDB occurrence is a historical record from 1776 approximately 30 miles southwest of the project area in the Chuckwalla Mountains (CNDDB 2010).	This species was not observed during spring 2009-2010 or 2013 field surveys. This species has a potential to occur within Sonoran creosote bush scrub and desert wash habitats within the project area.
California satintail *Imperata brevifolia*	This species occurs in grassy areas found near chaparral, desert scrub, riparian scrubs, coastal scrub, wet springs, meadows, stream sides, and floodplains from sea level to approximately 1,500 feet above MSL. There are 64 records from the Consortium of California Herbaria database from many northern and southern California Counties. Records from Riverside County are from the Palm Springs and San Jacinto Mountains area along irrigation ditches or streams.	California satintail has a low potential to occur within the study area due to the presence of suitable habitat although lack of occurrences from the project area. This species was not observed during spring 2009-2010 or 2013 field surveys.
Chaparral sand verbena *Abronia villosa* var. *aurita*	This species occupies sandy soil areas of chaparral, coastal sage scrub, and sandy desert dune habitats (CNPS 2009) from approximately 240 feet to 4,800 feet above MSL. There are 147 records in the Consortium of California Herbaria database many from Riverside County in the San Jacinto Mountains area.	Chaparral sand verbena has a low potential to occur within the study area due to the presence of suitable habitat although lack of occurrences from the project area. This species was not observed during spring 2009-2010 or 2013 field surveys.

Species	Habitat Requirements and Geographic Range	Potential to Occur or Presence On Site
Coachella Valley milk-vetch *Astragalus lentiginosus* var. *coachellae*	The Coachella Valley Multiple Species Habitat Conservation Plan states that this species occurs on "dunes and sandy flats, along the disturbed margins of sandy washes, and in sandy soils along roadsides and in areas formerly occupied by undisturbed sand dunes. Within the sand dunes and sand fields, this milk-vetch tends to occur in the coarser sands at the margins of dunes, not in the most active blowsand areas. As this species is strongly affiliated with sandy substrates, it may occur in localized pockets where sand has been deposited by wind or by active washes. It may also occur in sandy substrates in creosote bush scrub, not directly associated with sand dune habitat (CVAG 2007). This plant species blooms from February to May, producing pink to deep magenta-colored flowers. This species occurs on aeolian deposits with fewer than 25 occurrences in the Coachella Valley. Coachella Valley milk-vetch depends on natural disturbances from fluvial and aeolian processes for seedling establishment (BLM CDD 2002).	This species was not observed during spring 2009-2010 or 2013 surveys and does not have a potential to occur in the study area. This species is not expected to occur in the project area. The distribution of Coachella Valley milk-vetch is restricted to the Coachella Valley in Riverside County, between Cabazon and Indio. CVAG (2007) identifies six outlying occurrences within a 5-mile area along Rice Road in the Chuckwalla Valley north of Desert Center, California (CVAG 2007); however, USFWS staff has indicated that these occurrences are not of the listed taxon (Engelhard, pers. comm.).
Cove's cassia *Senna covesii*	This species occurs on dry, sandy desert washes and slopes of the Sonoran Desert between 1,600 to 2,000 feet above MSL. This species occurs in sandy washes, roadsides, and alkaline flats in the Mojave and northern Sonoran deserts between 1,600 to 2,000 feet above MSL (CNPS 2009).	Cove's cassia has a low potential to occur within the study area due to the presence of suitable habitat and the project site being located below the typical elevation range where this species is known from. This species was not observed during spring 2009-2010 or 2013 field surveys.
Crucifixion thorn *Castela emoryi*	This species occurs in Sonoran and Mojavean deserts in scrub habitats and playas with dry, gravelly washes, slopes, and plains from approximately 300 to 2,100 feet above MSL. There are 64 records in the Consortium of California Herbaria database from Riverside, San Bernardino, Imperial counties among others and often times prefers grassy or hayfield habitats. There is a record from a hayfield in Chuckwalla Valley.	This species has a low potential to occur within the study area due to the presence of suitable habitat and appropriate elevation range of the project site. This species was not observed during spring 2009-2010 or 2013 field surveys.
Desert portulaca *Portulaca hamiloides*	This species occurs in Joshua tree woodlands and has been reported from Riverside and San Bernardino counties and portions of Arizona and Baja, California from 3,000 feet to 3,600 feet above MSL (CNPS 2009).	This species is not expected to occur within the study area due to lack of typical habitat associations and the project site being located outside of the elevation range. This species was not observed during spring 2009-2010 or 2013 field surveys.

Species	Habitat Requirements and Geographic Range	Potential to Occur or Presence On Site
Desert sand parsley *Ammoselinum giganteum*	This species occupies Sonoran creosote bush scrub habitat and has been reported from Riverside County, California and portions of Arizona (CNPS 2009) at approximately 1,200 feet above MSL (There are two records from the Consortium of California Herbaria database from Riverside County from the Chuckwalla Valley where this species was observed growing in dry basins at 500 feet above MSL (CCH 2010).	Desert sand parsley has a low potential to occur within the study area due to presence of suitable habitat and reported occurrences from the Chuckwalla Valley. This species was not observed during spring 2009-2010 or 2013 field surveys.
Desert spike moss *Selaginella eremophila*	This is a dense, mat forming, non-flowering plant. This species occurs in Sonoran creosote scrub habitats in gravelly or rocky soils from approximately 600 to 2,700 feet above MSL. There are 56 records in the Consortium of California Herbaria database from Riverside and San Diego counties with several records from Anza Borrego State Park, Palm Springs, Palm Canyon, and San Jacinto Mountain Range. One collection from Riverside County is from the vicinity of the Chocolate-Chuckwalla Mountain region near the north side of the Orocopia Mountains from sloped rocky, shady surfaces in gravelly soils (CCH 2010).	This species was not observed during spring 2009-2010 or 2013 field surveys. This species has a low potential to occur within the study area give the presence of suitable desert scrub habitat and historic collections from the project area, although the project site is located below the typical elevation range of this species.
Dwarf germander *Teucrium cubense* ssp. *depressum*	This species occurs in desert dune, playa margins, and Sonoran desert scrub habitats from approximately 100 feet to 1,200 feet above MSL. This species typically blooms from March to May but may also bloom from September through November. This species typically occurs in sandy soils and wash habitats and is known from fewer than 10 occurrences in California (CNPS 2009). There are 15 records from Consortium of California Herbaria database from Riverside and Imperial counties; there are records from the Chuckwalla Valley in the Hayfield area and Palo Verde Valley. There is a CNDDB record from Wiley's Well Road (400 feet elevation) from 1979 (CNDDB 2010). Another CNDDB occurrence is a historical record from 1912 located approximately 7 miles southeast of the project area from the Palo Verde Valley (CNDDB 2010).	This species has a low potential to occur due to the presence of suitable habitat and appropriate elevation range of the site. This species was not observed during spring 2009-2010 or 2013 field surveys.

Species	Habitat Requirements and Geographic Range	Potential to Occur or Presence On Site
Foxtail cactus *Coryphantha alversonii*	This species occurs on rocky, granitic soils in Sonoran and Mojavean desert scrub habitats from 200 feet to 4,600 feet above MSL. Prior to conducting spring 2009 field surveys, a reference population was observed on April 9, 2009 at a gravel pit northwest of Blythe along State Route 95 and several individuals were observed in relatively undisturbed Sonoran creosote bush scrub on granitic rock, a preferred habitat type of this species (CNPS 2009). This species was not found during surveys performed in the Biological Resources Survey Area (BRSA). There are 25 records of this species from the Consortium of California Herbaria database from Riverside, Imperial, and San Bernardino counties. There are records from the Chuckwalla Valley from rocky, granitic slopes (CCH 2010).	Foxtail cactus has a low potential to occur within the study area due to the presence of suitable desert scrub habitat and appropriate elevation of the site although lack of rocky, grantic soils. This species was not observed during spring 2009-2010 or 2013 field surveys.
Mesquite nest straw *Stylocline sonorensis*	This species occupies Sonoran desert scrub habitats around 1,300 feet elevation and has been reported from Riverside County and portions of Arizona and Sonora, Mexico (CNPS 2009). There are two records from the Consortium of California Herbaria database from Riverside County both from the Chuckwalla Mountains, Hayfields region from 1930 (CCH 2010).	This species was not observed during spring 2009-2010 or 2013 field surveys. Mesquite nest straw has a low potential to occur within the study area due to suitable habitat present within the site.
Orocopia sage *Salvia greatae*	This species occurs in the southeastern Sonoran Desert and is associated with the Orocopia and Chocolate Mountains on alluvial slopes between 100 and 800 feet above MSL. There are 49 records from the Consortium of California Herbaria database, several from the Chocolate, Chuckwalla, and Orocopia mountain areas (CCH 2010).	This species was not observed during spring 2009-2010 or 2013 field surveys. This species has a low potential to occur within the study area due to the presence of suitable habitat and appropriate elevation range of the site.
Pink fairyduster *Calliandra eriophylla*	This species occurs in the Sonoran Desert in sandy washes, slopes and mesas from 350 to 5,000 feet above MSL. There are 62 records from the Consortium of California Herbaria database, several from the Chocolate-Chuckwalla Mountains area in Imperial and San Diego counties (CCH 2010).	This species was not observed during spring 2009-2010 or 2013 field surveys. Pink fairy duster has a low potential to occur within the study area due to suitable habitats, appropriate elevation range of the site, and reported records from the project area.

Species	Habitat Requirements and Geographic Range	Potential to Occur or Presence On Site
Pink velvet mallow *Horsfordia alata*	This species occurs in the Sonoran Desert in California, Arizona, and Mexico. It occurs in Sonoran desert scrub habitats from approximately 300 to 1,500 feet above MSL. There are no CNDDB records for this species for the entire state of California; the most recent collections have been from the Chocolate, Chuckwalla, and Cargo Muchacho Mountains approximately 50 miles south of the study area and are believed to be extant.	This species was not observed during spring 2009-2010 or 2013 field surveys.
Sand evening-primrose *Camissonia arenaria*	This species occupies sandy and gravelly areas of Sonoran desert scrub habitat and has been reported from Imperial and Riverside counties and areas of Arizona and Mexico from 200 feet to 2,700 feet above MSL (CNPS 2009). There are 13 records of this species in the Consortium of California Herbaria database several from the Chocolate-Chuckwalla Mountains, Palo Verde Valley, and Ogilby Pass area (CCH 2010).	This species has a low potential to occur within the study area due to the presence of suitable habitat and appropriate elevation of the site. This species was not observed during spring 2009-2010 or 2013 field surveys.
Slender woolly-heads *Nemacaulis denudata* var. *gracilis*	This species occupies desert sand dunes, coastal dunes, and Sonoran desert scrub (CNPS 2009) from 150 to 1,200 feet above MSL. There are 45 records in the Consortium of California Herbaria database from the Palm Springs, Indian Wells area in Riverside County (CCH 2010).	Slender woolly-heads has a low potential to occur within the study area due to suitable habitat and appropriate elevation range of the site. This species was not observed during spring 2009-2010 or 2013 field surveys.
Small-flowered androstephium *Androstephium breviflorum*	This species occurs in desert dune and Mojavean desert scrub habitats from approximately 700 feet to 2,000 feet above MSL (CNPS 2009). This species blooms from March through April and often occurs on desert bajadas. The nearest CNDDB record for this species is from Cadiz Valley from Riverside and San Bernardino Counties approximately one mile north of Highway 62 during 1995 from a sandy, Mojavean Desert shrub-land bajada (CNDDB 2010).	This species has a potential to occur within the site due to suitable sand dune habitat and appropriate elevation range of the site. Species was not observed during 2009-2010 or 2013 field surveys.
Spearleaf *Matelea parvifolia*	This species occurs in Mojavean and Sonoran desert scrub habitats from 1,320 feet to approximately 3,300 feet above MSL. This species blooms from March through May (CNPS 2009). The nearest CNDDB record for this species is from the Chuckwalla Bench area during 1986 from desert dry wash woodland and creosote scrub habitats (CNDDB 2010).	This species has a potential to occur within the project site although was not observed during spring 2009 field surveys. The project site is located below the typical elevation range of this species. This species was not observed during spring 2009-2010 or 2013 field surveys.

Species	Habitat Requirements and Geographic Range	Potential to Occur or Presence On Site
Wiggins' cholla *Cylindropuntia wigginsii*	Wiggins' cholla is not recognized as a species, but is considered a hybrid of silver cholla (*C. echinocarpa*) and pencil cholla (*C. remosissima*). Wiggins' cholla is not found as a separate species in The Jepson Manual nor in A California Flora and Supplement (Munz and Keck 1959, Munz 1968); however, the BLM's Proposed NECO identifies Wiggins' cholla as a special-status species (BLM CDD 2002). CNPS considers this species a sporadic hybrid of the two Cylindropuntia species mentioned above (CNPS 2009).	Since this species is not a recognized subspecies, Wiggins' cholla is not expected to occur in the project area.
Birds		
~~Bendire's thrasher~~ ~~*Toxostoma bendirei*~~	~~Bendire's thrashers are known in California from scattered locations in Kern, Inyo, San Bernardino, and Riverside counties. This species is a summer resident in southeastern California, and arrives at breeding grounds from mid-March through May, and departs by late August. It favors open grassland, shrubland, or woodland with scattered shrubs, primarily in areas that contain large cholla, Joshua tree, Spanish bayonet, Mojave yucca, palo verde, mesquite, catclaw, desert-thorn, or agave. The status of populations of this species is poorly understood, but threats are believed to be loss of habitat due to urbanization, harvesting of yucca and Joshua trees, overgrazing, and off-road vehicle activity. In parts of the range, grazing may increase habitat suitability by increasing scattered junipers within the area.~~	~~The desert dry wash natural community provides potential habitat for this species (148 acres), although this species was not observed during surveys. There are CNDDB (2010) records from near the Desert Center, approximately 8 miles west of the project, from 2004.~~
~~Black-tailed gnatcatcher~~ ~~*Polioptila melanura*~~	~~A year round resident in southwestern United States and central and northern Mexico, in California the black-tailed gnatcatcher is found in the southeast desert wash habitat from Palm Springs and Joshua Tree National Monument south, and along the Colorado River. It is now rare in eastern Mojave Desert north to the Amargosa River, Inyo Co. This species nests primarily in wooded desert wash habitat, but also occurs in creosote scrub habitat during the non-breeding season.~~	~~Based on a review of the natural community descriptions provided by the Applicant, the project site contains little, if any, of the dense scrub habitat preferred by this species. They are known from the area, including from McCoy Spring, Palen Valley, and Chuckwalla Well (Fitton 2008). The closet occurrence based on the CNDDB (2010) is from 1977 and is approximately 16.5 miles east of the project site.~~

Species	Habitat Requirements and Geographic Range	Potential to Occur or Presence On Site
~~Crissal thrasher~~ ~~*Toxostoma crissale*~~	~~Crissal thrashers are non-migratory residents ranging from southern Nevada and southeastern California to western Texas and central Mexico. This species prefers habitats characterized by dense, low scrubby vegetation, which, at lower elevations, includes desert and foothill scrub and riparian brush. Nests of this species typically consist of an open cup of twigs, lined with finer vegetation, and are placed in the middle of a dense shrub.~~	~~Based on a review of the natural community descriptions provided by the Applicant, the project site contains little, if any, of the dense scrub habitat preferred by this species. They are known from the area, including from McCoy Spring, Palen Valley, and Chuckwalla Well (Fitton 2008). The closet occurrence based on the CNDDB (2010) is from 1977 and is approximately 16.5 miles east of the project site.~~
~~Ferruginous hawk~~ ~~*Buteo regalis*~~	~~Ferruginous hawks do not breed in California, but are winter residents and in California are most common in grassland and agricultural areas in the southwest. Ferruginous hawks are found in open terrain from grasslands to deserts, and are usually associated with concentrations of small mammals. Threats to this species include loss of wintering habitat from urbanization and cultivation.~~	~~The project site contains suitable wintering habitat for this species. There are nine CNDDB (2010) records for this species in western Riverside County.~~
~~Gila woodpecker~~ ~~*Melanerpes uropygialis*~~	~~The Gila woodpecker's range is limited to a small area of southwestern United States and northwestern Mexico. In California, this species is found only along the Colorado River and in small numbers in Imperial County. In southeastern California, Gila woodpeckers were formerly associated with desert washes extending up to 1 mile from the Colorado River. Currently, they are found only in riparian areas along the Colorado River.~~	~~In California, this species is currently known only from the Colorado River; therefore this species is not expected in the project site. The project site does not contain suitable nesting habitat for this species. The closest CNDDB (2010) record for this species is a 1986 record east of the project site at the Colorado River.~~
~~Gilded flicker~~ ~~*Colaptes chrysoides*~~	~~In California, the gilded flicker is known from the southeast; habitat includes stands of giant cactus, Joshua tree, and riparian groves of cottonwoods and tree willows in warm desert lowlands and foothills. Until the mid-1990's, this species was considered a subspecies of northern flicker (*C. atratus*). This species nests primarily in cactus, but also will use cottonwoods and willows of riparian woodlands. This species may be nearly extinct in California.~~	~~This species is not expected to regularly use the project site due to lack of suitable habitat. The closest CNDDB (2010) records for this species are along the Colorado River.~~
~~Mountain plover~~ ~~Charadrius montanus~~	~~Mountain plovers do not breed in California, but are winter visitors primarily from September to mid-March. In California they are found in the Central Valley, Antelope Valley, San Jacinto Valley, Imperial Valley, and Palo Verde Valley. Mountain plover habitat includes short-grass prairie or their equivalents, and in southern California deserts are associated primarily with agricultural areas, though use of these areas is suspected to be because of loss of native grassland and playa habitats.~~	~~This species may use the dry lakebed and nearby agricultural areas as winter habitat. The closest CNDDB (2010) record for this species is in Imperial County at the southern end of the Salton Sea.~~

Species	Habitat Requirements and Geographic Range	Potential to Occur or Presence On Site
~~Northern harrier~~ ~~*Circus cyaneus*~~	~~In western North America, the northern harrier breeds from northern Alaska south to Baja California, Mexico. This species does not commonly breed in desert regions of California, where suitable habitat is limited, but winters broadly throughout California in areas with suitable habitat. Northern harriers forage in open habitats including deserts, pasturelands, grasslands, and old fields.~~	~~The project site contains suitable wintering habitat for the northern harrier, and this species was observed during 2009 and 2010 project site surveys (Solar Millennium 2009a). There are CNDDB (2010) nesting records for this species in eastern Riverside County.~~
~~Peregrine falcon~~ ~~*Falco peregrinus*~~	~~The Peregrine falcon's year-round range includes coastal and northwestern California and the Sierra Nevada and other California mountains. Additionally, this species winters inland throughout the Central Valley and in northeastern California. They are rare in the arid southeast, but they occur and are suspected to breed in the lower Colorado River Valley. Peregrine falcons require open habitat for foraging, and prefer breeding sites near water. Nesting habitat includes cliffs, steep banks, dunes, mounds, and some human-made structures.~~	~~This species may forage on the project site and nest in nearby mountains, but was not observed in the project site during project surveys. There are no CNDDB (2010) records for Riverside County.~~
~~Purple martin~~ ~~*Progne subis*~~	~~The historical breeding range of the purple martin includes southern California, though populations have shrunk dramatically. Neither the historical or current breeding range, however, includes the Colorado Desert. Purple martins habitat requirements include adequate nest sites and availability of large aerial insects, and therefore are most abundant near wetlands and other water sources. Threats to this species include loss of large tree and snags and competition from European starlings.~~	~~This species was observed migrating through the project site, but is not expected to extensively use the project site. There are six CNDDB (2010) records for this species from western Riverside County, the most recent of which include nesting records from 1983 and 1993.~~
~~Short-eared owl~~ ~~*Asio flammeus*~~	~~Short-eared owls breed through much of northern North America, and are year-round residents in some areas of California. Historically, this species occurred throughout much of California, west of the southern deserts, in low numbers. Currently, small populations breed in regularly in the Great Basin and in the Sacramento/San Joaquin River Delta area, but sporadically in other parts of its former range. Short-eared owls require open country that supports small mammal populations, and that also provides adequate vegetation to provide cover for nests. This includes salt- and freshwater marshes, irrigated alfalfa or grain fields, and ungrazed grasslands and old pastures.~~	~~The project site contains suitable wintering habitat for the short-eared owl. This species was not observed during surveys for this project, it was observed during surveys for a nearby proposed energy facility site immediately west of the McCoy Mountains. There are no Riverside County CNDDB (2010) records for this species.~~

Species	Habitat Requirements and Geographic Range	Potential to Occur or Presence On Site
~~Swainson's hawk~~ ~~*Buteo swainsoni*~~	~~Swainson's hawks require large areas of open landscape for foraging, including grasslands and agricultural lands that provide low-growing vegetation for hunting and high rodent prey populations. Swainson's hawks typically nest in large native trees such as valley oak, cottonwood, walnut, and willow, and occasionally in nonnative trees, such as eucalyptus within riparian woodlands, roadside trees, trees along field borders, isolated trees, small groves, and on the edges of remnant oak woodlands. While there are historical breeding records of this species from the Colorado Desert, this species is now known from southern California only as a spring and fall migrant. This reduction in breeding range is believed to be from loss of nesting habitat.~~	~~The project site may provide foraging habitat for migrating individuals, and this species was observed in the project site during 2009 and 2010 surveys. There are no CNDDB (2010) records for this species in Riverside County.~~
~~Vaux's swift~~ ~~*Chaetura vauxi*~~	~~This species is not known to breed in Riverside County or elsewhere in southern California. Very few nests have been found so their breeding range has been inferred from sightings of birds flying over potential nesting areas during their nesting season, in June and July. Vaux's swifts prefer to nest in the hollows formed naturally inside of large old conifer trees, especially snags, which are entirely lacking from the project site.~~	~~This species was observed during surveys, but occurrences are expected to be of migrants, only.~~
~~Vermilion flycatcher~~ ~~*Pyrocephalus rubinus*~~	~~Vermilion flycatchers are rare breeders or residents in localized areas of southern California, including along the Colorado River. They are usually found near water in arid scrub, farmlands, parks, golf courses, desert, savanna, cultivated lands, and riparian woodlands; nesting substrate includes cottonwood, willow, and mesquite.~~	~~Within the project vicinity, occurrences of this species are limited to the Colorado River. This species is not expected in the project site. The closest CNDDB (2010) records include a recent (1983) record from the Blythe golf course.~~
~~Yellow warbler~~ ~~*Dendroica petechia*~~	~~Yellow warblers historically bred throughout much of California except for high elevations, the Colorado Desert, and most of the Mojave Desert. Breeding abundance for this species has declined in much of California, as has the breeding range, especially in the Central Valley and parts of Owens Valley. In southeastern California, this species is known only from the lower Colorado River Valley from the middle of San Bernardino County through Riverside and Imperial Counties. Currently, this species no longer breeds in much of the Riverside County segment of the lower Colorado River Valley. This species commonly uses wet, deciduous thickets for breeding, and seeks a variety of wooded, scrubby habitats in winter.~~	~~This species was not observed during surveys, and is not expected to nest in the project site due to lack of suitable habitat. The closest CNDDB (2010) records for this species are two 1986 records east of the project site at the Colorado River.~~

Species	Habitat Requirements and Geographic Range	Potential to Occur or Presence On Site
~~Yellow-breasted chat~~ ~~*Icteria virens*~~	~~The yellow-breasted chat occurs as a summer resident and migrant in California. In the southeastern California, the yellow-breasted chat breeds primarily in scattered locations in Owen's Valley and the Mojave, from the Salton Sea, and from the lower Colorado River Valley. This species occupies shrubby riparian habitat with an open canopy, and will next in non-native species including tamarisk. Threats to this species include loss of riparian habitat, and, it is suspected, pressure from cowbird parasitism.~~	~~In this region, this species is associated with the Colorado River only. The project site does not contain suitable habitat for this species. CNDDB (2010) records in the region are associated with the Salton Sea or the Colorado River. The closest CNDDB records for this species are two 1986 records east of the project site at the Colorado River.~~
Mammals		
Colorado Valley woodrat *Neotoma albigula venusta*	Occurs from southern Nevada, southeastern California, northeastern Baja California, to western Arizona. Colorado Valley woodrats are found in a variety of habitats including low desert, pinyon-juniper woodlands, and desert-transition chaparral. Suitable habitat elements for this species include washes where organic debris gathers, areas of prickly pear cactus and mesquite, rocky areas, and crevices in boulders which are used for cover and nest sites.	This species is not expected to occur due to coarse soils and disturbance of the project site from past agricultural activities. The nearest CNDDB record is from 1934 near Blythe (CNDDB 2010).
Arizona myotis *Myotis occultus*	This species has been found from southeastern California through Arizona, New Mexico, and south into Chihauhau, Mexico. Arizona myotis is most commonly known from conifer forests from 6,000 to 9,000 feet in elevation, although maternity roosts are known from much lower elevations including areas along the Colorado River in California.	This species is not expected to occur due to lack of coniferous forests and low elevation of the study area. The closest CNDDB (2010) record is a historical occurrence from 1945 approximately 10 miles south of the study area near the town of Ripley.
Big-free tailed bat *Nyctinomops macrotis*	This species ranges from most of South America northward to include Mexico, Arizona, New Mexico, southern and western Texas, southern California, southeastern Nevada, southern Utah, and north and western Colorado from generally sea level to 8,000 feet in elevation. This species occurs in desert shrub, woodlands, and coniferous forests. It roosts mostly in the crevices of rocks although big free-tailed bats may roosts in buildings, caves, and tree cavities	This species has the potential to roost and forage within the project area. The nearest occurrences for this species in Riverside County are from the vicinity of Palm Springs and Joshua Tree National Park (CNDDB 2010). A single bat of an unidentified species was observed roosting beneath a bridge near Corn Springs Road near the location of the proposed substation during December 2009 surveys (AECOM 2010a).

Species	Habitat Requirements and Geographic Range	Potential to Occur or Presence On Site
~~California leaf-nosed bat~~ ~~*Macrotus californicus*~~	~~California leaf-nosed bats occur in the deserts of California, southern Nevada, Arizona and south to northwestern Mexico. In California, they are now found primarily in the mountain ranges bordering the Colorado River Basin. In California, the two largest roosts (each sheltering 1,500 bats during winter months) are in mines in extreme southeastern California. This species depends on either caves or mines for roosting habitat. All major maternity, mating, and overwintering sites are in mines or caves (BLM CDD 2002). Radio-telemetry studies of *Macrotus* in the California desert show that the California leaf-nosed bat forages almost exclusively among desert wash vegetation within 6.2 miles of their roost (WBWG 2005-2009).~~	~~All habitats within the Project Disturbance Area are suitable habitats for this species. A single bat of an unidentified species was observed roosting beneath a bridge near Corn Springs Road near the location of the proposed substation during December 2009 surveys (AECOM 2010a). There are several CNDDB records in the vicinity of the study area. The nearest record is from 1993 near the McCoy Mountains area in creosote bush scrub habitat approximately where approximately 300 adults were observed roosting (CNDDB 2010).~~
Cave myotis *Myotis velifer*	The cave myotis occurs from western Texas, to southern Nevada, southeastern California (only along the Colorado River), southward into Mexico, and is also widely distributed in Arizona. This species is found primarily at lower elevations (the Sonoran and Transition life zones) of the arid southwest in areas dominated by creosote bush, palo verde, and cactus. This species is a “cave dweller” and caves are the main roosts although this species may also use mines, buildings, and bridges for roosts.	This species has a potential to occur within the study area, more likely as a foraging species than a roosting bat species. The nearest CNDDB record for this species is from 2002 near the I-15 bridge over the Colorado River in Blythe where individual bats of this species were detected acoustically during April 2002 (CNDDB 2010).
Hoary bat *Lasiurus cinereus*	Hoary bat is the most widespread of North American bats and are highly associated with forested habitats in the west. Hoary bat roosts are usually located at the edge of a clearing although more unusual roosting sites have been reported in caves, beneath rock ledges, woodpecker holes, squirrel nests, and building sides.	This species has a potential to roost and forage within the project area. The closest CNDDB (2010) record is a historical occurrence approximately from the town of Neighbors during 1919. A single bat of an unidentified species was observed roosting beneath a bridge near Corn Springs Road near the location of the proposed substation during December 2009 surveys (AECOM 2010a).

Species	Habitat Requirements and Geographic Range	Potential to Occur or Presence On Site
~~Pallid bat~~ ~~*Antrozous pallidus*~~	~~Pallid bats inhabit low elevation (less than 6,000 feet) rocky, arid deserts and canyonlands, shrub/steppe grasslands, but also occur in higher elevation coniferous forests, greater than 7,000 feet in elevation. This species is most abundant in xeric landscapes including the Great Basin, Sonoran, and Mojave deserts (WBWG 2005-2009). Pallid bats are known from Cuba, Mexico, and throughout the southwestern and western United States. Population trends are not well known, but there are indications of decline. Pallid bats roost alone, in small groups (2 to 20 bats), or gregariously (100s of individuals). Day and night roosts include crevices in rocky outcrops and cliffs, caves, mines, trees with exfoliating bark, and various human structures such as bridges, barns, porches, bat boxes, and human-occupied as well as vacant buildings (WBWG 2005-2009).~~	~~This species has a potential to roost and forage within the project area. A single bat of an unidentified species was observed roosting beneath a bridge near Corn Springs Road near the location of the proposed substation during December 2009 surveys (AECOM 2010a). Anabat/Sonobat surveys, which allows for more precise identification of bat species based on the recording of echolocation frequencies, were not conducted in conjunction with the December 2009 surveys. The nearest CNDDB record is approximately 5 miles southeast of the project site (CNDDB 2010).~~
~~Pocketed free-tailed bat~~ ~~*Nyctinomops femorosaccus*~~	~~This species occurs in western North America, from southern California, central Arizona, southern New Mexico, western Texas, south into Mexico and Baja, California (WBWG 2005-2009). Despite only a limited number of records, pocketed free-tailed bats are known to occur in the desert from March through August, when they are migrating out of the area. In California, they are found primarily in creosote bush and chaparral habitats in proximity to granite boulders, cliffs, or rocky canyons.~~	~~This species has a potential to roost and forage within the project site based on what is understood of its habitat requirements and roosting habits. The nearest CNDDB record for this species is from 2002 near the I-15 bridge over the Colorado River in Blythe. Individual bats of this species were detected acoustically during April 2002 (CNDDB 2010). A single bat of an unidentified species was observed roosting beneath a bridge near Corn Springs Road near the location of the proposed substation during December 2009 surveys (AECOM 2010a).~~
Spotted bat *Euderma maculatum*	This species is known from all the states west of and including Montana, Wyoming, Colorado, New Mexico and Texas. Although broadly distributed, this species is rarely common, but may occur locally from southern British Columbia, northern Arizona, Arizona/ Utah border, and western Texas from below sea level to 8,100 feet above MSL. Spotted bats occur in arid, low desert habitats to high elevation conifer forests and prominent rock features appear to be a necessary feature for roosting.	This species has a potential to roost and forage within the project site based on what is understood of its habitat requirements and roosting habits. The nearest CNDDB record is a historical occurrence from 1907 in the Colorado Desert near Mecca (CNDDB 2010). A single bat of an unidentified species was observed roosting beneath a bridge near Corn Springs Road near the location of the proposed substation during December 2009 surveys (AECOM 2010a).

Species	Habitat Requirements and Geographic Range	Potential to Occur or Presence On Site
~~Townsend's big-eared bat~~ ~~*Corynorhinus townsendii*~~	~~This species has been reported in a wide variety of habitat types ranging from sea level to approximately 9,000 feet above MSL. Habitat associations include coniferous forests, deserts, native prairies, riparian communities, active agricultural areas, and coastal habitat types. Foraging associations include edge habitats along streams, adjacent to and within a variety of wooded habitats.~~	~~This species has a potential to forage within the Study although roosting is unlikely to occur since cave and abandoned buildings do not occur within the study area. A single bat of an unidentified species was observed roosting beneath a bridge near Corn Springs Road near the location of the proposed substation during December 2009 surveys (AECOM 2010a).~~
~~Western mastiff bat~~ ~~*Eumops perotis*~~	~~The subspecies that occurs in North America, *E. p. californicus*, ranges from central Mexico across the southwestern United States including parts of California, southern Nevada, Arizona, southern New Mexico and western Texas. Recent surveys have extended the previously known range to the north in both Arizona with several localities near the Utah border and California. It is found in a variety of habitats, from desert scrub to chaparral to oak woodland and into the ponderosa pine belt and high elevation meadows of mixed conifer forests. Surveys in northern Arizona have documented roosts at approximately 3,600 feet above MSL and foraging bat species at 7,500 feet above MSL (WBWG 2005-2009).~~	~~The project site does not support suitable roosting habitat for western mastiff bat but this species may utilize the study area for foraging. The nearest CNDDB record is approximately five miles southwest of the study area (CDFW 2010). A single bat of an unidentified species was observed roosting beneath a bridge near Corn Springs Road near the location of the proposed substation during December 2009 surveys (AECOM 2010a).~~
~~Yuma myotis~~ ~~*Myotis yumanensis*~~	~~This species ranges across the western third of North America from British Columbia, Canada, to Baja California and southern Mexico. Yuma myotis is usually associated with permanent sources of water, typically rivers and streams, feeding primarily on aquatic emergent insects, but Yuma myotis also use tinajas in the arid west. It occurs in a variety of habitats including riparian, arid scrublands and deserts, and forests. The species roosts in bridges, buildings, cliff crevices, caves, mines, and trees.~~	~~This species has a potential to roost and forage within the project site. The nearest CNDDB record is from 2002 near the Blythe bridge over the Colorado River where individual bats of this species were detected acoustically during April 2002 (CNDDB 2010).~~

Species	Habitat Requirements and Geographic Range	Potential to Occur or Presence On Site
Yuma mountain lion *Puma concolor browni*	In the NECO planning area, mountain lions primarily inhabit the low mountains and extensive wash systems in and around Chuckwalla Bench, Chuckwalla Mountains, Chocolate Mountains, Picacho Mountains, Milpitas Wash, Vinagre Wash, and other washes in that area. Mountain lions typically occur in habitats with extensive, well-developed riparian or shrubby vegetation interspersed with irregular terrain, rocky outcrops, and community edges. Mountain lions are restricted to the southern Colorado Desert from Joshua Tree National Park south and east to the Colorado River. Burro deer, the primary prey item, are known to spend the hot summer and fall in riparian areas along the Colorado River and in dense microphyll woodlands near the Coachella Canal.	Mountain lion likely use the BRSA but no definitive sign for this species was observed during 2009 spring surveys. This species or its sign was not reported to be observed during spring 2013 surveys for the PSEGS along the proposed generation tie-line or the natural gasline route.

ASSESSMENT OF IMPACTS AND DISCUSSION OF MITIGATION

CONSTRUCTION AND OPERATION – DIRECT IMPACTS, INDIRECT IMPACTS, AND MITIGATION

Direct impacts are those resulting from a project and occurring at the same time and place. Indirect impacts are caused by a project, but can occur later in time or farther removed in distance while still reasonably foreseeable and related to the project. The potential impacts discussed in this analysis are those most likely to be associated with construction and operation of the project.

Impact analyses typically characterize effects to plant communities as temporary or permanent, with a permanent impact referring to areas that are paved or otherwise precluded from restoration to a pre-project state. In the desert ecosystems the definition of permanent impacts needs to reflect the slow recovery rates of its plant communities. Natural recovery rates from disturbance in these systems depend on the nature and severity of the impact. For example, creosote bushes can resprout a full canopy within five years after damage from heavy vehicle traffic (Gibson et al. 2004), but more severe damage involving vegetation removal and soil disturbance can take from 50 to 300 years for partial recovery; complete ecosystem recovery may require over 3,000 years (Lovich and Bainbridge 1999). In this analysis, an impact is considered temporary only if there is evidence to indicate that pre-disturbance levels of biomass, cover, density, community structure, and soil characteristics could be achieved within five years.

Summary of Impacts

Biological Resources Table 5 summarizes the direct, indirect and cumulative impacts to biological resources and includes the proposed conditions of certification that would mitigate these impacts. **Biological Resources Table 6** provides a summary of acreage impacts and recommended mitigation.

Biological Resources Table 5
Summary of Impacts and Mitigation

Biological Resource	Impact/Mitigation
Sonoran Creosote Bush Scrub & Associated Wildlife Habitat	**Direct Impacts:** Permanent loss of 3,335[a] acres; fragmentation of adjacent wildlife habitat and native plant communities. **Indirect Impacts:** Disturbance (noise, lights, dust) to surrounding plant and animal communities; spread of non-native invasive plants; changes in drainage patterns downslope of project; erosion and sedimentation of disturbed soils. **Cumulative Impacts:** Contributes to cumulatively considerable loss of habitat, fragmentation, and indirect effects from past, present, and foreseeable future projects in the California Desert region of the NECO planning area. **Mitigation:** Off-site habitat acquisition and enhancement (**BIO-12**); implement impact avoidance and minimization measures (**BIO-8)** and weed control plan (**BIO-14**). **Impact Significance:** Direct and Indirect Impacts are Less than Significant with Mitigation; Cumulative Impacts are Less than Significant with Mitigation.

Biological Resource	Impact/Mitigation
Stabilized and Partially Stabilized Dunes	**Direct Impacts:** Permanent loss of 187 acres of stabilized and partially stabilized dune habitat; potential accidental direct impacts to adjacent preserved habitat during construction and operation. **Indirect Impacts:** Disruption of sand transport corridor resulting in downwind impacts to sand dune habitat; introduction and spread of non-native invasive plants; erosion and sedimentation of disturbed soils; fragmentation and degradation of remaining habitat. **Cumulative Impacts:** Contributes substantially~~100%~~ to cumulative impacts~~loss~~ from future projects within Chuckwalla Valley and NECO planning area. **Mitigation:** Implement **BIO-20,** Sand Dune Community Impact Mitigation. **Impact Significance:** Direct and Indirect Impacts are Less than Significant with Mitigation; Cumulative Impacts are Less than Significant with Mitigation.
Waters of the State/ Sensitive Plant Communities	**Direct Impacts:** Permanent loss biological functions and values of 375.3[a] acres of state waters, including: • 206.5 [a] acres desert dry wash woodland • 168.2 [a] acres of unvegetated ephemeral dry wash **Indirect Impacts:** Indirect impacts to approximately 0.55 acres of state waters. Impacts include colonization of invasive weeds and erosion/sedimentation to downstream areas. **Cumulative Impacts:** Contributes to cumulative loss of habitat from future projects within the Chuckwalla Valley and NECO planning area. Indirect effects cumulatively considerable. **Mitigation:** Acquisition and enhancement of 788 acres of ephemeral desert washes, implementation of avoidance and minimization measures to protect state waters (**BIO-21**); implement weed management plan (**BIO-14**). **Impact Significance:** Direct and Indirect Impacts are Less than Significant with Mitigation; Cumulative Impacts are Less than Significant with Mitigation.
Groundwater-dependent Plant Communities	**Direct Impacts:** None. The effects of pumping may take several-to-many years to appear, depending on the degree of separation in the confining layers between the shallow aquifer (supporting plants) and deep aquifers (where pumping will occur); see below. **Indirect and Cumulative Impacts:** Potential for significant adverse effects to groundwater-dependent plant ecosystems (GDEs) near Palen Dry Lake, including loss of habitat function and value for wildlife, reduced plant cover which increases wind erosion and affects air quality, increase in weedy species, impacts to special-status species inhabiting the GDEs. Even minor individual impacts to GDEs are considered cumulatively considerable. **Mitigation:** Monitoring groundwater-dependent plant communities near the project site (**BIO-23**) and implementation of remedial action and compensatory mitigation if adverse effects are detected (**BIO-24**). **BIO-7** BRMIMP ensures enforcement of all conditions of certification. **Impact Significance:** Direct and Indirect Impacts are Less than Significant with Mitigation Cumulative Impacts are Less than Significant with Mitigation.

Biological Resource	Impact/Mitigation
Desert Tortoise	**Direct Impacts:** Potential take of individuals during operation and construction; permanent loss of 3,948[a] acres (including 228[a] acres of critical habitat) of low to moderate quality desert tortoise habitat and fragmentation of surrounding habitat. **Indirect Impacts:** Increased risk of predation from ravens, coyotes, feral dogs; disturbance from increased noise and lighting; introduction and spread of weeds; increased road kill hazard. **Cumulative Impacts:** Contributes to cumulative loss of low to moderate value desert tortoise habitat from future projects in NECO, based on USGS habitat model (Nussear et al. 2009). Impedes movement in the region. Impacts to higher quality habitat values less than cumulatively considerable. **Mitigation:** Implement avoidance and minimization measures (**BIO-6** through **BIO-11**) and acquire 4,860 acres of desert tortoise habitat (**BIO-12**). **Impact Significance:** Direct and Indirect Impacts are Less than Significant with Mitigation; Cumulative Impacts are Less than Significant with Mitigation.
Mojave Fringe-toed Lizard	**Direct Impacts:** Mortality to individuals during construction and permanent loss of 1,480 acres of Mojave fringe-toed lizard habitat; increased road kill hazard from construction traffic; potential accidental direct impacts to adjacent preserved habitat during construction and operation, increased risk of disturbance or mortality from vegetation management activities. **Indirect Impacts:** Disruption of sand transport (25%-100%); introduction and spread of non-native invasive plants; erosion and sedimentation of disturbed soils; fragmentation and degradation of remaining habitat; increased road kill hazard from construction and operations traffic; harm from accidental spraying/drift of herbicides and dust suppression chemicals. **Cumulative Impacts:** Contributes substantially to cumulative loss of Mojave fringe-toed lizard habitat in the Chuckwalla Valley. Project's contribution to fragmentation and indirect impacts cumulatively considerable. **Mitigation:** Implement **BIO-20,** Mojave fringe-toed lizard compensation, and **BIO-8,** impact avoidance and minimization measures; **BIO-14** weed management plan. **Impact Significance:** Direct and Indirect Impacts are Less than Significant with Mitigation; Cumulative Impacts are Less than Significant with Mitigation.

Biological Resource	Impact/Mitigation
Western Burrowing Owl	**Direct Impacts:** Permanent loss of breeding and foraging habitat for at least two pairs of resident burrowing owls; potential loss of eggs and young **Indirect Impacts:** Degradation and fragmentation of remaining adjacent habitat from edge effects; disturbance of nesting and foraging activities for nesting pairs near the plant site and linear facilities. Collisions with project features, glare, also collision, electrocution, glare, and exposure to elevated levels of solar flux. Increased road kill hazard from operations traffic and collision with mirrors; increased predation from ravens; disturbance of nesting activities from operations. **Cumulative Impacts:** Contributes to cumulative loss of habitat from future projects in the Chuckwalla Valley and NECO planning area. Indirect impacts also cumulatively considerable. **Mitigation:** Implement burrowing owl impact avoidance and mitigation measures, including a minimum acquisition of 78 acres of burrowing owl habitat (**BIO 18**). If additional breeding owls are detected additional compensatory mitigation will be required. Additionally, implement impact avoidance and minimization measures (**BIO-1** through **BIO-8**); pre-construction nest surveys (**BIO-15**); avian enhancement and conservation plan (**BIO-16a**), and avian and bat protection plans (**BIO-16b**). **Impact Significance:** Direct Impacts are Less than Significant with Mitigation; Indirect Impacts May Remain Significant After Mitigation; Cumulative Impacts May Remain Significant After Mitigation
Golden Eagle/Bald Eagle	**Direct Impacts**: Loss of foraging habitat, potential mortality or disturbance during construction and operation, loss or fragmentation of habitat, displacement, and disruption of movement. **Indirect Impacts**: Collision, glare, electrocution, and death or injury from exposure to concentrated solar flux. Fragmentation of local population; introduction and spread of non-native invasive plants; increased risk of fire; and degradation of off-site springs or seeps. Weed abatement, mirror washing and maintenance. Glare or heat associated with the heliostats may also adversely affect bird's use of the site. **Cumulative Impacts:** The modified project would contribute to cumulative loss of foraging habitat (Sonoran creosote scrub and desert dry wash woodland) within a 140-mile radius of the project, and also would contribute to cumulatively considerable loss of habitat, fragmentation, and direct loss of these species from past, present, and foreseeable future projects within 140-mile radius of the modified project. Fragmentation and indirect impacts also would be cumulatively considerable. Mitigation: Off-site habitat acquisition and enhancement (**BIO-12** and **BIO-21**); pre-construction nest surveys (**BIO-15**); avian enhancement and conservation plan (**BIO-16a**), and avian and bat protection plans (**BIO-16b**). **Impact Significance:** Direct Impacts are Less than Significant with Mitigation; Indirect Impacts May Remain Significant After Mitigation; Cumulative Impacts May Remain Significant After Mitigation.

Biological Resource	Impact/Mitigation
Special-status Avian Species	**Direct Impacts:** Permanent loss of breeding and foraging habitat, Sonoran creosote bush scrub and desert dry wash woodland); potential loss of eggs and young; disturbance of nesting and foraging activities for populations on and near the plant site and linear facilities; degradation and fragmentation of remaining adjacent habitat from edge effects; disturbance from operations. **Indirect Impacts:** Increased road kill hazard from operations traffic; increased predation from ravens; fragmentation of local population; introduction and spread of non-native invasive plants; increased risk of fire; degradation of off-site springs or seeps; weed abatement; mirror washing and maintenance; death or injury from exposure to concentrated solar flux; and glare or heat associated with the heliostats may adversely affect bird's use of the site. **Cumulative Impacts:** Contributes cumulative loss of habitat from future projects within NECO planning area desert dry wash woodland. Project's cumulative contribution to fragmentation, indirect impacts, and direct loss of special status and migratory birds from collisions and exposure to solar flux would be considerable. **Mitigation:** Implement impact avoidance and minimization measures (**BIO-1** through **BIO-8**); pre-construction nest surveys (**BIO-15**); avian protection plan (**BIO-16**) off-site habitat acquisition and enhancement (**BIO-12**). Pre-construction nest surveys (**BIO-15**); avian enhancement and conservation plan (**BIO-16a**), and avian and bat protection plans (**BIO-16b**). **Impact Significance:** Direct Impacts are Less than Significant with Mitigation; Indirect Impacts May Remain Significant After Mitigation; Cumulative Impacts May Remain Significant After Mitigation.
Special Status Bats	**Direct Impacts**: No anticipated direct loss of maternity, day roosts, or hibernacula. Loss of foraging habitat. Bats that forage near the ground, such as the pallid bat, would also be subject to crushing or disturbance by vehicles driving at dusk, dawn, or during the night. Collision with facility structures, exposure to concentrated solar flux **Indirect Impacts**: the loss of foraging habitat due to type conversion, night time lighting that exposes bats to predation, and alteration in prey base. Degradation to groundwater dependent communities in the vicinity of the project site. **Cumulative Impacts**: Contributes to cumulatively considerable loss of habitat, fragmentation, and direct loss of these species from past, present, and foreseeable future projects in the Chuckwalla Valley. Mitigation: **BIO-1** through **BIO-8** requires avoidance and minimization measures during life of project, construction monitoring, worker training, fugitive dust control, fire prevention and weed management. pre-construction nest surveys (**BIO-15**); avian enhancement and conservation plan (**BIO-16a**), and avian and bat protection plans (**BIO-16b**). **BIO-23** requires monitoring to track the impacts of pumping to groundwater levels as they develop during the life of the project, and defines triggers for adaptive management to be implemented if data indicate impending adverse effects. **Impact Significance:** Direct and Indirect Impacts are Less than Significant with Mitigation; Cumulative Impacts are Less than Significant with Mitigation.

Biological Resource	Impact/Mitigation
Desert Kit Fox & American Badger	**Direct Impacts:** Permanent loss of 3,899[a] acres of habitat; fragmentation and degradation of remaining habitat, loss of foraging grounds, crushing or entombing of animals during construction; increased risk of road kill hazard from construction traffic. **Indirect Impacts:** Disturbance from increased noise and lighting; introduction and spread of weeds; increased risk of road kill from operations traffic; increased risk of infection from Canine Distemper Virus (CDV) during passive relocation or hazing activities conducted in an area experiencing or adjacent to distemper cases, increased risk of disturbance or mortality from vegetation management activities. **Cumulative Impacts:** Contributes to cumulative loss of habitat from future projects within the NECO planning area. Project's contribution to fragmentation and indirect impacts also cumulatively considerable. **Mitigation:** Implementation of impact avoidance and minimization measures (**BIO-17**); off-site habitat acquisition and enhancement (**BIO-12**). **Impact Significance:** Direct and Indirect Impacts are Less than Significant with Mitigation; Cumulative Impacts are Less than Significant with Mitigation.
Special Wildlife Management Areas	**Desert Wildlife Management Areas:** A portion of the proposed generation tie-line would be located in the Chuckwalla DWMA south of I-10. **Areas of Critical Environmental Concern:** None. **Wildlife Habitat Management Areas:** Contributes to the loss of Sonoran creosote scrub and desert dry wash woodland habitat from future projects within Palen-Ford WHMA. Project would not contribute to the loss of sand dune communities within the WHMA. Contributes to the loss to the DWMA Connectivity WHMA. No cumulative contribution to habitat loss in Big Maria Mountains WHMA. **Desert Tortoise Critical Habitat:** Approximately 228 acres of the southwestern corner of the project overlaps the northern boundary of the Chuckwalla Desert Tortoise Critical Habitat Area. **Mitigation:** Mitigate loss of critical habitat with acquisition and preservation of suitable desert tortoise at a 5:1 ratio (**BIO-12**). **Impact Significance:** Direct and Indirect Impacts are Less than Significant with Mitigation; Cumulative Impacts are Less than Significant with Mitigation.

Biological Resource	Impact/Mitigation
Special-status Plants	**Direct Impacts:** – • Harwood's milk-vetch: Less-than-significant direct loss of approximately six in Project Disturbance Area; • Harwood's eriastrum: No direct impacts; • California ditaxis: Loss of 11 plants significant; • Ribbed cryptantha: abundant throughout the vicinity; less-than-significant direct effect; • New taxon of saltbush: No direct impacts. • Late-season plants: no direct impacts within approved PSPP project footprint. Potentially significant impacts to fall-blooming plants not detected during spring surveys along new PSEGS features, including modified generation tie-line corridor (Sonoran creosote bush scrub and dry desert wash woodland). **Indirect Impacts:** Minor to potentially significant indirect impacts to all plants in close proximity to site from introduction and spread of non-native invasive plants; increased risk of fire; altered drainage patterns downstream of site; erosion and sedimentation of disturbed soils; accidental chemical and herbicide drift; disruption of photosynthesis and other metabolic processes from dust; fragmentation of population and impaired gene flow and increased vulnerability to local extinctions, and accidental impacts to avoided plants during construction. **Cumulative Impacts:** Project's contribution to spread of weeds, fragmentation, altered hydrology, and risk of fire is cumulatively considerable, however these effects would be reduced through the implementation of staffs proposed conditions of certification. **Mitigation:** Implement impact avoidance and minimization measures (**BIO-8**); Avoidance and minimization measures (**subsection A, BIO-19**); conduct fall surveys (subs**ection B, BIO-19**) and mitigate according to thresholds in **BIO-19**); implement avoidance and compensation mitigation according to performance standards in subs**ection D, BIO-19**; implement weed management plan (**BIO-14**); implement worker training in fire prevention (**BIO-8**). **Impact Significance:** Direct and Indirect Impacts are Less than Significant with Mitigation; Cumulative Impacts are Less than Significant with Mitigation.

Sources for impact acreage:
a. Supplemental Spring 2013 Surveys (Palen 2013jj)

Biological Resources Table 6a
Acreage of Direct and Indirect Impacts to Biological Resources and Recommended Mitigation

Resource	Acres Impacted	Mitigation Ratio	Recommended Mitigation Acreage
Desert Tortoise Habitat[1]			
Within Critical Habitat	228	5:1	1,140
Outside Critical Habitat	3,720	1:1	3,720
Desert Tortoise Total	**3,948**	—	**4,860**
Mojave Fringe-toed Lizard (MFTL) – Direct Impacts[2]			
Stabilized and partially stabilized sand dunes – direct impacts	187	3:1	561
Non-dune habitats occupied by MTFL (sand fields vegetated with sparse creosote bush scrub)	1,292	1:1	1,292
Mojave Fringe-Toed Lizard – Indirect Impacts	421	0.5:1	210.5
MTFL Total	**1,900**	—	**2063.5**
State Waters - Direct Impacts[3]			
Desert Dry Wash Woodland	206.5	3:1	619
Unvegetated Ephemeral Dry Wash	168.16	1:1	168
State Waters Subtotal	***374.7***	**—**	***787***
State Waters – Indirect Impacts from Changes in Hydrology[3]			
Desert Dry Wash Woodland	0.03	1.5:1	0.045
Unvegetated Ephemeral Dry Wash	0.52	0.5:1	0.260
State Waters Subtotal	***0.55***	**—**	0.305
State Waters Total	**375.2**	—	**788**
Burrowing Owl Habitat – two pairs, four individuals, 19.5 acres each (per 1993 CBOC guidelines)	**78**	**n/a**	**78**

1 – Desert tortoise calculations BIO-29 Table 1 in PSH's Final Comments on the PSA (Palen 2013pp) .
2 –MFTL calculation based on identified habitat from the PSPP and final acre calculations are from an email from project owner on 8/13/2013.
3 –State waters calculations are from Table 1 in Applicant's Supplement NO.1 (Palen 2013jj).

Waters of the State: Impacts and Mitigation

Biological Resources Table 6a summarizes the direct and indirect impacts to waters of the state as a result of project construction, and includes recommendations from Energy Commission staff and CDFW for compensatory mitigation ratios.

Construction of the PSEGS project would result in direct and indirect impacts to numerous ephemeral streams and washes that occur within the Project Disturbance Area. Construction and operation would alter the hydrological, biogeochemical, vegetation and wildlife functions of these drainages. This would result from the construction of evaporation ponds, roads, and placement of the power towers, heliostats, and ancillary facilities. Approximately 374.7 acres of jurisdictional waters of the state were delineated by the project owner on the PSEGS project site and linear facilities (Palen 2013y). Waters of the United States do not occur on the project site or linear facilities (Palen 2013a).

For the approved PSPP project all vegetation would be removed and the ephemeral drainages graded within the Project Disturbance Area. To control flooding an engineered channel would have been constructed to contain the 100 year storm event. For the PSEGS project impacts to desert washes would be minimized by allowing water to pass through the site, rather than diverting flows around the site in artificially constructed channels. This analysis recognizes that at least a portion of the hydrologic and geomorphic functions would be maintained. However, staff and the CDFW maintain that wildlife habitat functions and values of the streams would be eliminated or significantly diminished by construction and operation of the facility. A review of Appendix A of the project owner's Hydrology Report (Palen 2013a) identified approximately 27 percent of the site would be developed by dirt roads, heliostats, or other facilities. Activities including road construction and maintenance; the placement of perimeter exclusion fencing; dust and weed control; periodic vegetation removal; and mirror-washing would contribute to the loss of functions within the site. Glint and glare, nighttime lighting, human disturbance, and potential erosion and sedimentation of streams during storm events would also diminish habitat values for plants and wildlife. The functions and values of the ephemeral washes associated with the natural gas pipeline and transmission line could also be adversely affected.

Direct impacts to state jurisdictional waters would include the removal of native vegetation including some areas characterized by microphyll woodland, the discharge of fill, degradation of water quality, and vegetation removal. Indirect impacts could include alterations to the existing topographical and hydrological conditions and the introduction of non-native, invasive plant species. As described previously the diversity and episodic nature of streams and streambed materials creates habitat niches within the floodplain for wildlife. Operational impacts would include routine mowing of vegetation, vehicle access, weed abatement, mirror washing and facility maintenance. Desert washes downstream from the project area, comprising approximately 32 acres of state waters, would be indirectly impacted as a result of changes to upstream hydrology; however these effects would be minimal as flows would be allowed to pass through the site. Nonetheless, a small portion of these waters could be affected through the spread of weeds or disruption of flows.

Staff considers direct and indirect impacts of the project to approximately 374.7 acres of state jurisdictional waters to be significant. The extensive ephemeral drainage network at the project site currently provides many functions and values, including landscape hydrologic connections, stream energy dissipation during high-water flows that reduces erosion and improves water quality, water supply and water-quality filtering functions, surface and subsurface water storage, groundwater recharge, sediment transport, storage, and deposition aiding in floodplain maintenance and development, nutrient cycling, wildlife habitat and movement/migration, and support for vegetation communities that help stabilize stream banks and provide wildlife habitat. The project would eliminate most of these functions and values from mowing, weed abatement, and the operation and maintenance of the facility. Because the site would be fenced; remaining habitat features would not be available to many species of wildlife.

Staff and CDFW agree that acquisition and enhancement of off-site state waters would mitigate project impacts for the PSEGS and would be consistent with the Commission's decision for the PSPP. The Energy Commission adopted a 3:1 mitigation ratio for desert dry wash woodland as required by guidelines in the Northern and Eastern Colorado Desert Coordinated Management Plan (NECO) (BLM-CDD 2002) and a 1:1 mitigation ratio for the loss of ephemeral dry wash habitat.

Table 3 of the project owner's Supplemental Spring 2013 Biological Survey Report (Palen 2013ii) identifies indentifies the expected direct and indirect impacts to state waters that would occur from the implementation of the PSEGS project. Condition of Certification **BIO-21** provides the specifics of impact avoidance and mitigation measures for impacts to ephemeral drainages of the Project Disturbance Area. Implementation of Condition of Certification **BIO-21** would reduce project impacts to state waters to less-than-significant levels.

Impacts to Wildlife Connectivity

The entire valley floor in this region is an important corridor that links the mountain ranges together (Solar Millennium 2010a), and the culverts under I-10 are an important component of the corridor. The operation of the I-10 fragments the valley floor and makes it difficult for wildlife to disperse between mountain ranges. Wildlife likely relies on these culverts to cross the I-10 because high traffic volumes likely cause wildlife to avoid crossing over the I-10, which is raised well above existing grade.

Project impacts to the network of ephemeral drainages and the placement of perimeter fencing at the site would adversely affect wildlife connectivity, and would impede the ability of wildlife to move through washes and under I-10 in the project area. Surveys conducted by Solar Millennium (Solar Millennium 2010a) and field observations by staff indicate that the culverts and associated major washes are used by a variety of wildlife, including deer, coyote, roadrunner, black-tailed jackrabbit, gray fox, Gambel's quail, woodrat, and other small rodents. The project owner's biologists found both recent and old tracks indicating culverts are important crossing points for wildlife as they move between mountain ranges and along the valley floor. Partial fencing on the box culvert under I-10 at the central wash, and complete fencing on the eastern culvert impedes some wildlife from using the culverts. CDFW reports that numerous tracks have been noted around three bridges under I-10, close to the site (M. Rodriquez pers comm.).

Solar Millennium (prior project owner) conducted additional surveys and provided the report *Wildlife Movement and Desert Tortoise Habitat Connectivity* (AECOM 2010f). This report includes the location and photographs of 24 underpasses under I-10 along a 32-mile stretch between Desert Center and Wileys Well Road and further details describing five underpasses closest to the PSEGS project. The majority of these underpasses are suitably open enough to allow wildlife movement, and many provide moderate cover as well. This includes the underpasses closest to the PSEGS project. Staff concluded that with implementation of proposed conditions of certification the PSPP project would not result in significant unmitigated impacts to connectivity for desert tortoise and other wildlife. Impacts to connectivity would be similar for the PSEGS project and no changes to conditions of certification are proposed. Conditions of certification include **BIO-9**, #1, which requires construction of desert tortoise exclusion fencing on both sides of I-10 to direct desert tortoise and other wildlife to safe passage under the freeway bridges. See "Impacts to Desert Tortoise" subsection for a further discussion of fencing along I-10.

Impacts to Sand Transport Corridor and Sand Dune Habitat

The northeastern portion of the project lies within in the Palen Dry Lake–Chuckwalla sand transport corridor as mapped in the Preliminary Geomorphic Aeolian and Ancient Lake Shoreline Report (Geomorphic Report) (Solar Millennium 2010b). The Geomorphic Report (page 22, Solar Millennium 2010b) divides the sand transport corridor into different zones based on the amount of sand transported, noting that Zone 1 (off the project site) transports "a minimum of 80 percent" of the total volume of sand within the corridor, sand migration within Zone 2 is described as "moderately strong", and sand transport in Zone 3 is "relatively low."

For the PSPP, staff concluded that the intrusion of the project within an active sand transport corridor, Zone 2, and to a lesser extent Zone 3, would have significant on-site impacts and would interfere with the creation and maintenance of sand dunes off-site. The Palen Dry Lake–Chuckwalla sand corridor is a major source of sand that supports downwind sand dunes; because most sand transport takes place close the ground (a general rule of thumb is that 90 percent of sand transport occurs within 6 feet of the ground surface) wind fences and solar arrays would effectively block sand transport.

The PSPP would also have had offsite impacts, cutting off the supply of sand within the PSPP Project Disturbance Area that would otherwise have been transported downwind to other dune areas, and would deflate downwind sand dunes, gradually diminishing their depth and extent over time as sand output exceeds sand input. New sand that would have been transported across the project footprint from upwind would potentially be cut off by drainage ditches, wind fences and above ground infrastructure. Staff modeled the indirect impacts to these sand transport zones, including impacts by percent reduction in sand input to areas downwind of the PSPP project. The PSEGS project has been designed to eliminate the PSPP project's 30 foot tall wind fences that contributed to disruption of the sand transport (Palen 2013a). The revised PSEGS project boundary is proposed to be defined by an 18-inch tortoise fence surmounted by a 7- foot chain-link fence, which will have a very different effect on wind flow and sand transport. The project owner assumed 39.7 acres of indirect impacts for the private parcel adjacent to project site that would be surrounded on three sides by project fencing (Palen 2013a). The project owner initially assumed with removal of the 30 foot tall wind fence required for the PSPP that all sand would flow through site unrestricted and the heliostats would behave in a similar fashion to desert plants as it relates to blocking sand transport (April 17, 2013 workshop). Staff subsequently undertook an independent modeling effort to ascertain indirect effects to Zones II and III of the sand transport corridor (CEC 2013v). Staff utilized the "PWA Model" (included as **APPENDIX A**) which was also used for the original project proceeding. The project owner also prepared an assessment of the transport corridor, without the incorporation of a model (Palen 2013kk). While the results of these two reports have fairly similar conclusions regarding direct impacts, the predictions of indirect effects showed more considerable deviation. Both staff's modeled results and the project owner's assessment of the effects of the PSEGS project to be greater than either of the Reconfigured Alternatives 2 or 3. While the wind fence from the PSPP project did indeed block sand transport, the new project footprint and facility features, such as size and number of pylons used to support heliostats, and the presence of the towers and the footings they require, has, in fact, greater effects to the sand transport system than the PSPP project. The PWA model does have limitations, and the report (CEC 2013v) acknowledges uncertainty in offsite impacts. The PWA model also is limited in predicting the extent of degradation would actually be realized off the project site. Refer to **Table 6b** for the acreage of direct and indirect impacts sand transport corridor.

Biological Resources Table 6b
Acreage of Direct and Indirect Impacts to Sand Transport Corridor

	PSEGS Modifed Project (acres)	PSPP Reconfigured Alternative 2 (acres)	PSPP Reconfigured Alternative 3 (acres)
Direct Impacts to Zone II	267	140	150
Direct Impacts to Zone III	893	540	640
Total Direct	**1,160**	**680**	**790**
Indirect Impacts to Zone II (25-50%, 50-75%, 75-100%) (Staff)	119 95 135 [348]	80 39 11 [130]	68 10 1 [79]
Indirect Impacts to Zone III (25-50%, 50-75%, 75-100%) (Staff)	9 10 54 [73]	3 6 5 [14]	6 9 1 [16]
Total Indirect (Staff)	**421**	**144**	**95**
Indirect Impacts to Zone II (0-50%, 50-100%) (Project Owner)	158 111 [269]	n/a	n/a
Indirect Impacts to Zone III (0-50%, 50-100%) (Project Owner)	23 67 [90]	n/a	n/a
Total Indirect (Project Owner)	**359**	**n/a**	**n/a**

The project owner has suggested that only blockages of 50% or more to the sand transport corridor should be mitigated. Staff disagrees with this approach. The project owner has submitted no documentation supporting this approach, while an abundance of literature exists demonstrating the adverse effects of sand corridor blockages to dune-dependant ecosystems and species, including Mojave fringe-toed lizard (Turner et al 1984, Barrows 1996) and special status plants. Blockages in the sand transport system start a cascading chain of events. When sand supply is interrupted, deflation of the area begins to occur, as enough sand is not available to maintain the dune structure, and wind and surface water flow continue to move sand out of the area. As this deflation occurs, a successional shift in the type of cover of plant species inhabiting the dunes will occur, and generally, the dunes will become stabilized over time as plant roots and corresponding biota accumulate. And even if deflation (the loss of sand) is not rapid or significant, the lack of new sand coming to the dunes will result in stabilization. Sand sheets and patch size are highly influential in distribution and movement of Mojave fringe-toed lizard (Barrows and Allen 2007, Barrows 1996), and perturbations should appropriately be mitigated. Furthermore, this matter has already been before the Commission. During the original permitting process for the PSPP, staff used the threshold of 25% percent sand corridor blockage. This approach is fundamental to condition of certification **BIO-20**, which was adopted in the Final Decision for the PSPP project (CEC 2010f). Therefore, staff has continued to use the threshold of 25 percent corridor blockage to be significant, and believe this level of habitat degradation should be mitigated, consistent with the mitigation approach for the PSPP.

The PSPP also had an impact on sand transport by eliminating the network of desert washes throughout the site and replacing them with engineered channels (**BIOLOGICAL RESOURCES APPENDIX A**). Part of the sediment-delivery system that contributes to active sand dunes northeast of the project area consists of fluvial depositional areas fed episodically by ephemeral streams. Finer fluvial sediments (typically sand size and finer) are mobilized in the sand transport corridor, which may be recharged with fine-grained sediment during large flood events. Project construction on the alluvial fans and alteration of stream channels by channelization may have reduced the amount of fluvial sediment reaching the depositional areas upwind of sand dunes. The proposed PSEGS eliminates the large drainage control channels and the majority of the project site would maintain the original grades and natural drainage features (Palen 2012a). However, indirect impacts to sand transport would be greater for the PSEGS than the PSPP primarily due to the heliostat array. The PSEGS heliostat array is predicted to have a very significant effect on sand transport such that sand transport will be reduced by 93% at 1,738 feet into the array (CEC 2013v).

The approved PSPP, Reconfigured Alternatives 2 and 3, shifted the project footprint out of the sand transport corridor, and thus avoided substantial interference with the sand transport corridor and reduced impacts to sand dune dependent species such as Mojave fringe-toed lizards. The PSEGS project footprint is still within the sand transport corridor and the heliostats field intrudes further than wind fence for the PSPP Reconfigured Alternatives 2 and 3 (Refer to **Figure 5b**). Therefore the PSEGS would have greater effects than either of the approved Reconfigured Alternatives 2 or 3. The direct and indirect impacts of the PSEGS on sand dunes and the processes that support them would significantly affect sand dune-dependent species such as Mojave fringe-toed lizards, and could also impact Harwood's woolly-star, Harwood's milk-vetch and sand dune-dependent insect species. The direct, indirect and cumulative impacts of PSEGS to sand dune habitat would still be considered significant but can be mitigated to less-than-significant levels with implementation of staff's proposed Condition of Certification **BIO-20** (Sand Dune Community/Mojave Fringe-Toed Lizard Mitigation).

Impacts to Groundwater-Dependent Vegetation from Groundwater Pumping and Project Groundwater Use

The modified project would use less groundwater during both construction and operation than the originally approved PSPP project. Construction groundwater use is stated to be 1,130 acre-feet per year (AFY), a reduction from the original permitted project groundwater consumption of 1,917 AFY. Operational groundwater use is stated as 201 AFY, a reduction of nearly 100 AFY. No further analysis has been conducted for the modified project, as the original analysis is considered conservative, tailored to mitigate for greater impacts, and therefore is still fully protective of groundwater dependant resources. The following analysis is predominately taken from the PSPP RSA.

Groundwater levels near the project's water supply wells will decline during the project pumping (Galati & Blek 2010i, Soil and Water Figures 2 and 3). During the operation phase only 300 acre feet per year (AFY) would be required for this dry-cooled project. However, to supply the needed quantity of water during construction, and because of the uncertainty in well yield due to the limited number of well tests, the project proposes to install and operate *up to* 10 wells on site, or as needed to yield 5,750 AFY for the 39-month duration of construction.

Groundwater pumping could have significant impacts to biological resources if it lowers the alluvial (shallow) aquifer water table in areas where groundwater-dependent ecosystems occur. Based on a worst-case analysis that assumes no groundwater recharge during the 30-year life of the project, groundwater in the deep fossil aquifers where water would be extracted[5] is predicted to drawdown between approximately 0.1 feet and 5 feet within a 2-mile (approximate) radius centered on each project well (Galati & Blek 2010i, Soil and Water Figures 2 and 3).

The present-day shoreline of Palen Dry Lake ("Palen Lake") is located approximately 2 miles from the nearest project pumping well; the northeastern-most well. The area between this well and Palen Lake supports habitats associated with shallow groundwater, including alkali sink scrubs of iodine bush (a facultative wetland[6] species) and bush seep-weed (facultative), and scattered stands of honey mesquite (Solar Millennium 2009a; Evens & Hartman 2007; Sawyer et al. 2009; Silverman pers. comm.).

The extent to which this drawdown will also occur in the alluvial (shallow) aquifer that supports groundwater-dependent ecosystems is dependent on the extent to which the

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[5] Water would be pumped from the "Bouse Formation" deep aquifer; see Section C.9 Soil & Water Resources for a detailed discussion of the groundwater analysis.

[6] Facultative Wetland = Usually occurs in wetlands (estimated probability 67%-99%), but occasionally found in non-wetlands; Facultative = Equally likely to occur in wetlands or non-wetlands (estimated probability 34%-66%). The wetland indicator categories should not be equated to degrees of wetness (USFWS 1993).

confining or separating layers of impermeable clays (the "aquitard") have been fractured by faulting (Worley-Parsons 2010). Worley-Parsons (2009) contend that the two aquifers are fully contained and separated by confining layers of low permeability sediments, citing the *Geologic Map of the Blythe Quadrangle* (Stone 2006) and the *Chuckwalla Valley Groundwater Basin Description* (DWR 2004) as evidence that faults are not known to extend upward into the basin fill materials. In Data Response S&W #197 (AECOM 2010a), from the PSPP proceeding the applicant stated: "*The results of the aquifer testing on the PSPP site suggest there is interconnectivity between shallow and deeper aquifer units below the site*..... *Draw downs of up to 10 feet were observed during the constant-rate discharge test, suggesting a component of vertical flow and connectivity to the overlying sediments. While it is not certain whether the former water supply well tested was gravel packed and if the gravel pack extended to the surface, it is probable that there was some measure of vertical influence*."

Staff concurs that the position of the site near the playa, where finer sediments predominate, combined with a history of relatively little faulting, suggest that the confining layers are more likely to be intact and with less vertical movement of groundwater between the shallow and deep aquifers than areas with more faulting and coarser-grained fills. However, the evidence does not preclude the possibility for fracturing and vertical hydraulic conductivity and the potential for drawdown in the shallow aquifer to lower the groundwater below the effective rooting level for some species, particularly the shallower-rooted sink scrubs. Further, the resources at risk are rare and sensitive habitats that support a wide variety of special-status plant and animal species. Staff is particularly concerned about those that occur in close proximity to the proposed pumping wells because: 1) the significance of the drawdown (5 to 10 ft in some areas just off the northeastern boundary 2) because the drawdown will occur quickly (within a few years), and 3) the effects of pumping are greatest near the well.

Because the evidence is not conclusive, staff supports a more conservative approach and recommends long-term monitoring and adaptive management in the event that adverse effects are detected. This adaptive approach is discussed in more detail under "Mitigation", below, and in Condition of Certification **BIO-23** and **BIO-24**.

Groundwater-Dependent Ecosystems and Phreatophytes in the Project Area

The groundwater-dependent ecosystems and other habitats at risk are documented as rare natural communities by the California Department of Fish and Game Vegetation Program (CDFG 2003). Some are also BLM NECO Sensitive communities. Groundwater-dependent ecosystems documented in the area of predicted drawdown (Solar Millennium 2009a; Evens & Hartman 2007; Sawyer et al. 2009; Silverman pers. comm.) include:

- Honey mesquite woodlands (mostly small groves);
- Alkali sink scrubs (dominated or co-dominated by bush seep-weed, iodine bush, fourwing saltbush, spinescale, and allscale);
- Sparsely vegetated playa lake beds;
- Jackass clover unique stands (a special-status plant);
- Stabilized and partially stabilized dunes (mesic dune swales), and

- Microphyll woodlands (ironwood and palo verde desert wash woodlands)

Groundwater-dependent ecosystems are an important component of biological diversity in the California Desert region. Because they are rare or limited in distribution, they often support rare or special-status plants and animals, and the project area is no exception: in the area predicted to incur the greatest drawdown, *i.e.*, surrounding the northeastern well, special-status species documented include Mojave fringe-toed lizard, American badger, desert kit fox, Harwood's woolly-star, Harwood's milk-vetch, jackass clover, ribbed cryptantha, a newly discovered species (or taxon) of saltbush, and a historic occurrence of a species presumed extinct in California: mesquite nest straw (AECOM 2010v, CNDDB 2010, CCH 2010). Ground waters are important to sustain vegetation for wildlife habitat in areas where surface waters are not present (RWQCB 2006). Common mammals observed and/or associated with the habitats in the area where drawdowns are predicted include: black-tailed jackrabbits, round-tailed ground squirrels, white-tailed antelope ground squirrels, kangaroo rats, kit foxes, and coyotes. The most common birds include: horned larks, loggerhead shrikes, lesser nighthawks, ravens, black-throated sparrows, and white-crowned sparrows. Reptiles observed or expected to occur include: zebra tail lizards, desert horned lizards, desert iguanas, Mojave fringe-toed lizards, western whiptail lizards, coachwhips. Other important species observed in this area include these special-status birds: ferruginous hawk, northern harrier, and Swainson's hawk (AECOM 2010d).

Use of Groundwater by Phreatophytes

Within the 2- to 3-mile radius drawdown zone, the GDEs are dominated or defined by "phreatophytes". Phreatophytes have deep roots that extend down to, and extract water from a periodically stable water supply, including the capillary fringe, *i.e.*, the zone just above the water table that is not completely saturated, where water is lifted up by capillary action, or surface tension (Brown et al 2007). Even though the groundwater may never be visible at the ground surface, as it is in a wetland or spring, phreatophytic ecosystems can still be groundwater-dependent (Naumberg et al 2005).

The use of groundwater may not be year-round by phreatophytes. In these instances, other water sources are used during the rainy season but groundwater is used in the dry season (Froend & Loomes 2004). In the project vicinity, for example, phreatophytes may utilize precipitation, stormwater runoff, or temporary ponding on the playas during the rainy season, and use groundwater during the dry season. There is also growing evidence that the dimorphic shallow and deep root systems of some phreatophytes (*e.g.*, honey mesquite) that alternately act as conduits that potentially redistribute water from moist layers to dry layers, a phenomenon termed "hydraulic redistribution" (Hultine et al 2003) that may play an important role during summer drought for surrounding shallow-rooted species and perhaps for the larger ecosystem (Brown et al 2007; Caldwell et al. 1998).

Obligate versus Facultative Phreatophytes

Desert phreatophytes are a complex group of species with varied adaptive mechanisms to tolerate or avoid drought. They should not be considered simply as a group of species that avoid desert water stress by utilizing deep ground water unavailable to other desert species (Nilsen et al 1984). There are two types of phreatophytes:

1) Obligate phreatophytes, which are deep rooted plants that only inhabit areas where they can access groundwater, via the capillary fringe, to satisfy at least some proportion of their environmental water requirement. Access to groundwater is a critically important to their presence in a landscape; and

2) Facultative phreatophytes, which are deep rooted plant species that tap into groundwater, via the capillary fringe, to satisfy at least some portion of their environmental water requirement, but will also inhabit areas where their water requirements can be met by soil moisture reserves alone. That is, the species will be groundwater dependent in some environments, but not in others.

Determination of Groundwater-Dependency

The dependence of these species on groundwater is a function of the hydrogeologic setting of the ecosystem, which governs whether a shallow water table exists that the species can use. Groundwater levels beneath the southeastern portions of Palen Lake, and a small ancillary playa located approximately one mile southeast of Palen Lake, were reported by Steinemann (1989) as being 20 to 30 feet below ground level. With capillary rise, this would be well within the reach of many or most of the phreatophytes known to occur here.

The identification of phreatophytic ecosystems can be challenging because there is no comprehensive list, but the following are general guidelines for deciding if an ecosystem or species is phreatophytic (Brown et al 2007; LeMaite et al 1999; Froend & Loomes 2004):

- It is known or documented to depend on groundwater, expert opinion or local knowledge can be useful in making a determination as some species' dependence varies by setting;
- A species known to have roots extending over a meter in depth;
- The community occurs in areas where the water table is known to be 'near' the surface;
- In arid regions, the herbaceous or shrub vegetation is still green or has a high leaf area late in the season (compared to other dry areas in the same watershed that do not have access to groundwater).

Additionally, stable isotope analysis can be used to identify whether groundwater is supplying the species' or ecosystem water needs (Froend & Loomes 2004).

The key ecosystem attributes of phreatophytic ecosystems include one or more of the following attributes (Brown et al 2007):

- The depth below surface of the water table;
- The chemical quality of the groundwater or soil, as expressed in terms of pH, salinity, or other nutrients (or contaminants).

Response to Water Stress

The response of these ecosystems to change in these attributes is variable (SKM 2006). The phreatophytes known to occur in the project area are mostly facultative phreatophytes (Steinberg 2001; USFWS 1993; and others). Phreatophyte trees and shrubs have a range of strategies for dealing with water stress and some species are better adapted to deal with water stress than others, whether they are obligate or facultative phreatophytes. There is insufficient information available to assess whether facultative phreatophytes have a greater resistance to change in groundwater condition than obligate phreatophytes. However, obligate phreatophytes are less resilient than facultative phreatophytes and will only grow in areas where specific groundwater conditions exist, and require uninterrupted access to the water table; all of these species are groundwater-*dependent*. “Facultative” phreatophytes, however, can use groundwater if it is available but they can also occur in settings where groundwater is not available (Naiman et al 2005).

A plant affected by competition for water displays signs of stress (e.g. Manning and Barbour 1988), and stress can be manifested as anything from diminished physiological processes to plant death. Lowering the local water table from groundwater pumping has been demonstrated to cause habitat conversions and reduce plant cover where pumping causes water levels to drop below the effective plant rooting depths, increasing wind erosion of the soil and affecting air quality, and native habitats converted to invasive exotic communities (Patten et al 2007; Lovich 1999; Manning 2006).

Secondly, declining water tables may *reduce* the amounts of salts and water wicked to the surface by capillary action, potentially altering the chemistry of surface soils (Patten et al. 2007) around the playa (Palen Lake) margins. If the surface salinity decreases, it could render the habitat unsuitable for the halophytes (salt-adapted plants) that make up these ecosystems, which includes several rare or special-status plants, and cause a habitat conversion to non-halophytes (Dodd & Donovan 1999). Reduced surface salinity may be an expected response of regional groundwater withdrawal for urban expansion and other uses in the Great Basin and Mojave Deserts (Patten et al. 2007), and now also in the Sonoran Desert of California for solar thermal development and other groundwater uses.

As Elmore et al. (2006) and Manning (2007) showed, as water table is lowered by pumping, total live plant abundance (plant cover) on a site decreases correspondingly. Shallower rooted herbs are the first affected and least adapted; deep-rooted woody phreatophytes can take many years longer to die, but the effects of stress may be evident in indicators of plant vigor that would not be visible in an aerial photo. Non-native opportunistic “weed” species (e.g., Russian thistle) are better adapted to nutrient-poor soils and wider variety of soil moisture regimes or conditions, and may demonstrate a competitive edge. Lower plant cover can also lead to increased soil erosion, due to wind or water, leading to loss of nutrients, minerals, and structure necessary for seed germination of plants adapted to prior groundwater conditions on the site. The complex below-ground systems of bacteria, algae, and fungi, which provide many valuable ecosystems services (e.g. breakdown of organic matter, nitrogen fixation, carbon storage, and recycling of nutrients) are also disrupted when water tables are lowered. Ultimately, if pumping lowers the water table below the effective rooting depth of the predominant species, a decline in plant cover and change in species abundance due to groundwater withdrawal from groundwater-dependent ecosystems may result in severe consequences, depending on the organism(s) involved or the prevailing ecosystem processes (Manning 2009).

Animals, including mammals, reptiles, birds, and invertebrates, who may require certain plant species or a certain vegetation structure, may no longer find suitable food or living space. Local extirpations are compounded if the displaced animal is an important food source for another animal. If the vegetation is dependent on the groundwater aquifer, but the decline in water table depth is minor and/or temporary (i.e., a minor drawdown and restored to spring baseline levels following construction), the ecosystem effects may be correspondingly minor or temporary, depending on the time required to refill the impacted aquifer.

Impacts to Springs

According to the prior project owner's (Solar Millennium) analysis of the potential impacts of the project pumping to area springs (AECOM 2010a, DR 181-233):

> *"Corn Spring appears to derive its water from precipitation falling onto the Chuckwalla Mountains, and movement of groundwater under pressure along an historic fault that bisects the mountains. Groundwater extraction from the PSPP site will not affect Corn Spring. According to the NWIS database, seeps and surface discharge/outfall (along with streams, lakes, wetlands, and diversions) are categorized as "surface water sites" and four sites are located in the Chuckwalla Valley Groundwater Basin. One of the four locations is the aforementioned Corn Spring Wash, while two other sites are located near the northern edge of the Chuckwalla Mountains approximately eight and 13 miles west of the PSPP site. Water in these three sites appear to originate from infiltration of precipitation that falls on the Chuckwalla Mountains as all three sites are located either within the Chuckwalla Mountains or are less than one mile downslope from the Chuckwalla Mountains. At this great distance and given the source of water to the sites, groundwater extracted from the PSPP site will not affect these three sites. The fourth "surface water site" listed in the NWIS database for the Chuckwalla Valley Groundwater Basin is Coxcomb Wash, located approximately eight miles northwest of the PSPP site. Coxcomb Wash is an ephemeral dry wash that flows southeastward from the Coxcomb Mountains. As a result, groundwater extracted from the PSPP site will not affect the flow of water in Coxcomb Wash. The locations of Corn Spring and other "surface water sites" identified in the NWIS database and through the several other data sources are shown on Figure DR-S&W-193. The sites are listed on Table DR-S&W-193-1."*

McCoy Spring is located at an elevation of 889 feet at the outlet of a bedrock canyon near the toe of the western slope of the McCoy Mountains, approximately 15 miles to the northeast of the project. According to the groundwater investigation conducted by Worley-Parsons (2009):

"Springs may be considered surface extensions of the local groundwater system; however, springs and seeps that occur near the interface between bedrock mountains are often associated with base flow discharge or perched aquifers that are part of a separate groundwater flow system that originates in the surrounding mountains and do not have direct hydraulic connection to the adjacent basin aquifer system. Based on the close proximity of bedrock outcrops to the spring, it likely represents baseflow discharge from the McCoy Mountains. As such, it does not appear to have a direct hydraulic connection to groundwater levels in the Chuckwalla Valley Groundwater Basin, which occurs in the basin fill materials to the west of McCoy Spring. They concluded that a groundwater level drawdown of many feet would be required to cause a change in the baseflow discharge from the McCoy Mountains."

The **SOIL AND WATER RESOURCES** section provides a discussion of potential project impacts to springs. Biological Resources staff agrees with the conclusion that springs would not be affected by project groundwater pumping. This conclusion is based on the distance of the project from these features, as well as the bedrock geology and physiographic setting.

Impacts to Non-Phreatophytes

The proposed groundwater pumping could also potentially cause some loss of habitat function or value for drought-tolerant, upland species that occur in close proximity to a pumping well. Creosote bush are not characteristically dependent on groundwater but could be affected if a significant drawdown were to occur quickly and in an area where this shallow-rooted species is accustomed to the regular availability of soil moisture. The permanent diversion of surface flows north of I-10 after construction of the freeway and diversion dikes has had a marked adverse effect on the vigor of the creosote scrub community, apparent in the stunted, depauperate shrubs, low cover density and low species diversity. These drought-adapted and shallow-rooted species are typically supported by precipitation (or, in the I-10 example, by sheet flow). It is unclear if a drawdown in the groundwater would significantly affect the creosote bush scrub close to the wells but staff remains cautious and recommends sampling the creosote bush scrub habitats in the long-term monitoring program (see "Mitigation for Impacts to Groundwater Dependent Plant Communities", below).

Monitoring for Early Detection of Potential Impacts

In general, the hydrologic threshold for vegetation change is not well understood (Patten et al. 2007) but is expected to occur as tolerance levels, along a gradient from wetland to upland, or beginning with the obligate or least resilient species, depending on the depth, timing and duration of the drawdown, and where tolerances are exceeded for the dominant plant taxa.

Patten, Rouse & Stromberg (2007) suggest that on-site monitoring is critical for detecting impacts, and, in addition to monitoring groundwater responses, emphasize direct monitoring of ecosystem function (Eamus et al 2006; Lake & Bond 2007; Stromberg et al 2006). Long-term vegetation data are capable of providing early warning signs of impending changes in ecosystem processes (Patten et al. 2007). Combined with the data on groundwater and climate, sampling of plant communities can provide sensitive metrics for assessing ecological changes over time. However, to ensure that the information is appropriate for management, it is important that monitoring and analysis be designed to test for magnitudes of changes rather than just existence of change, a phenomenon which can occur under disturbance or non-disturbance conditions.

Mitigation for Impacts to Groundwater Dependent Plant Communities–

Two conditions of certification, **BIO-23** and **BIO-24** were required for the PSPP project. No new or additional impacts were identified in conjunction with the modified project, and therefore no new conditions, or edits to the existing Conditions of Certification **BIO-23** or **BIO-24** (described further below), other than updates to dates and map references, are necessary. Condition of Certification **BIO-23** provides specifications and performance standards for the development of a detailed, peer-reviewed Vegetation Monitoring Plan (Plan). Monitoring would occur for the life of the project. In addition to monitoring indicators of plant vigor, water table monitoring and soil core sampling will also be used to provide additional warning signs of impending changes and ensure that remedial action is taken before effects reach a level of plant mortality or significant impairment of the habitat function and values.

Condition of Certification **BIO-24** requires the project owner to take remedial action if the monitoring described in **BIO-23** detects declining spring and post-monsoon water tables in the alluvial (shallow) aquifer—in any amount greater than the baseline seasonal variability— in combination with a decline in plant vigor of greater than 20 percent when compared to the same plots pre-disturbance. Remedial measures described in **BIO-24** establish a performance standard of restoring the groundwater tables to baseline levels by: 1) relocating the project pumping well to another location where the groundwater-dependent vegetation is no longer within the area of groundwater drawdown, or 2) reducing the project water usage through water conservation methods or new technologies to a level required to restore groundwater levels in the shallow aquifer to pre-impact levels.

One of the possible remedial actions required in Condition of Certification **BIO-24** is installation of a new well in a location that avoids impacts to phreatophytic plants or plant community. Because the location of the new well cannot be within an area that supports phreatophytic species or communities, staff has provided the following criteria for deciding if an ecosystem (or species) is phreatophytic (Brown et al 2007; LeMaite et al 1999; Froend & Loomes 2004):

- It is not known or documented to depend on groundwater, based on scientific literature or expert opinion (local knowledge can be useful in making a determination as some species' dependence varies by setting);
- The species are not known to have roots extending over a meter in depth;
- The community does not occur in an area where the water table is known to be 'near' the surface (relative to the documented rooting depths of the species);
- The herbaceous or shrub vegetation is not still green and/or does not have a high leaf area late in the dry season (compared to other dry areas in the same watershed that do not have access to groundwater).

Special-status Species: Impacts and Mitigation

Desert Tortoise

Direct Impacts

Protocol-level surveys for desert tortoise were conducted for the PSPP project site and linear facilities between March 17 and May 22, 2009 (study area except substation) and October 24 to 25, 2009 (substation site and buffer). Clearance surveys were conducted on portions of the PSPP project site in 2010. Surveys conducted in 2009 detected 17 burrows (Class 3–5), 15 tortoise pallets (Class 4 or 5), and 19 tortoise shell remains (Class 5) in the project area (AECOM 2010a). Surveys conducted in 2010 identified seven tortoises (adult and juvenile) in the project area including four along the generation tie line and three tortoises south of I-10, the latter being outside of the Project Disturbance Area and buffer area. Only one tortoise was detected in the Project Disturbance Area along the gen-tie line for the PSPP project (Solar Millennium 2010k, Table 1 and Figure 1). Desert tortoises were not detected on the PSPP solar field.

Protocol surveys for desert tortoise were conducted for the PSEGS project from April 7 to April 30, 2013. These surveys were limited to areas not previously surveyed for the PSPP project and included portions of the generation tie-in and the new natural gas pipeline alignment. Desert tortoises were not detected during these surveys (Palen 2013m). Two desert tortoise burrows showing sign of recent occupation were detected on the generation tie-in south of I-10 and a possible burrow was noted in a survey buffer north of the freeway (Palen 2013m). Supplemental surveys for desert tortoise were not conducted in the Project Disturbance Area of the solar field for the PSEGS project.

In public workshops, status reports, and in a comment letter on the PSA the Center for Biological Diversity (CBD) raised concerns regarding the age of the desert tortoise surveys for the PSEGS project; contending that the surveys were out of date and not in conformance with guidelines identified by the USFWS (TN# 200055 CBD letter 7-29). Staff considered the age of the surveys and coordinated with agency staff during preparation of the PSA and FSA. The guidelines identified in the Desert Tortoise Recovery Plan are recommendations when working in desert tortoise habitat to facilitate permitting. Please see Response to Public and Agency Comments, below, for additional information regarding the timing and age of the surveys.

Although desert tortoises were not detected on the project site this species is known to occur in the project region. Desert tortoise sign is present on the project site and the species has been periodically detected in adjacent habitat. In addition, for the PSPP project resource agency staff located a possible desert tortoise burrow near the bridge associated with the large wash that flows into the center of the Project Disturbance Area (LaPre, pers. comm.). Potential desert tortoise burrows were noted by staff during reconnaissance level surveys of the project area during April 2010 and April 2013. Additional observations of desert tortoise from project buffers for the PSPP project were included in the Revised Desert Tortoise Technical Report (Galati & Blek 2010b, Revised Desert Tortoise Technical Report). **Biological Resources Figure 7** identifies desert tortoise sign detected by the project owner during surveys of the PSPP and PSEGS project site.

Although desert tortoise were not detected on the solar field and only a small number of desert tortoises were detected in the buffer area it is likely that the project area supports desert tortoise that were not observed by the surveyors. Desert tortoises are frequently unavailable to be sampled by field crews because they make extensive use of underground shelters (Nussear 2004). Similarly, desert tortoises spend much of the year in burrows even during the active season (Woodbury and Hardy 1948; Marlow 1979; Nagy and Medica 1986; Bulova 1994), and only the proportion of the tortoise population that is above ground is usually sampled (Nussear 2004). In a study conducted at Marine Corps Air Ground Combat Center Twentynine Palms, Duda et al (1999) found that during the spring, desert tortoises were located above-ground 45 percent of the time in a productive year, compared with only 20 percent in a drought year. They further noted that surface activity declined from spring levels in the summer of both years, yet the difference between years was still significant. Desert tortoises were located on the surface 26 percent in the productive year and 11 percent in the drought year. Even when desert tortoise are active and above ground during the surveys only a subset of these animals are usually detected. This can lead to a violation of a critical assumption of the line distance sampling technique, namely, that all animals on the line are found (Anderson et al. 2001; Buckland et al. 2001).

In order to account for observer bias, weather conditions, and desert tortoise behavior the USFWS developed a predictive model (USFWS 2010) for estimating the expected range of desert tortoise that may be present based on the limited ability to detect animals during the surveys. The USFWS 2010 survey protocol takes into account the probability that tortoises would be present above ground based on the previous winter's rainfall and the fact that not all tortoises within the survey area are seen by surveyors. The model then provides a mathematical formula that is used to estimate the number of adult and subadult tortoises that are actually present. Statistical techniques can provide further estimates of minimum and maximum numbers of tortoises expected, within a 95 percent confidence interval. In addition, most juvenile tortoises and tortoise eggs are not detected during field surveys. The use of this model requires the detection of live adult or subadult desert tortoise; neither of which was detected on the proposed solar field. The absence of live tortoise data limits the ability of the model to provide statistically defensible estimates of desert tortoise density. Similarly, the fact that living desert tortoises were not detected during surveys does not suggest that desert tortoises are not present on the project site. Review of range wide data, existing site conditions and historic disturbance, and the results of the surveys completed to date suggest the site is expected to support a relatively low number of desert tortoise.

In a comment letter on the PSA the CBD raised concerns regarding the estimates of desert tortoise that may occur on the PSEGS project site. To support the preparation of the Biological Opinion (BO) for the approved PSPP project the USFWS used desert tortoises found in the buffer transects of the generation tie-in and regional estimates to estimate tortoise density for the project (Palen 2013m). Based on this information the USFWS concluded that two to twelve subadult or adult tortoises occupy the project site (USFWS 2011b). In addition to adult and subadult desert tortoises, the proposed project site is expected to support a population of juvenile tortoises that are not considered in the USFWS formula.

Juvenile tortoises are extremely difficult to detect because of their small size and cryptic nature. In many instances juveniles are overlooked during surveys. However, estimates of juvenile tortoise populations can be extrapolated using information based on a four-year study of tortoise population ecology conducted by Turner et al. (1987). This study determined that juveniles accounted for approximately 31.1 to 51.1 percent of the overall tortoise population. Using this range, the USFWS estimated between four and six juvenile desert tortoises may occur on the project site. The project site may also support the eggs of desert tortoise. The number of tortoise eggs that could be present on the project site was estimated by the USFWS based on the assumption of a 1:1 sex ratio and that all females present would lay eggs (clutch) in a given year. Applying the 1:1 sex ratio six out of the 12 desert tortoises could be reproductive females. Given one clutch per reproductive female in a given year multiplied by the average number of eggs found in a clutch (i.e., 5.8; see USFWS 1994b); approximately 35 eggs would be expected to occur in a given year (USFWS 2011b). However, fewer eggs are likely to be onsite at any given time because not all females are expected to be of reproductive age or elected to produce eggs during any given year.

Biological Resources Table 7a
Estimated Number of Desert Tortoise on the Project Site and Linear Facilities

Adult and Sub-adults*		**Juvenile Estimates***		**Eggs***	**Total Adult/Sub-adult and Juvenile**	
Lower	Upper	Lower	Upper		Lower	Upper
2	12	3	6	35	**5**	**18**

*All estimates of desert tortoise abundance are based on values identified in the 2011 Biological Opinion for the Approved PSPP (USFWS 2011b).

As part of its authority granted by the Warren-Alquist Act, the Energy Commission has in-lieu permitting authority for local and state agencies; therefore the State Incidental Take Permit (2081) for desert tortoise would be subsumed in the Commission Final Decision. For the purposes of this analysis staff considers the USFWS 2011 Biological Opinion for the approved PSPP project to provide a reasonable estimate of the expected number of desert tortoise that may occur on the PSEGS site. Because live desert tortoises were not detected during the surveys staff acknowledges that this data is based on the extrapolation of existing information. The actual number of desert tortoises that may occur in the project Disturbance Area is likely much lower. The actual number of desert tortoise encountered on the site, if any, will be quantified during pre-construction clearance surveys and monitoring during construction of the facility.

During construction of the project desert tortoises may be harmed during clearing, grading, and trenching activities or may become entrapped within open trenches and pipes. Construction activities could also result in direct mortality, injury, or harassment of individuals as a result of encounters with vehicles or heavy equipment. Other direct effects could include individual tortoises being crushed or entombed in their burrows, collection or vandalism, disruption of tortoise behavior during construction or operation of facilities, disturbance by noise or vibrations from the heavy equipment, and injury or mortality from encounters with workers’ or visitors' pets. Desert tortoises may be attracted to the construction area by application of water to control dust, placing them at higher risk of injury or mortality. Increased human activity and vehicle travel would occur from the construction and improvement of access roads, which could disturb, injure, or kill individual tortoises. Tortoises may seek shade and thermal cover by taking shelter under parked vehicles and can be killed, injured, or harassed when the vehicle is moved.

Use of paved roads, including I-10, and dirt access roads could result in mortality of desert tortoises by vehicle strikes. The potential for increased traffic-related tortoise mortality is greatest along paved roads where vehicle frequency and speed is greatest. Desert tortoises on dirt roads may be affected depending on vehicle frequency and speed. Data indicate that desert tortoise numbers decline as vehicle use increases (Bury et al. 1977) and that tortoise sign increases with increased distance from roads (Nicholson 1978; Karl 1989; von Seckendorf & Marlow 1997, 2002).

Construction activities that result in accidental fires can directly affect desert tortoise and their habitat. Because of the abundance of weeds in the region wildfires that result from welding, vehicles carelessly parked on vegetation, smoking, or other ignition sources pose a potential direct impact to desert tortoise and can quickly spread to off-site areas. Direct effects of fire on desert tortoise include mortality by incineration, elevating body temperature, poisoning by smoke, and asphyxiation (Whelan 1995). Small individuals such as hatchlings are more at risk from lethal heating than large ones because they have a higher surface to volume ratio that allows heat to penetrate their vital organs relatively quickly (Brooks and Esque 2002).

The prior project owner (Solar Millennium) recommended impact avoidance and minimization measures to reduce these impacts to desert tortoise, including installation of exclusion fencing to keep desert tortoise out of construction areas, translocating the resident desert tortoise from the project site, controlling construction traffic, reducing speed limits to decrease the incidence of road kills, and worker environmental awareness training programs.

Staff incorporated these recommendations into conditions of certification for the PSPP and PSEGS. Conditions of Certification **BIO-1** through **BIO-5,** requires qualified biologists with authority to implement mitigation measures be on site during all construction activities. Condition of Certification **BIO-6** requires the development and implementation of a Worker Environmental Awareness Program to train all workers to minimize impacts to sensitive species and their habitats. Condition of Certification **BIO-7** requires the project owner to prepare and implement a Biological Resources Mitigation Implementation and Monitoring Plan (BRMIMP) that incorporates the mitigation and compliance measures required by local, state, and federal LORS regarding biological resources. Condition of Certification **BIO-8** describes Best Management Practices and other impact avoidance and minimization measures.

Conditions of Certification **BIO-9** through **BIO-11** are specific to desert tortoise. Condition of Certification **BIO-9** requires installation of security and desert tortoise exclusionary fencing around the entire Project Disturbance Area and on portions of I-10 south of the project area. **BIO-10** requires the development and implementation of a desert tortoise relocation/translocation plan to move any desert tortoises found in the Project Disturbance Area to identified relocation or translocation sites. Condition of Certification **BIO-11** requires verification that all desert tortoise impact avoidance, minimization, and compensation measures have been implemented. These conditions are consistent with the Commission's decision for the PSPP.

Implementation of Conditions of Certification **BIO-9** and **BIO-10** have inherent risks and could themselves result in effects such as mortality, injury, or harassment of desert tortoises due to equipment operation, fence installation activities, removal of tortoise burrows, and tortoise relocation/translocation. These impacts are described in more detail below.

Impacts to Critical Habitat

The project area overlaps a portion of the Chuckwalla Desert Tortoise Critical Habitat Unit (Chuckwalla CHU). The Chuckwalla CHU is 1,020,600 acres (USFWS 1994b) and 228 acres would be directly or indirectly impacted by the PSEGS project (Palen 2013m). The functions and values of desert tortoise critical habitat north of I-10 are relatively low; however the presence of desert tortoise in this area has been detected. Habitat south of I-10 is better for desert tortoise and generally increases with proximity to the Chuckwalla Mountains. Both proposed substation sites are south of I-10, and are located in desert tortoise critical habitat. Southern California Edison (SCE) is currently building the Red Bluff substation and has provided mitigation for that project.

The critical habitat area overlapping with the project site contains at least three sizeable washes with major bridges that provide for dispersal and long term gene flow across I-10 which is needed to achieve population connectivity between the Chuckwalla and Chemehuevi critical habitat units. Although I-10 has disrupted the hydrology and associated microphyll woodland components of the lesser washes, the shrub and herbaceous annual vegetative components between the washes remain hydrologically unaffected and support comparable community characteristics with areas south of I-10. Since desert tortoise forage predominantly on annual plants, the hydrologic effects on the tree canopy do not affect foraging habitat characteristics. Therefore, while the habitat in this area may be considered low quality, the area is occupied (based on the presence of sign) and provides a vital role and function of the critical habitat designation for maintaining inter-DWMA population connectivity espoused in the species' recovery plan (USFWS 1994a).

Although the three major culverts under I-10 would remain open to desert tortoise movement, the project would disrupt local movement patterns by forcing tortoises to walk around the project site. Thus, tortoises north of the project site attempting to move in a southward direction would be diverted to the east or west, and the perimeter fencing around the project site would direct tortoises towards I-10 on the traffic surface (AECOM 2010b. Tortoise-proof fencing has not been installed along this segment of I-10, so desert tortoises moving around the project site rather than moving through washes would potentially experience increased rates of vehicular-related mortality. Increased mortality would further reduce local population levels and increase the adverse effects of habitat fragmentation by preventing dispersal between the Chuckwalla Mountains to the southwest and Palen Mountains to the northeast. Staff considers the potential increase in desert tortoise road fatalities to be a significant impact of the project. This impact would be reduced to less-than-significant levels with installation of desert tortoise exclusion fencing along I-10 south of the project site, as described in Condition of Certification **BIO-9** (Desert Tortoise Clearance Surveys and

Fencing). This proposed fencing is consistent with guidance in the NECO, which specifies that: "Interstate Highways 40 and 10 would be fenced by Caltrans along their common boundaries with DWMAs to preclude tortoise mortality and limit other wildlife mortality" (BLM-CDD 2002, page 2-29).

Impacts of Relocation/Translocation

For many projects the regulatory agencies require that desert tortoises be captured and relocated from the development site. This relocation is defined as "translocation" if a desert tortoises is moved more than a certain distance from their current location (i.e., typically greater than 500 meters/1642 feet). Although desert tortoises were not found on the proposed solar field it is likely that a low number of desert tortoises are present. If detected during clearance surveys, desert tortoises will require translocation to off-site locations.

Large scale land acquisition to support military training, residential and commercial development, and the construction of industrial level solar infrastructure projects has necessitated the use of translocation as a tool to minimize direct losses to desert tortoise and other sensitive wildlife. Construction of the proposed project would require the translocation or removal of all desert tortoises, including adults, subadults, and any juveniles that are found on the site during clearance surveys. An important consideration in assessing potential impacts from the translocation effort is establishing the proposed translocation sites. Translocation and control sites should occur on lands that can be managed for the protection of this species. The translocation of animals to privately held lands is not recommended by USFWS and CDFW, given the threat of future development and other inherent risks to desert tortoise associated with private land. The primary and secondary recipient sites identified for the approved PSPP project were located on roughly 11,129 ha (27,500 ac) of BLM lands in the Chuckwalla DWMA along the upper bajadas on the north side of the Chuckwalla and Little Chuckwalla Mountains (USFWS 2011b). Staff expects that additional information on the proposed translocation sites will be developed as part of the revised Desert Tortoise Translocation Plan prepared as part of **BIO-10**.

The distance of the translocation site from the project site also affects the methods used during the implementation of the plan. USFWS may require disease testing and quarantine for any tortoise translocated more than 500 meters (1642 feet). This requirement is intended to limit the potential exposure risk to healthy tortoises adjacent the project site. However, for each desert tortoise translocated to a long distance sites, two other tortoises must be handled, disease tested, and radio tagged. Therefore, a total of three tortoises are handled for each translocation event. Desert tortoises at the recipient site and control site are diseased tested and radio tagged in order to ensure that healthy animals are not being introduced into a diseased population and to track the animals post-release. In addition disease testing and radio tagging allows the agencies to track the mortality of translocated versus host or control populations; provides long term monitoring of the populations; and provides a mechanism for evaluating whether mortality occurs uniformly across the three groups. These requirements may not be enacted in the event that only short distance translocation occurs and if the number of desert tortoises is determined to be low (i.e., usually less than five animals).

The USFWS may limit the maximum number of desert tortoises that may be relocated to a particular area to minimize potential effects to the host population from resource competition. In order to assess this impact, additional information is required, specifically the density of desert tortoises inhabiting proposed translocation sites.

Translocation activities require the implementation of a series of actions. Some of the proposed activities include but are not limited to:

- The identification of the proposed translocation and control sites;
- The evaluation of the habitat quality on the translocation and control sites;
- A determination of existing tortoise density and an assessment of the sites ability to accommodate additional tortoises above baseline conditions;
- Pre-construction fencing and clearance surveys of the project site;
- The construction of holding pens for quarantined translocated tortoises prior to their release into host populations;
- Pre-construction surveys of the proposed translocation sites;
- The placement of tracking units (GPS) on tortoises from the project site, translocation site, and control site;
- Possible disease testing for long distance translocated tortoises, host, and control sites;
- Long term monitoring and reporting of control and translocated and host populations; and
- The implementation of remedial actions should excessive predation or mortality be observed.

Translocation of desert tortoise has inherent risks that must be considered when implementing this activity. Capturing, handling, and relocating desert tortoises could result in harassment, injury, or mortality of desert tortoises. Impacts of translocation may include elevated stress hormone levels, changes in behavior and social structure dynamics, genetic mixing, increased movement (caused by antagonistic behavior with other tortoises, avoidance of predators or anthropogenic influence, homing, or seeking out of preferred habitat), spread of disease, and increased predation. Handling, holding, and transport protocols may also compound with abiotic factors to affect the outcome for translocated individuals (Bertolero et al. 2007; Field et al. 2007; Rittenhouse et al. 2007; Teixeira et al. 2007), particularly during extreme temperatures, or if they void their bladders. Averill-Murray (2001) determined that tortoises that voided their bladders during handling had significantly lower overall survival rates (0.81-0.88) than those that did not void (0.96). Desert tortoises that are improperly handled by biologists without the use of appropriate protective measures may be exposed to pathogens that spread among tortoises in both resident and translocated animals. The introduction of diseased tortoises to a recipient site or holding pen may result in the spread of upper respiratory tract disease (URTD). The USFWS consider URTD to be one of the most serious infectious disease affecting desert tortoises.

Translocation may be a useful tool in the conservation of some species, yet well designed studies are necessary to properly evaluate its efficacy (Field et al 2007). As of 2013 there are a number of ongoing translocation actions that are underway. Most of these translocation events are related to military land expansion and solar energy development although a large scale translocation event is planned to occur on BLM lands near Pahrump Nevada. Definitions of success are variable and determining ultimate success can require lengthy studies (Fischer and Lindenmayer 2000, Seigel and Dodd 2002). For the PSEGS project translocation is considered a mechanism to salvage existing animals and place them in an area where they have the potential to survive post construction.

Success rates of herpetofauna translocations range from 14 percent to 42 percent, suggesting that improved efforts are essential for the future recovery of many reptiles and amphibians (Dodd and Seigel 1991; Germano and Bishop 2009). Existing studies suggest that animals move away from the translocation site and move through the landscape at a higher rate than control animals (Sullivan et al. 2004; Bertolero et al. 2007; Field et al. 2007). More specifically, a review of 91 herpetofauna translocation projects reported the primary causes of translocation failure were homing response by translocated individuals and poor habitat in translocated areas, followed by human collection, predation, food and nutrient limitation, and disease (Germano and Bishop 2009). The risks and uncertainties of translocation to desert tortoises are well recognized in the desert tortoise scientific community. The Desert Tortoise Recovery Office (DTRO) Science Advisory Committee (SAC) has made the following observation regarding desert tortoise translocations (DTRO 2009, p. 2):

> *As such, consensus (if not unanimity) exists among the SAC and other meeting participants that translocation is fraught with long-term uncertainties, notwithstanding recent research showing short-term successes, and should not be considered lightly as a management option. When considered, translocation should be part of a strategic population augmentation program, targeted toward depleted Populations in areas containing "good" habitat. The SAC recognizes that quantitative measures of habitat quality relative to desert tortoise demographics or population status currently do not exist, and a specific measure of "depleted" (e.g., ratio of dead to live tortoises in surveys of the potential translocation area) was not identified. Augmentations may also be useful to increase less depleted populations if the goal is to obtain a better demographic structure for long-term population persistence. Therefore, any translocations should be accompanied by specific monitoring or research to study the effectiveness or success of the translocation relative to changes in land use, management, or environmental condition.*

However, many translocations of desert tortoises have been limited in scope and applicability; shortcomings have included small sample size, loss of tortoises by death, poaching, transmitter failure, limited sampling period, inadequate information on resident tortoises; variation in release techniques or timing of releases, and use of captive or penned tortoises (Walde et al. 2011). In a study conducted over four years at Fort Irwin the USGS observed highly variable mortality rates ranging from 34 percent in 2009 to 1.5 percent in 2011(Drake et al. 2011). Tortoise mortality rate for 2011 continued to decrease from previous years despite an increase in the number of tortoises being monitored (*ibid.*). **Biological Resource Table 7b** provides a summary of the data taken from the 2011 USGS study at Fort Irwin California.

Biological Resource Table 7b
Desert tortoise mortality from 2008-2011 at the Ft. Irwin Study Site.*

Study Year	Number Dead	Number Monitored	Percent Mortality
2008	39	121	32.2
2009	31	90	34.4
2010	11	82	13.4
2011	8	525	1.5

*Drake et al 2011.

This study suggested that the majority of desert tortoise mortality could be attributed indirectly to predation. In times of drought when predators (e.g. coyotes, kit foxes, and bobcats) have fewer mammalian prey items available, they increase take of less preferred prey including desert tortoises (Woodbury and Hardy 1948, Berry 1974). During droughts, coyotes apparently killed most of the tortoises in one study at the Desert Tortoise Natural Area (Peterson 1994) and 21 to 28 percent of the marked wild population in a study near Ridgecrest, California were killed by canids. Longshore et al. (2003) found that periods of drought may directly influence tortoise survivorship leading to regional population declines. Turner et al. (1984) also reported unpublished materials from K.H. Berry indicating that a site in the west Mojave had less than five percent mortality during five previous years (estimated from carcass remains), followed by a year when she observed 27 percent mortality among 48 marked tortoises over 12.5 km^2. Esque et al. (2010) found mortality rates at sites spanning the Mojave Desert ranged from zero to 43.5 percent, where two of the sites had no mortality observed and seven sites had some mortality in at least one of three years reported here.

Mortality data compiled from the ISEGS Monthly Compliance Report - July 2012 identified that of approximately 504 animals tracked (i.e., hatchlings, resident, control, and translocated animals) 32 were deceased and 21 have been identified as missing. The breakdown of mortalities included four hatchlings (born in the holding pens), six control animals, six resident animals, eight animals identified for translocation but held in pens, and seven animals that were subject to short distance translocation efforts. Excluding hatchlings and missing animals, mortality rates (i.e., 28/ 447 animals) for all desert tortoise including resident, control, and translocatees is approximately six percent at this time. However, this is preliminary data and the long term effects of translocation for this population are not yet known.

While data suggests that translocation may be an effective tool for salvaging desert tortoise from large scale land use projects; the implementation of translocation activities must be completed in a thorough and well-coordinated manner. To provide guidance for these actions the USFWS prepared specific draft guidelines for clearance and translocation of desert tortoises from the project sites. This included the *Translocation of Desert Tortoises (Mojave Population) From Project Sites: Plan Development Guidance* (USFWS 2010b). This document provides guidance including the timing of relocation/translocation, disease testing requirements, and other actions intended to minimize impacts to desert tortoise.

Biological Resources Table 7c (Desert Tortoise Density Estimates and Impact Summary) estimates of the numbers of tortoises that may be translocated from the project site; numbers of tortoises that may be handled at the translocation and control sites; and numbers of undetected juveniles and eggs that may occur at the project site. These figures are based on the values provided in the 2011 USFWS BO for the approved PSPP project (USFWS 2011b). Because no living desert tortoises were identified on the proposed solar field the actual number of desert tortoises that require translocation from the Project Disturbance Area is expected to be lower than the values identified in **Biological Resources Table 7c**.

Biological Resources Table 7c
Desert Tortoise Density Estimates and Impact Summary

	Estimated Number of Tortoises Subject to Direct Project Effects*						
Project Feature	**Adult and Sub-adults**		**Juvenile Estimates**		**Eggs**	**Total Adult/Sub-adult and Juvenile**	
	Lower	Upper	Lower	Upper		Lower	Upper
Project Site	2	12	3	6	35	5	18
Translocation Area²	2	12	3	6	N/A	5	18
Control Area³	2	12	3	6	N/A	5	18
Subtotal	6	36	9	18	N/A	15	54

**All estimates of desert tortoise abundance are based on values identified in the 2011 Biological Opinion for the Approved PSPP (USFWS 2011b).

As described in **Biological Resources Table 7c** (Desert Tortoise Density Estimates and Impact Summary) approximately two to 12 adult or subadult desert tortoises, three to six juvenile tortoises, and 35 eggs have the potential to occur on the proposed project site. The actual number of animals that may be subject to translocation is expected to be a subset of this value. It is estimated that only 15 percent of juvenile tortoises (0.15 multiplied by the number of juveniles) on the site would be located during clearance surveys.

There are inherent risks to any action that requires the handling, disease testing, and translocation of desert tortoise. For the proposed project these risks could occur in the translocated, host, and the control population. Although desert tortoises will not be translocated into the control population some mortality may occur from handling or if used, from the placement of GPS tracking devices. For example, mortality at control populations is expected to be approximately five percent based on a review of scientific studies of tortoise mortalities associated with routine handling (Moore pers. comm. 2010).

For this project translocation mortality rates are assumed to range up to 45 percent. This value represents the high end of documented translocation mortality for desert tortoise at this time. Using the five percent mortality rate for the control population (adult and juvenile tortoises multiplied by 0.05) and the 45 percent mortality rate for the translocated and host populations (adults and juveniles multiplied by 0.45) this would result in the potential loss of between five and 20 tortoises from translocation mortality. All of the 35 eggs would be lost. If fewer desert tortoises are discovered or mortality rates are lower there would be a corresponding reduction in desert tortoise deaths from translocation activities.

The prior project owner prepared a draft Desert Tortoise Relocation/Translocation Plan as part of the Incidental Take Permit application (AECOM 2010a, Attachment DR-BIO-47) for the approved PSPP project which includes measures to avoid and minimize adverse impacts to resident and translocated desert tortoise. Condition of Certification **BIO-10** requires development of a Desert Tortoise Translocation Plan in consultation with CDFW, BLM, and USFWS. The Desert Tortoise Translocation Plan will include the identification and prioritization of potentially suitable locations for translocation; desert tortoise handling and transport considerations (including temperature); animal health considerations; a description of translocation scheduling, site preparation, and management; and specification of monitoring and reporting activities for evaluating success of translocation. With implementation of proposed Condition of Certification **BIO-10**, adverse impacts associated with desert tortoise translocation would be minimized.

Mitigation for Desert Tortoise Habitat Loss

The PSEGS project would result in the direct and indirect loss of approximately 3,948 acres of desert tortoise habitat. Construction would also result in the fragmentation and disturbance to adjacent habitat. These impacts are significant and require compensatory mitigation. With the exception of the dune areas desert tortoise habitat is present across most of the PSEGS project site. Habitat conditions vary on the site and generally consist of low to moderate quality habitat. Historic military training, agriculture, the spread of exotic plants, construction of I-10 and the large wing-dykes near the foothills of the Chuckwalla Mountains have contributed to the decline of habitat conditions on the project site. Staff agrees that little of the habitat quality within the Project Disturbance Area could be described as high quality, but all of it is suitable for desert tortoise and all could be potentially occupied.

For the approved PSPP project staff, USFWS, CDFW, and BLM recommended compensatory mitigation ratio of 5:1 for disturbance to critical habitat and at a 1:1 ratio for areas outside of critical habitat. These ratios were adopted for the PSPP and have been recommended for the PSEGS. Staff from BLM, Energy Commission, USFWS, and CDFW agrees that compensatory mitigation at these ratios is appropriate for the PSEGS project because the project would eliminate desert tortoise habitat, fragment adjacent habitat, and adversely affect connectivity for desert tortoise and other wildlife. The compensation ratio for the BLM is determined by its bioregional land use plan rather than the specific effects of the PSEGS project on desert tortoise. The NECO specifies the following desert tortoise compensation requirements applicable for the PSEGS project site (from page D-2, Appendix D, BLM-CCD 2002):

> "*A mitigation fee based on the amount of acreage disturbed shall be required of proponents of new development. Within Desert Wildlife Management Areas (DWMAs) (Category I) the lands delivered or equivalent fee shall be an amount that achieves a ratio of 5 acres of compensation land for every 1 acre disturbed. Outside DWMAs (Category III) the lands delivered or equivalent fee shall be an amount that achieves a ratio of one 1 acre of compensation land for every 1 acre disturbed. Funds may be expended as approved by the Management Oversight Group in 1991. Lands will be acquired or enhanced within the same recovery unit as the disturbance. CDFG may require additional fees for management of lands and for rehabilitation of lands.*"

The project owner suggested revisions to Condition of Certification **BIO-12**. These revisions recommended an alternative mitigation strategy for desert tortoise compensation based on the retirement of grazing allotments. During a workshop conducted on July 24, 2013 the project owner provided further information on the proposed ratios and how this may benefit desert tortoise. On July 31, 2013 the project owner filed additional revisions to Condition **BIO-12** based on workshop discussions and recommended that up to 50 percent of the mitigation land requirement could be achieved through the retirement of grazing allotments. The project owner proposed mitigation ratios of 3:1 for areas outside of critical habitat and 15:1 ratios for habitat in the Chuckwalla Critical Habitat Unit. Staff considered the request for this change and acknowledges retirement of grazing allotments can benefit desert tortoise. However, after coordination with REAT group team members, staff does not recommend adopting the revised language for the FSA. The approach has merit however, staff is not convinced that the changes to the condition are warranted at this time. The current mitigation approach was considered and adopted by the Commission for the PSPP. The proposed changes are considerable; depart from the adopted mitigation strategy; have not been subject to public review; and the REAT agencies are not in full agreement on the efficacy of this approach in this area Integrating State and Federal Desert Tortoise Mitigation

Compensatory mitigation for desert tortoise typically involves balancing the acreage of habitat loss with acquisition of lands that would be permanently protected and enhanced to support healthy populations of desert tortoise. The compensation comes about by removing threats to desert tortoise and by improving the carrying capacity of the acquired property so that more desert tortoises will survive and reproduce on these lands.

While staff from BLM, Energy Commission, USFWS, and CDFW agree that ratios adopted for the PSPP and recommended for the PSEGS for compensatory mitigation are appropriate for project impacts to desert tortoise habitat, some differences remain between the federal and state approach to desert tortoise mitigation that currently preclude a complete integration of desert tortoise mitigation requirements. One difference is the state requirement for permanent protection of acquired mitigation lands. Energy Commission staff and CDFW require that mitigation lands acquired for endangered species be maintained and protected in perpetuity for the benefit of those species. The BLM cannot always make the same commitment to protecting acquired mitigation lands because their multiple use mandate restricts their ability to designate lands solely for conservation purposes and to exclude potentially incompatible development and activities.

For the acquisition of mitigation lands to truly compensate for the habitat loss and to make up for the numbers of desert tortoise that would otherwise have been supported by that habitat, the acquisition must be accompanied by: (1) permanent protection and management of the lands for desert tortoise, and (2) enhancement actions. The permanent protection is essential because it would allow the lands to be managed in a way that excludes multiple threats and incompatible uses (grazing, off-highway vehicle use, roads and trails, utility corridors, military operations, construction, mining, grazing by livestock and burros, invasive species, fire, and environmental contaminants). Without this protection and management desert tortoise populations on the acquired lands would be subject to the same threats that led to its population declines and threatened status. This level of protection would be necessary to meet the mitigation requirements for loss of desert tortoise habitat under CESA. An equally important component of mitigation is the implementation of enhancement actions to improve desert tortoise survival and reproduction. These actions might include habitat restoration, invasive plant control, road closures or road fencing, reducing livestock and burro grazing, reduce the risk of wildfires, and by controlling ravens and other predators. Without permanent protection and enhancement actions on lands acquired for mitigation, the project's impacts would result in a net loss of desert tortoises and their habitat.

The REAT agencies agree that to address the in-perpetuity protection requirement for any lands acquired and subsequently donated to BLM will have either a deed restriction or conservation easement in title that will preclude future development of the land (Fesnock pers. comm., Flint pers. comm.). The REAT agencies also note that protection could be achieved by buying private in-holdings within designated wilderness or wilderness study areas, being that these areas are congressionally designated and as such preclude any development within them, thus meeting the requirement for in-perpetuity protection. The BLM has an established process for accepting lands with deed restrictions or conservation easements and is working on streamlined version of this process. The BLM has also indicated that for any land enhancement actions or recovery actions implemented on existing BLM-owned lands, BLM would develop a Memorandum of Understanding (MOU) with CDFW containing provisions for notification of any proposed projects affecting those lands (BLM 2009a). The BLM agreed that future projects authorized on these mitigation lands that might degrade or diminish the desert tortoise recovery value would be compensated at a higher rate (BLM 2009a).

Calculation of Security for Desert Tortoise Compensatory Mitigation

To satisfy CDFW's full mitigation standard the proposed mitigation must meet criteria described in Title 14, California Code of Regulations, sections 783.4(a) and (b). These criteria include requirements that the proposed mitigation would be capable of successful implementation, and that adequate funding is provided to implement the required mitigation measures and to monitor compliance effectiveness of the measures. These financial assurances are generally provided in the form of an irrevocable letter of credit, a pledged savings account or another form of security prior to initiating ground-disturbing project activities. Staff's proposed conditions of certification typically specify the dollar amount of the security, and include a provision for adjusting that security amount when parcel-specific information is available.

This financial security amount is calculated by multiplying the acreage of the impact area by the total per-acre costs, a figure which represents the sum of the costs required for: (1) land acquisition, (2) initial habitat improvements, and (3) a fund to support long-term management of the acquired lands. The latter cost for the long-term management fund is typically the largest component of the mitigation fee. Interest from the fund provides enough income to cover annual stewardship costs on the acquired lands and includes a buffer to offset inflation.

The REAT agencies have developed a total cost accounting method for calculating acquisition or conservation easement costs for mitigation lands, as shown in **Biological Resources Table 8** below. This method provides an estimate of security costs for mitigation and includes the costs associated with the purchase transactions, appraisal, escrow, and title insurance including mineral, oil, and gas rights. The estimate also addresses costs of initial enhancement (e.g., signs, fencing, and boundary/property line surveys; or restoration actions such as removal of exotic species, roads), management for ongoing activities such as public access and enforcement; and monitoring the implementation, effectiveness, and compliance of conservation measures with the goals and objectives of the mitigation. For those projects using the REAT Mitigation Account for implementing mitigation actions, the budget includes administration of contracts and reporting.

Biological Resources Table 8
REAT Biological Resources Mitigation/Compensation Cost Estimate Calculation Table for PSEGS[1]

	Desert Tortoise Compensation	Mojave Fringe Toed Lizard Habitat	Burrowing Owl	Streambed Compensation
Number of Acres	4,860	2063.5	78	788
Estimated number of parcels to be acquired, at 160 acres per parcel[2]	30	13	1	5
Land cost at $1000/acre[3]	$ 4,860,000	$2,063,700	$78,000	$788,000
Level 1 Environmental Site Assessment at $3000/parcel	$91,925	$38,694	$3,000	$14,775
Appraisal at no less than $5,000/parcel	$ 151,875	$64,491	$5,000	$24,625
Initial site work - clean-up, restoration or enhancement, at $250/acre[4]	$1,215,00	$515,925	$19,500	$197,000
Closing and Escrow Cost at $5000 for 2 transactions[5]	$151,875	$64,490	$5,000	$24,625
Biological survey for determining mitigation value of land (habitat based with species specific augmentation) at $5000/parcel	$151,875	$64,490	$5,000	$24,625
3rd Party Administrative Costs (Land Cost x 10%)[6]	$486,000	$206,370	$7,800	$78,800
Agency cost to accept land donation[7] (Land Cost x 15%) x 1.17 (17% of the 15% for overhead)	$852,930	$362,179	$13,689	$138,294
Subtotal of Acquisition and Initial Site Work	$7,960,680	$3,380,341	$136,989	$1,290,744
Long-term Management and Maintenance (LTMM) fee at $1450/acre [8]	$7,047,000	$2,992,365	$113,100	$1,142,600
Management Fees				

Establish Project Specific Account[9]	$12,000			
Call for and Process Pre-Proposal Modified RFP or RPF [10]	$30,000			
Management fee for Acquisition and Enhancement Actions (Subtotal x 3%)	$235,820	$101,410	$4,109	$38,722
Management Fee for LTMM account (LTMM x 1%)	$70,470.00	$29,924	$1,131	$11,426
Subtotal of Management Fees	$351,290	$131,334	$5,240	$50,148
TOTAL Estimated cost for deposit in project specific sub-account	$ 15,358,970	$6,504,039	$255,330	$2,483,492

1. All costs are calculated based on the REAT Biological Resources Mitigation/Compensation Cost Estimate table (July 23, 2010**)** and are best estimates as of summer 2010. Actual costs will be determined at the time of the transactions and may change the funding needed to implement the required mitigation obligation. Note: regardless of the estimates, the developer is responsible for providing adequate funding to implement the required mitigation.
2. For the purposes of determining costs, a parcel is defined at 160 acres, recognizing that some will be larger and some will be smaller, but that 160 acres provides a good estimate for the number of transactions anticipated (based on input from CDD).
3. Generalized estimate taking into consideration a likely jump in land costs due to demand, and an 18-24 month window to acquire the land after agency decisions are made. If the agencies, developer, or 3rd party has better, credible information on land costs in the specific area where project-specific mitigation lands are likely to be purchased, that data overrides this general estimate. Note: regardless of the estimates, the developer is responsible for providing adequate funding to implement the required mitigation.
4. Based on information from CDFW.
5. Two transactions at $2500 each: landowner to 3rd party; 3rd party to agency. The transactions will likely be separated in time.
6. Includes staff time to work with agencies and landowners; develop management plan; oversee land transaction; organizational reporting and due diligence; review of acquisition documents; assembling acres to acquire….)
7. Includes agency costs to accept the land into the public management system and costs associated with tracking/managing the costs associated with the donation acceptance, including 2 physical inspections; review and approval of the Level 1 ESA assessment; review of all title documents; drafting deed and deed restrictions; issue escrow instructions; mapping the parcels….
8. Estimate for purposes of calculating general costs. The actual long term management costs will be determined using a Property Assessment Report (PAR) tailored to the specific acquisition. Includes land management; enforcement and defense of easement or title [short and long term]; monitoring….
9. Each renewable energy project will be a separate sub-account within the REAT account, regardless of the number of required mitigation actions per project.
10. If determined necessary by the REAT agencies if multiple 3rd parties have expressed interest; for transparency and objective selection of 3rd party to carryout acquisition.

The cost for the long-term maintenance and management is typically the largest component of the mitigation fee. Interest from the long-term maintenance and management fee creates a funding source that provides enough income to cover annual stewardship costs on the acquired lands and includes a buffer to offset inflation. The amount for the long-term maintenance and management fee is established by a Property Analysis Record (PAR), a computerized database methodology developed by the Center for Natural Lands Management (<www.cnlm.org/cms>) which calculates the costs of land management activities for a particular parcel. These activities include development of a desert tortoise management plan tailored for each parcel of mitigation land to assess habitat status, identify desired conditions, and develop plans to achieve conditions that would best support desert tortoise. Once the management plan is developed and approved by the appropriate resource agencies, implementation of enhancement actions such as fencing, road closure, weed control, habitat restoration as well as monitoring can begin. The goal of these activities is to increase the carrying capacity of the acquired lands for desert tortoise and increase their population numbers by enhancing survivorship and reproduction.

Funding for the initial habitat improvements supports those actions needed immediately upon acquisition of the property to secure it and remove hazards. These activities might include fencing or debris clean-up, or other urgent remedial action identified prior to when the parcels were acquired. When the management plan is completed for the acquired parcel activities like these are thereafter funded from the interest produced by the long-term maintenance and management fee described above.

Condition of Certification **BIO-12** specifies acquisition of 4,860 acres to mitigate for impacts to desert tortoise habitat. Based on the calculations summarized in Biological Resources Table 6a, the estimated security with management fees would be $15,358,970. The security amount without management fees would be $15,007,680. The estimated composite mitigation cost for establishing the financial security would be $3,506 per acre (see **Biological Resources Table 8** for a breakdown of expected costs). This security amount may change when an updated appraisal is made and a PAR is prepared for the parcels that have been selected for acquisition. These are estimates based on current costs and the current REAT compensation table; the requirement is defined in terms of acres, not dollars per acre, and actual costs may vary. If the security proves to be inadequate to secure the necessary acreage because of increases in land costs, the project owner would need to make up the difference. Similarly, if the security was an overestimate the project owner would be refunded the excess.

The project owner may elect to purchase and permanently protect compensation lands itself; to fund the acquisition and initial improvement of compensation lands through the Renewable Energy Action Team (REAT) Account; or to fund the acquisition of compensation lands through a third party, as outlined in **BIO-12**. REAT options are described below. Further, **BIO-12** would require that the project owner provide financial assurances to guarantee an adequate level of funding to implement the compensation measures described above. Because there are several suitable options available to the project owner to satisfy the compensation requirement, and because mitigation requirements must satisfy the requirements of both state and federal Endangered Species acts, the calculation of the security amount includes estimates of all transaction and management fees described above. These calculations are presented in **Biological Resources Table 8**.

Indirect and Operational Impacts

Indirect effects to desert tortoises could include soil compaction, fugitive dust, the introduction of non-native and invasive plant species, and increased human presence along access roads. Indirect effects may also include habitat fragmentation, the disruption of existing home ranges, and barriers to dispersal. Increased human presence from new access roads or interest in the facility could lead to increased road kill, illegal collecting and the spread of disease due to abandonment of captive tortoises infected with upper respiratory tract disease. Operational impacts to desert tortoise include both direct and indirect effects including those described above. Typically, these effects are similar in type but smaller in magnitude when compared to construction related effects. These effects may include the risk of mortality from vehicle traffic, crushing of burrows by routine maintenance activities on access roads or if any desert tortoises remain in the facility area post construction, vegetation management activities, and washing of the heliostats. Other operational effects include fires, habitat degradation, and the spread of invasive plant species. Increased road traffic on roads in the region either from facility staff or sightseers increases the risk of road kill to both tortoises and common wildlife. This not only results in the loss of desert tortoise but increases the risk for subsidized predators such as ravens and coyotes.

Ravens and Other Predators

Construction and operation of the project has the potential to increase raven and coyote presence in the project area. Ravens depend on human encroachment to expand into areas where they were previously absent or in low abundance. Common ravens were rarely observed within the Project Disturbance Area during surveys in 2009, although one pair was observed nesting in a desert ironwood tree in the north central portion of the Project Disturbance Area (Solar Millennium 2009a, Volume II, Appendix F). Staff noted ravens at the site during surveys in 2013 and this species is known from the region. Ravens habituate to human activities and are subsidized by the food and water, as well as roosting and nesting resources that are introduced or augmented by human encroachment. Common raven populations in some areas of the Mojave Desert increased 1,500 percent from 1968 to 1988 in response to expanding human use of the desert (Boarman 2002). Since ravens were scarce in this area prior to 1940, the current level of raven predation on juvenile desert tortoises is considered to be an unnatural occurrence (BLM 1990; USFWS 2008a). Multiple coyotes were also observed by staff foraging in the adjacent date farm during surveys of the site in May 2013. In addition to ravens and coyotes, feral dogs have emerged as major predators of the tortoise. Dogs may range several miles into the desert and have been found digging up and killing desert tortoises (USFWS 2011a; Evans 2001). However the site is located in a rural area with only sparse residential development.

Ravens may use the perimeter fence as potential perch sites and new transmission line structures as nest and perch sites increasing the potential for loss of tortoises from raven predation. Several raven subsidies occur in the region including the existing date farm, a small reservoir located adjacent to the project fence line, and other agricultural activities located northwest of the site. Periodic roadkill on I-10 also provides subsidies for opportunistic predators/scavengers such as ravens. Road kills would mount with increased project construction and operations traffic, further exacerbating the raven/predator attractions and increasing desert tortoise predation levels. Bird collisions with facility structures or transmission lines may attract ravens. As the project area is already subject to elevated raven predation pressure the loss of juvenile tortoise in an area supporting limited tortoise densities could have a long-term effect on the tortoise population by reducing the recruitment of juvenile tortoises into the adult life stages (Boarman 2003). The effects of reduced recruitment may not be apparent for years because tortoises do not typically reach sexual maturity until approximately 15 to 20 years of age, and are therefore considered indirect impacts of project operation. Subsidies

Implementation of Condition of Certification **BIO-6** worker environmental awareness training; and**BIO-8** restrictions on pets being brought to the site required of all personnel, and the collection of road kill, would reduce or eliminate the potential for these impacts. The project owner would also implement Condition of Certification **BIO-13** (Raven management Fee) to further reduce impacts to desert tortoise from the projects contribution to raven subsidies in the region.

Regional Approach to Raven Control

The USFWS, in cooperation with CDFW and BLM, has developed a comprehensive regional raven management and monitoring program in the California Desert Conservation Area to address the regional, significant cumulative threat that increased numbers of common ravens pose to desert tortoise recovery efforts (USFWS 2010b). The Regional Raven Management Program will implement recommendations in the USFWS E*nvironmental Assessment to Implement a Desert Tortoise Recovery Plan Task: Reduce Common Raven Predation on the Desert Tortoise* (USFWS 2008). To mitigate the PSEGS's contribution to cumulative and indirect impacts on desert tortoise from raven predation, the project owner would contribute toward implementation of the USFWS Regional Raven Management Program (USFWS 2010a) as described in Condition of Certification **BIO-13**. The project owner's payment would support the regional raven management plan activities focused within the Colorado Desert Recovery Unit, which would be adversely affected by increases in raven subsidies attributable to the PSEGS project. The fees contributed by the project owner would fund implementation of the raven removal actions, education and outreach efforts, and surveying and monitoring activities identified in the Environmental Assessment (USFWS 2008). Implementation of these actions would be an effective means of reducing the project's cumulative contributions to desert tortoise predation from increased raven numbers.

The prior project owner prepared a draft Raven Monitoring and Control Plan (AECOM 2010a DR-BIO-57) in response to staff's request to develop methods and best management practices to avoid and minimize raven attractants and subsidies for the approved PSPP project site. This draft raven plan is integrated into Condition of Certification **BIO-13.** The project owner's final Common Raven Monitoring, Management and Control Plan would involve identifying and preventing conditions that might attract or support ravens (for example, eliminating food sources such as garbage or roadkill, minimizing creation of structures that could provide ravens perches, nests or roosts), monitoring the effectiveness of raven management and control measures, and then implementing additional adaptive management measures to make sure that the project does not result in an increase in raven numbers. Implementation of measures in **BIO-13** would avoid or minimize the contributions of the project to increased desert tortoise predation from ravens to less than significant levels.

Increased Risk from Roads/Traffic

Vehicle traffic would increase as a result of construction and improvement of access roads, increasing the risk of injuring or killing desert tortoise. The potential for increased traffic-related tortoise mortality is greatest along paved roads where vehicle frequency and speed is greatest though tortoises on dirt roads may also be affected depending on vehicle frequency and speed. Census data indicate that desert tortoise numbers decline as vehicle use increases and that tortoise sign increases with increased distance from roads (Nicholson 1978; Hoff and Marlow 2002). Additional unauthorized impacts that may occur from casual use of the access roads in the project area include unauthorized trail creation.

Condition of Certification **BIO-8** contains a variety of minimization measures to minimize the risks of increased traffic fatality and other hazards associated with roads at the project site, These measures include confining vehicular traffic to and from the project site to existing routes of travel, prohibiting cross country vehicle and equipment use outside designated work areas, and imposing a speed limit of 25 miles per hour on paved and stabilized unpaved roads within the construction site and 10 miles per hour on unpaved areas within the construction site .

As discussed above, local movement patterns of desert tortoise would be disrupted by the project, and tortoises north of the project site attempting to move in a southward direction would be diverted to the east or west, and the perimeter fencing around the project site would direct tortoises towards I-10 on the traffic surface (AECOM 2010b). Tortoise-proof fencing has not been installed along this segment of I-10, so desert tortoises moving around the project site would potentially experience increased rates of vehicular-related mortality. Staff considers the potential increase in desert tortoise road fatalities to be a significant impact of the project. To reduce this impact to less-than-significant levels, Condition of Certification **BIO-9** (Desert Tortoise Clearance Surveys and Fencing) requires installation of desert tortoise exclusion fencing along both sides of I-10 south of the project area, and maintenance of the bridge undercrossings of I-10 as safe and accessible passage for desert tortoise.

The placement of fencing in this area would reduce the potential for tortoise mortality on I-10 and would be considered beneficial to the species. Implementation of standard best management practices such as those identified in Condition of Certification **BIO-8** would reduce impacts to desert tortoise during the installation of the fence.

Impacts from Noxious Weeds

Many invasive non-native species are adapted to and promoted by soil disturbance (Lathrop & Archibald 1980). Once introduced, they can out-compete native species because of minimal water requirements, high germination potential and high seed production (Beatley 1994). Weeds can outcompete native annuals where nitrogen deposition (near highways such as I-10) and precipitation rates are higher, leading to higher risk of wildfire (Allen et al. 2010), and can become locally dominant, representing a serious threat to native desert ecosystems (Abella et al. 2008). Sahara mustard (*Brassica tournefortii*) is regarded as one of the most invasive wildland pest plants in the Colorado and Mojave deserts, one of the most common invasive plants in desert tortoise habitat, and capable of dominating entire desert landscapes if no control actions are taken. Sahara mustard spreads explosively during wet years but even during a 12-year drought in Riverside County (1989-1991), the population of Sahara mustard increased by nearly 35 times. Densities equivalent to as high as three million plants per acre have been recorded at Lake Mead National Recreation Area (Graham et al. 2002).

Left uncontrolled, Sahara mustard out-competes and ultimately replaces native wildflowers that provide valuable forage for the desert tortoise. It forms dense thickets that can increase the frequency, intensity, and size of desert fires, increasing the threat to native plant communities, the desert tortoise, and other wildlife (Brooks 2010). In areas where Sahara mustard is particularly dense it may also impede desert tortoise movement (Berry pers. comm.). In the Colorado and Mojave deserts, a single tortoise was necropsied that had died from renal failure, related to renal oxalosis, and the crystals present in the kidneys were identified as oxalates (Jacobson et al. 2009). One additional tortoise was later necropsied that died of oxalosis in the same region (Berry pers. comm. 2010). Although many native plants in the Mojave and Colorado deserts contain oxalates, however, the oxalate-containing weed Sahara mustard is one of the most common invasives in desert tortoise habitat and is a suspected cause of the renal failure (Berry pers. comm.). See “Indirect Impacts to Special-Status Plants” for additional information on the risk invasive weeds pose to desert ecosystems. Condition of Certification **BIO-14** (Weed Management Plan) includes monitoring and control measures that would reduce impacts to desert tortoise from increases in Sahara mustard and other weeds to less than significant levels.

Other Indirect Impacts

Indirect effects to desert tortoise may occur from wildfires. Desert tortoises that escape direct mortality from wildfires may be affected by fire-induced habitat alteration. Alterations to habitat can result in mortality, decreased fecundity, increased predation, starvation, and dehydration; all resulting in reduced viability of this species (USFWS 2011a). Reduction in plant cover also reduces available shelter as perennial plants, especially woody shrubs, provide protection for desert tortoises from mortality due to predators and overheating from the sun (Woodbury and Hardy 1948; Burge 1978; Mushinsky and Gibson 1991). Although single fires may not produce long-term reduction in the cover of perennial plants or biomass of native annual plants (O’Leary and Minnich 1981), recurrent fire can convert native desert scrub to alien annual grasslands (Brown and Minnich 1986; Duck et al. 1997; Esque et al 2003). Indirect effects can also increase the risk of predation by predators attracted to the area by increased human activity, water or food subsidies. Clearing and grading activities would result in the exposure of large numbers of fossorial species such as small rodents and reptiles. Many of these species are killed or injured during these activities and attract ravens and other opportunistic predators. Potential deposition of sediment loads as a result of construction-related sediment mobilization during heavy rain events and flooding downstream would impact existing desert tortoise burrows outside of the Project Disturbance Area.

Connectivity

The PSEGS project is located within designated Wildlife Habitat Management Areas (WHMAs). These include the Palen-Ford WHMA and DWMA Continuity WHMA (USFWS 2011b). Management emphasis for the Palen-Ford WHMA is on the management of the dunes and playas within the Palen-Ford dune system. Management emphasis for the DWMA Continuity WHMA is providing connectivity of tortoises between conservation areas north and south of I–10 (i.e., the Chuckwalla DWMA and Chemehuevi DWMA). The PSEGS project (solar field) is located north of I-10. Adjacent land uses include date farms, a small development and natural lands including the Palen Dunes.

The RSA for the approved project indicated that the project area may be important for desert tortoise movements between higher quality habitats available in the Palen Mountains to the northeast and the Chuckwalla Mountains to the south; the location of the project area connects these higher quality habitats (Galati & Blek 2010b). Similarly, desert tortoise are known to use low-quality intermountain habitat, such as that present across most of the project area, as dispersal routes over time, providing connectivity between high-quality habitat areas in the surrounding mountains (Averill-Murray and Averill-Murray 2005). Currently, three large culverts under I-10, occurring along the existing washes in the project area, provide desert tortoise and other wildlife a safe passage under I-10 in a north-south direction across the project area (Galati & Blek 2010b). The box culverts, range in width from 90 to 150 feet and provide an outlet for Corn Springs Wash and other drainages that flow beneath I-10.

Recent studies indicate that habitat fragmentation and isolation of natural areas ultimately results in the loss of native species within those communities (Soulé et al. 1988). Populations of animals that are isolated from other populations are at higher risk of extirpation both from sources such as drought, disease, or wildlife. In the Colorado Desert large areas have been subject to habitat fragmentation from development (i.e., Desert Center, Blythe, State Prisons), agricultural practices, and off highway vehicle use. On a local scale, large solar infrastructure projects have been permitted and several are currently under construction in the Chuckwalla Valley. All of these features fragment habitat and reduce connectivity for some species of wildlife. The amount and distribution of suitable habitat is an essential element to consider for the management of wildlife. For example, some species require, and are often limited to, unique vegetation or terrain features for breeding or foraging such as desert tortoise.

Construction of the PSEGS project would result in a barrier to desert tortoise in the region. The placement of perimeter fencing will exclude desert tortoise from the site and remove approximately 3,948 acres of habitat for this species. Similarly, the facility will eliminate the large washes and other ephemeral drainages within the Project Disturbance Area and would impair local wildlife movement and reduce habitat connectivity for desert tortoise. Although desert tortoise is not a migratory species, opportunities for local movements within its home range and dispersal are important for maintaining viable populations (Galati and Blek 2010b). Impairment to connectivity through the project vicinity could disrupt desert tortoise population dispersal from the Chuckwalla Mountains to the southwest connecting to the Palen Mountains in the northeast and vice versa (Galati and Blek 2010b); this impact to connectivity was identified as significant and unmitigable in the Staff Assessment/Draft Environmental Impact Statement (SA/DEIS).

After the SA/DEIS was published, the prior project owner conducted a survey of the project-vicinity undercrossings and prepared a report of the findings (*Wildlife Movement and Desert Tortoise Habitat*, AECOM 2010f). The results of this report show that there are numerous project-vicinity undercrossings that provide wildlife movement corridors and provide the opportunity for desert tortoise connectivity. In addition, sand dune habitat and Palen Dry Lake are to the north of the project site; washes associated with the project lead directly into this sand dune and dry lake habitat. While desert tortoises will cross desert pavement and dunes, areas of heavy dune concentration and areas consisting purely of dunes offer little in the way forage and make burrowing difficult, and Palen Dry Lake is also inhospitable to desert tortoise (Galati and Blek 2010j). Staff agrees that these areas are not likely to be a regular part of tortoise home ranges, and with or without the project desert tortoises moving through the area would be forced either to the east or west. Desert tortoise would maintain access through the three large culverts which would remain open after project construction, but their utility as a wildlife movement corridor would be significantly impaired because of the loss of downstream washes that connect to the culverts.

Desert tortoise traveling around the project from the north may attempt to cross I-10 at grade rather than use the underpass, increasing risk of mortality. Fencing on the west side of the project could guide desert tortoise directly onto I-10. In addition to the three underpasses that occur adjacent to the project site, an additional 21 underpasses occur along the existing washes in the 36-mile-long stretch on either side of the proposed project, between Wiley Wells Road and Desert Center (see Figure 8 in AECOM 2010a). The 2011 BO for the approved PSPP project indicated AECOM surveyed these underpasses and determined that all are suitable for tortoise use and provide passage under I–10 in a north–south direction to allow tortoise passage. Therefore, although the proposed project would reduce the amount of available tortoise habitat and result in reduced habitat connectivity; habitat would remain to the west and east of the proposed project to provide connectivity of tortoises in the long term (USFWS 2011b).

To facilitate desert tortoise movement and to connect the undercrossings south of the project with open areas to the west, the prior project owner proposed installation of a large box culvert under the proposed access road leading to the project site from I-10. This, along with desert tortoise fencing along both sides of I-10 to direct desert tortoise to nearby undercrossings, would mitigate impacts to connectivity below a level of significant. Staff incorporated these measures into conditions of certification **BIO-8** and **BIO-9** and recommends the same measures for PSEGS.

Staff considered this loss of connectivity for local wildlife movement and for desert tortoise to be a significant impact of the PSPP and also consider it a significant impact for the PSEGS project. Condition of Certification **BIO-12** requires land acquisitions of parcels that contribute to desert tortoise habitat connectivity and build linkages between desert tortoise populations and designated critical habitat. Implementation of this condition of certification would offset impacts to desert tortoise. These targeted areas are consistent with those described in the California Desert Connectivity Project (Science and Collaboration for Connected Wildlands Desert Linkages Habitat

Connectivity Study <www.scwildlands.org>) (Spencer et al. 2010). With implementation of Conditions of Certification **BIO-8**, **BIO-9**, and **BIO-12**, project impacts to desert tortoise connectivity would be reduced to less-than-significant levels.

Conclusion – Impacts and Mitigation for Desert Tortoise

Conditions of Certification **BIO-9** through **BIO-11** describe measures that would avoid and minimize direct impacts to desert tortoise, and staff concluded that implementation of these measures would reduce potential direct impacts of PSEGS to less-than-significant levels for the PSPP and has proposed the same conditions for the PSEGS. To fully mitigate the loss of 3,948 acres of desert tortoise habitat, and associated fragmentation and loss of connectivity, staff's proposed Condition of Certification **BIO-12** requires acquisition and enhancement of 4,860 acres of desert tortoise habitat within the Colorado Desert Recovery Unit in areas that have potential to contribute to desert tortoise habitat connectivity and build linkages between desert tortoise populations. Staff has determined that sufficient compensatory mitigation lands are available in the Colorado Desert Recovery Unit to fulfill this acquisition requirement.

Mojave Fringe-toed Lizard

The project would directly impact 1,480 acres of Mojave fringe-toed lizard habitat in the northeastern portion of the Project Disturbance Area, an area of active wind-blown sand with relatively shallow sand deposits, as well as areas of deeper and more active vegetated sand dunes. In addition to this direct and immediate loss of habitat, the project would significantly affect downwind Mojave fringe-toed lizard habitat The northeastern portion of the project as originally configured would interrupt the regional wind-borne sand transport corridor that moves sand southeast and east along the Chuckwalla Valley and toward the Colorado River (**BIOLOGICAL RESOURCES APPENDIX A**).

The Mojave fringe-toed lizard relies on vegetated sand dunes and a regular supply of fine wind-blown sand for its habitat. Active sand dunes (i.e., dunes that have an active layer of mobile sand) exist in a state of dynamic equilibrium, continuously losing sand downwind due to erosion and transport and gaining new supplies from upwind. If the upwind sand supply is cut off the dunes deflate, losing sand downwind and shrinking in size and depth. The finest sand (which is most easily transported) is lost first with coarser sand and gravel being left behind to form an armor or lag. This lag does not support Mojave fringe-toed lizard habitat.

The PSPP would have affected sand transport because it included a perimeter sand fence that is 30 feet high designed to stop sand from entering the solar array. Most sand transport occurs close to the ground through the processes of rolling and saltation (bouncing of sand particles) with approximately 90 percent of sand transport occurs within six feet of the ground surface (see **BIOLOGICAL RESOURCES APPENDIX A**). Staff concluded that wind fence would pose an effective barrier to sand transport, and create a "sand shadow" downwind. A sand shadow is defined as an area downwind of a sand barrier where the wind is able to remove sand but there is no supply of new sand upwind. Over time existing sand dunes in a shadow area will be deflated because they will shrink and become coarser as the fine sand is blown away by the wind.

As described earlier in the subsection on impacts to the sand transport corridor, the PSPP would have had an impact on sand transport and Mojave fringe-toed lizard habitat by eliminating the network of desert washes throughout the site and replacing them with engineered channels (**BIOLOGICAL RESOURCES APPENDIX A**). Project construction on the alluvial fans and alteration of stream channels by channelization may have reduced the amount of fluvial sediment reaching the depositional areas upwind of sand dunes and Mojave fringe-toed lizard habitat. Similar effects have been observed in the Coachella Valley, with adverse consequences for Coachella Valley fringe-toed lizard habitat (Griffiths et al. 2002). The direct impacts for the PSEGS project on the sand transport corridor have been reduced to 1,129 acres from the PSPP (1,503 acres for Reconfigured Alternative 3 and 1,542 acres for Reconfigured Alternative 3). The proposed PSEGS eliminates the large drainage control channels and the majority of the project site would maintain the original grades and natural drainage features (Palen 2012a). The PSEGS project has also been designed to eliminate the PSPP project's 30 foot tall wind fences that contributed to disruption of the sand transport (Palen 2013a). The revised PSEGS project boundary is proposed to be defined by a chain-link fence, which will have a very different effect on wind flow and sand transport. Sand may pass through the fence and winds will be affected by the heliostat array (CEC 2013l). The project owner initially assumed 39.7 acres of indirect impacts for the private parcel adjacent to project site that would be surrounded on three sides by project fencing (Palen 2013a).

As discussed under Impacts to Sand Transport Corridor and Sand Dune Habita,t staff utilized the "PWA Model" (included as Appendix C to the RSA (CEC 2010c)), which was also used for the original project proceeding. The project owner also prepared an assessment of the transport corridor, without the incorporation of a model (Palen 2013kk). Both staff's modeled results and the project owner's assessment of the indirect effects of the PSEGS project to be greater than either of the Reconfigured Alternatives 2 or 3.

Other potential indirect and operational impacts of the PSEGS project include: mortality from vehicle strikes; introduction and spread of non-native invasive plants; erosion and sedimentation of disturbed soils; edge effects including fragmentation and degradation of remaining habitat; increased road kill hazard from operations traffic; harm from vegetation management activities including mowing, trimming, and other vegetation removal methods, harm from accidental spraying or drift of dust suppression chemicals; and, an increase in access for avian predators (such as loggerhead shrikes) due to new perching structures. Sahara mustard, in particular, is a noxious weed of high concern in the Colorado Desert. Sahara mustard may affect wildlife by altering the availability of forage plants and characteristics of their habitat structure. Vehicle strikes have been a reported cause of mortality to Mojave fringe toed lizard on project access roads in the region. At least 118 Mojave fringe-toed lizards had been killed by vehicle strikes on the Colorado River Substation access road as of January 2013 (BLM 2013b). In addition, at least two Couch's spadefoot toads have been killed on the Colorado River Substation access road (BLM 2013b).

Staff requested the project owner supply further data relative to onsite vegetation management regimes, and specifically, providing a draft vegetation management plan that describes the mowing plan for the site (CEC 2013h). However, the project owner will not be submitting a vegetation management plan but did provide further detail on the extent of vegetation management within the PSEGS site (Palen 2013cc). It is unclear how mowing may affect fringe-toed lizard that remain within the site or travel through the site to other areas of habitat however staff has added measures to Condition of Certification **BIO-8** to address potential impacts from vegetation management. .

Barrows et al. (2009) found the Coachella Valley fringe-toed lizard to be the only animal species of five vertebrates evaluated to demonstrate a negative response to Sahara mustard abundance. Lizard abundance was monitored in undisturbed, weedy habitat and compared abundance in weeded control sites. The author noted that Coachella Valley fringe-toed lizard abundance on weeded plots showed a decrease (Barrows et al 2009). This negative impact was short-lived and declined no more than a year after the mustard's dominance waned. This indicates that Sahara mustard removal would improve habitat quality for fringe-toed lizards. An indirect effect of Sahara mustard on fringe-toed lizard is that it may increase sand compaction within aeolian sand (active dune) communities (Barrows et al 2009). Over time, sand compaction could lead to a change in habitat from an aeolian sand community to a stabilized sand community.

The distribution of Mojave fringe-toed lizards is naturally fragmented because of its obligate habitat specificity to a patchy habitat type, and many local populations of this species are quite small, with small patches of sand supporting small populations of lizards. This fragmented pattern of distribution leaves the species vulnerable to local extirpations from additional habitat disturbance and fragmentation (Murphy et al. 2007). The Mojave fringe-toed lizard population in the Chuckwalla Valley, along with a very small population in Joshua Tree National Park's Pinto Basin, represents the southernmost distribution of this species (Barrows, pers. comm.). This southern population may represent an important gene pool in light of the likely warming and drying that will occur in this region as a result of climate change; these southernmost lizards that may be already adapted to hotter and drier conditions than those further north could represent a source of genetic variation that could stave off extinction of this species in selected refugia (Barrows, pers. comm.). The cumulative impact of all the PSEGS alternatives would be to increase the already fragmented distribution of the Mojave fringe-toed lizards, and to increase the risk of extirpation of isolated populations within the Chuckwalla Valley.

For the PSPP, staff concluded that impacts to Mojave fringe-toed lizard habitat could be mitigated to less-than-significant levels with implementation of proposed Condition of Certification **BIO-20.** This condition recommends acquisition and protection of core populations of Mojave fringe-toed lizard habitat elsewhere in the Chuckwalla Valley. **BIO-20** requires that impacts to stabilized and partially stabilized sand dunes from the Project or any of its alternatives be mitigated at a 3:1, consistent with recommendations in the NECO plan and with the Commissions' original project Decision (CEC 2010f). For impacts to non-dune habitats occupied by Mojave fringe-toed lizards (sand fields vegetated with sparse creosote bush scrub) the mitigation ratio would be 1:1, with the requirement that acquired mitigation lands be within the Chuckwalla or Palen sand transport corridor. Any indirect “sand shadow” impacts would be mitigated at a 0.5:1 ratio.

The PSEGS project would directly affect 1,480 acres of Mojave fringe-toed lizard habitat, a slight reduction from both the Reconfigured Alternative #2 and #3 (1,503 acres and 1542 acres, respectively).Conversely, indirect impacts to downwind habitat, and Mojave fringe-toed lizards would increase in comparison to the PSPP. Offsite impacts could indirectly affect Mojave fringe-toed lizards downwind of the project, due to projected deflation, stabilization of the dunes, plant successional shifts, and other events that would all degrade Mojave fringe-toed lizard habitat. Offsite indirect impacts to Mojave fringe-toed lizards would be cumulatively significant but mitigable Implementation of **BIO-20** would still mitigate direct impacts to Mojave fringe-toed lizard habitat to less-than-significant levels. In addition, staff recommended measures for the PSPP including maintaining speed limits on site (**BIO-8**), and for the PSEGS staff has incorporated additional measures including posting additional speed limit signs in MFTL habitat, providing additional worker training related to Mojave fringe-toed lizard, and increasing monitoring and reporting of species and vehicle strikes along project access roads into existing conditions of certification (**BIO-6** and **BIO-8**). Impacts to Mojave fringe-toed lizard habitat could be mitigated to less-than-significant levels with implementation of proposed Condition of Certification in **BIO-6** and **BIO-8.**

Couch’s Spadefoot Toad

If Couch’s spadefoot toads are present in the Project Disturbance Area, impacts from construction would include loss of habitat and direct mortality during grading and construction. Construction activities that create pits or depressions during the summer rains could provide breeding habitat, which could either be vulnerable to additional construction impacts or be in substrate that is incapable of sustaining ponded water for the necessary time. During project construction and operation Couch’s spadefoot toads could be crushed on access roads, and it is possible for construction disturbance to cause toads to surface, regardless of whether the season is suitable for emergence. The project owner performed spadefoot toad microhabitat mapping in summer of 2013 (Palen 2013ii) and located no areas of ponding.

Western Burrowing Owl

Burrowing owl and their sign (feathers, whitewash, and/or pellets) was detected on the project site during protocol surveys conducted for the approved PSPP project. No burrowing owls or active owl burrows were documented within the ¾-mile and 1-mile buffer transects performed during spring 2009 surveys for this species (AECOM 2010a, Draft PSEGS Burrowing Owl Relocation/Translocation Plan). Surveys conducted for the natural gas pipeline alignment in 2013 detected one burrowing owl however an active burrow was not detected in the proposed disturbance area. As of 2010 at least five potentially active owl burrows occurred within the Project Disturbance Area. At that time staff determined that at least four owls (two adults and two juvenile/fledglings) were present on the project site. It is possible that the number of breeding owls on the project site has changed since the PSPP was approved. During avian point count and raptor surveys conducted in 2013, the project owner documented 18 burrowing owl observations across the project site (Palen 2013ii). These surveys are not intended to document nesting and these may be resident or transient birds.

Direct impacts to burrowing owl includes the loss of nest sites, eggs, and/or young; permanent loss of breeding and foraging habitat; and disturbance of nesting and foraging activities for burrowing owl pairs within the project site, buffer, or immediately surrounding area. This includes crushing burrows, increased noise levels from heavy equipment, disturbance from human presence, and exposure to fugitive dust. Because burrowing owls are cavity dwellers that are primarily active during crepuscular periods (i.e., dawn and dusk) or at night, birds flushed from burrows during the day would be exposed to elevated predation risk from raptors. Burrowing owls also exhibit site fidelity and owls displaced from a burrow during construction or from passive relocation activities have an increased risk of mortality from predation if they lack access to adequate burrows.

Indirect impacts to burrowing owls during construction and from operation of the facility can include increased road kill hazards, modifications to foraging and breeding activities, and loss of prey items and food sources due to a decreased number of fossorial mammals. Indirect and operational impacts to nesting birds may also include the loss of habitat due to the colonization of invasive plants and the disruption of breeding or foraging activity due to facility maintenance. Weed abatement, mirror washing, and maintenance activities would likely limit the use of some areas as foraging or nesting habitat. Burrowing owls may also be at risk from collision or electrocution with facility structures and from exposure to elevated levels of solar flux (see Impacts to Migratory/Special-status Bird Species).

Implementation of the PSEGS project would destroy occupied burrows or cause owls to abandon burrows. Construction during the breeding season could result in the incidental loss of fertile eggs or nestlings or otherwise lead to nest abandonment. The loss of occupied burrowing owl habitat (habitat known to have been occupied by owls during the nesting season within the past three years) or reductions in the number of this rare species, either directly or indirectly through nest abandonment or reproductive suppression, would constitute a significant impact absent mitigation. Furthermore, burrowing owls and their nests are protected under both federal and State laws and regulations, including the Migratory Bird Treaty Act and California Fish and Game Code Section 3503.5.

There is much debate among state, federal, local, and private entities over the most practicable and successful relocation/translocation methods for burrowing owl. When passive relocation is used solely as an impact avoidance measure, it is generally only effective when burrowing owl nesting territories are directly adjacent to permanently protected lands (i.e. military reservation, airport, wildlife reserve, agricultural reserve with appropriate crop type such as alfalfa) (Bloom 2003). Passive relocation has been criticized as a relocation method because relocated or displaced owls are tenacious about returning to their familiar burrows and are inclined to move back to the impact site if the impact site is still visible to the owl and/or if the impact site is not completely graded (Bloom, pers. comm.). Because project construction would be phased and occur over multiple years passive relocation may result in the repeated harassment of resident owls should they try to re-establish territories within the projects footprint. While construction of replacement burrows in off-site areas and the acquisition of mitigation lands would reduce impacts to the species, it is likely that owls would attempt to occupy areas close to known territories. This could require multiple passive relocation events for the same owls. Each of these events stresses the bird and exposes the owls to predation, lost breeding opportunities, thermal stress, and potential territorial disputes. Burrowing owls are put at increased risk when they are introduced to a new environment. The owls are naturally preyed upon by numerous diurnal and nocturnal avian and mammalian species and evicting owls from their familiar burrow, territory, and home range without a safe opportunity to become familiar with their new habitat increases the potential for predation (Pagel pers. com.). Thus, many burrowing owls likely die during passive relocations used for permanent owl eviction.

For successful active or passive relocation, breaking the owl's site fidelity is of utmost importance (Bloom 2003). The off-site location for the relocated owls should ideally have an existing burrowing owl colony and a large ground squirrel colony. Should neither colony already exist at the translocation site, artificial burrows should be installed if significant grassland or appropriate agricultural crop type is present (Bloom 2003). Active translocation of owls involves trapping owls, temporarily holding them in enclosures with supplemental feeding, and releasing at a suitable off-site location with existing or artificial burrows prior to breeding.

While active translocation might be a better solution than passive relocation for moving owls from large sites like the project site, California Fish and Game Code 3503.3 prohibits the active relocation of burrowing owls unless the effort is designed as a research project. Therefore, staff can only recommend the implementation of passive relocation techniques. Although passive relocation would be conducted to avoid direct mortality of owls within the proposed project area, previously occupied burrow(s) would be destroyed and foraging habitat would be degraded. Due to the loss of habitat compensatory mitigation is required to reduce these impacts to less than significant levels. The location and amount of compensatory habitat required to mitigate impacts to burrowing owl is often based on the number of impacted owls and assumes that currently occupied habitat will be replaced with nearby occupied habitat.

Compensatory mitigation for burrowing owls identified for the approved PSPP project was based on guidelines recommended in the CDFG Staff Report on Burrowing Owl Mitigation (CDFG, 1995) and by the California Burrowing Owl Consortium (CBOC 1993). When published these guidance documents used the best information available and provided strategies for reducing impacts to burrowing owls and recommended mitigation acreages for off-site replacement habitat. For example the California Burrowing Owl Consortium (CBOC 1993) guidelines for off-site replacement habitat included the following recommendations:

1. Replacement of occupied habitat with occupied habitat at 9.75 acres (6.5 acres times 1.5) per pair or single bird;

2. Replacement of occupied habitat with habitat contiguous to currently occupied habitat at 13.0 (6.5 acres times 2) acres per single pair or single bird, or;

3. Replacement of occupied habitat with suitable unoccupied habitat at 19.5 (6.5 acres times 3) acres per pair or single bird.

For the approved PSPP project the USFWS noted that the above guidelines were developed for owls nesting in coastal habitats, and their efficacy in desert environments has not been ascertained (Sorenson, pers. comm.). No documentation is available to statistically evaluate the success of passive relocation in southern California. Passive relocations in western Riverside County have not involved banded birds, so information on rates of success and direct/indirect mortality are not available. Reports elsewhere (Trulio 1995, 1997) do not provide long term analyses associated with passive relocation efforts to determine if passively relocated burrowing owls are present in the area after one or more years. The lack of documented success of passive translocations raises concerns regarding the fate of evicted owls.

In 2012 the CDFW (formerly CDFG) published The Staff Report on Burrowing Owl Mitigation (CDFG 2012). This document indicated that "reversing declining population and range trends for burrowing owls will require implementation of more effective conservation actions, and evaluating the efficacy of the Departments' existing recommended avoidance, minimization and mitigation approaches for burrowing owls". The new guidelines provide revised methods for surveying; reflect new data on the species; and recommend an ecological approach to establishing mitigation for this species. The 2012 guidance departs from the standardized approach to determining off-site habitat compensation because the acreages are often implemented as the "default" mitigation and may not reflect the actual habitat requirements of the species in a given location (CDFG 2012).

Acquisition of the appropriate amount of offsite habitat for burrowing owl should take into consideration the foraging distance and average home range of breeding and non-breeding owls. Diurnal home range for owls can be 150 feet on both sides of a burrow. Nocturnal home range is much larger, 1 square mile per owl pair, and several owls can overlap in that 1 square mile (Bloom, pers. comm.). The mean home range for 11 male burrowing owls in 1998 and 22 males in 1999 was 177 hectares (437 acres) and 189 hectares (467 acres), respectively, at naval air station in Lemoore, California located south of Fresno (Bloom 2003). Male burrowing owls often move greater than 1,000 meters when foraging in the breeding season and home ranges can often times overlap (Bloom 2003).

For the approved PSPP project staff recommended a minimum of 78 acres (19.5 acres each) of suitable, offsite (preferably occupied) burrowing owl habitat be acquired to offset the loss of foraging and nesting habitat for owls that occur in the Project Disturbance Area. This mitigation was based on the 1993 burrowing owl guidelines which the CDFW suggests may not adequately compensate for burrowing owls in arid ecosystems. Staff agrees that the compensatory mitigation approach would likely be different based on the 2012 guidelines and acknowledges that the mitigation acreages alone would not likely be effective in reducing impacts to the species from the loss of over 3,948 acres of foraging habitat. However, for the approved PSPP project and the PSEGS project the compensatory mitigation requirements for land acquisition would be "nested" within desert tortoise mitigation (see **BIO-12**). Under this condition the project owner would acquire approximately 4,860 acres of desert tortoise habitat. Provided the lands meet the requirements for burrowing owls staff considers this approach a viable mitigation option. The land acquisition identified under **BIO-12** would far exceed the recommendations for off-site compensatory burrowing owl mitigation identified in the 2012 guidelines and would theoretically support multiple pairs of owls.

To avoid potential impacts to burrowing owls in the Project Disturbance Area, staff is recommending that proposed conditions of certification (described below) include the completion of pre-construction surveys of the site using established protocols. If present, the project owner would establish a buffer and avoid active nests during the breeding season. If owls are detected using a burrow outside the breeding season the owls may be passively displaced pending the establishment of artificial burrows and the acquisition of adequate mitigation lands.

Condition of Certification **BIO-18** (Burrowing Owl Impact Avoidance, Minimization and Compensation Measures) would require the project owner to prepare and implement a Burrowing Owl Mitigation Plan that would include the following elements: a description of suitable burrowing owl relocation/translocation sites; guidelines for creation or enhancement of at least two natural or artificial burrows per relocated owl if an existing burrowing owl and/or ground squirrel colony does not occur outside the Project Disturbance Area; detailed methods and guidance for passive relocation of burrowing owls; and a description of proposed maintenance monitoring, reporting, and management of the relocated burrowing owls. This condition also requires acquisition and enhancement of a minimum of 78 acres of off-site suitable nesting and foraging burrowing owl habitat to mitigation for displacement of at least four owls. The prior project owner submitted a draft Burrowing Owl Relocation/Translocation Plan (AECOM 2010a, DR-BIO-51) which could serve as the basis for the Burrowing Owl Mitigation Plan. With implementation of Condition of Certification **BIO-18**, and **BIO-12**, direct impacts to burrowing owls would be reduced to less-than-significant levels. Indirect impacts to burrowing owl include collisions with project features, glare, also collision, electrocution, glare, and exposure to elevated levels of solar flux. Conditions of Certification **BIO-16a** and **BIO-16b** provide for ongoing project monitoring and implementation of a suite of habitat restoration and enhancement measures that would benefit burrowing owls, and implement adaptive management strategies based on results of project monitoring. However potential indirect impacts may remain significant after mitigation.

Golden Eagle

Golden eagles can be extremely susceptible to disturbance during the breeding season (Anderson et al. 1990; USFWS 2009b), and adverse effects are possible from various human activities up to (and in some cases exceeding) one mile from a nest site (Whitfield et al. 2008). Surveys documented two active nest approximately seven miles southwest of the PSEGS project site in the Chuckwalla Mountains, three inactive nests approximately 6 miles southwest of the site in the Chuckwalla Mountains, one inactive golden eagle nest just over ten miles southeast of the site in the Chuckwalla Mountains, and two active golden eagle nests just over 10 miles northeast of the site in the Palen Mountains (Solar Millennium 2010u), and preliminary results of spring 2013 helicopter surveys have indicated detection of three active nests in the Chuckwalla Mountains (Palen 2013x). Based on guidance provided by the USFWS (72 FR 31132, June 5, 2007) staff defined disturbance as an activity that would result in injury to an eagle or which would substantially interfere with normal breeding, feeding, or sheltering behavior. For example, a nestling being knocked from the nest by a startled adult would be considered an injury. A nestling fed inadequately because adults were agitated in the vicinity of the nest due to construction-related noise and activity would also be considered substantial interference, as would a situation in which nestlings starve because the adults were excluded from their familiar foraging grounds and could not provide adequate food to their young.

Staff concluded that project construction activities could potentially injure or disturb golden eagles if nests were established sufficiently close to project boundaries to be affected by the sights and sounds of construction. Staff considers these potential impacts unlikely, however, because suitable nesting substrate (i.e., cliff ledges, rocky outcrops, or large trees) does not occur within one mile of the PSEGS project area. The only potential nesting substrate within one mile of project boundaries would be transmission line towers. If such nesting occurs on transmission lines, disturbance to golden eagle nests would be avoided with implementation of Condition of Certification **BIO-16b**. This condition recommends that during construction, golden eagle nest surveys be conducted in accordance with USFWS guidelines to verify the status of golden eagle nesting territories within one mile of the project boundaries. Implementation of **BIO-16b** would reduce potential impacts of project construction on nesting golden eagles to less-than-significant levels.

Staff also assessed the impacts of the project to golden eagle foraging habitat, and concluded that the project would contribute to the cumulative loss of golden eagle foraging habitat within the NECO planning area. The Project would reduce the availability of eagle foraging habitat and could degrade nearby foraging habitat by the introduction and spread of noxious weeds. As discussed in the cumulative impact subsection, the project contributes to cumulative loss of foraging habitat from future projects within the NECO planning area (see **Biological Resources Table 15**). The potential for impacts to golden eagle foraging habitat can be reduced to less-than-significant levels by implementation of Conditions of Certification **BIO-12** (acquisition of desert tortoise compensatory mitigation lands), **BIO-21** (acquisition of state waters compensatory mitigation lands), and **BIO-14** (implementation of weed management plan). As described in **BIO-12**, the acquisition of desert tortoise mitigation lands would be targeted for areas within and near the Chuckwalla Bench and the Chuckwalla DWMA. Because these targeted areas are also within 10 miles of potential nesting sites for golden eagles, acquisition of these desert tortoise mitigation lands would also provide protected golden eagle foraging grounds. Potential golden eagle impacts attributable to concentration of solar flux during operation of the project are discussed below for all avian species, in the subsection titled “Operational Impacts to Flighted Species”.

Special-status Avian Species

Birds are the most conspicuous vertebrate found in the California Deserts (Latting and Rowlands 1995). Records exist for at least 425 species (Garrett and Dunn 1961) from 18 orders and 55 families. These approximately 350 species are characterized as Neotropical migrants who pass through the region during spring and fall migrations. These birds include various raptors including Swainson’s hawks; turkey vultures; and numerous passerines some of which include least Bell’s vireo, southwestern willow flycatchers, many hummingbirds, and various warblers. Shorebirds and other waterfowl are common migrants that have the potential to occur in the project area.

The project site and Chuckwalla Valley provide foraging, cover, and/or breeding habitat for a wide variety of resident and migratory birds. Localized water sources such as Lake Tamarisk are known to attract birds as are irrigated agricultural areas including the palm groves that abut the PSEGS project site. Ponds, including the small cement lined reservoir located at the northwest corner of the site are also expected to attract a variety of birds. Both the project site and adjacent habitat support microphyll woodlands that have been recognized as important habitat for resident and migratory birds.

How a given species is affected by project construction or operation is a function of the species ecology and behavior. Although the project area does not provide breeding habitat for many species (i.e., Swainson's hawks, northern harriers, peregrine falcons, or yellow warblers) these species are known from the region and have been documented overflying the site during migration or in the winter. These species may forage or rest on the project site. Similarly, many species of raptors winter in desert regions and become seasonal long term winter residents. Resident species are also affected by how they use the site. Some species of birds may be semi-permanent dwellers while nesting exhibiting strong site fidelity and territorial behavior; however these species may have much broader ranges during the winter.

Direct impacts to nesting and migratory birds would include the loss of foraging and nesting habitat and disturbance from construction activities. Construction during the breeding season could also result in displacement of breeding birds and abandonment of active nests. Small, well-hidden nests could be subject to loss during construction. Similarly, increased noise levels from heavy equipment, human presence, and exposure to fugitive dust could displace native birds or interfere with breeding. Habitat fragmentation, degradation and shifts in vegetative structure can affect nesting birds. In addition, noise and lighting effects have been demonstrated to adversely affect behavior, reproduction, and increase the risk of predation for some species.

Indirect impacts to nesting birds could include the loss of habitat due to the colonization of invasive plants and a disruption of breeding or foraging activity due to facility maintenance. Weed abatement, mirror washing, and maintenance activities would disrupt use of the area as foraging or nesting habitat.

During project construction, birds may nest on construction equipment, office trailers, and vehicles. Birds may also become trapped in any narrow vertical pipes left uncovered. Birds have been documented to descend into pipes either in search of nest cavities or food and become trapped in the pipes. Once inside the cavity, the birds cannot climb the slick interior or spread their wings to fly (Brean 2011). Vertical pipes have been found to be a significant threat to bird mortality in Nevada, where the wide-spread use of vertical PVC pipes for mining claims markers has led to the widespread mortality of thousands of birds that had become entrapped in them (American Bird Conservancy 2011). To date, the Nevada Department of Wildlife (NDOW) has found over 3,000 fatalities in 10,000 removed pipes (Brean 2011). California Audubon also indicated that open pipes kill birds indiscriminately and that both common birds and protected species have been found among the layers of dead birds in open pipes (http://ca.audubon.org/workinglands-pipes.php). A single pipe on a preserve in Kern County contained the remains of numerous birds (http://kern.audubon.org/Audubon_Kern_River_Preserve_death_pipes.pdf).

Implementation of the PSEGS project would result in the direct loss of habitat that supports breeding and foraging for a variety of resident and migratory birds. This includes the functional loss of approximately 3,948 acres of habitat including Sonoran creosote bush scrub; desert dry wash woodland; dunes; and ephemeral drainages. Although nesting habitat for most migratory birds would not be lost, the removal of foraging habitat, cover and roost sites for these species would be substantial. The project would have more substantial adverse effects to resident breeding birds, some of which include loggerhead shrike, California horned lark, and Le Conte's thrasher. For the PSEGS, the project owner has proposed to mow vegetation and allow some plants to persist within the heliostat field. However, remaining habitat would be degraded and nesting birds would be subject to ongoing maintenance activities. Le Conte's thrasher, loggerhead shrike and other wash-dependent species would in particular be affected by the loss of the cover, foraging and nesting opportunities provided by the structurally diverse and relatively lush desert dry wash woodland. Dry washes contain less than 5 percent of the Sonoran Desert's area, but are estimated to support 90 percent of Sonoran Desert birdlife (CalPIF 2006). The loss of habitat from the proposed project would be significant absent mitigation.

Condition of Certification **BIO-12,** the desert tortoise compensatory mitigation plan, **BIO-16a**, which would annually fund habitat enhancement and restoration, and **BIO-21,** mitigation for impacts to state waters, would offset the cumulative loss of habitat for these species.

Implementation of the PSEGS project would result in direct, indirect and operational effects to nesting birds. During construction it is expected that most birds would disperse to adjacent habitat during initial vegetation clearance. However, if site grading, brush removal, or construction occurs during the nesting season, bird nests may be destroyed, including eggs or nestling birds. Ground nesting species such as night hawks, poorwills, roadrunners, and horned lark, and various shrub nesters may disproportionally affected.

Noise during construction may adversely affect bird nesting success. For most common species, staff concludes that this impact would be less than significant, but staff believes that it could significantly affect breeding habitat suitability for native birds, including special-status species. The loss of active bird nests or young is regulated by the federal Migratory Bird Treaty Act and Fish and Game Code section 3503, which protects active nests or eggs of California birds. Mitigation measures to avoid and minimize impacts to nesting are contained in Conditions of Certification **BIO-8** (Impact Avoidance and Minimization Measures); **BIO-15** (Pre-construction Nest Surveys), which describes guidelines for performing pre-construction surveys; **BIO-16a,** (Avian Enhancement and Conservation Plan)**,** which would implement funding toward habitat restoration and enhancement; and **BIO-16b** (Avian Avian and Bat Protection Plan) which provides a mechanism to monitor for bird collisions and implement adaptive management measures to minimize impacts. Implementation of staff's proposed conditions of certification would avoid direct impacts to nests, eggs, or young of migratory birds, and would minimize the impacts to less than significant levels for construction disturbance to resident and migratory birds. Potential special status and migratory bird impacts attributable to operation of the project are discussed below for all avian species, in the subsection entitled "Operational Impacts to Flighted Species."

Bats

The project would adversely affect bats through the removal of foraging habitat. The entire project site is expected to support bat foraging, in particular desert dry washes, where increased presence of vegetation, especially microphyll woodland, would support a broad variety of insects prey items. Approximately 850 acres of agricultural development (jojoba and palm farms) occur immediately adjacent the project. Associated with these farms are two private pools, approximately two acres or less in size. Agriculture may support foraging by the species if they support appropriate insect fauna, because the plantation is irrigated and it is expected to support a host of unexpected insect species. The presence of an evaporation pond within the project may similarly serve as an attractant for insects, and therefore may attract bats for foraging.

Loss of roosting habitat is another impact of the PSEGS project. Suitable roosting habitat for bats within the modified project and linear features includes washes with large trees within the southern portions of the modified project in the central wash, and around the transmission line and substation. Large washes with riparian vegetation meander through the southern portion of the buffer around the transmission line and substation south of I-10. Some large trees are located within the southern portion of the central wash in the modified project. Large trees with exfoliating bark, tree cavities, rock crevices, bridges, and other locations may provide suitable roosting habitat for a variety of bat species within the modified project and buffer. Bat roosts are known to occur in the project area. Bat roosts are also known to occur in Eagles Nest Mine (Little Maria Mountains) and Paymaster Mine in the project vicinity (LaPre pers. comm.). Additionally, the taller ornamental palm trees within the plantation may be utilized for roosting by bats including Western yellow bats.

The majority of adverse impacts to bat populations in the region result from disturbance of roosting or hibernation sites, especially where large numbers of bats congregate; physical closures of old mine shafts, which eliminates roosting habitat; elimination of riparian or desert wash microphyll vegetation which is often productive foraging habitat; more general habitat loss or land use conversion; and agricultural pesticide use which may poison bats or eliminate their prey-base (Pierson & Rainey 1998; Gannon 2003).

The project owner has suggested that impacts to bats will be limited to loss of forage. However, staff believes that impacts to bats may be caused by collisions with stationary project features such as the tower and heliostats, as well as moving objects such as construction equipment and other moving vehicles, particularly during periods of night time construction. Other onsite practices that increase available water, such as mirror washing, dust control, and leaks/spills when filling water trucks may attract insects, in turn attracting bats to the site. Increased vehicle presence on access roads and the I-10 freeway may also adversely impact bats. Bats are known to collide with stationary objects, such as windows and television towers; and of these collisions, many involved illuminated objects that should have been detected by vision, if not certainly by echolocation (Orbach and Fenton, 2010). Bats do not maneuver solely using echolocation, in fact, some bats have very good eyesight, such as *Macrotus californicus*, a species that feeds by gleaning insects, and therefore would need to clearly see them against foliage in order to eat them. There are several species of bats likely foraging at the site that also feed by gleaning, such as the pallid bat. While bat vision is adapted for long-distance use, and even exceeds echolocation ranges (Suthers

1970), the short-range visual capability of bats is poorly understood (Orbach and Fenton, 2010).

While much documentation of road-kill mortality has focused on terrestrial mammals, birds, reptiles and amphibians, the impact of highways on bat populations has only recently been identified (Kiefer et al. 1995, Wray et al. 2005, Lesinski 2007, López et al. 2007). During studies along a highway conducted in 2009 (Russell et al. 2009) found carcasses of *Myotis lucifugus* and *Myotis sodalis* that were killed by vehicles, and the authors concluded that “most likely does not reflect the true impact of highway traffic on these bat colonies.” During telemetry studies in 2000 (Butchkoski & Hassinger 2002), bats were observed crossing US Route 22 as they emerged from the roosts at dusk, and noted road-killed bats.

A year’s worth of data was collected along a section of road, revealing 61 road-killed bats belonging to seven species (Lesinski et al 2008). The frequency of detection of carcasses varied both seasonally and by the type of habitat surrounding the roadside. Interestingly, species that were struck ranged in typical flight elevations, and the authors’ hypothesis that low-flying species would be killed more frequently was not confirmed.

Conditions of Certification **BIO-1** through **BIO-8** from the PSPP Commission Decision as modified by staff in this FSA would minimize overall project impacts to habitat, require worker training to minimize disturbances, biological monitoring and reporting of project disturbances, and compensate for habitat loss through the acquisition and management of offsite lands, including offset for dry desert wash habitat at a 3:1 ratio. Staff concludes that these measures would effectively mitigate foraging habitat impacts for special-status bats.

As discussed in the cumulative impact subsection, staff considers the project to be a substantial contributor to the cumulative loss habitat for the NECO planning area biological resources, including habitat for these special-status bats. Condition of Certification **BIO-12**, the desert tortoise compensatory mitigation plan and **BIO-21**, mitigation for impacts to state waters, would offset the cumulative loss of habitat for these species. For a discussion of potential bat impacts attributable to operation of the project, as well as a discussion of mitigation, refer to the following subsection titled “Operational Impacts to Flighted Species”.

American Badger and Desert Kit Fox

Construction of the project could kill or injure American badgers by crushing individuals with heavy equipment or could entomb them within a den. Construction activities could also result in disturbance or harassment of individuals . Staff has proposed deleting Condition of Certification **BIO-17** from the PSPP Commission Decision and replacing it with a new Condition of Certification **BIO-17** which would require development of an American Badger and Kit Fox Management Plan that includes, but is not limited to, conducting pre-construction baseline surveys and expanded avoidance measures to protect badgers and kit fox during construction and operation.

The desert kit fox is not a special-status species, but it is protected under Title 14, California Code of Regulations section 460, and potential impacts to individuals of this species must be avoided. Desert kit fox sign was detected on the PSPP project site during surveys conducted in 2009 and 2010, and the site includes suitable foraging and denning habitat for this species. This species has been detected on the site as recently as spring 2013 (CDFW 2013c).

In 2011, an outbreak of canine distemper virus (CDV) was identified in the desert kit fox population within or adjacent to the Genesis Solar Energy Project (GSEP) project site, located approximately 10 miles east of the PSEGS site. This disease had not been reported previously in wild desert kit foxes (Clifford 2011a). Additional CDV deaths were detected at the Colorado River substation approximately 11 miles south of the GSEP site in February 2012 and additional foxes shedding the virus were detected near both sites (Clifford 2013).To date 22 kit fox carcasses submitted from the solar projects have been necropsied and 11 of these deaths (50%) were due to distemper. The last known distemper death was detected in May 2012 near the Colorado River substation (Clifford 2013). It is thought that stress from animals being passively relocated or disturbed may put animals at greater risk of contracting the disease if conducted in an area experiencing or adjacent to a CDV outbreak, as CDV infection decreases immune function (Clifford 2011b). In addition, passive relocation activities in an area experiencing a CDV outbreak may result in increased movement of animals shedding the virus and thereby increase transmission into new areas.

CDFW Wildlife Investigations Laboratory have monitored, via telemetry and remote cameras, the survival of a sample ranging from 9-18 radio collared foxes living in close proximity to each site and their dens at four study sites since late January 2012 in order to better detect cases of CDV (Clifford 2013). Consultants for the Desert Sunlight project, Colorado substation, and GSEP are monitoring survival of the collared foxes near their respective sites while the Palen site is monitored by a CDFW wildlife technician. No distemper caused mortalities have been detected in monitored foxes near the PSEGS or Desert Sunlight sites located in the western portion of the Riverside East Solar Energy Zone (solar zone). However, testing of live foxes in 2012 and 2013 shows that some foxes in this area have been exposed to canine distemper virus as antibodies against the virus have been detected in their serum. Thus it is likely that canine distemper virus is also present in the western portion of the solar zone.

In order to address the concern of increasing the risk of spreading canine distemper virus within the Palen desert kit fox population, CDFW and BLM coordinated with staff to revise **BIO-17** based on measures developed for the GSEP project. In addition CDFW and BLM coordinated with staff to develop a CDFW-led Proposed Desert Kit Fox Health Monitoring and Mitigation Program. The CDFW-led Proposed Desert Kit Fox Health Monitoring and Mitigation Program would be initiated by CDFW potentially by the end of 2013 and project owners could opt to pay a fee to participate in the program. Program goals include the following:

- By minimizing the number of clinical cases (and therefore deaths) to the greatest extent possible and reducing the risk of disease spread through trapping and testing, radio collaring, monitoring, and selective vaccination of animals targeted for relocation.

- By utilizing best practices during relocation events to minimize stress to the greatest extent possible and by systematically evaluating relocation outcomes to determine factors associated with successful vs. unsuccessful outcomes.
- By providing treatment and rehabilitation for foxes found sick or injured due to construction site activities.
- By definitively determining the cause of death whenever possible for foxes that die or are found dead in the project impact area so that projects can address and potentially avoid any causes of death that are construction related.

Construction of the PSEGS project could kill or injure desert kit fox by crushing individuals with heavy equipment, or could entomb them within a den if avoidance measures are not implemented. Construction activities could also result in disturbance or harassment of individuals or introduction of foxes into populations with CDV or increase risk of contracting the disease. Staff's proposed Condition of Certification **BIO-17**, which replaces **BIO-17** from the PSPP Commission Decision in its entirety, requires development of an American Badger and Desert Kit Fox Mitigation and Monitoring Plan. During a workshop held with the project owner and other parties, the content of **BIO-17** was discussed and the project owner provided comments on the condition as part of comment on the PSA. Staff's proposed Condition of Certification **BIO-17** was further revised to include the option for the project owner to participate in the CDFW-led Proposed Desert Kit Fox Health Monitoring and Mitigation Program. The revised Condition of Certification **BIO-17**, which still requires development of an American Badger and Desert Kit Fox Mitigation and Monitoring Plan that includes, but is not limited to, procedures and impact avoidance measures for conducting pre-construction baseline surveys and avoidance measures to protect kit fox during construction and operation, would avoid this potential impact.

The PSEGS would permanently remove approximately 3,899 acres of foraging and denning habitat for American badgers and kit fox and would fragment and reduce the value of foraging and denning habitat adjacent to the project site. This habitat loss and degradation could adversely affect American badger and kit fox populations within the NECO planning area. As discussed in the cumulative impact subsection, staff considers the PSEGS project to be a substantial contributor to the cumulative loss of the NECO planning area biological resources, including American badgers and kit fox. Conditions of Certification **BIO-12**, the desert tortoise compensatory mitigation plan, and **BIO-21**, compensatory mitigation for state waters, would offset the loss of habitat for this species and reduce the impact to less-than-significant.

Nelson's Bighorn Sheep

The PSEGS site is not within any of the bighorn sheep connectivity corridors identified in the NECO; in addition the NECO identifies I-10 as a barrier to bighorn sheep movement (BLM CDD 2002). Staff concluded that the project site is not currently an important movement corridor because of the presence of I-10 and the width of the valley between suitable bighorn sheep habitat. The Society for Conservation of Bighorn Sheep has recommended a 1-mile buffer from the upper edge of any solar development to the base of the mountains to protect spring foraging habitat. The PSEGS site is over one mile from the base of either the Chuckwalla or Palen mountains. Barriers between the

Chuckwalla Mountains and the project site (I-10) and the Palen Mountains and the project site (sand dunes) further restrict the availability and usefulness of the project site for spring foraging habitat.

Also of interest are the potential impacts from project groundwater extraction to seeps, springs, or other water resources that are currently available to bighorn sheep that occupy the Palen Mountains. The prior project owner provided information (AECOM 2010a DR-S&W-193) about the closest water features, and concluded that groundwater extraction for the project would not affect these features. After reviewing the data provided in the Data Responses, staff agreed with the PSPP applicant that the PSPP project was unlikely to affect springs and seeps available for use by bighorn sheep. The PSEGS will not have any additional impacts on springs and seeps not already analyzed for the PSPP.

As discussed in the cumulative impacts section, the PSEGS project would not directly affect habitat within any NECO connectivity corridors or Wildlife Habitat Management Areas (WHMAs), and would not conflict with Desert Bighorn Sheep Conservation goals and objectives outlined in the NECO. In addition, staff has concluded that the project site does not represent significant direct or indirect impacts to bighorn sheep habitat connectivity or foraging.

Construction Noise

Construction activities would result in a temporary, although relatively long-term (34 months) increase in ambient noise level on the project site and in some adjacent habitat. Animals rely on hearing to avoid predators, obtain food, and communicate. Excessive construction noise could interfere with normal communication, potentially interfering with maintenance of contact between mated birds, obscuring warning and distress calls that signify predators and other threats, and affecting feeding behavior and protection of the young. High noise levels may also render an otherwise suitable nesting area unsuitable. Behavioral and physiological responses to noise and vibration have the potential to cause injury, energy loss (from movement away from noise source), a decrease in food intake, habitat avoidance and abandonment, and reproductive losses (Hunsaker 2001; National Park Service 1994).

Noise from operation of PSEGS and nighttime washing and maintenance activities of the heliostats could affect wildlife in adjacent habitats by interfering with breeding or foraging activities and movement patterns, causing animals to avoid areas adjacent to the project. This could disrupt foraging, breeding, sheltering, and other activities. However, lighting and noise from washing would disrupt nocturnal animals in adjacent habitat and those that remain within the project fence line. Staff considers noise effects to be of a concern for wildlife located in and adjacent to the project site.

The bighorn sheep WHMA, approximately 2.5 miles northeast of the PSEGS, is a sensitive noise receptor due to the presence of breeding Nelson’s bighorn sheep. Birds are also expected to nest in creosote scrub and desert dry wash woodland on the project site and on adjacent lands that border the site. Studies have shown that noise levels over 60 A-weighted decibels (dBA) can result in nest abandonment by birds and intense, long-lasting noise can mask bird calls, which can reduce reproductive success (Dooling and Popper 2007; Hunsaker 2001). Many bird species rely on vocalizations during the breeding season to attract a mate and noise from construction or operation could disturb nesting birds and other wildlife. Reijnen et al. (1995) demonstrated that for two species of European warbler (*Phylloscopus* spp.), sound levels between 26 dB(A) and 40 dB(A) reduced breeding density by up to 60 percent compared to areas without disturbance. Noise impact studies on bighorn sheep have not identified numerical noise impact thresholds. Weisenberger et al. (1996) found that bighorn sheep responded to aircraft over-flights (92-112 dBA) with increased heart rates and altered behavior; however, animal response decreased with increased exposure.

The project owner has not provided updated noise estimates to describe construction of the power towers or other facilities. Preliminary data from the project owner suggests noise levels would be similar to those described for the approved PSPP project. Assuming that construction noise is similar; the average construction noise of 85 dBA at 50 feet from the noise center and noise attenuation of 6 dBA per doubling of distance (Solar Millennium 2009a), normal construction noise would attenuate to about 60 dBA approximately 800 feet (0.15 mile) from the noise center. The majority of the construction activities would occur within the power blocks located approximately 3,750 feet (0.71 mile) from the project boundary. Therefore, it is anticipated that average construction noise levels would typically be less than 60 dBA in the bighorn sheep DWMA and surrounding the project site. The infrequent occasions when construction activities would occur near the project boundary and resultant noise levels would be temporarily elevated beyond 60 dBA surrounding the project would not significantly impact sensitive wildlife that occur in habitat adjacent to the PSEGS fence line. Animals that remain within the fence line would be subject to potentially significant noise effects.

Although average construction noise levels would usually attenuate to 60 dBA at the project boundary, unsilenced steam blows and pile driving produce short-term, sporadic, and loud noise that could substantially elevate noise levels in the bighorn sheep DWMA. The loudest proposed construction activity would be steam blows required to prepare a steam turbine for startup during the final phase before operation. This process cleans the piping and tubing which carry steam to the turbines; starting the turbines without cleaning these systems would destroy the turbine. High pressure steam blows require a series of short steam blows, lasting two or three minutes each, which would be performed several times daily over a period of two or three weeks. These steam blows can produce noise as loud as 130 dBA at a distance of 100 feet. This would attenuate to about 88 dBA at a distance of 2.5 miles from the project site, and 77 dBA at 9 miles from the project site. Silenced steam blows, however, are commonly reduced to 89 dBA at 50 feet, which would attenuate to less than 53 dBA at the project boundary. At this time the project owner has not provided information if this process would be the same for the PSEGS project. For the approved PSPP the prior project owner proposed to use a low-pressure technique for steam blows, which would release steam over a continuous period of about 36 hours and would result in noise levels of about 80 dBA at 100 feet and less than 50 dBA beyond the project boundary. Another relatively loud and short-term construction activity is pile driving. If required, noise from this activity could be expected to reach 101 dBA at a distance of 50 feet and attenuate to less than 59 dBA at a distance of 2.5 miles from the project site.

Elevated noise from steam blows and pile driving could adversely affect the breeding, roosting, or foraging activities of sensitive wildlife proximate to the project area. To minimize these potential noise impacts, Condition of Certification **BIO-8**, requires avoidance of loud construction activities (i.e., steam blowing and pile driving) that would result in noise levels over 65 dBA at potential wildlife breeding sites (such as dry desert wash woodland) between February 15 and April 15, the height of the bird breeding season. With implementation of this condition, impacts from project construction activities would be less-than-significant. Employing the low-pressure steam blow technique recommended by staff would further reduce noise levels and the potential for impacts to wildlife. For a complete analysis of construction noise impacts, refer to the **Noise** section of this FSA.

In order to efficiently produce and distribute concrete within the project site, the project owner will utilize a concrete batch plant for the PSEGS . The batch plant would have a similar impact as the concrete batch plant included as part of the project description for the PSPP. The PSPP would have had a concrete batch plant with a production capacity of 150 cubic yards per hour and would be expected to operate 10 hours per day, five days a week. Night operation of the batch plant would be required to overcome the difficulty of performing concrete placement in extremely high ambient temperatures.

The batch plant would be portable and would be moveable to a number of different locations to support current work activities but would occur entirely within the PSPP Project Disturbance Areas (Solar Millennium 2010p). The likely deployment locations for the produced concrete are the two power blocks and the project's main warehouse area. Batch plant noise levels would be approximately 90 decibels at 50 feet. The prior project owner stated that although noise levels would be slightly higher than the construction noise levels at the project site boundary assessed in the Application for Certification, noise levels from the concrete plant would attenuate over a greater distance since the plant would be located within the project boundaries (Galati & Blek 2010i).

The project owner states in the Petition to Amend that construction noise from the PSEGS is expected to be the same as for the PSPP. Therefore, staff assumes noise impacts from the concrete batch plant would be similar to those for the PSPP. Staff still believes that operation of the concrete plant at 90 decibels from the PSEGS project boundary could have negative effects to nesting birds and other wildlife during their breeding seasons. Operation of the batch plant for a ten hour period that spans into night-time hours at intermittent levels of up to 90 decibels could alter breeding, foraging, and other behaviors of wildlife such as small burrowing mammals, bats, nesting birds, especially nocturnal wildlife. With the implementation of site design measures and best management practices outlined in condition of certification **BIO-8** (Impact Avoidance and Minimization Measures), the impacts of additional, loud noise from the concrete batch plant to wildlife would be reduced to less-than-significant levels. If any additional impacts would occur staff will include additional analyses in the Final Staff Assessment

Operational Impacts to Flighted Species

The project would introduce several factors which could result in mortality, morbidity, and reduced reproductive success in birds and in bats, and to insects. Potential impacts of the operating facility to birds, bats, and insects include physical injury resulting from collision with power towers, heliostats, or other project infrastructure features; electrocution; and disorientation (disturbance from lighting, mirror reflection, etc.). Ocular damage, hyperthermia and, depending on period of exposure and level of flux, burning and other heat-caused damage to internal and external body parts, as well as residual damage (morbidity) may occur to bats, birds, or insects that enter the airspace over the heliostat field where elevated solar flux exists.

There are many factors that contribute to the potential risk of operational impacts (i.e., electrocution, collision, glare, or exposure to solar flux) to birds. In addition to weather, risk is a function of the birds ecological, physiological, and behavior characteristics. Some of these factors include when a bird is active (i.e., diurnal or nocturnal); the elevation at which a bird flies flies or migrates; flight and foraging behavior; the size or mass of the bird; bird color; localized residency pattern; and the period a bird is present in the region are other factors that effects risk. Each of these factors is considered below when assessing risk to a given species of bird from the operation of the PSEGS project.

For example, collision risk at night would be expected to increase for nocturnal species including migrants. Nocturnal migrants, which include many species of passerines, would be expected to have a higher collision risk and a lower risk from exposure to elevated levels of solar flux. Conversely, birds that are more active during periods of daylight may have an increased risk of flying into areas containing elevated levels of solar flux. For example many raptors and soaring birds rely on thermals to aid in flight; aerial foragers including swifts and swallows feed on flying insects and these species would be expected to have a higher risk from exposure to elevated levels of solar flux or glare.

However, in any natural system activity patterns may vary and species may be active during both diurnal and nocturnal periods.

Low flying birds or ground foragers including roadrunners are likely have a reduced risk from exposure to solar flux. Each of these effects is discussed in detail below.

Electrocution

Large raptors such as golden eagle, red-tailed hawk, and great-horned owl can be electrocuted by transmission lines when a bird’s wings simultaneously contact two conductors of different phases, or a conductor and a ground. This happens most frequently when a bird attempts to perch or take off from a structure with insufficient clearance between these elements. Electrocution can occur when horizontal separation is less than the wrist-to-wrist (flesh-to-flesh) distance of a bird’s wingspan or where vertical separation is less than a bird’s length from head-to-foot. Electrocution can also occur when birds perched side-by-side span the distance between these elements (APLIC 2006).

In addition, distribution lines that are less than 60 kV but greater than 1 kV pose an electrocution hazard for raptor species attempting to perch on the structure. The majority of bird electrocutions are caused by lines that are energized at voltage levels between 1-kV and 60-kV, and “the likelihood of electrocutions occurring at voltages greater than 60-kV is low” because phase-to-phase and phase-to-ground clearances for lines greater than 60-kV are typically sufficient to prevent bird electrocution (APLIC 2006).

The proposed transmission lines would be 230 kV and would be fitted on top of monopole structures are expected to be 120 feet in height and an average length of 1,100 feet between poles (Solar Millennium 2009a). The transmission line and pole fitting would be constructed in accordance with the guidelines of Institute of Electrical and Electronics Engineers (IEEE) Guide 524 “Guide to the Installation of Overhead Transmission Line Conductors” and would also follow the Suggested Practices for Avian Protection on Power Lines (APLIC 2006). Also, the lines would be insulated from the poles using porcelain insulators engineered for safe and reliable operation at a maximum operating voltage of 242-kV (Solar Millennium 2009a).

To minimize risk of electrocution, the project should impose a “raptor-friendly” construction design for the transmission line with conductor wire spacing greater than the wingspans of large birds to help prevent electrocution as described in Suggested Practices for Avian Protection on Power Lines (APLIC): The State of the Art in 2006 (APLIC 2006). Certification **BIO-8** requires above-ground transmission lines and all electrical components to be designed, installed, and maintained in accordance with APLIC guidelines to reduce the likelihood of large bird electrocutions and collisions. With the Implementation of proposed Condition of Certification **BIO-8**, the project transmission lines would not pose a significant electrocution threat to birds. Additionally, the project owner has proposed to conduct power line retrofits (Palen 2013a), and staff has incorporated this mitigation into Condition of Certification **BIO-16a**.

Collisions, Lighting, and Glare

The modified project would include two power towers, heliostat fields, and ancillary equipment including boilers and control facilities. Onsite facilities range from a height of 750 feet (power towers), to 120 feet for boilers and the air-cooled condenser unit. Each of the heliostats is approximately 12 feet high. The remaining facilities are generally less than 80 feet in height (Palen 2013a). All of these features would pose a potential collision risk for birds. Birds are known to collide with communications towers, transmission lines, and other elevated structures including buildings. Estimates of the number of bird fatalities specifically attributable to interactions with utility structures vary considerably. Nationwide, it is estimated that hundreds of thousands to as many as 175 million birds are lost annually to fatal collisions with transmission and distribution lines (Erickson et al., 2001). Numerous studies have also documented extensive avian collision mortality associated with buildings and similar structures such as smokestacks or monuments (*ibid*). In California, even general estimates are unavailable, although it is plausible that such collisions result in the deaths of hundreds of thousands of birds each year (Hunting, 2002).

Collisions typically result when the structures are invisible (e.g., bare power lines or guy wires at night), deceptive (e.g., glazing and reflective glare), or confusing (e.g., light refraction or reflection from mist) (Jaroslow 1979). Collision rates generally increase in low light conditions, during strong winds, and during panic flushes when birds are startled by a disturbance or are fleeing from danger. The Avian Power Line Interaction Committee (APLIC) has determined that collisions are more probable near wetlands, within valleys that are bisected by power lines, and within narrow passes where power lines run perpendicular to flight paths (APLIC 1996). Passerines (e.g., songbirds) and waterfowl (e.g., ducks) are known to collide with wires (APLIC 2006), particularly during nocturnal migrations or poor weather conditions (Avery et al. 1978).

Diurnal birds, or those active during daylight hours, could also collide with tall structures. Staff has concluded that the risk of such impacts is low. Most diurnal bird collisions with tall structures are associated with guyed towers in poor visibility conditions such as fog or inclement weather (Manville 2001). The PSEGS does not include guyed structures.

The project would have two evaporation ponds (approximately two acres each) that could attract birds to the site. Existing date palm and jojoba farms and other agricultural practices in the area may also be an attractant to birds, subjecting them to greater risk of collisions.

To date, little is known regarding the avian response to glare from solar technology. However, it is likely that glare will affect birds to some degree. In the same way that large mirrored buildings may be confused by birds as open sky; the mirrors will reflect light and take on the color of the image being reflected, and also polarize light, as discussed further below. This may result in birds confusing the heliostats as either open sky or water and increase the collision risk. Staff has reviewed research by McCrary et al. (1986) which quantified bird mortality, including collisions, at a 10 MW pilot SRSG (power tower) pilot facility (Solar One) near Daggett, California. The Solar One facility consisted of a 79-acre heliostat field and a 282-foot solar receiver tower. McCrary et al. documented 70 bird fatalities during the course of a 40-week study, and the total average mortality rate was 1.9 to 2.3 birds per week. Staff is not aware of any other scientific study of bird mortality at any other comparable generator. The authors partially attributed these collisions to high numbers of birds attracted to the adjacent evaporation ponds and agricultural fields. Anecdotal reports of collisions are becoming more common as large-scale photovoltaic (PV) and concentrating solar power facilities are developed in the desert. Similar to heliostat mirrors, photovoltaic panels can reflect light and may be confused by birds as water or sky. Although PV panels absorb solar radiation and are typically less reflective than heliostat panels they may still pose a collision risk to birds or bats. At both the Desert Sunlight Solar Farm project site, and the Genesis Solar Electric Project, birds and bats have been found injured or dead on the site, some of which appeared to be suffering from heat exhaustion. Of these, the majority consisted of waterbirds, species that would be expected as migrants not typically found foraging in desert habitat, and whose presence would not have been expected to occur at the project site (Dr. Joel Pagel, personal communication). A federally endangered species, the Yuma clapper rail, was among the recorded mortalities.

Lighting also plays a substantial role in collision risk because lights can attract nocturnal migrant songbirds, and major bird kill events have been reported at lighted communications towers (Manville 2001), with most kills from towers higher than 300 to 500 feet (Kerlinger 2004). Disruption of birds' migratory path, such as happens during storm events can cause birds to fly at lower heights, and be at risk of collision with the tower or other project facilities. Many of the avian fatalities at communications towers and other tall structures have been associated with steady-burning, red incandescent L-810 lights, which seem to attract birds (Gehring et al. 2009). Longcore et al. (2008) concluded that use of strobe or flashing lights on towers resulted in less bird aggregation, and, by extension, lower bird mortality, than use of steady burning lights. Bright night lighting close to the ground at the project site could also attract bats and disturb wildlife that occurs adjacent to the project site (e.g., nesting birds, foraging mammals, and flying insects). Another study determined that flashing of the normally steady-burning red light (the FAA type L-810 fixture) was considered acceptable, and further determined that on tall communication towers, the steady-burning lights could be extinguished altogether so long as the remaining lights flashed simultaneously between 27 and 33 flashes per minute. Flashing at faster speeds did not appear to offer any value because the light fixtures were not off long enough for to reduce the attractant value to migratory birds (Patterson 2012).

The project's transmission lines may pose a collision risk to bats. Although many studies have quantified bird strikes with transmission lines, analogous information on bats is very limited (Manville 2001). Collisions with distribution, collector or feeder lines will likely occur to some degree, however collision risk is not thought to pose a significant risk to bats in the project area. The most likely collision risk for bats is associated with vehicle or equipment as bats forage near roads or work areas.

Installation of heliostats could also cause an increase in Polarized Light Pollution (PLP) which typically occurs from light reflecting off of dark colored anthropogenic structures, and been demonstrated to be generated from even low-reflectance photovoltaic panels (Horvath et al. 2009). It is unknown to what extant this phenomenon will occur from the heliostats. According to Horvath et al., PLP caused by anthropogenic structures can alter the ability of wildlife to seek out suitable habitat and elude or detect the presence of predators (Horvath et al. 2010). It has also been documented that PLP can affect the ability to detect natural polarized light patterns in the sky which can negatively affect navigation ability and ultimately affect dispersal and reproduction (Horvath et al. 2009). Polarizing surfaces are also known to disrupt insect behavior, causing some insects to react as though the surface is water, and depositing eggs on polarizing surfaces (Horvath et al. 2009). Horvath et al (2009) determined that minimization of polarizing effects was possible by adding white grids onto solar panels, or otherwise minimizing the solar active area. The extent to which heliostats could serve as an attractant is not known.

Wagner et al. (1982) documented insect kills at a much smaller facility, Solar One, in excess of up 800 insects in under a minute, but the methods the authors used to make this estimate is unclear. The presence of insects may serve as an attractant to some species of birds and bats on the project site.

There is uncertainty regarding how many birds may be killed by collisions with project features, but bird mortality is expected. The significance of such mortality, in a CEQA context, is uncertain, and would vary depending on the number and species involved.

To minimize this risk of collision and disturbance to wildlife from lights, Condition of Certification **BIO-8** specifies that the lighting atop the towers be flashing strobe lights rather than steady burning lights, and that lighting be shielded, directed downward, and turned off when not needed. The project owner has proposed use of FAA lighting systems on the project, using only red lights at night with the longest permissible interval between flashes and the shortest flash duration permissible, which would further reduce the potential for nocturnal strikes. Staff has incorporated these measures into proposed Condition of Certification **VIS-3**, which directs the use, placement, and minimization of all lighting. Condition of Certification **BIO-16b**, which requires development of an Avian and Bat Protection Plan, would require the project owner to monitor, record, and report dead or injured birds found within the project footprint, and if feasible, to perform searches outside the project footprint as well. The plan would also require the implementation of remedial actions including the placement of aerial markers, ribbons, or other devices to reduce bird mortality. Monitoring of operational impacts for seasonal factors, and data on species of birds affected, and types of injuries or mortalities, requested by the USFWS, are considered crucial in understanding operational impacts, bird behavior, responses to stresses, and identifying and implementing measures to avoid, minimize, or mitigate impacts. However, residual impacts to avian species may exist after implementation of the staff recommended conditions of certification. Condition **BIO-16b** also requires monitoring of bird mortality due to glare. Staff concludes that the Avian and Bat Protection Plan and mortality monitoring as recommended in Condition of Certification **BIO-16b** would effectively determine rates of bird and bat mortality from collisions with structures. Condition of Certification **BIO-16a** would implement annual funding for avian and bat conservation efforts, effectively improving habitat for birds and bats. It may not be feasible to accurately determine the rate of latent mortality, when mortality occurs at a time and place removed from the project site.

Solar Energy Flux

Operation of the project would concentrate the sun's radiant energy (flux or solar flux) over the heliostat field. Flux levels increase approaching the power towers, and occupy the airspace over the heliostat fields. Any species of bird, bat, or insect that enter this airspace and is exposed to concentrated solar flux are at risk of injury, latent mortality on or off the project site, or mortality within the project footprint. The type and severity of damage experienced is not predictable; however, it is directly linked to the duration of exposure and the intensity of the flux encountered. While safe limits of flux have been established for humans, and the adverse effects of exposure well documented, little information exists to help staff understand what levels of flux may be safe for bats, birds, and insects.

Thresholds for solar flux exposure have been established for humans, and range from 1.42kW/m^2 (24CFR, Section 51.204 Appendix II) to 5kW/m^2 (49CFR Part 193). No published threshold for avian exposure has previously been identified. Exposure to solar flux has the potential to result in direct and indirect effects to birds by damaging their eyes, including the loss of sight; burning or singeing feathers; compromising the molecular structure of feathers (i.e., non-visible damage); and secondary, non-visible physiological changes including elevated body temperatures or thermal stress. In some circumstances exposure to elevated levels of solar energy flux (see **APPENDIX BIO1)** may result in the death of the bird either immediately or within a short period of time following exposure. The potential for injury depends on a variety of factors including the size and type of bird; length of exposure; and the level of solar energy flux. Staff has formulated a thermodynamic model to assist in evaluating impacts from exposure to elevated solar flux (see **APPENDIX BIO1**).

This model establishes a theoretical level of safe exposure for avian species (excluding bats and insects), at no more than a minute of exposure at 5kW/m^2. Solar flux will reach highest concentrations near the tower, likely approaching 500kW/m^2, as based on information filed for two separate BrightSource projects: the Rio Mesa Solar Electric Generating Facility (RMSEGF) and the Hidden Hills Solar Electric Generating System (HHSEGS). Staff assumed that flux fields created by PSEGS, would be essentially the same as the Rio Mesa Solar Electric Generating Facility, which is based on the same proprietary technology.

McCrary et al. (1986) found that 13 of the bird carcasses (19 percent) at the Solar One facility had been burned, reporting that the "heavily singed flight and contour feathers indicated that the birds burned to death," see **APPENDIX BIO2**, Figure 7. The authors interpreted these mortalities as the result of birds flying through that facility's standby points (i.e., areas of concentrated solar energy) though they did not observe the incidents, and that mortalities may have been caused by flying within elevated flux levels surrounding the SRSG during normal operation. Risk of burning was evidently higher for aerial foragers (swifts and swallows) because of their feeding behavior. The McCrary study was based on systematic searches of the 32 hectare (79 acre) Solar One site but not beyond the site boundaries. Thus, if any birds were injured but were able to fly beyond the site's boundaries (about 1,200 ft from the receiver tower), they would not have been found by the field biologists and could have been scavenged before being observed. For this reason, staff believes that actual mortality from burning may have been higher than reported. It is also possible that birds considered collision victims had suffered damage to flight feathers such that birds were unable to fly, or had experienced damage to the eyes and became disoriented, resulting in collision with the heliostats. However, the authors did not perform microscopic examination of feather structure or eyes that would make this determination possible.

Risk to Avian Species

The importance of migration to avian survivorship has been generally recognized for more than two centuries (Bewick 1797) and its significance has received even greater attention in the decades since, especially during the latter years of the 20th century. Carlisle et al (2009) suggest there is increasing recognition that migration is likely the most limiting time of year for migratory birds. It is during migration that the greatest number of bird species and individuals would be expected to pass through the PSEGS project area. Additionally, movement characteristics of migratory birds (for example: flocking, streaming, utilization of stopover locations, and responses to extreme weather) render them vulnerable to a host natural and anthropogenic risks along the way. Mortality rates "may be 15 times higher than those during the breeding and wintering periods when the bird is stationary" (Sillett and Holmes 2002). Thus exposing birds to additional risks during migration may have even greater significance relative to individual and species survivorship (at least at the meta-population or evolutionary significant unit levels). Although several features of the PSEGS facility impose additional threats that were not found with the PSPP (e.g., power towers, large mirror arrays; generation tie-lines), the virtually invisible but very large fields of elevated solar flux may be the greatest of these threats to migrant and resident birds.

There are more than 150 resident and/or spring migrant bird species that may occur at or near the PSEGS project site or Chuckwalla Valley. Some species have a high probability of occurrence in the region (i.e., neotropical song birds) although they occur in the project area for a limited period of time (i.e., during migratory periods); while others are year round residents. The risk to resident and migratory birds is a function of several factors, including: what species pass through the project area; which species have a high probability of occurring there in migration; and which species have the highest probability of experiencing adverse consequences resulting from exposure to elevated levels of solar flux. By investigating resident and spring migrants' natural history traits, including: whether they are daytime or nighttime migrants; known flight characteristics (e.g., whether or not they soar, use thermal air currents, or move in slow and steady or fast flight); their social patterns (e.g., whether a species moves in a flock, an amorphous stream, or as individuals); and whether feeding occurs during stopovers or in flight.

The physical impacts to birds caused by exposure to solar flux will depend on the length of time spent in the solar flux field and at what level intensity the bird flies through (McCrary et al 1986; Santolo unpubl. data). Shorter exposures of limited intensity are less harmful than longer exposures at higher intensities. In **APPENDIX BIO1**, staff combined occurrence potential with each species' natural history to predict which species would have the highest probability of suffering flux-related adverse effects and in what relative numbers.

Based on this information, staff has described the potential risk to various groups of birds. Generally speaking diurnal birds that exhibit flight patterns that place them in the highest potential concentrations of solar flux would be expected to be greater risk. However, some nocturnal migrants are expected to practice daytime migrations (e.g., as opposed to persisting at migratory stopover locations) or occur in the project area during daylight as a result of extreme weather conditions – high winds being one of the most prevalent in southern California deserts.

Species with the greatest potential to suffer adverse effects resulting from exposure to elevated levels of solar flux are expected to include members of two families, swallows (Family: Hirundinidae) and swifts (Family: Apodidae). There is existing documentation for the vulnerability of these families from previous studies at solar power tower energy generating facilities (McCrary et al 1986). These birds are diurnal migrants; they occur in large numbers throughout southern California deserts and have been documented at the Palen site. In addition, the period over which these species' migrations occur is lengthy (i.e. the period between earliest and latest movements spans several months); they move at relatively slow speeds in flight (12 – 20 mph) and at modest heights (between 100 and 1000 feet) above the desert floor typically associated with broad streams. Individuals may feed while moving, especially if a food source (flying insects) is found opportunistically, which may increase the amount of time spent within a limited airspace. Vaux's swift (*Chaetura vauxi*), would have similar risk patterns as swallows; however, the Vaux's swift typically migrates through a more limited time period and often migrates in large aggregates. This latter quality renders the Vaux's swift a species that could potentially suffer catastrophic, single-incident adverse consequences in the event a large migratory pulse encounters a region of elevated solar flux.

Turkey vulture (*Cathartes aura*; Family: Cathartidae), which occurs as a migrant as well as a winter and spring resident in the project area is a highly vulnerable species due to its overall slow flight progress and reliance on thermal currents. This species has been documented on the project site during surveys conducted by the project owner. The vulnerability of this species is due to slow flight speed, static soaring flight pattern (i.e., they rarely wing-flap and are obligate soaring migrants) that often follow circuitous flight paths (Mandela et al 2008). This species commonly occurs within the range of elevations in which solar flux will be generated.

Doves (Family: Columbidae) of two species, the mourning dove (*Zenaida macroura*) and the white-winged dove (*Zenaida asiatica*) would be subject to risk. These two species occur in large numbers throughout southern California deserts and are common migrants in the vicinity of the project area. They migrate during the day; the migration period is lengthy; their migratory flights occur in loosely-associated, broad streams; and individuals may feed opportunistically along the migration route (e.g., they may stop to feed daily). Doves migrate at relatively high speeds - they are capable of sustained speeds of around 55 m/h (88 km/h) - but typically at modest heights (between 100 and 1000 feet) above the desert floor in flights that may be periodically interrupted in order to feed on the ground. Doves' flight patterns are often highly erratic and typically non-linear rendering them vulnerable to solar flux in spite of their rapid flight.

Hummingbirds (Family: Trochilidae), including Anna's hummingbird (*Calypte anna*), Costa's hummingbird (*Calypte costae*), calliope hummingbird (*Selasphorus calliope*), and black-chinned hummingbird (*Archilochus alexandri*) are at extreme risk during migration because they migrate during the day; must feed daily; and must locate suitable nighttime refugia. Their small size puts them at heightened risk relative to all other migrants.

Several hawks (accipiters, harriers, and buteos; Family: Accipitridae) including the Coopers' hawk (*Accipiter cooperi*), sharp-shinned hawk (*Accipiter striatus*), Swainson's hawk (*Buteo swainsoni*), and northern harrier (*Circus cyaneus*) rank relatively high in terms of risk from exposure to elevated levels of solar flux. All of these are diurnal migrants whose documented occurrence in the project area, flight patterns, migration speed, and opportunistic feeding strategies render them vulnerable to regions of generated flux for significant periods when in migration. Two large buteos, the red-tailed hawk (*Buteo jamaicensis*) and the ferruginous hawk *(Buteo regalis*), which are also diurnal migrants would likely be at a lower risk primarily due to their lower expected numbers at the project site.

Several occurring flycatchers (Family: Tyrannidae) including the state endangered northwestern willow flycatcher (*Empidonax traillii brewsteri*), western kingbird (*Tyrannus verticalis*), gray flycatcher (*Empidonax wrightii*), western flycatcher (*Empidonax difficilis*), and ash-throated flycatcher (*Myiarchus cinerascens*) – all of which are primarily nighttime migrants – exhibit extensive daytime movements during which feeding is an important behavior. Although their nocturnal migration habits minimize overall threat of exposure to elevated levels of solar flux, their documented occurrence, flight patterns, speed during diurnal movements, and requisite fly-catching/hawking feeding behaviors render them vulnerable to some degree. The common raven (*Corvus corax*) is ranked similarly in many threat categories with the higher risk species turkey vulture.

Another species that may be at risk is the house finch (*Haemorhous mexicanus*; Family: Fringillidae). Though not an obligatory migrant, this species may occur in small numbers as migrants, and is a regular fall, winter, and spring resident that probably includes a breeding population. Local meta-populations of house finch families may swell into post-breeding agglomerations of between scores and hundreds. Movements of these groups may place relatively large numbers of individuals at risk from exposure to elevated levels of solar flux.

Less predictable species, for which adequate occurrence data are lacking, that may be at risk because of their flight patterns and behaviors include: thrashers (Family: Mimidae), especially the sage thrasher (*Oreoscoptes montanus*); nighthawks (Family: Caprimulgidae), especially the lesser nighthawk (*Chordeiles acutipennis*); Grosbeaks (Family: Cardinalidae), especially the black-headed grosbeak (*Pheucticus melanocephalus*), several species of blackbirds (Family: Icteridae), including the red-winged blackbird (*Agelaius phoeniceus*) and the Brewer's blackbird (*Euphagus cyanocephalus*); and owls (Family: Strigidae) including burrowing owl (*Athene cunicularia*), short-eared owl (*Asio flammeus*), and long-eared owl (*Asio otus*).

Conversely, some birds will likely be at lower risk from exposure. Resident species such as the verdin (*Auriparus flaviceps*), black-tailed gnatcatcher (*Polioptila melanura*), Gambel's quail (*Callipepla gambelii*) along with many ground-feeding, seed-eating, winter resident/nocturnal spring migrant species such as Brewer's sparrow (*Spizella breweri*), horned lark (*Eremophila alpestris*), and black-throated sparrow (*Amphispiza bilineata*), may be less likely to succumb to flux-related impacts due to several factors. Their nocturnal migration, ground-based feeding, consequent low-elevation flight (i.e. relative to projected height above ground or areas of expected elevated levels of solar flux), and loss of foraging habitats within the project area may make them less vulnerable from the operation of the PSEGS.

As described above, staff believes that extended exposure to high-intensity solar flux would likely kill birds. Staff also believes that shorter exposures to high-intensity solar flux would cause tissue or feather damage that could impair flight or vision or cause physiological effects that ultimately cause or contribute to mortality from other causes (e.g., reduce ability to forage, escape from predators, or thermoregulate). Staff believes that longer exposures to lower-intensity solar flux levels are likely to cause feather damage or physiological effects. The following discussion is intended to illustrate the role of feathers in birds, and the types of behavioral or physiological functions that may be impaired or destroyed following exposure to concentrated solar flux in excess of safe thresholds, estimated to be no more than one minute's exposure at $4kW/m^2$.

Damage to Plumage and Flight Feathers

A birds' plumage is well adapted to its environment, and serves a variety of roles, such as: flight, thermoregulation, protection from impact, defense, incubating eggs and young, tactile hunting, seasonal displays such as breeding plumage in male birds, and camouflage from predators (Raptor Research Foundation, 2012). When exposed to elevated levels of solar radiation, plumage may show the first signs of damage. Exposed skin, such as feet and legs, and eyes are also expected to be highly sensitive to elevated solar radiation. Little information is available to help staff assess how skin or eyes are affected by elevated levels of flux, nor is information available to help staff evaluate the potential physiological effects of overheating. Eye exposure is further discussed below in the section entitled "Irradiance". Staff has even less data regarding how bats or insects may respond to exposure to solar flux. All living organisms have general tolerance levels. Staff considers it highly likely that the level of flux, in combination with the size of the flux field, may exceed the level of tolerance for organisms that enter the flux field.

Surface feathers, or contour feathers, cover and streamline the remainder of the body and also contribute to aerodynamics. Insulating feathers are found beneath the contour feathers. Damage to insulating feathers may affect the bird's thermoregulation (body temperature control). A bird's plumage is critical to insulating the bird from the environment, and is influenced by color and structure of the plumage (Wolf and Walsberg 2000).

Bird feathers grow from lines, or tracts, pterylae (Raptor Research Foundation 2012) with bare patches of skin in between, called apteria (Ibid.) There are several types of feathers, including fluffy down insulating feathers (which are used in the manufacture of pillows); semi-plumes, which shape and insulate the bird, bristles, usually around the face and used in feeding; filoplumes, used to feel and sense vibrations, and contour feathers, which add shape to a bird. A diagram of a feather is depicted in **APPENDIX BIO2**, Figure 6. Feathers are comprised of a central shaft, or rachis, and barbs come off the rachis at an approximately 45 degree angle (45°). Between barbs are two sets of barbules, microscopic filaments that connect each barb (Doctors Foster and Smith 2012, Muller and Patone 1998). Barbules have even smaller microstructures, called barbicels, which hooks the barbules together. These barbules act like a zipper, connecting the barbs and making them airtight and able to withstand air resistance during flight (Ibid., see also Muller and Patone 1998). This microstructure of a feather, consisting of barbules and barbicels, comprises the majority of the feather, and is not visible to the naked eye. These components, so critical to flight, are used in establishing a safe avian exposure criteria (see **APPENDIX BIO1**).

Flight feathers may be one of the most important feathers at risk from exposure to high levels of solar energy. The long relatively rigid feathers of the wings and tail (flight feathers) are the bird's aerodynamic flight surfaces. These feathers provide lift and are adapted to the body style of the bird, that is, raptors have long wings and long pointed flight feathers that allow for catching air current and generating great speed, while other birds have wing lengths and flight feather construction that allow for various flight patterns and behaviors. The feathers used for flight include primary, secondary, and tertiary feathers which are located along the arm of the bird, while the large tail feathers are called retrices. Feathers are “instrumental in flying [and] they play a critical role in temperature regulation” (Sibley 2002), and are considered the most valuable asset a bird has (Raptor Research Foundation 2012).

Feathers damaged by concentrated solar flux could only be replaced during a molt, which generally occurs only once per year. Birds have no physiological means to replace damaged feathers other than seasonal molting. Molting generally occurs during or after the breeding season (Raptor Research Foundation 2012), and birds are known to time molting to optimize fitness such as after migration, or in concert with breeding. During a molt, the bird replaces all of the feathers over a period of four to 16 weeks. Typically the molt is staggered, with the bird losing a limited number of feathers at a time,to allow the bird to fly and maintain thermal protection. Depending on the stage of molt, the existing plumage would provide varying degrees of protection from solar energy. A bird in the middle of molt, that may have areas of exposed skin, would be expected to have an increased risk from exposure to elevated levels of solar energy flux and may experience immediate tissue damage to tissue; having no thermal protection from plumage.

Birds replace lost feathers slowly and even minimal damage to flight feathers can significantly affect flight performance. Large birds, such as eagles and vultures may take up to two years to molt (Raptor Research Foundation 2012); although a few species will molt all flight feathers at once (Ibid.). When a feather is actively growing, blood is supplied to the shaft of the feather. When fully grown and formed, the vessels that supply blood to the feather constrict and the feather is considered dead tissue, without feeling, similar to human hair. A feather broken while in the blood feather stage remains damaged until molt (Chubb 2003). Birds exposed to elevated levels of solar energy flux while in the blood feather stage may be subject to increased risk of feather damage. Additionally, it is unknown if a feather heated by flux could conduct heat through the feather shaft and into the follicle or skin of a bird.

Molting requires additional energy to create the feather components and synthesize them (Murphy 1999). A bird that has experienced damage from elevated levels of solar energy flux may have diminished abilities to meet existing energy requirements. Damaged plumage may require the use of additional energy to fly, forage, and perform normal behaviors lowering the survivability of the bird. Hawks and eagles manage the nutritional cost of molting by shedding just two feathers on each wing at a time, and typically having around 24 flight feathers total to be molted (Chubb 2003). Feathers produced during periods of poor nutrition can be faulty, showing ridges and other abnormalities (German Assn. for the Prot. Of Common Swifts 2012), therefore, one or more molts may be necessary to repair the damage, and a bird would be energetically challenged to do so if damaged feathers reduced the birds success at foraging.

Exposure to elevated levels of solar flux would be expected to damage feathers such that insulating and flight capacities are lost, impaired or even destroyed. Birds exposed to damaging levels of solar energy flux either during or after a recent molt may also have an increased the risk of mortality or decreased fitness. In a desert environment, staff expects that a bird exposed to high temperatures and with limited access to water would have low survivability, either succumbing to heat, or extreme cold during cold desert nights, or from being more susceptible to predation. Birds with exposed skin are considered “greatly disadvantaged” (Chubb 2003). As with most species, older and younger individuals would be considered more susceptible to injury or mortality from elevated levels of solar flux. For example, juvenile birds have feathers that are much softer, and are not as adept at maintaining feathers as adults (The Modern Apprentice 2012); and may be more susceptible to injury or mortality than older birds.

Flight Performance

Flight performance is critical to foraging, evading predators, conducting seasonal migration and breeding displays, and performing other life history characteristics. In pet birds, incorrect feeding or caging can cause damage and weakness in feathers such that swifts cannot thermoregulate or fly (German Assn. for the Prot. of Common Swifts 2012). Seemingly minor damage to flight feathers may affect a bird’s flight speed or its ability to maneuver; more significant damage to flight feathers would prevent flight altogether. Length of flight feathers, and asymmetry in flight feathers were noted to reduce take-off speed in birds, when impaired by damage, or during molt (Swaddle et al 1996). In rehabilitating wild birds, the condition of plumage is critical to determining if the bird can be released. If plumage conditions allow the bird to fly, thermoregulate, and waterproof themselves, the survival rate is much greater (Wildlife Rehabber 2012). Additionally, damage to flight feathers may impact a birds’ capability to migrate. Passerines with impaired flight feathers have been demonstrated to avoid long-distance flights (Hedenstrom 2003). Birds prevented from seasonal migrations due to the inability to effectively fly may experience mortality from the lack of food or exposure. Birds damaged by exposure to elevated solar energy flux would likely have limited abilities to complete these actives, and may suffer mortality at a later time or after leaving the site (i.e. off the project site). See **APPENDIX BIO1** for further discussion of flight mechanics.

Flight performance is also important in raising young. Adult birds make numerous trips back and forth from foraging grounds to the nest, carrying food items to young. A bird attempting to feed young with damaged flight feathers would have impaired flight capabilities that reduce the bird’s ability to forage or hunt. Raptors in particular carry large prey to young, and have feathers adapted to these heavy loads. Bald eagles are capable of carrying up to half of their weight (Nye 2005), and damaged flight feathers would be detrimental to successful fledging of chicks.

Flight speeds and patterns will affect the length of time a bird is exposed to solar flux while moving across the project site. Flight speeds are reported to be typically within 20 to 50 miles per hour (mph) (USGS 1998), and vary dramatically on the upper end of the range. **APPENDIX BIO1** provides estimates of the time required to traverse the solar field at various flight speeds, and also provides data for select flight paths and concentrated solar flux dose at the Solar One site. For reference purposes, horned larks and ravens are known to occur on the project site, and fly from 22 to 28 miles per hour, (mph) (USGS 2006), whereas mourning doves, which could also occur onsite, are faster flying, around 35 mph. It is unclear how flight speed may affect the likelihood of exposure to elevated levels of solar flux. Flight patterns would also affect the dose of solar flux a bird receives. Depending on species and behavior, birds exhibit various flight patterns such as continuous flapping, as well as non-continuous flapping such as soaring or gliding, flap-bounding and flap-gliding. Furthermore, flap speed varies depending upon energetics, weather conditions and speed needed, with swallows having a very low flap speed for birds of comparable size (Park et al 2001).

While it is unknown what the behavioral response of a bird will be from exposure to elevated levels of solar energy flux, passage through an area of high energy intensity could result in injury to the birds. Bird behavior will likely act in conjunction with flight speed to influence the probability of the exposure risk. Birds that fly at low elevations below elevated levels of solar energy flux are not expected to experience an exposure risk. However, aerial foraging birds, such as swifts and swallows, have been documented to be more likely to experience exposure to this risk (McCrary 1986).

The type and color of the plumage will also influence the potential risk to the bird. Plumage will absorb various amounts of solar radiation, depending on many factors. Plumage color, position of bird, density and structure of feathers, and flight speed, will all affect a birds' tolerance to this heat (Walshburg 1992). Other factors such as behavioral response to elevated flux levels, age of the bird, ambient temperature and humidity level will also affect how exposure to elevated solar energy levels will impact a bird. Birds will not be able to see the solar energy flux over the heliostat field, and therefore would not be expected to avoid the airspace where solar energy is concentrated. Birds may also become confused or disoriented and depending on behavioral response, such as flying lower, higher, or making evasive maneuvers will affect duration of exposure.

It is unknown what protection plumage will afford the different species of birds that may move into solar fields and experience elevated levels of solar energy flux. At low levels and short durations the birds may suffer little permanent damage and be able to survive post exposure. However, at exposure to high levels of solar energy flux even short durations may be lethal even if the bird is able to fly out of the flux field. For a large powerful bird, such as golden eagle, lethal damage to plumage, skin, or eyes from exposure to high levels of solar energy flux may occur, yet the bird may be able to fly away from the site. Documenting incidences of latent mortality that occur off the project site is likely not feasible nor is it possible to accurately predict what percentage of birds would be subject to this effect.

Irradiance

When the project is operating, the heliostats will reflect the sun's rays onto the SRSG, which occupies the top 130 feet of each solar power tower. During these times, the boilers absorb approximately 95 percent of the light that reaches them. Light that is not absorbed will be visible, reflecting off of the surfaces of the solar boilers.

The perceived brightness of objects is measured in terms of retinal irradiance, which is a measure of the intensity of the light reaching the retina. Retinal irradiance also has the potential to cause adverse impacts. The avian eye is comparatively larger than the human eye (Brooke et al 1999), and raptors have even larger size eyes than non-predatory birds of the same weight (*Ibid*). Birds eyes are typically fixed in the socket and unable to turn (Project Beak 2012), although some species such as raptors have limited ability to turn their eyes (White et al 2007) (O'Rourke et al 2007), and have very wide fields of view (O'Rourke et al 2007). Some birds may be unable to look away or avoid exposure, given their physiological attributes (Dr. Gregg Irvin, personal communication).

This lack of response would be considered similar to a "deer in the headlights". In humans, the sensation of pain is not linked to retinal damage, nor does it seem to be linked in animal species (*Ibid*).

Staff has developed an analysis of glint and glare on human receptors (**TRAFFIC AND TRANSPORTATION, APPENDIX TT2** of this final staff assessment); yet there is no further available data regarding the impacts of irradiance exposure on wildlife. That analysis was developed to answer a specific question, that is, does the project present a significant hazard to motorists passing by on the Interstate 10.The results cannot be directly extrapolated to bird, bat, or insect vision, however, birds in general have much better eyesight, and a wider field of view than humans. It's not known the threshold at which wildlife would experience either temporary damage or irreversible damage, or if this is even possible with the technology in question. While **APPENDIX TT2** ultimately determined that there is not a significant risk of heliostat positioning such that a motorist would be adversely affected, if this event occurred and a mirror was positioned such that a person looked directly at it, then a human's vision could be, at least temporarily, impaired at a distance of more than a mile from that mirror. It would be difficult to determine a birds' or bats' reaction to vision impairment and these animals may still be able to fly off the site, even if experiencing temporary or permanent damage, or impairment.

Staff believes irradiance has the potential to cause injury or lethality to avian species that fly within an un-quantified area of the solar field. It should be noted that the monitoring and mitigation protocol outlined in Conditions of Certification **BIO-16a** and **BIO-16b** would not detect eye damage, as necropsy of a live or freshly killed specimen would be needed to quantify damages. Staff has accounted for the lack of data by incorporating a safety margin (see **APPENDIX BIO1**) for flux exposure on feathers, and therefore will rely on damage to keratin (feathers) as the lowest endpoint of toxicity.

Conclusions and Discussion of Mitigation

Based on staff's understanding of solar energy flux intensity and exposure limits, staff believes that birds flying through energy flux in excess of safe thresholds will likely suffer significant damage to flight feathers, eyes, or skin. In some cases, where they fly through higher flux levels, these birds will fall to the ground with evidence of severe burning as reported by McCreary et al. (1986). Staff believes that many birds may continue flying for a few seconds or minutes, perhaps long enough to escape the hazard, but will be unable to fly effectively, find food, or escape predators and will die a short time after the exposure or persist for longer periods but with reduced reproductive success.

Staff believes that some birds exposed to concentrated solar flux will be at risk of suffering (1) hyperthermia, which may result in disorientation and/or other damaging physiological repercussions and, depending on time and level of exposure (2) feather damage with a consequent flight impediment: or anatomical effects such as tissue damage, temporary or permanent vision impairment. These effects are influenced by both the dose level and exposure time. These effects are considered significant and may be unmitigable, based on the species affected, and the severity of the impact.

Project Owner's Proposed Mitigation

The project owner has proposed three avian conditions of certification: **BIO-A**, **BIO-B**, and **BIO-C**, containing meaningful mitigation for avian and bat impacts. The project owner has suggested that these replace the existing condition **BIO-16**, developed for the PSPP project, as they are appropriate to mitigate impacts associated with the PSEGS. Condition **BIO-A** offers compensatory mitigation at a 1:1 ratio for habitat impacts (approximately 3,794 acres of habitat), with selection criteria that would ensure the acquisition of high quality habitat. This acreage is intended to "nest" within desert tortoise mitigation (e.g. lands acquired would be comparable to habitat impacted by construction of the project), and would not entail additional offsets outside of those required for desert tortoise mitigation, given that all selection criteria are met. These lands would be managed and preserved in perpetuity.

Condition **BIO-B**, Avian Enhancement and Conservation Measures, offers further avian mitigation in a two-pronged approach: the project owner has offered to fund the retro-fit or installation of avian diverters at non-APLIC compliant power poles within the greater vicinity of the project, and has pledged an amount of $300,000 towards this effort, to be held in trust under the National Fish and Wildlife Foundation's Bald and Golden Eagle Protection Act Account. The other part of **BIO-B** would mitigate for losses of migratory birds through funding of conservation actions. The project owner has offered $500,000 towards this effort, and has identified the following 11 conservation areas as having benefit to migratory birds:

1. Restoration of degraded habitat with native vegetation;
2. Restoration of agricultural fields to bird habitat;
3. Movement of agricultural fields to enhance bird populations;
4. Invasive plant species and artificial food or water source management;
5. Control and cleanup of potential avian hazards, such as lead or microtrash;
6. Retrofitting of buildings to minimize collisions;
7. Retrofitting of conductors and above-ground cables to minimize collisions;
8. Animal control programs;
9. Support for avian and bat research and/or management efforts within mitigation lands acquired pursuant to desert tortoise mitigation (**BIO-12**);
10. Funding efforts to address avian diseases or depredation due to the expansion of predators in response to anthropomorphic subsidies that may adversely affects birds; and
11. Contribute to the Migratory Bird Conservation Fund managed by the Migratory Bird Conservation Commission.

Condition **BIO-C**, Avian and Bat Surveys, Monitoring and Adaptive Management, outlines an extensive onsite program designed to monitor operational effects, if any, and to outline a pathway toward managing those impacts on an ongoing basis. These efforts would be memorialized in a Birds and Bat Conservation Strategy, or BBCS. Condition **BIO-C** details various efforts, including monitoring bird and bat use at the site, evaluation of wildlife behavior at the project site in comparison with behavior of birds in an unaltered environment; implement onsite mortality and injury monitoring to gauge operational effects of the project; identify conservation measures to minimize impacts, and develop and implement an adaptive management framework to respond directly to the results of project monitoring. The condition proposes monitoring golden eagle nest locations within 10 miles of the project site.

The project owner has outlined several meaningful approaches to benefit the range of potentially affected species, as well as the larger ecosystem within the NECO planning area. Staff has adapted as many of the tenets of **BIO-A**, **BIO-B**, and **BIO-C** as possible, and has revised Condition of Certification **BIO-16** to reflect these measures. The following is a discussion and explanation of how staff has blended the project owner's **BIO-A**, **BIO-B**, and **BIO-C**, into conditions **BIO-16a** and **BIO-16b**.

Staff's Integrated Mitigation Approach

Staff appreciates the comprehensive nature of the project owners' proposed mitigation, and has integrated the most valuable tenets into two conditions, **BIO-16a** and **BIO-16b**. Staff has not carried forward the project owner's offer of 1:1 habitat offsets for avian and bat species. While acquisitions are valuable, and ensure long-term preservation of habitat, staff believes that the requirements of **BIO-12** are equally conservative, ensuring acquisition of high quality habitat for the desert tortoise, which would also benefit avian species. Additionally, the stated selection requirements would likely "nest" or overlap with the desert tortoise offsets, and therefore would not ultimately result in acquisitions further than already recommended within **BIO-12**. Habitat acquisition is a useful tool. However, when attempting to mitigate potential ongoing losses of such a mobile and diverse group of vertebrates such as migratory birds in particular, and insects and bats to a lesser degree, restoration and enhancement of habitat may prove more useful than placing conservation easements. Restoration of habitat is one of few means of "creating" new habitat, and has the possibility of expanding both abundance and, in some instances, the range, of birds, bats, and insects. Therefore, staff's approach entails focusing on the project owner's mitigation **BIO-B**, enhancement and conservation actions. The essence of this mitigation is now present in **BIO-16a**, with several key modifications proposed by staff.

The project owner offered $500,000 towards funding various habitat enhancement and conservation actions, and staff has also adapted this. However, rather than payment of a lump sum, staff would prefer that the project owner fund an interest-bearing account to achieve this same goal. Monies held in an interest-bearing account would be managed by a non-profit investment entity (e.g., a community foundation such as the Imperial Valley Community Foundation) from which only annually earned interest and fund management fees may be distributed; that is, the investment vehicle will be designed and managed as an interest-bearing account.

Staff has considered a minimum annual benefit of approximately $50,000 is necessary to fund bird mitigation actions, during the operational life of the project. Staff believes in order to yield approximately $50,000 annually, the project owner would need to provide approximately $1,500,000 into an interest-bearing account. The recommended funding amount was determined by considering three primary factors:

a. A reasonable/achievable rate of capitalization (4.0% per annum);

b. Adequacy of the amount of the investment to allow for portfolio diversification; and

c. An annual funding amount of significant benefit to the affected resource

The actual funds needed to support this program may vary. While this approach is more costly than originally proposed by the project owner staff believes the approach is reasonable and may provide indirect benefits to the project owner; primarily that funds would be available to the owner at the end of the project; annual payouts would not incur tax liabilities, the program would provide not only annual revenue for an extended period but does so in a fiscally responsible manner; and the level of funding is expected to provide a significant, demonstrable, and measurable mitigation value that is linked directly, both spatially and temporally, to facility operation.

Alternatively, the project owner may pay $50,000 annually to fund the conservation activities for the life of the project, not to exceed a period of 30 years. If the project owner elects to make annual payments, the annual payments would be adjusted for cost of living increases.

Condition of Certification **BIO-16a** is designed to compensate for death, injury/morbidity, and/or generally reduced reproductive success of individuals or a distinct population segment or segments of bird and bat species resulting from adverse contact with elevated levels of solar flux, mirror-related disorientation, and power tower collisions. The specificity of these conditions links the proposed mitigation directly to project component-specific impacts and furthermore, links the funding of the mitigation measure solely to the period of project duration. The funding for this mitigation measure does not involve the establishment of an endowment that is intended to provide a funding mechanism in perpetuity. This mitigation measure is separate from all other project-related mitigation measures and responds directly to the question posed by the REAT agency biologists; namely, how do we mitigate for flux-related adverse effects to migratory birds and, albeit probabilistically at a more limited threshold, to bats during the operational life of the PSEGS.

Conservation Opportunities

Condition of Certification **BIO-16a** would, among other things, require the development and implementation of conservation opportunities, and envisions formation of a Technical Advisory Committee (TAC) to review data, and select annual mitigation funding recipients. Staff has conferred with various agencies to determine where conservation opportunities may exist. While the final determination of specific conservation actions would be made during development of the Bird and Bat Conservation Strategy, and are not limited to those opportunities presented here, the following are viable examples of conservation actions that may be taken by the project owner.

1. Funding support for the U. S. Bureau of Land Management's strategic plan for migratory bird conservation Emphasis Area 3: Habitat Management Maintenance, Enhancement, and Restoration. Areas to be served by this component of the plan include Important Bird Areas, Areas of Critical Environmental Concern, Watchable Wildlife, Habitat Management Plan Areas, and Habitat Management Areas, all of which have been identified and designated in the BLM's planning process.

2. Funding support for the California Wildlife conservation Board's Riparian Habitat Conservation Program, the mission of which is the development of coordinated conservation efforts aimed at protecting and restoring the state's riparian ecosystems.

3. Funding support for the California Migratory Bird Conservation Partnership, a cooperative venture of Audubon California, PRBO Conservation Science, and The Nature Conservancy that seeks to protect, restore, and enhance lands that support bird populations in California.

4. Funding support for the USFWS Joint Venture, a collaborative, regional partnership of government agencies, non-profit organizations, corporations, tribes, and individuals that conserves habitat for priority bird species, other wildlife, and people. Joint Ventures bring these diverse partners together under the guidance of national and international bird conservation plans to design and implement landscape-scale conservation efforts. Joint Ventures have been widely accepted as the model for collaborative conservation in the 21st century. Joint Venture actions include: biological planning, conservation design, and prioritization; project development and implementation; monitoring, evaluation, and research; communications, education, and outreach; and funding support for projects and activities.

   Within California, several JointVentures exist in the Central Valley, Intermountain, and Sonoran regions. Based on personal conversations with USFWS and the Sonoran JointVenture Coordinator, means of compensation benefitting desert avian species are in place (Robert Mesta, personal communication), and further, the Sonoran JointVenture program also has the capability of designing conservation plans responsive to certain bird species or specific geographic locales.

5. Project owner could fund an existing need (e.g., preservation, restoration, and enhancement) at an acknowledged important migratory stopover. For example, this fund would be adequate to support funding needs at the Ash Meadows National Wildlife Refuge to support their Habitat Management Goal 2: to restore and maintain the ecological integrity of natural communities within the refuge. Their current plan calls for the need to "[o]btain funding for and hire: 1 Integrated Pest Management Coordinator/Botanist, biological technician, or GIS specialist (part-time)".

6. The dedication of $50,000.00 in funds could facilitate a grant of $200,000 or more under the Neotropical Migratory Bird Conservation Act if the program identified is selected for funding*.* In accordance with the act, for every federal dollar, three non-

federal dollars are required in matching contributions. For projects in the United States, the non-federal share must be monetary.

In developing Conditions of Certification **BIO-16a** and **BIO-16b** with respect to species that are fully protected under the California Fish and Game Code (golden eagle, bald eagle, American peregrine falcon, Yuma clapper rail, among others), mitigation is provided for potential ongoing direct loss of individuals from project operation. However, even if project impacts to golden eagle and other fully protected species can be mitigated to less-than-significant under CEQA, take of fully protected species is not permitable under another state law. Take of golden eagles or other fully protected species would violate the Fish and Game Code sections (see **Biological Resources Table 1**) that protect fully protected species. However, the CDFW may allow the take of some fully protected species, including golden eagles, through the context of an adopted Natural Community Conservation Plan (NCCP). Although not yet adopted, the DRECP (an NCCP) is anticipated to provide coverage for some fully protected species, including the golden eagle. If the project falls within a development focus area as determined by the final DRECP, then it is possible that the PSEGS project owners will eventually be able to apply for a take permit of otherwise fully protected species through the DRECP.

Implementation of **BIO-16a** and **BIO-16b** would require the project owner to monitor, record, and report bird deaths and injuries from project construction and operation. Monitoring the project's operational impacts for seasonal factors, the species of birds affected, and the types of injuries or mortalities that occur have also been requested by the USFWS. This type of monitoring is considered crucial in documenting bird behavior, noting responses to stress, quantifying impacts, and subsequently identifying and implementing any available measures to avoid, minimize, or mitigate these impacts. If take occurs, it will be reported to the REAT agencies for further action.

Condition **BIO-16b** requires development of avian, bat, and golden eagle protection plans. These plans require development of project monitoring methodology and implementation of compensatory mitigation according to clear performance standards provided in the condition, should monitoring reveal significant impacts to avian or bat species. This mitigation shall be implemented as needed based on the levels of take revealed by monitoring, and would detail all appropriate minimization and compensatory actions, as determined in consultation with USFWS, CDFW, BLM, and the Energy Commission. These actions would vary from restoration of avian habitat that supports the species impacted by the project, power line retrofits or other means of minimizing take and enhancing habitat, and will allow for flexibility in measures imposed, based on effectiveness monitoring. These plans will also incorporate a means of accounting for individuals that may suffer damage from exposure to elevated levels of solar flux, yet still be capable of flying off the site. These animals would not be detected during onsite carcass searches, yet would be adversely impacted by the project.

While data collection is important, and could potentially inform new mitigation or adaptive management strategies, feasible mitigation to reduce impacts to avian species from exposure to elevated levels of solar energy flux or irradiance to below the level of significance may not exist. This is because mitigation cannot avoid bird mortality, and mitigation may not adequately replace birds in the local population that may be killed by solar flux exposure, particularly fully protected and other special status birds.

Evaporation Ponds

The project has proposed various modifications to the PSEGS project (Palen 2012a), including the reduction from two double-lined 4-acre evaporation ponds to two double-lined 2-acre evaporation ponds. These ponds will receive industrial waste streams that would primarily come from the PSEGS project's auxiliary cooling tower and boiler.

A variety of waterfowl and shorebirds could seasonally use evaporation ponds as resting, foraging, and nesting areas. Evaporation ponds in the Sonoran Desert pose several threats to wildlife. First, creation of a new water source to an area where water is scarce would attract ravens to the PSEGS project, potentially increasing predation rates on juvenile desert tortoise in adjacent habitat. Second, waterfowl, shorebirds, and other resident or migratory birds that drink or forage at the ponds or Couch's spadefoot toads and their eggs could be harmed by selenium or hyper-saline conditions resulting from high total-dissolved-solids concentrations that would exist in the waste contained in the evaporation ponds (EPTC 1999; Lemly 1996; Wingdingstad et al. 1987). Monitoring results from 2007 and 2011-2012 at NextEra Harper Lake Solar Electric Generating System (SEGS) VIII and IX located near Harper Lake in the Mojave Desert revealed that numerous waterfowl, primarily eared grebes, died at the evaporation ponds due to salt toxicosis (Luz 2007). Third, these ponds may attract birds, bats and insects to the project site, exposing them to solar flux and collision risks. Staff, CDFW, and USFWS are concerned about these threats to wildlife posed by the evaporation ponds.

Condition of Certification **BIO-26** requires installation of netting over the evaporation ponds to exclude birds and other wildlife as well as a monitoring program to ensure the effectiveness of exclusion. Implementation of this measure would reduce evaporation pond impacts to birds and other wildlife to less-than-significant levels. The use of netting over ponds has its own drawbacks, primarily that birds may become entangled in netting from time to time, and be unable to escape. Staff believes that even with this risk, netting the evaporation ponds is still a better choice than leaving them uncovered because of the known risk of salt toxicosis to wildlife. Staff researched additional means of making the evaporation ponds unappealing to wildlife; preliminary data shows that the addition of an orange or red colorant has served as a deterrent, as well as placement of large floating rafts in the ponds, but have not found a solution that reasonably appears to be a lower risk than netting.

Special-status Plant Species

Regional Overview

The Sonoran Desert region of southeastern California, a region bounded by the Mojave Desert to the north and by the higher elevations of the Peninsular Ranges to the west, has a uniquely 'tropical' warm desert climate influenced by the addition of monsoonal summer rains; a contrast to the dry summer Mediterranean climate that characterizes much of California. This under-surveyed southeastern corner of California has a bi-modal rainfall pattern, with cooler late fall and winter rains that originate in the North

Pacific Ocean, and tropical summer storms from southern Mexico (Conservation Biology Institute 2009).

The unique position of the region at the junction with the Neotropic ecozone to the south contributes to the presence of a number of rare and endemic plants and vegetation communities specially adapted to this bi-modal rainfall pattern, and not found elsewhere in California. These include microphyll woodlands, palm oases, and a number of summer annuals that only germinate after a significant warm summer rain.

This distinctive bi-modal climate of the Sonoran Desert distinguishes it, floristically, from other deserts, including the Mojave Desert, and from the rest of California, which is characterized by warm dry summers and a single rainy season in winter. In addition to being hotter and drier, the Sonoran Desert region also rarely experiences frost. Although the region supports numerous perennial species, including a wide variety of cacti, more than half of the region's plant species are herbaceous annuals, which reveal themselves only during years of suitable precipitation and temperature conditions (*ibid*).

This region also occupies an important biogeographic location and zone of ecological transition on the Pacific coast of North America, and so its floristic diversity includes many widespread taxa on the edge of their range. This includes all of the California Rare Plant Rank (RPR) 2 plants occurring in the region—species that are more common outside of California but here they represent geographically marginal, peripheral populations on the frontiers of their range. The evolutionary significance—and therefore the conservation value—of peripheral populations are well documented, as is their greater risk of extirpation (Leppig & White 2006).

The results of spring 2009 and 2010; and fall 2010 surveys for the PSPP ; and spring 2013 surveys of the PSEGS project linears indicated that construction of the project including the plant facility, transmission line, access road, telecommunication line, and construction water supply line could directly and/or indirectly impact five special-status plant species:

- Harwood's woolly-star (*Eriastrum harwoodii*, also sometimes referred to as Harwood's phlox or Harwood's eriastrum), a BLM Sensitive species, RPR 1B.2 (rare, threatened, or endangered throughout its range);
- Harwood's milk-vetch (*Astragalus insularis* var. *harwoodii*), a RPR List 2B.2 (rare, threatened, or endangered in California but more common elsewhere);
- Ribbed cryptantha (*Cryptantha costata*), a RPR List 4.3 meaning it is on a watch-list and not tracked in the CNDDB;
- California ditaxis (*Ditaxis serrata* var. *californica*), a RPR List 3.2 species (a review list) with a questionable taxonomic status; however, its occurrences in California are fairly endangered, and
- "Palen Lake saltbush" (*Atriplex* sp. nov. Andre), a potentially new taxon of saltbush detected on the margins of Palen Lake

These five special-status plant species would have the potential to be directly and/or indirectly impacted by construction of the PSEGS including the plant facility, transmission line, access road, telecommunication line, natural gas line, and construction water supply line. However, dune associated species are less likely to be present on the natural gas pipeline alignment.

A discussion of the methods staff used to assess the regional significance of PSPP effects to special-status plants is provided below, followed by a discussion of the impacts to plants detected during the spring 2009 and 2010 surveys and fall 2010 for the PSPP and spring 2013 surveys for the PSEGS. Also, a discussion of the significance of impacts to late-season species, if detected during the fall 2013 botanical surveys is provided below. No additional late-season species were detected in fall 2010. Included in this discussion is a summary of the mitigation measures staff devised to reduce the direct, indirect, and cumulative impacts of the project to special-status plants to a less-than-significant level. Staff requested additional information for all new areas of the project including the natural gas line corridor and the unsurveyed segment of the generation tie-line. The project owner submitted all requested information regarding rare plant surveys conducted in March 2013 and no additional special-status plant species were detected (Palen 2013jj).

Assessment Methodology and Analytical Tools

- Staff's determinations of significance were based on the following considerations:
- Proportion of occurrences affected by the project relative to the total number of documented occurrences in California;
- CNDDB (NatureServe) rank (which encompasses rarity, threats, and population trend);
- Impacts to the local or regional population from all proposed modified projects;
- Impacts to hydrologic or geomorphic processes necessary to sustain the habitat (e.g., diversion or alteration of desert washes, altered sediment transport, interrupted wind transport of dune-maintaining sands);
- Ecological integrity of affected and remaining habitat;
- Cumulative effects and threats to remaining occurrences;
- Ownership and management threats to remaining occurrences;
- Status as a peripheral or disjunct population (or position within the species range);
- Indications of any other population characteristics that may assign it local or regional significance, and
- Indirect effects, such as introduction or spread of invasive plants, operation impacts (dust, chemical drift), fragmentation (and its effects on gene flow)

In addition to state and federal-listed plant species, and BLM sensitive species, staff's definition of special-status plants also included California Rare Plant Rank (RPR) 1B, 2A, 2B, 3 and 4 plants, any potentially new species found, and a few currently unlisted plants that are proposed additions to the CNPS Inventory. RPR List 3 plants (plants of questionable taxonomic status) may be analyzed under CEQA if sufficient information is available to assess potential impacts to such plants (CDFG 2009). RPR List 3 and 4 may be considered regionally significant if, for example, the occurrence is located at the periphery of the species' range, exhibits unusual morphology, or occurs in an unusual habitat/substrate (ibid).

Staff consulted with several recognized experts in the region's rare plant flora during the preparation of the data requests and its analysis of impacts to special-status plants for the PSPP (J. Andre, T. LaDoux, D. Silverman, A. Sanders, pers. comm.). Other sources consulted include the CNDDB (CNDDB 2010), the CNPS online inventory (CNPS 2009) and the BLM Palm Springs occurrence records (unpublished). The Consortium of California Herbaria (CCH 2010) was reviewed to determine if there were additional documented occurrences that were not already included in CNDDB. To improve its analysis, staff entered occurrence data from all sources into a GIS-based web application that allowed staff to view all CNDDB and CCH occurrences overlain on various jurisdictional, biological, landform, utility, USGS topographic maps and aerial imagery. This allowed staff to assess a species' threats and management vulnerabilities relative to probable future renewable energy projects throughout their range. This included an examination of their distance and proximity to projects or features, their peripheral status, potential for fragmentation and other indirect effects from nearby development, potential for mitigation through acquisition or restoration. Because additional rare plant occurrences were not detected on the project site staff reviewed the datasets available for the Approved PSPP project. The datasets that were utilized in staff's analysis for the PSPP project included:

- PLATTS Transmission Data: licensed 3-rd party commercial transmission data);
- CA State County boundaries: http://atlas.ca.gov/download.html?sl=casil
- CNDDB RareFind: http://www.dfg.ca.gov/biogeodata/cnddb/cnddb_info.asp
- BLM Renewables Projects: BLM online solar and wind project data: http://www.blm.gov/ca/gis/
- CA STATSGO Soils: NRCS soil mapping from http://SoilDataMart.nrcs.usda.gov/
- CA Cities boundaries: Part of PLATTS Transmission Data delivery
- CA State Parks boundaries: http://atlas.ca.gov/download.html?sl=casil
- Federal Wilderness boundaries: http://www.blm.gov/ca/gis/
- Federal Lands ownership boundaries: http://www.blm.gov/ca/gis/
- CA GAP Vegetation: http://www.biogeog.ucsb.edu/projects/gap/gap_data_state.html
- Landforms NECO: from BLM Palm Springs Office – no Metadata – based on CA GAP but improved by BLM for NECO area
- Landforms MDEP: Mojave Desert Ecosystem project: http://www.mojavedata.gov/datasets.php?&qclass=geo
- Aerial Imagery – ESRI Data from ArcGIS.com
- USGS Topo – ESRI Data from ArcGIS.com

Impacts to Special-Status Plants Found During Spring and Fall Surveys

This section includes a detailed discussion of the special-status plants detected during the spring 2009 and spring and fall 2010 surveys within the Project Disturbance Area and one-mile buffer for the PSPP and spring 2013 within the Project Disturbance Area and 1,000 foot buffer for all new areas of the PSEGS project including the natural gas line corridor and the unsurveyed segment of the generation tie-line.

The spring 2009 surveys encompassed the entire Project Disturbance Area including the solar facility footprint, transmission line corridor, and survey buffer area. The new areas surveyed during 2010 were areas not previously surveyed during 2009 and included the Reconfigured Alternative footprint, Reconfigured Alternatives 2 and 3, new transmission line route, and associated buffer areas. The PSEGS project occurs within a sub-set of these areas. Staff requested additional information for all new areas of the project including the natural gas line corridor and the unsurveyed segment of the generation tie-line. The project owner has submitted the final spring 2013 survey report for rare plant surveys conducted in March 2013 (Palen 2013jj). No additional special-status species were found.

Harwood's Woolly-star

Harwood's woolly-star, also sometimes referred to as Harwood's phlox or Harwood's eriastrum, is a BLM Sensitive species, and RPR 1B.2 species, which indicates it is rare, threatened, or endangered throughout its range. This spring annual is associated with sandy plains or dunes, but typically semi-stabilized habitat (versus active dunes) (CNPS 2010). Its global distribution and range is restricted to 14 known locations in San Diego, Riverside, and San Bernardino counties, typically in dunes associated with the margins around dry lakes such as Dale, Cadiz, and Soda lakes. Recently, surveys conducted in spring of 2010 for the Blythe Solar Power Project (BSPP) located this plant primarily in the sandy areas south of I-10, where 2,134 plants were located and mapped, the majority of these plants of which occurred at the Colorado River Substation site (AECOM 2010v). Harwood's woolly-star was not previously known to occur in the project vicinity; the nearest known occurrences were at Anza Borrego, to the west, and to the north in the Dale Lake, Cadiz Valley and Ward Valley dune systems in San Bernardino County.

Staff reviewed the occurrence data in the Consortium of California Herbaria and detected two new occurrences that were not in the CNDDB (CCH 2010). Both of these are historical records from 1939 and 1958. Of the total of 14 occurrences in California (12 CNDDB plus two additional historic records), 3 of these are protected under National Park Service or State Park ownership. A total of three records are historical records. Four of these occurrences have documented threats, including OHV and non-native plant impacts.

A total of 13 GPS points totaling 169 plants were found in the dunes to the east of the PSEGS project. No plants were found within the Project Disturbance Area. The closest occurrences appear to be located on the dunes approximately 3,000 feet from the Project Disturbance Area. Based on these results, staff determined that the PSPP project would not result in direct impacts from construction, or indirect impacts from hydrologic changes to downstream areas supporting Harwood's woolly-star. Staff also has determined this for the PSEGS project. However, staff remains concerned about the potential for the spread of Sahara mustard into the dunes north of the project from construction-related disturbance near the dunes, transport of seeds on vehicles during construction and operation and transport via surface runoff). Construction-related soil disturbance and sedimentation from surface runoff render habitat vulnerable to noxious weed invasion, and the potential for the spread of Sahara mustard into the sensitive dune habitats north of the project is very high and the ecological consequences would be considerable. Several large infestations of this highly invasive plant occur along the area roads and the channel intake. The potential for Sahara mustard to spread quickly and aggressively, and the severe ecological consequences, are well documented (Barrows & Allen 2007; Brooks et al 2004; Pavlik 2008, and others). Although the project will have no direct effects, staff believes that project may contribute to the spread of Sahara mustard within Chuckwalla Valla and its dune habitats is cumulatively considerable. The PSPP conditions of certification are also recommended for the PSEGS to reduce the projects potential effects to Harwood's woolly-star. These include condition of certification: **BIO-8** (Impact Avoidance and Minimization Measures) #1, 5, 19-22), **BIO-14** (Weed Management Plan). Implementation of **BIO-8** and **BIO-14** would reduce the project's contribution to the spread of Sahara mustard into Harwood's woolly-star habitat to a less-than-significant level. No new conditions of certification are proposed for the PSEGS.

Harwood's Milk-Vetch

Harwood's milk-vetch is a RPR 2B.2 species; a rank that indicates it is rare, threatened, or endangered in California but more common elsewhere. It is also a covered species under the NECO Plan. It is found in desert dunes and sandy or gravelly areas in portions of Imperial, Riverside, and San Diego counties (CNPS 2009). Herbarium collections occur for this species from Ogilby Road in Imperial County and three locales west of Blythe, the Pinto Basin, and Chuckwalla Basin in Riverside County. Harwood's milk-vetch has also been reported from Baja California, Sonora Mexico, and portions of Yuma County, Arizona (Reiser 1994). There are several CNDDB records for this species within the project vicinity (CNDDB 2010). There is a record in the Consortium of California Herbaria database from Wiley's Well Road between McCoy and Mule Mountains from 400 feet elevation (CCH 2010). The Harwood's milk-vetch populations on the southern deserts are presumed stable given limited disturbance to their desert habitats (Reiser 1994), but the recent push for renewable energy development threatens a large portion of its habitat in Chuckwalla Valley and the broader NECO planning area.

Staff reviewed the occurrence data in the Consortium of California Herbaria and detected three new occurrences that were not in the CNDDB. All of these are historical occurrences. Of the total 21 documented occurrences in CNDDB, 9 of these are protected under National Park Service or State Park ownership. A total of 11 records are historical records. Sixteen of these occurrences have documented threats including development, OHV, agriculture, transmission lines, road maintenance, and trash dumping. The population of Harwood's milk-vetch in the project area would fall within the previously documented CNDDB occurrences in Chuckwalla Valley (CNDDB Occurrence numbers 16, 17 and 18).

It is important to clarify here that CNDDB protocol for mapping occurrences is to lump closely-spaced occurrences (<1/4 mile), that are in similar and unbroken habitat, into one ‘occurrence’. Typically, project surveys map rare plants at a high level of detail to facilitate avoidance or calculation of impacts. Thus, many of the GPS points would be lumped into a smaller number of ‘occurrences’ in CNDDB.

Spring 2010 surveys identified only seven Harwood’s milk-vetch individuals in the Project Disturbance Area for the PSPP (AECOM 2010u) out of a total population of ± 146 plants (Solar Millennium 2010l). However, many of the 140 plants documented in the buffer area for the PSPP (Solar Millennium 2010m) are located in close proximity to the northern boundary of the PSEGS project and in areas downstream of the site. Based on a review of the data it appears that six of the seven plants identified in the PSPP Project Disturbance Area would be directly impacted impacts by the proposed PSEGS project (Palen 2013ss). The 140 plants documented in the buffer area for the PSPP are also located adjacent to the PSEGS northern boundary so impacts would be similar.

For the PSEGS project staff considers the direct loss of six plants to be a minor direct effect, as was determined for the seven plant to be lost for the PSPP, given the large number of plants found off the project site (Solar Millennium 2009a, Solar Millennium 2010b, Solar Millennium 2010m) and in the buffer zone of other projects in the vicinity. Approximately 700 Harwood milk-vetch were documented in the GSEP study area, and 2,748 plants in the BSPP and the Colorado Substation study areas). It is important to note that although the 2010 populations were robust, significantly fewer plants (<100) were found in the disturbance area of three projects during the 2009 surveys—a relatively dry year. Staff expected, as described in the PSPP RSA, that the local Harwood’s milk-vetch population size expands and contracts with the normal wide variations in annual rainfall, similar to many other desert annuals. Thus, the same population in the next dry season could be expected to contract to a number that more closely resembles the population size documented in 2009.

Although the direct impacts of the PSEGS project to Harwood’s milk-vetch would be minor, staff is concerned about the close proximity of the off-site populations to the Project Disturbance Area. Staff believes additional accidental impacts could occur during construction, and that indirect impacts from the spread of Sahara mustard and other weeds into adjacent habitat—an effect readily observable in nearby transmission projects, and along roads—could result in impacts to this species. Staff also believes, plants located downstream of the project could be indirectly affected through the spread of weed seed, altered hydrology or sediment transport. Harwood’s milk-vetch may respond favorably to disturbance (loose, sparsely vegetated soils) but most weeds also quickly colonize disturbed soils.

Condition of Certification **BIO-14**, directs the project owner to finalize and implement a detailed weed management plan, which specifies detailed mapping, monitoring, and reporting requirements. Weed management would minimize the risk of Saharan mustard and other invasives from colonizing the disturbed soils along temporary access roads and transmission corridors; both of which are a common conduit for the spread of invasive pest plants. **BIO-19, Section A** (Special-status Plant Avoidance and Minimization Measures) will protect the off-site occurrence from accidental impacts during construction, and indirect effects during operation and closure activities. **BIO-27** (Revegetation of Temporarily Disturbed Areas) was designed to minimize the risk of Saharan mustard and other invasives from colonizing the disturbed soils along temporary access roads and transmission corridors; both of which are a common conduit for the spread of invasive pest plants. For the PSPP **BIO-27** was deleted and avoidance and minimization measures described in **BIO-27** were incorporated into **BIO-8** (Impact Avoidance and Minimization Measures), and weed management measures described in **BIO-27** were incorporated into **BIO-14** (Weed Management Plan).

No compensatory mitigation is required for Harwood's milk-vetch as only a small number of plants would be directly affected; however, for the PSPP the Commission adopted the recommendation that the compensatory mitigation for dunes and washes (habitat for Harwood's milk-vetch) in **BIO-20** and **BIO-22** must be acquired within the Chuckwalla Valley region. Staff is recommending this requirement for the PSEGS, as well. This additional requirement will minimize the cumulative effects of fragmentation by protecting, in perpetuity, private lands in the range of the species in Chuckwalla Valley from future development.

Ribbed Cryptantha

Ribbed cryptantha is a RPR 4.3 species, meaning that it has limited distribution in California; however it is not very threatened in California. There are 116 records of this species from several locations throughout Riverside, San Diego, and Imperial counties in the Consortium of California Herbaria database; the nearest collection is from the Palen Valley approximately three miles east of the Desert Center Airport (CCH 2010).

Spring 2010 botanical surveys identified several large populations of this species, estimated in the millions, within both the Project Disturbance Area and buffer area for the approved PSPP project. Sampling was used in the field to establish an estimate of 8,903 plants per acre (Solar Millennium 2010m). Approximately 285 acres and 1,309 acres of occupied ribbed cryptantha acreage were estimated within the PSPP Project Disturbance Area and buffer area, respectively (Solar Millennium 2010m, Table 3). It was estimated that an area of approximately 406 acres (estimated 3.6 million plants) located within the Project Disturbance Area would be directly impacted by the PSPP project (AECOM 2010u). Staff expects similar numbers of this species to be impacts from the PSEGS project. The project owner estimated that 15.9 acres of occupied ribbed cryptantha acreage (estimated 141,558 plants) were estimated within the PSEGS Project Disturbance Area (Palen 2013ss)

Many similarly large occurrences of ribbed cryptantha have been found in the disturbance areas for the Genesis and Blythe solar projects (TTEC 2010a, GSEP 2009a, Solar Millennium 2009a, Solar Millennium 2010b, and Solar Millennium 2010 m), totaling over 100,000 plants. Given the large number of ribbed cryptantha plants detected by all the I-10 projects, within and outside of their project areas, staff believes it is reasonable to expect that ribbed cryptantha are likely to occur in similar habitats nearby. Staff concluded that because of the local abundance of ribbed cryptantha and its apparently stable range in California, the direct impacts of the PSPP project to this RPR List 4.3 species are less-than-significant. The impacts from the PSEGS project to potential ribbed cryptantha habitat would be similar and would be considered less-than-significant.

Implementation of **BIO-8, BIO-14**, Section A of **BIO-19** (avoidance and minimization measures), **BIO-20** and **BIO-21**, would further reduce the impacts to this species. **BIO-20** and **BIO-21** help minimize future fragmentation of the habitat and other indirect impacts to the local population by placing large portions of private land within the Chuckwalla Valley under a permanent conservation easement.

California Ditaxis

California ditaxis is a CNDDB State Rank 2 (imperiled) species known from 15 occurrences statewide (CNDDB 2010). It is RPR List 3.2 species, meaning that it is on a review list and its taxonomic status is questionable. The ".2" threat rank means that the 15 documented occurrences in California are fairly threatened (CNPS 2009).

In general, RPR List 3 plants (plants of questionable taxonomic status; more information is needed) may not warrant consideration under CEQA §15380. However, List 3 plants may be analyzed under CEQA §15380 if sufficient information is available to assess potential impacts to such plants (CDFG 2009) According to one regional botanical expert, it appears to be a glabrous variety of the common *Ditaxis neomexicana* but the variety appears to be legitimately rare (Silverman pers. comm.). Staff took the conservative position during the PSPP proceedings and treated it as a special-status species warranting consideration under CEQA until there was documented evidence otherwise.

Staff reviewed the occurrence data in the Consortium of California Herbaria and detected four new occurrences that were not in the CNDDB and three of these are historical records from between 1921 and 1952. Although one more recent occurrence was found at Anza-Borrego Desert State Park near Starfish Cove Canyon. There are no previously documented occurrences in this portion of Chuckwalla Valley (east of Highway 177); all of the occurrences are to the west, from Desert Center to the Mecca Hills (CNDDB 2010; CCH 2010).

One group of 11 California ditaxis plants were observed within the Project Disturbance Area along the generation tie-line alignment for the approved PSPP project, approximately four miles west of the project. The generation tie-line for PSEGS also falls within this population observed during surveys for the PSPP. Another group of 11 plants were found in the survey buffer area (Solar Millennium 2010m, Table 3, and Solar Millennium 2010p, Figure 7).

In addition to the direct impacts to plants within the PSEGS Project Disturbance Area (50 percent of the local population), plants adjacent to the alignment could be indirectly affected by the spread of Sahara mustard, which out-competes with the plants, degrades the habitat, and increases the risk of fire. Roads and transmission corridors are common vectors for the spread of Sahara mustard. Vehicles are also common ignition sources for roadside fires, and the weeds that typically recolonize disturbed soils along roads and transmission corridors tend to increase the flammability. Changes to the vegetation management regime may increase the risk of spread of Sahara mustard. For the PSPP, staff considered the loss of half of the occurrence, combined with the indirect effects of Sahara mustard, to be significant, given that there are no other documented occurrences in the valley west of Desert Center. The Commission adopted the recommended avoidance and minimization measures contained in Section

A of **BIO-19**. Section A, #2-a, which required the project owner to limit the width of the work area, adjust the locations of poles, road and pipeline alignments, establish the occurrences as fenced Environmentally Sensitive Areas, and a variety of additional measures aimed at preventing accidental impacts during construction and indirect impacts during operation. Staff is recommending the same measures for the PSEGS as impacts would be similar. The project owner requested modifications to **BIO-19**, Section C.1 which allowed more flexibility for avoidance of late season Rank 2 plants. Staff incorporated the project owner's requested modifications, as appropriate, but clarified that these measures do not apply to populations of California ditaxis. Staff believes that with implementation of **BIO-8** (Impact Avoidance and Minimization Measures) and **BIO-14** (Weed Management Plan) , the contribution of the PSEGS project to the spread of Sahara mustard will be less-than-significant.

"Palen Lake Atriplex" (Atriplex sp. nov. Andre)

A potentially new taxon of saltbush (*Atriplex*) was discovered on the saline playa margins of Palen Dry Lake in 2009, and has been proposed in a preliminary report (Andre and La Doux, pers. comm.). The unnamed saltbush was first collected in 2005 at the dry lake just northeast of the Interstate 15 and Highway 95 junction, approx 35 miles east and northeast of Las Vegas, Nevada (Andre pers. comm.). The first vouchered observation of it in California was at Palen Lake in 2009. According to Andre (pers. comm.), there is potential for it to occur along the I-8 corridor in Imperial County. It may also have been observed in the Ford Dry Lake area (unconfirmed) and it has been observed in other saline (but non-playa) habitats on remnants of the lower Colorado River flood plain (ibid).

The BLM State Botanist and Plant Conservation Program Lead (Lund pers. comm.) indicated that BLM would treat all new taxa as BLM Sensitive species. Discoveries of new taxa are unusual in California, and are typically assigned to a CNPS list and considered as special-status species by the Forest Service, BLM, and other resource agencies. Staff took a conservative position for the PSPP and assumed that a new taxon proposed by a recognized expert in the flora of the California Desert region warrants consideration under CEQA until documented otherwise.

According to Andre (pers. comm.), although the unnamed saltbush resembles the common four-wing saltbush (*Atriplex canescens*)—a common plant of dunes which has very linear leaves—the new taxon has obovate leaves that distinguish it from all four-wing saltbush and its subspecies. It is also generally more confined to subsaline/saline playa margins than the common four-wing saltbush (ibid).

The preliminary botanical survey report for the PSPP (AECOM 2010d, Figure 2) shows several GPS localities of a saltbush recorded as the common four-wing saltbush, and indicated a total population size of 920 plants within the buffer. However, the report provided no other information, such as the characteristics used to distinguish the plants or whether the author even considered the plants to be distinct from the common four-wing saltbush. Four-wing saltbush is reported to hybridize more often than any other saltbush (Howard 2003). Even non-woody saltbush species may cross with four-wing saltbush and produce fertile offspring (ibid). Although their plasticity in fruit and vegetative characters hinders description and identification, many of the four-wing saltbush subspecies have been demonstrated to differ in ploidy level and chemical constituents and thus their biological validities are confirmed (Sanderson & Stutz 1994). Although the new taxon is distinct from the common species in its obovate leaves, it would be easy to overlook where the common and new taxon co-occur, even by experienced botanists (Andre pers. comm.). Since more information was not available, staff presumed that the plants documented by the prior project owner in a map of special-status plants were the proposed new taxon—not the common species or varieties—and that the occurrences warranted consideration under CEQA.

According to the PSPP project owner's map of special-status plants in the preliminary 2010 botanical report (Solar Millennium 2010m, Figure 7), no plants would be directly affected; however, some of the 920 plants documented in the buffer occur in close proximity to the northeastern boundary of the PSPP project and could be indirectly affected by the project. For the PSEGS there is a considerable buffer between the boundary of the project and the location of the mapped saltbush. Therefore, staff believes that for the PSEGS, the avoidance and minimization measures described in Section A of **BIO-19** would not be necessary; however, staff would prescribe **BIO-19** (Section A) to minimize the PSEGS project's potential for indirect impacts during operation and accidental construction impacts.

The PSEGS also carries a risk of indirect impacts from the proposed groundwater pumping, which is estimated to be reduced from 5,750 acre feet per day for the PSPP to 1,130 acre feet per day during the 34-month construction phase, with a predicted drawdown of 1 to 5 feet in the area just north of the northern project boundary. However, the PSEGS would use less groundwater during both construction and operation than the originally approved PSPP project. Construction groundwater use is stated to be 1,130 acre-feet per year (AFY), a reduction from the original permitted project groundwater consumption of 1,917 AFY. Operational groundwater use is stated as 201 AFY, a reduction of nearly 100 AFY. Alternatives 2 and 3 both reduced the potential for groundwater impacts in the dependent habitats north of the project, where the saltbush is located, by shifting the location of the wells approximately 3,000 feet to the south and away from shallow groundwater area. The PSEGS will use the same number of groundwater wells which will also be in the same location as for the PSPP.

Because the potential new taxon is reported to occur in the saline margins around dry lakes, and because a drawdown in the water table *reduces* salinity (Patten et al. 2007), staff believes there is a potential that the PSEGS project's groundwater pumping could eventually cause a habitat conversion from halophytic obligates (salt-loving plants) to non-halophytes (ibid) in the affected area. Staff expects that this would also render the habitat unsuitable for the new taxon. A detailed discussion of the impacts of groundwater pumping to dependent vegetation is provided above under "Impacts to Groundwater-Dependent Vegetation", and in the **SOIL AND WATER RESOURCES** section.

Condition of Certification **BIO-23** specifies vegetation, soil and groundwater monitoring in the area affected by pumping, for the life of the project. **BIO-24** prescribes remedial measures and compensatory mitigation if the monitoring indicates an impending decline in habitat function and value. **BIO-19**, Section A, would minimize the indirect effects of the project and avoid accidental impacts during construction for plants located in close proximity to the PSEGS project. With implementation of these measures, staff believes that the indirect impacts of the project to the “Palen Lake saltbush” (Andre, sp. *nov*.) would be minimized to a less-than-significant level.

Utah Vining Milkweed

Until recently discovered growing on the Palo Verde Mesa (AECOM 2010v), this RPR List 4 species was not expected to occur in the project area and it was believed that the project was outside of the range of Utah vining milkweed. As a RPR List 4, it is not tracked in CNDDB but there are 58 records of this species from the Consortium of California Herbaria database primarily from San Bernardino and San Diego counties; there is one record from the Big Maria Mountains from wash and stabilized dune habitat at approximately 1,200 feet elevation (CCH 2010). One population of Utah vining milkweed was found east of the project site at least 2.5 miles east of the eastern project boundary and outside of the Project Disturbance Area for the PSEGS and buffer area (Solar Millennium 2010m). Therefore, staff believes no direct or indirect impacts would occur to this species and no mitigation is needed.

Impacts to Summer-Fall Special-Status Plants

Although not detected during late season surveys conducted in fall 2010 for the PSPP there are a number of potentially occurring late-season special-status plants that have the potential to occur in the project region. In addition, late season special-status plant surveys have not been completed along the proposed new generation tie-line corridor but were conducted in the vicinity of the new natural gas line corridor for the PSEGS as part of the PSPP. Late season special-status plant surveys would be required for both new areas of the PSEGS. These species include:

- Abram’s spurge, a CNDDB State Rank 2 and RPR List 2B.2 species;
- Flat-seeded spurge, a BLM Sensitive species, CNDDB State Rank 1 and RPR List 1B.2,
- Lobed ground cherry, a CNDDB State Rank 2 and RPR List 2B.3 species.
- Glandular ditaxis, a CNDDB State Rank 1 and a RPR List 2B.2, and
- California ditaxis, a CNDDB State Rank 2 and RPR List 3.2

Staff identified these late-season special-status plants to have the highest potential for occurrence based on the presence of suitable habitat in the project area and known occurrences in the region. Their rarity, status, and known distribution are discussed below (California ditaxis was observed in the Project Disturbance Area and is analyzed in the previous section). Staff acknowledges that there is potential for unanticipated finds because the area is generally under-surveyed.

It has been estimated that 30 to 40 percent of the species in the California Desert flora reach their reproductive maturity in late summer or fall (Andre pers. comm.). However, there is a long-standing precedent of spring season surveys for special-status plants in California, based on the dry summers and summer-dormant flora of the Mediterranean climate that dominates California. There are exceptions, of course, for late-season blooming species, but the plant survey effort in California typically consists of a major spring survey with narrowly focused summer surveys for any late season species that may occur in the region. Regional botanical experts (J. Andre, T. LaDoux) concluded that significant finds could be missed without late season botanical surveys.

Because the region's flora is so under-surveyed and poorly understood, relative to other parts of the desert or state, and because its flora is so intertwined with its variable and unpredictable climate, it is difficult to predict accurately what special-status plants have potential to occur in this region. This is evidenced by the discovery of a potentially new taxon of saltbush on Palen Dry Lake (Andre pers. comm.), a new undescribed species of lupine on a renewable energy project near Barstow (Lund pers. comm.), and a recent discovery of a new perennial spurge in the Orocopia Mountains by Victor Steinmann (LaDoux pers. comm.). Further, several unanticipated range extensions of special-status plants have been found, such as for Utah vining milkweed, and a slight range extension for Harwood's woolly-star. Additionally, some rare plants have been found in habitats in which they were not previously known to occur. For example, lobed ground cherry was recently discovered growing outside of its characteristic playa margin habitat in upland habitats (Andre pers. comm.).

For the approved PSPP project, the project owner was required to implement Condition of Certification **BIO-19** , Section B; conduct late-season surveys in summer-fall 2010 to ensure that any special-status plants missed during the spring 2009-2010 surveys were detected and mitigated to a less-than-significant level. The project owner conducted late season surveys in 2010 and did not detect any sensitive late-season species. For the PSPP, staff believed that most of the footprint for the project had a low potential for supporting special-status plants because: 1) these areas have been significantly degraded by the near complete diversion of its ephemeral washes into one central wash and two outer washes, and 2) the soils and biotic soil crusts were compacted during the military training exercises during World War II. This assumption was validated by the results of the spring 2009 and 2010 surveys, which detected almost no rare plants in the proposed solar facility and it is assumed to be the same for the PSEGS. An analysis of PSEGS project impacts to the late-season plants with the highest potential for occurrence along the two new proposed linear features, if detected, is provided below. The analysis includes a discussion of mitigation that will be required if these species are detected.

To ensure that impacts to any unanticipated finds, including new species, are analyzed for significance, Section C of **BIO-19** summarizes the avoidance and compensatory mitigation that would be required for impacts, based on the species rarity and status, whether it exhibits any local or regional significance, and the portion of the local population affected. These are the factors upon which rare plant impact analyses are typically based. The CNDDB rank is based on the NatureServe protocol for assessing extinction risk, and encompasses a cumulative assessment of threats from invasive plants, development, ORV, mining, grazing, and many other factors. Section C of **BIO-19** also requires the consideration of indirect and cumulative effects, and specifies downstream/downwind impacts from altered hydrology or geomorphic processes shall be considered as direct impacts. Section C also requires the preparation of a Special-Status Plant Mitigation Plan, subject to review and approval of staff. Implementation of a Special-Status Plant Mitigation Plan based on the strict guidelines for fall surveys and reporting requirements, and performance standards for mitigation specified in **BIO-19** would reduce impacts to species detected during the late season surveys to less-than-significant levels.

Section D also includes a *contingency* measure in the unlikely event that no opportunities are available for off-site mitigation through either acquisition or restoration. The contingency measure provides detailed specifications and performance standards for conducting or funding a distribution and status study and preparing a management plan for future preservation and enhancement of the affected species. Information about the distribution and management of these under-surveyed species would help offset project impacts by providing the tools that BLM, NPS and other land managers need to protect and manage these species. The information can also be used to offset future impacts from other projects by providing critical information on ownership, threats, and management opportunities.

With the options and detailed performance standards for mitigation through either acquisition (preservation) or restoration, combined with mandatory avoidance requirements along the linears and facility perimeter, and the contingency measures, security requirements and verifications specified in **BIO-19**, staff concludes that the mitigation is still feasible for the PSEGS and that it would reduce project impacts to less-than-significant levels.

Abram's Spurge

Abram's spurge is a CNDDB State Rank 2 species, meaning it is 'imperiled' within its range in California due to very restricted range and very few populations (often 20 or fewer). CNDDB lists 15 occurrences for this species; 9 of which have been seen since 1990. Its RPR of 2B.2 (and its NatureServe Global Rank of 4) indicates that it is more common outside of California.

The project owner stated during workshops and as part of comment on the PSA that Abram's spurge, currently a CNDDB Rank 2 Plant, is so abundant along the I-10 corridor that its current ranking is being revisited (Palen 2013ss). A request for a Rare Plant Status review has been submitted to CNPS however it has not been formally initiated yet (Sims pers comm. 2013). Ultimately, this species is a 2B (previously rank 2 without the "B) and will be until or if it ever goes through a CNPS status review process for a rank change and therefore should be fully considered during preparation of environmental documents relating to CEQA (Sims pers comm. 2013).

Abram's spurge is a summer annual that is triggered to germinate by significant summer monsoonal rains; consequently, its year-to-year population size is highly variable. The playa margins and washes could support this species; it is known from similar habitats nearby at Ford Dry Lake (CNDDB Element Occurrence #5). This species is known to occur in halophytic (saline-alkaline) flats, playas, and along inlets and floodplains of playas. It tends to prefer the lower floodplain ecotone but can also extend higher up along the washes that feed the playa (Silverman, pers. comm.). The blooming period is described in the CNPS Inventory (CNPS 2009) as September through November but may be detected earlier if significant (>0.10mm) summer rain event occurred in June. On average, August receives the most rainfall, but the warm monsoonal rains sometimes overlap the start of the fall-winter rains of Pacific Northwest origin.

The CNDDB (CNDDB 2010) lists 15 occurrences of this plant in Riverside, Imperial, San Bernardino, and San Diego counties in California, east through Nevada to Arizona, and as far south as Baja California, Mexico. Of the total of 15 occurrences in California, 7 of these are protected under National Park Service, CDFW, or California State Park ownership. A total of 4 records are historical (pre-1972) that have not been confirmed since collected; 9 records have been observed since 1990. One of these occurrences is described as threatened by grazing. A recent (2000) CNDDB record (#5) is from a location approximately 0.50 mile east of Ford Dry Lake on Gasline Road just south of I-10 and the occurrence was reported as a “substantial population” (CNDDB 2010). The habitat at this site is described as “Silt and fine sand in flat areas with shallow depressions where water collects after rains, adjacent to the bank of the freeway” (CNDDB 2010).

If Abram’s spurge occurs within or near the Project Disturbance Area, staff concludes that direct or impacts would be significant unless only a minor portion of its local population, or habitat, was affected. Even if the occurrence was off-site, it could be indirectly affected if it occurs in close proximity to construction. Staff is also concerned about the contribution of the project to the spread of Sahara mustard and other invasives. Construction-related disturbance, roads, transmission corridors, and the transport of seed via washes are common vectors for Sahara mustard and other weeds.

All but one primary wash through the center of the project, and two washes on the western and eastern edges, were already diverted by the construction of I-10 and the diversion of all sheet flow and washes into the three primary channels. The effects of this diversion are apparent in the many dead or declining ironwood trees, stunted creosote bush, and overall low cover and low diversity over much of the site. Although the site has a history of disturbance from military training exercises during World War II, staff believes that the primary cause of the site’s degraded habitat function and value (outside of the primary washes) is due to the changes in surface drainage patterns from the construction of I-10. Nevertheless, the site, north of I-10, has a large enough watershed to support the development of a few smaller washes (outside of the primary washes) in the northeast portion of the project, washes that could potentially support Abram’s spurge or other summer annuals the prefer similar habitat.

Staff believes that potential direct impacts to Abram’s spurge can be mitigated to a level less-than-significant through implementation of subsection B of **BIO-19**, which mandates late-season botanical surveys, and by subsection C, which prescribes a level of avoidance and off-site mitigation depending on the species status, rarity, and other factors. Section D provides measurable performance standards for off-site mitigation for unavoided impacts. Section A protects any occurrences found in close proximity through a variety of BMPs and other measures. Staff has modified **BIO-19** based on comments on the PSA by the project owner to be consistent with the Commission Decision for the Genesis Solar Power Project (GSEP). Abram’s spurge is late summer/fall blooming that also has the potential to occur at the GSEP site. The modifications allow for complete avoidance along linears unless avoidance would cause disturbance to areas not previously surveyed for biological resources or would create greater environmental impacts in other disciplines (e.g. Cultural Resource Sites) or other restrictions (e.g., FAA or other restrictions for placement of transmission poles). If complete avoidance is not possible for the above listed reasons mitigation at a 2:1 ratio would be required. This modification would only apply to late summer/fall plants and would not apply to California ditaxis.

To address indirect and cumulative impacts to Abram's spurge, **BIO-8** (Impact Avoidance and Minimization Measures) and **BIO-14** (Weed Management Plan) would minimize the contribution of the project to the spread of Sahara mustard and other weeds. The conditions of certification require that acquisition for dunes and washes (**BIO-20** and **BIO-21**) occur within the Chuckwalla Valley region. This would minimize future fragmentation of Abram's spurge habitat (playa margins and washes) by placing private lands under permanent protection and preventing future development and the indirect effects of weeds and fragmentation that accompany development.

Flat-seeded Spurge

Flat-seeded spurge is a RPR 1B.2 species, meaning it is rare, threatened, or endangered throughout its range and it is fairly threatened in California. It is also a BLM Sensitive species and has a NatureServe rank of 1.2. Some experts have speculated that it may be a "waif" in California, or a species that is not naturalizing, and note that it is more common in Arizona and Mexico (CDFG 2010). Very little is known about the species because there are few or no extant occurrences. Its micro-habitat preferences are described in CNDDB (2010) as "sandy places or shifting dunes", and by the Arizona Native Plant Society as "shifting dunes of low to medium height". This suggests that the northeastern corner of the project was the most likely place for it to occur. It was not detected in this part of the PSPP during fall 2010 surveys. However, one botanist suggested that weedy disturbed areas and culverts where water collects should not be overlooked (Silverman pers. comm.). If present, impacts to flat-seeded spurge, a BLM Sensitive species, would be considered significant.

The Jepson Desert Manual (Baldwin et al. 2002) and the Arizona Native Plant Society indicate that it blooms in May. However, the CNPS Inventory (2009) lists the bloom period as February to September. Regional botanical experts consulted by staff indicated that it was also a "summer active" species, and like so many plants in the upper Sonoran/southeast Mojave transition zone, it flowers after it rains, and rains are about equally distributes in this region between spring and summer-fall (Andre pers. comm; Sanders pers. comm.; NOAA 2009).

Flat-seeded spurge has only 4 occurrences listed in the CNDDB (2010); the most recent observation was in 1974. Staff reviewed the occurrence data in the Consortium of California Herbaria and detected 1 new occurrence that was not in the CNDDB. This occurrence is also a historical record (1933). Of the total five occurrences in California (CNDDB plus one additional occurrence from CCH), only 1 of these are protected under State Park ownership. A total of three records are historical records. None of these occurrences documented threats.

The closest known occurrence of flat-seeded spurge is approximately 50 miles away. By virtue of its rarity and the distance to known occurrences, its occurrence in the project area is "unlikely" or "speculative", but it occurs along the western edge of the California desert and in Arizona; hence, it occurs on both sides of the project area (Silverman pers. comm; Sanders pers. comm.). The absence of known occurrences in this area may be because it is easily over-looked (Reiser 1994) or because the area is generally under-surveyed.

If present, potential indirect effects include the spread of Sahara mustard and other invasive pest plants into dune habitat; the ecological impacts of Sahara mustard and the potential for restoration are described in Barrows & Allen (2007); Barrows et al. 2009; Pavlik 2008, and others). Channel diversion and the interruption of aeolian and fluvial sediment transport could also adversely affect its persistence, if detected in the project area.

BLM requests 100 percent on-site avoidance for BLM Sensitive plants but the BLM State Botanist would decide the level of avoidance on a case-by-case basis, if present (Lund pers. comm.). Staff believes with the avoidance required in Section C of **BIO-19**, and the requirement for rescue of an off-site population for any unavoidable impacts, as specified in Sections C and D of **BIO-19**, that the project's direct impacts would be minimized to a less-than-significant level. For the PSPP it was determined that project's contribution to the spread of Sahara mustard, which immediately threatens dunes and other sandy habitats, would be less than cumulatively considerable with the implementation of **BIO-8** (Impact Avoidance and Minimization Measures) and **BIO-14** (Weed Management Plan) Staff's requirement for dune and wash compensation to occur locally (**BIO-20** and **BIO-21)** will minimize future fragmentation of flat-seeded spurge habitat in Chuckwalla (if present) by preventing future development and the indirect effects of weeds and fragmentation that accompany development. Impacts from the PSEGS would be similar and the conditions of certification are recommended to minimize the impacts from the PSEGS to a less-than-significant level.

Lobed Ground Cherry

Lobed ground cherry is a RPR 2.3 species, meaning that is rare, threatened, or endangered in California, but more common elsewhere; the threat rank indicates that it is not very endangered in California. During the proceedings for the PSPP, it had a State Rank of 1.3, indicating that it was known from fewer than 5 viable occurrences in California but the occurrences were somewhat stable. It has since been downgraded to a State Rank of 2 which indicates it is imperiled in California because of rarity due to very restricted range. Its Global rank of 5 indicates that it is relatively stable outside of California. It occurs largely on alkaline dry lake beds but it has also been found in drier, less saline-alkaline environments on decomposed granitic soils in Mojave Desert scrub habitat. Due to its preference for lakebeds, mudflats, and desert sinks, and its apparent preference for alkaline and sub-alkaline habitats, staff believed that the northern and northeastern portions of the project have the highest potential for occurrence but staff does not dismiss the possibility that it could occur anywhere on the project. It was not detected in these areas during fall 2010 surveys however surveys would be required along the two new proposed linear features.

For the PSPP, staff reviewed the occurrence data in the Consortium of California Herbaria and detected two new occurrences that were not in the CNDDB. Both of these are more recent occurrences, including one from Joshua Tree National Monument and one in the eastern Mojave Desert. Staff asserted that the two additional occurrences could (theoretically) reduce the State Rank from 1 (less than 5 viable occurrences) to a rank of 2 ("6 to 20 viable occurrences"), unless the threats to occurrences have increased. None of the 6 occurrences are historical records and none have documented threats (CNDDB 2010). Since 2010 this species has been downgraded to a State Rank 2

For the PSPP, staff considered that impacts to this very rare species in California would be significant, if present. Such an occurrence would also represent a range extension (i.e., occur at the periphery of its range in California). Potential indirect effects, if present, include the spread of Russian thistle and other alkaline-tolerant weeds into its habitat. Russian thistle is already present in the playa margin habitats and in the northeast portion of the project area. Construction-related disturbance and vehicle use along the existing roads are common vectors for the spread of invasive pest plants. Even if found off-site in the playa margins, it could be indirectly affected by alteration of the site hydrology or sedimentation, if located directly below the engineered channel discharge points. For the PSEGS, even with the downgrade to rank 2, staff would still consider impacts as described above to be significant if present.

If present, implementation of the avoidance and compensatory mitigation requirements in Sections C and D of **BIO-19** would reduce the project's impacts to a less-than-significant level. There does not appear to be opportunities for acquisition of occupied habitat at this time but there are private lands adjacent to the Lanfair Valley occurrence at Ox Ranch. Since lobed ground cherry was downgraded to a Rank 2 as a consequence of detecting new occurrences and a low risk of extinction from other threats, then acquisition could include adjacent lakebed or other alkaline and sub-alkaline habitats that are at risk of development. If such lands are acquired within Chuckwalla Valley, as proposed in **BIO-20** (compensatory mitigation for dunes and MFTL habitat) and **BIO-21** (compensatory mitigation for desert washes), then the acquisition would minimize the threat of future fragmentation of remaining habitat surrounding the project.

Implementation of **BIO-8** (Impact Avoidance and Minimization Measures) and **BIO-14** (Weed Management Plan), and the Best management Practices and other measures in Section A of **BIO-19** would minimize the PSEGS project's contribution to the spread of Russian thistle and other weeds to a less-than-significant level.

Indirect Impacts to Special-Status Plants

For the PSPP, staff considered the following indirect impacts to special-status plants, (i.e., impacts outside the Project Disturbance Area or that occur following construction): introduction and spread of invasive plants; alteration of the surface hydrology and basic geomorphic processes that support rare plants and their habitat (e.g., disrupted aeolian and fluvial sand transport processes from obstructions or diversions); population fragmentation and disruption of gene flow; potential impacts to pollinators; increased risk of fire; erosion and sedimentation of disturbed soils which render the habitat vulnerable to invasion by pest plants; disturbance of the structure and ecological functioning of biological soil crusts which affect seed germination, reduces soil nutrition, carbon sequestration, and renders the soil vulnerable to water and wind erosion (Belnap & Eldridge 2001); herbicide and other chemical drift; and disruption of photosynthesis and other metabolic processes from fugitive dust during construction and operation of the project. These impacts would be similar for the PSEGS.

Changes to drainage patterns downslope of the PSPP project area would have had significant impacts to special-status plant species. Therefore, staff included a measure in **BIO-21** (mitigation for impacts to state waters) and **BIO-19**, Section A (avoidance and minimization measures for special-status plants) related to diffuser design to minimize impacts downstream. Because diffusers would no longer be include in the project design this language has been recommended for deletation by the project owner and staff has made the deletion in the conditions of certification Although, the current design of the PSEGS project would allow flows to pass through the project; some disruption will still occur from roads and project facilities. However, because the disruption to surface hydrology to downstream areas would be limited impacts to plants in these areas would be considered less than significant.

Following construction, invasive species could occupy disturbed soils within the Project Disturbance Area, and then spread into adjacent undisturbed habitats—naturally disturbed habitats such as dunes and washes are particularly vulnerable to colonization by weeds. Staff is particularly concerned about the potential spread of Sahara mustard, which is already present along roads and near the freeway. The primary conduit for spread, however, is along roads and transmission corridors. The dramatic increase in vehicle use of the project vicinity roads and construction of transmission corridors and new roads is expected to increase the spread of this highly invasive wildland pest. Sahara mustard has shown a clear negative impact on native flora (Barrows et al. 2009). Sahara mustard can form dense stands and potentially crowd out native annual plants. Sahara mustard plants growing early in the season may dominate available soil moisture which may adversely affect native annuals which start growing a little later in the season (Barrows et al. 2009). Barrows et al. (2009) found that native annuals growing under a canopy of Sahara mustard were often taller and were etiolated, at the expense producing branches, flowers, and fruits. This led to a shift in the dominance of the following year's species composition from native annuals to Sahara mustard.

Staff requested the project owner supply further data relative to onsite vegetation management regimes, and specifically, to provide data regarding the long-term effects of mowing native vegetation (CEC 2013h). Staff has concerns that throughout the life of the project, successional changes to vegetation may occur. As native vegetation is mowed, the regrowth will happen quickly, and after several years, may deplete nutrients in the soil. It is possible that the vigor of native plants may suffer, and invasive species, which are tolerant of poor conditions, may then proliferate.

Mowing is anticipated to substantially decrease the quality of the vegetation as well as the value of the site for wildlife and all remaining vegetation, including wash vegetation, would be mowed to 12-18 inches (Palen 2013cc). Since vegetation will be managed by the project owner to facilitate use of the site and not to maintain vegetation on site staff is assuming a total loss of the function and value of the vegetation and habitats within the project site because ongoing disturbance and other anthropogenic activities at the site may continue to degrade habitat functions within the project footprint. Plants that are tolerant to disturbance may continue to occupy the site, however, staff does not consider leaving the vegetation on site a benefit to these species due to ongoing risk of destruction or disturbance from construction equipment operational work efforts including mowing, maintenance, and washing of the heliostats.

Tamarisk, Russian thistle, Sahara mustard and Mediterranean grasses are already present in the project area and are expected to increase as a result of construction- and operation-related disturbance. The proliferation of many non-native plants has dramatically increased the fuel load and frequency of fire in many desert ecosystems (Lovich & Bainbridge 1999). Unlike other ecosystems in California, fire was not an important part of the Mojave Desert ecosystems and most perennials are poorly adapted to even low-intensity fires, and the animals that coevolved are not likely to respond favorably to fire either. The potential spread or proliferation of non-native annual grasses, combined with the proximity to ignition sources could potentially increase the risk of fire, and the effects to these poor-adapted desert communities would be harmful, particularly to cacti and most native shrubs species. Burned creosote and other native shrubs are typically replaced by short-lived perennials and non-native grasses (Brown & Minnich 1986). The spread of invasive plants is a major threat to biological resources in the Colorado Desert because non-native plants can displace native plants, increase the threat of wildfire, and supplant wildlife foods that are important to herbivorous species.

Wildfires (caused by construction or downed transmission lines) are rare but the increase in daily vehicle use in the area from an anticipated 100 new jobs during operation and up to 840 jobs during construction could significantly increase the risk of ignition. Other temporary and permanent impacts from the project could occur to surrounding vegetation communities from grading activities creating air-born, fugitive dust, sedimentation, and erosion, which disruption of photosynthesis and other metabolic processes. The destruction of plants and soil crusts by windblown sand and dust also exacerbates the erosion of the soil and accelerates the loss of nutrients (Okin et al. 2001).

Indirect impacts to sensitive plants would be significant absent mitigation. Implementation of the following mitigation measures would reduce project impacts to less-than-significant levels: avoidance and minimization measures (**BIO-8**);, compensating for habitat loss by preventing the future development of desert lands through acquisition and permanent protection under conservation easements, and management of lands these lands to sustain enhanced populations of sensitive species and habitats (**BIO-12**, **BIO-19**, **BIO-20**, and **BIO-22**); focusing the acquisitions into important linkages for species dispersal into critical refugia,, restoring degraded portions of acquired lands (**BIO-12** and **BIO-19**); and minimizing the size of the disturbance area along the linears (**BIO-8** and **BIO-19**);

Impacts of Climate Change to Plants

In a recent study “Climate Change and the Future of California's Endemic Flora” (Loarie et al 2009), anticipated climate change is projected to cause greater than 80 percent reductions in range size for up to 66percent of California’s endemic species within a century. These results are comparable to other studies, but projected reductions depend on the magnitude of future emissions and on the ability of species to disperse from their current locations. California's varied terrain could cause species to move in very different directions, breaking up present-day floras. However, these projections also identify regions where species undergoing severe range reductions may persist. Protecting these potential future refugia and facilitating species dispersal will be essential to maintain biodiversity in the face of climate change (*ibid*). These include the cooler, more mesic microclimates of the mountainous areas, which may protect significant components of biodiversity into the next century. Many of these areas are already in some degree of federal wilderness protection. However, the value of these refugia depends critically on the ability to of species to disperse, underscoring the importance of landscape connectivity and potential restoration in the face of increasing urbanization, land use change, and disturbance (*ibid*).

The PSEGS project is expected to contribute to a cumulative reduction in greenhouse gases. However, the benefits gained by the project's reduction in greenhouse gases must also be weighed against the potential loss of carbon sequestration benefits from the desert vegetation. In order to build the facility, the plants, animals and soil of the native desert acreage are damaged and destroyed, which releases CO2. Presently, there is still dispute among scientists as to how to accurately measure the benefits and the loss (Campbell et al. 2009).

Biotic Soil Crusts and Other Carbon Sinks

Numerous studies conducted over the past 40 years have attempted to identify and quantify the major pools of carbon uptake for the various components of desert ecosystems as well as desert ecosystems as a whole (Schlesinger et al. 2009). The estimates of carbon uptake vary immensely between sites and researchers. In addition to vegetation, alkaline soils and biological soil crusts (BSCs), which are composed primarily of photosynthetic cyanobacteria, algae, lichens, and mosses, play a key role in arid and semi-arid ecosystems and are able to fix carbon. Schlesinger et al. (2009) point out, however, that those pools of carbon that biological crusts fix are relatively small. New evidence suggests alkaline desert soils may be responsible for considerable uptake of carbon. Although there is much uncertainty regarding where and how carbon is stored in desert ecosystems but the recent evidence suggests desert soils have the potential to be a carbon sink. Whether a result of biotic crusts, vegetation, alkaline soils, or an increase in average precipitation, the rate of carbon absorption in the soil has scientists considering whether desert ecosystems play a more critical role in the carbon cycle than previously believed (Stone 2008; Campbell et al. 2009). Some scientists, however, dispute these findings and attribute them to an anomaly caused by increased rain for the study period reported (Campbell et al. 2009). A study is currently underway by the University of Oregon "to determine whether the installation and operation of solar thermal plants will impact carbon sequestration capabilities of the Mojave Desert ecosystem and ecosystem services (assessment endpoint) to the extent that more carbon is released or inhibited from being stored than saved while utilizing solar technology." (Campbell et al. 2009).

Until the dispute about the sequestration benefits of alkaline soils and other carbon sinks is resolved, staff assumes that the answer may vary on a case-by-case basis. For example, project sites that are very sparsely vegetated with only a minor component of soil crusts may confer less sequestration capabilities than sites with a rich cover of biological soils crusts and succulent desert scrubs. There is currently no acceptable means to quantify the sequestration occurring on the project site. Staff believes that implementation of the conditions of certification for the PSEGS project would reduce potential adverse effects from the loss of carbon sequestration. These include avoidance and minimization measures (**BIO-8**), compensating for habitat loss by preventing the future development of desert lands through acquisition and permanent protection under conservation easements (**BIO-12, BIO-19, BIO-20** and **BIO-22**), focusing the acquisitions into important linkages for species dispersal into critical refugia,, restoring degraded portions of acquired lands (**BIO-12** and **BIO-19**), minimizing the size of the disturbance area along the linears (**BIO-8** and **BIO-19**), and revegetating after closure (**BIO-23**).

Cacti, Yucca, and Native Trees

The 2009 and 2010 surveys included an inventory of native cacti, succulents and native trees that are not considered rare (e.g., they are not tracked by CNDDB or included on the CNPS special-status plant lists) but the harvesting of these native plants is regulated under the California Native Plant Protection Act (Fish and Game Codes sections 1900-1913) and the California Desert Native Plant Act of 1981 (Food and Agricultural Code section 80001, et . seq. and Fish and Game Code sections 1925-1926), and prevent unlawful harvesting of non-listed native desert plants of the state (see **Biological Resources Table 1**).

During 2009 and at the request of the BLM, the prior project owner conducted sampling plots for cacti, yucca, and native trees in the PSPP study area primarily to search for and map any locations of California barrel cactus, cottontop cactus, or hedgehog cactus for future salvage when construction begins (Solar Millennium 2009a, Appendix F Biological Resources Technical Report). None of these species were observed in the study area during spring 2009; however, a total of four species in the Cactaceae family were observed during 2009 field surveys including teddybear cholla (*Opuntia bigelovii*), silver cholla (*Opuntia echinocarpa*), pencil cholla (*Opuntia ramosissima*), and common fishhook cactus (*Mammilaria tetrancistra*).

Native trees found during 2009 field surveys included smoke tree (*Psorothamnus spinosus*), ironwood (*Olneya tesota*), blue palo verde (*Cercidium floridium* ssp. *floridium*), ocotillo (*Fouquieria splendens* ssp. *splendens*), and honey mesquite (*Prosopsis glandulosa* var. *torreyana*). Additional mapping of cacti species was performed during 2010 and California barrel cacti, cottontop cactus, and hedgehog cactus were found; a single location with five barrel cacti was observed within the buffer study area and south of I-10 and a single location of cottontop cactus was found in the eastern portion of the Project Disturbance Area (Solar Millennium 2010m, Table 3 and Figure 7).

Staff requested additional information regarding native plants regulated under the California Native Plant Protection Act for all new areas of the project including the natural gas line corridor and the unsurveyed segment of the generation tie-line. The project owner submitted final information regarding rare plant surveys conducted in March 2013 which included a tabulation of all individuals of cacti, yucca, and trees protected by the California Desert Native Plant Act (Palen 2013jj). No California barrel cactus, cottontop cactus, or hedgehog cactus were detected during these additional surveys so no additional maps were provided. However, a total of three species in the Cactaceae family were observed during 2013 field surveys including silver cholla, pencil cholla, and common fishhook cactus. These species were found both along the generation tie-line corridor and the natural gas line corridor with the greatest numbers found along the north-south portion north of I-10. Native trees found during 2013 field surveys included ironwood, blue palo verde, and catclaw acacia (*Senegalia greggii*).

Condition of Certification **BIO-27** required preparation and implement a Revegetation Plan which would address the salvaging of topsoil and native desert plants to aid in the revegetation of temporarily disturbed areas following project construction. **BIO-27** was deleted and avoidance and minimization measures described in **BIO-27** were incorporated into **BIO-8** (Impact Avoidance and Minimization Measures), and weed management measures described in **BIO-27**were incorporated into **BIO-14** (Weed Management Plan). Restoration and revegetation of the solar facility and other permanently disturbed areas upon closure is addressed separately in **BIO-22**.

PROJECT CLOSURE

The original project owner (Solar Millennium) submitted a Draft Conceptual Decommissioning Plan – Palen Solar Power Project (Solar Millennium 2010a) in January 2010 in response to staff's data request for a conceptual decommissioning plan that addressed the fate of the engineered channels (CEC 2009a). Staff requested a conceptual plan for filling the re-created channels and restoring drainages on the project site, including a description of a revegetation plan for restoring the function and values of the ephemeral drainages. Staff also requested a cost estimate, adjusted for inflation, for implementing the closure, including the revegetation component of the closure activities for the drainages, and asked for a conceptual plan and funding mechanism for monitoring and maintenance of the ephemeral drainages until existing functions are reestablished. The proposed PSEGS eliminates the large drainage control channels and the majority of the project site would maintain the original grades and natural drainage features (Palen 2012a). A Revised Draft Conceptual Closure (formerly called Decommissioning) Plan and cost estimate for the PSEGS project would still be required to meet BLM regulations.

Regulations promulgated by BLM at Title 43 Code of Federal Regulations, sections 3809.550 et seq. require a detailed reclamation plan and an estimate. Page 5 of BLM's Instructional Memo for Oregon/Washington BLM Policy for Title 43 Code of Federal Regulations, section 3809 Notice and Plan-level Occupations, and Title 43 Code of Federal Regulations, section 3715 (Use and Occupancy and Reclamation Cost Estimates) (BLM 2009b), lists the requirements for a reclamation plan as follows:

"(c)Reclamation Plan. A plan for reclamation to meet the standards in §3809.420 with a description of the equipment, devices, or practices proposed for use including, where applicable, plans for:

(i) drill-hole plugging;

(ii) regarding and reshaping;

(iii) mine reclamation, including information on the feasibility of pit backfilling that details economic, environmental, and safety factors;

(iv) riparian mitigation;

(iv) wildlife habitat rehabilitation;

(v) topsoil handling;

(vi) revegetation;

(vii) isolation and control of acid-forming, toxic, or deleterious materials;

(ix) removal or stabilization of buildings, structures, and support facilities; and

(x) post-closure management."

Page 3 of the same document also explicitly requires an estimate of the costs of reclamation, as follows:

"Reclamation Cost Estimate. An estimate of the cost to fully reclaim disturbances created during the proposed operations as required by §3809.552. The reclamation cost estimate must be developed as if the BLM were to contract with a third party to reclaim the operations according to the reclamation plan."

Condition of Certification **BIO-22** requires the project owner to develop a Closure and Reclamation Plan and cost estimate that meets the requirements of BLM's regulations, prior to the start of project-related ground disturbing activities or alternate date as agreed to by the BLM. With implementation of Condition of Certification **BIO-22**, impacts to biological resources resulting from closure activities would be mitigated to less than significant levels.

CUMULATIVE IMPACT ANALYSIS

ANALYSIS OF CUMULATIVE EFFECTS TO BIOLOGICAL RESOURCES

"Cumulative" impacts refer to a proposed project's incremental effect viewed over time together with other closely related past and present projects and projects in the reasonably foreseeable future whose impacts may compound or increase the incremental effect of the proposed project (Public Resources Code Section 21083; California Code of Regulations, Title 14, Sections 15064[h], 15065[c], 15130, and 15355). The following sections present a definition of the geographic extent within which cumulative impacts are analyzed and an analysis of the project's potential incremental effects when combined with other past, present, and future projects.

SUMMARY OF THE APPROVED PSPP AND PROPOSED PSEGS PROJECT

Cumulative impacts of the approved PSPP project were considered in light of existing and reasonably foreseeable future projects that threaten plant and animal communities within the context or geographic scope of the Northern and Eastern Colorado Desert Coordinated Management Plan (NECO) (BLM-CDD 2002). The approach employed a combination of quantitative and qualitative analyses. A Geographic Information System (GIS)-based quantitative analysis was reviewed for assessing the direct cumulative effects to habitat loss, and a qualitative analysis was employed of the cumulatively considerable indirect effects, based on consultations with REAT agency biologists and regional experts, and a literature review of the threats to species and their habitats.

For the PSEGS project a qualitative assessment of cumulative effects was based on a review of the approved PSPP project's existing data, the conclusions regarding significance, and a review of any new or anticipated projects in the region. The review considered the projects onsite and offsite survey data, databases, literature, and consultation with regional experts. In addition to the combined effects of habitat loss and direct mortality, staff identified a range of indirect effects that combine with similar effects from other past, present, and foreseeable future project that must be factored into the cumulative analysis. This suite of indirect impacts to which the project would contribute includes: increase in ravens, coyotes, and other predators; introduction and spread of invasive weeds; the effects of groundwater pumping on ecosystems; altered surface drainage patterns; habitat fragmentation; increased risk of fire; erosion and sedimentation of streams; potential for the introduction and or spread of wildlife diseases; diminished habitat values from increased noise and lighting; exotic wildlife invasions; dust and air pollution; road kills; human disturbance; and other factors contributing to a significant cumulative effect.

GEOGRAPHIC SCOPE

This cumulative impact analysis makes a broad, regional evaluation of the impacts of existing and reasonably foreseeable future projects that threaten plant and animal communities within a 50 mile radius of the project area to account for differences in the ecology of various plants and wildlife and includes portions of the Northern and Eastern Colorado Desert Coordinated Management Plan (NECO) (BLM-CDD 2002). The NECO planning area is located in the southeastern California Desert Conservation Area (CDCA). It occurs primarily in the Sonoran Desert region but includes a small portion of the southern Mojave Desert region. For some biological resources, a different geographic scope was warranted, such as the use of watershed boundaries to analyze cumulative effects to desert washes and desert dry wash woodland, or the Chuckwalla Valley for locally significant populations and dune systems restricted to that geographic area.

REGIONAL OVERVIEW

This overview of regional impacts is followed by a more detailed discussion of the effects of past, present, and future projects to biological resources of the project vicinity, with an emphasis on resources found within the Chuckwalla Valley of eastern Riverside County. The California desert remained a desolate area for the first few decades of the 20th century. Disturbance was more or less restricted to highways, railroad, and utility corridors, scattered mining operations, and sheep grazing. In the 1940s, several large military reservations were created for military training, testing, and staging areas. The deserts of eastern Riverside County comprise 40 percent of the county's land area but less than one percent of its population. Outside of the small urban-agricultural center of Blythe, near the Colorado River and Arizona border, there are only a few scattered, small residential and agricultural areas between Indio (to the west) and Blythe; most of the lands are under BLM management. The BLM manages land for multiple uses. While maintenance of habitat features and functions is a priority, the BLM must allow uses that stand in direct conflict with many conservation goals. Mining claims, grazing leases, renewable energy and other project development, and recreational uses may all be permittable under certain circumstances.

Populations of many of the desert's sensitive plants and animals were considered relatively stable until recently, as the push for renewable energy development has placed many populations at risk. Renewable energy projects are part of the solution to climate change, one of the biggest environmental challenges of our time; however, renewable energy development has its own ecological consequences and portions of the Sonoran and Mojave deserts of California bear the brunt of these effects. Energy providers have submitted project applications that would collectively cover more than one million acres of the region (BLM 2010). Poorly planned development could contribute to habitat loss and fragmentation and barriers to species movement and gene flow. Although project permitting and regional planning evaluate basic environmental impacts of such projects, often they do not fully consider impacts on connectivity, conduct thorough cumulative effects analyses, or implement regional monitoring of effects or the efficacy of mitigation.

In the areas identified for renewable energy development in eastern Riverside County, some of the many sensitive biological resources at risk include: desert washes and desert dry wash woodland, desert tortoise, Mojave fringe-toed lizard (including an important local population), western burrowing owl, fragile dune ecosystems, dry lakes, groundwater-dependent ecosystems, and a wide variety of special-status wildlife and plants. Approximately 228 acres of the southwestern corner of the project overlaps the northern boundary of the Chuckwalla Desert Tortoise Critical Habitat Area. The project also lies within a Wildlife Habitat Management Area (Palen-Ford Wildlife Habitat Management Area), and is immediately northeast of the Chuckwalla DWMA.

The incremental, direct loss of habitat and individuals is more significant when considered with the significant indirect effects of fragmentation and its effects on gene flow, disrupted wildlife movement and connectivity, the introduction and spread of non-native plant species, and increases in predators such as ravens, which has also contributed to population declines and range contractions for many special-status plant and animal species (Boarman 2002a). Combined with the effects of historical grazing, agriculture, military training, and highway and aqueduct construction, the proposed wind and solar energy projects have the potential to further reduce and degrade native plant and animal populations. In the context of this large scale habitat loss, the project would contribute, at least incrementally, to the cumulative loss and degradation of habitat for desert plants and wildlife, including desert tortoise and Mojave fringe-toed lizards, in the Chuckwalla Valley and NECO planning area.

MAKING CONCLUSIONS ABOUT THE SEVERITY OR SIGNIFICANCE OF THE EFFECT

"No net loss" does not necessarily mean there are no cumulative impacts. The standard for a cumulative impacts analysis is defined by the use of the term "collectively significant" in the CEQA Guidelines section 15355; the analysis must assess the collective or combined effect of development. Cumulative impact assessments cannot conclude that contributions to cumulative impacts are not significant because the contributions represent a small percentage of the overall problem. Doing so could improperly omit facts relevant to an analysis of the collective effect that the project and other related projects would have upon biological resources. The result could be approval of projects based on an analysis that avoided evaluating the severity of impacts which, when taken in isolation appear insignificant, but when viewed together appear significant. For each cumulative effect the following questions were considered in making conclusions about the severity or significance of an effect:

- The health, status or condition of the resource as a result of past, present and reasonably foreseeable impacts;
- The contribution of the proposed modified project to the overall cumulative impact to the resource;
- The project's mitigated effect, when added to the effects of these planned future projects, and;

Impact avoidance and minimization: any project design changes that were made, or additional opportunities that could be taken, to avoid and minimize potential impacts in light of cumulative impact concerns.

PROJECTS CONTRIBUTING TO CUMULATIVE EFFECTS TO BIOLOGICAL RESOURCES

This analysis evaluates the impacts of the project in addition to the current baseline of past effects, present (existing) projects, and reasonably foreseeable or probable future projects in the I-10 corridor within a 50-mile radius of the proposed PSEGS project. For golden eagle, cumulative impact analysis extends to a 140-mile buffer around the project to account for the large area used by this species. **Biological Resources Figure 9** illustrates the numerous proposed renewable projects on BLM, state, and private land in the I-10 corridor between Desert Center and the Colorado River, near Blythe, in eastern Riverside County. **Biological Resources Table 9** lists the existing and foreseeable future projects (proposed) that were included in the quantitative analysis of cumulative effects for the approved PSPP project and the qualitative approach used to support the proposed modified project; these projects are illustrated spatially in **Biological Resources Figure 9.** Refer to **Executive Summary Attachment A – Table 1**, **Executive Summary Attachment A – Table 2**, and **Executive Summary Attachment – Table 3**, for a complete list of projects considered cumulative to the PSPP project, and therefore part of this analysis.

Biological Resources Table 9
Existing and Proposed Future Projects Considered in Cumulative Effects Analysis for the PSEGS Project

Existing Projects (analyzed quantitatively)	ROW Area[1] (acres)	Foreseeable Future Projects[1] [Proposed] (analyzed quantitatively)	ROW Area[1] (acres)
Chuckwalla State Prison	1,044	Palen Solar Electric Generating System (PSEGS)[2]	3,001
Ironwood State Prison	681	Blythe Solar Power Project[2]	7,239
Eagle Mountain Pumping Plant (MDWSC)	378	NextEra Energy – McCoy (solar)	20,560
Kaiser Mine	5,772	Genesis Solar Energy Project[2]	1,768
I-10 Corridor (200-ft freeway buffer from centerline (CL)	6,494	Bull Frog Green Energy – Big Maria Vista (solar)	22,663
State highways (50-ft highway buffer from CL)	2,640	Chuckwalla Solar 1	4,091
DPV2 transmission line and existing access roads (100ft T-line Tower Buffer; 20-ft road width)	2,861	Rice Solar Energy Project	3,859
Landfills (BLM NECO dataset)	n/a	Desert Quartzite (solar)	7,530
Blythe Energy Project I	153	Desert Sunlight (solar)	5,119
BLM Campgrounds – Wiley's Well, Coon Hollow, Cottonwood Spring, and Midland Long-Term Visitor Area	8,042	EnXco 1 (solar)	1,325
BLM Off-Road Vehicle-authorized/designated routes in Meccacopia SRMS. (BLM NECO Human Use LTVAs dataset)	3,031	Chuckwalla Valley Raceway	493
Blythe area urban and agricultural lands (GAP Analysis vegetation dataset)	88,317	Mule Mountain Solar Project	6,618
Desert Center area urban and agricultural lands (2005 NAIP imagery)	8,424	Eagle Mountain Pumped Storage Project	252
Pipeline (NECO pipelines dataset)	4,392		

Projects Considered Qualitatively			
Existing	**Area** (acres)		**Area** (acres)
BLM Grazing – cattle and sheep allotments (Lazy Daisy, Chemehuevi, Rice Valley, and Ford Dry Lake (recently closed)	n/a	Paradise Valley (residential "new town" development)	6,724
BLM Multiple Use – intensive multiple-use classes	n/a	Blythe Airport Solar I Project	639
General Patton military training areas	n/a	Eagle Mountain Landfill	1,,633
Colorado Aqueduct – open portions	n/a	Blythe Energy Project II	153
Chocolate Mountains Aerial Gunnery Range	n/a	DPV2 proposed roads (2-foot width) and towers (100 sq ft/tower)	256
Four approved commercial and 12 residential developments near Blythe	n/a	Genesis Solar Project access road	29

Projects Considered Qualitatively			
Existing	**Area** (acres)		**Area** (acres)
Solar projects at Arizona border	n/a	Blythe Energy Project transmission line towers	148
BLM renewable energy study areas (future, proposed)	n/a	Genesis Solar Project gas line (100-ft width)	85
BLM transmission corridors	n/a	EnXco 2 Mule Mountain	~2,021
		Red Bluff Substation – for Palen Solar Electric Generating System	90
		Colorado Substation – for Blythe Solar Power Project	44
Total Future Projects[1,3] – 02/05/2010			**339,704 acres**
Total Existing Disturbances[1,3]			**134,750 acres**

1 - Not all of the projects depicted here will complete the environmental review, not all projects will be funded and constructed, and many will not use the entire ROW area** 150,272 acres of agricultural and urban development mapped within the NECO boundary according to the NECO Plant Communities dataset (BLM CDD 2002).

2 - Acreage impacts depicted reflect the project footprint only; not the entire ROW. The unused portions of the ROW would be returned to BLM and not included in the final ROW permit

3 - Because some future projects are proposed on disturbed lands; the numbers shown above subtracted for overlap and represent the acreages used in this cumulative effects analysis.

ANALYSIS OF CUMULATIVE EFFECTS TO BIOLOGICAL RESOURCES

Waters of the State/Desert Washes

The geographic scope for the analysis of cumulative impacts to desert washes (including intermittent and ephemeral washes) included the Palen watershed and greater Chuckwalla Valley. The primary hydrologic feature in the Palen watershed is Corn Springs Wash; several branches of the wash pass through or around the site, some of which abate before reaching Palen Dry Lake. This dry lake is the receiving basin for the 1,496 miles of desert washes that drain the watershed (USGS 2010a). Most of the desert washes that pass through the project site are distributary channels of the alluvial fan—or bajada—that drains the northeastern flank of the Chuckwalla Mountains. Staff analyzed the cumulative effects within the context of the watershed because this relatively small watershed would be affected by several proposed solar projects: Palen Solar Electric Generating System; First Solar Desert Sunlight; enXco 2; and Chuckwalla Solar 1 (see **Biological Resources Figure 9**). Existing impacts to desert washes in the Palen watershed include: urban and agricultural lands around Desert Center, segments of the I-10 and Highway 177 corridors, Kaiser Mine, and various transmission corridors (gas and electric).

The watershed area analysis was based on the U.S. Geological Survey (USGS) National Hydrographic Dataset (2010a) within the watershed boundary as defined by the California Interagency Watershed Map of 1999 (California Interagency Watershed Mapping Committee 1999) (**Biological Resources Figure 3**: Desert Washes–Palen Watershed).

The cumulative effects to desert washes within the Palen watershed are cumulatively considerable and the project itself would be a major contributor to those effects. The effects of all projects are compounded by the fact that they also cause impairment of hydrologic, geochemical, geomorphic, and habitat function and values of the remaining reaches downstream of the impact.

Many of the existing washes in the Chuckwalla Valley have been subject to extensive impairment north of I-10. The highway roadbed and a series of collector ditches south of I-10 have permanently diverted stream flows into a few primary features and deprived flows from many miles of smaller washes. Standing dead ironwood trees, stunted, drought-stressed creosote bushes and other shrubs provides sparse cover with very low species diversity occurring north of I-10 in the Palen watershed. The decline in cover, vigor, and habitat function in this area is a testament to the downstream effects that channel diversions can have on both upland and riparian plant communities. Many of the smaller washes on the project site were already diverted and impaired by construction of I-10. Those washes were diverted, historically, into the three primary washes that pass through or around the site. Theoretically, the extra flows may have enhanced the extent of the desert dry wash woodland on these three washes, but the negative impacts apparent in the thousands of acres outside of these washes reflects the importance of these smaller washes to both riparian and upland ecosystems. For the project, impacts downstream from the site would be minimized by allowing existing flows to pass through the project. Allowing flows to pass through the project would minimize adverse effects to desert washes located in these areas. Therefore the project would not contribute to cumulatively considerable impacts to desert washes in downstream areas.

The effects of past, present, and foreseeable future projects combine with the project's effects and contribute to a significant cumulative impacts on desert washes in the local watershed, particularly on the habitat functions and value of the washes. These effects include impacts to water quality and sediment transport from culverts and road crossings, fragmentation of the habitat and the corresponding loss of habitat function and values, including wildlife movement; and the effects of interrupted fluvial sand transport on the Chuckwalla Valley dune system. Impacts to connectivity and wildlife movement from these diversions are discussed in more detail later in this cumulative effects analysis.

Energy Commission staff has concluded that the project's contribution to the direct loss of desert washes in the Palen watershed and surrounding region would be the same as the PSPP and would not be cumulatively considerable with implementation of Condition of Certification **BIO-21**, which requires the acquisition of desert washes within or adjacent to the Palen watershed. Conditions of Certification **BIO-8** (impact avoidance and minimization measures), and **BIO-7** (monitoring and reporting requirements) are designed to minimize accidental impacts during construction and operation.

Special-Status Wildlife

Desert Tortoise

The geographic extent of the analysis of cumulative impacts to desert tortoise is the range of the Mojave Desert portion of the population with special emphasis on the Colorado Desert Recovery Unit, as recognized by the USFWS (USFWS 2011a). Habitat within this recovery unit has been described as being in excellent condition despite declines in tortoise densities over the past several decades; disturbance was estimated at less than 1.3 percent throughout (USFWS 2005).

The PSEGS project is located in the Riverside Solar Energy Zone (BLM 2012). The Riverside Solar Energy Zone (SEZ) is situated between the Chuckwalla and Pinto Mountains and the SEZ may provide important connectivity for desert tortoise movements between the DWMAs (BLM 2012 and CDFG 2002; Stout 2009). According to habitat suitability models, approximately 136,800 acres (554 km2) of potentially suitable habitat could be directly affected by construction and operations of solar energy development on the revised SEZ (BLM 2012 Table 9.4.12.1-1).

The analysis considers the current USGS Desert Tortoise Habitat Model (Nussear et al. 2009) in defining potential habitat for desert tortoise and is a useful tool for evaluating different land-use issues that tortoises face at a landscape scale. **Biological Resources Figure 7** is a spatial representation of the predicted habitat potential index values for desert tortoise, based on the 2009 model. Nussear et al. (2009) identified approximately 5,547,333 acres of habitat for desert tortoise in the NECO planning area. The model is not intended to be used, or viewed, as a substitute for ground-based and site-specific field surveys. Model scores reflect a hypothesized habitat potential given the range of environmental conditions where tortoise occurrence was documented. Nussear et al. (2009, p. 15) specifically states:

> "*As such, there are likely areas of potential habitat for which habitat potential was not predicted to be high, and likewise, areas of low potential for which the model predicted higher potential. Finally, the map of desert tortoise potential habitat that we present does not account either for anthropogenic effects, such as urban development, habitat destruction, or fragmentation, or for natural disturbances, such as fire, which might have rendered potential habitat into habitat with much lower potential in recent years*".

Most of the proposed modified projects in the region appear to impact moderate- to low-quality desert tortoise habitat. Staff considers the PSEGS project contributions to cumulative habitat loss, even for moderate-to low-quality desert tortoise habitat, to be the same as described for the PSPP and would cumulatively considerable, given the species' decline and its present and future threats. The project would also make cumulatively considerable contributions to loss of desert tortoise connectivity between the Chuckwalla and Chemehuevi DWMAs and critical habitat areas. One of the objectives for desert tortoise recovery in the NECO is to "*mitigate effects on desert tortoise populations and habitat outside DWMAs to provide connectivity between DWMAs*." Maintaining connectivity is particularly important given the threats posed by global climate change, according to the USFWS 2008 Draft Revised Recovery Plan.

Probable desert tortoise linkages between the Chuckwalla and Chemehuevi critical habitat areas and DWMAs are shown in **Biological Resources Figure 6.**

The establishment of the Recovery Units was also intended to protect the species and its habitat requirements so that desert tortoises can maintain self-sustaining populations within each recovery unit into the future (USFWS 2011a). The linkages depicted represent areas of the best habitat quality for tortoises between the DWMAs and critical habitat, and therefore represent the most probable linkages and most important areas to protect to maintain connectivity between the Chemehuevi and Chuckwalla DWMAs. This area represents about 3.3 percent of available suitable habitat of the desert tortoise in the region. The BLM concluded that overall impacts on the desert tortoise from construction, operation, and closure of utility-scale solar energy facilities within the revised Riverside East SEZ is considered moderate, because the amount of potentially suitable habitat for this species in the area of direct effects represents between 1 and 10 percent of potentially suitable habitat in the region, and the implementation of programmatic design features alone is unlikely to substantially reduce these impacts (BLM 2012).

With implementation of Condition of Certification **BIO-12** (acquisition of desert tortoise compensation lands), the project's contribution to the cumulative loss of desert tortoise habitat would be reduced to a level less than cumulatively considerable and would be consistent with the Commission's decision for the PSPP. Condition of Certification **BIO-12** specifies that compensation habitat acquisitions occur within the Colorado Desert Recovery Unit in areas that have potential to contribute to desert tortoise habitat connectivity and build linkages between desert tortoise designated critical habitat, known populations of desert tortoise, and/or other preserve land. Many additional measures were devised to minimize indirect effects during operation and accidental impacts during construction, including: **BIO-1** through **BIO-11**, monitoring and reporting requirements (**BIO-7**), and desert tortoise compliance verification (**BIO-11**). Staff considers that the project's contribution to the spread of Sahara mustard in desert tortoise habitat to be the same as the PSPP project and would be individually minor but cumulatively considerable. Implementation of Condition of Certification **BIO-14** (Weed Management Plan) would minimize this effect.

Although project-specific desert tortoise mitigation measures reduce the project's contribution to cumulative effects to a level less than cumulatively considerable, there are still minor residual effects that could contribute to cumulative effects. These include fragmentation, impaired connectivity, and degradation of the function and values of remaining habitat from predators, non-native invasive plants, fire, and disease. These residual cumulative effects can only be addressed through a regional and coordinated planning effort aimed at preserving and enhancing large, intact expanses of wildlife habitat and linkages, including maintaining connections between wildlife management areas and other movement corridors.

Ongoing collaborative efforts by federal and state agencies to develop the Desert Renewable Energy Conservation Plan (DRECP) and the 2012 BLM Solar Energy Development Programmatic EIS offer an appropriate forum for such planning.

Nelson's Bighorn Sheep

The Approved PSPP project analysis of the NECO bighorn sheep WHMAs and connectivity corridors indicated that occupied and unoccupied ranges would be relatively unaffected by past and future projects (from habitat conversion), due largely to their position in wilderness areas and at higher elevations. However, large-scale renewable energy development could significantly impact gene flow between sheep populations through significant cumulative impacts to connectivity corridors, potentially decreasing the viability of the metapopulation of bighorn sheep. The project itself, however, would have no direct contribution to the loss of habitat within the identified connectivity corridors or WHMAs.

Proposed future projects could also cumulatively and significantly affect bighorn sheep through the loss of spring foraging habitat on the upper bajadas adjacent to occupied range. The impact of development within a one-mile buffer from the base of occupied ranges (or potentially restored populations in unoccupied ranges) was assessed for potential impacts to bighorn sheep foraging habitat. No significant direct impacts to bighorn sheep WHMAs, connectivity corridors, or spring foraging habitat would result from the proposed project; therefore, no mitigation measures relating to bighorn sheep are proposed by staff.

The project is located within the Palen-Ford multi-species WHMA (BLM CDD 2002; map 2-21); however, bighorn sheep are not expected to frequently use the I-10 box culvert undercrossing of Corn Springs Wash. Further, NECO identifies I-10 as a barrier to bighorn sheep movement (BLM CDD 2002). Although the project is expected to affect wildlife movement and connectivity with important wildlife areas north and south of I-10, the project is not expected to significantly affect—directly, indirectly, or cumulatively—bighorn sheep movement.

Mojave Fringe-toed Lizard

Reasonably anticipated cumulative effects considered by staff in a qualitative manner include habitat loss; fragmentation and diminished habitat values of remaining lands; and mortality from increased vehicle traffic through lands supporting this species. Other anticipated cumulative effects to Mojave fringe-toed lizard include impacts to sand transport systems and the maintenance of dunes from renewable energy projects (wind fencing and the obstruction of sand-carrying winds and water-deposited sands); premature stabilization of dunes by the spread of noxious weeds, which also fuel wildfires; and increased risk of fire from transmission lines or vehicle use; the effects of past and future grazing and off-road vehicle use; edge effects and fragmentation of the remaining habitat and reduced gene flow; and an increase in predation by ravens and other predators from an increase in perching structures. Obstructions to the wind-sand transport corridor from structures and wind-fencing, and the indirect effects of the obstruction to the maintenance of dunes downwind of the obstruction, are expected to be cumulatively considerable, and would result in an additional—and cumulatively considerable—loss of Mojave fringe-toed lizard habitat.

Within Chuckwalla Valley Mojave fringe-toed lizard habitat would be directly impacted by the construction of the PSEGS, and the project is a major contributor to that effect. These effects are significant when combined with the expected indirect effects to

Mojave fringe-toed lizard habitat, including: interruption of aeolian (wind-deposited) sand transport processes from projects and their wind fencing; diversions of desert washes and interruption of fluvial transport of sand that contribute to the maintenance of habitat; an increase in avian predators from the new perching structures provided by these projects, and the continuing spread of Sahara mustard.

The project's contribution to the loss of habitat, increased noise and lighting, road kills, fragmentation, and the spread of invasive pest plants is cumulatively considerable. However, the project's contribution to these effects would be reduced to a level less than cumulatively considerable through implementation of several conditions of certification designed to address indirect effects as well as habitat loss. Staff has concluded that the loss of Mojave fringe-toed lizard habitat resulting from the PSEGS project to be the similar to the PSPP project and could be mitigated to less than cumulatively considerable levels with implementation of Condition of Certification **BIO-20.** Staff believes that by requiring the project owner to acquire and preserve habitat within the Chuckwalla Valley dune system, at a ratio of 3:1, fragmentation from anticipated future development of private lands can be minimized by protecting, in perpetuity, these lands from future development. The project's contribution to the spread of Sahara mustard, which degrades the quality of Mojave fringe-toed lizard habitat to be the same as the PSPP project and would be individually minor but cumulatively considerable. Staff believes this effect can be reduced to a level less than cumulatively considerable through implementation of **BIO-14** (Weed Management Plan).

Bald and Golden Eagle

The habitat loss from the project is similar to the Commission approved PSPP and would contribute to the cumulatively considerable loss of golden eagle foraging habitats in the Chuckwalla Valley and the NECO planning area, as well as the loss of habitat utilized by bald eagle primarily during migration. The project's contribution to the cumulative impacts is more significant when combined with the reasonably foreseeable indirect effects of habitat fragmentation from the construction of proposed future projects. The USFWS and others (USFWS 2009b; Kochert et al. 2002) estimate there are approximately 30,000 golden eagles in the western U.S., down from an estimated 100,000 in the late 1970s. Survey data from 2003 and 2006–2008 indicate a decline of 26 percent since 2003. Climate change is also expected to impact golden eagle by increasing drought severity, and the CO_2 concentrations are expected to exacerbate the spread of non-native invasive plants, which displace native species and habitats, fuel wild fires, and alter fire regimes. Additionally, the proposed transmission lines for this and other proposed future projects are also expected to increase raptor collisions and electrocutions. The use of power tower technology may further contribute the decline of golden eagles from exposure to elevated levels of solar flux.

Proposed future projects within the NECO planning area and Chuckwalla Valley would cumulatively displace substantial amounts of foraging habitat for golden eagles including creosote bush scrub and desert dry wash woodland. Habitat loss for bald eagles would also occur but the species is expected to occur as a migrant. The project's contribution to the cumulative loss of foraging habitat within the NECO planning area would be minimized to level less than cumulatively considerable through mitigation measures for acquisition of 4,860 acres of Sonoran creosote bush scrub habitat, as specified in staff's proposed Condition of Certification **BIO-12.** Further, 788 acres of desert washes and riparian habitat within or adjacent to the Chuckwalla-Ford Dry Lake watershed would be placed under permanent protection under Condition of Certification **BIO-22**. While acquisition does not address the net loss of foraging habitat in the immediate future, it is expected to prevent future losses of habitat by placing a permanent conservation easement and deed restrictions on private lands that could otherwise be converted for urban or agricultural uses or energy development.

The project's contribution to the spread of invasive non-native plants such as Sahara mustard, which degrades the habitat and fuels fires, would be less than cumulatively considerable after implementation of Condition of Certification **BIO-14** (Weed Management Plan.

The project's associated transmission lines contribute to a cumulatively considerable effect from collisions and electrocutions for golden eagle and other raptors. This impact would be less than cumulatively considerable with implementation of Condition of Certification **BIO-8** (#5) which requires that transmission lines and all electrical components be designed, installed, and maintained in accordance with the Avian Power Line Interaction Committee's (APLIC's) Suggested Practices for Avian Protection on Power Lines (APLIC 2006) and Mitigating Bird Collisions with Power Lines (APLIC 1994). Implementation of Condition of Certification **BIO-16a and BIO-16b** would further minimize the project's contribution to cumulatively considerable impacts from collisions, electrocutions, and habitat loss and degradation through the development of monitoring and an adaptive management program, power line retrofits, and annual funding for the life of the project for avian conservation actions, including habitat enhancement and restoration, to avoid, minimize, and mitigate future project-related avian impacts.

The project's contribution to cumulative effects to golden eagles from the operation of the project may be cumulatively considerable even with the implementation of staffs recommended conditions of certification. This conclusion differs from the PSPP and is based on the risk from exposure to elevated levels of solar flux. While it is uncertain, project operation has the potential to result in injury or mortality (take) to golden eagles, and to a very limited extent to bald eagles from exposure to elevated levels of solar flux and or irradiance during the life of the project. Currently there are no scientific peer reviewed models that allow staff to accurately quantify the expected number of that would be subject to mortality or morbidity during the operation of the project. However, staff considers the risk to be real based on the presence and use of the area by golden eagles and periodically by bald eagles; the physical and behavioral characteristics of the eagles (i.e., large size, soaring flight patterns, elevation of flight), and the presence of elevated levels of solar flux. Staff considers Conditions of Certification **BIO-16a and BIO-16b** to provide meaningful mitigation that would minimize the project's contribution to cumulatively considerable impacts through habitat enhancement and other actions. However, the impacts may remain cumulatively considerable even with the implementation of mitigation.

Special Status Birds

Proposed future projects within the NECO planning area and Chuckwalla Valley would cumulatively displace substantial amounts of foraging and/or nesting habitat for other special status species including the state-threatened Swainson's hawk Yuma clapper rail, gilded flicker, elf owl, osprey, ferruginous hawk, burrowing owl, Cooper's hawk, bald eagle, sharp-shinned hawk, northern harrier, prairie falcon, peregrine falcon, Harris hawk, and short-eared owl (this is not a comprehensive list). The project's contribution to the cumulative loss of habitat is comparable to the cumulative loss of eagle habitat, described above and would be consistent with the Commission's decision for the PSPP. Staff concluded that the loss of habitat from all proposed future projects to be significant, and the project's contribution to that effect is cumulatively considerable. The project will also contribut7e to a cumulatively considerable impact from habitat fragmentation and edge effects, noise and lighting, increased road kills, increased risk of fire from weed invasion and increased ignition sources (vehicles), all of which ultimately degrade the function and values of the remaining habitat. The project's contribution to these indirect effects and loss of habitat would be mitigated to a level less than cumulatively considerable through: avoidance and minimization measures in BIO-8, BIO-14 (Weed Management Plan) and BIO-27 (Revegetation of Temporarily Disturbed Soils) to address the Project's contribution to the spread of Sahara mustard and other weeds; BIO-12 for acquisition of 4,860 acres of desert tortoise habitat, which is expected to contain suitable habitat for many resident and migratory birds; and BIO-21, which requires acquisition and protection of desert washes and adjacent habitat within the local watersheds, which will minimize future fragmentation in the Chuckwalla Valley. The Energy Commission determined that cumulative effects to most resident and migratory birds from construction of the PSPP would be mitigated to less than significant levels; however the risk to these birds from exposure to elevated levels of solar flux for the PSEGS may be cumulatively considerable even with the implementation of Conditions of Certification BIO-16a and BIO-16b. Many species of birds have been observed or are expected to occur in or near the site and have flight characteristics that place them at operational risk during the life of the project.

All of these species may be vulnerable to operational impacts including collision with heliostats or other project facilities and injury or mortality from exposure to solar flux.

Western Burrowing Owl

The project's contribution to the cumulative loss of burrowing owl habitat is comparable to the cumulative loss of badger and kit fox habitat, described above and would be consistent with the Commission's decision for the PSPP. Staff concluded that the loss of habitat from all proposed future projects to be significant, and the project's contribution to that effect is cumulatively considerable. The project will also contribute to a cumulatively considerable impact from habitat fragmentation and edge effects, noise and lighting, increased road kills, increased risk of fire from weed invasion and increased ignition sources (vehicles), and an increase in avian predators, all of which ultimately degrade the function and values of the remaining habitat. Burrowing owls may also be at risk from operation of the facility from collisions or exposure to elevated levels of solar flux.

The project's contribution to these indirect effects and loss of habitat would be mitigated to a level less than cumulatively considerable through: **BIO-18** avoidance and minimization measures specific to burrowing owl; measures for addressing impacts from noise, lighting, and traffic (road kills) through a variety of measures in **BIO-8**, **BIO-14** (Weed Management Plan) and **BIO-27** (Revegetation of Temporarily Disturbed Soils) to address the Project's contribution to the spread of Sahara mustard and other weeds; **BIO-12** for acquisition of 4,860 acres of desert tortoise habitat, which is expected to contain suitable habitat for badger and kit fox; and **BIO-21**, which requires acquisition and protection of desert washes and adjacent habitat within the local watersheds, which will minimize future fragmentation in the Chuckwalla Valley area by protecting lands from future development. The Raven Management Plan **(BIO-13)** is expected to minimize the project's contribution to the increase of avian predators of burrowing owl.

The Energy Commission determined that cumulative effects to burrowing owl from construction of the PSPP would be mitigated to less than significant levels; however the risk to burrowing owl from exposure to elevated levels of solar flux for the PSEGS may be cumulatively considerable even with the implementation of Conditions of Certification **BIO-16a** and **BIO-16b**. Burrowing owls have been routinely observed on the site; are known to occur in the region; and have flight characteristics that place them at operational risk during the life of the project.

Le Conte's Thrasher

The project's contribution to the cumulative loss of habitat for Le Conte's thrasher is comparable to the cumulative loss of badger and kit fox habitat, described above and would be consistent with the Commission's decision for the PSPP. The Le Conte's thrasher is showing steep population declines due to loss of habitat resulting from urbanization and water use combined with prolonged drought. Climate change is expected to exacerbate drought and compound the impacts of surface and groundwater use in the desert region. Further loss, fragmentation, and degradation of habitat could cause local extirpations and imperil Le Conte's thrashers in the Mojave and Sonoran deserts (CalPIF 2006). Current research indicates that many desert birds, including Le Conte's thrasher, are highly susceptible to habitat fragmentation and disturbance (Kershner, pers. comm.). The Le Conte's thrasher is typically found in very low densities and has large territories, and is therefore at risk of local extirpation from habitat loss.

The cumulative effects from foreseeable future projects on habitat loss are substantial. Although the project's contribution to these effects is individually minor, it nevertheless contributes, at least incrementally, to a cumulatively considerable effect. This species may also be at risk from operation of the facility from collisions or exposure to elevated levels of solar flux.

Staff believes that the project's contribution to the cumulative loss of habitat and the indirect effects would be consistent with the Commission's decision for the PSPP and would be minimized through implementation of the following conditions of certification: **BIO-21**, which requires acquisition and enhancement of 788 acres of desert dry wash woodland to be mitigated within the same local watersheds as the site of the impact; **BIO-15**, which requires pre-construction nesting bird surveys; **BIO-16**, which requires monitoring of bird kills and adaptive management; **BIO-23** and **BIO-24**, which would require monitoring for impacts to groundwater-dependent vegetation around Palen Dry

Lake and remedial action if adverse effects are detected, and **BIO-8**, which includes measures for minimizing the effects of noise, lighting, traffic, and other impacts. **BIO-21** will also minimize future fragmentation in the Chuckwalla Valley region by permanently protecting these critical resources from future development and its associated indirect effects.

The Energy Commission determined that cumulative effects to Le Conte's thrasher from construction of the PSPP would be mitigated to less than significant levels; however the risk to Le Conte's thrasher from exposure to elevated levels of solar flux may be cumulatively considerable even with the implementation of Conditions of Certification **BIO-16a** and **BIO-16b**. These birds appear in low densities and have flight characteristics that place them at operational risk during the life of the project.

American Badger and Desert Kit Fox

Reasonably anticipated cumulative effects considered by staff in a qualitative manner include habitat fragmentation and the diminished habitat values of remaining habitat from increased noise, lighting, exotic plant invasions including their ability to fuel wildfires and alter fire regimes, exotic wildlife invasions, dust and air pollution, increase in predators, agriculture, urban development and the consequences of human intrusion into previously undisturbed habitats: hunting, use of rodenticides and other poisons, road kills, trapping, and human disturbance.

American badger and desert kit fox habitat would be displaced by proposed future projects in the Chuckwalla Valley and NECO planning area. Staff considers this effect cumulatively considerable when combined with the anticipated indirect effects to remaining habitat and populations described above. Staff believes that the PSEGS project's contribution to the loss of habitat, increased noise and lighting, road kills, fragmentation, and the spread of invasive pest plants is cumulatively considerable and would be consistent with the Commission's decision for the PSPP. Staff concluded that the project's contribution to these effects would be reduced to a level less than cumulatively considerable through several conditions of certification designed to address indirect effects as well as habitat loss. These include **BIO-17**(Badger- and kit fox-specific avoidance and minimization measures):**BIO-8** (general avoidance and minimization measures) which contains specific measures to minimize noise and lighting impacts and provides mechanisms to monitor and control the spread of canine distemper; **BIO-14** (Weed Management Plan) to address the project's contribution to the spread of invasive plants, which degrade habitat and fuels fires; **BIO-12** for acquisition of 4,860 acres of desert tortoise habitat, which is expected to contain suitable habitat for badger and kit fox; and **BIO-21**, which requires acquisition and protection of desert washes and adjacent habitat within the local watersheds, which will minimize future fragmentation in the Chuckwalla Valley area by protecting lands from future development.

Burro Deer

Burro deer is a subspecies of mule deer found in the Colorado Desert of Southern California, primarily along the Colorado River and in Desert Wash Woodland communities in upland areas. During hot summers, water is critical, and deer concentrate along the Colorado River where water developments have been installed and where microphyll woodland is dense and provides good forage and cover. Impacts are most important within ¼ mile of natural or artificial watering sites.

The project's contribution to the loss of burro deer range is not cumulatively considerable and would be consistent with the Commission's decision for the PSPP. However, the project would contribute to a cumulatively considerable loss of desert dry wash woodland (microphyll woodland) within the Palen watershed.

Staff concluded that with implementation of **BIO-21**, which requires acquisition and enhancement of 788 acres of desert dry wash woodland to be mitigated within the same local watersheds as the site of the impact, the project's contribution would be less than cumulatively considerable and would be consistent with the Commission's decision for the PSPP. **BIO-21** will also minimize future fragmentation in the Chuckwalla Valley region by permanently protecting these critical resources from future development and its associated indirect effects.

Couch's Spadefoot Toad

One researcher (Dimmitt 1977) has indicated the Palen Lake area as being an area of interest for potential marginal populations; however, Dr. Dimmitt indicated (in consultations with staff) that the area containing suitable breeding habitat was observed on the north and east side of the Palen dunes, which intercept washes coming off the Palen Mountains. Recently this species was discovered east of the project site at the Genesis project and near the Colorado River substation; an ongoing SCE project. It is extremely likely that the western boundary of the Couch's spadefoot toad range extends farther west than reported by Dr. Dimmitt. Range extensions for many species have been recorded in recent years; in part due to the extensive survey efforts conducted to support renewable energy projects. Based on information from the project owner (AECOM 2010t) and Dr. Dimmitt (Dimmitt pers. comm.), staff concluded for the approved PSPP that no suitable habitat (temporary pools at the base of dunes, in washes, channels, or playas) occurs in the project area, and therefore the project would not result in cumulatively considerable impacts to this species and would be consistent with the Commission's decision for the PSPP. While it is possible that this species may occur along portions of the natural gas pipeline, the project owner did not detect this species during surveys performed in spring 2013 (Palen 2013ii).

Although not required the implementation of **BIO-12** for desert tortoise would preserve 4,860 acres of desert tortoise habitat, which may contain some habitat for Couch's spadefoot toad which may benefit this species by preserving land.

Wildlife Movement and Connectivity

Connectivity refers to the degree to which organisms can move among habitat patches and populations. Individuals must be able to move between patches to meet their resource needs, and in the long term populations must be connected to allow for dispersion, gene flow, and re-colonization. This discussion includes a qualitative assessment of cumulative effects to connectivity. The PSEGS project lies within the same area as the PSPP project, and therefore, analysis conducted for movement corridors is largely still applicable; staff has updated this analysis after developing a new list of projects considered cumulative to the PSEGS project.

In both the Palen-Ford WHMA and DWMA Continuity WHMA, the project is a major contributor to the cumulative effects of future projects on the loss of Sonoran creosote bush scrub within the WHMAs. Thus, the project could impede wildlife movement in these corridors and obstruct connectivity for wide ranging wildlife such as burro deer, kit fox, coyotes, and badgers, and on a population level could impede gene flow for desert tortoises. However, some connectivity would remain from existing underpasses along I-10. The project owner indicated that connectivity of habitat along 32-miles of I-10, including 24 undercrossings is preserved along this stretch of the freeway (AECOM 2010f). Based on this information staff concluded that with implementation of the measures described below, the project or its alternatives would not result in cumulatively considerable unmitigated impacts to connectivity for desert tortoise and other wildlife. This conclusion is consistent with the Commission's decision for the PSPP.

Conditions of Certification **BIO- 21** requires that compensation for the loss of desert washes, desert dry wash woodland, and their associated upland habitat must occur within Palen and adjacent watersheds; this is expected to minimize impacts in the Ford WHMA and DWMA Continuity WHMA to less than cumulatively considerable levels by ensuring that mitigation occurs locally and that further fragmentation is prevented by permanently protecting these lands from future development. Impacts to connectivity for desert tortoise could be minimized if the desert tortoise compensation lands were targeted for areas that would enhance wildlife connectivity within the same WHMA and corridor. Condition of Certification **BIO-12** requires that the land acquisitions be within the Colorado Desert Recovery Unit, and have potential to contribute to desert tortoise habitat connectivity and build linkages between desert tortoise populations and designated critical habitat.

Although the implementation of these conditions of certification would reduce the project's contribution to cumulative impacts to wildlife movement and connectivity to less than cumulatively considerable levels, there may still be minor residual impacts. These residual effects from all future projects can only be addressed through a regional and coordinated planning effort aimed at preserving and enhancing large, intact expanses of wildlife habitat and linkages, including maintaining connections between wildlife management areas and other movement corridors.

Ongoing collaborative efforts by federal and state agencies to develop the Desert Renewable Energy Conservation Plan (DRECP) and the 2012 BLM Solar Energy Development Programmatic EIS offer an appropriate forum for such planning.

Natural Communities

Significant cumulative effects to plant communities from proposed future projects are expected to occur in many community types, particularly playa, Sonoran creosote bush scrub, and desert dry wash woodland. Similarly, indirect effects to remaining habitat would occur from fragmentation, alteration of the surface drainage patterns which support many common and rare species, to both riparian *and upland* habitats. Other reasonably anticipated indirect effects which the project has a cumulatively considerable effect is an increase in the risk of fire (from increased vehicle use of area roads) and the introduction and spread of noxious weeds. Sahara mustard is of particular concern because it is already infesting many areas on and adjacent to the project and has the potential to spread explosively if not carefully managed. Climate change is expected to exacerbate the effects of drought and noxious weed spread. The project may also have a cumulatively considerable impact on groundwater-dependent ecosystems in the Palen Lake watershed from its proposed construction-related groundwater pumping. The project contributes at least incrementally to the cumulative loss of Sonoran creosote bush scrub and desert dry wash woodland. Sonoran creosote bush scrub is a common and widespread community in the southeastern deserts of California; however, this broad designation does not reflect the importance of large, intact blocks of habitat to wildlife movement, or to foraging and breeding habitat for wildlife, including state and federal listed species. The NECO mapping of plant communities also does not reflect the many uncommon and even rare plant assemblages within creosote scrub that have been documented and are monitored by the CDFW (CDFG 2003).

Condition of Certification **BIO-12** for acquisition of 4,860 acres of desert tortoise habitat (Sonoran creosote bush scrub) in Chuckwalla Valley, and Condition of Certification **BIO-21** for acquisition and protection of 788 acres of desert washes and desert dry wash woodland, would minimize the project's contribution to the cumulative loss of these habitats to a level less than cumulatively considerable. While acquisition does not address the net loss of habitat in the immediate future (a temporal net loss of habitat), it is expected to prevent future losses of habitat by placing a permanent conservation easement and deed restrictions on private lands that could otherwise be converted for urban, agricultural, or energy development.

Condition of Certification **BIO-14** for weed management would offset the project's contribution to the indirect cumulative effects of all projects on the spread of non-native invasive plants and their effects on wildlife and fire risk. Condition of Certification **BIO-23** and **BIO-24** for monitoring of groundwater-dependent vegetation (and remedial action in the event of adverse effects) would reduce the project's contribution to this effect to a level less than cumulatively considerable.

Playas and dry lakebeds appear to be disproportionately affected by the cumulative effects of potential future projects across NECO. Due to their limited extent and potential status as jurisdictional state waters, and their hydrologic importance and seasonal value to wildlife, staff considers this a significant cumulative effect. However, the project does not contribute directly to this effect. The project's potential indirect effects to nearby playa habitats would be minimized to a level less than cumulatively considerable through the implementation of **BIO-23** and **BIO-24.**

Landforms

The cumulative effects of future (proposed) projects to dunes, playas, and plains (including sandy plains, which make up a large portion of Mojave fringe-toed lizard habitat) would be substantial. Dunes and sandy plains provide habitat for several rare plants including Harwood's milk-vetch. The project's contribution to these effects, even when seemingly minor can be significant if they affect an extremely rare or limited resource, and the cumulative impact may be substantial. Staff considers the project's contribution to cumulative effects to sand dunes cumulatively considerable and consistent with the Commission's decision for the PSPP.

Condition of Certification **BIO-20** requires implementation of impact avoidance and minimization measures and acquisition of dune habitat at a 3:1 ratio for the sand dune habitat loss attributable to the project, and a 1:1 ratio for other sandy habitats that support Mojave fringe-toed lizards (e.g., sandy plains, sand-covered fans, and sand-covered playas) and 0.5:1 for indirect impacts to the sand transport corridor. These acquisitions would need to be targeted for dune habitat within the Chuckwalla Valley with potential to contribute to Mojave fringe-toed lizard habitat connectivity. Staff believes that implementation of **BIO-20** would offset the project's contribution to the loss of habitat.

The project's contribution to cumulatively considerable indirect effects from the spread of Sahara mustard and other invasive pest plants into dunes and the adjacent habitats upslope will be minimized to a level less than cumulatively considerable through implementation of Conditions of Certification **BIO-14** (Weed Management Plan), **BIO-27** (revegetation of temporarily disturbed areas using locally native seed). Impacts to the groundwater-dependent ecosystems that occur around the playa and in dunes will be minimized through **BIO-23** and **BIO-24** (monitoring of groundwater-dependent vegetation and remedial action in the event of adverse effects).

Desert Dry Wash Woodland (Microphyll Woodland)

The small overall area typically represented by this community, relative to Sonoran creosote bush scrub, belies its importance to wildlife. Although the project would attempt to maintain existing surface drainage, rather than divert the runoff around the project perimeter, staff considers the perimeter exclusion fencing, and regular vegetation mowing and spraying and road construction and maintenance, and human activity to be a significant impact to the habitat functions and value of the streams. Desert dry wash woodland is a sensitive natural community recognized under many LORS and area plans. Because it has a limited distribution (relative to common and widespread communities such as Sonoran creosote bush scrub) and carries an ecological importance that is disproportionate to its limited extent, staff considers this a cumulatively considerable effect, particularly in light of the project's contribution to cumulative effects to desert washes in the Palen watershed and is consistent with the Commission's decision for the PSPP. The project's contribution to the cumulative loss of desert dry wash woodland would be mitigated to a level less than cumulatively considerable through Condition of Certification **BIO-21,** which specifies acquisition and enhancement of desert wash woodland within or adjacent to the Palen watershed a 3:1 mitigation ratio.

Active Dune Habitat

Dunes provide habitat for a variety of special-status plants and animals; locally these include the Chuckwalla Valley population of Mojave fringe-toed lizard and a variety of special-status plants: Harwood's milk-vetch; Harwood's woolly-star; jackass clover; Palmer's jack-ass clover, and ribbed cryptantha. The effects of these past, present, and foreseeable future projects combined with the project's effects contribute to a significant cumulative effect to dune habitat from: obstruction of wind and fluvial sand transport systems (which are essential for the maintenance of the dunes) by new structures and wind fencing; fragmentation and degradation of remaining habitat by roads; development; off-road vehicles; altered drainage patterns; and the spread of noxious weeds and other invasive plants such as Russian thistle and Sahara mustard. Habitat values for dune-dependent wildlife are also affected by increased predation from avian predators, which benefit from new perching structures**.** Staff concluded that the direct, indirect, and cumulative impacts of the projects to dune habitat function and value were cumulatively considerable and may not be adequately mitigated through habitat acquisition proposed under Condition of Certification **BIO-20** when considering the project's significant indirect impacts to the sand transport corridor. This conclusion is consistent with the Commission's decision for the PSPP. Other mitigation to minimize indirect effects of the project on dunes and dune-dependent wildlife and plants include the raven and weed management plans (**BIO-13** and **BIO-14**).

Groundwater-dependent Vegetation

The cumulative impact analysis in the **SOIL AND WATER RESOURCES** section indicates that groundwater extraction during construction and operation of this and other foreseeable projects would place the Chuckwalla Valley groundwater basin into an overdraft condition. This impact may be exacerbated by other unidentified renewable energy projects in the I-10 corridor, which has been targeted as a potential area for further renewable energy development. However, water resources staff concluded that the project's contribution (300 acre-feet per year) to this cumulative effect is less than cumulatively considerable but recommended a number of monitoring conditions to ensure that the project's impact to area wells was less than cumulatively considerable. This conclusion is consistent with the Commission's decision for the PSPP.

Groundwater pumping could have a significant indirect impact to biological resources if it lowers the water table in areas where deep-rooted phreatophytes occur, such as mesquite bosques and succulent chenopod scrubs or alkali sink scrub. To ensure that the project would not adversely affect groundwater-dependent vegetation near the project well, Condition of Certification **BIO-23** for groundwater-dependent vegetation monitoring within two to three miles of the project well for the life of the project. Condition of Certification **BIO-24** requires a remedial action plan that would be triggered in the event that impending impacts to groundwater-dependent vegetation are detected during the vegetation, soil and shallow groundwater monitoring prescribed in **BIO-23**.

Special Status Plants

Harwood's Milk-Vetch

New occurrences of Harwood's milk-vetch have been found during surveys of proposed solar projects in the I-10 corridor and this species appears to be fairly well distributed in the dune habitats in the Chuckwalla Valley. Of the 46 total occurrences (CNDDB and CCH) known from 2010; 11 are historical occurrences and approximately 10 occurrences appear to be protected in federal wilderness or state park lands. Most of the remaining occurrences are not located on lands under federal or state protection. It is important to note, however, that survey data from projects in the region have not yet been incorporated into CNDDB or other databases. The new occurrences could theoretically downgrade the CNDDB rank of a species, but if many of the new occurrences would also be directly or indirectly affected by the various projects whose surveys resulted in their discovery, this would also be considered in the evaluation of extinction risk. Staff concludes that although the project's direct impacts to Harwood's milk-vetch are minor, they are cumulatively considerable, when combined with the reasonably expected indirect effects of noxious weeds and fragmentation. This conclusion is consistent with the Commission's decision for the PSPP.

Harwood's milk-vetch habitat would be disproportionately affected by renewable development in the region, and the species' range in California is nearly restricted to the NECO planning area. In the Chuckwalla Valley, its habitat is affected by probable future projects and some has already been lost from development. The loss of habitat quantified is exacerbated from the combined indirect effects of spread of noxious weeds, fragmentation and reduced gene flow among isolated populations from existing and future projects.

Although the project's contribution to these effects may be individually small, it contributes, at least incrementally to a cumulatively considerable effect. According to CEQA guidance, in situations where the cumulative impact is substantial, even small incremental impacts may be cumulatively considerable.

Other species restricted to dune and playa habitats, washes and other sandy habitats also have occurrences outside of federal wilderness or state park lands and are threatened by renewable energy development, but the cumulative effects to Harwood's milk-vetch are of particular concern due to the position of many occurrences in the immediate vicinity of probable future projects and the likelihood of significant indirect effects. Other species that would be subject to loss from reasonably anticipated cumulative effects include: lobed ground cherry, Abram's spurge, jack-ass clover, California and glandular ditaxis. Harwood's eriastrum is somewhat more affected than these aforementioned plant species, and dwarf germander and flat-seeded spurge have very few documented occurrences in California. They also have occurrences that are not protected in federal wilderness designation or in national or state park ownership.

Indirect effects to Harwood's milk-vetch and other plants occurring in close proximity to the project, and to which the project has a cumulatively considerable contribution, include: altered drainage patterns, disrupted wind- or fluvial-sand transport processes, fragmentation of the habitat and reduced gene flow between isolated populations, the spread of non-native plants, which fuel fires and degrade habitat. Climate change is expected to exacerbate the effects of drought, and CO_2 concentration has already been demonstrated to promote the spread of invasive plants.

California ditaxis, the only other special-status plant that would be directly affected, is documented with 21 occurrences (17 in CNDDB and four additional occurrences from the Consortium of California Herbaria that were not in the CNDDB). The occurrence found in the project area is not included in the 17 documented. Four of the records are historical records from between 1921 and 1952. Three are documented with threats from ORV; power line construction threatens another occurrence, and road grading is also a concern for one occurrence. Many occurrences of this species are on private land. However there are both threats to remaining occurrences, and opportunities for restoration and protection through acquisition.

The project's contribution to cumulatively considerable impacts to all special-status plants in the project area, including the four late-season species analyzed, will be minimized to a level less than cumulatively considerable through implementation of **BIO-19**, Section A (Avoidance & Minimization Measures for special-status plants) and through the additional avoidance and compensation requirements described in **BIO-19**. The project's contribution to the spread of noxious weeds will be minimized through **BIO-14** (Weed Management Plan). All of the special-status plants, including the four late-season species, are associated with dunes, washes or playa. **BIO-20** (dune compensation) and **BIO-21** (compensation for desert washes) will minimize future development and fragmentation in the Chuckwalla Valley region by requiring that compensation occur locally. These conclusions are consistent with the Commission's decision for the PSPP.

Overview: Cumulative Impacts to Biological Resources of the Chuckwalla Valley

The direct and indirect effects of the project on many biological resources, when combined with past, present, and foreseeable future development of the Chuckwalla Valley, and other portions of the I-10 region are cumulatively considerable. Of particular concern are the cumulative losses of desert washes, dune habitat, obstruction of the active aeolian sand transport corridor, the spread of Sahara mustard, increase in predation by ravens, roadkills, and fragmentation of the remaining habitat for Mojave fringe-toed lizard and several dune- and playa-associated rare plant species. Reasonably anticipated renewable energy development in Chuckwalla Valley could threaten what remains of the habitat and places several populations at risk of local extirpations—most notably, the local Chuckwalla Valley population of the Mojave fringe-toed lizard. Past and present impacts in Chuckwalla Valley that have already contributed to a decline in aeolian dune habitat, loss of habitat for Mojave fringe-toed lizard and dune-dependent rare plant species, or have indirectly degraded habitat include:

- Compaction and habitat degradation from historic military training operations during World War II;
- Past, present, and future off-road vehicle use around Ford Dry Lake;
- Past and recent sheep grazing around Ford Dry Lake;
- Electric and Natural Gas Transmission line construction;
- Road construction associated with the transmission construction;
- Construction and operation of the Wiley Wells Rest Stop;
- Construction of Interstate 10 (I-10) and the network of diversion ditches south of I-10;
- State Highway 177 and a network of both paved and unimproved roads;
- Urban and agricultural conversion around Desert Center (8,424 acres);
- DPV 1 and 2 Transmission Line and Access Road;
- Construction of the Colorado River Substation and Access road;
- Construction of the Genesis Solar Energy Project; and

- Construction of the Colorado Aqueduct.

The collector ditches associated with I-10 limit the depositional area of the Chuckwalla Mountains bajada to the south (upstream) of I-10 and concentrate the flows into three discrete channels, where historically numerous small channels fanned out over large areas contributing to fluvial sediment to the aeolian system. The downstream effects of these diversions are striking, severe, and very apparent throughout the I-10 corridor to the north, and in comparisons of current and historical photos. The perimeter stormwater conveyance channels proposed with nearly every solar project would closely mimic these effects to the fluvial transport systems. Some of the more apparent edge effects of the past and present stressors itemized above include the severe dune infestations of Russian thistle, which have effectively replaced native plant diversity with a monoculture of Russian thistle. More recently, Sahara mustard has invaded the valley and spread explosively since it was introduced some decades ago. Invasive plants increase fire frequency and are correlated with population declines of milk-vetch and fringe-toed lizard in Coachella Valley (Barrows and Allen 2007).

Reasonably foreseeable future actions that would further contribute to the loss of habitat, or to the fragmentation and degradation of dunes and habitat for fringe-toed lizard and dune-dependent rare plant species include:

- Palen Solar Electric Generating System (3,896 acres)
- Chuckwalla Solar 1 (4,091 acres)
- enXco 2 (Solar Energy Project, 1,325 acres)
- First Solar – Desert Sunlight (5,119 acres)

<u>On the dunes south of I-10:</u>

- LightSource Renewables – Mule Mountain II (not available) ;
- Altera - Mule Mountain (6,618 acres).

In Coachella Valley, blocked sand/wind corridors have been shown to lead to sand compaction and premature stabilization of the dunes, increased mean grain size (which reduces habitat suitability for fringe-toed lizards), and aeolian habitat loss (Turner et al. 1984). Stabilization of the dunes is also aggravated by an increase in non-native invasive plants, introduced through soil disturbance and an increase in vectors (vehicles). Invasive plants are correlated with decreases in the rare dune-endemic species of milk-vetch, fringe-toed lizard, and endemic sand treader cricket in Coachella Valley (Barrows and Allen 2007).

Road construction associated with new solar projects and their related transmission corridors further degrade and fragment the habitat, and lead to an increase in vehicle traffic and encroachment in previously undisturbed areas. Unpaved roads into the valley interior and historical grazing have led to a dramatic increase in noxious weed invasion over large areas of dunes and surrounding habitat, and an increase in vehicle-related mortality and habitat destruction. Human encroachment, agriculture, and development around Desert Center are also accompanied by an increase in predators, such as ravens. These indirect cumulative effects on dune-dependent species are particularly acute in isolated, fragmented habitats that lack the buffering effects of connectivity to larger populations. All of these stressor and effects are documented to have led to the decline of dune ecosystems in Coachella Valley and can reasonably be expected to occur in Chuckwalla Valley with future development.

CONCLUSION

Construction and operation of the PSEGS project would have cumulatively considerable effects in nearly every biological resource area analyzed. These include state waters (desert washes), vegetation, sensitive plants and wildlife, migratory birds, unique landforms (dunes), and wildlife movement. However, with the exception to avian species, the projects contribution to cumulatively considerable effects could be reduced to less than significant levels with the implementation of Conditions of Certification **BIO-1** through **BIO-26**. These effects, and the mitigation designed to minimize these effects, are summarized below.

Special Status Birds: The projects contribution to significant cumulative effects to all avian species (resident and migratory birds) is cumulatively considerable when combined with the anticipated indirect effects to remaining habitat and populations. Anticipated indirect effects may remain cumulatively considerable even with the application of proposed mitigation. These effects differ from the Commission's decision for the PSPP which did not propose power tower technology. **Mitigation**: Pre-construction nesting bird surveys **(BIO-15** compensation lands for loss of Sonoran creosote bush scrub **(BIO-12**); avoidance measures **(BIO-8)**, raven management **(BIO-13),** monitoring during project operation and adaptive management (**BIO-16b**), annual funding for habitat enhancement and restoration actions throughout the life of the project and power line retrofits (**BIO-16a)**and evaporation pond netting and monitoring (**BIO-26**).

Bald and Golden Eagle: The project would contribute a small but cumulatively considerable amount to the loss of foraging habitat for this species and is consistent with the Commission's decision for the PSPP. The risk to golden eagles from exposure to solar flux presents an ongoing threat of mortality or morbidity during the lifetime of the project. Anticipated indirect effects may remain cumulatively considerable even with the application of proposed mitigation. These include: collisions & electrocutions, mortality or morbidity from exposure to elevated levels of solar flux; fragmentation of remaining habitat, spread of Sahara mustard and increased risk of fire. **Mitigation:** Compensation lands for loss of Sonoran creosote bush scrub **(BIO-12**); golden eagle inventory & monitoring (**BIO-25**); avoidance measures (**BIO-8**) monitoring for offsite nesting, collisions, and adaptive management (**BIO-16 b**), and **BIO-16a**, funding for power line retrofits and habitat enhancement and restoration actions throughout the life of the project.

Western Burrowing Owl: The project's contribution to significant cumulative effects from habitat loss to burrowing owl are not cumulatively considerable after the implementation of conditions of certification intended to minimize or fully mitigate those impacts. These effects are consistent with the Commission's decision for the PSPP. However, indirect effects to burrowing owl may remain cumulatively considerable even with the application of proposed mitigation. These include: collisions & electrocutions, mortality or morbidity from exposure to elevated levels of solar flux; fragmentation of remaining habitat, spread of Sahara mustard and increased risk of fire. Mitigation: Burrowing owl-specific avoidance & minimization measures **(BIO-18**); general avoidance and minimization measures for noise, lighting, road kills, etc. in **BIO-8**; raven management **(BIO-13); BIO-14** (Weed Management Plan); fire prevention measures in **BIO-6**. Monitoring during project operation and adaptive management (**BIO-16 b**), and **BIO-16a**, funding for habitat enhancement and restoration actions throughout the life of the project.

Waters of the State/Desert Washes: The project's contribution to significant cumulative effects to desert washes is not cumulatively considerable after the implementation of conditions of certification intended to minimize those impacts and is consistent with the Commission's decision for the PSPP. The following impact avoidance, minimization, and mitigation measures would address the project's contribution to many of the significant cumulative impacts described above: **BIO-21**, which requires compensation in local watersheds to minimize future development and fragmentation of washes; and **BIO-14**, which requires a Weed Management Plan.

Desert Tortoise: The project's contribution to significant cumulative effects to desert tortoise are not cumulatively considerable after the implementation of conditions of certification intended to minimize or fully mitigate those impacts and is consistent with the Commission's decision for the PSPP. **Mitigation: BIO-13** (Raven Management Plan); Designated Biologist/Monitor (**BIO-1** through **BIO-5**); Worker Environmental Awareness Program with emphasis on desert tortoise (**BIO-6**); Avoidance & Minimization Measures (**BIO-8**) for construction and operation; desert tortoise clearance surveys and fencing (**BIO-9**); Relocation /Translocation Plan (**BIO-11)**; compensation lands to be acquired within the Colorado Desert Recovery Unit **(BIO-12**); compliance verification **(BIO-11)**; **BIO-14** (Weed Management Plan); and fire prevention measures **(BIO-6).**

Wildlife Movement & Connectivity: The project's contribution to cumulative impacts to connectivity and wildlife movement are minor and not cumulatively considerable after the implementation of conditions of certification intended to minimize those impacts and is consistent with the Commission's decision for the PSPP. **Mitigation: BIO- 21** requires compensation for desert washes, riparian and associated upland habitat must occur in local watersheds. Impacts to desert tortoise connectivity would be minimized with desert tortoise fencing and maintenance of undercrossings under I-10 south of the project area (**BIO-9**) and with acquisition of desert tortoise habitat (**BIO-12**) in identified connectivity corridors. Disturbance from noise and lighting would be minimized by implementing staff's proposed Condition of Certification **BIO-8**.

American Badger & Desert Kit Fox: The project's contribution to American badger and desert kit fox and Nelsons bighorn sheep are cumulatively considerable but mitigated by the implementation of conditions of certification. These effects are consistent with the Commission's decision for the PSPP. **Mitigation:** Badger & kit fox-specific avoidance & minimization measures (**BIO-17**); general avoidance and minimization measures for noise, lighting, road kills, etc. in **BIO-8**; fire prevention measures (**BIO-6).**

Natural Communities: The projects contributions to significant cumulative effects to natural communities are not cumulatively considerable after the implementation of conditions of certification intended to minimize or fully mitigate those impacts. These effects are consistent with the Commission's decision for the PSPP. **Mitigation:** Acquisition of desert washes in local watersheds to minimize future development and fragmentation of washes (**BIO-21**), requires dune compensation in Chuckwalla or Palen wind sand transport corridor **BIO-20**; **BIO-12** compensation for creosote bush scrub prevents future development of same habitat on alluvial fans/bajadas; **BIO-14** (Weed Management Plan); **BIO-27** (Revegetation of Temporarily Disturbed Soils). In addition, potential indirect impacts to groundwater-dependent ecosystems around the playa margins would be avoided/minimized through vegetation, groundwater and soil monitoring to detect impending changes from groundwater drawdown (**BIO-23**); and triggers for remedial action and compensation requirements if impacts detected (**BIO-24**).

Active Dune Habitat: The projects contribution to cumulatively considerable indirect effects to the loss of dunes will be minimized to a level less than cumulatively considerable through implementation of Conditions of Certification. These effects are consistent with the Commission's decision for the PSPP**. Mitigation: BIO-20** which requires compensation in the Chuckwalla or Palen wind sand transport corridor to minimize future development and fragmentation of dunes.

Groundwater-Dependent Vegetation (GDVs): Water Resources staff concluded that project's contribution to groundwater impacts in Chuckwalla basin is less than cumulatively considerable due to size and reservoir of aquifer and is consistent with the Commission's decision for the PSPP. Staff expects that impacts to GDVs, and the wildlife they support, across all groundwater basins in NECO are significant. Project contribution to impacts to GDVs is cumulatively considerable. **Mitigation:** Vegetation, groundwater and soil monitoring to detect impending changes from groundwater drawdown (**BIO-23**); and triggers for remedial action and compensation requirements if impacts detected (**BIO-24**).

Special-Status Plants: The project's contribution to cumulatively considerable impacts to all special-status plants in the project area, including the four late-season species analyzed will be minimized to a level less than cumulatively considerable through implementation of conditions of certification. These effects are consistent with the Commission's decision for the PSPP. **Mitigation:** Avoidance and minimization measures during construction, operation, and closure (**Section A, BIO-19**); **BIO-14** (Weed Management Plan); **BIO-27** (Revegetation of Temporarily Disturbed Soils); and (**Section D, BIO-19**) compensation must occur on occupied lands or adjacent buffer lands to minimize fragmentation and edge effects, and restoration must achieve a rescue of a population threatened by invasive weeds, ORV use, grazing, or hydrologic/geomorphic alterations. Requirement for local compensation for dunes (**BIO-20**) and desert washes (**BIO-21**) minimizes future fragmentation of remaining habitat through preservation and protection of the wind sand transport corridor.

Impacts to Biotic Soil Crusts and Carbon Sequestration Benefits of Native Vegetation and Soils: The PSEGS project is expected to contribute to a cumulative reduction in greenhouse gases and is consistent with the Commission's decision for the PSPP. Staff concluded that the following mitigation measures would reduce the project's contribution to the cumulative loss of sequestration benefits to a level less than significant: Mitigation: Minimizing the area of soil disturbed along the linears through avoidance and minimization measures (BIO-8 and BIO-19); preventing the future loss of habitat by placing permanent conservation easements on private lands that could otherwise be developed under the habitat acquisition requirements (BIO-12, BIO-20, and BIO-21); restoring degraded portions of compensatory mitigation lands, as required in BIO-12, BIO-20, and BIO-21; and revegetating the solar facility after Project closure (BIO-22)**.**

Mojave Fringe-toed Lizard: The project's contribution to significant cumulative effects to Mojave fringe-toes lizard are not cumulatively considerable after the implementation of conditions of certification intended to minimize or mitigate those impacts and is consistent with the Commission's decision for the PSPP. **Mitigation:** Designated Biologist/Monitor (**BIO-1** through **BIO-5**); Worker Environmental Awareness Program (**BIO-6**); Avoidance & Minimization Measures (**BIO-8**) for construction and operation; compensation lands (**BIO-20**); compliance verification **(BIO-11)**; **BIO-14** (Weed Management Plan); and fire prevention measures **(BIO-6).**

Burro Deer: The project's contribution to the loss of burro deer range is not cumulatively considerable and would be consistent with the Commission's decision for the PSPP. **Mitigation**: **BIO- 21** requires compensation for desert washes, riparian and associated upland habitat must occur in local watersheds; preventing the future loss of habitat by placing permanent conservation easements on private lands that could otherwise be developed under the habitat acquisition requirements (**BIO-12** and **BIO-20**).

Couch's Spadefoot Toad: The project's contribution to the loss of Couch's Spadefoot toad or their habitat is not cumulatively considerable and would be consistent with the Commission's decision for the PSPP. **Mitigation:** Although not required the implementation of **BIO-12** for desert tortoise would preserve 4,860 acres of desert tortoise habitat, which may benefit this species by preserving land.

COMPLIANCE WITH LORS

The PSEGS project must comply with state and federal laws, ordinances, regulations, and standards (LORS) that address state and federally listed species, as well as other sensitive species and their habitats.

STATE LORS

Under the Warren-Alquist Act (Pub. Resources Code § 25500) the Energy Commission's certificate for thermal power plants 50 MW and more is "in lieu of" other state, local, and regional permits (*ibid*.). Staff has incorporated into the conditions of certification in this FSA all required terms and conditions that might otherwise be included in state permits to satisfy the following state LORS:

Incidental Take Permit: California Endangered Species Act (Fish and Game Code Sections 2050 et seq.) The California Endangered Species Act (CESA) prohibits the "take" (defined as "to hunt, pursue, catch, capture, or kill") of state-listed species except as otherwise provided in state law. Construction and operation of the PSEGS project could result in the wake of desert tortoise, listed as threatened under CESA. Condition of Certification **BIO-12** specifies compensatory mitigation for desert tortoise habitat loss at a 5:1 ratio for all areas that occur within Critical Habitat and a 1:1 ratio for all other lands. Avoidance and minimization measures described in Conditions of Certification **BIO-6** through **BIO-11** and **BIO-13** would also mitigate for potential impacts to desert tortoise. Implementation of these conditions of certification would ensure compliance with CESA and ensure that impacts to desert tortoise are fully mitigated, with the exception of avian species. Take of any state listed threatened or endangered avian or batspecies by collision, exposure to elevated flux, or loss of foraging habitat, without a take permit would violate CESA and is prohibited.

Streambed Alteration Agreement: California Fish and Game Code Sections 1600 1607. Pursuant to these sections, CDFW typically regulates all changes to the natural flow, bed, or bank, of any river, stream, or lake that supports fish or wildlife resources. Construction and operation of the project would result in direct impacts to at least 374.7 waters of the state. The project may also result in minor indirect impacts to approximately 32 acres of state waters located downstream of the site. Condition of Certification **BIO-21** would minimize and offset direct and indirect impacts to state waters and would assure compliance with CDFW codes that provide protection to these waters.

Protected furbearing mammals (Title 14 California Code of Regulations, Title 14, Section 460). This regulation specifies that fisher, marten, river otter, desert kit fox and red fox may not be taken at any time. Condition of Certification **BIO 17** (American Badger and Kit Fox Avoidance Measures) requires the development of a management plan to safely exclude animals from the project site and ensure compliance with the California Fish and Game Code section 460 that provides protection to these species.

Fully Protected Species (Fish and Game Code, Sections 3511, 4700, 5050, and 5515). Designates certain species as fully protected and prohibits the take of such species or their habitat unless for scientific purposes (see also California Code of Regulations Title 14, section 670.7). Golden eagles are a fully protected species that occurs in the project area. Condition of certification **BIO-15** (Pre-construction Nesting Bird Surveys) will avoid direct take of this species during construction. Staff notes that this condition will not guarantee full protection of golden eagles during project operations. Staff's newly proposed Conditions of Certification **BIO-16a and BIO-16b** would require monitoring of the project site and impacts and implementation of a suite of recovery actions such as habitat enhancement, trash removal, power line retrofits, and other actions as determined to be beneficial across the range of species potentially impacted by construction and operation of the project. Loss of habitat would be off-set through Condition of Certification **BIO-12**, compensation lands for loss of Sonoran creosote bush scrub. Take of golden eagles, even if mitigated as required under CEQA, would violate the Fish and Game Code (Fully Protected Species) and is prohibited.

Nest or Eggs (Fish and Game Code Section 3503, 3503.5, and 3513). These regulations protect California's birds by making it unlawful to take, possess, or needlessly destroy the nest or eggs of any bird and by providing a nexus to the federal migratory bird treaty act. Implementation of Conditions of Certification **BIO-1** through **BIO-8** (Impact Avoidance and Best Management Practices) and **BIO-15** (Pre-construction Nest Surveys) would ensure the project complies with regulations that protect nesting birds and their nests.

FEDERAL LORS

The project is located on federal land under BLM's jurisdiction and is therefore subject to the provisions of BLM's California Desert Conservation Area (CDCA) Plan (BLM 1999). As an amendment to the CDCA Plan, BLM produced the Northern and Eastern Colorado Coordinated Management Plan (NECO) (BLM CDD 2002). This document consists of proposed management actions and alternatives for public lands in the NECO planning area. The project is within the central portion of the NECO planning area.

The BLM has worked with the USFWS and CDFW to develop a variety of land designations as tools to protect sensitive biological resources, including the desert tortoise. The siting of the PSEGS project considered the management direction of these designations, as described below:

Desert Wildlife Management Areas (DWMA) are general areas recommended by the Desert Tortoise Recovery Plan (USFWS 1994a) within which recovery efforts for the desert tortoise would be concentrated. DWMAs had no specific legal boundaries in the 1994 Recovery Plan. The BLM formalized the general DWMAs from the 1994 Recovery Plan through its planning process and administers them as Areas of Critical Environmental Concern (see below). The project site is immediately north of the Chuckwalla DWMA and approximately 1,400 linear feet of the proposed generation tie-line is located within the Chuckwalla DWMA. Construction in a DWMA is restricted to no more than one percent of the surface area. The proposed power plant and overhead transmission line require the BLM's approval of a right-of-way (ROW) grant and two CDCA Plan amendments, one amendment for the solar facility and one to allow the project's electric transmission line to be constructed outside a designated corridor. With the BLM's approval of the ROW grant and plan amendments, the PSEGS and the portion of the transmission line outside of the designated corridor would be consistent with the CDCA Plan. The project owner filed a revised plan of development with the BLM on February 13, 2013. BLM requires increased mitigation ratios to off-set habitat loss when constructing in a DWMA. Conditions of Certification **BIO-9** through **BIO-11** would mitigate the loss of desert tortoise habitat and ensure that the PSEGS is compatible with the Northern and Eastern Colorado Desert Coordinated Management Plan (NECO) area. Impacts to the DWMA will be mitigated at a 5:1 ratio.

Area of Critical Environmental Concern (ACEC) are specific, legally defined, BLM designations where special management is needed to protect and prevent irreparable damage to important historical, cultural, scenic values, fish and wildlife, and natural resources or to protect life and safety from natural hazards. The project is not included within any designated ACEC.

Critical Habitat consists of specific areas defined by the USFWS as areas essential for the conservation of the listed species, which support physical and biological features essential for survival and that may require special management considerations or protection. Critical habitat for the desert tortoise was designated in 1994, largely based on proposed DWMAs in the draft Recovery Plan. The southwestern portion of the project site, natural gas line corridor, and proposed generation tie-line corridor overlaps with 228 acres of the Chuckwalla Desert Tortoise Critical Habitat Unit. Conditions of Certification **BIO-9** through **BIO-11** would mitigate the loss of desert tortoise habitat and ensure that the PSEGS is compatible with the Northern and Eastern Colorado Desert Coordinated Management Plan (NECO) area. Impacts to the Chuckwalla Desert Tortoise Critical Habitat Unit will be mitigated at a 5:1 ratio.

Wildlife Habitat Management Areas (WHMAs) address other special-status species and habitat management in the NECO planning area, and include two kinds: one for bighorn sheep, one for all other special status species and habitats. Bighorn sheep WHMAs overlay the entire range of their occurrence and movement corridors. Multi-species WHMAs are complementary to existing restricted areas and DWMAs, which also cover other special status species and habitats. The entire PSEGS project is within a multi-species WHMA. Because PSEGS falls within a specially-designated solar energy zone, no CDCA plan amendment is required. Typically the BLM requires increased mitigation ratios to off-set habitat loss when constructing in a DWMA. The proposed power plant and overhead transmission line require the BLM's approval of a right-of-way (ROW) grant and two CDCA Plan amendments, one amendment for the solar facility and one to allow the project's electric transmission line to be constructed outside a designated corridor. With the BLM's approval of the ROW grant and plan amendments, the PSEGS and the portion of the transmission line outside of the designated corridor would be consistent with the CDCA Plan. The project owner filed a revised plan of development with the BLM on February 13, 2013.

Endangered Species Act (Title 16 United States Code Section 1531 et seq.). Potential take of the desert tortoise, listed as threatened by the USFWS, requires compliance with the federal Endangered Species Act (ESA).“Take” of a federally listed species is prohibited without an Incidental Take Permit, which would be obtained through a Section 7 consultation between BLM and the USFWS. The project owner has submitted a Revised Draft Biological Assessment (BA) for the project to BLM. As of July 2013 the BLM submitted the BA to the USFWS and formal Section 7 consultation process has been reinitiated. The Revised Biological Assessment additionally included the Yuma clapper rail as a covered species. Take of any other federally threatened or endangered species would constitute a violation of ESA.

Bald and Golden Eagle Protection Act (Title 16, United States Code, Sections 668-668c) A recently issued Final Rule (September 2009) provides for a regulatory mechanism under the Bald and Golden Eagle Protection Act (Eagle Act) to permit take of bald or golden eagles comparable to incidental take permits under the ESA. This rule adds a new section at Title 50, Code of Federal Regulation is, section 22.26 to authorize the issuance of permits to take bald eagles and golden eagles on a limited basis. The PSEGS project could potentially result in “take” of the golden eagle from disturbance to nesting pairs, loss of foraging habitat. Operation of the project could also result in injury or death of bald and golden eagles that encounter concentrated solar flux over the heliostat field, potential collisions with project features such as power towers and heliostats, or electrocution via contact with power lines. While the risk of injury or death to bald or golden is unpredictable, staff believes there is the potential for take to occur over the 30-year life of the project. Implementation of Condition of Certification **BIO-16b** would avoid take of golden eagles by monitoring eagle nests during construction and implementing adaptive management measures, and **BIO-16a** would benefit bald and golden eagles by requiring project monitoring and providing funds for various habitat conservation and enhancement measures that would benefit both bald and golden eagles by improving habitat and lessening the risk of electrocution by contacting power lines. Conditions of Certification **BIO-12** and **BIO-21** would provide suitable bald and golden eagle foraging habitat by requiring the acquisition of desert tortoise habitat similar to that lost at the project site, as well as acquisition and permanent protection of desert dry wash habitat. While acquisition does not address the net loss of foraging habitat in the immediate future, it would prevent future losses of habitat by placing a permanent conservation easement and deed restrictions on private lands. The project owner has not elected to apply for an Eagle Conservation Permit at this time; take of an eagle would be considered a violation of the Bald and Golden Eagle Protection Act

NOTEWORTHY PUBLIC BENEFITS

Energy Commission staff considers the analysis of noteworthy public benefits unchanged since the 2010 Decision for the PSPP was released. The PSEGS project and its alternatives would still result in significant impacts to sensitive biological resources, and would permanently diminish the extent and value of native plant and animal communities in the region. Staff has therefore concluded that the PSEGS project would not provide any noteworthy public benefits related to biological resources, despite the contributions the project would make to meeting federal and state mandates for development of renewable energy resources.

START HERE RESPONSE TO COMMENTS

Staff received six comment letters during preparation of the PSA and comment letters on the Biological Resources section of the PSA for the PSEGS project. Energy Commission staff has summarized comments from these letters that raise biological resource issues and have provided the following responses. Responses received during the preparation of the PSA have been included; however, in certain cases the identified responses have changed since publication of the PSA. Changes in staff’s rationale or mitigation approach are reflected within the body of this FSA, and staff responses that are now inaccurate are marked accordingly, for clarity.

LA CUNA DE AZTLAN SACRED SITES PROTECTION CIRCLE, ALFREDO A. FIGUEROA, OPPOSITION LETTER, TN # 69254, JANUARY 21, 2013:

La Cuna Comment: The Palen Solar Power Project will destroy hibernating sites for the Nuttall's poorwill, as well as pristine desert, and has provided information on the occurrence of Nuttall's poorwill in Riverside County.

Response: The common poorwill (*Phalaenoptilus nuttallii*), or Nuttall's poorwill, occurs throughout the western United States, and year round in southern California. This species is covered under the Migratory Bird Treaty Act as well as Fish and Game Code as a migrant, but has no other special protections afforded it by either state or federal regulatory agencies. Habitat consists of dry, open, grassy or shrubby areas in arid lands, and it feeds on night-flying insects. Suitable foraging habitat for this species occurs onsite, and in the general project vicinity. During the months of November to February, consistent with cool weather, this bird enters into "torpor", a state of diminished physical activity and reduced metabolism, similar to hibernation, although not as deep. When the common poorwill enters into torpor, it chooses rocky crevices above the grounds' surface, for security. Additionally, birds may enter a daily torpor during spring or fall months, when food is unavailable or in short supply (Brigham 1992). Individuals in short-term daily torpor may be on the ground, and at risk of crushing from construction vehicles and ground disturbing activities. Staff is unaware of rocky crevices onsite that could support birds in a state of long-term torpor while overwintering. Night-foraging poorwills may be confused by heliostat reflections and be at an unknown risk of collision with heliostats or other project features.

Conditions of Certification **BIO-12** would require 4,834 acres of upland habitat offsets, and mitigation for loss of desert dry wash woodland, which would benefit the common poorwill through preservation of foraging habitat. Additionally, nesting bird surveys would be completed under **BIO-15**, and Conditions of Certification **BIO-16a** and **BIO-16b** provide for ongoing project monitoring, would implement a framework of adaptive management, and provide funding on an annual basis, over the life of the project, for a suite of habitat restoration and enhancement measures that would benefit the common poorwill. Staff believes that implementation of these conditions would avoid, minimize, and mitigate any impacts to common poorwill.

STATE OF CALIFORNIA, ENERGY RESOURCES CONSERVATION AND DEVELOPMENT COMMISSION/CENTER FOR BIOLOGICAL DIVERSITY (CBD), LISA T. BELENKY, STATUS REPORT, TN # 70180, MARCH 29, 2013:

CBD Comment #1: CBD comments that new desert tortoise surveys are needed because the surveys relied on for the original application are now more than five years out of date.

Response: Staff considered a number of factors regarding the age of the surveys conducted to support the PSEGS project. These included the number of tortoises found during the initial surveys; the current understanding of desert tortoise density in the region (specifically north of I-10); existing habitat conditions; and the supplemental surveys conducted in 2010 and 2013 on portions of the PSPP and PSEGS project footprints. Staff also took into consideration that the project owner had obtained all appropriate permits and theoretically could have fenced and cleared the project site of any desert tortoise, if compensatory mitigation was provided.

Staff is aware that surveys represent a “snapshot” in time and that conditions on the site may have changed (i.e., more tortoises could be there in 2013 compared to 2010). However, the project area has been subject to some levels of disturbance and desert tortoise densities are generally considered to be low in this region. Staff did not believe that conditions on the site have changed appreciably since the previous surveys and that requiring the project owner to resurvey would not provide meaningful data at this time. Performance of pre-construction surveys (**BIO-9**) and development of a translocation plan (**BIO-10**), will allow for desert tortoise and burrows to be documented and properly managed before commencement of ground-disturbing activities.

CBD Comment #2: CBD comments that additional analysis is needed regarding impacts to desert tortoise and other species connectivity in light of the new information available regarding this issue over the last four years, including but not limited to the U.S. Fish and Wildlife Service’s Priority Desert Tortoise Connectivity Habitat, the Linkage Network for the California Deserts, and the BLM’s Final Solar PEIS. CBD also note as part of the Final Solar PEIS, two north-south wildlife connectivity corridors are to be established through the Riverside East Solar Energy Zone (Solar PEIS at 9.4-50). CBD also note that based on the need to identify the location of these corridors, an analysis must be done of the potential impact from this project to these crucial wildlife corridors.

Response: Staff has reviewed the BLM solar PEIS and it appears the project site is not located in a proposed wildlife corridor. The sites’ location, abutting the Palen dunes likely reduces tortoise movement in portions of the Valley near the PSEGS site. Desert tortoise would have some access through existing culverts under I-10. Staff considers the analysis identified in the PSA (and this FSA) to adequately address potential barriers to desert tortoise that may occur as a result of the PSEGS project.

CBD Comment #3: CBD comments that additional appropriate avian species surveys are needed due to the change in technology (power tower) which will have much greater impacts to avian species than the approved project. CBD also noted that these types of impacts were not addressed in the earlier environmental review.

Response: Staff has requested and received a series of supplemental data on avian use in the project region including winter 2012 and spring of 2013 golden eagle surveys. The project owner has also committed to the continuation of avian surveys during 2013. While data collection is ongoing, staff has reviewed and considered this data in the PSA (and this FSA).

In regards to the changing technology, the PSA (and this FSA) provides a robust analysis of the potential impacts of this technology to desert and migratory birds and bats. In the absence of robust survey data, staff compiled a database of bird species based on personal observations, published reports, and peer-reviewed database entries including from list serves and bulletin boards such as “Inland County Birds” and the web-based “eBird”. The PSA (and this FSA) identifies risk to various groups of birds and identifies how their natural history traits could put them at risk from exposure to elevated levels of solar flux. Some of these factors are time of migration-daytime or nighttime, known flight characteristics (e.g., whether they soar; use thermal air currents, or move in slow and steady or fast flight), social patterns (e.g., whether the species typically moves within a flock, within an amorphous stream, or as individuals), and whether feeding occurs during stopovers or in flight

CBD Comment #4: CBD comments that new Mojave fringe toed lizard surveys are needed because the surveys relied on for the original application are 5 years out of date. CBD also states that in order to adequately assess the current distribution and density of Mojave fringe-toed lizards on the project site and assess direct, indirect, and cumulative impacts to the local population and its habitat, updated surveys are necessary, and must also consider potential impacts from construction and operation activities in the up wind areas of the sand transport corridor which include several large solar projects. CBD also notes that the Center has been informed and is investigating reports that construction activities for the Colorado River substation and use of the access road has had a very high impact on Mojave fringe-toed lizards—the potential for roads near and in sand habitat to become population sinks must be considered in this review.

Response: As noted in the PSA, nearly half of the Project Disturbance Area for the PSPP contained suitable habitat for the Mojave fringe-toed lizard including stabilized and partially stabilized sand dunes, some wash habitat, and other areas within Sonoran creosote scrub bush habitat with appropriate soils. Numerous Mojave fringe-toed lizards were found in the dune areas and in buffer locations during surveys conducted to support the PSPP. A total of 95 Mojave fringe-toed lizards were detected from 2009 and 2010 surveys within the PSPP Project Disturbance Area. This species or its sign was not reported to be observed during spring 2013 surveys for the PSEGS along the proposed generation tie-line or the natural gasline route.

The conclusions of this paragraph have been altered based on further analysis of impacts to the sand transport corridor. Please refer to staff’s updated analysis in the body of this FSA. Staff acknowledges this species is present on portions of the PSEGS site and in adjacent dune area, but considers additional surveys of the project site are not required at this time for a number of reasons. The PSEGS has been designed to eliminate the PSPP project’s 30 foot tall wind fences that contributed to disruption of the sand transport system associated with the PSPP project. Although the PSEGS project footprint is still within the sand transport corridor, this effect is expected to be less than significant with the implementation of proposed Conditions of Certification. Conditions prescribed for the PSPP project are now conservative, given the reduction in impacts stemming from the PSEGS project design. Additional surveys, while providing useful data, would not be expected to alter the significance conclusions for the PSEGS at this time.

Staff is aware of the recent and ongoing mortality to MFTL at the Colorado River substation

CBD Comment #5: CBD requests that alternatives that could avoid impacts to the Mojave fringe-toed lizard and its rare sand dune and stabilized sand habitats, soils and surface waters, desert tortoise movement, avian impacts from solar flux and heliostat collision and other resources must be re-considered in light of the new power tower proposal which the project owner has in the past stated has more flexibility in site design as compared with the solar trough project originally approved.

Response: This FSA includes an analysis of these three alternatives to the proposed PSEGS:

- Solar Photovoltaic Alternative with Single-Axis Tracking Technology
- Parabolic Trough Alternative (No Project Alternative)
- Reduced Acreage Alternative

Please review the **ALTERNATIVES** section for an overview of impacts to Mojave fringe-toed lizard.

CBD Comment #6: CBD comments that new detailed surveys of kit fox on the site are also needed. CBD further comments that due to the unfortunate outbreak of canine distemper in the state protected desert kit fox in the vicinity of the Palen project, additional analysis of project impacts to this species is required.

Response: Staff is aware of the recent outbreaks of disease in this species in the Chuckwalla Valley. Staff has provided additional analysis for this species in the PSA, and conducted significant coordination with REAT agency biologists during preparation of the PSA (and this FSA). Further, staff proposes revised Condition of Certification **BIO-17** which requires pre-construction surveys for badger and kit fox dens in and near the project area, and requires implementation of passive relocation measures to protect them from direct construction impacts. The revised **BIO-17** incorporates knowledge gained from other solar projects in the region, and clarifies how to manage kit fox burrows located during pre-construction surveys. Staff has not requested additional surveys for this species on the project site as this species is already known to occur, and the given the high mobility of the species, does not see a benefit in performance of further surveys, outside of preconstruction surveys.

CBD Comment #7: CBD comments that additional analysis of all cumulative impacts is needed in light of additional projects that have been proposed and approved in this area subsequent to the original decision, including Desert Harvest and McCoy solar projects as well as the adoption of the BLM Solar PEIS after that time and any new information learned from the construction of Desert Sunlight and Genesis projects and updating any new information on the Eagle Mountain Pumped Storage Project.

Response: Where available, staff presents monitoring data gathered from solar projects in the vicinity of the PSEGS, and routinely conferences with REAT agency biologists to receive anecdotal and new information. Staff has revised the cumulative analysis in the PSA (and this FSA), to reflect the changes in approved and proposed projects.

STATE OF CALIFORNIA, ENERGY RESOURCES CONSERVATION AND DEVELOPMENT COMMISSION/CENTER FOR BIOLOGICAL DIVERSITY (CBD), LISA T. BELENKY, STATUS REPORT, MAY 21, 2013:

CBD Comment #8: CBD reiterated its comments from March 29, 2013 above, (CBD Comment #1). CBD also stated that to date, it is the Center's understanding that the Applicant has not undertaken these needed surveys and the spring survey window is rapidly drawing to a close. CBD further states that the earliest time that these necessary surveys could be conducted is the fall of 2013—the PSA schedule must be delayed until after these surveys have been conducted and the data provided to all parties for analysis.

Response: Please see staff's response to comment CBD Comment #1, above. Please refer to the PSA "Summary of Conclusions", as well as staff's monthly Status Reports for updates on the project owner's data collection and checklist of outstanding data.

CBD Comment #9: CBD reiterated its comments from March 29, 2013 above, (CBD Comment #2). CBD also states that to date, the Center is unaware of any information indicating that staff or the applicant has undertaken this critical analysis.

Response: Please see staff's response to comment CBD Comment #2 (responses to CBD March 29, 2013 Status Report) from the section above.

CBD Comment #10: CBD reiterated its comments from March 29, 2013 above, (CBD Comment #3). CBD also states that at recent workshops the Applicant indicated that they have begun some avian surveys but there remain questions regarding the appropriateness of the methodology used, appropriate seasons and scope of the surveys. The Applicant also indicated that they may not be undertaking needed bat surveys and monitoring at this time. Moreover, as far as the Center is aware, none of the avian data, other than the Winter 2013 Golden Eagle Survey Results, collected to date by the Applicant have yet been provided to all parties and therefore would not be available for inclusion in the PSA if it is issued on the current, rushed, schedule.

Response: Please see staff's response to comment CBD Comment #3 and #8, above.

CBD Comment #11: CBD reiterated its comments from March 29, 2013 above, (CBD Comment #4). CBD also states that to date the Center is unaware of any new data or updated survey information regarding sand habitat and Mojave fringe-toed lizards being collected by the Applicant or provided by the Applicant to all parties. CBD also comments that Alternatives must be considered that avoid sand dune habitat impacts on the proposed site and avoid, minimize and mitigate any remaining impacts to the sand dunes natural communities and Mojave fringe-toed lizard.

Response: Please see staff's response to comment CBD Comment #4 and #8 (responses to CBD March 29, 2013 Status Report) from the section above.

CBD Comment #12: CBD reiterated its comments from March 29, 2013 above, (CBD Comment #5). CBD also states that this information should be included in the PSA when issued but cannot be included without the needed additional data on avian species and other resources.

Response: Please see staff's response to comment CBD Comments #3 and #8, above.

CBD Comment #13: CBD reiterated its comments from March 29, 2013 above, (CBD Comment #6). CBD also states that to date the Center is unaware of any new data or surveys for desert kit fox being collected by the Applicant or provided by the Applicant to all parties.

Response: Please see staff's response to comment CBD Comment #6, above.

CBD Comment #14: CBD reiterated its comments from March 29, 2013 above, (CBD Comment #7). CBD also states that this analysis should be included in the PSA when issued but cannot be included without the needed additional data on avian species and other resources.

Response: Please see staff's response to comment CBD Comment #7(responses to CBD March 29, 2013 Status Report) from the section above.

STATE OF CALIFORNIA, ENERGY RESOURCES CONSERVATION AND DEVELOPMENT COMMISSION/CENTER FOR BIOLOGICAL DIVERSITY (CBD), LISA T. BELENKY, COMMENTS ON THE PSA, DATED JULY 29, 2013:

CBD Comments on the PSA Heading B Paragraph 1-2: CBD suggests the PSA did not fully analyze impacts of the proposed BLM East Riverside Solar Energy Zone.

Response: Impacts from projects proposed in the region including projects identified in the BLM SEIS were considered in the cumulative analysis (see Special-Status Wildlife - Desert Tortoise). Staff considers the analysis adequate for the purposes of CEQA.

CBD Comments on the PSA Heading C Paragraph 1: CBD reiterated comments from March 29, 2013 above, (CBD Comment #1). CBD also states that the surveys are out of compliance with regulatory standards.

Response: Please see staff's response to comment CBD Comment #1 (responses to CBD March 29, 2013 Status Report) from the section above. In addition, the guidance regarding desert tortoise survey protocols and allows flexibility provided the project owner coordinates with agency staff. To date ongoing coordination has occurred between the applicant, USFWS, BLM, CDFW, and Commission staff. Staff considers the data for this project site adequate to address impacts and provide compensatory mitigation.

CBD Comments on the PSA Heading C Paragraphs 2-4: CBD reiterated comments from March 29, 2013 above, (CBD Comment #2). CBD further states that increased mitigation ratios are required to compensate for loss of connectivity and that mitigation ratios for other projects were higher.

Response: Please see staff's response to comment CBD Comment #2 (responses to CBD March 29, 2013 Status Report) from the section above. In addition, staff considered and addressed impacts to Wildlife Habitat Management Areas in the PSA and FSA (See Desert Tortoise Impacts-Connectivity). Regarding mitigation for desert tortoise; staff recognizes the importance of fully mitigating impacts to desert tortoise in compliance with the requirements of the California Endangered Species Act. However, staff believes that the mitigation ratios identified in the PSA (and this FSA) are adequate and were developed in coordination with agency staff from the USFWS, BLM, and CDFW. Staff considered a wide range of biotic and abiotic factors when developing the mitigation approach for desert tortoise including the sites location; existing vegetation communities; level of disturbance; soil composition; density of tortoise in this section of the Chuckwalla Valley; and proximity to adjacent lands supporting desert tortoise populations. Staff took into consideration the number and distribution of desert tortoise on the project site; the landscape level scale of the project; the projects location; the sites importance for connectivity and regional movement and gene flow; and the cumulative effects of other projects.

Staff weighed these factors in the development of mitigation ratios in light of the fact that project development ultimately results in a net loss of habitat range wide. To address this loss Conditions of Certification **BIO-8**, through **BIO-12**, and **BIO-13**, require a combination of minimization, salvage, and relocation activities; land acquisition, preservation and enhancement; and management activities such as regional raven control. Staff considers these measures adequate to fully mitigate impacts of the PSEGS to desert tortoise. Mitigation ratios developed for other projects including the HHSEGS project considered site and region specific factors which are different from the PSEGS project site.

CBD Comments on the PSA, Heading C Paragraph 5-11: CBD states the applicant for ISEGS significantly underestimated the number of desert tortoise on the project site. In addition, CBD raises concerns regarding the use of translocation as mitigation and suggests that the PSA lacks adequate information regarding the translocation plan.

Response: Staff considers the survey methodologies and estimated number of desert tortoise that may occur on the PSEGS site to be adequate to support compliance with CESA. Surveys completed by past and current project owners complied with the USFWS's recommended guidelines for conducting surveys in desert tortoise habitat. The estimates of adult and subadult desert tortoise calculated by USFWS and staff provide the best available estimates of juvenile desert tortoise and eggs that may occur on the project site As presented in the PSA these calculations are only theoretical estimates of the expected number of desert tortoise that could be present and use the best available scientific data on this species.

CBD states the USFWS Desert Tortoise Recovery Office's Scientific Advisory Committee states that "translocation is fraught with long-term uncertainties…and therefore, any translocations should be accompanied by specific monitoring or research to study the effectiveness or success of the translocation….." The PSA acknowledges this concern and includes this language in the analysis of potential impacts to desert tortoise from translocation activities. The PSA also provides information from the USFWS and other researchers that suggest translocation may be an effective management tool to minimize impacts to desert tortoise from development projects under certain circumstances.

Staff agrees that the current translocation plan is in Draft form however staff disagrees that the PSA fails to provide reasonable information to analysis project impacts to desert tortoise. Staff considers the conditions of certification in the PSA (and this FSA) to be legally adequate and the analysis reflects a good faith effort to investigate and disclose environmental impacts of the PSEGS (see CEQA Guidelines § 15003 (i) & 15144). This FSA includes conditions of certification that require the preparation of more precise plans after approval of the license amendment, which is acceptable under CEQA provided that practical considerations make it difficult to develop the plan at this stage of the planning process and the agency "commits itself to eventually devising measures that will satisfy specific performance criteria articulated at the time of approval" (Sacramento Old City Association v. City Council (1991) (229 Cal.App.3d 1011, 1028 1029). See also CEQA Guidelines (14 Cal. Code Regs 15123.4 (a) (1) (B)), which provides that mitigation measures may specify performance standards that would mitigate the significant effect of the project and that may be accomplished in more than one specific way. In addition, the desert tortoise translocation plan would require coordination with the USFWS, BLM, and CDFW and approval of the CPM prior to implementation. This plan is a requirement of Condition of Certification **BIO-10** which specifies a series of reporting, tracking, monitoring, and disease testing. In addition, this plan is expected to follow the USFWS guidelines on translocation. Staff considers the existing conditions of certification to be adequate and considers translocation to be an accepted tool for minimizing project related impacts to desert tortoise on the project site.

CBD Comments on the PSA, Heading D (Mojave Fringe-toed Lizard) Paragraph 1-2: CBD states the PSA lacks information required to complete the analysis of the fringe-toed lizard. In addition, CBD suggests the PSA fails to address impacts to this species from the use of roads.

Response: Staff noted the information regarding sand transport was not available during the preparation of the PSA; however this data was reviewed and considered in the analysis of this FSA.

Regarding the contention that impacts to this species were overlooked in the PSA; staff provided detailed information regarding the threats to this species from roads, including referencing that 118 Mojave fringe-toed lizards had been killed by vehicle strikes on the Colorado River Substation access road. Staff further considered potential operational impacts from vehicle use, vegetation maintenance, and cumulative effects. Staff considers the analysis adequate and recommended conditions of certification to reduce impacts to this species.

CBD Comments on the PSA, Heading E (Desert Kit Fox) Paragraphs 1-7: CBD reiterated its comments from March 29, 2013 above, (CBD Comment #6) CBD also states that additional more stringent measures should be developed.

Response: Please see staff response to comment #6 above. Staff has collaborated extensively with REAT members to develop revised measures for desert kit fox. These have been included in Condition of Certification **BIO-17**. Staff considers this condition to be adequate to reduce impacts of the PSEGS to desert kit fox. It is staffs contention that Condition of Certification **BIO-17** contains performance standards and detailed requirements for execution of successful minimization activities. Nonetheless, in response to comments and in an effort to further strengthen the condition, staff has revised the condition to provide greater specificity regarding the types of actions that would occur including monitoring and reporting requirements, management actions, and remedial actions.

CBD Comments on the PSA, Heading F (Bighorn Sheep) Paragraphs 1-4: CBD states the PSEGS will eliminate sheep connectivity; requests additional data on the effects of glint and glare to bighorn sheep; and highlights the importance of seeps and springs to this species.

Response: Bighorn sheep are known from the region and have been documented to use valley floors to support intermountain movement. As described in the PSA, (and this FSA), BLM's Draft Supplemental EIS for the PSEGS, and the NECO Plan the project is not located in an important sheep connectivity area. Impacts of the PSEGS would not pose a complete barrier to dispersal for this species and the project is not located in a constrained linkage area. The PSA (and this FSA) accurately assess impacts to this species and concluded the project would not result in significant impacts to bighorn sheep.

There is little data available regarding the effects of glint or glare to most species of wildlife including bighorn sheep. Staff used the best available data and considered the sites location in addressing impacts of the PSEGS to this species. Staff considers the PSA (and this FSA) to accurately assess impacts to this species.

As described in the PSA (and this FSA) impacts to groundwater are expected to be less than significant with Conditions of Certification (**BIO-23** and **BIO-24**). The modified project would use less groundwater during both construction and operation than the PSPP project. Construction groundwater use is stated to be 1,130 acre-feet per year (AFY), a reduction from the original permitted project groundwater consumption of 1,917 AFY. Operational groundwater use is stated as 201 AFY, a reduction of nearly 100 AFY. In addition the nearest seeps and springs are located approximately eight and 13 miles west of the PSEGS site. Water in these sites appear to originate from infiltration of precipitation that falls on the Chuckwalla Mountains as all three sites are located either within the Chuckwalla Mountains or are less than one mile downslope from the Chuckwalla Mountains. At this great distance and given the source of water to the sites, groundwater extracted from the PSEGS site will not affect these seeps.

CBD Comments on the PSA, Heading G (Rare Plants) paragraphs 1-5: CBD states that inadequate survey data is available to analyze project related impacts; that avoidance is the preferred alternative; that additional mitigation should be required including seed collection and preservation. .

Response: The preliminary analysis in the PSA was based on information collected for the approved PSPP project. Since that time the project owner has provided supplemental biological surveys of the proposed linear facilities. Condition of Certification BIO-19 describes measures for avoiding and minimizing effects to avoided occurrences of Harwood's milk-vetch, California ditaxis and other special-status plants occurring within 100 feet of the project boundary, and guidelines for minimizing direct effects along project linears. BIO-19 also contains guidelines for conducting fall 2013 botanical surveys, triggers for mitigation, and detailed specifications and performance standards to ensure that any.

CBD Comments on the PSA, Heading H (Avian Species): CBD states the PSA inadequately assesses potential impacts to avian species and fails to include migratory bird information.

Response: The PSA (and this FSA) provided a robust analysis of potential impacts to birds from exposure to elevated levels of solar flux. More importantly the PSA included analysis describing the risk of mortality and morbidity to the guilds of birds that would be found in the region. The PSA did not attempt to quantify the exact number of birds that would be lost as this information would be highly speculative.

CBD Comments on the PSA, Heading H Section 1 (Yuma Clapper Rail): CBD states the PSA inadequately assess potential impacts to Yuma clapper rail.

Response: Information regarding the risk to Yuma clapper rail is presented in this FSA. Staff provided an analysis of risk to a variety of birds with the potential to occur in the region and provided conditions of certification to reduce those risks. The presence of this species on or near the project site may occur however the risk to this species is speculative. Nonetheless this FSA has described potential impacts to this species in the context of CESA and as a fully protected species.

CBD Comment: CBD states the information regarding burrowing owls in the PSA is confusing; recommends additional surveys to augment existing data; suggests the mitigation approach is outdated; and states there is no scientific evidence that passive relocation is an effective management tool for their long term survival.

Response: Information regarding the presence of burrowing owl on the PSEGS site has been updated in this FSA. This information is based on protocol surveys of the modified linear facilities and ongoing avian surveys of the facility site. As described in this FSA, one burrowing owl has been detected along the modified linear facilities, although no active burrow could be detected, and up to 18 observations of burrowing owls have been detected on or adjacent to the PSEGS solar field. At this time staff is not aware of the breeding status of the birds identified on the project site. Given that 18 individual observations have been made and acknowledging that some of the observations are likely of the same bird at different times, it is possible that some of these may birds consist of breeding pairs. This FSA provides adequate information to analyze project level effects to burrowing owl. Neither CEQA nor the CEQA Guidelines require that protocol level surveys be performed and incorporated into a Draft EIR. (Association of Irritated Residents v. County of Madera (2003) 107 Cal.App.4th 1383.) As described in this FSA, the “environmental setting” is based on expert review and analysis of existing information provided by the project owner. Further, a complete assessment of all potential burrows for this species will be conducted prior to project disturbance to identify active burrows for implementation of minimization and avoidance measures.

Staff considers the information adequate to address impacts to burrowing owls at this time. While additional data would be useful, the proposed compensatory mitigation requirements identified in Condition of Certification **BIO-18** (Burrowing Owl Impact Avoidance, Minimization, and Compensation Measures) and the large scale land acquisition required in **BIO-12** (Desert Tortoise Compensation) will provide reasonable and feasible mitigation for this species. As described in the PSA and FSA the approach to mitigation accounts for the large home ranges used by burrowing owls in arid environments; the rationale for not substantially altering the mitigation approach is because the current mitigation approach for desert tortoise fundamentally provides the same acreages that would be specified using the updated guidance from CDFW.

The CBD suggests that there is no scientific evidence that passive relocation is an effective management tool for their long term survival. Staff acknowledges there is uncertainty regarding the effectiveness of passive relocation in some circumstances. However, staff is recommending an accepted and agency approved method for displacing burrowing owls from the project site. Further the preservation of offsite lands is an acceptable mitigation strategy for the purposes of CEQA (see CEQA Guidelines, Section 15370) and the PSA (and this FSA) is not required to include an analysis of the exact locations of proposed mitigation lands (see California Native Plant Society v. City Rancho Cordova [March 24, 2009] 172 Cal. App. 4th 603). Similarly, the acquisition of these lands prior to displacing the owls is not a requirement; although staff acknowledges this would likely benefit owls. However, condition of certification **BIO-12** (Desert Tortoise Compensation) and **BIO-18** (Burrowing Owl Impact Avoidance, Minimization, and Compensation Measures) would require the project owner to provide financial security prior to purchase of mitigation lands prior to construction.

CBD Comments on the PSA, Heading L (Waters of the State) Paragraph 1-3: CBD states the PSA relies on outdated information regarding state waters; proposes that the project avoid state waters; and recommends that on-site hydrology be maintained.

Response: This FSA has been revised to include updated information provided by the applicant for State waters including the proposed modified linear facilities. Staff also considered a variety of alternatives to reduce project impacts to State waters. CEQA states that an EIR shall describe a range of reasonable alternatives to the project, or to the location of the project, which would feasibly attain most of the basic objectives of the project but would avoid or substantially lessen any of the significant effects of the project, and evaluate the comparative merits of the alternatives (CEQA Guidelines 15126.6(a)).The PSA presents a reasonable range of alternatives that would have varying effects to State waters and biological resources. Regarding the maintenance of surface hydrology; the PSEGS project design would maintain on-site hydrology and allow for ground water recharge. A reduced acreage alternative would have the most minimal impacts to waters of the state, whereas the other alternatives would result in impacts that are comparable to the PSEGS.

CBD Comments on the PSA, Heading J (Nesting Mitigation): CBD states mitigation must occur in the region and specifically within the recovery unit for desert tortoise. CBD is concerned that nesting must assure that all species are actually mitigated and occur on the proposed compensatory mitigation lands.

Response: The preservation of offsite lands is an acceptable mitigation strategy for the purposes of CEQA (see CEQA Guidelines, Section 15370) and the PSA (and this FSA) is not required to include an analysis of the exact locations of proposed mitigation lands (see California Native Plant Society v. City Rancho Cordova [March 24, 2009] 172 Cal. App. 4th 603); however, Condition of Certification **BIO-12** outlines specific performance standards and selection criteria for mitigation lands including: requirements for acreage, types of habitat to be protected, the potential locations, and minimum qualifications of conservation easement holders. Completion of protocol surveys on mitigation lands is not required prior to approval of the amendment. As stated in the condition, the CPM, in consultation with CDFG and USFWS, will approve the proposed mitigation lands provided they meet the specified criteria. Staff also considers the nesting of mitigation to be appropriate should the lands support the target species and its habitat.

CBD Comments on the PSA, Heading K (Missing Plans): CBD states that numerous plans required as a component of various conditions of certification are missing which makes it impossible for the public or decision makers to evaluate the project.

Response: The PSA (and this FSA) identifies a number of conditions of certification that require the preparation of more precise mitigation plans after approval of the license amendment, which is acceptable under CEQA, provided that practical considerations make it difficult to develop the plan at this stage of the planning process and the agency "commits itself to eventually devising measures that will satisfy specific performance criteria articulated at the time of approval" (Sacramento Old City Association v. City Council (1991) (229 Cal.App.3d 1011, 1028 1029). See also CEQA Guidelines (Cal. Code Regs, tit. 14, § 15123.4 [a] [1] [B]), which provides that mitigation measures may specify performance standards that would mitigate the significant effect of the project and that may be accomplished in more than one specific way.

CEQA states that formulation of mitigation measures (conditions of certification) may specify performance standards which would mitigate the significant effects of the project and which may be accomplished in more than one specified way. CEQA Guidelines § 15126.4(a)(1)(B). CEQA case law provides that an agency may properly defer formulation of the specifics pending further study for kinds of impacts for which mitigation is known to be feasible so long as the mitigation measure describes the options that will be considered and identifies specific and mandatory performance standards. See San Joaquin Raptor v. County of Merced, 149 Cal.App.4th 645, 669 (2007) at 671.

It is common for formulation of a mitigation plan to be deferred when a regulatory agency other than the Lead Agency will be reviewing or approving the mitigation (i.e., Desert Tortoise Translocation Plan, Avian Plan, Weed Management Plan etc.) and can be expected to impose mitigation requirements independent of CEQA as a condition of the permit. These requirements are often worked out through a consultation and approval process with the CPM that takes place after the project is approved. In this type of situation, it often makes sense to defer formulation of the specifics of mitigation measures to ensure they will meet the regulatory agency's requirements. Compliance with regulatory agency standards for mitigation can be relied upon to ensure adequate mitigation under CEQA. As a result, regulatory approval of a mitigation program might serve as an adequate performance standard as long as the regulatory agency'' standards for adequate mitigation are identified. See Defend the Bay v. City of Irvine, 119 Cal.App.4th 1261, 1275 (2004) (holding no improper deferral of mitigation even though future investigations and consultation with regulatory agencies was required and further holding that an agency may defer defining the specifics of mitigation measures if it "commits itself to mitigation and lists the alternatives to be considered, analyzed and possibly incorporated in the mitigation plan"); Endangered Habitats League v. County of Orange, 131 Cal.App.4th 777, 794 (2005) (upholding habitat mitigation measure because the EIR called for either off-site preservation of habitat at a specified ratio or obtaining habitat loss permits from relevant agencies).

CBD Comments on the PSA, Heading L (Soils and Water resources): CBD raised concerns regarding groundwater pumping and recommends that additional studies are conducted to address impacts to seeps and springs. CBD is concerned with the loss of state jurisdictional habitat and crypto biotic soils.

Response: Regarding project related effects to groundwater please see response to comment on the PSA, Heading F (Bighorn Sheep) Paragraphs 1-4 above. The PSA (and this FSA) adequately assessed impacts to seeps and springs from potential groundwater declines. In addition, the PSA disclosed impacts to and provided mitigation for impacts to state jurisdictional waters. The acreages of impacts to state waters has been revised in this FSA based on supplemental surveys conducted by the project owner that were not available at the time the PSA was prepared.

The PSA disclosed impacts to biotic soils however the PSA (and this FSA) acknowledges that until the dispute about the sequestration benefits of alkaline soils and other carbon sinks is resolved, staff assumes that the answer may vary on a case-by-case basis. For example, project sites that are very sparsely vegetated with only a minor component of soil crusts may confer less sequestration capabilities than sites with a rich cover of biological soils crusts and succulent desert scrubs. Nevertheless, there is little dispute that the loss of desert vegetation and biological soil crusts on a solar thermal plant site permanently eliminates the carbon sequestration benefits, and the soil disturbance during grading and construction releases the stored carbon back into the atmosphere.

Staff believes that implementation of the conditions of certification for the PSEGS project would reduce potential adverse effects from the loss of carbon sequestration.

CBD Comments on the PSA, Heading M (Cumulative Impacts): CBD states that analysis of cumulative impacts has not been fully disclosed.

Response: The PSA (and this FSA) correctly analyzed potential cumulative projects to biological resources. The discussion of cumulative impacts must provide a summary of the cumulative environmental effects that are expected and a reasonable analysis of the cumulative impacts of the relevant projects [CEQA Guidelines § 15130(b)]. The discussion of cumulative impacts need not provide the same level of detail as is provided for project-specific effects [CEQA Guidelines § 15130(b)]. A Lead Agency is not required to provide evidence supporting every fact underlying the evaluation of cumulative impacts nor is an exhaustive analysis required [CEQA Guidelines § 15130(b)].

The CEQA Guidelines contain two methods of identifying the universe of past, present and future projects to account for in assessing the significant of cumulative impacts: the "list method" and the "summary of projections" method [CEQA Guidelines § 15130(b)]. When using the "list" method (the method used in the PSA), the Lead Agency is obligated to use "reasonable efforts" to discover, disclose and discuss related past, present and future projects, even if under review by other agencies. CEQA Guidelines Section 15130(b) further provides that cumulative impact analysis in CEQA documents "should be guided by the standards of practicality and reasonableness." Moreover, not every project should be placed on the list; rather, "factors to consider when determining whether to include a related project should include the nature of each environmental resource being examined, the location of the project and its type" (CEQA Guideline Section 15130(b)(2).

CBD Comments on the PSA, Heading N (Conformance with Desert Renewable Conservation Plan): CBD states that the PSA should conform to the DRECP and fails to provide an evaluation of conformance with the Plan.

Response: Staff reviewed the preliminary maps for the DRECP. To date, the DRECP has not been finalized and it is uncertain which alternative will be selected. However, even if the project site was proposed within an identified area of Conservation Opportunity, this would not preclude permitting or construction of the facility. Project analysis is completed on a case by case bases and compensatory mitigation is developed for each area. Projects located in conservation areas will likely have higher mitigation ratios because of the proposed conservation value of the area.

STATE OF CALIFORNIA, ENERGY RESOURCES CONSERVATION AND DEVELOPMENT COMMISSION/CENTER FOR BIOLOGICAL DIVERSITY (CBD), LISA T. BELENKY, ATTACHMENTS 1-17 TO THE COMMENTS ON THE PSA, JULY 29, 2013:

Comment: CBD provided a collection of scientific papers and studies regarding biological resources in attachments one through 17 to their comments on the PSA.

Response: Staff acknowledges receipt of these papers, several of which are referenced in the PSA (and this FSA). This information does not alter the conclusions presented in this FSA.

STATE OF CALIFORNIA, ENERGY RESOURCES CONSERVATION AND DEVELOPMENT COMMISSION/BASIN AND RANGE WATCH, KEVIN EMMERICH AND LAURA CUNNINGHAM, TN # 70178, MARCH 29, 2013:

Basin and Range Watch (BRW) Comment #15: The California Energy Commission should also examine a photovoltaic alternative for the Palen Site. While a PV alternative in the same location would still have some of the same impacts, it would reduce the visual, hydrologic and avian impacts.

Response: Staff has included an analysis of a PV alternative in this FSA. Please refer to staff's response to the Center for Biological Diversity's Comment #5.

BRW Comment #16: Regarding Mojave fringe-toed lizard (MFL), BRW points out that the new project design and footprint does not eliminate all impacts to the aeolian corridor, nor does it completely eliminate impacts to MFL. BRW further recommends that a regional management plan be developed for the MFL.

Response: The PSEGS project would directly affect 1,480 acres of Mojave fringe-toed lizard habitat. The project would have significant but mitigatable impacts to Mojave fringe-toed lizards, and would generally avoid interference with the sand transport corridor. This impact is comparable with the original PSPP, and staff believes that mitigation of these impacts is possible by implementation of Condition of Certification **BIO-20**.

Staff agrees that development of coordinated regional plans can often be beneficial to both special status species and resources, and supports these efforts. However, the authorities and responsibilities incumbent upon the California Energy Commission do not extend to formulation of management plans for either species or habitats. The BLM and the CDFW respectively have congressional and state constitutional authority to manage MFL.

BRW Comment #17: BRW states concern that the issue of a take permit for golden eagle has not been resolved, and notes that take of an eagle may be a violation of federal law, as well as a violation of state laws.

Response: The PSA (and this FSA) contains a full description of all applicable laws, ordinances, regulations, and standards (LORS) relative to the golden eagle, and staff agrees that take of fully protected species, such as golden eagle, bald eagle, or peregrine falcon, would not be in conformance with state Fish and Game Code, or with federal LORS such as the Eagle Act. Please refer to **Table 1** for a complete listing of applicable state and federal law. Staff has also recommended that the project owner undertake preparation of avian management plans (**BIO-16b**), including an eagle protection plan, to aid in characterizing, monitoring, and avoiding project effects. **BIO-16a** would require power line retrofits, as well as annual funding for avian mitigation, over the life of the project. Staff recommends the project owner continue to work with the REAT agencies to determine appropriate management of this and any other species potentially at risk of exposure to concentrated solar flux within the project airspace.

BRW Comment #18: BRW has requested species lists for bats and birds that might occur on or over the project site.

Response: Please refer to the **Biological Resources Table 3** and **Table 4,** for this information, which has been updated for the PSEGS project analysis, based on staff's site visits, agency coordination, information from the applicant, and literature searches. This FSA provides an analysis of the groups of birds considered to most at risk of adverse effects, based on behavioral characteristics.

BRW Comment #19: BRW has mentioned the distemper disease outbreaks in kit fox from the Genesis Electric Solar Generating Project, as well as the Colorado substation, and notes that Condition of Certification **BIO-17**, which was developed for the PSEGS project, may not provide enough protection.

Response: Please refer to staff's response to Center for Biological Diversity's comment #6, above.

BRW Comment #20: BRW states that phreatophytic vegetation, such as desert ironwood, palo verde, and mesquite, present on and off the project site, could be impacted by groundwater pumping, and has further asked if staff and the project owner would agree to a "stop pumping trigger" of groundwater drawdown if negative impacts are detected in microphyll woodland. BRW has also asked what monitoring will be undertaken to detect the effects of groundwater drawdown on sensitive communities.

Response: The PSEGS project proposes a substantial reduction in use of groundwater, as compared to the PSPP project. The analysis of effects to groundwater dependent ecosystems (GDEs) for the approved PSPP project, and the subsequent conditions of certification (**BIO-23** and **BIO-24**) developed for the original project, addressed greater impacts than the PSEGS project would have. Staff believes that these measures, unmodified, will now be conservative for the PSEGS project. No new analysis of GDEs has been performed by staff, or requested from the project owner.

STATE OF CALIFORNIA, ENERGY RESOURCES CONSERVATION AND DEVELOPMENT COMMISSION/BASIN AND RANGE WATCH, KEVIN EMMERICH AND LAURA CUNNINGHAM, STATUS REPORT NO. 2, TN # 70697, MAY 8, 2013:

BRW Comment #21: BRW requests that staff consider alternatives to the proposed PSPP project, including distributed generation, brownfields, or the Westlands Solar Park, to reduce impacts to biological resources.

Response: Please refer to staff's response to CBD comment #5, above.

BRW Comment #22: BRW asks for updated MFL survey data, and recommends development of a regional management plan for the MFL.

Response: Please refer to staff's responses to CBD comment #4 and BRW comment #16, above.

BRW Comment #23: Confirms BRW's position that the project should be halted until operational impacts are understood, pending receipt of data from another concentrating solar power tower project, the Ivanpah Solar Electric Generating System, and requests lists of avian and bat species likely to be adversely affected by the project.

Response: Please refer to the staff's response to BRW comments #17, and #18, regarding potential adverse effects of the proposed project and species lists. Staff cautions that while data collected from operating power towers certainly is applicable to projects employing similar technology, differences in habitat, avian and bat assemblages, and basic topography between the PSEGS and ISEGS project sites will result in impacts unique to each site. Uncertainty regarding the level of these impacts (that is, not only of what outcomes may result but also the numbers of individuals that might be affected) require site-specific studies to augment the knowledge base. Please review the PSA section titled "Operation Impacts to Flighted Species" for more information regarding bird and bat species accounts, and how behavioral and physical attributes may influence risk of adverse effects.

To gain site-specific avian and bat information, staff, in conjunction with the REAT agency biologists, has developed a survey protocol specifically for the PSEGS project site, with data collection recommended throughout the permitting process (CEC 2013i), to help inform monitoring plans implemented via staff's proposed Conditions of Certification **BIO-16a** (Avian Enhancement and Conservation Plan), and **BIO-16b** (Avian and Bat Protection Plan).

BRW Comment #24: BRW requests new surveys for kit fox as well as a baseline census, and further requests staff address issues of canine distemper and other health relevant to the species.

Response: Please refer to staff's response to CBD comment #6.

STATE OF CALIFORNIA, ENERGY RESOURCES CONSERVATION AND DEVELOPMENT COMMISSION/BASIN AND RANGE WATCH, KEVIN EMMERICH AND LAURA CUNNINGHAM, COMMENTS ON THE PSA, TN # 200078, JULY 29, 2013:

BRW Comment Page 1 (Expedited Schedule): BRW requests additional time to review the document and suggests the PSA contains information from other solar proceedings.

Response: The PSA and FSA are being processed as an amendment and are proceeding along the timeframes identified by the Committee. Information contained in the document includes relevant analysis that describes impacts to a given species. Where impacts are similar; the text of a previous proceeding may be appropriate to describe the impact. Staff considers the PSA to adequately describe impacts to sensitive biological resources and recommends mitigation where feasible to reduce impacts to less than significant levels.

BRW Comment Page 1-3 (Alternatives, Brownfield Sites, and Distributed Generation): BRW requests that staff review consider alternatives to the proposed PSPP project, including distributed generation, brownfields, or the Westlands Solar Park, to reduce impacts to biological resources.

Response: Please refer to staff's response to CBD comment #5, above.

BRW Comment Page 5-6 (Biological Resources – Mojave Fringe-Toed Lizards): BRW requests that staff review the recent submittal of the Geomorphic Assessment of Sand Transport for the Modified Project, submitted in July. BRW also suggests that this species will be subject to greater impacts than the originally approved project and that alternative sites be considered.

Response: The Geomorphic Assessment of Sand Transport for the Modified Project was not available during the preparation of the PSA; however staff has reviewed the document and incorporated this analysis into this FSA. Specific conditions of certification have been recommended to off-set impacts of the PSEGS to Mojave fringe-toed lizards or their habitat. Please see response to comment #5 regarding alternatives.

BRW Comment Page 5-6 (Biological Resources – Solar Flux, Lake Effect, Avian Slaughter): BRW identifies that numerous shore birds including a Yuma clapper rail have been found dead on solar projects in the region. BRW further identifies that large scale solar projects may act as an attractant to some birds who may consider the solar field as a lake. BRW notes that staff states for the HHSEGS proceeding that the project would kill golden eagles.

Response: Information regarding the risk to avian species including shore birds was considered in the PSA. The PSA included a discussion of the risk to birds from collision with facility structures; how the site may act as an attractant to some birds; and how light reflecting off the heliostats may be perceived as water by various birds. This FSA has been revised to include updated information regarding shorebirds detected at other solar facilities in the region.

Staff adequately addressed impacts to birds in the PSA from exposure to elevated levels of solar flux, given available data. This FSA identifies the risk to birds, including golden eagles, and concludes that it is uncertain, but possible, that the facility will result in mortality or morbidity to golden eagles.

EMAIL FROM ALTOS VISTA VILLAGIO/SIGNED, VEENA DOIJODE, PUBLIC COMMENT, TN #70449, APRIL 24, 2013:

Comment #25: The commenter has requested that staff assess impacts to a private parcel, where an agricultural crop of palm dates is being considered.

Response: The private parcel referenced in the comment is located 5.3 miles southeast of the PSEGS project site, midway between the PSEGS and the Genesis Solar Electric Generating Project. While staff does consider all past, present, and probable future impacts to biological resources in the context of cumulative impacts (CEQA Section 15130), without specific information as to the size of project and other details, staff is unable to provide an analysis of impacts of a palm date farm cumulative to the proposed PSEGS project. Biological resources staff does not analyze potential impacts to crops, however, for the purposes of CEQA, staff has performed a comprehensive analysis of potential project impacts to biological resources adjacent the project site such as desert dry washes, sand transport corridors, native habitat, and special status plant and wildlife species, as well as special habitat designations such as desert tortoise critical habitat, both on the project site and off. In some instances, staff’s analysis includes resources as far as 140 miles from the PSEGS project. Staff has recommended 27 conditions of certification to preserve the health and function of these biological resources, as well as the function of the broader, regional landscape, including the commenter’s parcel.

STATE OF CALIFORNIA, DEPARTMENT OF TRANSPORTATION, DANIEL KOPULSKY, TN # 200198, AUGUST 12, 2013:

Comment: Condition of Certification **BIO-9** requires installation of security and desert tortoise exclusionary fencing around the entire project and portions of I-10. Proper fence maintenance is a critical prevention of tortoise road mortality. The Department of Transportation (Caltrans) suggested an MOU (Memorandum of Understanding) be developed between PSEGS and Caltrans, to implement mitigation measures for PSEGS installation and maintenance of the fencing throughout the life of the project.

Response: Staff has discussed this comment with Caltrans staff (Rebecca Forbes) and has determined that Caltrans may only enter into a maintenance agreement with a state or federal agency. This means that the BLM or the Energy Commission would need to enter into a maintenance agreement; while the PSEGS project owner would supply the funding. Staff has added a CEQA assessment of the impacts of adding desert tortoise exclusion fencing to the existing Caltrans ROW fence.

COUNTY OF RIVERSIDE, COMMENTS ON PSA, TN # 200094, JULY 30, 2013:

Comment 1: The County comments that additional information is necessary for determination of impacts to avian species, and notes bird mortalities at other industrial-scale facilities.

Response: Staff is in agreement; data in addition to what is currently available would be helpful. Given that the currently proposed project is a scale-up from any existing plants, such as GEMASolar project in Spain, minimal data is available. Staff has already incorporated available data from operating power tower projects into this FSA, and has formulated adaptive mitigation for impacts, including **BIO-16a** and **BIO-16b**, in conjunction with habitat acquisition and a suite of other measures. Implementation of these conditions would allow the REAT agencies to generate answers to some of the questions posed by the County.

Comment 2: The County poses concerns regarding the use of habitat acquisition as a mitigation approach for biological resources lost or degraded from implementation of the project.

Response: Mitigation lands are not typically selected during the permitting phase; however, consistent with CEQA, the conditions of certification include selection criteria for the lands. For the PSEGS project, staff has recommended that compensation be provided for the loss of onsite habitat, including desert washes and Sonoran creosote shrub. These acquisitions may be one contiguous parcel of land, but more commonly, are often a conglomeration of parcels separated in space. This is all dependent on what is available for purchase at the time acquisitions are contemplated. Acquisition lands could be private or under the public domain, and are not limited to Riverside County, but rather, are recommended to occur within the desert tortoise's Colorado Desert Recovery Unit. The eastern boundary of the Colorado Desert Recovery Unit is near Blythe, California, extending north to Searchlight, Nevada, south through the Chocolate Mountains Gunnery Range, and west past Palm Springs (USFW 2011).

GALATI BLEK LLP'S, MARIE FLEMIN/PALEN SOLAR HOLDINGS, LLC (PSH), FINAL COMMENTS ON THE PSA, TN # 200077, JULY 29, 2013

PSH has provided staff comments that are restricted to the conditions of certification. Staff has incorporated many of these comments, and had an opportunity to publically discuss PSH preliminary comments at workshops held on June 25 through 26, 2013. Given that staff and the project owner have largely come to resolution on the majority of issues, staff herein only provides responses to those PSH comments where resolution is yet to be had.

Comment on Condition of Certification BIO-12: PSH recommended an alternative mitigation strategy for desert tortoise compensation based on the retirement of grazing allotments. During a workshop conducted on July 24, 2013 the project owner provided further information on the proposed ratios and how this may benefit desert tortoise. On July 31, 2013 the project owner filed additional revisions to Condition BIO-12 based on workshop discussions and recommended that up to 50 percent of the mitigation land requirement could be achieved through the retirement of grazing allotments. The project owner proposed mitigation ratios of 3:1 for areas outside of critical habitat and 15:1 ratios for habitat in the Chuckwalla Critical Habitat Unit.

Response: Staff considered the request for this change and acknowledges retirement of grazing allotments can benefit desert tortoise. However, after coordination with REAT agency biologists staff does not recommend adopting the revised language for this FSA. The current mitigation approach was considered and adopted by the Commission. The proposed changes are considerable; depart from the adopted mitigation strategy; have not been subject to public review; and the REAT agencies are not in full agreement on the efficacy of this approach for this project; or in full agreement if this change will ensure full mitigation.

Comment on COC BIO-16: PSH provided a number of recommendations, particularly in payment of annual mitigation fund, and verification language.

Response: Staff has revised the condition based on both project owner and REAT agency feedback.

PSH'S SUPPLEMENTAL COMMENTS ON THE 07/26/13 VERSION OF CONDITION OF CERTIFICATION BIO-17

Comment: Palen Solar provided additional comments to Condition of Certification BIO-17, based on workshop conversations (July 25-26, 2013).

Response: Staff has provided updated language in **BIO-17**.

USFWS EMAIL SENT FROM PALM SPRINGS FISH AND WILDLIFE OFFICE, JULY 13, 2013:

Comment: Assumptions used regarding impacts, conclusions, and supporting rationale have yet to be quantified.

Response: Staff agrees that uncertainty of risk is inherent when permitting an emerging technology. Please refer to staff's response to County of Riverside, Comment 1.

Comment: The USFWS recommends that the project owner implement a Bird and Bat Conservation Agreement to reduce, avoid, and mitigate impacts to birds and bats, and implement an Eagle Conservation Plan (ECP), to minimize effects to bald and golden eagles.

Response: Staff agrees. Please refer to Condition of Certification **BIO-16a** and **BIO-16b** for mitigation specific to adverse effects from collision and damaging exposure to concentrated solar flux. Per BIO-16b #8, staff has recommended development of an Eagle Protection Plan (EPP), the equivalent of an ECP. Development of an ECP is voluntary, however, the USFWS has been clear in noting that advance cooperation of the project owner is recommended, in the event of eagle take. Energy Commission staff believe that implementation of a EPP would be beneficial for eagles, and working in conjunction with the REAT agencies, can capture pertinent tenants of the ECP that are beneficial for eagles.

Comment: The USFWS is formulating monitoring criteria for solar thermal plants, and currently are recommending that 30 percent of the facility footprint be surveyed.

Response: Staff has amended the condition accordingly, to reflect that data collected must be statistically robust. While on-site monitoring is fundamental to understand the impacts of the technology, staff cautions that sub-lethal mortality rates may be much larger than mortality rates, injured birds may travel offsite, or far from where injuries were sustained, and on-site monitoring alone will not capture these events. Energy Commission staff recommend a holistic mitigation approach, considering both lethal and sub-lethal impacts.

Comment: The USWFS maintains concerns regarding impacts to Mojave fringe-toed lizard.

Response: Staff undertook independent assessment of impacts to the sand transport corridor, which in turn, provides insight as to potential project effects on sand dune species, including the Mojave fringe-toed lizard. Please review this FSA for updated analysis.

SHAUN GONZALES, PUBLIC COMMENT, TN # 200041, JULY 25, 2013:

Comment: Birds have been found dead or injured at the two project sites located near the proposed PSEGS site; the majority of the birds were water birds. One of the dead birds was an endangered Yuma clapper rail found at the Desert Sunlight facility near Desert Center. The USFWS Draft Revised Recovery Plan for the Yuma clapper rail (2010) indicates that the species mostly inhabits the Colorado River corridor, while USFWS websites also indicate the species has been spotted at the Salton Sea. Assuming the bird was attracted to the site from its habitat along the Colorado River or Salton Sea, the bird may have flown over 35 miles to reach the project where it perished.

The PSEGS Final Staff Assessment should include analysis to determine 1.) from what distance birds may spot a facility projecting “lake effect” and fly off course, 2.) what species of birds are most prone to collision and “lake effect” distraction, and 3.) if/how the lake effect can be reduced or eliminated. The mortality of water birds should be given significant consideration in analysis of the project’s impacts. Local birds also seem to be at high risk.

Response: Please refer to staff’s response to Basin and Range Watch Comment #23, and responses to County of Riverside Comments #1 and #2, regarding the lack of available data on avian effects from construction and operation of tower power projects.

Comment: What methods will PSEGS use to evict kit foxes from their dens on the site? It seems quite likely that the methods used by NextEra at the Genesis Solar power project caused a canine distemper outbreak among kit foxes in the local area. One beaconed collar previously worn by a kit fox being monitored by wildlife officials was also tracked to a worker’s locked toolbox, raising further questions about solar developers’ compliance with conditions of certification, and the unexpectedly high toll taken on wildlife in the region. It is not clear that California Department of Fish and Wildlife officials determined the cause of that outbreak, or the reason a collar was likely taken by one of the project’s workers.

Response: Tracking animals using transponder collars such as those used at or near the GSEP site is an inexact process, and depending on the user and frequency tuning, may result in inaccurate readings. At the GSEP site, the kit fox in question was eventually tracked and located on the project site. Staff has recommended that the project owner prepare a Badger and Kit Fox Management Plan, per **BIO-17**, to expand on the protective measures already prescribed in **BIO-17**. Staff has conducted significant, additional coordination and outreach with the resource agencies, and has updated relevant Condition of Certification **BIO-17**. Please review this updated condition.

COLORADO RIVER INDIAN TRIBES (CRIT), COMMENTS ON PSA, TN # 200058, JULY 29, 2013:

Comment: Redtail hawks are present in the project area; impacts to this species will adversely impact CRIT and its members. Yet this impact is never mentioned, much less adequately analyzed, in the PSA.

Response: Staff agrees that red-tail hawk might experience adverse effects from construction and operation of the proposed PSEGS project; however, the list of bird species occurring at the project site, and therefore at risk of adverse impacts, is expansive, and staff cannot name and treat every species individually. Therefore, staff has focused attention on those species considered to be afforded extra protection under Appendix G of the CEQA Guidelines and performance standards or thresholds identified by the Energy Commission staff. Mitigation afforded under staff’s recommended condition of certification **BIO-16a** and **BIO-16b**, as well as those conditions requiring habitat acquisition, are applicable to threatened and endangered species, as well non-listed species, such as red-tail hawk. Please review this FSA’s subsection titled “Operation Impacts to Flighted Species” for more information regarding bird and bat impacts.

CONCLUSIONS

Overview of Impacts to Biological Resources: The Palen Solar Electric Generating System (PSEGS project or modified project) would have significant impacts to biological resources that occur on the project site. Implementation of the PSEGS, including site grading, mowing of vegetation and fencing of the site would result in the functional loss of all of the Sonoran creosote bush scrub, sand dunes, desert washes and other native plant and wildlife communities within the approximately 3,794 acre site. The PSEGS project would also result in significant indirect effects to dunes and dune-dependent species downwind of the facility. The direct impacts of the PSPP to sand dune habitat would have been considered significant but would have been mitigated to less-than-significant levels. The impacts of the PSEGS to sand dune habitat would also be considered significant but would be mitigated to less-than-significant levels. The PSEGS would also eliminate habitat for desert tortoise and other special status species, but these impacts can be mitigated to less-than-significant levels.

Without mitigation, the PSEGS project would contribute to cumulatively significant impacts to many biological resources within the Chuckwalla Valley and the Northern and Eastern Colorado Desert Coordinated Management Plan (NECO) area. Staff proposed avoidance, minimization and compensatory mitigation in conditions of certification to compensate for the direct and indirect loss of habitat for several species or natural communities and to offset the PSPP project's contribution to cumulative effects and would. Impacts to the sand transport corridor and sand dunes and all other biological resources could likely be mitigated to less-than-significant levels with implementation of staff's proposed conditions of certification.

Mitigation for Desert Tortoise: Most of the project site provides low to moderate quality habitat for desert tortoise, a species listed as threatened under the federal and state endangered species acts. The project would impact 3,948 acres of desert tortoise habitat, including 228 acres within the Chuckwalla Desert Critical Habitat Unit. Construction and operation of the project would therefore require state and federal endangered species "take" authorization. In addition to direct loss of habitat and impacts to connectivity among desert tortoise populations, the PSEGS project would fragment and degrade adjacent native plant and wildlife communities, and could promote the spread of invasive non-native plants and desert tortoise predators such as ravens.

Conditions of Certification **BIO-9** through **BIO-11** would avoid and minimize potential take of desert tortoise during project construction and operation. To offset the direct and indirect loss of 3,948 acres of desert tortoise habitat, the Condition of Certification **BIO-12** requires habitat compensation at a 1:1 ratio for desert tortoise (i.e., acquisition and preservation of one acre of compensation lands for every acre lost) for disturbance to lands that are not located in Critical Habitat. For project impacts to 228 acres of Chuckwalla Desert Critical Habitat Unit, the mitigation ratio is 5:1. This compensatory mitigation is consistent with BLM guidance in the NECO, and with recommendations from the California Department of Fish and Wildlife (CDFW) and U.S. Fish and Wildlife Service (USFWS). Condition of Certification **BIO-12** requires that the land acquisitions be within the Colorado Desert Recovery Unit, and have potential to contribute to desert tortoise habitat connectivity and build linkages between desert tortoise populations and designated critical habitat. These conditions satisfy the CDFW's requirements under Section 2081 of the California Fish and Game Code.

Condition of Certification **BIO-13** requires implementation of a Raven Management and Monitoring Plan to address project-related increases in ravens, a desert tortoise predator, as well as contributions to help fund a USFWS regional raven management program.

Ephemeral Streams: The project would directly impact 374.7 acres of state jurisdictional waters, eliminating the hydrological, biogeochemical, and habitat functions of this network of ephemeral streams. As many as 32 acres of ephemeral streams downstream of the project area could also be indirectly impacted to some degree. Staff considers the direct, indirect, and cumulative impacts to ephemeral streams to be significant. Condition of Certification **BIO-21** would minimize and offset direct and indirect impacts to state waters to less-than-significant levels and would ensure compliance with CDFW codes that provide protection to these waters. **BIO-21** specifies acquisition of state waters within the Palen watershed, or adjacent watersheds within the Chuckwalla Valley basin at a 1:1 ratio for unvegetated ephemeral dry wash and at a 3:1 ratio for desert dry wash woodland.

Impacts to Groundwater-Dependent Ecosystems: The PSEGS would use 1,130 acre feet/year (afy) of groundwater for the 39-month construction period and 201 afy for the 30 years of operation. Groundwater pumping during construction and operation for the approved PSPP project would have resulted in a drawdown of the water table between 0.1 and 5 feet in an area that contains groundwater-dependent ecosystems such as mesquite groves and desert sink scrubs. The affected area would extend approximately 2 miles out from each well during construction, and includes the sensitive habitats along the southwestern margins of Palen Lake. By the end of operation the affected area would have extended to a 4-mile radius, to the Chuckwalla Valley Dune Thicket Area of Critical Environmental Concern on the southeastern side of Palen Lake; however, the drawdown at that distance would be minor, even under a worst-case analysis assuming no basin recharge. Because the PSEGS would use substantially less water during construction (i.e., 1,130 afy for PSEGS vs. 5,750 afy for PSPP) and operation (i.e., 201 afy for PSEGS vs. 300 afy for PSPP), staff expects the drawdown of ground water to be lower.

Staff anticipates that groundwater-dependent vegetation could experience significant adverse effects if the spring baseline water table drops below the effective rooting depth of the plants. It is uncertain what the maximum rooting depth is and the extent to which these plants depend on groundwater (versus surface flows or precipitation). Consequently, staff is requiring monitoring of groundwater levels and of groundwater-dependent vegetation in proposed Condition of Certification **BIO-23.** If the monitoring detects adverse effects as described in **BIO-23**, remedial action and compensatory mitigation would be implemented as described in proposed Condition of Certification **BIO-24**. With implementation of these mitigation measures the project impacts to groundwater-dependent plant communities would be reduced to less-than-significant levels.

Special-Status Plants: No federal- or state-listed plant species occur within the Project Disturbance Area, but three unlisted species of special-status plants were detected within the disturbance area during the spring 2010 surveys: Harwood's milk-vetch, a California Rare Plant Rank (RPR) List 2B.2 species, California ditaxis (RPR 3.2), and ribbed cryptantha (RPR 4.3 "watch list" species). Harwood's milk-vetch and California ditaxis are also CNDDB State Rank 2, meaning that they are documented from fewer than 20 viable occurrences statewide. Impacts to Harwood's milk-vetch were considered less than significant due to the small numbers of plants impacted by the PSPP project and impacts are similar for the PSEGS. Staff considers impacts to California ditaxis and ribbed cryptantha to be significant absent mitigation. Condition of Certification **BIO-19** describes measures for avoiding and minimizing effects to avoided occurrences of California ditaxis, ribbed cryptantha, and other special-status plants occurring within 100 feet of the project boundary, and contains guidelines for minimizing direct effects along project linears. **BIO-19** also contains guidelines for conducting fall 2013 botanical surveys, triggers for mitigation, and detailed specifications and performance standards to ensure that any additional special-status plants that would have been missed during the previous spring and fall surveys would be mitigated to a less-than-significant level.

Birds: Implementation of the proposed PSEGS project will result in the direct loss of foraging habitat for resident and migratory birds. Desert dry wash woodland, Sonoran creosote bush scrub and other habitat within the project area provides foraging, cover, and/or breeding habitat for resident and migratory birds, including a number of state and federally listed bird species potentially occurring at the site (Swainson's hawk, Yuma clapper rail, bald and golden eagle, gilded flicker, gila woodpecker), as well as various species of special concern (western burrowing owl, short-eared owl, Prairie falcon, yellow warbler, Leconte's thrasher). Migratory birds and their eggs and young are protected by the federal Migratory Bird Treaty Act and Fish and Game Code section 3503. Golden eagles are fully protected under state law, and a take of a golden eagle would violate the California Fish and Game Code. Take permits are not issued for fully protected species. With implementation of proposed conditions of certification, the project may comply with most laws, ordinances, regulations, and standards (LORS), and most direct, indirect, and cumulative impacts would be avoided, minimized, or mitigated to less than significant levels. However, even with the implementation of the proposed conditions of certification the project would kill or injure a large number of birds from either collisions with structures (including mirrors) or from solar flux damage. Birds at risk include golden eagles, a species often seen at the site. Should take of golden eagle occur, a federal permit for such would be required pursuant to federal law. Since state law does not allow take of golden eagle, such take could not be in compliance with state law.

Construction and operation of the project could result in the death or injury of resident and migratory birds. Conditions of Certification **BIO-8** (Impact Avoidance and Best Management Practices), **BIO-15** (Pre-construction Nest Surveys), and staff's newly proposed **BIO-16b** (Avian Protection Plan) would avoid these potentially significant impacts to resident and migratory birds. Potential impacts to burrowing owls would be mitigated by implementation of staff's proposed Condition of Certification **BIO-18.** This condition involves passive relocation of burrowing owls, as well as acquisition of 78 acres of off-site compensatory mitigation lands suitable for burrowing owl. **BIO-16b** requires surveys for nesting golden eagles within one mile of project boundaries, as well as monitoring of the project site for sublethal injury or mortality, and requires funding for a menu of habitat restoration and enhancement measures that would benefit resident and migratory birds. Additionally, **BIO-16b** requires implementation of power line retrofits that would lessen the risk of electrocution for large raptors such as bald and golden eagles, and Swainson's hawk (**BIO-16a**). Conditions of Certification **BIO-12** and **BIO-21** would mitigate for the loss of foraging habitat at the project site by requiring the acquisition of desert tortoise habitat and desert dry washes, which would provide forage and potential migratory stopover resting and shelter sites for birds.

Staff has adopted portions of the recommended mitigation approach provided by the project owner to off-set potential impact to birds from operation of the facility. The approach includes funding the retrofit and enhancement of existing utility lines and the dedication of funds to provide for migratory bird conservation. Staff recommends the project owner increase the amount of the endowment from $500,000.00 to $1,500,000.00. Dedication of this amount would provide an annual stipend that would be used to fund conservation activities during the operational life of the facility. At the conclusion of operation, these funds would be returned to the project owner, provided they complied with applicable facility closure activities.

Alternatively, the project owner may pay $50,000 annually to fund the conservation activities for the life of the project, not to exceed a period of 30 years. If the project owner elects to make annual payments, the annual payments would be adjusted for cost of living increases.

Staff believes significant impacts to avian species may not be fully mitigated even after the implementation of the proposed Conditions of Certification.

<u>Burrowing Mammals</u> American badgers and desert kit fox occur throughout the project area, and construction of the PSEGS is expected to result in direct effects to badgers and kit fox. Because of the large size of the project, badgers or kit foxes may be confined within the desert tortoise exclusion fence and subject to mortality from road kill, loss or alteration of foraging habitat, overlapping territories or barriers to dispersal. In order to construct the PSEGS, the project owner will passively relocate badgers and kit foxes form the site. State regulations (Fish and Game code) currently prohibit trapping of desert kit fox. However, American badger may be trapped as a last resort by a permitted trapper. Staff's proposed revised Condition of Certification **BIO-17** incorporates the project owner's proposed revisions as well as revisions based on coordination with BLM and CDFW. This condition requires pre-construction baseline surveys and avoidance measures to protect badgers and kit fox to reduce project impacts to less than significant levels, as well as an option to participate in the CDFW-led Desert Kit Fox Health Monitoring and Mitigation Program, when established.

<u>Impacts to Sand Dunes/Mojave Fringe-toed Lizards:</u> The PSPP (Reconfigured Alternatives 2 and 3) would have had significant but mitigatable impacts to Mojave fringe-toed lizards, and would have generally avoided interference with the sand transport corridor. The PSEGS would directly affect 1,480 acres of Mojave fringe-toed lizard habitat. The majority of the direct impacts for the PSEGS would be in the less sensitive Zone 3 sand transport corridor. Indirect impacts would occur from impacts to

the sand transport corridor, increased vehicle traffic, and the spread of invasive non-native species.

The Mojave fringe-toed lizards in the Chuckwalla Valley are at the southernmost portion of their range and the direct and indirect impacts of the PSEGS project would significantly increase the risk of local extirpation of already fragmented and isolated populations. Condition of Certification **BIO-20** recommends acquisition, protection and enhancement of core populations of Mojave fringe-toed lizard habitat elsewhere in the Chuckwalla Valley. This compensatory mitigation would offset impacts of the PSEGS to less-than-significant levels.

<u>Cumulative Effects:</u> Construction and operation of the PSEGS project would have cumulatively considerable impacts to many biological resources within the Chuckwalla Valley and NECO planning area, including: desert washes; Mojave fringe-toed lizard; desert tortoise habitat, movement and connectivity; golden eagle; burrowing owl; American badger and desert kit fox; LeConte's thrasher and other desert and migratory birds; the Chuckwalla Valley dune system, desert wash woodland, groundwater-dependent ecosystems, and other natural communities; and special-status plants.

The project's contribution to all impacts, except those to avian species, would be minimized to a level less than cumulatively considerable with implementation of staff's proposed conditions of certification. These conditions include general and species-specific measures for avoidance, minimization, and compensation, detailed monitoring and reporting requirements, and mitigation security and verification to ensure implementation. Staff's proposed conditions address individually minor but cumulatively considerable effects and include measures to minimize the spread of invasive non-native plants, fragmentation, an increase in raven predation, increased roadkills, bird collisions, electrocutions, exposure to solar flux, increased disturbance from noise and lighting, fugitive dust, chemical drift, unauthorized ORV use of temporary access roads, and accidental impacts during construction and operation.

PROPOSED CONDITIONS OF CERTIFICATION

Staff has proposed modifications to the **Biological Resources** conditions of certification as shown below. (**Note:** Deleted text is in ~~strikethrough~~, new text is **<u>bold and underlined</u>**).

The conditions of certification below are generally the same as those in the Commission Final Decision for the PSPP published in March 2010. However, staff has revised some of the conditions to reflect suggested changes and additional information from the project owner and other parties, changes from the approved project to the PSEGS project, and from new information available since the publication of the Commission Final Decision in 2010. In 2013, as mandated by AB 2402, California Department of Fish and Game (DFG) officially changed its name to California Department of Fish and Wildlife (CDFW), Staff has updated all relevant conditions of certification to reflect the new name. **Biological Resources Table 11** summarizes the changes to conditions of certification for the PSEGS from the Commission Final Decision for the PSPP.

Biological Resources Table 11
Summary of Changes to Conditions of Certification

Condition of Certification	Changes from RSA to PSPP Commission Final Decision
BIO-1 Designated Biologist Selection and Qualifications	Changed the timing of verification for the submittal of Designated Biologist resume from 30 days to 60 days to allow approval prior submittal of plans which require Designated Biologist review; clarified the verification timing to coordinate with key project definitions in the revised General Conditions.
BIO-2 Designated Biologist Duties	Clarified timing of performance of Designated Biologist monitoring activities to coordinate with key project definitions in the revised General Conditions; revised duties to address recent guidance regarding desert kit fox mortality reporting in response to outbreak of canine distemper in the region; revised duties regarding addressing standing water in response to lessons learned on other solar projects in region.
BIO-3 Biological Monitor Selection and Qualifications	Clarified the Designated Biologist must be approved prior to submitting Biological Monitor resumes; changed the timing of verification for the submittal of Biological Monitor resume from 30 days to45 days to allow approval prior to performance of required pre-construction surveys; clarified the verification timing to prior to pre-construction site mobilization.
BIO-4 Biological Monitor Duties	Clarified timing of performance of Biological Monitor monitoring activities to coordinate with key project definitions in the revised General Conditions.
BIO-5 Designated Biologist and Biological Monitor Authority	No change.
BIO-6 Worker Environmental Awareness Program	Clarified role of party responsible for developing WEAP; clarified training requirements to address providing more pertinent information regarding special-status species; modified content of training to address solar flux impacts during operations; clarified reporting of WEAP training; changed the timing of verification for the submittal of WEAP from 30 days to 45 days to allow approval prior to performance of required pre-construction surveys; clarified the verification timing to coordinate with key project definitions in the revised General Conditions.
BIO-7 Biological Resources Mitigation Implementation & Monitoring Plan	Added the American Badger and Kit Fox Management Plan to list of plans to be included in BRMIMP; added requirements to address canine distemper outbreak in regional desert kit fox population and issues with standing water on other solar projects in construction; added standard requirement to provide aerial photographs prior to disturbance and post-construction; changed the timing of verification for the submittal of draft BRMIMP from 30 days to 60 days and final BRMIMP from 7 days to 30 days to allow approval prior to performance of required pre-construction surveys; clarified the verification timing to coordinate with key project definitions in the revised General Conditions;
BIO-8 Impact Avoidance and Minimization Measures	Item 4 edited since vegetation will be left on site and that a Designated Biologist or Biological Monitor shall be onsite during all project activities that have potential to disturb previously undisturbed soil, vegetation or wildlife. Clarified drivers during project construction and operation shall abide posted speed limits on paved roads; clarified wildlife salvage requirements to address canine distemper outbreak in regional desert kit fox populations; added additional requirements regarding use of toxic substances; clarified guidance in most recent USFWS Desert Tortoise Field Manual will be followed; added reporting and handling requirements for desert kit fox in response to recent canine distemper

Condition of Certification	Changes from RSA to PSPP Commission Final Decision
	outbreak in regional population; add requirements to address noxious weeds to address impacts from leaving vegetation on site during project development and operations; added requirements to address Best Management Practices for vegetation management, clarified the verification timing to coordinate with key project definitions in the revised General Conditions
BIO-9 Desert Tortoise Clearance Surveys and Fencing	Clarified proposed alignments for permanent or temporary fencing shall be flagged; clarified guidance in most recent USFWS Desert Tortoise Field Manual will be followed.
BIO-10 Desert Tortoise Relocation/Translocation Plan	Revised to include requirement to submit revised draft plan based on previously submitted draft plan to incorporate changes to the project from the PSPP, clarified the verification timing to coordinate with key project definitions in the revised General Conditions
BIO-11 Desert Tortoise Compliance Verification	No change except updated CDFG to CDFW.
BIO-12 Desert Tortoise Compensatory Mitigation	Clarified that ground disturbance includes pre-construction site mobilization
BIO-13 Raven Management Plan	Revised to include requirement to submit revised draft plan based on previously submitted draft plan to incorporate changes to the project from the PSPP. Clarified the verification timing to coordinate with key project definitions in the revised General Conditions
BIO-14 Weed Management Plan	Added requirement that a copy of the BLM issued Pesticide Use Permit prior to using herbicides onsite. Clarified the verification timing to coordinate with key project definitions in the revised General Conditions
BIO-15 Pre-Construction Nest Surveys	No change.
BIO-16 Avian Protection Plan	Now revised into two parts, **BIO-16a** and **BIO-16b**. Now titled Avian Enhancement and Conservation Plan
BIO-16b	Avian and Bat Protection Plan
BIO-17 Badger and Kit Fox Avoidance and Minimization Measures-	Approved language deleted in its entirety. Extensively revised and expanded to address recent issues with canine distemper outbreak in desert kit fox populations in region of project. Updated based on PSH comments on PSA and coordination with BLM and CDFW. Incorporated newly proposed CDFW led Monitoring and Mitigation Program.
BIO-18 Burrowing Owl Impact Avoidance and Minimization Measures	Incorporated project owner proposed edits. Incorporated CDFW Staff Report on Burrowing Owl (2012) requirements. Clarified the verification timing to coordinate with key project definitions in the revised General Conditions
BIO-19 Special-Status Plant Impact Avoidance and Minimization	Updated fall plant survey requirements from 2010 to 2013. Incorporated project owner proposed edits. Clarified the verification timing to coordinate with key project definitions in the revised General Conditions
BIO-20 Sand Dune Community/Mojave Fringe-Toed Lizard Mitigation	Clarified the verification timing to coordinate with key project definitions in the revised General Conditions
BIO-21 Mitigation for Impacts to State Waters	Clarified the verification timing to coordinate with key project definitions in the revised General Conditions
BIO-22 Closure Plan	Clarified the verification timing to coordinate with key project definitions in the revised General Conditions
BIO-23 Groundwater Dependent Vegetation Monitoring	Removed language referencing 2010 start date of construction and updated map references for PSEGS.
BIO-24 Remedial Action for Adverse Effects to	No change

Condition of Certification	Changes from RSA to PSPP Commission Final Decision
Groundwater-dependent Biological Resources	
BIO-25 Golden Eagle Inventory and Monitoring	Staff has adapted the tenets of the Golden Eagle Inventory and Monitoring Plan within the revised Condition of Certification **BIO-16**, Avian and Bat Protection Plan; and therefore has deleted this condition.
BIO-26 Evaporation Pond Netting and Monitoring	No change.
BIO-27 Revegetation of Temporarily Disturbed Areas	**BIO-27** deleted as part PSPP Final Commission Decision,
BIO-28 In-Lieu Fee Mitigation Option	Incorporated project owner proposed edits
BIO-29 Phasing	Updated Tables 1-3 to include new impacts acreages and costs.

Compensatory mitigation securities, based on the REAT Biological Resources Mitigation/Compensation Cost Estimate Calculation Table dated July 23, 2010 (REAT 2010) (**Biological Resources Table 6b**) are included in **Biological Resources Table 22. Biological Resources Tables 23 and 24** include impacts and securities estimates based on a phased construction approach. Securities are subject to change based on updates to the REAT Biological Resources Table, and mitigation amounts are subject to change based on changes to the Project Disturbance Area impacts.

Biological Resources Table 12[1]
Compensatory Mitigation Securities

COC	Description	Security		
		PSEGS (proposed modified project)	PSPP Reconfigured Alternative 2 (approved project)	PSPP Reconfigured Alternative 3 (approved project)
BIO-12	Loss of desert tortoise habitat	$15,007,680	$16,169,290	$15,962,857
BIO-13	One-time USFWS Regional Raven Management Program fee[2]	$414,540	$458,430	$454,650
BIO-18	Impacts to burrowing owls	$250,089	$255,330	$255,330
BIO-20	Loss of Mojave fringe-toed lizards and habitat	$6,372,705	$5,765,569	$6,002,358
BIO-21	Impacts to state waters	$2,433,344	$2,580,835	$2,433,275

1– Securities (aside from Raven fees) based on REAT Biological Resources Mitigation/Compensation Cost Estimate Calculation Table - July 23, 2010 (REAT 2010) but assuming 160-acre parcels. Security amounts may change based on final project footprint. The final amount shall be determined by an updated appraisal conducted as described in **BIO-12.**
2 – Based on U.S. Fish and Wildlife Service Cost Allocation Methodology for Implementation of the Regional Raven Management Plan, dated July 9, 2010 (USFWS 2010b). Fee calculated at $105/acre for direct project impacts.

Biological Resources Table 13[1]
Compensatory Mitigation Acreage – Phased Approach

COC	Description	Compensatory Acreage		
		PSEGS (proposed modified project)	PSPP (approved project) Reconfigured Alternative 2	PSPP (approved project) Reconfigured Alternative 3
Phase 1				
BIO-12	Loss of desert tortoise habitat[2]	1658	3263	3120
BIO-13	Acres subject to the one-time USFWS Regional Raven Management Program fee	954	2398	2271
BIO-18	Impacts to 4 burrowing owls	78	78	78
BIO-20	Loss of Mojave fringe-toed lizards and habitat	27.7	827	827
BIO-21	Impacts to state waters	64.8	713	680
Phase 2				
BIO-12	Loss of desert tortoise habitat[2]	3203	1854	1929
BIO-13	One-time USFWS Regional Raven Management Program fee	2993.9	1968	2059
BIO-18	Impacts to 4 burrowing owls	0	0	0
BIO-20	Loss of Mojave fringe-toed lizards and habitat	2036	1060	1138
BIO-21	Impacts to state waters	723	101	91

1 – Sources: PSEGS project – estimate prepared by staff based on GIS files provide by Palen Solar Holdings (Palen 2013a)); Reconfigured Alternatives 2 and 3 - Solar Millennium 2010l.
2 – Impacts to desert tortoise critical habitat are assumed to be wholly within the Phase 1 Project Disturbance Area.
3 – Phase 1 impacts include some impacts that are indirect impacts of Phase 1, but direct impacts of Phase 2. Phase 2 impact acreages are adjusted to credit acreages already captured in Phase 1.

Biological Resources Table 14[1]
Compensatory Mitigation Securities – Phased Approach

COC	Description	Security: PSEGS (proposed modified project)	Security: PSPP (approved project) Reconfigured Alternative 2	Security: PSPP (approved project) Reconfigured Alternative 3
Phase 1				
BIO-12	Loss of desert tortoise habitat[2]	$5,116,816.00	$10,337,345	$9,884,387
BIO-13	One-time USFWS Regional Raven Management Program fee[3]	$100,181	$251,805	$238,430
BIO-18	Impacts to 4 burrowing owls [4]	$250,089	$255,330	$255,330
BIO-20	Loss of Mojave fringe-toed lizards and habitat[2]	$85,537	$2,529,118	$2,529,118
BIO-21	Impacts to state waters	$200,720	$2,257,200	$2,158,204
BIO-24	Remedial action for adverse effects to groundwater-dependent plants	Pending	Pending	Pending
Phase 2				
BIO-12	Loss of desert tortoise habitat[2]	$9,890,864	$5,892,485	$6,139,011
BIO-13	One-time USFWS Regional Raven Management Program fee[3]	$314,360	$206,625	$216,220
BIO-18	Impacts to 4 burrowing owls (78 acres of compensatory mitigation) [4]	0	0	0
BIO-20	Loss of Mojave fringe-toed lizards and habitat[2]	$6,287,168	$3,236,451	$3,473,241
BIO-21	Impacts to state waters	$2,232,624	$325,213	$293,641

1– Securities (aside from Raven fees) based on REAT Biological Resources Mitigation/Compensation Cost Estimate Calculation Table - July 23, 2010 (REAT 2010) but assuming 160-acre parcels. Security amounts may change based on final project footprint. The final amount shall be determined by an updated appraisal conducted as described in **BIO-12.** Total securities for desert tortoise and state water mitigation under the phased approach may be higher than the lump sum total described in **Biological Resources Table 12**; some fees included in the REAT (2010) table are based on the number of transactions, which would be higher under the phased approach.
2 – Impacts to desert tortoise critical habitat are assumed to be wholly within the Phase 1 Project Disturbance Area.
3 – Based on U.S. Fish and Wildlife Service Cost Allocation Methodology for Implementation of the Regional Raven Management Plan, dated July 9, 2010 (USFWS 2010b). Fee calculated at $105/acre for direct project impacts.
4 –Phase 1 securities include some securities for impacts that are indirect impacts in Phase 1, but direct impacts of Phase 2. Phase 2 securities are adjusted to credit securities already captured in Phase 1.

DESIGNATED BIOLOGIST SELECTION AND QUALIFICATIONS[7]

BIO-1 The Project owner shall assign at least one Designated Biologist to the Project. The Project owner shall submit the resume of the proposed Designated Biologist(s), with at least three references and contact information, to the Energy Commission Compliance Project Manager (CPM) for approval in consultation with CDF~~G~~**W** and USFWS.

The Designated Biologist must meet the following minimum qualifications:

1. Bachelor's degree in biological sciences, zoology, botany, ecology, or a closely related field;

2. Three years of experience in field biology or current certification of a nationally recognized biological society, such as The Ecological Society of America or The Wildlife Society;

3. Have at least one year of field experience with biological resources found in or near the Project area;

4. Meet the current USFWS Authorized Biologist qualifications criteria (www.fws.gov/ventura/speciesinfo/protocols_guidelines), demonstrate familiarity with protocols and guidelines for the desert tortoise, and be approved by the USFWS; and

5. Possess a California ESA Memorandum of Understanding pursuant to Section 2081(a) for desert tortoise.

In lieu of the above requirements, the resume shall demonstrate to the satisfaction of the CPM, in consultation with CDF~~G~~**W** and USFWS, that the proposed Designated Biologist or alternate has the appropriate training and background to effectively implement the Conditions of Certification.

Verification: At least ~~30~~ **60** days prior to ~~construction-related ground disturbance~~ **site mobilization or construction activities**, the Project owner shall submit the resumes of the Designated Biologists(s) along with the completed USFWS Desert Tortoise Authorized Biologist Request Form (www.fws.gov/ventura/speciesinfo/protocols_guidelines) and submit it to the USFWS and the CPM for review and final approval.

No site mobilization or construction-related ground disturbance ~~, grading, boring, or trenching~~ shall commence until an approved Designated Biologist is available to be on site.

[7] USFWS <www.fws.gov/ventura/speciesinfo/protocols_guidelines/docs/dt> designates biologists who are approved to handle tortoises as "Authorized Biologists." Such biologists have demonstrated to the USFWS that they possess sufficient desert tortoise knowledge and experience to handle and move tortoises appropriately, and have received USFWS approval. Authorized Biologists are permitted to then approve specific monitors to handle tortoises, at their discretion. The California Department of Fish and Wildlife (CDFW) must also approve such biologists, potentially including individual approvals for monitors approved by the Authorized Biologist. **Designated Biologists are the equivalent of Authorized Biologists.** Only Designated Biologists and certain Biological Monitors who have been approved by the Designated Biologist would be allowed to handle desert tortoises

If a Designated Biologist needs to be replaced, the specified information of the proposed replacement must be submitted to the CPM at least 10 working days prior to the termination or release of the preceding Designated Biologist. In an emergency, the Project owner shall immediately notify the CPM to discuss the qualifications and approval of a short-term replacement while a permanent Designated Biologist is proposed to the CPM for consideration.

DESIGNATED BIOLOGIST DUTIES

BIO-2 The Project owner shall ensure that the Designated Biologist performs the activities described below during any site mobilization **and construction** ~~activities, construction-related ground disturbance, grading, boring, or trenching activities,~~ **commissioning, operation, non-operation or closure, or other activities that may impact biological resources**. The Designated Biologist may be assisted by the approved Biological Monitor(s) but remains the contact for the Project owner and the CPM. The Designated Biologist Duties shall include the following:

1. Advise the Project owner's Construction and Operation Managers on the implementation of the biological resources conditions of certification;

2. Consult on the preparation of the Biological Resources Mitigation Implementation and Monitoring Plan (BRMIMP) to be submitted by the Project owner;

3. Be available to supervise, conduct and coordinate mitigation, monitoring, and other biological resources compliance efforts, particularly in areas requiring avoidance or containing sensitive biological resources, such as special-status species or their habitat;

4. Clearly mark sensitive biological resource areas and inspect these areas at appropriate intervals for compliance with regulatory terms and conditions;

5. Inspect active construction areas where animals may have become trapped prior to construction commencing each day. At the end of the day, inspect for the installation of structures that prevent entrapment or allow escape during periods of construction inactivity. Periodically inspect areas with high vehicle activity (e.g., parking lots) for animals in harm’s way;

6. Notify the Project owner and the CPM of any non-compliance with any biological resources condition of certification;

7. Respond directly to inquiries of the CPM regarding biological resource issues;

8. **Determine and oversee implementation of remedial actions any time water has been observed standing onsite in accordance with Condition of Certification BIO-8. The project owner shall initiate remedial methods in consultation with the Designated Biologist in accordance with Condition of Certification BIO-8 after standing water**

has been observed on the project site. Remedial methods may include grading, pumping spraying, tilling, or any other means to disperse or ensure evaporation and/or absorption of standing water. Other remedial efforts may be determined in conjunction with CPM review and approval. Descriptions of remedial efforts, including photo documentation, and discussion of results of remedial efforts must be included in the Monthly Compliance Report;

9. **Respond to reports of onsite kit fox mortality or injury, and to the extent possible, reports of dead or injured kit fox offsite and immediately adjacent the project boundaries or on access roads in accordance with Condition of Certification BIO-17, and undertake restorative and/or disease prevention actions as specified within the American Badger and Kit Fox Management Plan prepared in accordance with Condition of Certification BIO-17;**

10. Maintain written records of the tasks specified above and those included in the BRMIMP. Summaries of these records shall be submitted in the Monthly Compliance Report and the Annual Compliance Report;

11. Train the Biological Monitors as appropriate, and ensure their familiarity with the BRMIMP, Worker Environmental Awareness Program (WEAP) training, and USFWS guidelines on desert tortoise surveys and handling procedures <www.fws.gov/ventura/speciesinfo/protocols_guidelines>; and

12. Maintain the ability to be in regular, direct communication with representatives of CDF~~G~~**W**, USFWS, and the CPM, including notifying these agencies of dead or injured listed species and reporting special-status species observations to the California Natural Diversity Database (CNDDB).

Verification: The Designated Biologist shall provide copies of all written reports and summaries that document biological resources compliance activities in the Monthly Compliance Reports submitted to the CPM. If actions may affect biological resources during operation a Designated Biologist shall be available for monitoring and reporting. During Project operation, the Designated Biologist shall submit record summaries in the Annual Compliance Report unless his or her duties cease, as approved by the CPM.

BIOLOGICAL MONITOR SELECTION AND QUALIFICATIONS

BIO-3 The **project owner's approved** Designated Biologist shall submit the resume, at least three references, and contact information of the proposed Biological Monitors to the CPM. The resume shall demonstrate, to the satisfaction of the CPM, the appropriate education and experience to accomplish the assigned biological resource tasks. The Biological Monitor is the equivalent of the USFWS designated Desert Tortoise Monitor (USFWS 2008).

Biological Monitor(s) training by the Designated Biologist shall include familiarity with the conditions of certification, BRMIMP, WEAP, and USFWS guidelines on desert tortoise surveys and handling procedures <www.fws.gov/ventura/speciesinfo/protocols_guidelines>.

Verification: The Project owner shall submit the specified information to the CPM for approval at least ~~30~~ **45** days prior to the start of any site mobilization or construction **activities**~~-related ground disturbance, grading, boring, and trenching~~. The Designated Biologist shall submit a written statement to the CPM confirming that individual Biological Monitor(s) has been trained including the date when training was completed. If additional biological monitors are needed during construction the specified information shall be submitted to the CPM for approval at least 10 days prior to their first day of monitoring activities.

BIOLOGICAL MONITOR DUTIES

BIO-4 The Biological Monitors shall assist the Designated Biologist in conducting surveys and in monitoring of site mobilization ~~activities,~~ **and** construction **including**~~-related~~ ground disturbance**, site preparation, or permanent installation activities, including installation of desert tortoise exclusion fencing,** ~~grading, boring, trenching,~~ or reporting. The Designated Biologist shall remain the contact for the Project owner and the CPM.

Verification: The Designated Biologist shall submit in the Monthly Compliance Report to the CPM copies of all written reports and summaries that document biological resources compliance activities, including those conducted by Biological Monitors. If actions may affect biological resources during operation a Biological Monitor, under the supervision of the Designated Biologist, shall be available for monitoring and reporting.

DESIGNATED BIOLOGIST AND BIOLOGICAL MONITOR AUTHORITY

BIO-5 The Project owner's construction/operation manager shall act on the advice of the Designated Biologist and Biological Monitor(s) to ensure conformance with the biological resources conditions of certification. The Project owner shall provide Energy Commission staff with reasonable access to the Project site under the control of the Project owner and shall otherwise fully cooperate with the Energy Commission's efforts to verify the Project owner's compliance with, or the effectiveness of, mitigation measures set forth in the conditions of certification. The Designated Biologist shall have the authority to immediately stop any activity that is not in compliance with these conditions and/or order any reasonable measure to avoid take of an individual of a listed species. If required by the Designated Biologist and Biological Monitor(s) the Project owner's construction/operation manager shall halt all site mobilization **and construction**, **including** ground disturbance, **site preparation, or permanent installation activities, including installation of desert tortoise exclusion fencing**~~, grading, boring, trenching~~, and operation activities in areas specified by the Designated Biologist. The Designated Biologist shall:

1. Require a halt to all activities in any area when determined that there would be an unauthorized adverse impact to biological resources if the activities continued;

2. Inform the Project owner and the construction/operation manager when to resume activities; and

3. Notify the CPM if there is a halt of any activities and advise them of any corrective actions that have been taken or would be instituted as a result of the work stoppage. If the work stoppage relates to desert tortoise or any other federal- or state-listed species, the ~~Carlsbad~~ **Palm Springs** Office of the USFWS and the Ontario Office of the CDF~~G~~**W** shall also be notified.

If the Designated Biologist is unavailable for direct consultation, the Biological Monitor shall act on behalf of the Designated Biologist. **It is expected the Designated Biologist will be onsite during construction or otherwise available by phone.**

Verification: The Project owner shall ensure that the Designated Biologist or Biological Monitor notifies the CPM and BLM immediately (and no later than the morning following the incident, or Monday morning in the case of a weekend) of any non-compliance or a halt of any site mobilization, ground disturbance, grading, construction, or operation activities. If the non-compliance or halt to construction or operation relates to desert tortoise or any other federal- or state-listed species, the Project owner shall also notify ~~Carlsbad~~ **Palm Springs** Office of the USFWS and the Ontario Office of the CDF~~G~~**W** at the same time. The Project owner shall notify the CPM of the circumstances and actions being taken to resolve the problem.

Whenever corrective action is taken by the Project owner, a determination of success or failure will be made by the CPM in consultation with BLM, USFWS and CDF~~G~~**W** within 5 working days after receipt of notice that corrective action is completed, or the Project owner would be notified by the CPM that coordination with other agencies would require additional time before a determination can be made.

WORKER ENVIRONMENTAL AWARENESS PROGRAM (WEAP)

BIO-6 The Project owner shall develop and implement a Project-specific Worker Environmental Awareness Program (WEAP) and shall secure approval for the WEAP from the CPM. The Project owner shall also provide the USFWS and CDF~~G~~**W** a copy of all portions of the WEAP relating to desert tortoise and any other federal or state-listed species for review and comment. The WEAP shall be administered to all onsite personnel including surveyors, construction engineers, employees, contractors, contractor's employees, supervisors, inspectors, subcontractors, and delivery personnel. The WEAP shall be implemented during site **mobilization and** ~~preconstruction,~~ construction, **commissioning,** operation, **non-operation,** and closure. The WEAP shall:

1. Be developed by or in consultation with the Designated Biologist and consist of an on-site or training center presentation in which supporting written material and electronic media, including photographs of protected species **and their habitat**, is made available to all participants;

2. Discuss the locations and types of sensitive biological resources on the Project site and adjacent areas, and explain the reasons for protecting these resources; provide information to participants that no snakes or

other wildlife shall be **intentionally** harmed **(unless posing a reasonable and immediate threat to humans)**;

3. Place special emphasis on desert tortoise, including **pictures and** information on physical characteristics, distribution, behavior, ecology, sensitivity to human activities, legal protection, penalties for violations, reporting requirements, and protection measures;

4. **Provide pictures of golden eagles, American badger, desert kit fox, Mojave fringe-toed lizard, and burrowing owl, provide information on sensitivity to human activities, legal protection, reporting requirements, and how to identify construction avoidance zones for these species as marked by flagging, staking, or other means, also describe the protections for bird nests and provide information as described above;**

5. **Provide overview for staff of potential impacts to reptiles and amphibians from vehicle strikes on all project roads (paved and unpaved) during construction, operations, closure phases, reporting requirements, and protection measures;**

6. **Provide overview of potential impacts to avian species from concentrated solar flux created during start up and operations phase, reporting requirements, and protection measures;**

7. Include a discussion of fire prevention measures to be implemented by workers during Project activities and request workers to: a) dispose of cigarettes and cigars appropriately and not leave them on the ground or buried, b) keep vehicles on graveled or well-maintained roads at all times to prevent vehicle exhaust systems from coming in contact with roadside weeds, c) use and maintain approved spark arresters on all power equipment, and d) keep a fire extinguisher on hand at all times

8. Describe the temporary and permanent habitat protection measures to be implemented at the Project site;

9. Identify whom to contact if there are further comments and questions about the material discussed in the program; and

10. Include a training acknowledgment form to be signed by each worker indicating that they received training and shall abide by the guidelines.

The specific program can be administered by a competent individual(s) acceptable to the Designated Biologist, **and documented within the Monthly Compliance Report.**

Verification: At least ~~30~~ **45** days prior to start of **site mobilization and** construction~~-related ground disturbance~~, the Project owner shall provide to the CPM for review and approval and to BLM, USFWS and **CDFW**~~G~~ a copy of the final WEAP and all supporting written materials and electronic media prepared or reviewed by the Designated Biologist and a resume of the person(s) administering the program.

The project owner shall provide in the Monthly Compliance Report the number of persons who have completed the training in the prior month and a running total of all persons who have completed the training to date. At least 10 days prior to **site mobilization and** construction~~-related ground disturbance activities~~ the project owner shall submit two copies of the approved final WEAP **and implement the training for all workers.**

Training acknowledgement forms signed during construction shall be kept on file by the project owner for at least 6 months after the start of commercial operation.

Throughout the life of the project, the WEAP shall be repeated annually for permanent employees, and shall be routinely administered within 1 week of arrival to any new construction personnel, foremen, contractors, subcontractors, and other personnel potentially working within the project area. Upon completion of the orientation, employees shall sign a form stating that they attended the program and understand all protection measures. These forms shall be maintained by the project owner and shall be made available to the CPM, BLM, USFWS and ~~CDFG~~ **CDFW** and upon request. Workers shall receive and be required to visibly display a hardhat sticker or certificate that they have completed the training.

During Project operation, signed statements for operational personnel shall be kept on file for 6 months following the termination of an individual's employment.

BIOLOGICAL RESOURCES MITIGATION IMPLEMENTATION AND MONITORING PLAN

BIO-7 The Project owner shall develop a Biological Resources Mitigation Implementation and Monitoring Plan (BRMIMP), and shall submit two copies of the proposed BRMIMP to the CPM and BLM for review and approval and USFWS and CDF~~G~~**W** for review. The Project owner shall implement the measures identified in the approved BRMIMP. The BRMIMP shall incorporate avoidance and minimization measures described in final versions of the Desert Tortoise Translocation Plan~~, **the Biological Opinion,**~~ the Raven Management Plan, the Closure, Conceptual Restoration Plan, **the American Badger and Kit Fox Management Plan,** the Burrowing Owl Mitigation and Monitoring Plan, the Weed Management Plan, and all other individual biological mitigation and/or monitoring plans associated with the Project. The Project owner shall provide to CDF~~GW~~ and USFWS a copy of all portions of the BRMIMP relating to desert tortoise and any other federal or state-listed species for review and comment.

The BRMIMP shall be prepared in consultation with the Designated Biologist and shall include accurate and up-to-date maps depicting the location of sensitive biological resources that require temporary or permanent protection during construction and operation. The BRMIMP shall include complete and detailed descriptions of the following:

1. All biological resources mitigation, monitoring, and compliance measures proposed and agreed to by the Project owner;

2. All biological resources conditions of certification identified as necessary to avoid or mitigate impacts;

3. All biological resource mitigation, monitoring, and compliance measures required in federal agency terms and conditions, such as those provided in the USFWS Biological Opinion;

4. All sensitive biological resources to be impacted, avoided, or mitigated by Project construction, operation, and closure;

5. All required mitigation measures for each sensitive biological resource, **including remedial actions for standing water onsite in accordance with Condition of Certification BIO-8 and known or suspected disease outbreaks on the project site in accordance with Condition of Certification BIO-17**;

6. **Aerial photographs, at an approved scale, of all areas to be disturbed during project construction activities; include one set prior to any site or related facilities mobilization disturbance and one set subsequent to completion of project construction. Provide planned timing of aerial photography and a description of why times were chosen. Provide a final accounting of the before/after whole acreages and a determination of whether more or less habitat compensation is necessary in the Construction Termination Report prepared in accordance with BIO-29**

7. All measures that shall be taken to avoid or mitigate temporary disturbances from construction activities;

8. Duration for each type of monitoring and a description of monitoring methodologies and frequency;

9. Performance standards to be used to help decide if/when proposed mitigation is or is not successful;

10. All performance standards and remedial measures to be implemented if performance standards are not met;

11. Biological resources-related facility closure measures including a description of funding mechanism(s);

12. A process for proposing plan modifications to the CPM and appropriate agencies for review and approval; and

13. A requirement to submit any sightings of any special-status species that are observed on or in proximity to the Project site, or during Project surveys, to the CNDDB per CDF~~G~~**W** and BLM requirements.

Verification: The Project owner shall submit the draft BRMIMP to the CPM and BLM at least ~~30~~ **45** days prior to start of any **site mobilization and construction** ~~preconstruction site mobilization and construction-related ground disturbance, grading, boring, and trenching~~. At the same time the Project owner shall provide to CDF~~G~~**W** and USFWS a copy of all portions of the draft BRMIMP relating to desert tortoise and any other federal or state-listed species. The Project owner shall provide final BRMIMP to the CPM, BLM, CDF~~G~~**W** and USFWS at least 7 days prior to start of any ~~**preconstruction**~~ **site mobilization and** construction~~-related ground disturbance, grading, boring, and trenching~~. The BRMIMP shall contain all of the required measures included in all biological conditions of certification. No **site mobilization or**~~-~~construction **activities**~~-related ground disturbance, grading, boring, or trenching~~ may occur prior to approval of the final BRMIMP by the CPM and BLM.

If any permits have not yet been received when the final BRMIMP is submitted, these permits shall be submitted to the CPM within 5 days of their receipt, and the BRMIMP shall be revised or supplemented to reflect the permit condition(s). The Project owner shall submit to the CPM and BLM the revised or supplemented BRMIMP within 10 days following the Project owner's receipt of any additional permits. Under no circumstances shall ground disturbance proceed without implementation of all permit conditions.

To verify that the extent of construction disturbance does not exceed that described in these conditions, the Project owner shall submit aerial photographs, at an approved scale, taken before and after construction to the CPM, BLM, USFWS and CDF~~G~~**W**. The first set of aerial photographs shall reflect site conditions prior to any ~~preconstruction~~ site mobilization and construction **activities**~~-related ground disturbance, grading, boring, and trenching,~~ and shall be submitted prior to initiation of such activities. The second set of aerial photographs shall be taken subsequent to completion of construction, and shall be submitted to the CPM, BLM, USFWS and CDF~~G~~**W** no later than 90 days after completion of construction. The Project owner shall also provide a final accounting in whole acres of vegetation communities/cover types present before and after construction. Construction acreages shall be rounded to the nearest acre.

Any changes to the approved BRMIMP must be approved by the CPM and BLM in consultation with CDF~~G~~**W** and USFWS.

Implementation of BRMIMP measures (for example, construction activities that were monitored, species observed) shall be reported in the Monthly Compliance Reports by the Designated Biologist. Within 30 days after completion of Project construction, the Project owner shall provide to the CPM, for review and approval, a written construction termination report identifying which items of the BRMIMP have been completed, a summary of all modifications to mitigation measures made during the Project's ~~preconstruction~~ site mobilization and construction **activities**~~-related ground disturbance,~~

~~grading, boring, and trenching~~, and which mitigation and monitoring items are still outstanding.

IMPACT AVOIDANCE AND MINIMIZATION MEASURES

BIO-8 The Project owner shall undertake the following measures to manage the Project site and related facilities during **site mobilization,** construction, operation and maintenance in a manner to avoid or minimize impacts to biological resources:

1. Limit Disturbance Areas. Minimize soil disturbance by locating staging areas, laydowns, and temporary parking or storage for linears in existing disturbed areas. Equipment maintenance and refueling shall not be conducted within 100 feet of any sensitive resource (for example, waters of the state, desert dry wash woodland, dune habitats and rare plant populations). Limit the width of the work area near sensitive resources. Avoid blading temporary access roads where feasible and instead drive over and crush the vegetation to preserve the seed bank and biotic soil crusts. The boundaries of all areas to be disturbed (including staging areas, access roads, and sites for temporary placement of spoils) shall be delineated with stakes and flagging prior to **site mobilization and** construction activities in consultation with the Designated Biologist. Spoils and topsoil shall be stockpiled in disturbed areas lacking native vegetation and which do not provide habitat for special-status species. Parking areas, staging and disposal site locations shall similarly be located in areas without native vegetation or special-status species habitat. All disturbances, Project vehicles and equipment shall be confined to the flagged areas.

2. Minimize Road Impacts. New and existing roads that are planned for construction, widening, or other improvements shall not extend beyond the flagged impact area as described above. All vehicles passing or turning around would do so within the planned impact area or in previously disturbed areas. Where new access is required outside of existing roads or the construction zone, the route shall be clearly marked (i.e., flagged and/or staked) prior to the onset of construction.

3. Minimize Traffic Impacts. Vehicular traffic during Project **site mobilization,** construction and operation shall be confined to existing routes of travel to and from the Project site, and cross country vehicle and equipment use outside designated work areas shall be prohibited. The speed limit shall not exceed 25 miles per hour **on paved or stabilized unpaved roads** within the Project area, on maintenance roads for linear facilities, or on access roads to the Project site. **No vehicle shall exceed 10 miles per hour on unpaved areas within the project site, except on stabilized unpaved roads. Project vehicles shall abide by posted speed limits on public paved access roads outside the project site. Additional speed limit signs shall be posted within areas where Mojave fringe toed lizard are known to occur or have the potential to occur on site.**

4. Monitor During Construction. In areas that have not been fenced with desert tortoise exclusion fencing and cleared, the Designated Biologist shall be present at the construction site during all Project activities that have potential to disturb soil, vegetation, and wildlife. **Upon completion of desert tortoise fencing installation and clearing the Designated Biologist or Biological Monitor shall be present at the construction site during all Project activities that have potential to disturb soil, vegetation, and wildlife**. The Designated Biologist or Biological Monitor shall clear ahead of equipment during brushing and grading activities. If desert tortoises are found during construction monitoring, procedures outlined in **BIO-9** shall be implemented.

5. **Salvage or Relocate Wildlife during Ground Disturbance Activities. The Designated Biologist or Biological Monitor shall salvage or relocate sensitive wildlife during ground disturbance activities including clearing, grubbing, and grading operations when feasible to off-site habitat or out of harm's way. The species shall be salvaged or relocated when conditions will not jeopardize the health and safety of the monitor.**

6. Minimize Impacts of Transmission/Pipeline Alignments, Roads, and Staging Areas. Staging areas for construction on the plant site shall be within the area that has been fenced with desert tortoise exclusion fencing and cleared. For construction activities outside of the plant site (transmission line, pipeline alignments) access roads, pulling sites, and storage and parking areas shall be **desi**gned, installed, and maintained with the goal of minimizing impacts to native plant communities and sensitive biological resources. Transmission lines and all electrical components shall be designed, installed, and maintained in accordance with the Avian Power Line Interaction Committee's (APLIC's) S*uggested Practices for Avian Protection on Power Lines* (APLIC 2006) and *Mitigating Bird Collisions with Power Lines* (APLIC 1994) to reduce the likelihood of large bird electrocutions and collisions. Where feasible avoid impacts to desert washes and special-status plants by adjusting the locations of poles and laydown areas, and the alignment of the roads and pipelines. Construction drawings and grading plans shall depict the locations of sensitive resources and demonstrate where temporary impacts to sensitive resources can be avoided and where they cannot.

7. Avoid Use of Toxic Substances. Soil bonding and weighting agents used on unpaved surfaces shall be non-toxic to wildlife and plants. **Anticoagulants shall not be used for rodent control. Pre-emergents and other herbicides with documented residual toxicity shall not be used. Herbicides shall be applied in conformance with federal, State, and local laws and according to the guidelines for wildlife-safe use of herbicides in BIO-14 (Weed Management Plan).**

8. Minimize Lighting Impacts. Facility lighting shall be designed, installed, and maintained to prevent side casting of light towards wildlife habitat.

9. Minimize Noise Impacts. A continuous low-pressure technique shall be used for steam blows, to the extent possible, in order to reduce noise levels in sensitive habitat proximate to the Project site. Loud construction activities (e.g., unsilenced high pressure steam blowing, pile driving, or other) shall be avoided from February 15 to April 15, when it would result in noise levels over 65 dBA in nesting habitat (excluding noise from passing vehicles). Loud construction activities may be permitted from February 15 to April 15 only if:

   a. The Designated Biologist provides documentation (i.e., nesting bird data collected using methods described in **BIO-15** and maps depicting location of the nest survey area in relation to noisy construction) to the CPM indicating that no active nests would be subject to 65 dBA noise, OR

   b. The Designated Biologist or Biological Monitor monitors active nests within the range of construction-related noise exceeding 65 dBA. The monitoring shall be conducted in accordance with Nesting Bird Monitoring and Management Plan approved by the CPM. The Plan shall include adaptive management measures to prevent disturbance to nesting birds from construction related noise. Triggers for adaptive management shall be evidence of Project-related disturbance to nesting birds such as: agitation behavior (displacement, avoidance, and defense); increased vigilance behavior at nest sites; changes in foraging and feeding behavior, or nest site abandonment. The Nesting Bird Monitoring and Management Plan shall include a description of adaptive management actions, which shall include, but not be limited to, cessation of construction activities that are deemed by the Designated Biologist to be the source of disturbance to the nesting bird.

10. Avoid Vehicle Impacts to Desert Tortoise. Parking and storage shall occur within the area enclosed by desert tortoise exclusion fencing to the extent feasible. No vehicles or construction equipment parked outside the fenced area shall be moved prior to an inspection of the ground beneath the vehicle for the presence of desert tortoise. If a desert tortoise is observed outside the areas fenced with desert tortoise exclusion fencing it shall be left to move on its own. If it does not move within 15 minutes, a Designated Biologist or Biological Monitor under the Designated Biologist’s direct supervision may move it out of harm’s way as described in the USFWS Desert Tortoise Field Manual (USFWS 2009a)

11. Install Box Culvert. To provide for connectivity for desert tortoise and other wildlife, the Project owner shall install a box culvert suitable for passage by desert tortoise and other wildlife under the Project Site Access Road. The box culvert shall be a concrete structure no less than 4 feet high and 6 feet wide with 3:1 side slopes and shall maintain a minimum of 18 inches of native material on the floor of the culvert at all times to facilitate tortoise movement.

12. Avoid Wildlife Pitfalls. To avoid trapping desert tortoise and other wildlife in trenches, pipes or culverts, the following measures shall be implemented:

    a. Backfill Trenches. At the end of each work day, the Designated Biologist **or Biological Monitor** shall ensure that all potential wildlife pitfalls (trenches, bores, and other excavations) outside the area fenced with desert tortoise exclusion fencing have been backfilled. If backfilling is not feasible, all trenches, bores, and other excavations shall be sloped at a 3:1 ratio at the ends to provide wildlife escape ramps, or covered completely to prevent wildlife access, or fully enclosed with desert tortoise-exclusion fencing. All trenches, bores, and other excavations outside the areas permanently fenced with desert tortoise exclusion fencing shall be inspected periodically throughout the day, at the end of each workday, and at the beginning of each day by the Designated Biologist or a Biological Monitor. Should a tortoise or other wildlife become trapped, the Designated Biologist or Biological Monitor shall move the tortoise out of harm's way as described in the **most recent** USFWS Desert Tortoise Field Manual (**currently** USFWS 2009a). Any wildlife encountered during the course of construction shall be allowed to leave the construction area unharmed.

    b. Avoid Entrapment of Desert Tortoise. Any construction pipe, culvert, or similar structure with a diameter greater than 3 inches, stored less than 8 inches aboveground and within desert tortoise habitat (i.e., outside the permanently fenced area) for one or more nights, shall be inspected for tortoises before the material is moved, buried or capped. As an alternative, all such structures may be capped before being stored outside the fenced area, or placed on elevated pipe racks. These materials would not need to be inspected or capped if they are stored within the permanently fenced area after the clearance surveys have been completed.

13. Minimize Standing Water. Water applied to dirt roads and construction areas (trenches or spoil piles) for dust abatement shall use the minimal amount needed to meet safety and air quality standards in an effort to prevent the formation of puddles, which could attract desert tortoises and common ravens to construction sites. A Biological Monitor shall patrol these areas to ensure water does not puddle and shall take appropriate action to reduce water application where necessary.

14. Dispose of Road-killed Animals. Road killed animals or other carcasses detected by personnel on roads associated with the Project area will be reported immediately to a Biological Monitor or Designated Biologist (or Project Environmental Compliance Monitor, during Project operations), who will promptly remove the roadkill. For special-status species road-kill, the Biological Monitor or Designated Biologist (or Project Environmental Compliance Monitor, during Project operations) shall contact **the CPM,** CDF**W**~~G~~**,** and USFWS within 1 working day of detection **(within 8 hours in the case of a desert kit fox)** of the carcass for guidance on disposal or

storage of the carcass; all other road kill shall be disposed of promptly. **Handling of desert kit fox carcasses shall follow handling requirements included in the BIO-18 American Badger and Kit Fox Management Plan.** The Biological Monitor shall provide the special-status species record as described in **BIO-11** below.

15. Minimize Spills of Hazardous Materials. All vehicles and equipment shall be maintained in proper working condition to minimize the potential for fugitive emissions of motor oil, antifreeze, hydraulic fluid, grease, or other hazardous materials. The Designated Biologist shall be informed of any hazardous spills immediately as directed in the Project Hazardous Materials Plan. Hazardous spills shall be immediately cleaned up and the contaminated soil properly disposed of at a licensed facility. Servicing of construction equipment shall take place only at a designated area. Service/maintenance vehicles shall carry a bucket and pads to absorb leaks or spills.

16. Worker Guidelines. During construction all trash and food-related waste shall be placed in self-closing containers and removed daily from the site. Workers shall not feed wildlife or bring pets to the Project site. Except for law enforcement personnel, no workers or visitors to the site shall bring firearms or weapons. ~~Vehicular traffic shall be confined to existing routes of travel to and from the Project site, and cross country vehicle and equipment use outside designated work areas shall be prohibited. The speed limit when traveling on dirt access routes within desert tortoise habitat shall not exceed 25 miles per hour.~~

17. **Avoid Spread of Noxious Weeds. The project owner shall implement the following Best Management Practices during construction and operation, and all other measures as required in the final approved Weed Management Plan (BIO-14) to prevent the spread and propagation of noxious weeds and other invasive plants:**

    a. **For work outside the project facility fenceline, limit the size of any vegetation and/or ground disturbance and limit ingress and egress to defined routes;**

    b. **Prevent spread of non-native plants via vehicular sources by implementing Trackclean™ or other methods of vehicle cleaning for vehicles coming and going from construction sites. Earth-moving equipment shall be cleaned prior to transport to the construction site; and**

    c. **Use only weed-free straw, hay bales, and seed for erosion control and sediment barrier installations.**

18. Implement Sediment Control Measures Near Desert Washes. Standard erosion control measures shall be implemented for all phases of construction and operation where sediment run-off from exposed slopes threatens to enter waters of the state. Sediment and other flow-restricting

materials shall be moved to a location where they shall not be washed back into the stream. Areas of disturbed soils (access and staging areas) which slope toward drainages shall be stabilized to reduce erosion potential.

19. Monitor Ground Disturbing Activities Prior to Pre-Construction Site Mobilization. If pre-construction site mobilization requires ground-disturbing activities such as for geotechnical borings or hazardous waste evaluations, a Designated Biologist or Biological Monitor shall be present to monitor any actions that could disturb soil, vegetation, or wildlife.

~~20. Control Unauthorized Use of the Project Access Roads. The secondary access road shall be gated at both ends and restricted to emergency response personnel as per proposed **COC WORKER SAFETY-6**. The Project owner shall also monitor and control any unauthorized use of the Project roads with gates, signage, and fencing as necessary to minimize traffic-related roadkills and ORV disturbance off-roads.~~

21. Implement Erosion Control Measures. All disturbed soils and roads within the Project site shall be stabilized to reduce erosion potential, both during and following construction. All areas subject to temporary disturbance shall be restored to pre-project grade and stabilized to prevent erosion and promote natural revegetation. Temporarily disturbed areas within the Project area include, but are not limited to: linear facilities, temporary access roads, temporary lay-down and staging areas. If erosion control measures include the use of seed, only locally native plant species from a local seed source shall be used. Local seed includes seeds from plants within the Chuckwalla Valley or Colorado River Hydrologic Units.

22. Avoid Spreading Weeds. Prior to the start of **site mobilization and** construction, flag and avoid dense populations of highly invasive noxious weeds. If these areas cannot be avoided, they shall be pre-treated by the methods described in **BIO-14** (Weed Management Plan). Noxious weeds and other invasive non-native plants in the temporarily disturbed areas shall be managed according to the requirements in BIO-14.

21. Salvage Topsoil. Topsoil from the Project site shall be salvaged, preserved and re-used for restoration of temporarily disturbed areas. Salvaged topsoil shall be collected, stored and applied in a way that maintains the viability of seed and soil crusts. The Project owner shall excavate and collect the upper soil layer (the top 1 to 2 inches that includes the seed bank and biotic soil crust) as well as the lower soil layer up to a depth of 6 to 8 inches. The upper and lower soil layers shall be stockpiled separately in areas that will not be impacted by other grading, flooding, erosion, or pollutants. If the soil is to be stored more than 2 weeks it shall be spread out to a depth of no more than 6 inches to maintain the seed and soil crust viability. The Project owner shall install temporary construction fencing around stockpiled topsoil, and signage that indicates whether the pile is the upper layer seed bank, or the lower layer, and clearly indicates that

the piles are for use only in erosion control. After construction, the Project owner shall replace the topsoil in the temporarily disturbed areas in the reverse order of stockpiling, starting with the 6-8 inch layer of subsoil, and then the seed-containing upper layer using a harrow or similar equipment to thinly distribute the layer to depths no greater than 1 to 2 inches.

22. Decommission Temporary Access Roads with Vertical Mulching. Discourage ORV use of temporary construction roads by installing vertical mulching at the head of the road to a distance necessary to obscure the road from view. Boulder barricades and gates shall not be used unless the remainder of the site is fenced to prevent driving around the gate or barricade. Designated ORV routes and roads shall not be closed.

21. Vegetation Management Best Management Practices. All Mowing and Vegetation Management will follow the Best Management Practices (BMPs) for Wildlife Habitat as defined by BLM Handbook H-1601-1 or most current BLM guidance:

   a. Minimize direct impacts to species of concern through appropriate mitigation measures (e.g. season of activity, etc.). Avoid treatments during critical periods for wildlife (e.g. breeding, nesting, foaling, etc.).

   b. Consider habitat needs of bird populations (both migratory and non-migratory). Avoid activities that may disrupt nesting and breeding of sensitive bird species.

Verification: All mitigation measures and their implementation methods shall be included in the BRMIMP and implemented. Implementation of the measures shall be reported in the Monthly Compliance Reports by the Designated Biologist. Within 30 days after completion of Project construction, the Project owner shall provide to the CPM, for review and approval, a written construction termination report identifying how measures have been completed. As part of the Annual Compliance Report, each year following construction the Designated Biologist shall provide a report to the CPM that describes compliance with avoidance and minimization measures to be implemented during operation (for example, a summary of the incidence of roadkilled animals during the year, implementation of measures to avoid toxic spills, erosion and sedimentation, efforts to enforce worker guidelines, etc.).

No less than 30 days prior to **site mobilization and construction** ~~construction-related ground disturbance~~ the Project owner shall provide the CPM, USFWS and CDF**W**~~G~~ with plans showing the design of a culvert under the Project Site Access Road that would provide access for desert tortoise and other wildlife. No less than 30 days after of completion of construction of the Project site access road the Project owner shall provide as-built drawings of the culvert.

If loud construction activities are proposed between February 15 to April 15 which would result in noise levels over 65 dBA in nesting habitat, the Project owner shall submit nest survey results (as described in 8a) to the CPM no more than 7 days before initiating such construction. If an active nest is detected within this survey area the Project owner shall submit a Nesting Bird Monitoring and Management Plan to the CPM for review and approval no more than 7 days before initiating noisy construction.

DESERT TORTOISE CLEARANCE SURVEYS AND FENCING

BIO-9 The project owner shall undertake appropriate measures to manage the project site and related facilities in a manner to avoid or minimize impacts to desert tortoise**.** Methods for clearance surveys, fence specification and installation, tortoise handling, artificial burrow construction, egg handling and other procedures shall be consistent with those described in the **most recent** USFWS~~'~~ Desert Tortoise Field Manual (**currently** USFWS 2009**a**) http://www.fws.gov/ventura/speciesinfo/protocols_guidelines ~~or more current guidance provided by CDFG**W** and USFWS~~. The project owner shall also implement all terms and conditions described in the Biological Opinion prepared by USFWS. The project owner shall implement the following measures:

1. Desert Tortoise Fencing along Interstate 10. To avoid increases in vehicular-related mortality from disruption of local movement patterns along the existing ephemeral wash systems, permanent desert tortoise-proof fencing shall be installed along the existing freeway right-of-way fencing, on both sides of Interstate 10 (I-10) between the wash on the westernmost end of the ~~proposed Project~~ **PSEGS** site and the easternmost wash associated with the ~~proposed Project~~ **PSEGS** site (labeled as #10 and #**13**~~12~~ in Wildlife Movement and Desert Tortoise Habitat [tn56755], AECOM 2010f). The project owner shall secure approval from California Department of Transportation (Caltrans) for the installation and maintenance of desert tortoise exclusion fencing prior to construction or repair. ~~If either Reconfigured Alternative 2 or Reconfigured Alternative 3 is selected, the fence shall extend from the westernmost wash (#10) to the wash immediately east of the alternative disturbance area (#13).~~ The tortoise fencing shall be designed to direct tortoises to existing undercrossing to provide safe passage under the freeway, and shall be inspected per 2.d. and maintained for the life of the Project.

2. Desert Tortoise Exclusion Fence Installation. To avoid impacts to desert tortoises, permanent exclusion fencing shall be installed along the permanent perimeter security fence (boundaries) as phases are constructed. Temporary fencing shall be installed along any subset of the plant site phasing that does not correspond to permanent perimeter fencing. Temporary fencing shall be installed along linear features unless a Biological Monitor is present in the immediate vicinity of construction activities for the linear facility. All **proposed alignments for permanent or temporary desert tortoise** fencing shall be flagged and surveyed within 24 hours prior to the initiation of fence construction. Clearance surveys of the desert tortoise exclusionary fence and utility rights-of-way alignments shall be conducted by the Designated Biologist(s) using techniques outlined in the **most recent USFWS** Desert Tortoise Field Manual (**currently** USFWS 2009**a**), ~~or more recent guidance approved by the CPM~~, and may be conducted in any season with USFWS and CDF~~G~~**W**

approval. Biological Monitors may assist the Designated Biologist under his or her supervision. These fence clearance surveys shall provide 100-percent coverage of all areas to be disturbed and an additional transect along both sides of the fence line. Disturbance associated with desert tortoise exclusionary fence construction shall not exceed 30 feet on either side of the proposed fence alignment. Prior to the surveys the project owner shall provide to the CPM, CDF~~G~~**W** and USFWS a figure clearly depicting the limits of construction disturbance for the proposed fence installation. The fence line survey area shall be 90 feet wide centered on the fence alignment. Where construction disturbance for fence line installation can be limited to 15 feet on either side of the fence line, this fence line survey area may be reduced to an area approximately 60 feet wide centered on the fence alignment. Transects shall be no greater than 15 feet apart. For the I-10 desert tortoise exclusion fence, the Project Owner may have a Designated Biologist present to clear ahead of fence construction and be present in the immediate vicinity of fence installation activities. Desert tortoise located within the utility ROW alignments shall be moved out of harm's way in accordance with the USFWS Desert Tortoise Field Manual (USFWS 2009**a**), or more recent guidance approved by the CPM. Any desert tortoise detected during clearance surveys for fencing within the plant site and along the perimeter fence alignment shall be translocated and monitored in accordance with the Desert Tortoise Relocation/Translocation Plan (**BIO-10**). Tortoise shall be handled by the Designated Biologist(s) in accordance with the USFWS' Desert Tortoise Field Manual (USFWS 2009).

a. Timing and Supervision of Fence Installation. The exclusion fencing shall be installed in any area subject to disturbance prior to the onset of site clearing and grubbing in that area. The fence installation shall be supervised by the Designated Biologist and monitored by the Biological Monitors to ensure the safety of any tortoise present.

b. Fence Material and Installation. All desert tortoise exclusionary fencing shall be constructed in accordance with the **most recent** USFWS' Desert Tortoise Field Manual (**currently** USFWS 2009) (Chapter 8 – Desert Tortoise Exclusion Fence)).

c. Security Gates. Security gates shall be designed with minimal ground clearance to deter ingress by tortoises. The gates may be electronically activated to open and close immediately after the vehicle(s) have entered or exited to prevent the gates from being kept open for long periods of time.

d. Fence Inspections. Following installation of the desert tortoise exclusion fencing for both the permanent and temporary fencing, the fencing shall be regularly inspected. If tortoise were moved out of harm's way during fence construction, permanent and temporary fencing shall be inspected at least two times a day for the first 7 days to ensure a recently moved tortoise has not been trapped within the fence. Thereafter, permanent fencing shall be inspected monthly and within 24 hours following all major rainfall events or after notification of an accident. A major rainfall event is defined as one for which flow is detectable within the fenced drainage. Any damage to the fencing shall be temporarily repaired immediately to keep tortoises out of the site, and permanently repaired within 48 hours of observing damage. Repairs on I-10 fencing shall occur after any required authorization from Caltrans for work within their Right-of-Way. Inspections of permanent site fencing shall occur for the life of the project. Temporary fencing shall be inspected weekly and, where drainages intersect the fencing, during and within 24 hours following major rainfall events. All temporary fencing shall be repaired immediately upon discovery and, if the fence may have permitted tortoise entry while damaged, the Designated Biologist shall inspect the area for tortoise.

3. Desert Tortoise Clearance Surveys within the Plant Site. Clearance surveys shall be conducted in accordance with the USFWS Desert Tortoise Field Manual (USFWS 2009) (Chapter 6 – Clearance Survey Protocol for the Desert Tortoise – Mojave Population) **or the most recent USFWS Desert Tortoise Field Manual (currently USFWS 2009a**) and shall consist of two surveys covering 100 percent the project area by walking transects no more than 15-feet apart. If a desert tortoise is located on the second survey, a third survey shall be conducted. **To maximize the opportunity to find all tortoises, each** separate survey shall be walked in a different direction**, in opposite directions, and/or offset** to allow opposing angles of observation**, or as directed in the Biological Opinion**. Clearance surveys of the plant site may only be conducted when tortoises are most active (April through May or September through October) unless the project receives approval from CDF~~G~~**W** and USFWS. Clearance surveys of linear features may be conducted during anytime of the year. Any tortoise located during clearance surveys of the power plant site and linear features shall be translocated or relocated and monitored in accordance with the Desert Tortoise Relocation/Translocation Plan:

   a. Burrow Searches. During clearance surveys all desert tortoise burrows, and burrows constructed by other species that might be used by desert tortoises, shall be examined by the Designated Biologist, who may be assisted by the Biological Monitors, to assess occupancy of each burrow by desert tortoises and handled in accordance with the USFWS Desert Tortoise Field Manual (USFWS 2009**a**). To prevent reentry by a tortoise or other wildlife, all burrows shall be collapsed once absence has been determined in accordance with the Desert Tortoise Relocation/Translocation Plan. Tortoises taken from burrows and from elsewhere on the power plant site shall be relocated or translocated as described in the Desert Tortoise Relocation/Translocation Plan.

   b. Burrow Excavation/Handling. All potential desert tortoise burrows located during clearance surveys would be excavated by hand, tortoises removed, and collapsed or blocked to prevent occupation by desert tortoises in accordance with the Desert Tortoise Relocation/Translocation Plan. All desert tortoise handling, and removal, and burrow excavations, including nests, would be conducted by the Designated Biologist, who may be assisted by a Biological Monitor in accordance with the USFWS Desert Tortoise Field Manual (USFWS 2009) or more recent guidance approved by the CPM.

4. Monitoring Following Clearing. Following the desert tortoise clearance and removal from the power plant site and utility corridors, workers and heavy equipment shall be allowed to enter the project site to perform clearing, grubbing, leveling, and trenching activities. A Designated Biologist or Biological Monitor shall be onsite for clearing and grading activities to move tortoises missed during the initial tortoise clearance survey. Should a tortoise be discovered, it shall be relocated or translocated as described in the Desert Tortoise Relocation/Translocation Plan.

5. Reporting. The Designated Biologist shall record the following information for any desert tortoises handled: a) the locations (narrative and maps) and dates of observation; b) general condition and health, including injuries, state of healing and whether desert tortoise voided their bladders; c) location moved from and location moved to (using GPS technology); d) gender, carapace length, and diagnostic markings (i.e., identification numbers or marked lateral scutes); e) ambient temperature when handled and released; and f) digital photograph of each handled desert. Desert tortoise moved from within project areas shall be marked and monitored in accordance with the Desert Tortoise Relocation/Translocation Plan.

Verification: All mitigation measures and their implementation methods shall be included in the BRMIMP and implemented. Implementation of the measures shall be reported in the Monthly Compliance Reports by the Designated Biologist. Within 30 days after completion of desert tortoise clearance surveys the Designated Biologist shall submit a report to BLM, the CPM, USFWS, and CDF~~G~~**W** describing implementation of each of the mitigation measures listed above. The report shall include the desert tortoise survey results, capture and release locations of any relocated desert tortoises, and any other information needed to demonstrate compliance with the measures described above.

Within 6 months of completion of desert tortoise exclusion fence ~~for Phase 1~~, I-10 desert tortoise exclusion fencing shall be installed. Within 3 months of completion of I-10 desert tortoise exclusion fence construction, the Project owner shall provide the CPM, BLM, USFWS, and CDF~~G~~**W** with maps as well as photographic documentation showing the design and location of the fencing on both sides of I-10 south of the Project site.

The Project Owner shall provide evidence of approval from Caltrans for installation of desert tortoise fencing along I-10 within their right-of-way at least 30-days prior to construction of the fencing.

DESERT TORTOISE RELOCATION/TRANSLOCATION PLAN

BIO-10 The Project owner shall develop and implement a final Desert Tortoise Relocation/Translocation Plan (Plan) that is consistent with current USFWS approved guidelines, and meets the approval of the CPM. The Plan shall include guidance specific to each of the two phases of Project construction, as described in **BIO-29** (Phasing), and shall include measures to minimize the potential for repeated translocations of individual desert tortoises. The goals of the Desert Tortoise Relocation/Translocation Plan shall be to: relocate/translocate all desert tortoises from the project site to nearby suitable habitat; minimize impacts on resident desert tortoises outside the project site; minimize stress, disturbance, and injuries to relocated/translocated tortoises; and assess the success of the translocation effort through monitoring**.** The ~~final~~ **revised draft** Plan shall be based on the draft Desert Tortoise Relocation/Translocation Plan prepared by the **prior project owner**~~Applicant~~ (AECOM 2010a, DR-BIO-55) and shall include all revisions deemed necessary by BLM, USFWS, CDF~~G~~**W** and the Energy Commission staff.

Verification: **At least 60 days prior to site mobilization and construction the Project owner shall provide the CPM with a revised draft of a Plan to the CPM for review and approval in consultation with BLM, USFWS and CDFW.** At least 30 days prior to site mobilization **and construction**, the Project owner shall provide the CPM with the final version of a Plan that has been reviewed and approved by the CPM in consultation with BLM, USFWS and CDF~~G~~**W**. All modifications to the approved Plan shall be made only after approval by the CPM, in consultation with BLM, USFWS and CDF~~G~~**W**.

Within 30 days after initiation of relocation and/or translocation activities, the Designated Biologist shall provide to the CPM for review and approval, a written report identifying which items of the Plan have been completed, and a summary of all modifications to measures made during implementation of the Plan.

DESERT TORTOISE COMPLIANCE VERIFICATION

BIO-11 The Project owner shall provide Energy Commission, BLM, CDF~~G~~**W**, and USFWS staff with reasonable access to the Project site and compensation lands under the control of the Project owner and shall otherwise fully cooperate with the Energy Commission's and BLM's efforts to verify the Project owner's compliance with, or the effectiveness of, mitigation measures set forth in the conditions of certification. The Designated Biologist shall do all of the following:

1. Notification. Notify the CPM at least 14 calendar days before initiating ~~construction-related ground disturbance~~ **site mobilization and construction** activities; immediately notify the CPM in writing if the Project owner is not in compliance with any conditions of certification, including but not limited to any actual or anticipated failure to implement mitigation measures within the time periods specified in the conditions of certification;

2. Monitoring During Grubbing and Grading. Remain onsite daily while vegetation salvage, grubbing, grading and other ground-disturbance construction activities are taking place to avoid or minimize take of listed species, and verify personally or use Biological Monitors to check for compliance with all impact avoidance and minimization measures, including checking all exclusion zones to ensure that signs, stakes, and fencing are intact and that human activities are restricted in these protective zones.

3. Monthly Compliance Inspections. Conduct compliance inspections at a minimum of once per month after **ground disturbance activities including** clearing, grubbing, and grading are completed and submit a monthly compliance report to the CPM, BLM, USFWS and CDF~~G~~**W** during construction

4. Notification of Injured or Dead Listed Species. If an injured or dead listed species is detected within or near the Project Disturbance Area the CPM, BLM, the Ontario Office of CDF~~G~~**W**, and the ~~Carlsbad~~ **Palm Springs** Office of USFWS shall be notified immediately by phone **and email**. Notification shall occur no later than noon on the business day following the event if it occurs outside normal business hours so that the agencies can determine if further actions are required to protect listed species **(within 8 hours in the case of desert kit fox).** Written follow-up notification via FAX or electronic communication shall be submitted to these agencies within two calendar days of the incident and include the following information as relevant:

   a. Injured Desert Tortoise. If a desert tortoise is injured as a result of Project-related activities during construction, the Designated Biologist or approved Biological Monitor shall immediately take it to a CDF~~G~~**W**-approved wildlife rehabilitation and/or veterinarian clinic. Any veterinarian bills for such injured animals shall be paid by the Project owner. Following phone notification as required above, the CPM, CDF~~G~~**W**, and USFWS shall determine the final disposition of the injured animal, if it recovers. Written notification shall include, at a minimum, the date, time, and location, circumstances of the incident, and the name of the facility where the animal was taken.

   b. Desert Tortoise Fatality. If a desert tortoise is killed by Project-related activities during construction or operation, a written report with the same information as an injury report shall be submitted to the CPM, BLM, the Ontario Office of CDF ~~G~~**W**, and the ~~Carlsbad~~ **Palm Springs** Office of USFWS. These desert tortoises shall be salvaged according to guidelines described in *Salvaging Injured, Recently Dead, Ill, and Dying Wild, Free-Roaming Desert Tortoise* (Berry 2001) **or most recent guidelines approved by the CPM.** The Project owner shall pay to have the desert tortoises transported and necropsied. The report shall include the date and time of the finding or incident.

5. Final Listed Species Report. The Designated Biologist shall provide the CPM and BLM a Final Listed Species Mitigation Report that includes, at a minimum: 1) a copy of the table in the BRMIMP with notes showing when each of the mitigation measures was implemented; 2) all available information about Project-related incidental take of listed species; 3) information about other Project impacts on the listed species; 4) construction dates; 5) an assessment of the effectiveness of conditions of certification in minimizing and compensating for Project impacts; 6) recommendations on how mitigation measures might be changed to more effectively minimize and mitigate the impacts of future Projects on the listed species; and 7) any other pertinent information, including the level of take of the listed species associated with the Project.

6. Stop Work Order. The CPM may issue the Project owner a written stop work order to suspend any activity related to the construction or operation of the Project to prevent or remedy a violation of one or more conditions of certification (including but not limited to failure to comply with reporting, monitoring, or habitat acquisition obligations) or to prevent the illegal take of an endangered, threatened, or candidate species. The Project owner shall comply with the stop work order immediately upon receipt thereof.

Verification: No later than 2 days following the above required notification of a sighting, injury, kill, or relocation of a listed species, the Project owner shall deliver to the CPM, BLM, CDF~~G~~**W**, and USFWS via FAX or electronic communication the written report from the Designated Biologist describing all reported incidents of injury, kill, or relocation of a listed species, identifying who was notified, and explaining when the incidents occurred. In the case of a sighting in an active construction area, the Project owner shall, at the same time, submit a map (e.g., using Geographic Information Systems) depicting both the limits of construction and sighting location to the CPM, BLM, CDF~~G~~**W** and USFWS.

No later than 45 days after initiation of Project operation the Designated Biologist shall provide the CPM and BLM a Final Listed Species Mitigation Report.

Beginning with the first month after clearing, grubbing and grading are completed and continuing every month until construction is complete the Project owner shall submit a report describing the results of Monthly Compliance Inspections to the CPM, BLM, USFWS and CDF~~G~~**W**.

DESERT TORTOISE COMPENSATORY MITIGATION

BIO-12 To fully mitigate for habitat loss and potential take of desert tortoise, the Project owner shall provide compensatory mitigation per **BIO-29** – Table 2, adjusted to reflect the final Project footprint. For purposes of this condition, the Project footprint means all lands disturbed in the construction and operation of the Palen Project, including all Project linears, as well as undeveloped areas inside the Project's boundaries that will no longer provide viable long-term habitat for the desert tortoise. To satisfy this condition, the Project owner shall acquire, protect and transfer 5 acres of desert tortoise habitat for every acre of habitat within critical habitat and within the final

Project footprint, and 1 acre of desert tortoise habitat for every acre of habitat outside of critical habitat but within the final Project footprint, and provide associated funding for the acquired lands, as specified below. Condition **BIO-28** may provide the Project owner with one means for satisfying some or all of the requirements in this condition. In lieu of acquiring lands itself, the Project owner may satisfy the requirements of this condition by depositing funds into the Renewable Energy Action Team (REAT) **or with another CPM-approved entity**

~~Account established with the National Fish and Wildlife Foundation (NFWF)~~, as provided below in section 3.i. of this condition.

The timing of the mitigation shall correspond with the timing of the site disturbance activities as stated in **BIO-29** (phasing). If compensation lands are acquired in fee title or in easement, the requirements for acquisition, initial improvement and long-term management of compensation lands include all of the following:

1. Selection Criteria for Compensation Lands. The compensation lands selected for acquisition in fee title or in easement shall:
   a. be within the Colorado Desert Recovery Unit, with potential to contribute to desert tortoise habitat connectivity and build linkages between desert tortoise designated critical habitat, known populations of desert tortoise, and/or other preserve lands;

   b. provide habitat for desert tortoise with capacity to regenerate naturally when disturbances are removed;

   c. be prioritized near larger blocks of lands that are either already protected or planned for protection, such as DWMAs within the Colorado Desert Recovery Unit (Chuckwalla DWMA as first priority, Chemehuevi DMWA as the second) or which could feasibly be protected long-term by a public resource agency or a non-governmental organization dedicated to habitat preservation;

   d. be connected to lands with desert tortoise habitat equal to or better quality than the Project Site, ideally with populations that are stable, recovering, or likely to recover;

   e. not have a history of intensive recreational use or other disturbance that does not have the capacity to regenerate naturally when disturbances are removed or might make habitat recovery and restoration infeasible;

   f. not be characterized by high densities of invasive species, either on or immediately adjacent to the parcels under consideration, that might jeopardize habitat recovery and restoration;

   g. not contain hazardous wastes that cannot be removed to the extent that the site could not provide suitable habitat; and

h. have water and mineral rights included as part of the acquisition, unless the CPM, in consultation with CDFW, BLM and USFWS, agrees in writing to the acceptability of the land.

2. Review and Approval of Compensation Lands Prior to Acquisition. The Project owner shall submit a formal acquisition proposal to the CPM, CDF~~G~~**W**, USFWS, and BLM describing the parcel(s) intended for purchase. This acquisition proposal shall discuss the suitability of the proposed parcel(s) as compensation lands for desert tortoise in relation to the criteria listed above. Approval from the CPM and CDF~~G~~**W**, in consultation with BLM and the USFWS, shall be required for acquisition of all compensatory mitigation parcels.

3. Compensation Lands Acquisition Requirements. The Project owner shall comply with the following requirements relating to acquisition of the compensation lands after the CPM and CDF~~G~~**W**, in consultation with BLM and the USFWS, have approved the proposed compensation lands:

   a. Preliminary Report. The Project owner, or approved third party, shall provide a recent preliminary title report, initial hazardous materials survey report, biological analysis, and other necessary or requested documents for the proposed compensation land to the CPM and CDF~~G~~**W**. All documents conveying or conserving compensation lands and all conditions of title are subject to review and approval by the CPM and CDF~~G~~**W**, in consultation with BLM and the USFWS. For conveyances to the State, approval may also be required from the California Department of General Services, the Fish and Game Commission and the Wildlife Conservation Board.

   b. Title/Conveyance. The Project owner shall transfer fee title to the compensation lands, a conservation easement over the lands, or both fee title and conservation easement as required by the CPM and CDF~~G~~**W**. Transfer of either fee title or an approved conservation easement will usually be sufficient, but some situations, e.g., the donation of lands burdened by a conservation easement to BLM, will require that both types of transfers be completed. Any transfer of a conservation easement or fee title must be to CDF~~G~~**W**, a non-profit organization qualified to hold title to and manage compensation lands (pursuant to California Government Code section 65965), or to BLM under terms approved by the CPM and CDF~~G~~**W**. If an approved non-profit organization holds title to the compensation lands, a conservation easement shall be recorded in favor of CDF~~G~~**W** in a form approved by CDF~~G~~**W**. If an approved non-profit holds a conservation easement, CDFW shall be named a third party beneficiary. **If a Security is provided, the project owner or an approved third party shall complete the proposed compensation lands acquisition within 18 months of the start of project ground-disturbing activities.**

c. <u>Initial Habitat Improvement Fund.</u> The Project owner shall fund the initial protection and habitat improvement of the compensation lands. Alternatively, a non-profit organization may hold the habitat improvement funds if it is qualified to manage the compensation lands (pursuant to California Government Code section 65965) and if it meets the approval of CDF~~G~~**W** and the CPM. If CDF~~G~~**W** takes fee title to the compensation lands, the habitat improvement fund must be paid to CDF~~G~~**W** or its designee.

d. <u>Property Analysis Record.</u> Upon identification of the compensation lands, the Project owner shall conduct a Property Analysis Record (PAR) or PAR-like analysis to establish the appropriate long-term maintenance and management fee to fund the in-perpetuity management of the acquired mitigation lands.

e. <u>Long-term Maintenance and Management Fund.</u> In accordance with **BIO-29** (phasing), the Project owner shall deposit in~~NFWF's~~ REAT Account, **<u>or with another CPM-approved entity</u>**, a capital long-term maintenance and management fee in the amount determined through the Property Analysis Record (PAR) or PAR-like analysis conducted for the compensation lands.

   The CPM, in consultation with CDF~~G~~**<u>W</u>**, may designate another non-profit organization to hold the long-term maintenance and management fee if the organization is qualified to manage the compensation lands in perpetuity. If CDF~~G~~**<u>W</u>** takes fee title to the compensation lands, CDF~~G~~**<u>W</u>** shall determine whether it will hold the long-term management fee in the special deposit fund, leave the money in the REAT Account, or designate another entity to manage the long-term maintenance and management fee for CDF~~G~~**<u>W</u>** and with CDF~~G~~**<u>W</u>** supervision.

f. <u>Interest, Principal, and Pooling of Funds</u>. The Project owner shall ensure that an agreement is in place with the long-term maintenance and management fee holder/manager to ensure the following conditions:

   i. <u>Interest</u>. Interest generated from the initial capital long-term maintenance and management fee shall be available for reinvestment into the principal and for the long-term operation, management, and protection of the approved compensation lands, including reasonable administrative overhead, biological monitoring, improvements to carrying capacity, law enforcement measures, and any other action approved by CDF~~G~~**W** designed to protect or improve the habitat values of the compensation lands.

ii. Withdrawal of Principal. The long-term maintenance and management fee principal shall not be drawn upon unless such withdrawal is deemed necessary by the CDF~~G~~**W** or the approved third-party long-term maintenance and management fee manager to ensure the continued viability of the species on the compensation lands. If CDF~~G~~**W** takes fee title to the compensation lands, monies received by CDF~~G~~**W** pursuant to this provision shall be deposited in a special deposit fund established solely for the purpose to manage lands in perpetuity unless CDF~~G~~**W** designates ~~NFWF or~~ another entity to manage the long-term maintenance and management fee for CDF~~G~~**W**.

iii. Pooling Long-Term Maintenance and Management Fee Funds. CDFW, or a CPM-and CDF~~G~~**W**-approved non-profit organization qualified to hold long-term maintenance and management fees solely for the purpose to manage lands in perpetuity, may pool the endowment with other endowments for the operation, management, and protection of the compensation lands for local populations of desert tortoise. However, for reporting purposes, the long-term maintenance and management fee fund must be tracked and reported individually to the CDF~~G~~**W** and CPM.

g. Other expenses. In addition to the costs listed above, the Project owner shall be responsible for all other costs related to acquisition of compensation lands and conservation easements, including but not limited to title and document review costs, expenses incurred from other state agency reviews, and overhead related to providing compensation lands to CDF~~G~~**W** or an approved third party; escrow fees or costs; environmental contaminants clearance; and other site cleanup measures.

h. Mitigation Security. The Project owner shall provide financial assurances in accordance with **BIO-29** (phasing) to the CPM and CDF~~G~~**W** with copies of the document(s) to BLM and the USFWS, to guarantee that an adequate level of funding is available to implement the mitigation measures described in this condition. These funds shall be used solely for implementation of the measures associated with the Project in the event the Project owner fails to comply with the requirements specified in this condition, or shall be returned to the Project owner upon successful compliance with the requirements in this condition. The CPM's or CDF~~G~~**W**'s use of the security to implement measures in this condition may not fully satisfy the Project owner's obligations under this condition. Financial assurance can be provided to the CPM and CDF~~G~~**W** in the form of an irrevocable letter of credit, a pledged savings account or another form of security ("Security"). Prior to submitting the Security to the CPM, the Project owner shall obtain the CPM's approval in consultation with CDF~~G~~**W**. BLM and the USFWS, of the form of the Security. Security shall be provided as described in **BIO-29 – Table 3** and the beginning of the conditions of certification subsection. The actual costs to comply with this condition will vary depending on the final footprint of the Project and its two phases, and the actual costs of acquiring, improving and managing the compensation lands.

i. ~~NFWF~~ REAT Account. The Project owner may elect to fund the acquisition and initial improvement of compensation lands ~~through NFWF~~ by depositing funds for that purpose into ~~NFWF's~~**the** REAT Account. Initial deposits for this purpose must be made in the same amounts as the security required in section 3.h., above, and may be provided in lieu of security. If this option is used for the acquisition and initial improvement, the Project owner shall make an additional deposit into the REAT Account if necessary to cover the actual acquisition costs and administrative costs and fees of the compensation land purchase once land is identified and the actual costs are known. If the actual costs for acquisition and administrative costs and fees are less than described in **Biological Resources Table 6b**, the excess money deposited in the REAT Account shall be returned to the Project owner. Money deposited for the initial protection and improvement of the compensation lands shall not be returned to the Project owner.

The responsibility for acquisition of compensation lands may be delegated to **an authorized** third party~~other than NFWF~~, such as a non-governmental organization supportive of desert habitat conservation, by written agreement of the Energy Commission and CDF~~G~~**W**. Such delegation shall be subject to approval by the CPM and CDF~~G~~**W**, in consultation with BLM and USFWS, prior to land acquisition, initial protection or maintenance and management activities. Agreements to delegate land acquisition to an approved third party, or to manage compensation lands, shall be implemented with 18 months of the Energy Commission's approval.

Verification: If the mitigation actions required under this condition are not completed prior to the start of ground-disturbing activities **including site mobilization construction**, the Project owner shall provide the CPM and CDF~~G~~**W** with an approved form of Security in accordance with this condition of certification no later than 30 days prior to beginning Project ground-disturbing activities**, including site mobilization and construction**. Actual Security shall be provided no later than 7 days prior to the beginning of Project ground-disturbing activities. If Security is provided, the Project owner, or an approved third party, shall complete and provide written verification to the CPM, CDF~~G~~**W**, BLM and USFWS of the compensation lands acquisition and transfer within 18 months of the start of Project ground-disturbing activities**, including site mobilization construction**.

The Project owner may elect to fund the acquisition and initial improvement of compensation lands through ~~NFWF~~ **the REAT** or other approved third party by depositing funds for that purpose into ~~NFWF's~~ **the** REAT Account. Initial deposits for this purpose must be made in the same amounts as the Security required in section 3.h.

of this condition. Payment of the initial funds for acquisition and initial improvement must be made at least 30 days prior to the start of ground-disturbing activities.

No fewer than 90 days prior to acquisition of the property, the Project owner shall submit a formal acquisition proposal to the CPM, CDF~~G~~**W** , USFWS, and BLM describing the parcels intended for purchase and shall obtain approval from the CPM and CDFW prior to the acquisition.

No fewer than 30 days after acquisition of the property the Project owner shall deposit the funds required by Section 3e above (long term management and maintenance fee) and provide proof of the deposit to the CPM.

The Project owner, or an approved third party, shall provide the CPM, CDF~~G~~**W**, BLM, and USFWS with a management plan for the compensation lands within 180 days of the land or easement purchase, as determined by the date on the title. The CPM shall review and approve the management plan for the compensatory mitigation lands, in consultation with CDF~~G~~**W**, BLM and the USFWS.

Within 90 days after completion of all project related ground disturbance, the Project owner shall provide to the CPM, CDF~~G~~**W**, BLM and USFWS an analysis, based on aerial photography, with the final accounting of the amount of habitat disturbed during Project construction. This shall be the basis for the final number of acres required to be acquired.

RAVEN MANAGEMENT PLAN AND FEE

BIO-13 The Project owner shall implement a Raven Monitoring, Management, and Control Plan (Raven Plan) that is consistent with the most current USFWS-approved raven management guidelines, and which meets the approval of the ~~CMP~~ **CPM**, in consultation with USFWS and CDF~~G~~**W**. The draft Common Raven Monitoring, Management, and Control Plan submitted by the **project owner** (AECOM 2010a, Attachment DR-BIO-57) shall provide the basis for the **revised draft and** final Raven Plan, subject to review, revisions and approval from the CPM, CDF~~G~~**W** and USFWS. The Raven Plan shall include but not be limited to a program to monitor raven presence in the Project vicinity, determine if raven numbers are increasing, and to implement raven control measures as needed based on that monitoring. The purpose of the plan is to avoid any Project-related increases in raven numbers during construction, operation, and ~~decommissioning~~ **closure**. In addition, the Project owner shall also provide funding for implementation of the USFWS Regional Raven Management Program, as described below.

1. The Raven Plan shall:
    a. Identify conditions associated with the Project that might provide raven subsidies or attractants;
    b. Describe management practices to avoid or minimize conditions that might increase raven numbers and predatory activities;
    c. Describe control practices for ravens;

d. Establish thresholds that would trigger implementation of control practices;

e. Address monitoring and nest removal during construction and for the life of the Project, and;

f. Discuss reporting requirements.

2. <u>USFWS Regional Raven Management Program</u>. The Project owner shall submit payment to the project sub-account of the REAT Account ~~held by the National Fish and Wildlife Foundation (NFWF)~~ to support the USFWS Regional Raven Management Program. The one-time fee shall be as described by the USFWS in the *Renewable Energy Development and Common Raven Predation on the Desert Tortoise – Summary, dated May 2010* (USFWS 2010a) and the Cost Allocation Methodology for Implementation of the Regional Raven Management Plan, dated July 9, 2010) or more current guidance as provided by USFWS or CDFG~~W~~ (USFWS 2010b).

<u>**Verification:**</u> <u>**At least 45 days prior to any project-related ground disturbance activities, the project owner shall submit the revised draft Raven Plan to the CPM for review and approval and CDFW and USFWS for review and comment.**</u> No less than 10 days prior to the start of any Project-related ground disturbance activities, <u>**including pre-construction site mobilization**</u>, the Project owner shall provide the CPM, USFWS, and CDFW with the final version of a Raven Plan. All modifications to the approved Raven Plan shall be made only with approval of the CPM in consultation with USFWS and CDFW.

No less than 10 days prior to the start of any Project-related ground disturbance, <u>**including pre-construction site mobilization**</u>, activities for each phase of Project construction as described in **BIO-29**, the Project owner shall provide documentation to the CPM, CDFW and USFWS that the one-time fee for the USFWS Regional Raven Management Program of has been deposited to the REAT-NFWS subaccount for the Project. Payment of the fees may be phased as described in **BIO-29 – Table 3**.

Within 30 days after completion of Project construction, the Project owner shall provide to the CPM for review and approval, a written report identifying which items of the Raven Plan have been completed, a summary of all modifications to mitigation measures made during the Project's construction phase, and which items are still outstanding.

As part of the annual compliance report, each year following construction the Designated Biologist shall provide a report to the CPM that includes: a summary of the results of raven management and control activities for the year; a discussion of whether raven control and management goals for the year were met; and recommendations for raven management activities for the upcoming year.

WEED MANAGEMENT PLAN

BIO-14 The Project owner shall implement a Weed Management Plan (Plan) that meets the approval of the CPM. The objective of the Plan shall be to prevent the introduction of any new weeds and the spread of existing weeds as a result of Project **site mobilization,** construction, operation, and **closure**~~decommissioning~~. The Draft Weed Management Plan, submitted by the~~ Applicant~~ **project owner (Palen 2013u, Response to Data Request 52)** shall provide the basis for the final Plan, subject to review and revisions from the CPM **and the BLM**. The Plan shall include the following:

1. **Weed Plan Requirements**. The Project owner shall provide a map to the CPM indicating the location of the Weed Management Area, which shall include all areas within 100 feet of the Project Disturbance Area, access roads, staging and laydown sites, and all other areas subject to temporary disturbance. The Project owner shall provide a Plan for the Weed Management Area includes at a minimum the following information: specific weed management objectives and measures for each target non-native weed species; baseline conditions; a map of the Weed Management Areas; map of existing populations of target weeds within 100 feet of the Project Disturbance Area and access roads; weed risk assessment; measures to prevent the introduction and spread of weeds; measures to minimize the risk of unintended harm to wildlife and other plants from weed control activities; monitoring and surveying methods; and reporting requirements. Weed control described in the Plan shall focus on prevention, early detection of new infestations, and early eradication for the life of the Project. Weed control along the Project linears shall be limited to the areas where soils were disturbed during construction. Weed monitoring shall occur a minimum of once per year during the early spring months (March-April) to detect seedlings before they set seed. The focus of the Plan shall be on avoiding the introduction of new invasive weeds or the spread of highly invasive species, such as Sahara mustard. Non-native species with low ecological risk, or that are very widespread, such as Mediterranean grass, shall be noted but control shall not be required. When detected, infestations of high priority species shall be eradicated immediately.

2. **Avoidance and Treatment of Dense Weed Populations**. The Plan shall include a requirement to flag and avoid dense populations of the most invasive non-native weeds during any Project-related construction operation in or adjacent to infestations. If these areas cannot be avoided, they shall be pre-treated by one of the following methods: a) treating the infested areas in the season prior to construction by removing and properly disposing of seed heads by hand, prior to maturity, or spraying the new crop of plants that emerge in early spring, the season prior to construction, to reduce the viable seed contained in the soil, or b) removing and disposing the upper 2 inches of soil and disposing it offsite at a sanitary landfill or other site approved by the County Agricultural Commissioner , or burying the infested soil, e.g., under the solar facility or

in a pit, and covering the infested soil with at least three feet of uncontaminated soil.

3. **Cleaning Vehicles and Equipment**. The Plan shall include specifications and requirements for the cleaning and removal of weed seed and weed plant parts from vehicles and equipment involved in Project-related construction and operation. Vehicles and equipment working in weed-infested areas (including previous job sites) shall be required to clean the equipment tires, tracks, and undercarriage *before* entering the Project area and before moving to infested areas of the Project Disturbance Area to uninfested areas. Cleaning shall be conducted on all track and bucket/blade components to adequately remove all visible dirt and plant debris. Cleaning using hand tools, such as brushes, brooms, rakes, or shovels, is preferred. If water must be used, the water/slurry shall be contained to prevent seeds and plant parts from washing into adjacent habitat.

4. **Safe Use of Herbicides**. The final Plan shall include detailed specifications for avoiding herbicide and soil stabilizer drift, and shall include a list of herbicides and soil stabilizers that will be used on the Project with manufacturer's guidance on appropriate use **and include a copy of the Pesticide Use Permit issued by BLM**. The Plan shall indicate where the herbicides will be used, and what techniques will be used to avoid chemical drift or residual toxicity to special-status species and their pollinators, and consistent with the Nature Conservancy guidelines and the criteria under #2, below. Only weed control measures for target weeds with a demonstrated record of success shall be used, based on the best available information from sources such as The Nature Conservancy's The Global Invasive Species Team, California Invasive Plant Council: http://www.cal-ipc.org/ip/management/plant_profiles/index.php, and the California Department of Food & Agriculture Encycloweedia: http://www.cdfa.ca.gov/phpps/ipc/encycloweedia/encycloweedia_h p.htm.

5. The methods for weed control described in the final Plan shall meet the following criteria:

   a. Manual: Well-timed removal of plants or seed heads with hand tools; seed heads and plants must be disposed of in accordance with guidelines from the Riverside County Agricultural Commissioner.

   b. Chemical: Herbicides known to have residual toxicity, such as pre-emergents and pellets, shall not be used in natural areas or within the engineered channels. Only the following application methods may be used: wick (wiping onto leaves); inner bark injection; cut stump; frill or hack and squirt (into cuts in the trunk); basal bark girdling; foliar spot spraying with backpack sprayers or pump sprayers at low pressure or with a shield attachment to control drift, and only on windless days, or with a squeeze bottle for small infestations (see Nature Conservancy guidelines described above);

c. Biological: Biological methods may be used subject to review and approval by CDF~~G~~**W** and USFWS and only if approved for such use by CDFA, and are either locally native species or have no demonstrated threat of naturalizing or hybridizing with native species;

d. Mechanical: Disking, tilling, and mechanical mowers or other heavy equipment shall not be employed in natural areas but hand weed trimmers (electric or gas-powered) may be used. Mechanical trimmers shall not be used during periods of high fire risk and shall only be used with implementation of fire prevention measures.

Verification: No less than 10 days prior to start of any Project-related ground disturbance activities **including site mobilization and construction**, the Project owner shall provide the CPM with the final version of a Weed Management Plan that has been reviewed by BLM and Energy Commission staff. Modifications to the approved Weed Control Plan shall be made only with approval from the CPM in consultation with BLM.

Within 30 days after completion of Project construction, the Project owner shall provide to the CPM for review and approval, a written report identifying which items of the Weed Management Plan have been completed, a summary of all modifications to mitigation measures made during the Project's construction phase, and which items are still outstanding.

As part of the Annual Compliance Report, each year following construction the Designated Biologist shall provide a report to the CPM and BLM that includes: a summary of the results of noxious weeds surveys and management activities for the year; a discussion of whether weed management goals for the year were met; and recommendations for weed management activities for the upcoming year.

PRE-CONSTRUCTION NEST SURVEYS AND AVOIDANCE MEASURES

BIO-15 Pre-construction nest surveys shall be conducted if **site mobilization and** construction activities would occur from February 1 through July 31. The Designated Biologist or Biological Monitor conducting the surveys shall be experienced bird surveyors familiar with standard nest-locating techniques such as those described in Martin and Guepel (1993). The goal of the nesting surveys shall be to identify the general location of the nest sites, sufficient to establish a protective buffer zone around the potential nest site, and need not include identification of the precise nest locations. Surveyors performing nest surveys shall not concurrently be conducting desert tortoise surveys. The bird surveyors shall perform surveys in accordance with the following guidelines:

1. Surveys shall cover all potential nesting habitat in areas that could be disturbed by each phase of construction, as described in **BIO-29** (Phasing). Surveys shall also include areas within 500 feet of the boundaries of the active construction areas (including linear facilities);

2. At least two pre-construction surveys shall be conducted, separated by a minimum 10-day interval. One of the surveys shall be conducted within the 14-day period preceding initiation of construction activity. Additional follow-up surveys may be required if periods of construction inactivity exceed

three weeks, an interval during which birds may establish a nesting territory and initiate egg laying and incubation;

3. If active nests or suspected active nests are detected during the survey, a buffer zone (protected area surrounding the nest, the size of which is to be determined by the Designated Biologist in consultation with CDFW) and monitoring plan shall be developed. Nest locations shall be mapped and submitted, along with a report stating the survey results, to the CPM; and

4. The Designated Biologist or Biological Monitor shall monitor the nest until he or she determines that nestlings have fledged and dispersed; activities that might, in the opinion of the Designated Biologist, disturb nesting activities, shall be prohibited within the buffer zone until such a determination is made.

Verification: At least 10 days prior to the start of any site mobilization and construction -related ground disturbance activities during the nesting season, the Project owner shall provide the CPM a letter-report describing the findings of the pre-construction nest surveys, including the time, date, and duration of the survey; identity and qualifications of the surveyor (s); and a list of species observed. If active or suspected active nests are detected during the survey, the report shall include a map or aerial photo identifying the location or suspected location of the nest and shall depict the boundaries of the no-disturbance buffer zone around the nest(s) that would be avoided during Project construction.

Each year during construction as part of the annual compliance report a follow-up report shall be provided to the CPM, BLM, CDF~~G~~**W**, and USFWS describing the success of the buffer zones in preventing disturbance to nesting activity and a brief description of the outcome of the nesting effort (for example, whether young were successfully fledged from the nest or if the nest failed).

~~AVIAN PROTECTION PLAN~~

~~**BIO-16**~~ ~~The Project owner shall prepare and implement an Avian Protection Plan to monitor the death and injury of birds from collisions with facility features such as transmission lines, reflective mirror-like surfaces and from heat, and bright light from concentrating sunlight. The monitoring data shall be used to inform an adaptive management program that would avoid and minimize Project-related avian impacts. The study design shall be approved by the CPM in consultation with BLM, CDFG and USFWS, and shall be consistent with guidance from the USFWS on development of avian and bat protection plans (USFWS 2010c). The monitoring and adaptive management measures described in the Avian Protection Plan shall be incorporated into the Project's BRMIMP and implemented. The Avian Protection Plan shall include detailed specifications on data and carcass collection protocol and a rationale justifying the proposed schedule of carcass searches. The plan shall also include seasonal trials to assess bias from carcass removal by scavengers as well as searcher bias.~~

~~**Verification:** At least 30 days prior to the start of commercial operation of any of the power plant units the Project owner shall submit to the CPM, USFWS, and CDFG a final Avian Protection Plan. Modifications to the Avian Protection Plan shall be made only after approval from the CPM.~~

~~For one year following the beginning of power plant operation the Designated Biologist shall submit quarterly reports to the CPM, BLM, CDFG, and USFWS describing the dates, durations, and results of monitoring. The quarterly reports shall provide a detailed description of any Project-related bird deaths or injuries detected during the monitoring study or at any other time, and describe adaptive management measures implemented to avoid or minimize deaths or injuries. Following the completion of the fourth quarter of monitoring the Designated Biologist shall prepare an Annual Report that summarizes the year's data, analyzes any Project-related bird fatalities or injuries detected, and provides recommendations for future monitoring and any adaptive management actions needed.~~

~~The Annual Report shall be provided to the CPM, BLM, CDFG, and USFWS. Quarterly reporting shall continue until the CPM, in consultation with CDFG and USFWS determine whether more years of monitoring are needed, and whether mitigation and adaptive management measures are necessary.~~

AVIAN ENHANCEMENT AND CONSERVATION PLAN

BIO-16a **The Project owner shall implement the following measure to conserve and enhance avian populations in the vicinity of the project and throughout the region:**

1. **Regional Avian Electrocution Risk and Cable Collision Avoidance Measures. Consistent with the DRECP framework (DRECP 2012), the project owner shall, prior to the commencement of commercial operations at the facility, fund the retrofitting of non-compliant utility poles in the vicinity of the project to APLIC (2006) standards or fund the installation of bird diverters in the vicinity of the Project. A total amount of $300,000 will be provided for these enhancements. The funding shall be provided to an independent third party who will perform the actual retrofitting, pursuant to a Retrofit Plan approved by the CPM.**

   The Retrofit Plan will develop a tiered approach to minimizing electrocution and collision risk, wherein the first funding is applied to retrofit poles in areas where either mortalities are highest or area use is highest. The second tier of retrofitted poles would be areas of lesser importance. If funds remain available after first and second tier poles have been retrofitted, then the CPM may apply the remaining funds to other avian protection objectives outlined by the DRECP, in conjunction with BLM, USFWS, and CDFW. As an alternative to the Retrofitting Plan and the use of a CPM-approved third party, the total funding can be accomplished by making a payment in the amount of $300,000 to the National Fish and Wildlife Foundation's Bald and Golden Eagle Protection Act account.

2. Additional Migratory Bird Conservation: The Project owner shall, prior to the commencement of commercial operation of the facility, provide funds for mitigation in one of two ways:

   a. Pay $1,500,000.00 to fund the activities of a CPM-approved third party that will perform additional migratory bird conservation measures. Alternatively, the project owner may prepare a promissory note to deposit said funds at the onset of operations while at the same time providing funding of the initial year of mitigation in the non-refundable amount of $50,000.00 to a project fund as determined by CPM, in conjunction with BLM, CDFW, and USFWS, for the initial year of mitigation in the absence of accrued interest.

   b. Alternatively, the project owner may pay $50,000 annually to fund the annual activities of the CPM-approved third party for the life of the project, not to exceed a period of 30 years, commencing at commercial operation. If the project owner elects to make annual payments, the annual payments should be adjusted for cost of living increases using the CPI-U (All Urban Consumers) for the Los Angeles CMSA (includes the counties of Los Angeles, Orange, Riverside, San Bernardino and Ventura) as calculated and published by the California Department of Finance (http://www.dof.ca.gov/html/fs_data/latestecondata/FS_Price.htm). To avoid the adjustment, the project owner may elect to place the amount of $50,000 in an interest bearing account that would allow the cost of living increases to be paid from such account.

3. Such measures shall be approved by the CPM and may include, but not be limited to: (i) restoration of degraded habitat with native vegetation; (ii) restoration of agricultural fields to bird habitat; (iii) management of agricultural fields to enhance bird populations; (iv) invasive plant species and artificial food or water source management; (v) control and cleanup of potential avian hazards, such as lead or microtrash; (vi) retrofitting of buildings to minimize collisions; (vii) retrofitting of conductors and above ground cables to minimize collisions; (viii) animal control programs; (ix) support for avian and bat research and/or management efforts conducted by entities approved by the CPM within the project's mitigation lands or other approved locations; (x) funding efforts to address avian diseases or depredation due to the expansion of predators in response to anthropomorphic subsidies that may adversely affect birds that use the mitigation lands or other approved locations; and (xi) contribute to the Migratory Bird Conservation Fund managed by the Migratory Bird Conservation Commission.

a. Neither the principal of the fund nor its earned interest is redeemable by project owner during the life of the project; specifically, the investment instrument will be prepared such that an independent investment firm/management entity manages and distributes monies. When developing the fund instrument, criteria will be established that will trigger the release of the fund residual to the project owner only at the conclusion of the project, or, in the event that an alternative technology is implemented to replace the currently proposed solar energy generating facility.

b. The investment fund residual will be transferred to the project owner under specified conditions:

   1. At end of the project's life after infrastructure removal has been completed and permit-specified site reclamation criteria have been met;

   2. If the proposed project is converted to an alternative technology that does not impose a similar threat to migratory birds or to bats.

Verification: For power line retrofits:

1. At least six months prior to commercial operation, the project owner shall submit the draft Retrofit Plan to the CPM for review and approval and CDFW and USFWS for review and comment. At least 30 days prior to ~~start of any flux generation~~ commercial operation, the project owner shall provide the CPM the final version of the Retrofit Plan. Any modifications to the approved Retrofit Plan must be approved by the CPM in consultation with USFWS, BLM, and CDFW. The project owner shall notify the CPM no less than five working days before implementing any CPM approved modifications to the Retrofit Plan; alternately, the project owner may elect to deposit funds into the National Fish and Wildlife Foundation's Bald and Golden Eagle Protection Act account.

2. If the project owner elects not to fund a third party to perform retrofits, then no less than 30 days prior to beginning commercial operations, the project owner shall provide written verification to the CPM that security has been established in the National Fish and Wildlife Foundation's Bald and Golden Eagle Protection Act account, in accordance with this condition of certification.

3. The project owner shall provide an annual summary of the actions taken, an accounting of money distributed, and a map of retrofitted power lines as per the Retrofit Plan. If the project owner elects to fund the National Fish and Wildlife Foundation's Bald and Golden Eagle Protection Act account, then the project owner shall, within five (5) years of starting commercial operations, provide a summary specifying how the National Fish and Wildlife Foundation has or is using the funds.

For interest bearing fund:

1. **No later than 30 days prior to commercial operation, the project owner shall provide the CPM written verification of selection of a ~~non-wasting~~ interest-bearing account held by an approved investment entity, in accordance with this condition of certification. The account shall be fully funded no later than 7 days prior to commercial operation.**

2. **If the project owner elects to provide a promissory note for $1,500,000.00 the CPM must be provided the note within 30 days of starting operations, and must also fund $50,000 for the first year's benefit, within 7 days of starting operations.**

3. **The project owner, or the account's administrator (investment entity) shall submit to the CPM an annual report summarizing the performance of the fund and describing all restoration/enhancement actions taken.**

AVIAN AND BAT PROTECTION PLAN

BIO-16b The Project owner shall prepare a Bird and Bat Conservation Strategy (BBCS) and submit it to the CPM for review and approval, in conjunction with BLM, CDFW, and USFWS for review and comment. The BBCS shall provide for the following:

- **Survey and monitor onsite and offsite avian use and behavior to document species composition on and offsite, compare onsite and offsite rates of avian and bat use, document changes in avian and bat use over time, and evaluate the general behavior of birds in and near the facility.**
- **Implement an onsite and offsite (if feasible) avian and bat mortality and injury monitoring program to identify the extent of potential avian or bat mortality or injury from collisions with facility structures or from elevated levels of solar flux that may be encountered within the facility airspace, including:**
  - **assessing levels of collision-related mortality and injury with heliostats, perimeter fences and power tower structures;**
  - **calculating rates of solar flux-related avian mortality and injury, if any;**
  - **documenting seasonal, temporal, and weather-related patterns associated with collision- or solar flux-related mortality and injury, if any; and**
  - **documenting flight spatial patterns that may be associated with collision- or flux-related mortality and injury, if any.**
  - **documenting spatial patterns that may be associated with avoidance of the facility.**
- **Identify specific conservation measures and/or programs to minimize impacts and evaluate the effectiveness of those measures.**

- Implement an adaptive management and decision-making framework for reviewing, characterizing, and responding to quantitative survey and monitoring results.

BBCS Components

The project owner shall prepare and implement a BBCS adopting all requirements applicable to solar generation in current guidelines recommended by the USFWS (currently 2012 USFWS Land Based Wind Energy Guidelines). The BBCS shall include the following components:

1. Preconstruction Baseline survey results. A description and summary of the baseline survey methods and results.

2. Formation of a technical advisory committee (TAC). The TAC will facilitate concurrent project owner, CPM, and state and federal wildlife agency review of seasonal and annual survey results, the effectiveness of the adaptive management measures implemented by the project owner, modification of the surveys in response to the results, if necessary, and the identification of additional mitigation responses that are commensurate with the extent of impacts that may be identified in the monitoring studies. A meeting schedule for the TAC will be indentified, for regular review of avian and bat injury and mortality monitoring results, and recommend any necessary changes to monitoring, adaptive management, and appropriate dissemination of mitigation funds per BIO-16a #2. The TAC will also assist the CPM in implementing the following provisions #3 - #8.

3. Avian and bat use and behavior surveys. Avian and bat site-use behavior surveys shall be conducted. The program will outline survey methodology and field documentation, identification of appropriate onsite and offsite survey locations, control sites, and the seasonal considerations. Prey abundance surveys will also be conducted to identify the locations and changes in the abundance of prey species. Bat acoustic sampling may be implemented depending on results of the baseline study.

4. Golden eagle nest surveys and monitoring. Results of annual pedestrian and/or helicopter surveys of golden eagle nesting sites within a 10-mile radius of the project site, including a summary of available information concerning golden eagle nesting activity in the project vicinity.

5. Avian and bat mortality and injury monitoring: An avian and bat injury and mortality monitoring program shall be implemented, including:

   (a) Onsite monitoring that will systematically survey representative locations within the facility, at a level that will produce statistically robust data; account for potential spatial bias and allow for the extrapolation of survey results to unsurveyed areas and the survey interval based on scavenger and searcher efficiency trials and detection rates.

(b) Offsite monitoring, to the extent that access can be reasonably and feasibly obtained by the project owner, of one or more locations adjacent to the project facilities using the same or comparable methods as implemented for the onsite monitoring to identify which avian species potentially injured by collisions or solar flux within adjacent areas.

(c) Low-visibility and high-wind weather event monitoring to document potential weather-related collision risks that may be associated with the power towers at the facility, including foggy, highly overcast, or rainy night-time weather typically associated with an advancing frontal system, and high wind events (40 miles per hour winds) are sustained for period of greater than 4 hours. The monitoring report shall include survey frequency, locations and methods.

(d) Scavenger and searcher efficiency trials to document the extent to which avian or bat fatalities remain visible over time and can be detected within the project area and to adjust the survey timing and survey results to reflect scavenger and searcher efficiency rates.

(e) Statistical methods used to generate facility estimates of potential avian and bat impacts based on the observed number of detections during standardized searches during the monitoring season for which the cause of death can be determined and is determined to be facility-related.

(f) Field detection and mortality or injury identification, cause attribution, handling and reporting protocols consistent with applicable legal requirements.

6. Survey schedule and period. All surveys and monitoring studies included in the BBCS shall be conducted for three years following commercial operation and approval of the BBCS by the CPM. At the end of the three-year period, the project owner and the CPM shall meet and confer to determine whether the survey program shall be continued for subsequent periods. The monitoring program may be modified with the approval of the CPM in response to survey results, identified scavenging efficiency rates, or other factors to increase monitoring accuracy and reliability or in accordance with the adaptive management decision-making framework included in the BBCS.

7. **Adaptive management. An adaptive management program shall be developed to identify and implement reasonable and feasible measures that would reduce any biologically significant levels of avian or bat mortality or injury attributable to project operations and facilities. Any such impact reduction measures must be commensurate (in terms of factors that include geographic scope, costs, and scale of effort) to the level of avian or bat mortality or injury that is specifically and clearly attributable to the project facilities. The adaptive management program shall include the following elements:**

   (a) **Reasonable measures for characterizing the extent and significance of detected mortality and injuries clearly attributable to the project.**

   (b) **Measures that the project owner will implement to adaptively respond to detected mortality and injuries attributable to the project, including passive avian diverter installations along the perimeter or at other locations within the project to avoid site use, the use of sound, light or other means to discourage site use consistent with applicable legal requirements, onsite prey or habitat control measures consistent with applicable legal requirements, and additional perch and nest proofing of project facilities.**

8. **Eagle Protection Plan (EPP): The project owner shall prepare and implement an Eagle Protection Plan adopting all requirements applicable to solar generation as outlined in guidelines recommended by the USFWS (currently 2012 USFWS Land Based Wind Energy Guidelines2011b). The EPP may be prepared as a stand-alone document or included as a chapter within the BBCS. The EPP shall describe all available baseline data on golden eagle occurrence, seasonality, activity, and behavior throughout the project area and vicinity. The EPP shall outline a study protocol consistent with Item 5 above to include annual pedestrian and/or helicopter surveys of golden eagle breeding sites within a 10 mile radius of the project site, to be reviewed and approved by the CPM, in consultation with the USFWS, BLM, and CDFW.**

The EPP shall describe all proposed measures to prevent death and injury of eagles from (1) collisions with facility features including the heliostats, power towers, and gen-tie line towers or transmission lines, (2) electrocutions on transmission lines or other project components, and (3) concentrated solar flux created over the solar field. The EPP shall describe efforts taken pursuant to BIO-16a.

The EPP shall also include any feasible adaptive modifications to heliostat positioning during operation (including day time and night time) in order to minimize collisions and/or risk of exposure to concentrated solar flux. Any such adaptive minimization measures must

be commensurate (in terms of factors that include geographic scope, costs, and scale of effort) to the level of avian or bat risk that is specifically and clearly attributable to the project facilities. The EPP shall provide a reporting schedule for all monitoring or other activities related to bird or bat conservation or protection during project construction or operation. The EPP shall be subject to review and approval by the CPM in consultation with CDFW, BLM, and USFWS, and shall be incorporated into the project's BRMIMP and BBCS, and implemented.

Verification: The BBCS shall be submitted to the CPM for review and approval and to CDFW, BLM, and USFWS for review and comment no less than 60 days after start of construction. The project owner shall provide the CPM with copies of any written or electronic transmittal from the USFWS, BLM, or CDFW related to the BBCS within 30 days of receiving any such transmittal. Survey reports shall be submitted to the CPM after each season and in an annual summary report throughout the course of the three-year study period and as set forth in the approved monitoring study plan. The reports will include all monitoring data required as part of the monitoring program.

Methods and results of the Monitoring Study shall be submitted to the CPM in Monthly and Annual Compliance Reports throughout the course of the study, or as otherwise directed by the CPM. The Monitoring Study shall continue ~~and~~ until the CPM, in consultation with CDFW, BLM, and USFWS, concludes that the cumulative monitoring data provide sufficient basis for estimating long-term bird mortality for the project. The reports will include all monitoring data required as part of the monitoring program.

The reports shall also summarize any additional wildlife mortality or injury documented on the project site during the year, regardless of cause, and assess any adaptive management measure implemented during the prior year as approved by the CPM. After the third year of the monitoring program, the CPM shall meet and confer with the TAC to determine if the study period shall be extended based on data quality and sufficiency of analysis, or if needed, to document efficacy of any adaptive management measures undertaken by the project owner. If a carcass of a golden eagle or any state or federally listed threatened or endangered species is found at any time by the monitoring study or project operations staff, the project owner, Designated Biologist, or other qualified biologist that may be identified by the Designated Biologist shall contact the CPM, CDFW and USFWS by email, fax or other electronic means within one working day of any such detection.

~~**Verification:** The BBCS shall be submitted to the CPM for review and approval and to CDFW and USFWS for review and comment no less than 120 days prior to the commercial operation of the first unit. The Project owner shall provide the CPM with copies of any written or electronic transmittal from the USFWS, BLM, or CDFW related to the BBCS within 30 days of receiving any such transmittal. Survey reports shall be submitted to the CPM after each season and in an annual summary report throughout the course of the three-year study period and as set forth in the approved monitoring~~

~~study plan. The reports will include all monitoring data required as part of the monitoring program.~~

~~Methods and results of the Monitoring Study shall be submitted to the CPM in Monthly and Annual Compliance Reports throughout the course of the study and until the CPM, in consultation with the other agencies, concludes that the cumulative monitoring data provide sufficient basis for estimating long-term bird mortality for the project. The Reports will include all monitoring data required as part of the monitoring program.~~

~~The reports also shall summarize any additional wildlife mortality or injury documented on the project site during the year, regardless of cause, and assess any adaptive management measure implemented during the prior year as approved by the CPM. After the third year of the monitoring program, the CPM shall meet and confer with the project owner to determine of the study period should be extended based on data quality and sufficiency of analysis or if needed to document efficacy of any adaptive management measures undertaken by the Project owner. The study period may be extended up to five years from the commencement of facility operations. If a carcass of a golden eagle or any state or federally listed threatened or endangered species is found at any time by the monitoring study or Project operations staff, the Project owner, Designated Biologist, or other qualified biologist that may be identified by the Designated Biologist shall contact the CPM, CDFW and USFWS by email, fax or other electronic means within one working day of any such detection.~~

~~AMERICAN BADGER AND DESERT KIT FOX IMPACT AVOIDANCE AND MINIMIZATION MEASURES~~

~~**BIO-17**~~ ~~To avoid direct impacts to American badgers and desert kit fox, pre-construction surveys shall be conducted for these species concurrent with the desert tortoise surveys to facilitate passive relocation. Surveys shall be conducted as described below:~~

1. ~~Biological Monitors shall perform pre-construction surveys for badger and kit fox dens in the Project disturbance area and a 20-foot buffer beyond the Project disturbance area, including utility corridors and access roads. If dens are detected each den shall be classified as inactive, potentially active, or definitely active. Surveys may be concurrent with desert tortoise surveys.~~

2. ~~Inactive dens that would be directly impacted by construction activities shall be excavated by hand and backfilled to prevent reuse by badgers or kit fox.~~

3. ~~Potentially and definitely active dens that would be directly impacted by construction activities shall be monitored by the Biological Monitor for three consecutive nights using a tracking medium (such as diatomaceous earth or fire clay) and/or infrared camera stations at the entrance.~~

4. ~~If no tracks are observed in the tracking medium or no photos of the target species are captured after three nights, the den shall be excavated and backfilled by hand.~~

5. ~~If tracks are observed, the den shall be progressively blocked with natural materials (rocks, dirt, sticks, and vegetation piled in front of the entrance) for the next three to five nights to discourage the badger or kit fox from continued use. After verification that the den is unoccupied it shall then be excavated and backfilled by hand to ensure that no badgers or kit fox are trapped in the den. BLM approval may be required prior to release of badgers on public lands.~~

~~**Verification:** The Project owner shall submit a report to the CPM, BLM and CDFG within 30 days of completion of badger and kit fox surveys. The report shall describe survey methods, results, impact avoidance and minimization measures implemented, and the results of those measures.~~

AMERICAN BADGER AND DESERT KIT FOX IMPACT AVOIDANCE AND MINIMIZATION MEASURES

BIO-17 The project owner shall contract a qualified biologist to conduct a baseline pre-construction desert kit fox and American badger survey and develop and implement an American Badger and Desert Kit Fox Mitigation and Monitoring Plan (Plan). The survey data will be used to revise the final Plan, as necessary, with the most recent species data from the project site.

The project owner shall conduct a baseline kit fox census survey and submit a summary report that includes the following procedures:

1. **A qualified biologist with demonstrated mammal experience shall complete a baseline pre-construction survey of desert kit fox and American badger populations on the project site and the anticipated dispersal areas for passive relocation between 30 and 60 days prior to initiation of any ground disturbing activities, including site assessment and construction activities that include installation of desert tortoise fencing. The anticipated dispersal areas shall be defined as all suitable desert kit fox habitat within 500 meters of the project boundaries where desert kit fox would likely be displaced. The survey shall identify and record the locations of all potential dens throughout the project site (or phase) and shall characterize the approximate number and distribution of the badger and kit foxes on the site and anticipated dispersal areas. Depending on the season of the surveys (i.e. breeding or non-breeding) other demographic data will be collected if possible to determine. The baseline pre-construction survey shall include the following components:**

   a. **An inventory and mapped locations of desert kit fox dens and burrows on the project site (including all project disturbance areas) and in the anticipated dispersal areas, and an evaluation whether each burrow is occupied, and reproductive status of kit foxes (single animal, mated pair, or family group with young), if known. If status unknown measures as required under Item 2b, below, will be implemented.**

b. **Reporting: The project owner shall provide a draft Summary Report of the Baseline American Badger and Desert Kit Fox Survey to the CPM and BLM for review in consultation with CDFW. The project owner and the project owner's Designated Biologist shall consult with the CPM and BLM on any changes to the final Plan that would result from the baseline pre-construction survey data provided in the Summary Report. The project owner shall not implement the American Badger and Desert Kit Fox Mitigation and Monitoring Plan (below) until receiving the CPM and BLM's written approval of the final Plan.**

The objective of the plan shall be to avoid direct impacts to the American badger and desert kit fox as a result of site mobilization and construction of the power plant and linear facilities, as well as during project operation and non-operation and closure. The final plan is subject to review and comment by BLM and revision and approval by the CPM, in consultation with California Department of Fish and Wildlife (CDFW). The final Plan shall include, but is not limited to, the following procedures and impact avoidance measures:

2. **Describe pre-construction survey and clearance field protocol, to determine the number and locations of single or paired kit foxes or badgers on the project site that would need to be avoided or passively relocated and the number and locations of desert kit fox or badger burrows or burrow complexes that would need to be collapsed to prevent re-occupancy by the animals.**

   a. Pre-Construction Surveys. A baseline, preconstruction survey shall be conducted as described above under Item 1. Surveys may be concurrent with desert tortoise and burrowing owl surveys to the extent it does not conflict with desert tortoise and burrowing owl agency protocols. Depending on the timing of the project phases and time between phases, surveys may need to be conducted for each phase of construction Options for timing of surveys shall be detailed in the Plan. If dens are detected during the survey(s), each den shall be classified as inactive, potentially active, definitely active den, or natal den.

   b. Monitoring and Protection Measures, Passive Hazing, and Den Excavation: The plan will include details on monitoring requirements, types and methods of passive hazing, and methods and timing of den excavation, including, but not limited to the following:

      i. Inactive dens. Inactive dens (e.g. inactive dens are dens that are mostly or entirely silted in and ones in which the back of the den can clearly be seen (e.g., the den isn't deep and doesn't curve) that would be directly impacted by construction activities shall be excavated by hand and backfilled to prevent reuse by badger or kit fox.

ii. Potentially and definitely active dens. Potentially and definitely active dens that would be directly impacted by construction activities shall be monitored by the Biological Monitor for three consecutive nights using a tracking medium (such as diatomaceous earth or fire clay) and/or infrared camera stations at the entrance. If no tracks are observed in the tracking medium or no photos of the target species are captured after three nights, the den shall be excavated and backfilled by hand. If tracks are observed, the den shall be progressively blocked with natural materials (rocks, dirt, sticks, and vegetation piled in front of the entrance) for the next three to five nights to discourage the badger or kit fox from continued use. After verification that the den is unoccupied it shall then be excavated and backfilled by hand to ensure that no badgers or kit fox are trapped in the den. If the den is proven inactive then den may be collapsed during whelping season. BLM approval may be required prior to release of badgers on public lands.

iii. Active natal/pupping dens. If an active natal den (a den with pups) is detected on the site, the project owner shall proceed to implement the approved Plan and shall also notify the BLM, CPM, and CDFW within 24 hours. If the situation is unusual and/or not addressed by the approved Plan, then the project owner's biologist shall consult with the CPM,BLM, and CDFW to determine the appropriate course of action to minimize the potential for animal harm or mortality. The course of action would depend on the age of the pups, location of the den on the site (e.g. is the den in a central area or in a perimeter location), status of the perimeter site fence (completed or not), and the pending construction activities proposed near the den. A 500-foot no-disturbance buffer shall be maintained around all active dens. The denning season for American badger is approximately March to August, and for desert kit fox the denning season is approximately Mid-January to pup independence typically by July 1 (or with confirmation of pup independence based on monitoring data). If the den is active during the whelping season, even if pups are not seen, disturbance is not allowed. Active natal/pupping dens will not be excavated or passively relocated.

c. Exception for American badger. In the event that passive relocation techniques fail for badgers, outside the denning season, or during the denning season if individual badgers can be verified to not have a litter, then live-trapping by a CDFW and CPM approved trapper is an option that may be employed to safely perform active removal as a last resort. A live-trapping plan including trapping methods as well as the name and resume, including documentation of relevant handling permits of the

proposed trapper, would be included in detail as part of the approved Plan. In the event live-trapping would be employed as a last resort, written notification would be submitted to the CPM for review and approval in consultation with BLM and CDFW. The CPM, BLM and CDFW would be notified in writing no less than 1 week prior to live trapping of badger. The notification would at a minimum include what passive relocation methods have been attempted to date and the justification for live-trapping as a last resort. In addition timing, and location of release of the individual badger as well as the name of the proposed trapper and resume, including documentation of relevant handling permits if not previously included and approved in the Plan shall be included in the notification. BLM approval may be required prior to release of badgers on public lands.

3. **Address other factors and procedures that may affect the success of kit fox and American badger relocation offsite, such as:**

   a. **Qualitative discussion of availability of suitable habitat on off-site surrounding lands within 10 miles of the project boundary, and evaluation of kit fox burrows with 500 meters of the project boundary, in areas where onsite foxes may disperse (e.g., by inventorying burrow numbers in selected representative sample areas) as identified in the pre-construction surveys above;**

   b. **Estimates of the distances kit foxes would need to travel across the project site and across adjacent lands to safely access suitable habitat (including burrows) off-site;**

   c. **Proposed scheduling of the passive relocation effort;**

   d. **Methods to minimize likelihood that the animals will return to the project site;**

   e. **Descriptions of any proposed or potential ground disturbing activities related to kit fox relocation, and locations of those activities (e.g., artificial burrow construction);**

   f. **A monitoring and reporting plan to evaluate success of the relocation efforts and any subsequent re-occupation of the project site; and**

   g. **A plan to subsequently relocate any animals that may return to the site (e.g., by digging beneath fences).**

4. **Address notification procedures for notifying the CPM, BLM and CDFW if injured, sick, or dead badger or kit fox are detected. Notify the CPM, BLM and CDFW if injured, sick, or dead American badger and desert kit fox are found. If an injured, sick, or dead animal is detected on any area associated with the solar project site or**

associated linear facilities, the CPM, BLM Palm Springs/ South Coast Field Office and the Ontario CDFW Office as well as the CDFW Wildlife Investigation Lab (WIL) shall be notified immediately by phone (8 hours in the case of a fatality). Written follow-up notification via FAX or electronic communication shall be submitted to the CPM, BLM and CDFW within 24 hours of the incident and shall include the following information as appropriate:

a. Injured animals. If an American badger or desert kit fox is injured because of any project-related activities, the Designated Biologist or approved Biological Monitor shall immediately notify the CPM, BLM and CDFW personnel regarding the capture and transport of the animal to CDFW-approved wildlife rehabilitation and/or veterinarian clinic. Following the phone notification, the CPM and CDFW shall determine the final disposition of the injured animal, if it recovers. A written notification of the incident shall be sent to the CPM, BLM and CDFW containing, at a minimum, the date, time, location, and circumstances of the incident.

b. Sick animals. If an American badger or desert kit fox is found sick and incapacitated on any area associated with the project site or associated linear facilities, the Designated Biologist or approved Biological Monitor shall immediately notify the CPM, BLM and CDFW personnel for immediate capture and transport of the animal to a CDFW-approved wildlife rehabilitation and/or veterinarian clinic. Following the phone notification, the CPM and CDFW shall determine the final disposition of the sick animal, if it recovers. A necropsy shall be performed by a CDFW-approved facility to determine the cause of death. The project owner shall pay to have the animal transported and a necropsy performed. A written notification of the incident shall be sent to the CPM, BLM and CDFW and contain, at a minimum, the date, time, location, and circumstances of the incident.

c. Fatalities. If an American badger or desert kit fox is killed because of any project-related activities during construction, operation, and closure or is found dead on the project site or along associated linear facilities, the Designated Biologist or approved Biological Monitor shall immediately refrigerate the carcass and notify the CPM, BLM and CDFW personnel within 24 hours (8 hours in the case of desert kit fox) of the discovery to receive further instructions on the handling of the animal. Handling of a dead kit fox shall follow the most recently issued Guidelines for Handling a Desert Kit Fox Carcass (currently CDFW WIL 2011) or. A necropsy shall be performed by a CDFW-approved facility to determine the cause of death. The project owner shall pay to have the animal transported and a necropsy performed.

5. **Additional protection measures to be included in the Plan and implemented:**

   a. **All pipes within the project disturbance area must be capped and/or covered every evening or when not in use to prevent desert kit foxes or other animals from accessing the pipes.**

   b. **All project-related water sources shall be covered and secured when not in use to prevent drowning.**

   c. **The project owner shall coordinate with CDFW to identify any additional fence design features to maximize the effectiveness of the fence to exclude kit foxes from the project.**

   d. **Incorporate and implement the CDFW Veterinarian's guidance regarding impact avoidance measures including measures to prevent disease spread among desert kit foxes.**

   e. **Include measures to reduce traffic impacts to wildlife if the project owner anticipates night-time construction. The plan must also include a discussion of what information will be provided to all night-time workers, including truck drivers, to educate them about the threats to kit fox, what they need to do to avoid impacts to kit fox, and what to report if they see a live, injured, or dead kit fox.**

   f. **In order to reduce the likelihood of distemper transmission:**

      i. **No pets shall be allowed on the site prior to or during site mobilization and construction, operation, and non-operation and closure, with the possible exception of vaccinated kit fox scat detection dogs during preconstruction surveys, and then only with prior CPM and CDFW approval;**

      ii. **Any hazing activities that include the use of chemical or other repellents (e.g. ultrasonic noise makers, or non-animal-based chemical repellents) must be cleared through the CPM and CDFW prior to use. The use of animal tissue or excretion based repellents (e.g. coyote urine, anal gland products) is not permitted.**

      iii. **Any sick or diseased kit fox, or documented kit fox mortality shall be reported to the CPM, CDFW, and the BLM immediately upon identification (within 8 hours for mortality). If a dead kit fox is observed, it shall be collected and stored according to established protocols distributed by CDFW WIL, and the WIL shall be contacted to determine carcass suitability for necropsy.**

6. **The project owner may opt to participate in the CDFW-led fee-based Monitoring and Mitigation Program if in place prior to start of site mobilization and construction in lieu of implementation of certain items in above 3f, 4b, 4c, 5d, 5f and other items above if included in the program when established. This includes financial responsibility for transportation and necropsy of desert kit fox mortalities due to project-related activities or sick animals found on or near the project site or associated linears as well as measures to address other factors and procedures that may affect the success of kit fox and American badger relocation offsite. If in place, the CDFW Monitoring and Mitigation Program activities associated with the Project and associated fees will be fully described in the final Plan. The project owner may also opt to participate in the program if established at a later date during site mobilization and construction or operation and will submit a revised Plan that includes the program information when established and confirmation that fees are paid.**

Verification: No fewer than 90 days prior to the start of any site mobilization and construction the project owner shall provide the CPM, BLM, and CDFW with a draft American Badger and Desert Kit Fox Mitigation and Monitoring Plan for review and comment.

Between 30 to 60 days prior to initiation of site mobilization and construction activities, a qualified biologist with demonstrated mammal experience shall complete a baseline study of American badger and desert kit fox populations on the project site and the anticipated dispersal areas for passive relocation.

The Project owner shall submit a summary report to the CPM, BLM and CDFW within 7 days of completion of any badger and kit fox surveys. The report shall describe survey methods and results of the surveys. The project owner and the Designated Biologist shall consult with the CPM and BLM upon submitting the summary report regarding any changes to the final Plan.

No fewer than 15 days prior to start of any site mobilization and construction, the project owner shall provide an electronic copy of the CPM-approved final Plan to the CPM, BLM and CDFW and implement the Plan.

No later than 24 hours following a phone notification of an injured, sick, or dead American badger or desert kit fox, the project owner shall provide to the CPM, BLM and CDFW, via FAX or electronic communication, a written report from the Designated Biologist describing the incident of sickness, injury, or death of an American badger or desert kit fox, when the incident occurred, and who else was notified.

Beginning with the first month after start of construction and continuing every month until construction is completed, the Designated Biologist shall include a summary of events regarding the American badger and desert kit fox in each Monthly Compliance Reports (MCR). The impact avoidance and minimization measure(s) implemented and the results of implementation of those measures shall be reported in each MCR.

No later than 45 days after initiation of project operation, the Designated Biologist shall provide the CPM and BLM a final American Badger and Desert Kit Fox Mitigation and Monitoring Plan Report that includes: 1) a discussion of all mitigation measures that were and currently are being implemented; 2) all information about project-related kit fox and badger injuries and/or deaths; 3) all information regarding sick kit fox and badger found within the project site and along related linear facilities; and 4) recommendations on how mitigation measures might be changed to more effectively minimize and mitigate the impacts of future projects on the American badger and desert kit fox.

Within 30 days of participation in the CDFW-led fee-based Monitoring and Mitigation Program during site mobilization and construction or operation, the project owner will submit a revised Plan that includes the program information related to the project and confirmation that all fees are paid.

BURROWING OWL IMPACT AVOIDANCE, MINIMIZATION, AND COMPENSATION MEASURES

BIO-18 The Project owner shall implement the following measures to avoid, minimize and offset impacts to burrowing owls:

1. Pre-Construction Surveys. The Designated Biologist or Biological Monitor shall conduct pre-construction surveys for burrowing owls no more than 30 days prior to initiation of **site mobilization and** construction activities **in accordance with CDFW guidelines (CDFW 2012).** Surveys shall be focused exclusively on detecting burrowing owls, and shall be conducted from two hours before sunset to 1 hour after or from 1 hour before to 2 hours after sunrise. The survey area shall include the Project Disturbance Area and surrounding 500 foot survey buffer for each phase of construction in accordance with **BIO-29** (phasing).

2. Implement Burrowing Owl Mitigation Plan. The Project owner shall implement measures described in the final Burrowing Owl Mitigation Plan. The final Burrowing Owl Mitigation Plan shall be approved by the CPM, in consultation with BLM, USFWS and CDF~~G~~**W**, and shall:

    a. identify suitable sites within 1 mile of the Project Disturbance Areas for creation or enhancement of burrows prior to passive relocation efforts;

    b. provide guidelines for creation or enhancement of at least two natural or artificial burrows per relocated owl; **design of the artificial burrows shall be consistent with CDFW guidelines (CDFW 2012) and shall be approved by the CPM in consultation with CDFW and USFWS;**

    c. provide detailed methods and guidance for passive relocation of burrowing owls occurring within the Project Disturbance Area; and

    d. describe monitoring and management of the passive relocation effort, including the created or enhanced burrow location and the project area where burrowing owls were relocated from, and provide a reporting plan.

3. Implement Avoidance Measures. If an active burrowing owl burrow is detected within 500 feet from the Project Disturbance Area the following avoidance and minimization measures shall be implemented:

   a. Establish Non-Disturbance Buffer. Fencing shall be installed at a 250-foot radius from the occupied burrow to create a non-disturbance buffer around the burrow. The non-disturbance buffer and fence line may be reduced to 160 feet if all Project-related activities that might disturb burrowing owls would be conducted during the non-breeding season (September 1 through January 31). Signs shall be posted in English and Spanish at the fence line indicating no entry or disturbance is permitted within the fenced buffer.

   b. Monitoring: If construction activities would occur within 500 feet of the occupied burrow during the nesting season (February 1 – August 31) the Designated Biologist or Biological Monitor shall monitor to determine if these activities have potential to adversely affect nesting efforts, and shall make recommendations to minimize or avoid such disturbance.

4. Acquire Burrowing Owl Habitat. The Project owner shall acquire, in fee or in easement land suitable to support a resident population of burrowing owls and shall provide funding for the enhancement and long-term management of these compensation lands. The responsibilities for acquisition and management of the compensation lands may be delegated by written agreement to CDF~~G~~**W** or to a third party, such as a non-governmental organization dedicated to habitat conservation, subject to approval by the CPM, in consultation with CDF~~G~~**W** and USFWS prior to land acquisition or management activities. Additional funds shall be based on the adjusted market value of compensation lands at the time of construction to acquire and manage habitat.

   a. Criteria for Burrowing Owl Mitigation Lands. The terms and conditions of this acquisition or easement shall be as described in **BIO-12** [Desert Tortoise Compensatory Mitigation], with the additional criteria to include: 1) mitigation land per **BIO-29 - Table 2** that must provide suitable habitat for burrowing owls, and 2) the acquisition lands must either currently support burrowing owls or be **within dispersal distance from areas occupied by burrowing owls (generally approximately five miles).** ~~no farther than 5 miles from an active burrowing owl nesting territory.~~ The burrowing owl mitigation lands may be included with the desert tortoise mitigation lands ONLY if these two burrowing owl criteria are met. If the burrowing owl mitigation land is separate from the acreage required for desert tortoise compensation lands, the Project owner shall fulfill the requirements described below in this condition.

   b. Security. If the burrowing owl mitigation land is separate from the acreage required for desert tortoise compensation lands the Project owner or an approved third party shall complete acquisition of the proposed compensation lands within the time period specified for this acquisition (see the verification section at the end of this condition). Alternatively, financial assurance can be provided by the Project owner to the CPM and CDF~~G~~**W**, according to the measures outlined in **BIO-12**. The amount of the Security shall be as described in **BIO-29 – Table 3** for the proposed Project or any of the Project alternatives. These funds shall be used solely for implementation of the measures associated with the Project. Financial assurance can be provided to the CPM in the form of an irrevocable letter of credit, a pledged savings account or another form of security ("Security") prior to initiating ground-disturbing Project activities. Prior to submittal to the CPM, the Security shall be approved by the CPM, in consultation with CDF~~G~~**W** and the USFWS to ensure funding. The final amount due will be determined by an updated appraisal and PAR analysis conducted as described in **BIO-12**.

Verification: If pre-construction surveys detect burrowing owls within the Project Disturbance Area and relocation of the owls is required, within 30 days of completion of the burrowing owl pre-construction surveys the Project owner shall submit to the CPM, BLM, CDF~~G~~**W**, and USFWS a Burrowing Owl Mitigation Plan. The Burrowing Owl Mitigation Plan shall identify suitable areas for construction of burrows and the other passive relocation as described above. As part of the Annual Compliance Report each year following construction for a period of five years, the Designated Biologist shall provide a report to the CPM, BLM, USFWS and CDF~~G~~**W** that describes the results of monitoring and management of the burrowing owl burrow creation or enhancement area(s).

If pre-construction surveys detect burrowing owls within 500 feet of proposed construction activities, at least 10 days prior to the start of any Project-related site disturbance activities the Designated Biologist shall provide to the CPM, BLM, CDF~~G~~**W**, and USFWS documentation indicating that non-disturbance buffer fencing has been installed as described above. The Project owner shall report monthly to the CPM, BLM, CDF~~G~~**W** and USFWS for the duration of construction on the implementation of burrowing owl avoidance and minimization measures. Within 30 days after completion of construction the Project owner shall provide to the CPM and CDF~~G~~**W** a written report identifying how mitigation measures described in the plan have been completed.

No less than 30 days prior to the start of **site mobilization and construction** ~~Project ground-disturbing~~ activities the Project owner shall provide the CPM with an approved form of Security in accordance with this condition of certification. Actual Security for acquisition of 78 acres of burrowing owl habitat shall be provided no later than 7 days prior to the beginning of **site mobilization and construction** ~~Project ground-disturbing~~ activities.

No fewer than 90 days prior to the land or easement purchase, as determined by the date on the title, the Project owner shall provide the CPM with a management plan for review and approval, in consultation with CDF~~G~~**W**, BLM, and USFWS, for the compensation lands and associated funds.

No later than 18 months from initiation of construction, the Project owner shall provide written verification to the CPM that the compensation lands or conservation easements have been acquired and recorded in favor of the approved recipient.

SPECIAL-STATUS PLANT IMPACT AVOIDANCE, MINIMIZATION AND COMPENSATION

BIO-19 This condition contains the following four sections:

- **Section A: Special-Status Plant Impact Avoidance and Minimization Measures** contains the Best Management Practices and other measures designed to avoid accidental indirect impacts to plants during **site mobilization,** construction, operation, and closure. The measures are required for special-status plants located outside of the Project Disturbance Area and within 100 feet of the Project Disturbance Area. The same measures shall also be implemented for plants within the Project Disturbance Area that are avoided pursuant to Section C of this condition.
- **Section B: Conduct Late Season Botanical Surveys** describes guidelines for conducting summer-fall 201~~0~~**3** surveys to detect special-status plants that would have been missed during the spring 201~~0~~**3** surveys.
- **Section C: Avoidance Requirements for Special-Status Plants** Detected **in the Summer/Fall 201~~0~~3 Surveys** outlines the level of on-site avoidance required for any special-status plants detected during the summer-fall surveys, and specifies when off-site mitigation is required..
- **Section D: Off-Site Compensatory Mitigation for Special-Status Plants** describes performance standards for off-site mitigation through acquisition or restoration/enhancement.

"Project Disturbance Area" encompasses all areas to be temporarily and permanently disturbed by the Project, including the plant site, linear facilities, and areas disturbed by temporary access roads, fence installation, construction work lay-down and staging areas, parking, storage, or by any other activities resulting in disturbance to soil or vegetation. The term "Permanent Project Disturbance Area" refers only to the solar facility; "linears" includes transmission lines, laydown areas, pipelines, and access roads.

The Project owner shall implement the following measures in Section A, B, C, and D to avoid, minimize, and compensate for direct, indirect, and cumulative impacts to special-status plant species:

Section A: Special-Status Plant Impact Avoidance and Minimization Measures

To protect all special-status plants[8][9]located outside of the Project Disturbance Area and within 100 feet of the permitted Project Disturbance Area from accidental and indirect impacts during **site mobilization** construction, operation, and closure, the Project owner shall implement the following measures:

1. Designated Botanist. An experienced botanist who meets the qualifications described in Section **B-2** below shall oversee compliance with all special-status plant avoidance, minimization, and compensation measures described in this condition throughout construction and closure. The Designated Botanist shall oversee and train all other Biological Monitors tasked with conducting botanical survey and monitoring work. During operation of the Project, the Designated Biologist shall be responsible for protecting special-status plant occurrences within 100 feet of the Project boundaries.

2. Special-Status Plant Impact Avoidance and Minimization Measures. The Project owner shall incorporate all measures for protecting special-status plants in close proximity to the site into the BRMIMP (**BIO-7**). These measures shall include the following elements:

   a. Site Design Modifications: i) Incorporate s modifications to site design or construction techniques to minimize direct and indirect impacts to special-status plants along the Project linears to include: limiting the width of the work area; adjusting the location of staging areas, lay downs, spur roads and poles or towers; driving and crushing vegetation as an alternative to blading temporary roads to preserve the seed bank, and minor adjustments to the alignment of the roads and pipelines within the constraints of the ROW; ~~ii)modify diffusers on engineered channel to ensure discharge into existing small channels that were deprived of flows from diversion into engineered channel to minimize impacts downstream and maintain the natural surface drainage patterns and sediment transport critical to wash-dependent special-status plants; iii~~**ii**) These modifications shall be clearly depicted on the grading and construction plans, and on report-sized maps in the BRMIMP.

[8] This shall include special-status plants found during the fall 2010 surveys and the following species found during the spring 2009-2010 surveys: Harwood's milk-vetch; Harwood's woolly-star; California ditaxis; ribbed cryptantha, and the "Palen Lake atriplex (Andre sp. nov.).

[9] Staff defines special-status plants as described in *Protocols for Surveying and Evaluating Impacts to Special-Status Native Plant Populations and Natural Communities* (California Natural Resources Agency, Department of Fish and Game, issued November 24, 2009). "List 3 plants may be analyzed under CEQA §15380 if sufficient information is available to assess potential impacts to such plants. Factors such as regional rarity vs. statewide rarity should be considered in determining whether cumulative impacts to a List 4 plant are significant even if individual project impacts are not."

b. Establish Environmentally Sensitive Areas (ESAs). Prior to the start of any ground- or vegetation-disturbing activities, the Designated Botanist shall establish ESAs to protect avoided[10] special-status plants located outside of the Project Disturbance Areas and within 100 feet of the boundary of construction. This includes plant occurrences identified during the **all** spring ~~2009-2010 surveys and the~~ **and** late season ~~2010~~ surveys **previously conducted**. The locations of ESAs shall be clearly depicted on construction drawings, which shall also include all avoidance and minimization measures on the margins of the construction plans. The boundaries of the ESAs shall be placed a minimum of 20 feet from the uphill side of the occurrence and 10 feet from the downhill side. Where this is not possible due to construction constraints, other protection measures such as silt-fencing and sediment controls may be employed to protect the occurrences. Equipment and vehicle maintenance areas, and wash areas, shall be located 100 feet from the uphill side of any ESAs. ESAs shall be clearly delineated in the field with temporary construction fencing and signs prohibiting movement of the fencing or sediment controls under penalty of work stoppages and additional compensatory mitigation. ESAs shall also be clearly identified (with signage or by mapping on site plans) to ensure that avoided plants are not inadvertently harmed during construction, operation, or closure.

c. Special-Status Plant Worker Environmental Awareness Program (WEAP). The WEAP **(BIO-6)** shall include training components specific to protection of special-status plants as outlined in this condition.

d. Herbicide and Soil Stabilizer Drift Control Measures. Special-status plant occurrences within 100 feet of the Project Disturbance Area, and any occurrences avoided within the Project Disturbance Area[3] shall be protected from herbicide and soil stabilizer drift. The Weed **Management Plan** ~~Control Program~~ (**BIO-14**) shall include measures to avoid chemical drift or residual toxicity to special-status plants consistent with guidelines such as those provided by the Nature Conservancy's *The Global Invasive Species Team*[11] , the U.S. Environmental Protection Agency, and the Pesticide Action Network Database[12].

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[10] "Avoided" includes plants occurring within 100 feet outside of the Project boundary, and all plants within the Project Disturbance Area (linears or solar facility) that were avoided pursuant to Section C of this condition.

[11] Hillmer, J. & D. Liedtke. 2003. Safe herbicide handling: a guide for land stewards and volunteer stewards. Ohio Chapter, The Nature Conservancy, Dublin, OH. 20 pp. Online: <http://www.invasive.org/gist/products.html.

[12] Pesticide Action Network of North America. Kegley, S.E., Hill, B.R., Orme S., Choi A.H., PAN Pesticide Database, Pesticide Action Network, North America. San Francisco, CA, 2010 <http://www.pesticideinfo.org>

e. Erosion and Sediment Control Measures. Erosion and sediment control measures shall not inadvertently impact special-status plants by using invasive or non-native plants in seed mixes, introducing pest plants through contaminated seed or straw, accidental burial by mulches, etc. These specifications shall be incorporated in the Drainage, Erosion, and Sedimentation Control Plan required under **SOIL&WATER-1**.

f. Locate Staging, Parking, Spoils, and Storage Areas Away from Special-Status Plant Occurrences. Areas for spoils, equipment, vehicles, and materials storage areas; parking; equipment and vehicle maintenance areas, and wash areas shall be placed at least 100 feet from any ESAs. These specifications shall be incorporated in the Drainage, Erosion, and Sedimentation Control Plan required under **SOIL&WATER-1**.

g. Pre-Construction Seed Collection. For all significant impacts to special-status plants, mitigation shall include seed collection from the affected special-status plants population on-site prior to construction to conserve the germplasm and provide a seed source for restoration efforts. Seed collection shall follow the guidelines described in Section D.III.3 of this condition.

h. Monitoring and Reporting Requirements. The Designated Botanist, or B**iological** M**onitor** under supervision of the Designated Botanist, shall conduct weekly monitoring of the ESAs that protect special-status plant occurrences during construction and ~~decommissioning~~ **closure** activities.

Section B: Conduct Late-Season Botanical Surveys

The Project owner shall conduct late-summer/fall botanical surveys for late-season special-status plants prior to start of construction or by the end of 201~~0~~**3**, as described below:

1. Survey Timing. Surveys shall be timed to detect: a) summer annuals triggered to germinate by the warm, tropical summer storms (which may occur any time between June and October), and b) fall-blooming perennials that respond to the cooler, later season storms (typically beginning in September or October). For those species that are identified by vegetative characteristics, surveys do not have to be timed for blooming or fruiting. The surveys shall not be timed to coincide with the statistical peak bloom period of the target species but shall instead, if possible, be based on plant phenology and the timing of a significant storm event (e. g., a 10mm or greater rain or multiple storm events of sufficient volume to trigger germination as determined by a qualified botanist.). If possible, surveys shall occur at the appropriate time to capture the characteristics necessary to identify the taxon. Construction is authorized to commence following a 201~~0~~**3** late season survey.

2. Surveyor Qualifications and Training. Surveys shall be conducted by a qualified botanist knowledgeable in the complex biology of the local flora, and consistent with CDFG (2009) and BLM (2009) guidelines for surveyor qualifications. Each surveyor shall be equipped with a GPS unit and record a complete tracklog; these data shall be compiled and submitted along with the Summer-Fall Survey Botanical Report (described below). Prior to the start of surveys, all crew members shall, at a minimum, visit reference sites (where available) and/or review herbarium specimens of all BLM Sensitive plants, ~~CNPS List~~ **California Rare Plant Rank (RPR)** 1B or 2 (Nature Serve rank S1 and S2) or proposed ~~List~~ **RPR** 1B or 2 taxa, and any new reported or documented taxa, to obtain a search image. Because the potential for range extensions is unknown, the list of potentially occurring special-status plants shall include all special-status taxa known to occur within the Sonoran Desert region and the eastern portion of the Mojave in California. The list shall also include taxa with bloom seasons that begin in fall and extend into the early spring as many of these are reported to be easier to detect in fall, following the start of the fall rains.

3. Survey Coverage. The survey coverage or intensity shall be in accordance with **most recent** BLM Survey Protocols (**currently** issued July 2009)[13], which specify that intuitive controlled surveys shall only be accomplished by botanists familiar with the habitats and species that may reasonably be expected to occur in the project area.

4. Pre-Construction Seed Collection. For all significant impacts to special-status plants, mitigation shall include seed collection from the affected special-status plants population on-site prior to construction to conserve the germplasm and provide a seed source for restoration efforts. Seed collection shall be conducted during the late-season surveys follow the guidelines described in Section D.III.3 of this condition.

5. Documenting Occurrences. If a special-status plant is detected, the full extent of the population onsite shall be recorded using GPS in accordance with BLM survey protocols. Additionally, the extent of the population within one mile of Project boundaries shall be assessed at least qualitatively to facilitate an accurate estimation of the proportion of the population affected by the Project. For populations that are very dense or very large, the population size may be estimated by simple sampling techniques. When populations are very extensive or locally abundant, the surveyor must provide some basis for this assertion and roughly map the extent on a topographic map. All but the smallest populations (e.g., a population occupying less than 100 square feet) shall be recorded as area polygons; the smallest populations may be recorded as point features. All GPS-recorded occurrences shall include: the number of plants, phenology, observed threats (e.g., OHV or invasive exotics), and habitat or

[13] Bureau of Land Management (BLM), California State Office. *Survey Protocols Required for NEPA/ESA Compliance for BLM Special Status Plant Species*. Issued July 2009.

community type. The map of occurrences submitted with the final botanical report shall be prepared to ensure consistency with definition of an occurrence by CNDDB, i.e., occurrences found within 0.25 miles of another occurrence of the same taxon, and not separated by significant habitat discontinuities, shall be combined into a single 'occurrence'. The Project owner shall also submit the raw GPS shape files and metadata, and completed CNDDB forms for each 'occurrence' (as defined by CNDDB).

6. Reporting. Raw GPS data, metadata, and CNDDB field forms shall be provided to the CPM and the BLM State Botanist within ~~two~~ **four** weeks of the completion of each survey. If surveys are split into two or more periods (e.g., a late summer survey and a fall survey), then a summary letter shall be submitted following each survey period.

   The Final Summer-Fall Botanical Survey Report shall be prepared consistent with CDF~~G~~**W** guidelines (**currently** CDFG 2009), and **currently** BLM 2009 guidelines **(or the most recent version of CDFW and BLM guidelines)** and shall include all of the following components:

   a. the BLM designation, NatureServe Global and State Rank of each species or taxon found (or proposed rank, or CNPS List);

   b. the number or percent of the occurrence that will be directly affected, and indirectly affected by changes in drainage patterns or altered geomorphic processes;

   c. the habitat or plant community that supports the occurrence and the total acres of that habitat or community type that occurs in the Project Disturbance Area;

   d. an indication of whether the occurrence has any local or regional significance (e.g., if it exhibits any unusual morphology, occurs at the periphery of its range in California, represents a significant range extension or disjunct occurrence, or occurs in an atypical habitat or substrate);

   e. a completed CNDDB field form for every occurrence (occurrences of the same species within one-quarter mile or less of each other combined as one occurrence, consistent with CNDDB methodology), and

   f. two maps: one that depicts the raw GPS data (as collected in the field) on a topographic base map with Project features; and a second map that follows the CNDDB protocol for occurrence mapping.

Section C: Avoidance Requirements for Special-Status Plants Detected in the Summer/Fall ~~2010~~2013 Surveys

The Project owner shall apply the following avoidance and mitigation standards for impacts to late blooming special-status plants that might be detected during late summer/fall season surveys. The Project owner shall immediately notify the CDF~~G~~**W**, USFWS, BLM State Botanist, and the CPM if any State- or Federal-listed species or BLM Sensitive species are detected. Avoidance and/or the off-site mitigation measures described in Section D below would reduce impacts to these special-status plant species to less-than-significant levels. Plants shall be considered impacted if they are within the Project footprint, or if they would be affected by Project-related hydrologic changes or changes to the local sand transport system Downstream/ downwind impacts from altered hydrology or geomorphic processes shall be considered direct impacts.

Mitigation for CNDDB **State** Rank 1 Plants (Critically Imperiled). If late blooming species with a CNDDB **State** rank **(S rank)** of 1[14] are detected within the Project Disturbance Area, complete avoidance is mandatory along the linears and within construction laydown areas. The Project owner shall limit the width of the work area; adjusting the location of staging areas, lay downs, spur roads and poles or towers; driving and crushing vegetation as an alternative to blading temporary roads, and other construction or design modifications as necessary to achieve avoidance of any Rank 1 plants detected.

If late-season **State** Rank **(S)** 1 plants are detected on the solar facility, the Project owner shall avoid all plants around the perimeter[15] of the facility as necessary to achieve 75 percent avoidance of the local population of the affected species. The local population shall be measured by the number of individuals occurring on the Project Site and within the immediate watershed of the Project for wash dependent-species or species of unknown dispersal mechanism, or within the local sand transport corridor for wind dispersed species. Measurement of percent avoidance shall be based on population for perennials and on habitat for annuals (habitat containing the species' micro-habitat preferences, such as "fine silts and moist depressions"). Avoidance within the central portion of the solar facility is not recommended because it would create fragmented conditions that would not sustain persistence of the affected species. For all portions of the local population not avoided, the Project owner shall implement off-site mitigation at a ratio of 3:1. The off-site mitigation may include land acquisition or implementation of a restoration/enhancement program for the species, and shall meet the

[14] The CNDDB **State** Rank is provided in the California Natural Diversity Database (CNDDB) **is a Natural Heritage rank that is generated using a rank calculator from the Heritage program, and in California this ranking process is managed by CNDDB and refers to the imperilment status only within California's state boundaries**. Plants with a Rank of 1 are "Critically imperiled in the nation or state/province because of extreme rarity (often 5 or fewer occurrences) or because of some factor(s) such as very steep declines making it especially vulnerable to extirpation from the state."

[15] The inside "perimeter" is used here to describe the distance or length equal to two troughs.

performance standards described in section D of this Condition. The Applicant must demonstrate, subject to review and approval by the CPM, that the impacts, after mitigation, will not cause a loss of viability[16] for that species. The Project owner shall prepare and implement a Special-Status Plant Mitigation Plan (Plan). The content of the Plan and definitions shall be as described above in subsection C.3, below.

1. Mitigation for CNDDB **State** Rank 2[17] Plants (Imperiled). If late-season CNDDB **State** Rank **(S)** 2 species are detected within the Project Disturbance Area avoidance is mandatory along the linears **unless such avoidance would cause disturbance to areas not previously surveyed for biological resources or would create greater environmental impacts in all other disciplines (e.g. Cultural Resource Sites) or other restrictions (e.g., FAA or other restrictions for placement of transmission poles), except for the known population of California ditaxis. The Project owner shall provide compensatory mitigation, at a ratio of 2:1, as described below in Section D for impacts to S2 plants that could not be avoided.** ~~and~~ **.Complete avoidance is mandatory on** construction laydown areas. The Project owner shall limit the width of the work area, adjusting the location of staging areas, lay downs, spur roads and poles or towers; driving and crushing vegetation as an alternative to blading temporary roads, and other construction or design modifications as necessary to achieve avoidance of any ~~Rank~~ **S**2 plants detected[18].

   If late-season ~~Rank~~ **S**2 plants are detected on the solar facility, the Project owner shall implement off-site mitigation, at a ratio of 2:1, for any impacts exceeding 25 percent of the local population. The off-site mitigation may include land acquisition or implementation of a restoration/enhancement program for the species, and shall meet the performance standards described in section D of this Condition. The Project owner must demonstrate, subject to review and approval by the CPM, that the impacts, after mitigation, will not cause a loss of viability for that species.

[16] A "viable" species is one consisting of self-sustaining and interacting populations that are well-distributed throughout the species' range. "Self-sustaining populations" are those that are sufficiently abundant and have sufficient diversity to display the array of life history strategies and forms to provide for their long-term persistence and adaptability over time. The definition of the term "well-distributed" can vary based on current, historic, and potential population and habitat conditions. Maintaining viability is a means of ensuring, as much as possible, that a species will not go extinct in the foreseeable future. Because species and their environments are dynamic, there is not a single population size above which a species is viable and below which it will become extinct. Viability is best expressed as a level of risk of extinction.

[17] CNDDB State Rank 2 plants are "Imperiled in the nation or state/province because of rarity due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors making it very vulnerable to extirpation from the state".

[18] The CNDDB State Rank 2 plants California ditaxis was detected along the linears within the Project Disturbance Area (Solar Millenium 2010p). Staff concluded the impact was significant and all terms and conditions of Section C.2 shall be implemented. Staff concluded that the direct impacts to Harwood's milk-vetch were minor and no compensatory mitigation is required beyond the avoidance and minimization measures described in Section A of this condition.

The Project owner shall prepare and implement a Special-Status Plant Mitigation Plan (Plan). The content of the Plan and definitions shall be as described above in subsection C.3, below.

2. Mitigation for CNDDB **State** Rank 3[19] Plants (Vulnerable). If CNDDB **State** Rank **(S)** 3 plants are detected (which constitutes most **RPR** 4 plants), mitigation is not required unless the occurrence has local or regional significance, in which case the plant occurrence shall be treated as a CNDDB ~~Rank~~ **S**2 plant; avoidance and mitigation would be as described above under C.2. A plant occurrence would be considered to have local or regional significance if:

   a. It occurs at the outermost periphery of its range in California;

   b. It occurs in an atypical habitat, region, or elevation for the taxon that suggests that the occurrence may have genetic significance (e.g., that may increase its ability to survive future threats), or;

   c. It exhibits any unusual morphology that is not clearly attributable to environmental factors that may indicate a potential new variety or sub-species.

3. Prepare Special-Status Plant Mitigation Plan. If the project will impact any CNDDB ~~Rank~~ **S**1 or ~~Rank~~ **S**2 plants, or ~~Rank~~ **S**3 plants of local or regional significance, or new taxa, the Project owner shall prepare and implement a Special-Status Plant Mitigation Plan (Plan). Compensatory mitigation, as described in Section D of this condition, and at a mitigation ratio of 3:1 for Rank 1 plants, and 2:1 for R~~ank~~ **S**2 plants and ~~Rank~~ **S**1 plants of local or regional significance, and new taxa. The Plan shall include, at a minimum, the following components and definitions:

   a. A description of the occurrences of the affected special-status species, ecological characteristics such as soil, hydrology, and other micro-habitat requirements, ecosystem processes required for maintenance of the species or its habitat, reproduction and dispersal mechanisms, pollinators, local distribution, a description of the extent of the population off-site, the percentage of the local population affected, and a description of how these occurrences would be impacted by the Project, including direct and indirect effects. Occurrences shall be considered impacted if they are within the Project footprint, and if they would be affected by Project-related hydrologic changes or changes to the local sand transport system.

   b. A description of the avoidance and minimization measures that would achieve complete avoidance of occurrences on the Project linears and construction laydown areas. If avoidance is also required on the solar facility (Rank 1 species), provide a description of the measures that

[19] CNDDB State Rank 3 plants are "Vulnerable in the nation or state/province due to a restricted range, relatively few populations (often 80or fewer), recent and widespread declines, or other factors making it vulnerable to extirpation.

would be implemented to avoid or minimize impacts to occurrences on the solar facility. “Avoidance” shall include protection of the ecosystem processes essential for maintenance of the protected plant occurrence, and protection of the seed bank. Isolated ‘islands’ of protected plants disconnected by the Project from natural fluvial, aeolian (wind), or other processes essential for maintenance of the species, shall not be considered avoidance.

c. If off-site mitigation is also required, pursuant to C.1 –C.3 above, the Plan shall include a description of the proposed mitigation (acquisition or restoration/enhancement) and demonstrate how the mitigation will meet the performance standards described in Section D of this condition.

   For CNDDB Rank 1 plants that cannot be avoided (i.e., plants located in the central portion of the solar facility), the Plan must demonstrate that the impacts (after mitigation) will not cause a loss of viability for that species. The assessment of viability shall include: *i*) current literature compilation and review on the affected species, it’s documented and reported occurrences, range and distribution, habitat, and the ecological conditions needed to support it; *ii)* consultation with scientists and others with expertise and local knowledge of the species to gather unpublished data and other information to supplement the literature review findings, and (if available) *iii*) information on species’ habitat relationships, demographics, genetics, and risk factors.

Section D: Off-Site Compensatory Mitigation for Special-Status Plants

Where compensatory mitigation is required under the terms of Section C, above, the Project owner shall mitigate Project impacts to special-status plant occurrences with compensatory mitigation. Compensatory mitigation shall consist of acquisition of habitat supporting the target species, or restoration/enhancement of populations of the target species, and shall meet the performance standards for mitigation described below. In the event that no opportunities for acquisition or restoration/enhancement exist, the Project owner can fund a species distribution study designed to promote the future preservation, protection or recovery of the species. Compensatory mitigation shall be at a ratio of 3:1 for Rank 1 plants, with three acres of habitat acquired or restored/enhanced for every acre of habitat occupied by the special status plant that will be disturbed by the Project Disturbance Area (for example if the area occupied by the special status plant collectively measured is ¼ acre than the compensatory mitigation will be ¾ of an acre). The mitigation ratio for Rank 2 plants shall be 2:1. So, for the example above, the mitigation ratio would be one-half acre for the Rank 2 plants.

The Project owner shall provide funding for the acquisition and/or restoration/enhancement, initial improvement, and long-term maintenance and management of the acquired or restored lands. The actual costs to comply with this condition will vary depending on the Project Disturbance Area, the actual costs of acquiring compensation habitat, the actual costs of initially improving the habitat, the actual costs of long-term management as determined by a Property Analysis Record (PAR) report, and other transactional costs related to the use of compensatory mitigation.

The Project owner shall comply with other related requirements in this condition:

I. Compensatory Mitigation by Acquisition: The requirements for the acquisition, initial protection and habitat improvement, and long-term maintenance and management of special-status plant compensation lands include all of the following:

1. Selection Criteria for Acquisition Lands. The compensation lands selected for acquisition may include any of the following three categories:

    a. Occupied Habitat, No Habitat Threats. The compensation lands selected for acquisition shall be occupied by the target plant population and shall be characterized by site integrity and habitat quality that are required to support the target species, and shall be of equal or better habitat quality than that of the affected occurrence. The occurrence of the target special-status plant on the proposed acquisition lands should be viable, stable or increasing (in size and reproduction).

    b. Occupied Habitat, Habitat Threats. Occupied compensation lands characterized by habitat threats may also be acquired as long as the population could be reasonably expected to recover with habitat restoration efforts (e.g., OHV or grazing exclusion, or removal of invasive non-native plants) and is accompanied by a Habitat Enhancement/Restoration Plan as described in Section D.II, below.

    c. Unoccupied but Adjacent. The Project owner may also acquire habitat for which occupancy by the target species has not been documented, if the proposed acquisition lands are adjacent to occupied habitat. The Project owner shall provide evidence that acquisitions of such unoccupied lands would improve the defensibility and long-term sustainability of the occupied habitat by providing a protective buffer around the occurrence and by enhancing connectivity with undisturbed habitat. This acquisition may include habitat restoration efforts where appropriate, particularly when these restoration efforts will benefit adjacent habitat that is occupied by the target species.

2. Review and Approval of Compensation Lands Prior to Acquisition. The Project owner shall submit a formal acquisition proposal to the CPM describing the parcel(s) intended for purchase. This acquisition proposal shall discuss the suitability of the proposed parcel(s) as compensation lands for special-status plants in relation to the criteria listed above, and must be approved by the CPM.

3. Management Plan. The Project owner or approved third party shall prepare a management plan for the compensation lands in consultation with the entity that will be managing the lands. The goal of the management plan shall be to support and enhance the long-term viability of the target special-status plant occurrences. The Management Plan shall be submitted for review and approval to the CPM.

4. Integrating Special-Status Plant Mitigation with Other Mitigation lands. If all or any portion of the acquired Desert Tortoise, Waters of the State, or other required compensation lands meets the criteria above for special-status plant compensation lands, the portion of the other species' or habitat compensation lands that meets any of the criteria above may be used to fulfill that portion of the obligation for special-status plant mitigation.

5. Compensation Lands Acquisition Requirements. The Project owner shall comply with the following requirements relating to acquisition of the compensation lands after the CPM, has approved the proposed compensation lands:

   a. Preliminary Report. The Project owner, or an approved third party, shall provide a recent preliminary title report, initial hazardous materials survey report, biological analysis, and other necessary or requested documents for the proposed compensation land to the CPM. All documents conveying or conserving compensation lands and all conditions of title are subject to review and approval by the CPM. For conveyances to the State, approval may also be required from the California Department of General Services, the Fish and Game Commission and the Wildlife Conservation Board.

   b. Title/Conveyance. The Project owner shall acquire and transfer fee title to the compensation lands, a conservation easement over the lands, or both fee title and conservation easement, as required by the CPM. Any transfer of a conservation easement or fee title must be to ~~CDFG~~ **CDFW**, a non-profit organization qualified to hold title to and manage compensation lands (pursuant to California Government Code section 65965), or to BLM or other public agency approved by the CPM. If an approved non-profit organization holds fee title to the compensation lands, a conservation easement shall be recorded in favor of ~~CDFG~~ **CDFW** or another entity approved by the CPM. If an entity other than ~~CDFG~~ **CDFW** holds a conservation easement over the compensation lands, the CPM may require that ~~CDFG~~ **CDFW** or another entity approved by the CPM, in consultation with ~~CDFG~~ **CDFW**, be named a third party beneficiary of the conservation easement. The Project owner shall obtain approval of the CPM of the terms of any transfer of fee title or conservation easement to the compensation lands.

c. Initial Protection and Habitat Improvement. The Project owner shall fund activities that the CPM requires for the initial protection and habitat improvement of the compensation lands. These activities will vary depending on the condition and location of the land acquired, but may include trash removal, construction and repair of fences, invasive plant removal, and similar measures to protect habitat and improve habitat quality on the compensation lands. The costs of these activities would use the estimated cost per acre for Desert Tortoise mitigation as a best available proxy, at the ratio of 3:1 for Rank 1 plants and 2:1 for Rank 2 plants, but actual costs will vary depending on the measures that are required for the compensation lands. A non-profit organization, ~~CDFG~~ **CDFW** or another public agency may hold and expend the habitat improvement funds if it is qualified to manage the compensation lands (pursuant to California Government Code section 65965), if it meets the approval of the CPM in consultation with ~~CDFG~~ **CDFW**, and if it is authorized to participate in implementing the required activities on the compensation lands. If ~~CDFG~~ **CDFW** takes fee title to the compensation lands, the habitat improvement fund must be paid to ~~CDFG~~ **CDFW** or its designee.

d. Property Analysis Record. Upon identification of the compensation lands, the Project owner shall conduct a Property Analysis Record (PAR) or PAR-like analysis to establish the appropriate amount of the long-term maintenance and management fund to pay the in-perpetuity management of the compensation lands. The PAR or PAR-like analysis must be approved by the CPM before it can be used to establish funding levels or management activities for the compensation lands.

e. Long-term Maintenance and Management Funding. The Project owner shall deposit in~~NFWF's~~ **the** REAT Account, **or other CPM approved entity,** a capital long-term maintenance and management fee in the amount determined through the Property Analysis Record (PAR) or PAR-like analysis conducted for the compensation lands.

The CPM, in consultation with **CDFW** , may designate another non-profit organization to hold the long-term maintenance and management fee if the organization is qualified to manage the compensation lands in perpetuity. If ~~CDFG~~ **CDFW** takes fee title to the compensation lands, ~~CDFG~~ **CDFW** shall determine whether it will hold the long-term management fee in the special deposit fund, leave the money in the REAT Account, or designate another entity to manage the long-term maintenance and management fee for ~~CDFG~~ **CDFW** and with ~~CDFG~~ **CDFW** supervision.

Interest, Principal, and Pooling of Funds. The Project owner shall ensure that an agreement is in place with the long-term maintenance and management fund (endowment) holder/manager to ensure the following requirements are met:

i. Interest. Interest generated from the initial capital long-term maintenance and management fund shall be available for reinvestment into the principal and for the long-term operation, management, and protection of the approved compensation lands, including reasonable administrative overhead, biological monitoring, improvements to carrying capacity, law enforcement measures, and any other action that is approved by the CPM and is designed to protect or improve the habitat values of the compensation lands.

ii. Withdrawal of Principal. The long-term maintenance and management fund principal shall not be drawn upon unless such withdrawal is deemed necessary by the CPM or by the approved third-party long-term maintenance and management fund manager, to ensure the continued viability of the species on the compensation lands.

iii. Pooling Long-Term Maintenance and Management Funds. An entity approved to hold long-term maintenance and management funds for the Project may pool those funds with similar funds that it holds from other projects for long-term maintenance and management of compensation lands for special-status plants. However, for reporting purposes, the long-term maintenance and management funds for this Project must be tracked and reported individually to the CPM.

f. Other Expenses. In addition to the costs listed above, the Project owner shall be responsible for all other costs related to acquisition of compensation lands and conservation easements, including but not limited to the title and document review costs incurred from other state agency reviews, overhead related to providing compensation lands to ~~CDFG~~ **CDFW** or an approved third party, escrow fees or costs, environmental contaminants clearance, and other site cleanup measures.

g. Mitigation Security. The Project owner shall provide financial assurances to the CPM to guarantee that an adequate level of funding is available to implement any of the mitigation measures required by this condition that are not completed prior to the start of ground-disturbing Project activities. Financial assurances shall be provided to the CPM in the form of an irrevocable letter of credit, a pledged savings account or another form of security ("Security") approved by the CPM. The amount of the Security shall use the estimated cost per acre for Desert Tortoise mitigation as a best available proxy, at a ratio of 3:1 for Rank 1 plants and 2:1 for Rank 2 plants, for every acre of habitat supporting the target special-status plant species which is significantly impacted by the project. The actual costs to comply with this condition will vary depending on the actual costs of acquiring compensation habitat, the costs of initially improving the habitat, and the actual costs of long-term management as determined by a PAR report. Prior to submitting the Security to the CPM, the Project owner shall obtain the CPM's approval of the form of the Security. The CPM may draw on the Security if the CPM determines the Project owner has failed to comply with the requirements specified in this condition. The CPM may use money from the Security solely for implementation of the requirements of this condition. The CPM's use of the Security to implement measures in this condition may not fully satisfy the Project owner's obligations under this condition, and the Project owner remains responsible for satisfying the obligations under this condition if the Security is insufficient. The unused Security shall be returned to the Project owner in whole or in part upon successful completion of the associated requirements in this condition.

h. ~~NFWF~~ REAT Account. The Project owner may elect to comply with the requirements in this condition for acquisition of compensation lands, initial protection and habitat improvement on the compensation lands, or long-term maintenance and management of the compensation lands by funding, or any combination of these three requirements, by providing funds to implement those measures into the Renewable Energy Action Team (REAT) Account~~established with the National Fish and Wildlife Foundation (NFWF~~**).** To use this option, the Project owner must make an initial deposit to the REAT Account in an amount equal to the estimated costs (as set forth in the Security section of this condition) of implementing the requirement. If the actual cost of the acquisition, initial protection and habitat improvements, or long-term funding is more than the estimated amount initially paid by the Project owner, the Project owner shall make an additional deposit into the REAT Account sufficient to cover the actual acquisition costs, the actual costs of initial protection and habitat improvement on the compensation lands, and the long-term funding requirements as established in an approved PAR or PAR-like analysis. If those actual costs or PAR projections are less than the amount initially transferred by the Applicant, the remaining balance shall be returned to the Project owner.

The responsibility for acquisition of compensation lands may be delegated to a third party~~other than NFWF~~, such as a non-governmental organization supportive of desert habitat conservation, by written agreement of the Energy Commission. Such delegation shall be subject to approval by the CPM, in consultation with ~~CDFG~~ **CDFW**, BLM and USFWS, prior to land acquisition, enhancement or management activities. Agreements to delegate land acquisition to an approved third party, or to manage compensation lands, shall be executed and implemented within 18 months of the start of ground disturbance.

II. Compensatory Mitigation by Habitat Enhancement/Restoration: As an alternative or adjunct to land acquisition for compensatory mitigation the Project owner may undertake habitat enhancement or restoration for the target special-status plant species. Habitat enhancement or restoration activities must achieve protection at a 3:1 ratio for Rank 1 plants and 2:1 for Rank 2 plants, with improvements applied to three acres, or two acres, respectively, of habitat for every acre special-status plant habitat directly or indirectly disturbed by the Project Disturbance Area (for example if the area occupied by the special status plant collectively measured is 1/4 acre than the improvements would be applied to an area equal to 3/4 of an acre at a 3:1 ratio, or one-half acre at a 2:1 ratio). Examples of suitable enhancement projects include but are not limited to the following: i) control unauthorized vehicle use into an occurrence (or pedestrian use if clearly damaging to the species); ii) control of invasive non-native plants that infest or pose an immediate threat to an occurrence; iii) exclude grazing by wild burros or livestock from an occurrence; or iv) restore lost or degraded hydrologic or geomorphic functions critical to the species by restoring previously diverted flows, removing obstructions to the wind sand transport corridor above an occurrence, or increasing groundwater availability for dependent species.

If the Project owner elects to undertake a habitat enhancement project for mitigation, the project must meet the following performance standards: The proposed enhancement project shall achieve rescue of an off-site occurrence that is currently assessed, based on the NatureServe threat ranking system[20] with one of the following threat ranks: a) long-term decline >30%; b) an immediate threat that affects >30% of the population, or c) has an overall threat impact that is High to Very High. "Rescue" would be considered successful if it achieves an improvement in the occurrence trend to "stable" or "increasing" status, or downgrading of the overall threat rank to slight or low (from "High" to "Very High").

[20] Master, L., D. Faber-Langendoen, R. Bittman, G. A., Hammerson, B. Heidel, J. Nichols, L. Ramsay, and A. Tomaino. 2009. *NatureServe Conservation Status Assessments: Factors for Assessing Extinction Risk.* NatureServe, Arlington, VA. Online: http://www.natureserve.org/publications/ConsStatusAssess_StatusFactors.pdf, "Threats". See also: Morse, L.E., J.M. Randall, N. Benton, R. Hiebert, and S. Lu. 2004. An Invasive Species Assessment Protocol: Evaluating Non-Native Plants for Their Impact on Biodiversity. Version 1. NatureServe, Arlington, Virginia. Online: http://www.natureserve.org/publications/pubs/invasiveSpecies.pdf

If the Project owner elects to undertake a habitat enhancement project for mitigation, they shall submit a Habitat Enhancement/Restoration Plan to the CPM for review and approval, and shall provide sufficient funding for implementation and monitoring of the Plan. The amount of the Security shall use the estimated cost per acre for Desert Tortoise mitigation as a best available proxy, at the ratio of 3:1 for Rank 1 plants and 2:1 for Rank 2 plants, for every acre of habitat supporting the target special-status plant species which is directly or indirectly impacted by the project. The amount of the security may be adjusted based on the actual costs of implementing the enhancement, restoration and monitoring. The implementation and monitoring of the enhancement/restoration may be undertaken by an appropriate third party~~such as NFWF,~~ subject to approval by the CPM. The Habitat Enhancement/Restoration Plan shall include each of the following:

1. Goals and Objectives. Define the goals of the restoration or enhancement project and a measurable course of action developed to achieve those goals. The objective of the proposed habitat enhancement plan shall include restoration of a target special-status plant occurrence that is currently threatened with a long-term decline. The proposed enhancement plan shall achieve an improvement in the occurrence trend to “stable” or “increasing” status, or downgrading of the overall threat rank to slight or low (from “High” to “Very High”).

2. Historical Conditions. Provide a description of the pre-impact or historical conditions (before the site was degraded by weeds or grazing or ORV, etc.), and the desired conditions.

3. Site Characteristics. Describe other site characteristics relevant to the restoration or enhancement project (e.g., composition of native and pest plants, topography and drainage patterns, soil types, geomorphic and hydrologic processes important to the site or species.

4. Ecological Factors. Describe other important ecological factors of the species being protected, restored, or enhanced such as total population, reproduction, distribution, pollinators, etc.

5. Methods. Describe the restoration methods that will be used (e.g., invasive exotics control, site protection, seedling protection, propagation techniques, etc.) and the long-term maintenance required. The implementation phase of the enhancement must be completed within five years.

6. Budget. Provide a detailed budget and time-line, and develop clear, measurable, objective-driven annual success criteria.

7. Monitoring. Develop clear, measurable monitoring methods that can be used to evaluate the effectiveness of the restoration and the benefit to the affected species. The Plan shall include a minimum of five years of quarterly monitoring, and then annual monitoring for the remainder of

the enhancement project, and until the performance standards for rescue of a threatened occurrence are met. At a minimum the progress reports shall include: quantitative measurements of the projects progress in meeting the enhancement project success criteria, detailed description of remedial actions taken or proposed, and contact information for the responsible parties.

8. Reporting Program. The Plan shall ensure accountability with a reporting program that includes progress toward goals and success criteria. Include names of responsible parties.

9. Contingency Plan. Describe the contingency plan for failure to meet annual goals.

10. Long-term Protection. Include proof of long-term protection for the restoration site. For private lands this would include conservations easements or other deed restrictions; projects on public lands must be contained in a Desert Wildlife Management Area, Wildlife Habitat Management Area, or other land use protections that will protect the mitigation site and target species.

II. Contingency Measures

1. Preservation of the Germplasm of Affected Special-Status Plants. For all significant impacts to special-status plants, mitigation shall also include seed collection from the affected special-status plants population on-site prior to construction to conserve the germplasm and provide a seed source for restoration efforts. The seed shall be collected under the supervision or guidance of a reputable seed storage facility such as the Rancho Santa Ana Botanical Garden Seed Conservation Program, San Diego Natural History Museum, or the Missouri Botanical Garden. The costs associated with the long-term storage of the seed shall be the responsibility of the Project owner. Any efforts to propagate and reintroduce special-status plants from seeds in the wild shall be carried out under the direct supervision of specialists such as those listed above and as part of a Habitat Restoration/Enhancement Plan approved by the CPM.

2. Compensatory Mitigation by Conducting or Contributing to a Management Plan for the Affected Species. Subject to approval of the CPM, as a contingency measure in the event there are no opportunities for mitigation through acquisition or restoration/enhancement to meet the obligations for off-site mitigation as described in Section C.1-3 of this condition, , a Management Plan for the affected special-status plant species may be conducted or funded. The goal of the Management Plan is to devise a science-based, region-wide strategy to ensure the long-term viability of the affected species, and to acquire, protect, and restore existing populations and the habitat that supports them. The information gathered shall be used to develop conservation approaches to address

the identified risk factors. These approaches include land allocations, restoration needs, identifying and preserving important refugia to facilitate species dispersal and maintain biodiversity in the face of climate change, recommending Best Management Practices or other measures that could be used to minimize threats, and identifying planning needs at the regional level. The results of the study would also be provided to the resource agencies, conservation organizations, and academic institutions, as well as the state's Natural Diversity Database and Consortium of California Herbaria.

3. Under this contingency measure, the Project owner shall acquire all available information on the distribution, status or health of known occurrences, ecological requirements, and ownership and management opportunities of the affected special-status plant species and other special status plants known to occur in the Chuckwalla Valley. Some of these late blooming species are only known from a few viable occurrences in California, and historic occurrences that have not been re-located or surveyed since they were first documented. At a minimum, the study shall include the following:

    a. <u>Occurrence and Life History Review</u>. The Study shall include an evaluation of all documented, historical and reported localities for the affected species, and a review of current information on the species life history. This would include a review of the CNDDB database, records from regional and national herbaria, literature review, consultation with U.C. Riverside, San Diego Natural History Museum, and other educational institutions or natural heritage organizations in California, Arizona, and Nevada, etc.), other biotechnical survey reports from the region, and information from regional botanical experts.

    b. <u>Conduct Site Visits to Documented and Reported Localities.</u> Documented and reported occurrences would be evaluated in the field during the appropriate time of the year for each late blooming species. If located, these occurrences would be evaluated for population size (area and quantity), population trend, ecological characteristics, soils, habitat quality, potential threats, degree and immediacy of threats, ownership and management opportunities. GPS location data would also be collected during these site visits.

    c. <u>Survey Surrounding Areas.</u> Areas surrounding the occurrences that contain habitat suitable to support the affected species shall be surveyed to determine the full extent of its range and distribution. If additional populations are found, collect data (GPS and assessment) on these additional populations consistent with III.2 above.

    d. <u>Prepare Report on Status, Distribution, and Management Needs.</u> A report shall be prepared that contains the results of the surveys and assessment. The report shall contain the following components: a)

Range and Distribution (including maps and GPS data); b) Abundance and Population Trends; c) Life History; d) Habitat Necessary for Survival; d) Factors Affecting Ability to Survive and Reproduce; e) Degree and Immediacy of Threat; f) Ownership and Management Opportunities for Protection or Recovery; g) Sources of Information, and g) Conclusions. The conclusions shall contain an explanation of whether the species' survival is threatened by any of the following factors: i) present or threatened modification or destruction of its habitat; ii) competition; iii) disease; iv) other natural occurrences (such as climate change) or human-related activities. This valuable information will provide a better understanding of the ecological factors driving the distribution of these species, and will identify opportunities for mitigation and management opportunities for recovery. All data from this study will be submitted for incorporation into the CNDDB system and the study report will be made available to resource agencies, and conservation groups, and other interested parties.

e. The cost to implement or fund the study shall be no greater than the cost for acquisition, enhancement, and long-term management of compensatory mitigation lands based on the specifications and standards for acquisition or restoration/enhancement described above under D.I and D.II.

<u>Verification:</u> The Special-Status Plant Impact Avoidance and Minimization Measures shall be incorporated into the BRMIMP as required under Condition of Certification **BIO-7.**

The Project owner shall notify the CPM and the BLM State Botanist no less than 14 days prior to the start of late-season surveys and provide a target list of late season special-status plants that will be considered. Concurrently, the Project owner shall coordinate with BLM to obtain a permit for seed collection. Seed collection is required for all special-status plants located within the Project Disturbance Area and shall be conducted according to the specifications in Section D.III.1 of this condition and with all terms and conditions of the BLM permit.

Raw GPS data, metadata, and CNDDB field forms shall be submitted to the CPM and **<u>the BLM State Botanist</u>** within ~~two~~**<u>four</u>** weeks of the completion of each survey. A preliminary summary of results for the late summer/fall botanical surveys, prepared according to guidelines in Section B of this condition, shall also be submitted to the CPM and BLM's State Botanist within two weeks following the completion of the surveys. If surveys are split into more than one period, then a summary letter shall be submitted following each survey period. The Final Summer-Fall Botanical Survey Report, GIS shape files and metadata shall be submitted to the BLM State Botanist and the CPM no less than 30 days prior to the start of **<u>site mobilization and construction</u>** ~~ground-disturbing~~ activities. The Final Report shall include a detailed accounting of the acreage of Project impacts to special-status plant occurrences.

For any special-status plant species located within the Project Disturbance Area, the Project owner shall submit to the CPM to less than 30 days prior to the start of **site mobilization and construction** ~~ground-disturbing~~ activities proof, in the form of a letter or receipt, of the seed or other propagules collected pursuant to Section D.III #1 of this Condition.

The draft conceptual Special-Status Plant Mitigation Plan, as described under Section C.4 of this condition, shall be submitted to the CPM for review and approval no less than 30 days prior to the start of **site mobilization and construction** ~~ground-disturbing~~ activities.

The Project owner shall immediately provide written notification to the CPM, ~~CDFG~~**CDFW**, USFWS, and BLM State Botanist if it detects a State- or Federal-Listed Species, or BLM Sensitive Species at any time during its late summer/fall botanical surveys or at any time thereafter through the life of the Project, including conclusion of Project **closure** ~~decommissioning~~.

No less than 30 days prior to the start of ground-disturbing activities the Project owner shall submit grading plans and construction drawings to the CPM which depict the location of Environmentally Sensitive Areas and the Avoidance and Minimization Measures contained in Section A of this Condition, and under Section C.1-3.

If compensatory mitigation is required, pursuant to Section C.1-3, no less than 30 days prior to the start of **site mobilization and construction** ~~ground-disturbing~~ activities the Project owner shall submit to the CPM the form of Security adequate to acquire compensatory mitigation lands and/or undertake habitat enhancement or restoration activities, as described in this condition. Actual Security shall be provided 7 days prior to start of **site mobilization and construction** ~~ground-disturbing~~ activities.

No fewer than 90 days prior to acquisition of compensatory mitigation lands, the Project owner shall submit a formal acquisition proposal and draft Management Plan for the proposed lands to the CPM, with copies to ~~CDFG~~**CDFW**, USFWS, and BLM, describing the parcels intended for purchase and shall obtain approval from the CPM prior to the acquisition. No fewer than 90 days prior to acquisition of compensatory mitigation lands, the Project owner shall submit to the CPM and obtain CPM approval of any agreements to delegate land acquisition to an approved third party, or to manage compensation lands; such agreement shall be executed and implemented within 18 months of the start of ground disturbance.

No fewer than 30 days after acquisition of the property the Project owner shall deposit the funds required by Section I e above (long term management and maintenance fee) and provide proof of the deposit to the CPM.

The Project owner or an approved third party shall complete the acquisition and all required transfers of the compensation lands, and provide written verification to the CPM of such completion no later than 18 months after the start of **site mobilization and construction** ~~Project ground-disturbing~~ activities. If ~~NFWF or another approved~~ **a** third party is being used for the acquisition, the Project owner shall ensure that funds needed to accomplish the acquisition are transferred in timely manner to facilitate the planned acquisition and to ensure the land can be acquired and transferred prior to the 18-month deadline. If habitat enhancement is proposed, no later than six months following the start of ground-disturbing activities, the Project owner shall obtain CPM approval of the final Habitat Enhancement/Restoration Plan, prepared in accordance with Section D, and submit to the CPM or a third party approved by the CPM Security adequate for long-term implementation and monitoring of the Habitat Enhancement/Restoration Plan.

Enhancement/restoration activities shall be initiated no later than 12 months from the start of construction. The implementation phase of the enhancement project shall be completed within five years of initiation. Until completion of the five-year implementation portion of the enhancement action, a report shall be prepared and submitted as part of the Annual Compliance Report. This report shall provide, at a minimum: a summary of activities for the preceding year and a summary of activities for the following year; quantitative measurements of the Project's progress in meeting the enhancement project success criteria; detailed description of remedial actions taken or proposed; and contact information for the responsible parties.

If a contingency measure is required, as described in Section D.III of this condition, the Project owner shall submit commence no later than six months following the start of ground-disturbing activities. The draft study shall be submitted to the CPM and BLM State Botanist for review and approval no more than two years following the start of ground-disturbing activities. The final study shall be submitted no more than 30 months following the start of ground-disturbing activities.

If a Distribution Study is implemented as contingency mitigation, the study shall be initiated no later than 6 months from the start of construction. The implementation phase of the study shall be completed within two years of the start of construction.

Within 18 months of **site mobilization and construction** activities, the Project owner shall transfer to the CPM or an approved third party the difference between the Security paid and the actual costs of (1) acquiring compensatory mitigation lands, completing initial protection and habitat improvement , and funding the long-term maintenance and management of compensatory mitigation lands; and/or (2) implementing and providing for the long-term protection and monitoring of habitat enhancement or restoration activities.

Implementation of the special-status plant impact avoidance and minimization measures shall be reported in the Monthly Compliance Reports prepared by the Designated Botanist. Within 30 days after completion of Project construction, the Project owner shall provide to the CPM, for review and approval, in consultation with the BLM State Botanist, a written construction termination report identifying how measures have been completed.

The Project owner shall submit a monitoring report every year for the life of the project to monitor effectiveness of protection measures for all avoided special-status plants to the CPM and BLM State Botanist. The monitoring report shall include: dates of worker awareness training sessions and attendees, completed CNDDB field forms for each avoided occurrence on-site and within 100 feet of the Project boundary off-site, and description of the remedial action, if warranted and planned for the upcoming year. The completed forms shall include an inventory of the special-status plant occurrences and description of the habitat conditions, an indication of population and habitat quality trends.

SAND DUNE/MOJAVE FRINGE-TOED LIZARD MITIGATION

BIO-20 To mitigate for habitat loss and direct impacts to Mojave fringe-toed lizards the Project owner shall provide compensatory mitigation, which may include compensation lands purchased in fee or in easement in whole or in part, at the following ratios:

- 3:1 mitigation for direct impacts to stabilized and partially stabilized sand dunes (per **BIO-29 – Table 2** or final acreage impacted by the Project footprint);
- 1:1 mitigation for direct impacts non-dune Mojave fringe-toed lizard habitat (per **BIO-29 – Table 2** or final acreage impacted by the Project footprint); and
- 0.5:1 mitigation for indirect impacts to stabilized and partially stabilized sand dunes (per **BIO-29 – Table 2** or final acreage impacted by the Project footprint).

If compensation lands are acquired, the Project owner shall provide funding for the acquisition in fee title or in easement, initial habitat improvements, and long-term maintenance and management of the compensation lands. In addition, the compensation lands must include, at a minimum, the number acres of stabilized and partially stabilized sand dune habitat shown in **BIO-29 Table 2**.

1. <u>Criteria for Compensation Lands</u>: The compensation lands selected for acquisition shall:
   a. Provide suitable habitat for Mojave fringe-toed lizards, and, aside from the minimum amount of stabilized and partially stabilized sand dunes, may include stabilized and partially stabilized desert dunes, sand drifts over playas, or Sonoran creosote bush scrub;

   b. Be within the Palen or Chuckwalla valleys with potential to contribute to Mojave fringe-toed lizard habitat connectivity and build linkages between known populations of Mojave fringe-toed lizards and preserve lands with suitable habitat;

   c. Be prioritized near larger blocks of lands that are either already protected or planned for protection, or which could feasibly be protected long-term by a public resource agency or a non-governmental organization dedicated to habitat preservation;

   d. Provide quality habitat for Mojave fringe-toed lizard that has the capacity to regenerate naturally when disturbances are removed;

e. Not have a history of intensive recreational use or other disturbance that might make habitat recovery and restoration infeasible;

f. Not be characterized by high densities of invasive species, either on or immediately adjacent to the parcels under consideration, that might jeopardize habitat recovery and restoration;

g. Not contain hazardous wastes that cannot be removed to the extent the site is suitable for habitat;

h. Have water and mineral rights included as part of the acquisition, unless the CPM, in consultation with ~~CDFG~~**CDFW**, BLM and USFWS, agrees in writing to the acceptability of the land; and

i. Be on land for which long-term management is feasible.

2. Security for Implementation of Mitigation: The Project owner shall provide financial assurances to the CPM to guarantee that an adequate level of funding is available to implement the acquisitions and enhancement of Mojave fringe-toed lizard habitat as described in this condition. These funds shall be used solely for implementation of the measures associated with the Project. Financial assurance can be provided to the CPM according to the measures outlined in **BIO-12**, and within the time period specified for this assurance (see the verification section at the end of this condition). The final amount due will be determined by an updated appraisal and a PAR analysis conducted as described in **BIO-12**, but current estimates are included in **Biological Resources Tables ~~2~~12** and ~~2~~**13** located at the beginning of the conditions of certification subsection.

3. Preparation of Management Plan: The Project owner shall submit to the CPM, BLM, and ~~CDFG~~**CDFW** a draft Management Plan that reflects site-specific enhancement measures for the Mojave fringe-toed lizard habitat on the acquired compensation lands. The objective of the Management Plan shall be to enhance the value of the compensation lands for Mojave fringe-toed lizards, and may include enhancement actions such as weed control, fencing to exclude livestock, erosion control, or protection of sand sources or sand transport corridors.

Verification: No later than 30 days prior to beginning **site mobilization and construction** ~~Project ground-disturbing~~ activities, the Project owner shall provide written verification of an approved form of Security in accordance with this condition of certification. Actual Security shall be provided no later than 7 days prior to the beginning of Project ground-disturbing activities for each Project phase as described in **BIO-29**. The Project owner, or an approved third party, shall complete and provide written verification of the proposed compensation lands acquisition within 18 months of the start of Project ground-disturbing activities for each Project phase.

No less than 90 days prior to acquisition of the property, the Project owner shall submit a formal acquisition proposal to the CPM, ~~CDFG~~ **CDFW**, and USFWS describing the parcels intended for purchase.

The Project owner, or an approved third party, shall provide the CPM, BLM, and ~~CDFG~~ **CDFW**, with a management plan for the compensation lands and associated funds within 180 days of the land or easement purchase, as determined by the date on the title. The CPM shall review and approve the management plan, in consultation with BLM and ~~CDFG~~ **CDFW**.

Within 90 days after completion of Project construction, the Project owner shall provide to the CPM and ~~CDFG~~ **CDFW** an analysis with the final accounting of the amount (detailed by habitat type) of Mojave fringe-toed lizard habitat disturbed during Project construction.

The Project owner shall provide written verification to the CPM, and ~~CDFG~~ **CDFW** that the compensation lands or conservation easements have been acquired and recorded in favor of the approved recipient no later than 18 months from the start of ground-disturbing activities.

MITIGATION FOR IMPACTS TO STATE WATERS

BIO-21 The Project owner shall implement the following measures to avoid, minimize and mitigate for direct and indirect impacts to waters of the state and to satisfy requirements of California Fish and Game Code sections 1600 and 1607.

1. Acquire Off-Site State Waters: The Project owner shall acquire, in fee or in easement, a parcel or parcels of land that includes state jurisdictional waters per **BIO-29 – Table 2**, or the area of state waters directly or indirectly impacted by the final Project footprint. The Project footprint means all lands disturbed by construction and operation of the Palen Project, including all linears. The parcel or parcels comprising the ephemeral washes shall include desert dry wash woodland per **BIO-29 – Table 2**, or the acreage of desert dry was woodland impacted by the final Project footprint at a 3:1 ratio. The terms and conditions of this acquisition or easement shall be as described in Condition of Certification **BIO 12**, and the timing associated with **BIO-29** (phasing). The current estimated costs are included in **BIO-29 – Table 3** located at the beginning of the Conditions of Certification subsection. Mitigation for impacts to state waters shall occur within the Chuckwalla, East Salton Sea, Hayfield, Rice, or portion of Whitewater within the NECO, Hydrologic Units (HUs) or the Palo Verde Watershed and be prioritized within the Chuckwalla HU in the Palen or adjacent watersheds.

2. Security for Implementation of Mitigation: The Project owner shall provide financial assurances to the CPM and CDF~~G~~**W** to guarantee that an adequate level of funding is available to implement the acquisitions and enhancement of state waters as described in this condition. These funds shall be used solely for implementation of the measures associated with the Project. Financial assurance can be provided to the CPM and CDF~~G~~**W**in the form of an irrevocable letter of credit, a pledged savings account or Security prior to initiating ground-disturbing Project activities. Prior to submittal to the CPM, the Security shall be approved by the CPM,

in consultation with CDF~~G~~**W**, to ensure funding. The final amount due shall be determined by updated appraisals and the PAR analysis conducted pursuant to **BIO-12.**

3. Preparation of Management Plan: The Project owner shall submit to the CPM and CDFW a draft Management Plan that reflects site-specific enhancement measures for the drainages on the acquired compensation lands. The objective of the Management Plan shall be to enhance the wildlife value of the drainages, and may include enhancement actions such as weed control, fencing to exclude livestock, or erosion control.

4. Code of Regulations: The Project owner shall provide a copy of this condition (Condition of Certification **BIO-21**) from the Energy Commission Decision to all contractors, subcontractors, and the Applicant's Project supervisors. Copies shall be readily available at work sites at all times during periods of active work and must be presented to any CDF~~G~~**W** personnel upon demand. The CPM reserves the right to issue a stop work order or allow CDF~~G~~**W** to issue a stop work order after giving notice to the Project owner and the CPM, if the CPM in consultation with CDF~~G~~**W**, determines that the Project owner has breached any of the terms or conditions or for other reasons, including but not limited to the following:

   a. The information provided by the Applicant regarding impacts to waters of the state is incomplete or inaccurate;

   b. New information becomes available that was not known in preparing the terms and conditions; or

   c. The Project or Project activities as described in the Revised Staff Assessment have changed.

5. Road Crossings at Streams. The Project owner shall preserve pre-development downstream flows and sediment transport in washes crossed by permanent roads by incorporating culverts and Arizona crossings at stream crossings. Arizona crossings are the preferred option and shall be employed wherever such crossings do not present a safety hazard and where the roadbed elevation allows the construction of such crossings. Drainages that have been graded for temporary construction access shall be restored to original contours and surface drainage patterns and shall be revegetated according to specifications in **BIO-8**.

~~6. Diffuser Design. The Project owner shall maintain pre-project flow patterns (location and volume of flows) downstream of the Project boundaries. Flows shall not be discharged indiscriminately as sheet flow across the entire length of the diffusers, irrespective of the natural surface drainage patterns, but rather shall be designed to discharge into existing natural washes downslope of the Project.~~

7. Best Management Practices: The Project owner shall also comply with the following conditions to protect drainages near the Project Disturbance Area:

   a. The Project owner shall minimize road building, construction activities and vegetation clearing within ephemeral drainages to the extent feasible.

   b. The Project owner shall not allow water containing mud, silt, or other pollutants from grading, aggregate washing, or other activities to enter ephemeral drainages or be placed in locations that may be subjected to high storm flows.

   c. The Project owner shall comply with all litter and pollution laws. All contractors, subcontractors, and employees shall also obey these laws, and it shall be the responsibility of the Project owner to ensure compliance.

   d. Spoil sites shall be located at least 30 feet from the boundaries and drainages or in locations that may be subjected to high storm flows, where spoils might be washed back into drainages.

   e. Raw cement/concrete or washings thereof, asphalt, paint or other coating material, oil or other petroleum products, or any other substances that could be hazardous to vegetation or wildlife resources, resulting from Project-related activities, shall be prevented from contaminating the soil and/or entering waters of the state. These materials, placed within or where they may enter a drainage, shall be removed immediately.

   f. No broken concrete, debris, soil, silt, sand, bark, slash, sawdust, rubbish, cement or concrete or washings thereof, oil or petroleum products or other organic or earthen material from any construction or associated activity of whatever nature shall be allowed to enter into, or placed where it may be washed by rainfall or runoff into, waters of the state.

   g. When operations are completed, any excess materials or debris shall be removed from the work area. No rubbish shall be deposited within 150 feet of the high water mark of any drainage.

   h. No equipment maintenance shall occur within 150 feet of any ephemeral drainage where petroleum products or other pollutants from the equipment may enter these areas under any flow.

8. Changes of Conditions. A notifying report shall be provided to the CPM and CDF~~G~~**W** if a change of conditions is identified. As used here, change of condition refers to the process, procedures, and methods of operation of a Project; the biological and physical characteristics of a Project area; or the laws or regulations pertinent to the Project as defined below. A copy

of the notifying change of conditions report shall be included in the annual reports or until it is deemed unnecessary by the CPM, in consultation with CDF~~G~~**W**.

a. Biological Conditions: a change in biological conditions includes, but is not limited to, the following: 1) the presence of biological resources within or adjacent to the Project area, whether native or non-native, not previously known to occur in the area; or 2) the presence of biological resources within or adjacent to the Project area, whether native or non-native, the status of which has changed to endangered, rare, or threatened, as defined in section 15380 of Title 14 of the California Code of Regulations.

b. Physical Conditions: a change in physical conditions includes, but is not limited to, the following: 1) a change in the morphology of a river, stream, or lake, such as the lowering of a bed or scouring of a bank, or substantial changes in stream form and configuration caused by storm events; 2) the movement of a river or stream channel to a different location; 3) a reduction of or other change in vegetation on the bed, channel, or bank of a drainage, or 4) changes to the hydrologic regime such as fluctuations in the timing or volume of water flows in a river or stream.

c. Legal Conditions: a change in legal conditions includes, but is not limited to, a change in Regulations, Statutory Law, a Judicial or Court decision, or the listing of a species, the status of which has changed to endangered, rare, or threatened, as defined in section 15380 of Title 14 of the California Code of Regulations.

Verification: No less than 30 days prior to the start of **site mobilization and** construction-related ground disturbance activities potentially affecting waters of the state, the Project owner shall provide written verification (i.e., through incorporation into the BRMIMP) to the CPM that the above best management practices will be implemented. The Project owner shall also provide a discussion of work in waters of the state in Annual Compliance Reports for the duration of the Project.

No less than 30 days prior to beginning Project ground-disturbing activities for each project phase as described in **BIO-29**, the Project owner shall provide to the CPM design drawings ~~of drainage diffusers depicting how these structures restore~~ **demonstrating how** pre-development drainage patterns (location and volume of flows) to drainages downstream of the Project boundaries **will be unaffected**. At the same time the Project owner shall provide design drawings for temporary and permanent stream crossings.

No less than 30 days prior to beginning Project ground-disturbing activities, the Project owner shall provide the form of Security in accordance with this condition of certification. No later than 7 days prior to beginning Project ground-disturbing activities, the Project owner shall provide written verification of the actual Security. The Project owner, or an approved third party, shall complete and provide written verification of the proposed compensation lands acquisition within 18 months of the start of Project ground-disturbing activities.

The Project owner, or an approved third party, shall provide the CPM, BLM, CDF~~G~~**W,** and USFWS with a management plan for the compensation lands and associated funds within 180 days of the land or easement purchase, as determined by the date on the title. The CPM shall review and approve the management plan, in consultation with CDF~~G~~**W** and the USFWS.

Within 90 days after completion of Project construction, the Project owner shall provide to the CPM, BLM, USFWS, and CDF~~G~~**W** an analysis with the final accounting of the amount of jurisdictional state waters disturbed during Project construction.

The Project owner shall provide written verification to the CPM, BLM, USFWS and CDF~~G~~**W** that the compensation lands or conservation easements have been acquired and recorded in favor of the approved recipient no later than 18 months of the start of Project ground-disturbing activities.

The Project owner shall notify the CPM and CDF~~G~~**W**, in writing, at least five days prior to initiation of Project ground-disturbing activities in jurisdictional state waters and at least five days prior to completion of Project activities in jurisdictional areas. The Project owner shall notify the CPM and CDF~~G~~**W** of any change of conditions to the Project, impacts to state waters, or the mitigation efforts.

~~DECOMMISSIONING~~ CLOSURE AND RECLAMATION PLAN

BIO-22 Upon Project closure the Project owner shall implement a final ~~Decommissioning~~ **Closure** and Reclamation Plan. The ~~Decommissioning~~ **Closure** and Reclamation Plan shall include a cost estimate for implementing the proposed ~~decommissioning~~ **closure** and reclamation activities, and shall be consistent with the guidelines in BLM's 43 CFR 3809.550 et seq.

Verification: No fewer than 30 days prior to the start of **site mobilization and construction** ~~Project-related ground disturbing~~ activities or alternate date as agreed to with the BLM, the Project owner shall provide to the CPM (for review) and BLM (for review and approval) a draft ~~Decommissioning~~ **Closure** and Reclamation Plan. The plan shall be finalized prior to the start of commercial operation and reviewed every five years thereafter and submitted to the CPM for review and to the BLM for approval. Modifications to the approved ~~Decommissioning~~ **Closure** and Reclamation Plan shall be made only after approval from the BLM. The Project owner shall provide a copy of the approved ~~Decommissioning~~ **Closure** and Reclamation Plan and any BLM approved revisions to the CPM.

GROUNDWATER DEPENDENT VEGETATION MONITORING

BIO-23 The Project owner shall prepare a Groundwater-Dependent Vegetation Monitoring Plan for monitoring the Project effects of groundwater pumping on groundwater dependent vegetation. The monitoring shall encompass the area depicted in *Figure Soil and Water-~~3~~**14*** (*~~Project Only Revised Operational Water Supply End of 30 Years~~**Chuckwalla Valley Groundwater Basin Impacts to Groundwater Basin Impacts to Groundwater Levels, End of***

Operation) within the 0.1-foot drawdown polygon of the Model Predicted Drawdown ~~(Galati & Blek 2010i)~~. The vegetation and groundwater data collected as part of the Plan shall be used to determine if remedial action is required, as described in **BIO-24.**

The Project owner may forgo development of a Groundwater Dependent Vegetation Monitoring Plan, or may cease implementation of such a plan, by providing evidence to the CPM that the source of water for the GDEs is a shallow perched water-bearing zone rather than the regional groundwater system and that the shallow perched water-bearing zone is unrelated and not influenced by the regional groundwater system that the Project owner proposes to use for water as described below under 15a – 15d.

The Project owner shall develop and implement a Groundwater-Dependent Vegetation Monitoring Plan (Plan) that meets the performance standards described below and includes the following components:

1. Monitoring Objectives and Performance Standards. The objectives of the Plan shall be to monitor the Project effects of groundwater pumping on vegetation and groundwater-dependent ecosystems (GDEs) and, in conjunction with the remedial action described in **BIO-24**, to ensure that the Project groundwater pumping has a less than significant effect on biological resources. Monitoring shall be conducted at a level of detail adequate for detecting adverse effects, as reflected in vegetation attributes and groundwater levels in the shallow (alluvial) aquifer. The baseline for groundwater levels shall be the lowest baseline water level as measured at the Project site prior to the start of groundwater pumping.

2. Location of Monitoring Plots. The monitoring plots shall be established within the area depicted in *Figure Soil and Water -~~3~~**14** (Project Only Revised Operational Water Supply End of 30 Years~~ Years~~**Chuckwalla Valley Groundwater Basin Impacts to Groundwater Basin Impacts to Groundwater Levels, End of Operation**)* within the Model Predicted Drawdown showing the 0.1-foot drawdown polygon ~~(Galati & Blek 2010i)~~. The majority of the plots shall be in the area north and east of the Project site, where groundwater-dependent ecosystems (GDEs) and the intersection of the ground surface and shallow groundwater are located, in the topographic lows in the valley.

3. Monitoring Plots and Controls. Because of the variation in vegetation types and depth to groundwater within the predicted groundwater drawdown zone, the study design shall treat the monitoring plot with a corresponding control plot as a pair (versus comparing the mean of all treatment plots to the mean of all control plots). The “control” plots shall consist of the data collected at the same plot during the baseline (pre-disturbance) monitoring for a pre-disturbance vs. post-disturbance comparison. Appropriate statistical methods shall be used to analyze the

differences between the control and monitoring plots (for example, a one-tailed paired-sample statistical test (Manly 2008)[21]).

4. Off-Site Reference Plots: Off-site monitoring plots shall be established as reference sites to distinguish changes in plant vigor seen at the site from the effects of a region-wide drought. The off-site reference plots can be located within Chuckwalla Valley but shall be within areas that would not be affected hydrologically by groundwater pumping for the Project or other projects or agricultural operations. Off-site monitoring reference plots shall be located in the same general hydrologic and geologic setting (i.e., playa margins), in the same climatic region (Sonoran Desert region of California), and contain the same natural communities or vegetation alliances as those to which they are being compared. Impacts from pests and diseases, if present, must also be considered and excluded or adjusted for as part of the analysis. Data on climate and surface runoff in the study area shall be collected to identify "drought" conditions and correlate groundwater changes and weather changes.

5. Sample Size and Design The number of monitoring sites shall be established using appropriate statistical methods (for example, by a "priori power analysis" (Elzinga et al. 1998)) and shall be sufficient to achieve adequate (90%) statistical power. Following collection of the baseline data a statistical analysis shall be conducted to refine the power analysis and evaluate the adequacy of the sampling design. If the analysis of baseline data indicates that the sampling design is insufficient to achieve adequate statistical power, the design shall be modified (for example, by adding additional monitoring sites).

6. Water Table Monitoring. The Project owner shall install piezometers at each of the dominant vegetation community types within or near the monitoring plots. The number, location, depth and monitoring frequency of the piezometers shall be sufficient to establish the effect of Project groundwater pumping on the shallow aquifer water levels. At a minimum, each piezometer shall be monitored twice per year, in early spring (March) and post-monsoon (September). The piezometers shall be designed to monitor the maximum expected fluctuation in the water table and to last the duration of the Project. Data collected from the Project wells and piezometers for **SOIL &WATER-4** (Groundwater Level Monitoring, Mitigation, and Reporting) and **S&W-6** (groundwater monitoring for the evaporation ponds and land treatment unit) shall be used to refine the modeling of the predicted groundwater drawdown and zone of influence after two years of data collection following the start of groundwater production. The Project owner shall submit to the CPM, for review and approval, a report on the results of the refined modeling. The report shall include all calculations and assumptions made in development of report data and interpretations, and all well monitoring data and piezometer data

[21] Manly, B. 2008. Statistics for Environmental Science and Management (2nd ed). CRC Press/Chapman and Hall. 292 pages.

collected and used in the calculations. If the results indicate that the drawdown and zone of influence is greater than the effect predicted in the GRI, and the GDE are found to be drawing groundwater that is hydraulically connected to the regional groundwater system, then the project owner will submit a revised monitoring plan for GDE areas outside of the original monitoring area.

7. Soil Monitoring. Soil salinity and pH shall be monitored annually at every monitoring plot. The Plan shall describe the monitoring devices and techniques used to collect and interpret this data, relative to ecosystem function. One soil core sample per community type shall be collected as part of the baseline data to establish the approximate rooting depth of the phreatophytes, and thereafter shall be repeated every five years. The coring method must provide a continuous core that will provide visual examination of roots and root nodules, soil profile, and soil moisture.

8. Baseline and Long-term Data Collection. At a minimum, baseline data shall be collected at all monitoring sites prior to the start of pumping; however, vegetation data collected from sites farther from the nearest wells will allow for the collection of multiple years of “pre-disturbance” data. ~~Although the project proposes to begin construction (and pumping) by December 2010, it appears that the effects of pumping would not reach the areas supporting the GDEs or phreatophytic plants for several years (see C.9 **Soil and Water Resources**).~~ Because the proposed well in the northeast portion of the ~~P~~roject (Soil & Water Figure 1**4**, ~~Galati & Blek 2010i~~) is located in very close proximity to known phreatophytes, this well shall not be used within the first 3 years of the ~~P~~roject in order to allow an adequate period for baseline data collection in the area northeast of the Project. Subject to approval by the CPM, if groundwater pumping ceases or is replaced by other water sources, groundwater and vegetation monitoring shall continue for a period of 5 years or until refined modeling indicates that the groundwater levels have returned to baseline levels and the decline in plant vigor has been restored to pre-disturbance conditions.

9. Target Vegetation Population. The monitoring sites shall include GDEs and other vegetation potentially affected by the drawdown that occur**s** within the zone of influence. The following phreatophytes have been documented to occur around Palen Lake: honey mesquite (*Prosopis glandulosa*); iodine bush (*Allenrolfea occidentalis*), bush seep-weed (*Suaeda moquinii*), jackass clover (*Wislizenia refracta*), four-wing saltbush (*Atriplex canescens*), allscale (*A. polycarpa*), spinescale (*A. spinifera*), a potentially new taxon of saltbush (*Atriplex* sp. nov. Andre), ironwood (*Olneya tesota*), palo verde (*Cercidium microphyllum*), cat’s claw (*Acacia greggii*), and smoke tree (*Psorothamnus spinosus).*The final number of each community type sample needed shall be based on the *priori* power test conducted after the first year of baseline data collection.

10. Fine-Scale Vegetation Mapping. Within the monitoring sites vegetation shall be mapped to the alliance level, consistent with classification protocol in the *Manual of California, 2nd edition* (Sawyer et al. 2009) but any important associations shall also be mapped. Mapping shall be done using minimum 1 meter resolution color orthophotos or higher resolution infrared imagery. The mapping shall also be used to determine the acreages of GDEs and establish the amount of security to be deposited in the event that adverse effects are detected during the monitoring. Boundaries of the permanent plots and any off-site reference sites shall be recorded using GPS technology and depicted on the geo-referenced aerials. GIS shapefiles and metadata shall be submitted along with the draft Plan and any subsequent revisions to the Plan (i.e., following the collection of baseline data and subsequent power analysis).

11. Guidelines for the Monitoring Plan. The Groundwater-Dependent Vegetation Monitoring Plan (Plan) shall be prepared with guidance from *Measuring and Monitoring Plant Populations* (Elzinga et al. 1998). The Plan shall provide a detailed description of each of the following components:

    a. Sampling Design. The sampling design shall include a description of: a) the populations (vegetation types) sampled; b) number, size, and shape of the sampling units; c) layout of the sampling units; d) methods for permanently marking plots in the field; e) monitoring schedule/frequency; f) vegetation and other attributes sampled; and g) sampling objectives (target/threshold, change/trend-based) for each attribute.

    b. Habitat Function and Values. The Plan shall describe the hydrologic, geologic/geomorphic, geochemical, biological and ecological characteristics of the GDEs, and shall also describe whether species are obligate or facultative; root growth and water acquisition characteristics; morphological adaptations to the desert environment; reproduction and germination characteristics; general and micro-habitat preferences; obligate or facultative halophytes and phreatophytes; role in the morphology of dunes; and importance to wildlife, etc.

    c. Field techniques for measuring vegetation. This will include the vegetation (or other) attributes selected based on a demonstrated knowledge of the biology and morphology of the species, and include a discussion of the limitations involved in each measurement. Examples of appropriate field techniques for measuring drought response include: percent dieback; live crown density; crown height and width, percent cover of live (versus dead or residual) vegetation, percent cover/frequency of associated species; percent composition of native versus non-native species; and percent cover based on wetland status codes (OBL, FACW, FAC, FACU, UPL[22]) and status as phreatophytes or halophytes. Photo monitoring shall not be considered an acceptable monitoring method but may be useful to conduct periodically (e.g., every 3 to 5 years).

d. Data Management. Including how the data will be recorded in the field (e.g., using a GPS data dictionary), processed and stored.

e. Training of personnel. Describe minimum standards for training and monitoring personnel.

f. Statistical analysis. Describe statistical methods used to analyze the monitoring data (incorporating the minimum standards for statistical power and error rate described above).

12. Peer Review of the Plan. The draft Plan shall undergo a peer review by recognized experts, which shall include one or more scientists with expertise in: the preparation of monitoring plans for plant populations; the physiological responses of desert phreatophytes to drought stress; assessing the effects of groundwater withdrawal on vegetation in the desert region; and biostatistics. The Project owner shall provide the resumes of suggested peer reviewers to the CPM for review and approval.

13. Annual Monitoring Report. Annual Monitoring Reports shall be submitted to the CPM and BLM and shall include, at a minimum: a) names and contact information for the responsible parties and monitoring personnel; b) summaries of the results of the monitoring as required in **Soil&Water-4 and Soil&Water-6**; c) piezometer monitoring results**,** and a comparison of predicted versus actual water table declines; d) summary of the results of vegetation, groundwater, and soil monitoring data compared to the baseline data for each plot (pre- versus post-disturbance comparison); e) description of sampling and monitoring techniques used for each attribute; f) description of the data management and statistical analysis; g) photos; h) conclusions and recommendations for remedial action, if the monitoring data indicates that the threshold described below has been met.

The first Annual Monitoring Report shall include an appropriate statistical analysis using the first year baseline monitoring data to assess whether the sampling design was adequate to provide statistically meaningful data, as described above. If warranted, the first year Annual Monitoring Report shall include recommendations for revisions to the Plan based on this analysis.

[22] OBL= Obligate Wetland; FACW= Facultative Wetland; FAC= Facultative; FACU= Facultative Upland UPL= Obligate Upland. *In;* U.S. Fish and Wildlife Service. 1993. **1993 supplement to list of plant species that occur in wetlands: Northwest (Region 9).** Supplement to U.S. Fish & Wildlife Service Biological Report 88 (24.9). Online: http://plants.usda.gov/wetinfo.html

14. Threshold for Remedial Action: The Project owner shall implement remedial action, as described in Condition of Certification **BIO-24,** if the monitoring described in **BIO-23** detects a decline in plant vigor of 20 percent or more compared to the same plots pre-disturbance AND also detects a decline in the alluvial (shallow) aquifer confirmed by two consecutive annual water monitoring events in any amount greater than the lowest baseline water level as measured prior to groundwater pumping. If regional drought, off-site pumping or other activities unrelated to the Project are also contributing to the decline in water table, the Project owner shall only be responsible for the portion of the effect that can be statistically demonstrated to be the result of Project pumping. To determine whether declines in plant vigor are related to Project pumping as opposed to region wide drought or offsite pumping conditions the Project owner shall install a network background monitoring piezometers and incorporate these data in the assessment of Project-related effects on GDEs.

15. To understand the source of the water for the GDEs, the Project owner shall prepare a groundwater investigation work plan for submittal to the CPM that will outline steps to determine if the source of water for the GDEs is a shallow perched water-bearing zone rather than the regional groundwater system, and that the shallow perched water-bearing zone is not hydraulically connected to the regional groundwater system. The groundwater investigation will be comprised of the following components:

    a. A continuous soil coring program at five locations to be identified based on field mapping of GDEs in the area shown on the Figure *Soil and Water-~~3~~**14** (~~Project Only Revised Operational Water Supply End of 30 Years~~)* within the 0.1-foot drawdown polygon of the Model Predicted Drawdown (~~Galati & Blek 2010i~~). One of the five borings will be drilled adjacent to a GDE containing mesquite, and the other four located to provide an assessment of the range of plant communities within GDEs in the area of interest (i.e., to assess the variability of GDE plant type water requirements and root zone depth).

    b. The soil cores shall extend a minimum of 20 feet below the deepest root zones of the GDEs investigated to demonstrate separation between the shallow and regional water zones. At a minimum the soil cores shall show that 20 feet of unsaturated conditions are present below the deepest root zones of the plant communities investigated. The soil cores will be logged by a professional geologist in the State of California, and the coring program will be overseen by a qualified biologist with experienced in the plant communities identified within each GDE.

    c. A sampling plan for selective analysis of soil moisture content and saturation will also be conducted for each soil core advanced adjacent to a GDE. The number and frequency of soil samples shall be established to confirm field observations of soil moisture content in the shallow water-bearing zone, through the root zone and in the deeper sediments below the root zone above the regional water table. Soil samples shall be analyzed for moisture content after ASTM Method D2216.

d. Depending on the results of the soil coring program, piezometers may be installed as monitoring points for the regional water table and to monitoring changes in the shallow water-bearing zone from Project pumping. In the report of results from the soil coring program, a water-level monitoring program shall be proposed if it is shown that the regional water table is in direct hydraulic connection to the source of water to the GDE's. If the field data clearly shows an unsaturated zone of 20 feet or more below the deepest root zones of the GDEs, then piezometers will not be installed.

If the results of the pre-construction field observations and soil sampling demonstrate 20 feet or more of unsaturated sediments between the deepest root zones of the GDEs and the regional water table, there will be no requirements to implement any of the underlying conditions as provided for in **BIO-23** and **BIO-24**, as sufficient evidence will have been provided to demonstrate that the groundwater is not the source for the GDE's.

If the refined modeling of the predicted groundwater drawdown and zone of influence after two years of data collection (following the start of groundwater production), as described in Subsection 6 of this condition and in **SOIL&WATER-4** and **SOIL&WATER-6**, indicates the drawdown or zone of influence would be greater than predicted in the Project owner's Groundwater Resources Investigation (GRI), and the GDE are found to be drawing groundwater that is hydraulically connected to the regional groundwater system, then the project owner will submit a revised monitoring plan for GDE areas outside of the original monitoring area .

Verification: At least 30 days prior to operation of project pumping wells, the Project owner shall submit to the CPM and BLM for review and approval a draft Groundwater-Dependent Vegetation Monitoring Plan (Plan). The final plan shall incorporate recommendations from the peer review and shall be submitted to the CPM and BLM no less than 15 days prior to the start of groundwater pumping.

No less than 15 days prior to the start of groundwater pumping the Project owner shall submit as-built drawings indicating the location and depth of piezometers, and shall provide evidence that the piezometers are operational.

Baseline groundwater and groundwater-dependent vegetation monitoring shall begin 15 days prior to construction and shall occur every year during the same one to two week time period in early spring (March) and post-monsoon (September).

The First Annual Monitoring Report shall be provided to the CPM and BLM no later than January 31 following the first year of data collection, and shall include an assessment of whether the sampling design would provide statistically adequate monitoring data and whether modifications to the monitoring design would be needed. If the first Annual

Monitoring Report recommends a revised sampling design, the Project owner shall submit the revised Plan to the CPM and BLM no later than March 1.

Thereafter the Project owner shall submit a Groundwater-Dependent Vegetation Annual Monitoring Report to the CPM and BLM no later than January 31 of each year for the duration of Project operation.

If the project owner elects to prepare a geologic and groundwater investigation (as described in Subsection 15 a-d of this condition) to determine if the source of water for the GDEs is a shallow perched water-bearing zone rather than the regional groundwater system, and that the shallow perched water-bearing zone is not hydraulically connected to the regional groundwater system that the Project owner proposes to use for water supply, the project owner shall submit the resumes of at least two independent, qualified peer reviewers 45 days prior to submittal of the report to the CPM and BLM for review and approval. The Project owner must submit the results of their investigation, subject to review and approval by the CPM, prior to the start of construction or Project groundwater use.

If the refined modeling conducted according subsection 6 of this condition indicates that the drawdown and zone of influence is greater than the effect predicted in the GRI, and the GDE are found to be drawing groundwater that is hydraulically connected to the regional groundwater system, then the Project owner shall submit a revised monitoring plan for GDE areas outside of the original monitoring area. The Revised Monitoring Plan shall be submitted no later than January 31 in the third year following the start of groundwater pumping and well monitoring.

REMEDIAL ACTION AND COMPENSATION FOR ADVERSE EFFECTS TO GROUNDWATER-DEPENDENT BIOLOGICAL RESOURCES

BIO-24 If monitoring detects Project-related adverse impacts to groundwater dependent ecosystems (GDEs), as described in **BIO-23** and the impacts are shown to be the result of a decline in the regional groundwater table due to Project pumping, the Project owner shall determine which well(s) are the source of the adverse impacts and shall implement remedial measures as outlined below. If regional drought, off-site pumping or other activities unrelated to the Project are also contributing to the decline in water table, the Project owner shall only be responsible for the portion of the effect that can be demonstrated to be the result of Project pumping. The remedial measures shall be implemented with the objective of restoring the groundwater levels to the baseline described in **BIO-23**, and shall compensate for impacts to GDEs with off-site habitat acquisition or restoration. The Project owner shall do all of the following:

1. <u>Modification and/or Cessation of Pumping</u>: The Project owner shall provide to the CPM evidence based on groundwater monitoring and modeling indicating which wells are likely to be causing adverse impacts to GDEs. The Project owner shall initially modify operation of those wells to reduce the offsite drawdown in the areas of the GDEs.

2. Remedial Action Plan: The objective of remedial action shall be restoration of the spring groundwater table in the alluvial (shallow) aquifer to baseline levels, as described in **BIO-23**. The Remedial Action Plan shall include one or more of the following measures: 1) Begin rotational operation of the site water supply wells reducing pumping in wells that are the most proximal to the GDEs, 2) reducing the pumping rate in the wells that have been identified as the cause of the drawdown in the area of the GDEs, 3) focus pumping on wells on the southern portion of the project site away from the GDEs 4) cease operation of the well(s) that are the cause of the drawdown. Groundwater water level monitoring shall increase to a frequency necessary to document change and recovery in the drawdown from the changes in the pumping program.

   The Remedial Action Plan shall include a water level monitoring program of sufficient frequency to document changes in operation of the water supply wells, and demonstrate that the water table has been restored to baseline levels.

   The Project owner shall use the following guidelines for determining if an ecosystem (or species) is phreatophytic (Brown et al 2007; LeMaitre et al 1999; Froend & Loomes 2004):

   a. It is not known or documented to depend on groundwater, based on scientific literature or expert opinion (local knowledge can be useful in making a determination as some species' dependence varies by setting);

   b. The species are not known to have roots extending over a meter in depth;

   c. The community does not occur in an area where the water table is known to be 'near' the surface (relative to the documented rooting depths of the species);

   d. The herbaceous or shrub vegetation is not still green and/or does not have a high leaf area late in the dry season (compared to other dry areas in the same watershed that do not have access to groundwater).

3. Compensate for Loss of Ecosystem Function. If the decline in the water table in the alluvial (shallow) aquifer is accompanied by a corresponding decline in plant vigor greater than 20 percent (as described in BIO-23), the Project owner shall compensate for the loss of habitat functions and values in the affected groundwater-dependent ecosystems. The amount of compensation shall be at a 3:1 ratio based on area of affected area, using mapping as described in **BIO-23**. The Project owner shall acquire, in fee or in easement, a parcel or parcels of land that include an amount of groundwater-dependent vegetation that is of the same habitat-type as the community affected (e.g., mesquite woodland, alkali sink scrubs, or microphyll woodland) and of an equal or greater habitat quality. The compensation lands shall be located within the watersheds encompassing

the Chuckwalla or Palen valleys. As an alternative to habitat compensation, the Project owner may submit a plan that achieves restoration of lost habitat function and value at another location within the Chuckwalla Groundwater Basin that contains the same habitats as those affected.

a. Review and Approval of Compensation Lands Prior to Acquisition or Restoration. The Project owner shall submit a formal acquisition proposal to the CPM describing the parcel(s) intended for purchase. This acquisition proposal shall discuss the suitability of the proposed parcel(s) as compensation lands in relation to the criteria listed above. Approval from the CPM shall be required for acquisition of all compensatory mitigation parcels.

b. Preparation of Management Plan: The Project owner shall submit to the CPM and CDFW a draft Management Plan that reflects site-specific enhancement measures for the acquired compensation lands. The objective of the Management Plan shall be to maintain the functions and values of the acquired GDE plant communities and may include enhancement actions such as weed control, fencing to exclude livestock, or erosion control.

c. Delegation of Acquisition. The responsibility for acquisition of compensation lands may be delegated to ~~NFWF or another~~ **a** third party ~~other than NFWF,~~ such as a non-governmental organization supportive of desert habitat conservation, by written agreement of the Energy Commission. Such delegation shall be subject to approval by the CPM prior to land acquisition, enhancement or management activities.

Verification: No more than 30 days following submission of the Groundwater Dependent Vegetation Annual Monitoring Report the Project owner shall submit to the CPM for review and approval a draft Remedial Action Plan if that report indicates that the threshold for remedial action as described in **BIO-23** has been met. At the same time the Project owner shall submit written evidence that the Project wells responsible for impacts to groundwater levels and GDEs have modified their operation or ceased operation.

A final Remedial Action Plan shall be submitted to the CPM within 30 days of receipt of the CPM's comments on the draft plan. No later than 6 months following approval of the final Remedial Action Plan, the Project owner shall provide to the CPM written documentation of the effectiveness of the completed remedial action.

No more than 30 days following submission of the Groundwater-Dependent Vegetation Annual Monitoring Report**,** the Project owner shall provide to the CPM a final accounting of the amount of GDE habitat affected by Project groundwater pumping.

No more than 6 months following submission of the Groundwater-Dependent Vegetation Annual Monitoring Report the Project owner shall submit a formal acquisition or restoration proposal to the CPM, describing the mitigation parcels intended for purchase or restoration. The acquisition/restoration proposal shall describe how the proposed parcels meet the acquisition or restoration criteria described in this condition.

No fewer than 90 days prior to compensatory acquisition or restoration, the Project owner shall submit to the CPM and obtain CPM approval of any agreements to delegate land acquisition to an approved third party, or to manage compensation lands; such agreement shall be executed and implemented no more than months following approval of the acquisition proposal.

The Project owner shall provide written verification to the CPM that the compensation lands or conservation easements have been acquired and recorded in favor of the approved recipient no later than 18 months from submission of the Groundwater-Dependent Vegetation Annual Monitoring Report.

~~GOLDEN EAGLE INVENTORY AND MONITORING~~

~~**BIO-25**~~ ~~The Project owner shall implement the following measures to avoid or minimize Project-related construction impacts to golden eagles.~~

1. ~~Annual Inventory During Construction. For each calendar year during which construction will occur an inventory shall be conducted to determine if golden eagle territories occur within one mile of the Project boundaries. Survey methods for the inventory shall be as described in the Interim Golden Eagle Inventory and Monitoring Protocols; and Other Recommendations (Pagel et al. 2010) or more current guidance from the USFWS.~~

2. ~~Inventory Data: Data collected during the inventory shall include at least the following: territory status (unknown, vacant, occupied, breeding successful, breeding unsuccessful); nest location, nest elevation; age class of golden eagles observed; nesting chronology; number of young at each visit; digital photographs; and substrate upon which nest is placed.~~

3. ~~Determination of Unoccupied Territory Status: A nesting territory or inventoried habitat shall be considered unoccupied by golden eagles ONLY after completing at least 2 full surveys in a single breeding season. In circumstances where ground observation occurs rather than aerial surveys, at least 2 ground observation periods lasting at least 4 hours or more are necessary to designate an inventoried habitat or territory as unoccupied as long as all potential nest sites and alternate nests are visible and monitored. These observation periods shall be at least 30 days apart for an inventory, and at least 30 days apart for monitoring of known territories.~~

4. ~~Monitoring and Adaptive Management Plan: If an occupied[23] nest is detected within one mile of the Project boundaries, the Project owner shall prepare and implement a Golden Eagle Monitoring and Adaptive Management Plan for the duration of construction to ensure that Project construction activities do not result in injury or disturbance to golden eagles. The monitoring methods shall be consistent with those described in the Interim Golden Eagle Inventory and Monitoring Protocols; and Other Recommendations (Pagel et al. 2010) or more current guidance from the USFWS. The Monitoring and Management Plan shall be prepared in consultation with the USFWS. Triggers for adaptive management shall include any evidence of Project-related disturbance to nesting golden eagles, including but not limited to: agitation behavior (displacement, avoidance, and defense); increased vigilance behavior at nest sites; changes in foraging and feeding behavior, or nest site abandonment. The Monitoring and Adaptive Management Plan shall include a description of adaptive management actions, which shall include, but not be limited to, cessation of construction activities that are deemed by the Designated Biologist to be the source of golden eagle disturbance.~~

~~**Verification:** No fewer than 30 days from completion of the golden eagle inventory the project owner shall submit a report to the CPM, BLM, CDFGCDFW, and USFWS documenting the results of the inventory.~~

~~If an occupied nest is detected within one mile of the Project boundary during the inventory the Project owner shall contact staff at the USFWS Carlsbad Office and CDFGCDFW within one working day of detection of the nest for interim guidance on monitoring and nest protection. The project owner shall provide the CPM, CDFGCDFW, and USFWS with the final version of the Golden Eagle Monitoring and Management Plan within 30 days after detection of the nest. This final Plan shall have been reviewed and approved by the CPM in consultation with USFWS and CDFGCDFW.~~

EVAPORATION POND NETTING AND MONITORING

BIO-26 The Project owner shall cover the evaporation ponds prior to any discharge with 1.5-inch mesh netting designed to exclude birds and other wildlife from drinking or landing on the water of the ponds. Netting with mesh sizes other than 1.5-inches may be installed if approved by the CPM in consultation with CDFW and USFWS. The netted ponds shall be monitored regularly to verify that the netting remains intact, is fulfilling its function in excluding birds and other wildlife from the ponds, and does not pose an entanglement threat to birds and other wildlife. The ponds shall include a visual deterrent in addition to the netting, and the pond shall be designed such that the netting shall

[23] An occupied nest is one used for breeding by a pair of golden eagles in the current year. Presence of an adult, eggs, or young, freshly molted feathers or plucked down, or current years' mutes (whitewash) also indicate site occupancy. Additionally, all breeding sites within a breeding territory are deemed occupied while raptors are demonstrating pair bonding activities and developing an affinity to a given area. If this culminates in an individual nest being selected for use by a breeding pair, then the other nests in the nesting territory will no longer be considered occupied for the current breeding season. A nest site is considered occupied throughout the periods of initial courtship and pair bonding, egg-laying, incubation, brooding, fledging, and post-fledging dependency of the young.

never contact the water. Monitoring of the evaporation ponds shall include the following:

1. Monthly Monitoring. The Designated Biologist or Biological Monitor shall regularly survey the ponds at least once per month starting with the first month of operation of the evaporation ponds. The purpose of the surveys shall be to determine if the netted ponds are effective in excluding birds, if the nets pose an entrapment hazard to birds and wildlife, and to assess the structural integrity of the nets. The monthly survey shall be conducted in 1 day for a minimum of 2 hours following sunrise (i.e., dawn), a minimum of 1 hour mid-day (i.e., 1100 to 1300), and a minimum of 2 hours preceding sunset (i.e., dusk) in order to provide an accurate assessment of bird and wildlife use of the ponds during all seasons. Surveyors shall be experienced with bird identification and survey techniques. Operations staff at the Project site shall also report finding any dead birds or other wildlife at the evaporation ponds to the Designated Biologist within 1 day of the detection of the carcass. The Designated Biologists shall report any bird or other wildlife deaths or entanglements within 2 days of the discovery to the CPM, CDFW, and USFWS.

2. Dead or Entangled Birds. If dead or entangled birds are detected, the Designated Biologist shall take immediate action to correct the source of mortality or entanglement. The Designated Biologist shall make immediate efforts to contact and consult the CPM, CDFW, and USFWS by phone and electronic communications prior to taking remedial action upon detection of the problem, but the inability to reach these parties shall not delay taking action that would, in the judgment of the Designated Biologist, prevent further mortality of birds or other wildlife at the evaporation ponds.

3. Quarterly Monitoring. If after 12 consecutive monthly site visits no bird or wildlife deaths or entanglements are detected at the evaporation ponds by or reported to the Designated Biologist, monitoring, as described in paragraph 1, can be conducted on a quarterly basis.

4. Biannual Monitoring. If after 12 consecutive quarterly site visits no bird or wildlife deaths or entanglements are detected by or reported to the Designated Biologist and with approval from the CPM, USFWS, and CDFW, future surveys may be reduced to 2 surveys per year, during the spring nesting season and during fall migration. If approved by the CPM, USFWS, and CDFW, monitoring outside the nesting season may be conducted by the Environmental Compliance Manager.

5. Modification of Monitoring Program. CDFW or USFWS may submit a request for modifications to the evaporation pond monitoring program based on information acquired during monitoring, and may also suggest adaptive management measures to remedy any problems that are detected during monitoring or modifications if bird impacts are not observed. Modifications to the evaporation pond monitoring described above and implementation of adaptive management measures shall be

made only after approval from the CPM, in consultation with USFWS and CDFW.

Verification: No less than 30 days prior to operation of the evaporation ponds the project owner shall provide to the CPM as-built drawings and photographs of the ponds indicating that the bird exclusion netting has been installed. For the first year of operation the Designated Biologist shall submit quarterly reports to the CPM, BLM, CDF~~G~~**W**, and USFWS describing the dates, durations and results of site visits conducted at the evaporation ponds. Thereafter the Designated Biologist shall submit annual monitoring reports with this information. The quarterly and annual reports shall fully describe any bird or wildlife death or entanglements detected during the site visits or at any other time, and shall describe actions taken to remedy these problems. The annual report shall be submitted to the CPM, BLM, CDF~~G~~**W**, and USFWS no later than January 31 of every year for the life of the project.

REVEGETATION & RESTORATION OF TEMPORARILY DISTURBED AREAS

~~**BIO-27**~~ *Staff and the prior project owner agreed to delete this condition.*

IN-LIEU FEE MITIGATION OPTION

BIO-28 The Project owner may choose to satisfy its mitigation obligations by paying an in-lieu fee instead of acquiring compensation lands, pursuant to Fish and Game code sections 2069 and 2099. **Alternately, the CPM, in conjunction with the BLM, CDFW, and USFWS, may approve the project owner's use of another mitigation program** or any other applicable in-lieu fee provision, provided that the Project's in-lieu fee proposal **or mitigation program** is found by the ~~Commission~~ **CPM** to the mitigate the impacts identified herein. If the in-lieu fee proposal **or mitigation program** is found by the ~~Commission~~ **CPM, in coordination with the BLM, CDFW, and USFWS** to be in compliance, and the Project Owner chooses to satisfy its mitigation obligations through the in-lieu fee, the Project Owner shall provide proof of the in-lieu fee payment to the CPM prior to construction related ground disturbance.

Verification: If electing to use this provision, the Project owner shall notify the **CPM** ~~Commission and all parties to the proceeding~~ that it would like a determination that the Project's in-lieu fee proposal would mitigate for the impacts identified herein. Prior to **site mobilization and** construction related ground disturbance the Project Owner shall provide proof of the in lieu fee payment to the CPM.

PROJECT CONSTRUCTION PHASING PLAN

BIO-29 The Project Owner shall provide compensatory mitigation for the total Project Disturbance Area and may provide such mitigation in two phases for ~~Units 1 and 2 as described in Figures BIO-5 and BIO-6 in the July 19, 2010 Response to Data Request (AECOM 2010u~~) **as depicted in Figure 1 (Palen Solar - Construction Phases) in the Supplement No. 1 Petition to Amend dated February 8, 2013 or updated figure provided by project owner and approved by the CPM.** For purposes of this condition, the Project

Disturbance Area means all lands disturbed in the construction and operation of the ~~Palen~~ **Palen Solar Energy Generating System** Project or its phases, including all linears and ancillary facilities, as well as undeveloped areas inside the Project's boundaries that would no longer provide viable long-term habitat.

The disturbance area for each project Phase and resource type is provided in **BIO-29** Table 1 below. Mitigation is shown in **BIO-29** Table 2, and mitigation security is shown in **BIO-29 Table 3,** below**.** This table shall be refined prior to the start of each construction phase with the disturbance area adjusted to reflect the final Project footprint for each phase. Prior to initiating each phase of construction the Project owner shall submit the actual construction schedule, a figure depicting the locations of proposed construction and amount of acres to be disturbed. Mitigation acres are calculated based on the compensation requirements for each resource type as described in the above Conditions of Certification – **BIO-12** (Desert Tortoise), **BIO-20** (Mojave Fringe-toed Lizard), **BIO-18** (Western Burrowing Owl), and **BIO-22** (State Waters). Compensatory mitigation for each phase shall be implemented according to the timing required by each condition.

~~BIO-29 Table 1. Area of Habitat Type Disturbed by Construction Phase (acres)~~[1]

~~Habitat Type~~	~~Reconfigured Alternative 2 Disturbance Area~~		~~Reconfigured Alternative 3 Disturbance Area~~	
	~~Phase 1~~	~~Phase 2~~	~~Phase 1~~	~~Phase 2~~
~~MFTL Habitat~~	-	-	-	-
~~Stabilized & Partially Stabilized Dunes~~	~~44~~	~~112~~	~~59~~	~~128~~
~~Non-Dunes~~	~~637~~	~~711~~	~~509~~	~~845~~
~~Indirect Impacts~~[2]	**~~117~~**	**~~27~~**	**~~280~~**	**~~-186~~**
~~TOTAL~~	**~~798~~**	**~~850~~**	**~~848~~**	**~~787~~**
~~DT Habitat~~	-	-	-	-
~~DT Habitat - inside critical habitat~~[3]	~~225~~	~~0~~	~~225~~	~~0~~
~~DT Habitat - outside critical habitat~~	~~2115~~	~~1855~~	~~1969~~	~~1933~~
~~TOTAL~~[4] -	**~~2340~~**	**~~1855~~**	**~~2194~~**	**~~1933~~**
~~WBO Habitat~~	-	-	-	-
~~Impacts to 4 WBO~~	~~4 WBO~~	~~0~~	~~4 WBO~~	~~0~~
~~TOTAL~~ -	~~4 WBO~~	**~~0~~**	~~4 WBO~~	**~~0~~**
~~Jurisdictional Waters (Direct Impact)~~				
~~Dry Desert Wash Woodland~~	~~202~~	~~6~~	~~193~~	~~5~~
~~Unvegetated Ephemeral Dry Wash~~	~~99~~	~~81~~	~~95~~	~~73~~
~~Subtotal~~	***~~301~~***	***~~87~~***	***~~287~~***	***~~78~~***
~~Jurisdictional Waters (Indirect Impact)~~				
~~Dry Desert Wash Woodland~~	~~0~~	~~0~~	~~0~~	~~0~~
~~Unvegetated Ephemeral Dry Wash~~	~~17~~	~~2~~	~~15~~	~~2~~
~~Subtotal~~	***~~17~~***	***~~2~~***	***~~15~~***	***~~2~~***
~~TOTAL WATERS~~	**~~317~~**	**~~89~~**	**~~303~~**	**~~80~~**

~~1 – Sources: Reconfigured Alternatives 2 and 3 - Solar Millennium 2010l.~~
~~2 –Some indirect impacts in Alternative 3 within Phase 1 become direct impact in Phase 2. The security in Phase 3 is reduced to credit that portion of the security already provided to cover the indirect impacts in Phase 2.~~
~~3 – Impacts to desert tortoise critical habitat are assumed to be wholly within the Phase 1 Project Disturbance Area.~~
~~4 – Raven Acres subject to the one-time USFWS Regional Raven Management Program fee are equivalent to the total DT Habitat impact acreages.~~

~~BIO 29 Table 2. Mitigation by Habitat Type Disturbed by Construction Phase (acres)~~ [1]

Habitat Type	Mitigation Ratio	Reconfigured Alternative 2 Disturbance Area		Reconfigured Alternative 3 Disturbance Area	
		Phase 1	Phase 2	Phase 1	Phase 2
MFTL Habitat	-	-	-	-	-
Stabilized & Partially Stabilized Dunes	3:1	**132**	336	178	385
Non-Dunes	1:1	637	711	509	845
Indirect Impacts	0.5:1	**59**	**14**	**140**	**-93**
TOTAL	-	***828***	***1061***	***827***	***1137***
DT Habitat	-	-	-	-	-
DT Habitat - inside critical habitat[2]	5:1	1127	0	1126	0
DT Habitat - outside critical habitat	1:1	2115	1855	1969	1933
TOTAL	-	**3242**	**1855**	**3095**	**1933**
WBO Habitat		-	-	-	-
Impacts to 4 WBO	19.5 acre/WBO	78	0	78	0
TOTAL -		78	**0**	78	**0**
Jurisdictional Waters (Direct Impact)					
Vegetated (Dry Desert Wash Woodland)	3:1	605	18	578	15
Unvegetated Ephemeral Dry Wash	1:1	99	81	95	73
Subtotal	-	***704***	***99***	***673***	***88***
Jurisdictional Waters (Indirect Impact)					
Vegetated (Dry Desert Wash Woodland)	1.5:1	0	0	0	0
Unvegetated Ephemeral Dry Wash	0.5:1	8	1	8	1
Subtotal	-	***8***	***1***	***8***	***1***
TOTAL WATERS	-	**712**	**100**	**680**	**89**

~~1 – Sources: Reconfigured Alternatives 2 and 3 - Solar Millennium 2010l.~~
~~2 – Impacts to desert tortoise critical habitat are assumed to be wholly within the Phase 1 Project Disturbance Area.~~

~~BIO-29 Table 3. Mitigation Securities by Construction Phase (acres)~~ [1]

~~Habitat Type~~	~~Reconfigured Alternative 2 Security~~		~~Reconfigured Alternative 3 Security~~	
	~~Phase 1~~	~~Phase 2~~	~~Phase 1~~	~~Phase 2~~
~~MFTL Habitat~~	~~$2,553,714~~	~~$3,283,006~~	~~$2,550,739~~	~~$3,509,144~~
~~DT Habitat~~	~~$10,006,571~~	~~$5,735,553~~	~~$9,551,173~~	~~$5,967,642~~
~~Raven Fee Impacts~~[2]	~~$340,410~~	~~$194,775~~	~~$324,975~~	~~$202,965~~
~~WBO Habitat~~	~~$250,089~~	~~$0~~	~~$250,089~~	~~$0~~
~~Jurisdictional Waters~~	~~$2,190,556~~	~~$315,550~~	~~$2,095,340~~	~~$282,820~~
~~**Total**~~	~~**$15,341,340**~~	~~**$9,528,883**~~	~~**$14,772,315**~~	~~**$9,962,570**~~

~~1– Securities (aside from Raven fees) based on REAT Biological Resources Mitigation/Compensation Cost Estimate Calculation Table - July 23, 2010 (REAT 2010), adjusted to reflect a 160-acre parcel size estimate. Security does not include NFWF fees. Security amounts may change based on final Project footprint. The final amount shall be determined by an updated appraisal conducted as described in **BIO-12.**~~

~~2 – Based on U.S. Fish and Wildlife Service Cost Allocation Methodology for Implementation of the Regional Raven Management Plan, dated July 9, 2010 (USFWS 2010b). Fee calculated at $105/acre for direct project impacts.~~

BIO-29 Table 1. Area of Habitat Type Disturbed by Construction Phase (acres)[1]

Habitat Type	PSEGS Disturbance Area Phase 1	PSEGS Disturbance Area Phase 2
MFTL Habitat		
Stabilized & Partially Stabilized Dunes	0	186.8
Non-Dunes	34.2	1258.2
Indirect Impacts[2]	0	421
TOTAL	34.2	1,866
DT Habitat		
DT Habitat - inside critical habitat	172.2	52.2
DT Habitat - outside critical habitat	770.2	2902
DT Indirect Habitat - inside critical habitat	3.7	0
DT Direct Habitat - outside critical habitat	8	39.7
TOTAL[3]	954.1	2993.9
WBO Habitat		
Impacts to 4 WBO[4]	4 WBO	0
TOTAL	4 WBO	0
Jurisdictional Waters (Direct Impact)		
Dry Desert Wash Woodland	17.95	188.5
Unvegetated Ephemeral Dry Wash	10.9	157.3
Subtotal	28.85	345.8
Jurisdictional Waters (Indirect Impact)		
Dry Desert Wash Woodland	0.03	0
Unvegetated Ephemeral Dry Wash	0.04	0.47
Subtotal	0.08	0.47
TOTAL WATERS	28.93	346.27

1 – Sources: PSH Final Comments on the PSA (Palen 2013pp) and Geomorphic Assessment of Sand Transport for the Modified Project (Palen Solar Electric Generating System) (CEC 2013v)
2 –Project owner assumed 39.7 of indirect impacts for private parcel adjacent to project site however staff will provide an independent assessment of indirect impacts. Indirect impacts will be assessed pending results of additional sand transport modeling in the Final Staff Assessment.
3 – Raven Acres subject to the one-time USFWS Regional Raven Management Program fee are equivalent to the total DT Habitat impact acreages.
4 – Impact to burrowing owl may change based on results of additional burrowing owl surveys along proposed modified generation tie-line corridor and new natural gasline corridor.

BIO 29 Table 2. Mitigation by Habitat Type Disturbed by Construction Phase (acres) [1]

Habitat Type	Mitigation Ratio	PSEGS Disturbance Area	
		Phase 1	Phase 2
MFTL Habitat			
Stabilized & Partially Stabilized Dunes	3:1		560.4
Non-Dunes	1:1	34.2	
Indirect Impacts	0.5:1	0	210.5
TOTAL	-	34.2	2029.1
DT Habitat			
DT Habitat - inside critical habitat[2]	5:1	861	261
DT Habitat - outside critical habitat	1:1	770.2	2902
DT Indirect Habitat - inside critical habitat	5:1	18.50	0
DT Direct Habitat - outside critical habitat	1:1	8	39.7
TOTAL		1657.7	3202.7
WBO Habitat			
Impacts to 4 WBO	19.5 acre/WBO	78	0
TOTAL		78	0
Jurisdictional Waters (Direct Impact)			
Vegetated (Dry Desert Wash Woodland)	3:1	53.9	565.5
Unvegetated Ephemeral Dry Wash	1:1	10.9	157.3
Subtotal		64.8	722.8
Jurisdictional Waters (Indirect Impact)			
Vegetated (Dry Desert Wash Woodland)	1.5:1	0.05	0.00
Unvegetated Ephemeral Dry Wash	0.5:1	0.03	0.24
Subtotal		0.07	0.24
TOTAL WATERS		64.8	723.0

1 – Sources: Palen 2013pp except for indirect impacts to MFTL (2013v)
2 – Impacts to desert tortoise critical habitat are assumed to be within the Phase 1 and Phase 2 Project Disturbance Area.

BIO-29 Table 3. Mitigation Securities by Construction Phase (acres)[1]

Habitat Type	PSEGS Security	
	Phase 1	Phase 2
MFTL Habitat	$85,537	$6,287,168
DT Habitat	$5,116,816	$9,890,864
Raven Fee Impacts[2]	$100,181	$314,360
WBO Habitat	$250,089	$00.00
Jurisdictional Waters	$200,720	$2,232,624
Total	$5,753,343	$18,725,016

1– Securities (aside from Raven fees) based on REAT Biological Resources Mitigation/Compensation Cost Estimate Calculation Table - July 23, 2010 (REAT 2010), adjusted to reflect a 160-acre parcel size estimate. Security does not include authorized entity fees. Security amounts may change based on final Project footprint. The final amount shall be determined by an updated appraisal conducted as described in BIO-12.
2 – Based on U.S. Fish and Wildlife Service Cost Allocation Methodology for Implementation of the Regional Raven Management Plan, dated July 9, 2010 (USFWS 2010b). Fee calculated at $105/acre for direct project impacts.

Verification: The Project owner shall not disturb any area outside of the area that has been approved for that phase of construction and for the previously approved phases of construction.

No less than 30 days prior to the start of desert tortoise clearance surveys for each phase, the Project owner shall submit a description of the proposed construction activities for that phase to CDFW, USFWS and BLM for review and to the CPM for review and approval. The description for each phase shall include the proposed construction schedule, a figure depicting the locations of proposed construction, and amount of acres of each habitat type to be disturbed.

No less than 30 days prior to beginning Project ground-disturbing activities for each phase, the Project owner shall provide the form of Security in accordance with this Condition of Certification in the amounts described in **BIO-29 Table 3.** No later than 7 days prior to beginning Project ground-disturbing activities for each phase, the Project owner shall provide written verification of the actual Security. The Project owner, or an approved third party, shall complete and provide written verification of the proposed compensation lands acquisition within 18 months of the start of Project ground-disturbing activities for each phase.

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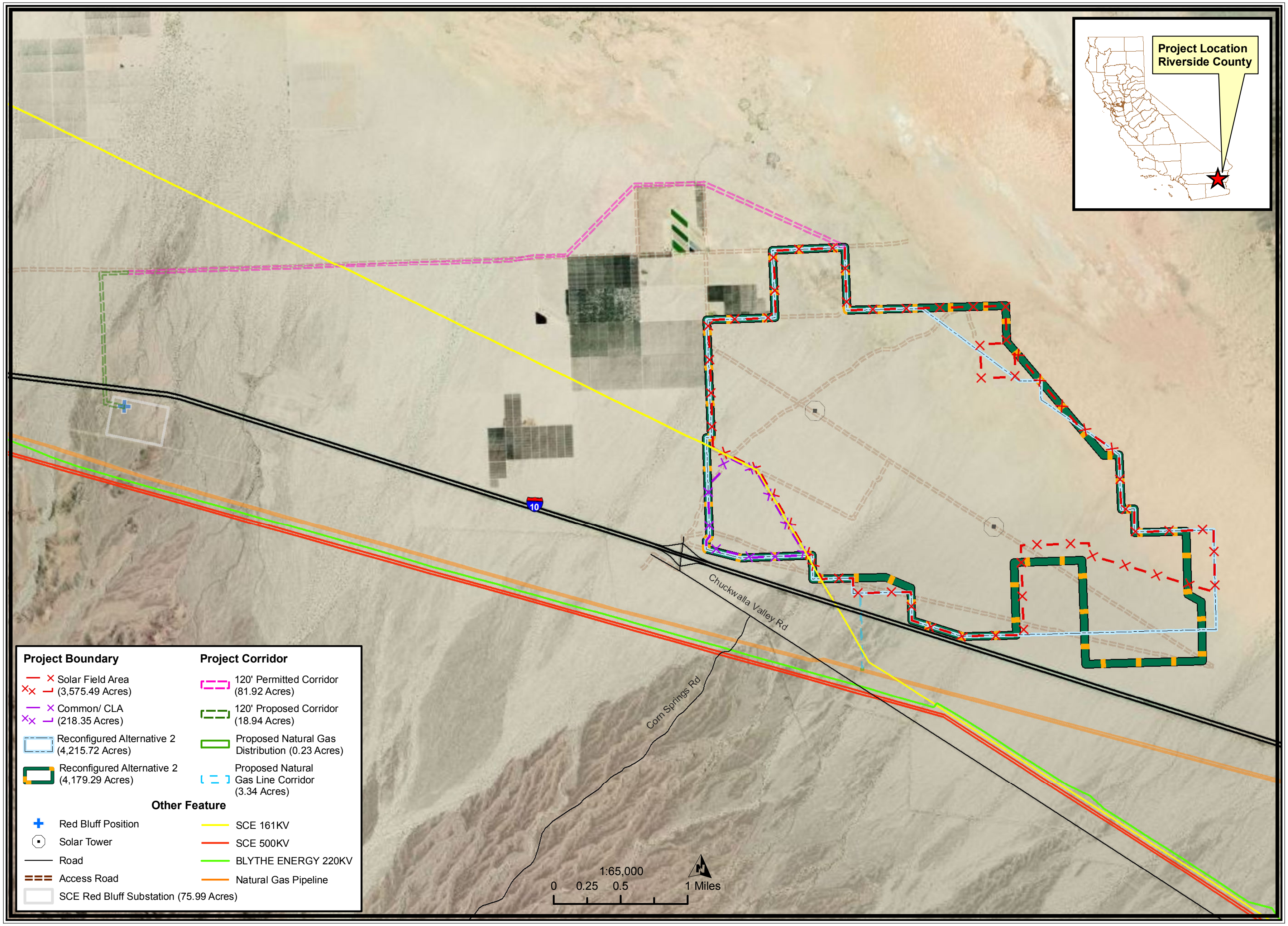
Willoughby, John. BLM State Botanist [retired] and co-author Measuring and monitoring plant populations (Elzinga et al. 1998). Various telephone and electronic communications with Carolyn Chainey-Davis, California Energy Commission, August 2010, regarding methods of statistical analysis of long-term vegetation monitoring programs.

BIOLOGICAL RESOURCES - FIGURE 1

Palen Solar Electric Generating System - Boundary of Approved and Modified Projects

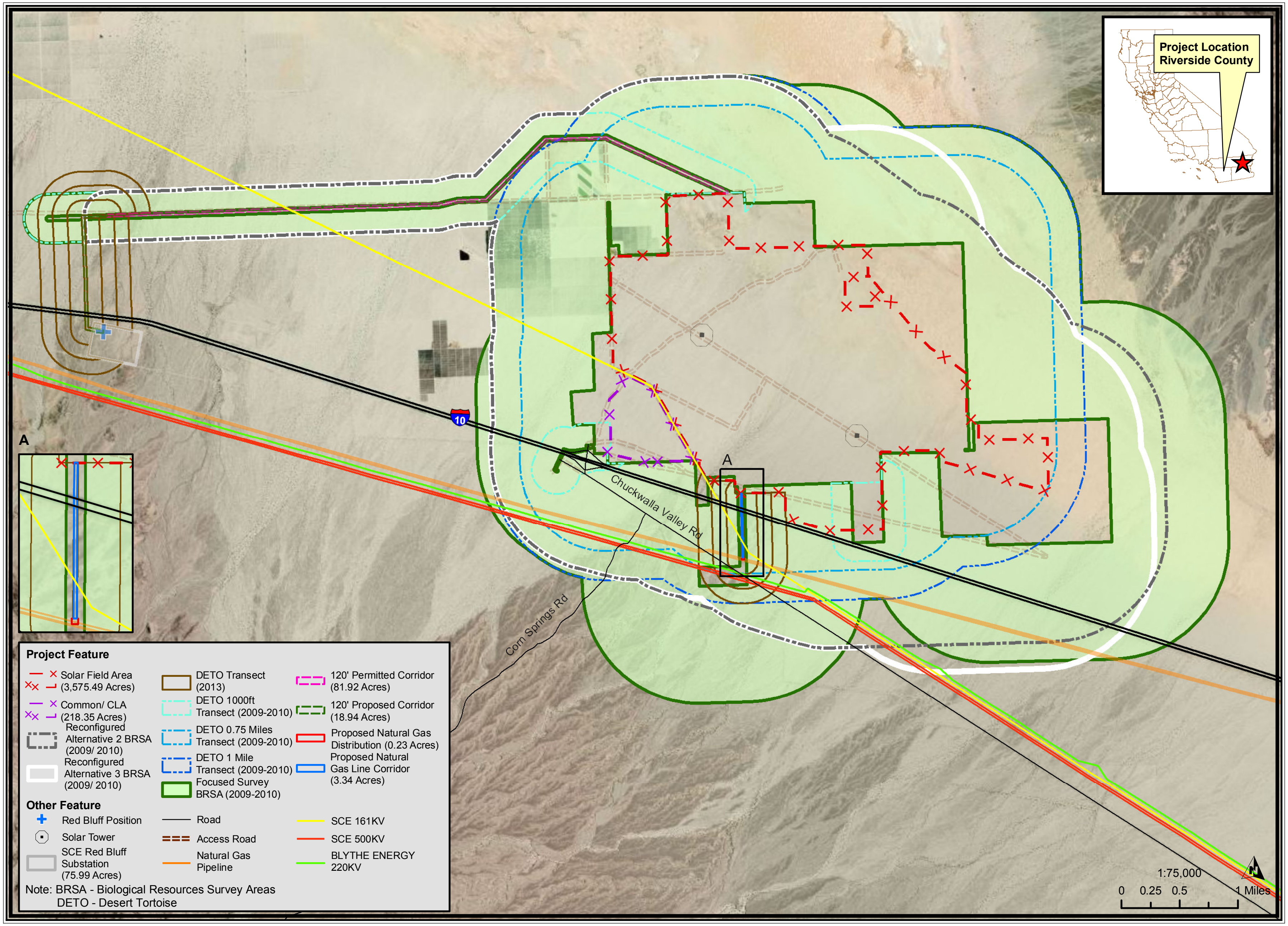


CALIFORNIA ENERGY COMMISSION - SITING,TRANSMISSION AND ENVIRONMENTAL PROTECTION DIVISION

SOURCE: SOURCE: Bing Aerial, BrightSource - May 2013, OpenStreetMap - May 2013, CEC Transmission Line, Natural Gas Line - June 2013

BIOLOGICAL RESOURCES - FIGURE 2

Palen Solar Electric Generating System - Biological Resources Survey Areas for Approved and Modified Projects



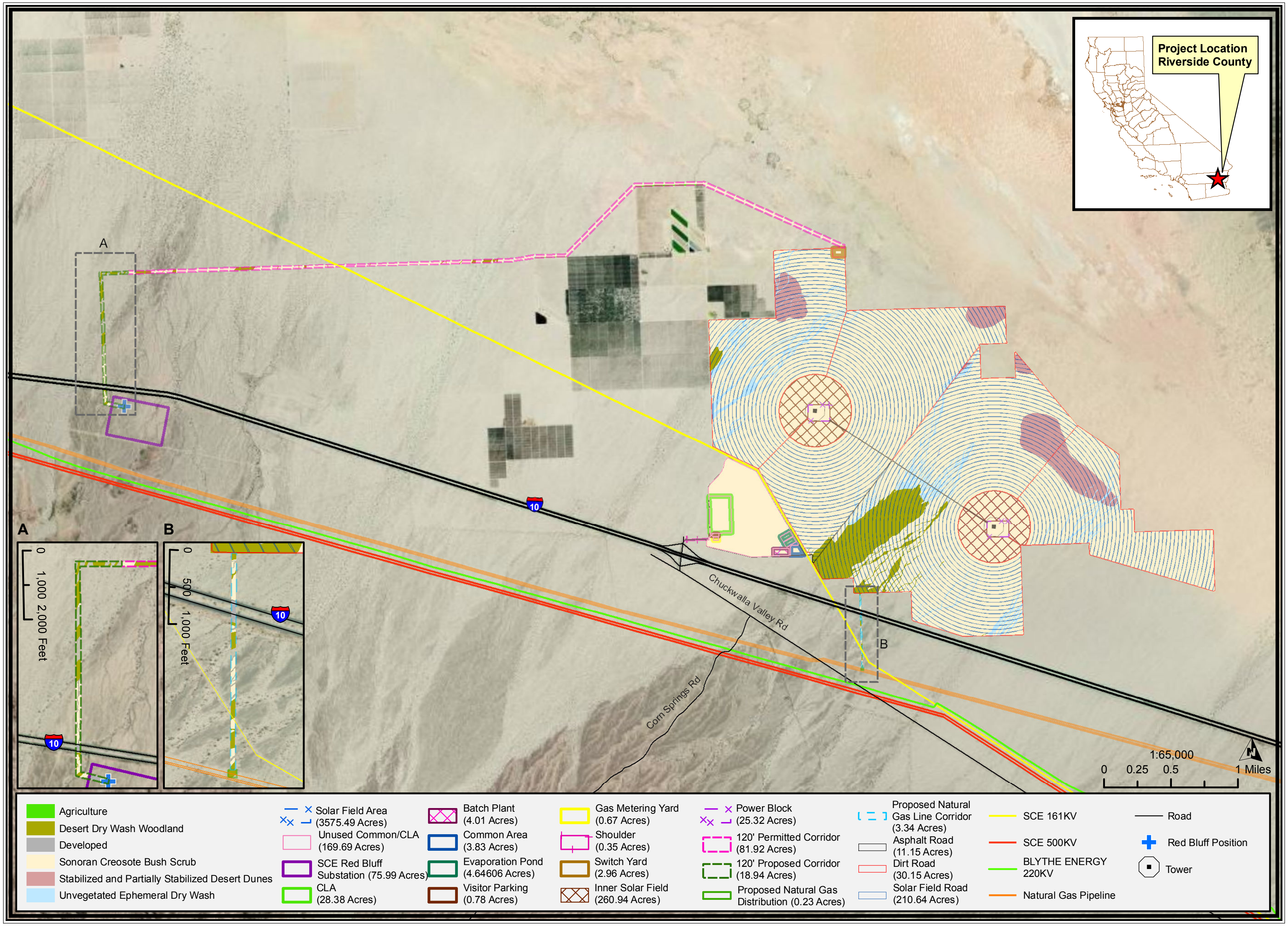
BIOLOGICAL RESOURCES

CALIFORNIA ENERGY COMMISSION - SITING,TRANSMISSION AND ENVIRONMENTAL PROTECTION DIVISION

SOURCE: SOURCE: Bing Aerial, BrightSource - May 2013, OpenStreetMap - May 2013, CEC Transmission Line, Natural Gas Line - June 2013

BIOLOGICAL RESOURCES - FIGURE 3

Palen Solar Electric Generating System - Vegetation Communities

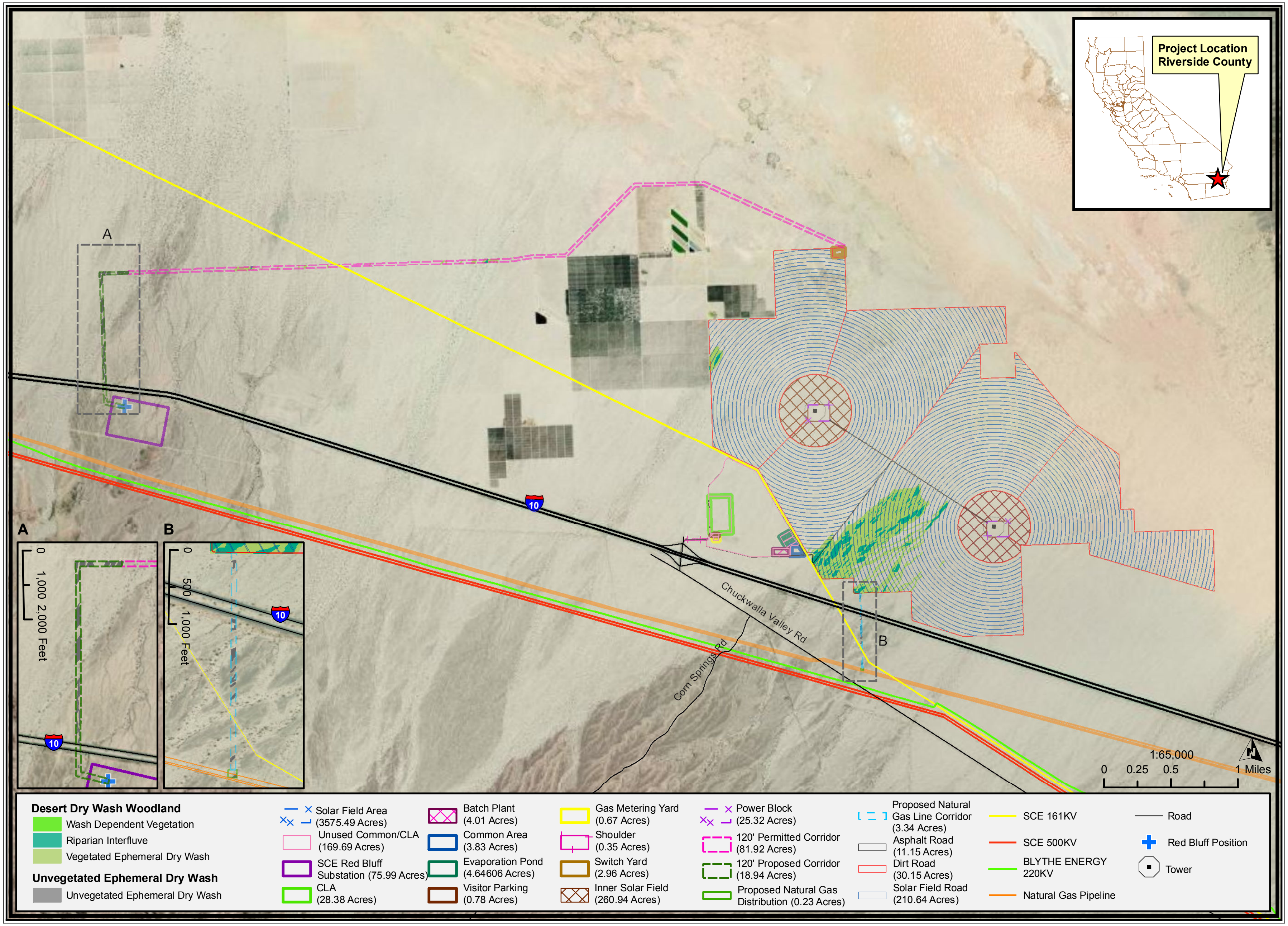


BIOLOGICAL RESOURCES

CALIFORNIA ENERGY COMMISSION - SITING,TRANSMISSION AND ENVIRONMENTAL PROTECTION DIVISION

SOURCE: SOURCE: Bing Aerial, BrightSource - May 2013, OpenStreetMap - May 2013, CEC Transmission Line, Natural Gas Line - August 2013

BIOLOGICAL RESOURCES - FIGURE 4
Palen Solar Electric Generating System - State Jurisdictional Waters

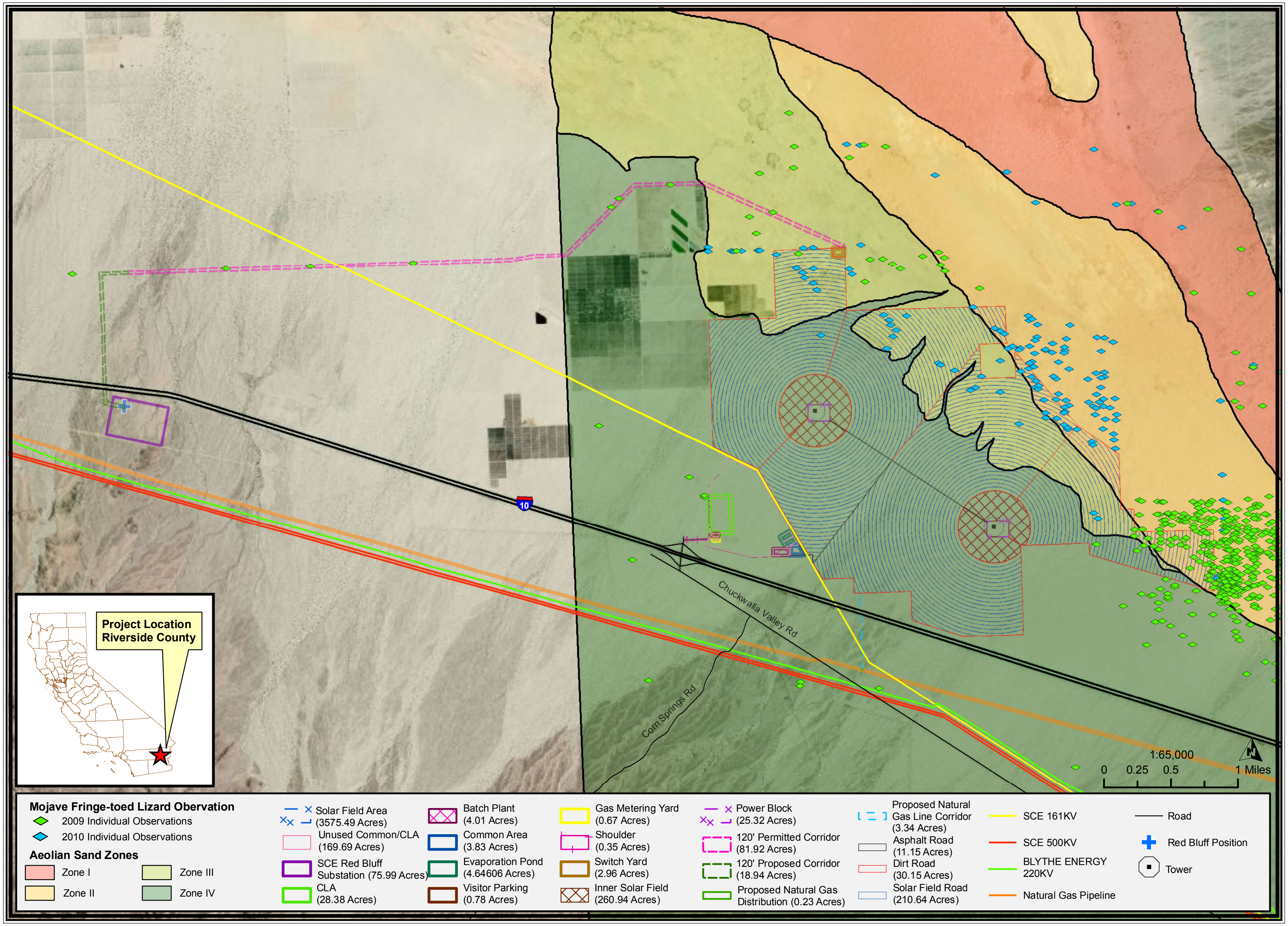


BIOLOGICAL RESOURCES

CALIFORNIA ENERGY COMMISSION - SITING,TRANSMISSION AND ENVIRONMENTAL PROTECTION DIVISION
SOURCE: SOURCE: Bing Aerial, BrightSource - May 2013, OpenStreetMap - May 2013, CEC Transmission Line, Natural Gas Line - August 2013

BIOLOGICAL RESOURCES - FIGURE 5

Palen Solar Electric Generating System - Mojave Fringe-toed Lizard Observation & Aeolian Sand Zones

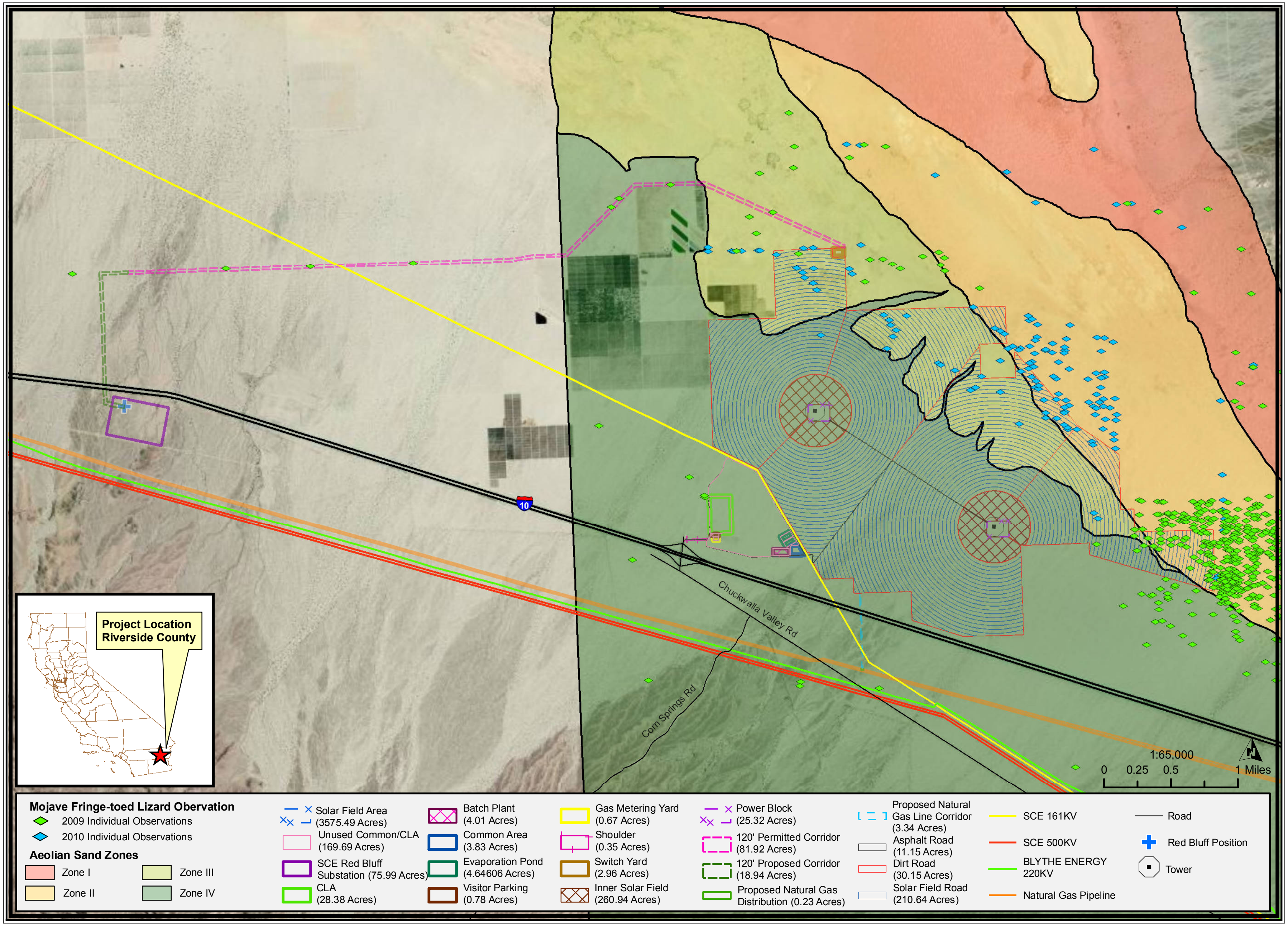


CALIFORNIA ENERGY COMMISSION - SITING,TRANSMISSION AND ENVIRONMENTAL PROTECTION DIVISION

SOURCE: SOURCE: Bing Aerial, BrightSource - May 2013, OpenStreetMap - May 2013, CEC Transmission Line, Natural Gas Line - June 2013

BIOLOGICAL RESOURCES - FIGURE 5A

Palen Solar Electric Generating System - Mojave Fringe-toed Lizard Observation & Aeolian Sand Zones



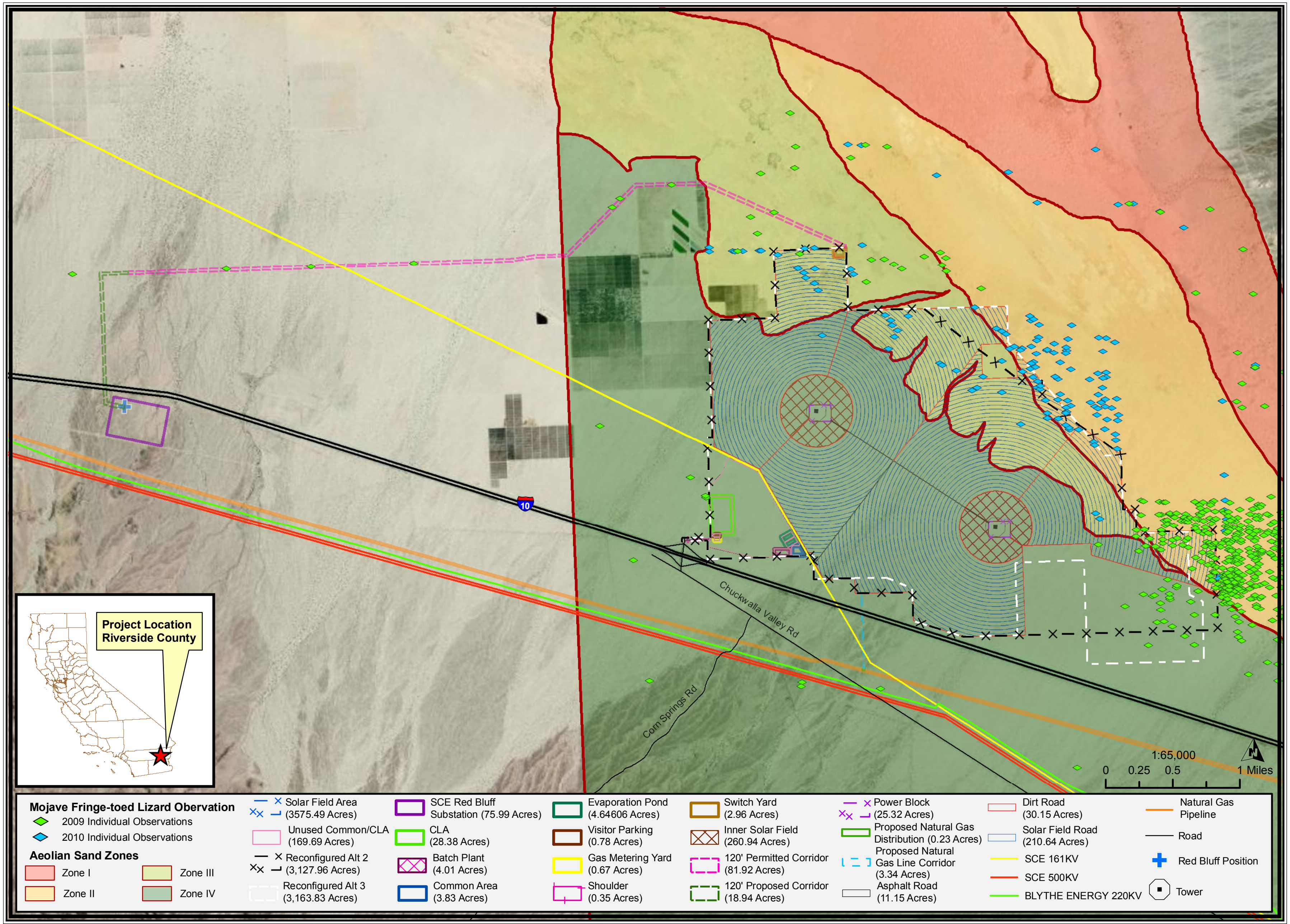
BIOLOGICAL RESOURCES

CALIFORNIA ENERGY COMMISSION - SITING,TRANSMISSION AND ENVIRONMENTAL PROTECTION DIVISION

SOURCE: SOURCE: Bing Aerial, BrightSource - May 2013, OpenStreetMap - May 2013, CEC Transmission Line, Natural Gas Line - June 2013

BIOLOGICAL RESOURCES - FIGURE 5B

Palen Solar Electric Generating System - Mojave Fringe-toed Lizard Observation & Aeolian Sand Zones

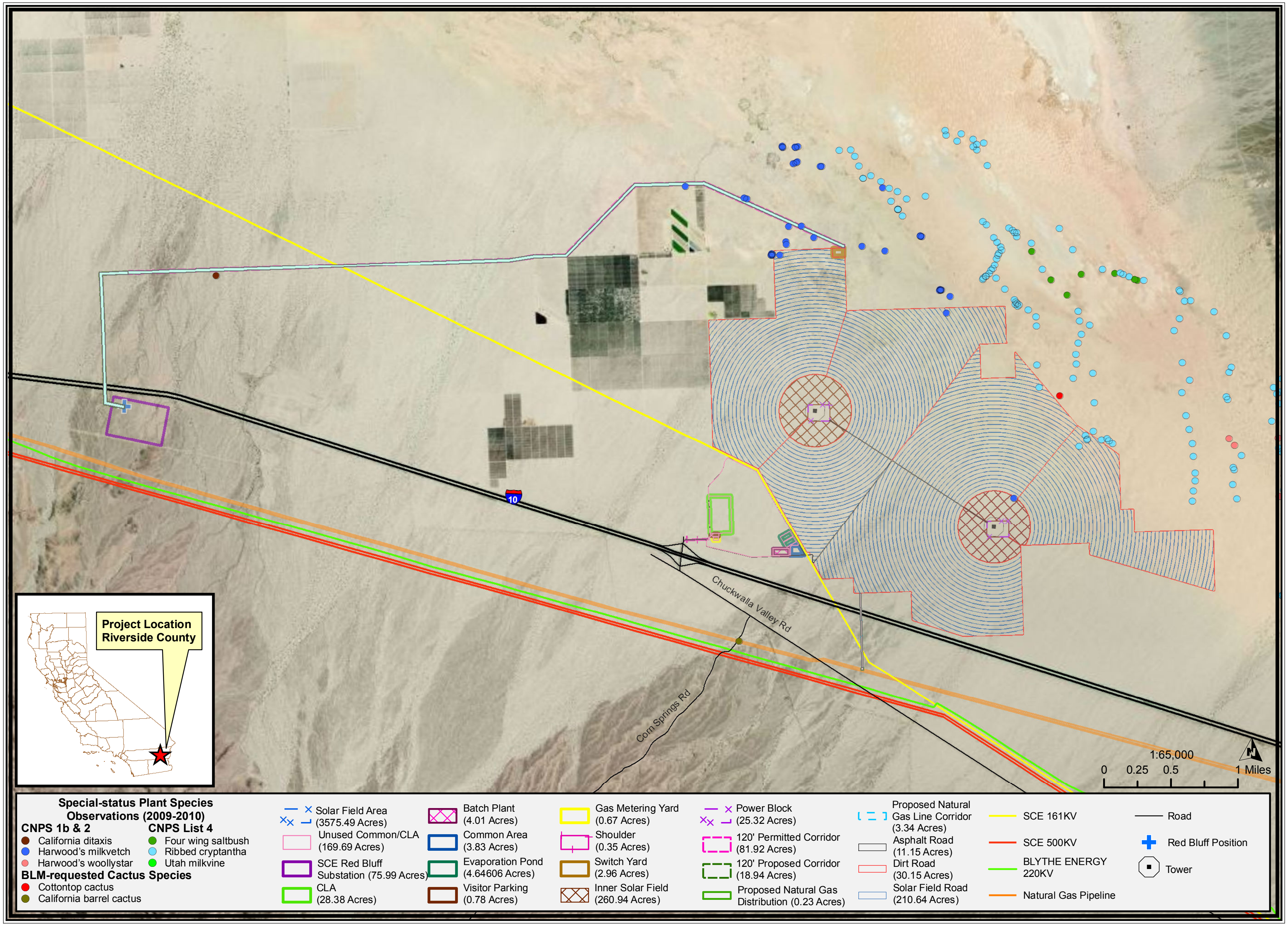


CALIFORNIA ENERGY COMMISSION - SITING,TRANSMISSION AND ENVIRONMENTAL PROTECTION DIVISION

SOURCE: SOURCE: Bing Aerial, BrightSource - May 2013, OpenStreetMap - May 2013, CEC Transmission Line, Natural Gas Line - June 2013

BIOLOGICAL RESOURCES - FIGURE 6

Palen Solar Electric Generating System - Special-status Plant Species

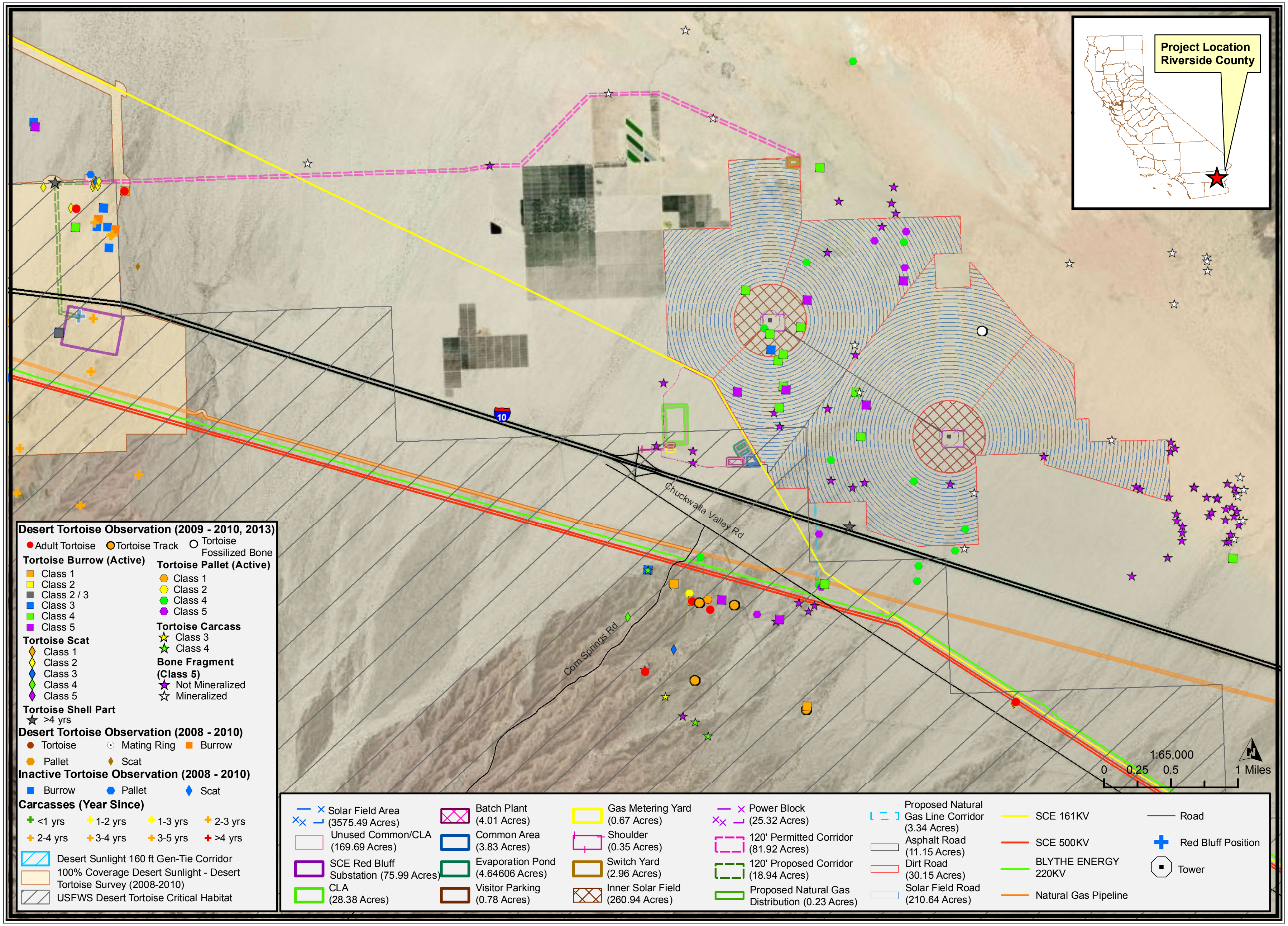


CALIFORNIA ENERGY COMMISSION - SITING,TRANSMISSION AND ENVIRONMENTAL PROTECTION DIVISION

SOURCE: SOURCE: Bing Aerial, BrightSource - May 2013, OpenStreetMap - May 2013, CEC Transmission Line, Natural Gas Line - June 2013

BIOLOGICAL RESOURCES - FIGURE 7

Palen Solar Electric Generating System - Desert Tortoise



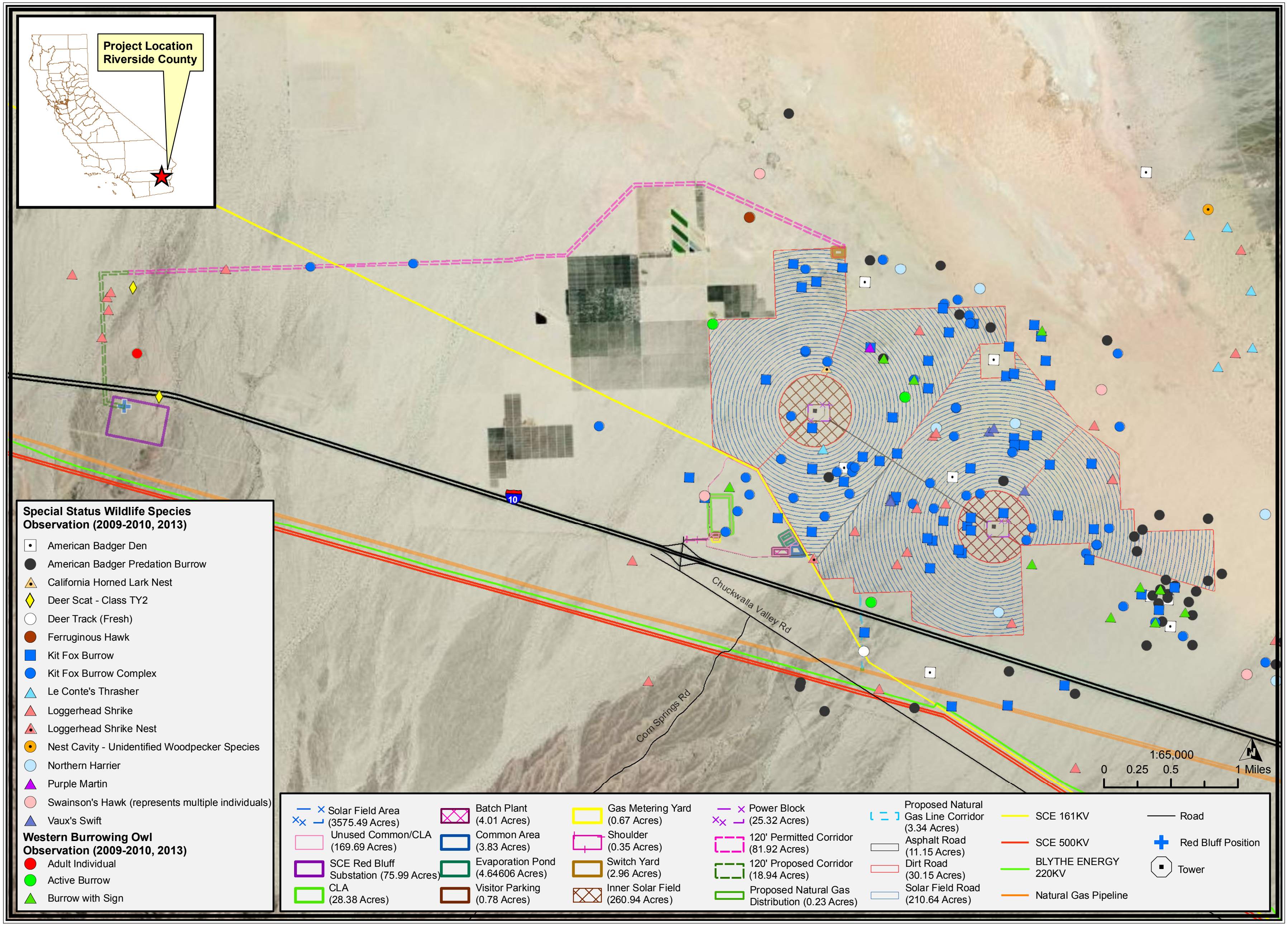
BIOLOGICAL RESOURCES

CALIFORNIA ENERGY COMMISSION - SITING,TRANSMISSION AND ENVIRONMENTAL PROTECTION DIVISION

SOURCE: SOURCE: Bing Aerial, BrightSource - May 2013, OpenStreetMap - May 2013, CEC Transmission Line, Natural Gas Line - June 2013

BIOLOGICAL RESOURCES - FIGURE 8

Palen Solar Electric Generating System - Special-status Wildlife

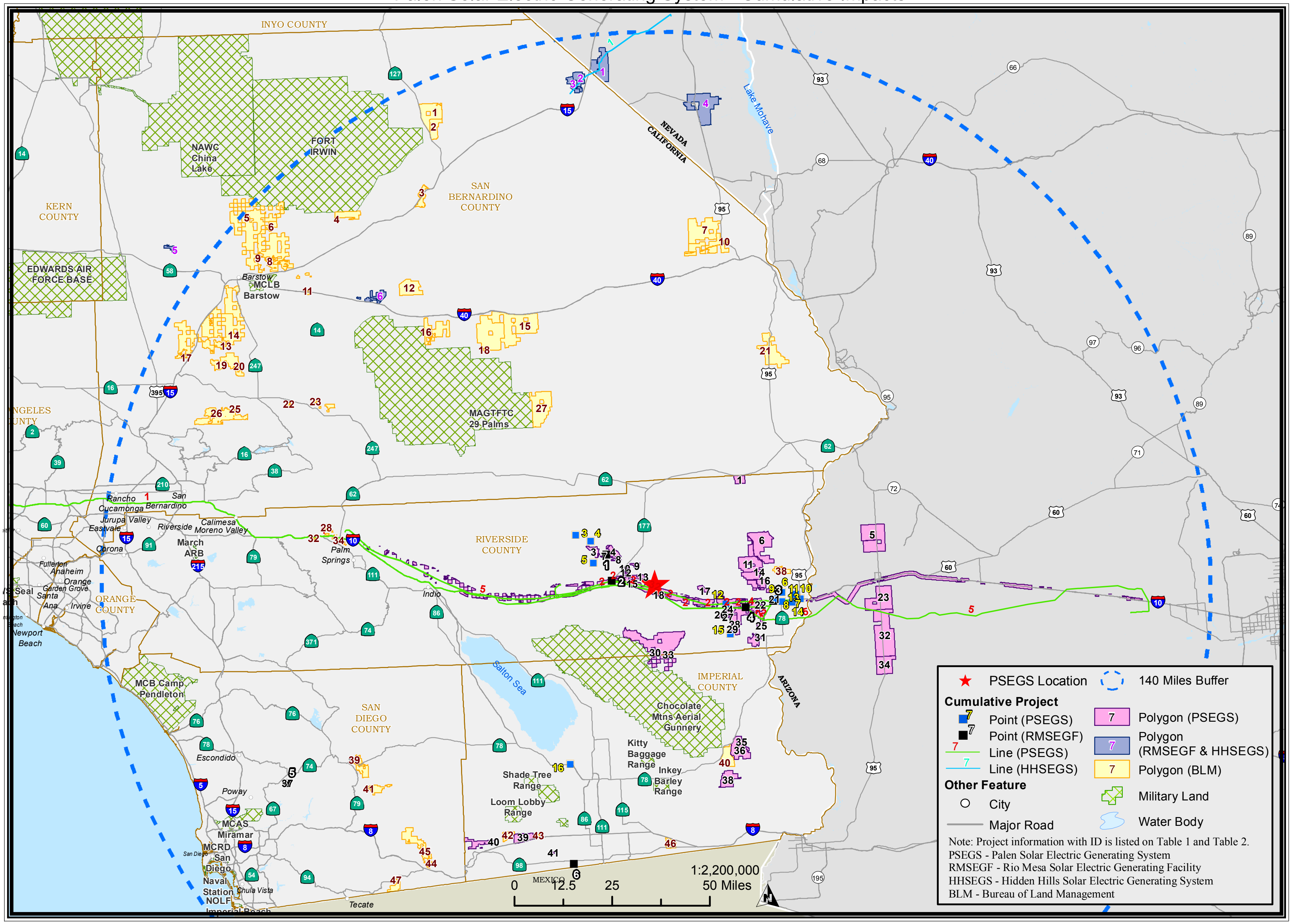


CALIFORNIA ENERGY COMMISSION - SITING,TRANSMISSION AND ENVIRONMENTAL PROTECTION DIVISION

SOURCE: SOURCE: Bing Aerial, BrightSource - May 2013, OpenStreetMap - May 2013, CEC Transmission Line, Natural Gas Line - August 2013

BIOLOGICAL RESOURCES - FIGURE 9

Palen Solar Electric Generating System - Cumulative Impacts

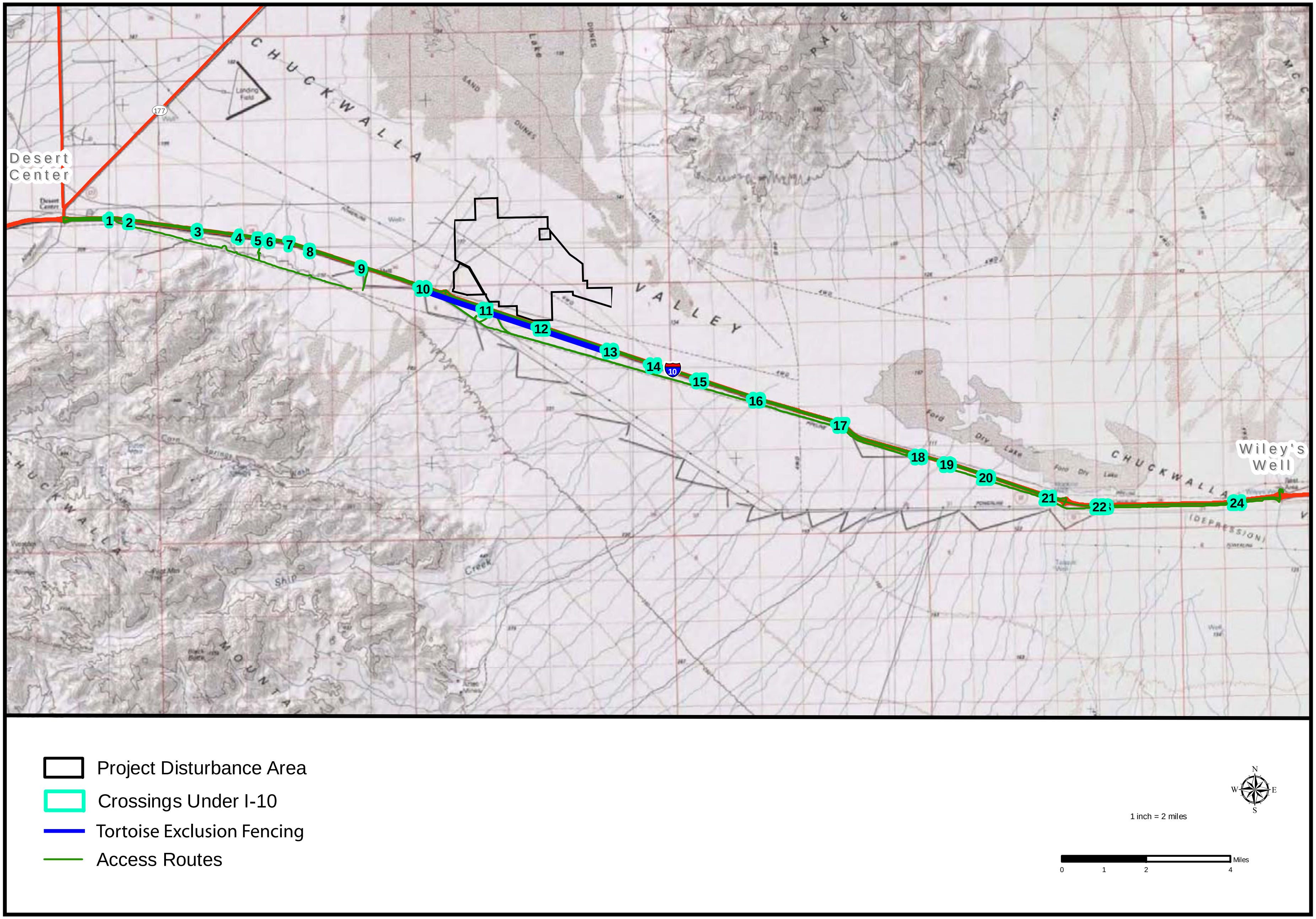


CALIFORNIA ENERGY COMMISSION - SITING, TRANSMISSION AND ENVIRONMENTAL PROTECTION DIVISION

SOURCE: Microsoft Bing Aerial, BrightSource, OpenStreetMap - May 2013, Bureau of Land Management - May 2013

BIOLOGICAL RESOURCES - FIGURE 10

Palen Solar Electric Generating System - I 10 Desert Tortoise Exclusion Fencing



CALIFORNIA ENERGY COMMISSION - SITING, TRANSMISSION AND ENVIRONMENTAL PROTECTION DIVISION

SOURCE: AECOM 2010 - Palen Solar Power Project Figure 1, I-10 Wildlife Crossing Analysis

APPENDIX BIO1 - BIOLOGICAL RESOURCES RISK ASSESSMENT OF AVIAN EXPOSURE TO CONCENTRATED SOLAR RADIATION

Geoff Lesh PE, Rick Tyler, Alvin Greenberg Ph.D., and William E. Hass MS

SUMMARY OF CONCLUSIONS

The risk assessment examines the potential effect of avian exposure to concentrated solar radiation. Staff examines the nature and probability of adverse effects to birds, when exposed to concentrated solar electromagnetic radiation, including infrared, visible and ultraviolet light.

Staff's analysis of avian exposure to concentrated solar radiation indicates that a threshold of safe exposure does not exist above a solar flux density of 4 kilowatts per square meter or kW/m^2 for a one-minute exposure. The analysis also indicates that both the Hidden Hills and Rio Mesa facilities pose significant risk to avian populations that may encounter the air space in the facilities where concentrated flux density is above the safe levels, potentially resulting in avian morbidity and mortality. The available data regarding avian impacts is very limited; however, such data does provide at least some perspective regarding potential for impact.

There are significant questions regarding extrapolation from the available information regarding avian impacts. The most vexing is the complete absence of data that would allow estimation of avian morbidity. Staff's assessment provides estimates of exposure and dose that can lead to injury and late fatality. In addition, there are major unknowns in estimation of differences in avian populations from one site to the next. These limitations in the available data require exercise of considerable judgment in extrapolation of data from one site to another. However, the errors introduced by the lack of site specific data are likely to be small in comparison to the absence of morbidity estimates and effects of dramatically increased potential exposure duration resulting from the increased volume of the air space affected by concentrated solar flux at commercial-sized facilities like Hidden Hills as compared to pilot-scale facilities.

Staff reviewed the following list of submittals provided by Bright Source regarding potential for impacts on avian resources as a result of potential exposure to concentrated solar flux. While providing descriptions of the heat flux field strengths around the solar receiver steam generator tower, the references are unpublished, lack peer review, are of very limited duration, and are from facilities that are much smaller than the proposed facility with regard to observed adverse avian effects of concentrated solar radiation.

Bright Source contends based on this information that the proposed Hidden Hills Project poses no significant risk to birds that would be exposed to the concentrated flux field associated with the project. They also contend that $50kW/m^2$ is a safe level of exposure for a duration of 30 seconds and that exposures to lower flux densities are without consequence. Staff disagrees with these conclusions, and provides its own independent analysis, with references, of the potential for impacts on avian resources associated with the proposed Hidden Hills Project.

1. BS 2012a – Bright Source (TN 63357). Rio Mesa Solar Electric Generating Facility CEC Biological Resources Workshop Presentation, dated January 6, 2012. Submitted to CEC Docket Unit on January 12, 2012.

2. BS 2012c – Bright Source/T. Stewart (TN 63365). Rio Mesa Avian Survey Counterproposal, dated January 12, 2012. Submitted to CEC Docket Unit on January 13, 2012.

3. ESH 2012a – Ellison Schneider & Harris, LLP/C. Ellison (TN 63475). Bright Source Comments on Issues Identification Report, dated January 30, 2012. Submitted to CEC Dockets Unit on January 30, 2012.

4. CBD 2012a – Center for Biological Diversity/L. Belenky (TN 63521). Comments on Issues Identification Report, dated January 31, 2012. Submitted to CEC / Dockets Unit on February 2, 2012.

5. FWS 2012a - Fish and Wildlife Services (TN 63565) Rio Mesa Golden Eagle Survey Clarification, dated January 31, 2012. Submitted to CEC Dockets Unit on February 6, 2012.

6. ESH 2012b – Ellison Schneider & Harris, LLP (TN 63956) Applicant's Notice Pursuant to 20 C.C.R. § 1716(f) For California Energy Commission's Staff Data Request Set 1A, dated March 2, 2012. Submitted to CEC Dockets Unit on March 2, 2012.

7. URS 2012a – URS/A. Leiba (TN 64060) Applicant's Data Response to Data Request Set 1A, dated March 8, 2012. Submitted to CEC Dockets Unit on March 8, 2012.

8. BS 2012m – Bright Source (TN 64467) Biological Workshop Presentation, dated March 13, 2012. Submitted to CEC Dockets Unit on March 28, 2012.

9. EHS 2012c – Ellison Schneider & Harris/C. Ellison (TN 64093) Applicant's Opening Brief for March 19, 2012. Status Conference, dated March 9, 2012. Submitted to CEC Dockets Unit on March 9, 2012.

10. CBD 2012c – Center for Biological Diversity/L. Belenky (TN 64173) Center for Biological Diversity Data Request, dated March 15, 2012. Submitted to CEC Dockets Unit on March 16, 2012.

11. URS 2012c – URS/A. Leiba (TN 64722) Response to Center for Biological Diversity Data Request, dated April 12, 2012. Submitted to CEC Dockets Unit on April 12, 2012.

12. URS 2012e – URS/A. Leiba (TN 64814) Supplemental Response, dated April 16, 2012. Submitted to CEC Dockets on April 16, 2012.

13. MDM 2012a – Michael D. McCrary, etal. (TN 64807) Avian Mortality at a Solar Energy Power Plant, accepted January 24,1986. Submitted to CEC Dockets Unit on April 17, 2012.

14. BS 2012r – Bright Source (TN 65431) Applicant's Supplemental Response to Data Requests, Set 1B, 143 and 144, dated May 23, 2012. Submitted to CEC Dockets Unit on May 23, 2012.

15. ESH 2012c – Ellison Schneider & Harris, LLP (TN 65696) Applicant's Notice – Staff's Data Requests Set 2A, dated June 8, 2012. Submitted to CEC Dockets Unit on June 8, 2012.

16. ESH 2012e – Ellison Schneider & Harris, LLP (TN 65745) Applicant's Supplemental Notice for CEC Staff's Data Requests Set 2A, dated June 13, 2012. Submitted to CEC Dockets Unit on June 13, 2012.

17. BS 2012u – Bright Source/ T. Stewart (TN 66280) Applicant's Response to Data Requests, Set 2A, #159 dated July 20, 2012. Submitted to CEC Dockets Unit on July 20, 2012.

18. BS 2012v – BrightSource (TN 68364) Applicant Submitted Power Point Presentation (Flux Impacts on Avian Species) for August 28, 2012 Joint Workshop on Rio Mesa SEGF and Hidden Hills SEGS , dated August 28, 2012. Submitted to CEC Dockets Unit on November 5, 2012.

19. BS 2012w – BrightSource (TN 68360) Applicant Submitted Slide on Dr. Pleguezuelos' Conclusions at GEMASolar Plant in Andulusia, Spain, for August 28, 2012 Joint Workshop on Rio Mesa SEGF and Hidden Hills SEGS. Submitted to CEC Dockets Unit on November 5, 2012.

20. BS 2012u – Bright Source/ T. Stewart (TN 66280) Applicant's Response to Data Requests, Set 2A, #159 dated July 20, 2012. Submitted to CEC Dockets Unit on July 20, 2012.

21. BS 2012v – BrightSource (TN 68364) Applicant Submitted Power Point Presentation (Flux Impacts on Avian Species) for August 28, 2012 Joint Workshop on Rio Mesa SEGF and Hidden Hills SEGS , dated August 28, 2012. Submitted to CEC Dockets Unit on November 5, 2012.

22. BS 2012w – BrightSource (TN 68360) Applicant Submitted Slide on Dr. Pleguezuelos' Conclusions at GEMASolar Plant in Andulusia, Spain, for August 28, 2012 Joint Workshop on Rio Mesa SEGF and Hidden Hills SEGS. Submitted to CEC Dockets Unit on November 5, 2012.

23. BS 2012x – BrightSource (TN 68294) Applicant Supplemental Avian Study Information – 1: Assessment of Potential Impacts to Birds from Solar Thermal Power Plant, Dimona Israel; 2: Environmental Impact of the GEMASOLAR Thermosolar Plant on the Bird Community in the Monclova Surrounding Area (Fuentes de Andalucía, Seville, Spain, Juan M Pleguezuelos, Granada, 08-23-2012); 3: Impact of the GEMASOLAR Solar Power Plant (La Monclova, Fuentes de Andalucía, Province of Seville) on the Bird Population, Report 4 (September 2010): Nesting avifauna in the study area during the plant construction phase (March – July 2009-2010); 4: Impact of the GEMASOLAR Solar Power Plant (La Monclova, Fuentes de Andalucía, Province of Seville) on the Bird Population.

24. CH2 2012qq- CH2MHill/j. Carrier (TN 68630) Data Response, Set 3. 11/21/2012.

25. SJ 2012a- Dr. Johnsen Ph.D (TN 68785) Dr. Johnsen's Presentation at December 5, 2012 Joint Rio Mesa SEGF and Hidden Hills SEGF Workshop Submitted to CEC Docket Unit On December 5, 2012.

SETTING

Concentrating solar thermal power plants, like Hidden Hills and Rio Mesa, collect ambient solar radiation and concentrate it onto a solar receiver to generate steam for the steam turbine generator. The concentration of the solar radiation creates a range of solar radiation flux densities between the solar receiver steam generator located atop the power tower and the reflecting mirrors arrayed on the ground. At ground level, nominal solar radiation, or solar energy per unit area, is about 1 kilowatt per square meter (kW/m^2). At the solar receiver steam generator, the reflected concentrated solar radiation is about 600 kW/m^2.

However, because the heliostat mirror arrays do not form a continuous reflective surface across the solar field due to gaps from roads or non-uniform spacing due to terrain or maintenance spacing, the solar flux density does not increase linearly with increasing elevation up to the maximum at the receiver. Gaps in the mirror array result in discontinuities in flux overlaps at elevations closer to the mirrors.

The applicant provided flux density modeling results of the proposed Rio Mesa solar flux fields in response to Staff Data Request 159. Staff relied upon these modeling results for this analysis, but has not been provided the necessary information to independently verify the modeling results. Consequently, staff's analysis remains subject to additional information and analysis of the flux fields. Nevertheless, as expected, values are low near the surface of the mirrors and increase in a non-linear manner in close proximity to the receiver. When the mirrors are concentrating sunlight onto the receiver, the shape of the higher flux regions between the receiver and mirror is an inverted cone, with a small section at the receiver that broadens as you descend towards the solar field. When the mirrors are directed off the receiver in standby mode, the shape of the higher flux regions are like two cones, one facing downward towards the mirrors and one upward away from the focal point (BS 2012u, Fig. 5).

Note that our sun emits a broad spectrum of radiation, including radio waves, visible light, and x-rays. The earth's atmospheric layers filter much of the radiation, diminishing and/or eliminating certain wavelengths particularly in the ultraviolet (UV) spectrum. And the solar field heliostat mirrors further diminish the reflected solar radiation of the shorter (e.g., UV) wave lengths.

It may not be obvious to the reader what the nature of these various flux intensities is, or at what point they could become dangerous. It is instructive because typically people are unaware of the level of flux exposure they are undergoing, aside from being under a sunny clear sky (a level of 1 kW/m^2), whether it is near a fireplace, radiant heater, or other warm device. Thus, to give some perspective to the lower range of values discussed herein, the following **Appendix BIO1 Table 1** (Drysdale 1998, p. 61) shows the effects of thermal radiation (flux) on various organic materials. Reported experiments have shown that several polymeric materials can be heated to beyond 300°C by radiant flux levels ranging from 11 to 15 kW/m^2. Similarly, experiments have shown that wood can be heated to 350 °C by 12 kW/m^2 and to 600°C by 28 kW/m^2 (Drysdale 1998, p. 221, Table 6.5). Staffs notes that these effects are for still air, and surface temperatures would be reduced somewhat in moving air.

Appendix BIO1 Table 1 Effects of thermal radiation

Radiant Heat flux (kW/m^2)	Observed effect
0.67	Summer sunshine in UK[a]
1	Maximum for indefinite skin exposure
6.4	Pain after 8 s skin exposure[b]
10.4	Pain after 3 s skin exposure[a]
12.5	Volatiles from wood may be ignited by pilot after prolonged exposure
16	Blistering of skin after 5 s[b]
29	Wood ignites spontaneously after prolonged exposure[a]
52	Fibreboard ignites spontaneously in 5 s[a]

[a]D. I. Lawson (1954) [b]S.H. Tan (1967)

The data quoted for human exposure are essentially in agreement with information given by Purser (1995) and Mudan and Croce (1995)

Table source: Drysdale 1998, An introduction to Fire Dynamics, 2nd Ed., by Dougal Drysdale, Publ. John Wiley and Sons, 1998, Table 2.8, P. 61

HIDDEN HILLS

The Hidden Hills Solar Electric Generating System (HHSEGS) would be located on Old Spanish Highway, near the community of Charleston View on approximately 3,277 acres (5.12 square miles) of privately owned land in Inyo County, California, adjacent to the Nevada border. The project site is approximately 8 miles south of Pahrump, Nevada, and approximately 45 miles west of Las Vegas, Nevada.

HHSEGS would consist of two 250 MW solar plants. Each solar plant would use heliostats which are elevated mirrors mounted on a pylon to focus the sun's rays on one solar receiver steam generator (SRSG) or receiver atop a 750-foot tall solar power tower near the center of each solar field. In each solar plant, one Rankine-cycle steam turbine would receive steam from the SRSG (or solar boiler) to generate electricity. The solar field and power generation equipment would start each morning after sunrise and would shut down when insolation[1] drops below the level required keeping the turbine online, or during upsets and emergencies.

Each of the heliostat assemblies would be composed of two mirrors, each approximately 12 feet high by 8.5 feet wide with a total reflecting surface of approximately 204 square feet (19 square meters – m^2). Each heliostat assembly would be mounted on a single pylon, along with a computer-programmed aiming control system that directs the motion of the heliostat to track the movement of the sun. The 85,000 heliostats have an effective total reflective area of approximately 1.7 million m^2. These heliostats concentrate solar radiation on the solar receiver boiler and superheater

[1] **Insolation** is a measure of solar radiation energy received on a given surface area and recorded during a given time. It is also called solar irradiation and expressed as hourly irradiation if recorded during an hour, daily irradiation if recorded during a day.

sections (the SRSG is four -sided, with boiler tube walls on the outside to be heated by the concentrated solar radiation).

The receiver absorbs the concentrated radiation from the heliostats and transfers the resultant heat into water and steam in steel tubes at the receiver surface. The efficiency of the Rankine-cycle (steam cycle) is about 43 percent under optimum conditions (summer mid-day). This equates to a solar energy transfer of about 610 million watts (610 MW) between the heliostats and the receiver. While the concentration to an energy density of 600 kW/m^2 is roughly analogous to focusing a 3 inch magnifying glass down to a 1/8 inch point, the power tower does not focus the reflected sun to a point, but rather overlays thousand of heliostat reflections onto the boiler tube walls of the receiver.

The total concentrated solar energy of 610 MWhr is approximately equal to burning 17,000 gallons of gasoline per hour. The solar flux density is intense enough that if the water and steam in the boiler were to stop flowing and the heliostats remained focused on the receiver, it would be destroyed in a short period of time.

RIO MESA

The Rio Mesa Solar Electric Generating Facility (RMSEGF) is very similar to the Hidden Hills facility and consists of two 250-megawatt (MW) (nominal) solar concentration thermal power plants situated on the Palo Verde Mesa in Riverside County, California, 13 miles southwest of Blythe, and is located partially on private land and partially on public land administered by BLM. Design aspects of the RMSEGF are essentially the same as for the HHSEGS.

ANALYTICAL APPROACH

Staff’s analysis includes the following analytical steps in estimating the avian mortality and morbidly from exposure to concentrated solar radiation:

a. Hazard Assessment -- the determination of whether a particular environmental exposure is or is not causally linked to particular health effects on the receptors.

b. Dose-Response Assessment -- the determination of the relation between the magnitude of exposure and the probability of occurrence of the health effects in question.

c. Exposure Assessment -- the determination of the extent of receptor exposure before or after application of regulatory controls.

d. Risk Characterization -- the description of the nature and often the magnitude of receptor risk.

e. Analysis of Uncertainty -- Uncertainty represents a discussion of the gaps in knowledge about factors such as adverse effects or exposure levels which may be reduced with additional study. Generally, risk assessments carry several categories of uncertainty, and each merits consideration. Measurement uncertainty refers to the usual error that accompanies scientific measurements -- standard statistical techniques can often be used to express measurement uncertainty. An amount of uncertainty is often inherent in environmental sampling. There are likewise uncertainties associated with the use of scientific models, e.g., dose-response models, models of the physical environment, the assumed values of material properties that may vary in nature or not be well characterized, the probability of occurrence of particular circumstances, etc.

Birds are exposed to this concentrated solar radiation when they enter the flux field and receive the incident radiant energy that is reflected from the array of heliostats on the ground. The radiant energy that exists in the flux field is converted to heat when it is absorbed on any solid opaque surface that receives the transmission of the radiant energy through an otherwise transparent medium (air).

The absorption efficiency of radiant flux is governed by the emissivity of the surface of the object that receives it. Emissivity can range from 0 to 1 with 0 representing perfect reflection of all the incident radiation and 1 representing complete absorption and conversion to heat. It is also governed by the angle of incidence between the radiant flux and the surface that receives it. A mirror is an example of a surface with a low emissivity (typically below 0.05) absorbing and converting to heat less than 5 percent of the incident light. Black pavement is an example of a surface with high emissivity (about 0.95) absorbing 95 percent of the incident light. This is the reason that blacktop becomes so hot when exposed to sunlight.

In actual circumstances the rise in temperature of a surface exposed to radiant flux is often diminished by the transfer of heat to the surrounding air from that surface. This is typically referred to as convective heat transfer. The amount of heat removed by convection is governed by the speed and turbulence of the air passing over the surface and the temperature difference between the air and the heated surface. In the case of birds, the speed of flight through the air is equivalent to a velocity of air over the surface.

The convective heat transfer between bird feathers and the ambient air is analogous to the convective heat transfer between the heated boiler tubes in the receiver and the water and steam flowing in the receivers at the Hidden Hills and Rio Mesa power plants. In the absence of this continuous convective heat removal by the water and steam inside the boiler tubes (i.e. if the tubes were too empty) the temperature of the boiler tubes would rise rapidly to a new higher equilibrium temperature much higher than the normal 540 ^{o}C operating temperature. The surface of the receiver would be damaged unless the incident radiation is removed by putting the heliostats in a standby mode whereby radiant flux is no longer directed on to the receiver.

The potential for injury to birds that fly through a concentrated solar flux field results from heating of the outer surface feathers and subsequent conduction of heat into the exposed feathers causing breakdown of their molecular structure. Conduction is the transfer of heat into a solid object due to the temperature difference between the object and its surroundings. While exposure could also cause a rise in body temperature it is likely that severe damage to the outer feathers would occur much more quickly as a result of the insulating effect of the plumage covering the bird’s body.

In this analysis, staff has attempted to estimate levels of exposure to concentrated radiant flux that are safe and would result in little or no damage to exposed birds. It can then be concluded that exposures above such safe levels would result in irreversible and potentially significant impact to exposed birds that enter the flux field.

HAZARD ASSESSMENT

While the highest flux density occurs at the surface of the receiver, high concentration solar flux densities also occur in other parts of the air space above the heliostats, ranging continuously from 1 up to 600 times the background solar radiation of about 1 kW per square meter (1.0 kW/m^2). The applicant's response to Data Request 159 (BS 2012u) provides maps of flux densities throughout the air space above the Rio Mesa Solar fields. Similar flux density fields will exist at the proposed Hidden Hills facility.

When high solar flux densities impinge on objects, for example, a bird's flight feathers (primary, secondary, and tail feathers), the solar radiant flux is converted to heat, which can cause damage resulting in injury or death depending on the exposure level and duration of exposure (i.e. dose). For example, for exposed (bare) human skin, at an exposure level of 5 kW/m^2, first-degree burns would occur within 20 seconds of continuous exposure; second-degree burns would occur within 30 seconds; and third-degree burns would occur within 50 seconds with a 1 percent fatality rate. Because feathers are effectively dead structural protein similar to hair without nerves and other physiological activity, bare human skin is more sensitive than avian feathers to the effects of thermal radiation but does serve as a useful comparison.

Exposures of birds to concentrated solar flux did actually occur at the Solar One facility near Daggett California (McCrary et. al. 1986). Birds were found dead on the site that had clear evidence of thermally induced damage to flight feathers caused by exposure to concentrated solar flux. The birds had near complete removal of both barbules and barbs of flight feathers leaving only the rachis (the main central shaft of the flight feather) remaining. This suggests that the flight feathers had reached temperatures in excess of 300 ^oC and demonstrates the potential for damage to flight feathers resulting from exposure to concentrated solar flux. The barbules, which comprise the major resistance to air flow through surface of the feather, are essential to the creation of lift by wing flapping. The barbules are very small (less than 1/1000 of an inch thick) and have very low mass. Thus, damage to barbules from exposure to concentrated flux will be virtually instantaneous, and damage to barbs, feathers and birds very likely.

DOSE RESPONSE ASSESSMENT

This assessment provides an analysis of the potential damage to flight feathers of the bird associated with exposure to concentrated solar flux. Staff has determined that damage to surface feathers is one of the most sensitive types of adverse effects that can occur in avian species from such exposure. Staff's dose response assessment provides analysis of the relationship of potential feather damage associated with increasing levels of concentrated radiant flux exposure. Staff's analysis identifies levels of concentrated solar flux exposure that are just below the levels that could cause irreversible damage to flight feathers as the criteria to establish safe avian exposure levels.

Bird feathers are composed predominantly of keratin which is a naturally occurring polymeric protein chain. These polymer chains of keratins also form secondary structures creating hard natural fibers (for example hair and wool) and hard fibrous sheets (for example feathers, claws, nails, and hooves). The keratin in feathers is the beta form of keratin, or β-keratin. It has a macromolecular secondary form resulting from folding and cross linking at the edges of the poly peptide polymer primary chains. The β-keratin in feathers also typically contains small amounts of both loosely bound water and more tightly bound water that exists in the molecular structures of the secondary proteins (Conn et al 1987 pages 84-99) (Mazur and Harrow 1968 pages 61-72) (Greenwold and Sawer 2010 page1).

The structural properties (strength, stiffness, elasticity etc.) of the keratin that makes up feathers is central to the feathers function in flight (Bachmann et. al. 2007) (Bachmann and Wagner 2011) (Videler 2005 pages 46 -55). Intact keratin structure is also essential to maintenance of the feather's aerodynamic shape and surface smoothness. Both structural and molecular changes occur when keratin is exposed to temperatures above about 160 ^{o}C (Takahashi et. al. 2004) (Senoz.et.al. 2011) (Istrate et. al. 2011). Alpha and Beta keratin from wool, hair, and feathers have remarkably similar thermal decomposition characteristics (Brebu et. al. 2011).

At ambient, atmospheric pressure, feathers lose unbound water before the feather surface temperature can rise above 100 ^{o}C. Unbound water can also be lost through evaporation at temperatures below 100 ^{o}C with low relative humidity. Heating above 100 ^{o}C in the absence of water is often referred to as heating in the dry state. Keratin is more resistant to thermal degradation when heated in a dry state than in a wet state (Takahashi et. all 2004). Because unbound water cannot exist in the keratin at temperatures above 100 ^{o}C at ambient atmospheric pressure, exposures to concentrated radiant solar flux at ambient conditions will result in dry heating.

Loss of water that is unbound (not molecularly bound) is reversible. Typically the presence of unbound water would result in a transient period before temperatures inside the feather would rise upon heating above 100 ^{o}C due to latent heat required to vaporize the unbound water. However, in the environment of the project site in summer the elevated ambient temperatures and low humidity would suggest very low moisture content in the feathers of indigenous birds, particularly for the flight feathers.

At about 160 ^{o}C, bonds in the molecular structure of secondary proteins are broken leading to loss of structural integrity of the β-keratin molecular structure and a permanently weakened feather. The keratin begins to melt at about 250 ^{o}C. At temperatures of 250 to 450 ^{o}C, bonds in the primary polymer protein chains are broken into smaller molecular compounds through pyrolysis (Senoz et. al. 2011) (Brebu et. al. 2011). When temperatures reach 450 to 500 ^{o}C, keratin will almost completely break down and carbon will be the primary constituent of what remains.

Once bonds on the ends of the protein chains are broken, damage to the keratin is not reversible and thus the structural properties of the secondary proteins and ultimately the exposed feathers are adversely affected. This breaking of the chemical bonds that secure the secondary molecular structure of keratin, which leads to structural changes without affecting the primary protein chains is referred to as denaturing (Istrate 2011)

(Takahashi et. al. 2004). This is very similar to the boiling of an egg where the protein structures in the albumin (egg whites) are permanently changed but the basic protein chains are not disrupted. Ultimately the level of damage to the flight feathers will be a function of both the magnitude of exposure and its duration. The dose will thus have units of kilowatt-seconds per square meter or kW-s/m^2.

Based on the results of staff's thermodynamic equilibrium analysis discussed below, exposure to solar flux greater than 4kW/m^2 can result in temperatures above 160 ^oC with 60 seconds of exposure. Exposure of 4kW/m^2 can be considered a no observed adverse effect level (NOAEL). Exposures above this level can compromise the keratin molecular structure of a bird's flight feathers, therefore potentially causing irreversibly weakening of feathers leading to an irreversible adverse impact on the feathers. While molting may ultimately replace some damaged feathers, it will in most cases not occur for some time after that damage occurs. Feathers, in which the quill was heated enough to damage the follicle from which the feather grows, might not get replaced during molt.

EXPOSURE ASSESSMENT

To estimate exposure staff modeled the change in surface temperature of flight feathers of a bird during flight when the bird's feathers are exposed on their underside to a concentrated flux in a solar heliostat field. The intensity of exposure depends on the path the bird traverses from the point where it enters a space with concentrated flux until it exits that space. The figures in the applicant's response to Data Request 159 (BS 2012u) are contour plot depictions of concentrated flux density isopleths indicating the locations of flux density levels of 5, 10, 25, 50, 100, and 150 kW/m^2.

To evaluate the potential for damage, it is necessary to convert the radiant flux to a resultant increase in the temperature at the surface of the exposed feathers. During flight, concentrated solar radiation is reflected from the heliostats on to the bottom surface of the feather, causing heating of the surface. The rate of heating depends upon the intensity, or flux, and how fast the surface is simultaneously being cooled. By summing the heat being gained from the incoming flux together with the heat losses occurring through convection and radiation, the resulting feather surface temperature can be estimated.

Potential cooling of the exposed feather surface results from the ongoing heat loss from the bottom surface of the wing feather by multiple mechanisms. The most important of these is convection of heat to the air stream passing under the wing bottom surface (at the bird's air speed). Additional losses include re-radiation of heat (energy) from the hot surface, and by conduction of heat through the feather to its backside, where it can be lost through convection to the air stream passing over the top side of the feather, but only for those areas of the backside that are exposed to topside airflow. Staff has assumed that most flux-exposed feathers will have much of their backside surfaces covered by either other feathers or body skin. Therefore, for purposes of conducting a worst-case risk analysis, staff has ignored the potential heat loss mechanisms of back-side convection and back-side re-radiation (i.e. heat loss from the top of the wing). Staff modeled convective loss from the wing using a heat transfer coefficient from a flat or cambered plate assuming laminar flow over the plate (McArthur 2008, Mueller 1999, Pelletier and Muller 2000, Tucker 1987, Tucker and Parrot 1969). Approximation of a wing using a flat or cambered plate model is the accepted method of modeling fluid flow over wings and is, therefore, also the best method for modeling heat transfer to and from a wing, particularly on the underside where there is no issue of flow separation from the wing surface (Ward 1999), (Withers 1981), Holman 1976), (Incroera 2007), Cengel 2007), (MERM 2001).

These loss mechanisms depend upon the difference between the surface temperature of the feather and the temperature of the ambient air, and they increase in effectiveness as the temperature difference increases. Thus, as the feather surface temperature heats from solar radiation exposure, the heat losses increase until they collectively match in their heat loss rate, the heat gain rate caused by the concentrated solar radiation. At that point the surface temperature stabilizes, and becomes what is called "steady-state." Due to the extremely small size and low mass density of the keratin micro structures that make up the surface of the feather, at realistic bird flight speeds in the gradually changing solar flux densities of a solar field, surface temperatures reach to within a few degrees of this steady-state temperature virtually instantaneously. During realistic flight conditions in the power plant's solar field, flux densities change continuously with location, so any sudden change is an unrealistic simplification of actual conditions experienced in flying through the air space having concentrated flux densities.

Because changes in flux density occur gradually during flight, there are no large "step changes", so temperature rise-times for re-equilibration to changing flux levels can be ignored. After conducting dynamic analyses and examination of several plausible flight paths and comparing those results to the simple assumption of instantaneous equilibrium, staff used the assumption of instantaneous equilibrium to establish safe exposure criteria as this assumption created little error in the result. Assuming instantaneous equilibrium eliminates the dependence on flight path in analyzing potential avian exposures to concentrated solar radiation. **Appendix BIO1 Tables 1** and **2** below provide estimates of equilibrium temperatures for a range of plausible exposure intensities and exposure conditions, a flight speed of 18 miles-per-hour (about 8 meters-per-second), an ambient temperature of 45 ^oC, and at incidence angles of 0 degrees and 71 degrees off-perpendicular to the feather surfaces.

Appendix BIO1 Figures 1 through **4** below show the results of dynamic modeling of a range of plausible flight paths. The simplification of using instantaneous equilibrium, allows staff to reduce multiple variables (flux level, emissivity, angle of incidence, flight speed, path through solar field) down to a simpler set of only two variables (flux level and exposure time). Equilibrium surface temperatures are also largely dependent on the cord length of the bird wing (i.e. the distance from the front of the wing to the trailing edge). **Appendix BIO 1 Figure 5** provides an analysis of flux levels causing 160 ^oC surface temperatures for different cord lengths and flight speeds. The vast majority of bird species fly within a range of 6 to 16 meters-per-second (Videler 2005 Pages 154 and 155) (Alerstam et. al.)). During flap gliding flight, birds fly at the lower end of the range. Therefore, staff used a flight speed of 8 meters-per-second or 18 miles-per-hour.

Dynamic modeling was conducted by choosing several plausible straight-line flight paths through the solar field, utilizing the isopleth solar field diagrams provided by the applicant. This was be done by re-calculating the feather surface temperature at onehundredth of a second intervals along a presumed flight path by adjusting for the incoming radiant flux and convective and radiative loses that would be occurring at each interval using the assumed ambient air temperature, flight speed, and incidence angle, etc.

Staff used linear interpolation to estimate flux intensities between isopleths, then plotted temperature on a continuous basis during the flight path through the field. Points where exposure resulted in estimated surface temperatures above 160 ^{o}C, and 300 ^{o}C were noted. **Appendix BIO1 Tables 2** and **3** provide estimates and comparisons of maximum surface temperatures reached based on varying flux densities, and flight paths to assumed steady-state exposure to flux levels.

Appendix BIO1 Table 2 Feather Surface Temperatures vs Flux Intensity

Flux Intensity (kW/m^2)	Steady State Temp (deg C)	Flight Condition		
		Directly at Tower Temp (deg C)	Tangent to 100yds off Tower (deg C)	Flying upward near tower (deg C)
1	80	70	68	60
5	170	160	160	140
10	260	240	240	160
25	430	360	410	220
50	610	600	na	410
100	810	740	na	Na
150	950	930	na	Na

All at 18mph, View factor = 1 (Angle of incidence = 0 deg)

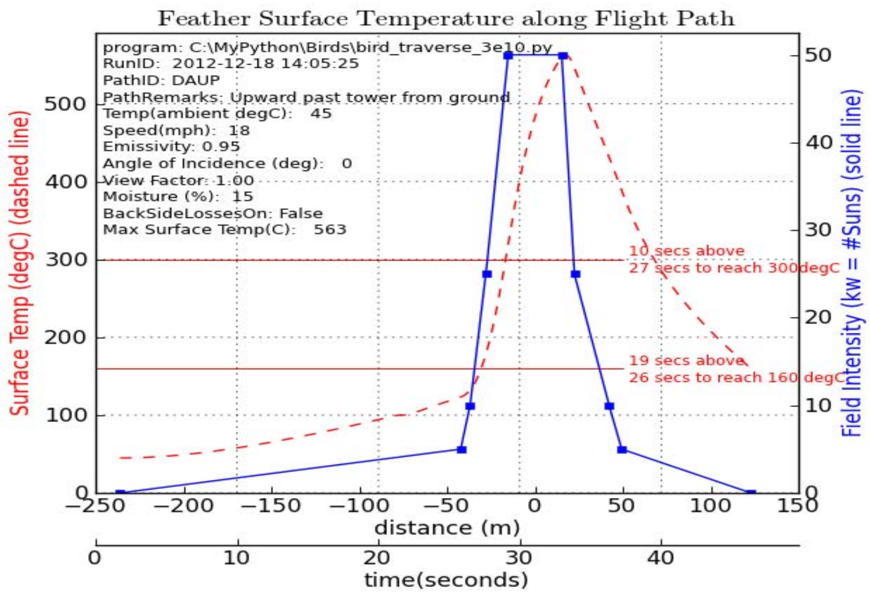
Appendix BIO1 Table 3 Feather Surface Temperatures vs Flux Intensity

Flux Intensity (kW/m^2)	Steady State Temp (deg C)	Flight Condition	
		Directly at Tower Temp (deg C)	Tangent to 100yds off Tower (deg C)
1	60	54	55
5	90	87	88
10	130	120	120
25	220	160	200
50	340	330	na
100	500	380	na
150	600	500	na

All at 18mph, View factor = 0.33 (Angle of incidence = 71 deg)

Staff modeled absorption of flux by the feather to occur in the initial half-thickness of material, at and just beneath the surface of the feather. The resultant heating is the cause of the temperature rise in the feather material and of the subsequent damage to the fragile keratin structures and molecules that provide the structural integrity of feathers.

Appendix BIO1 Figure 1 Path is from ground up past tower receiver while operating at full load



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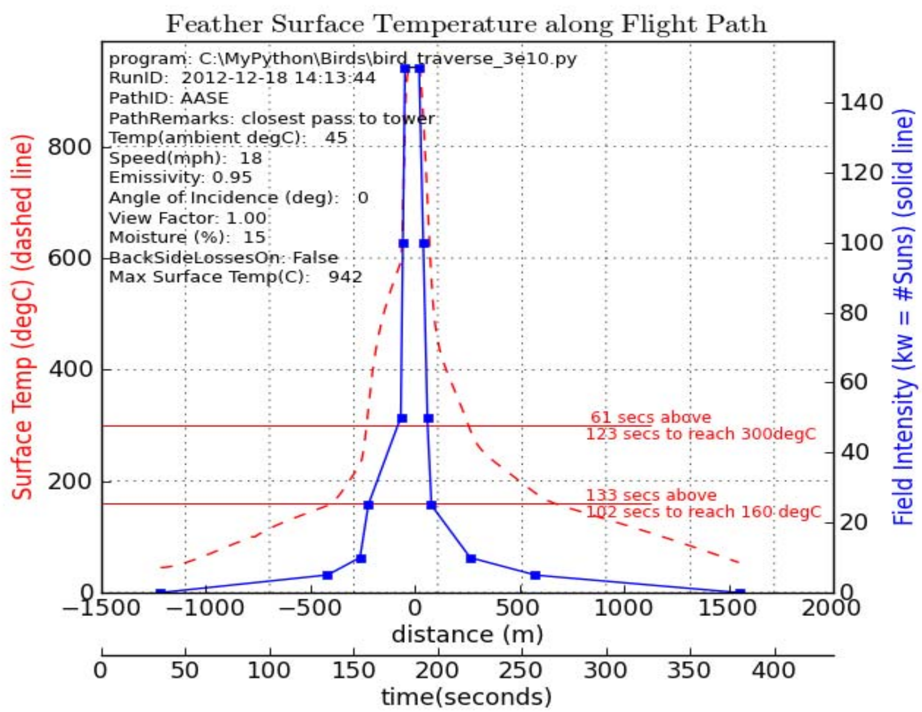
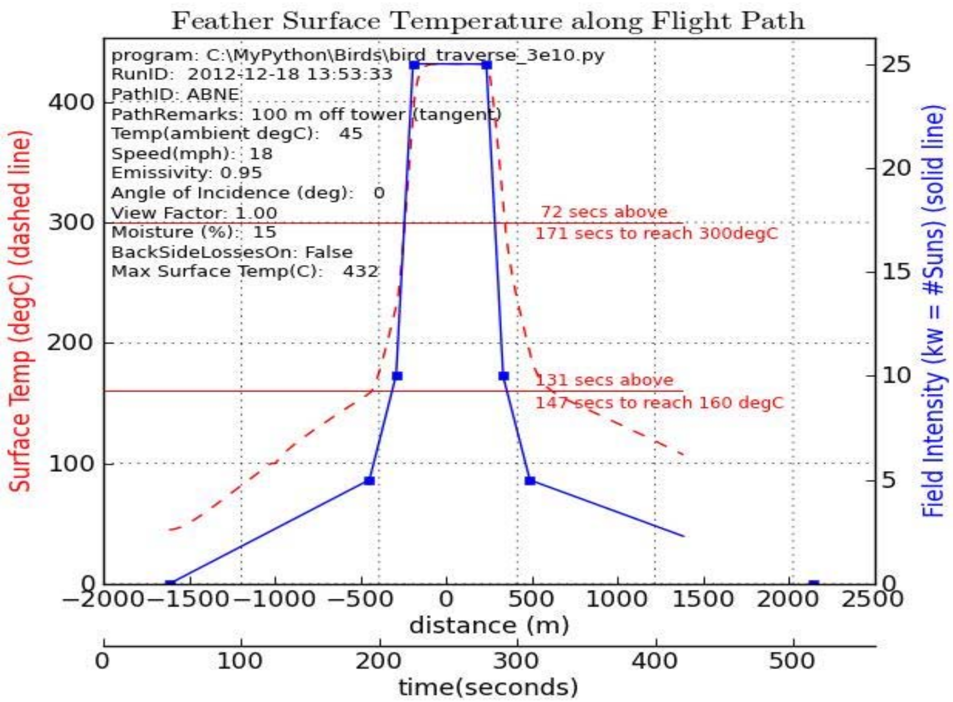
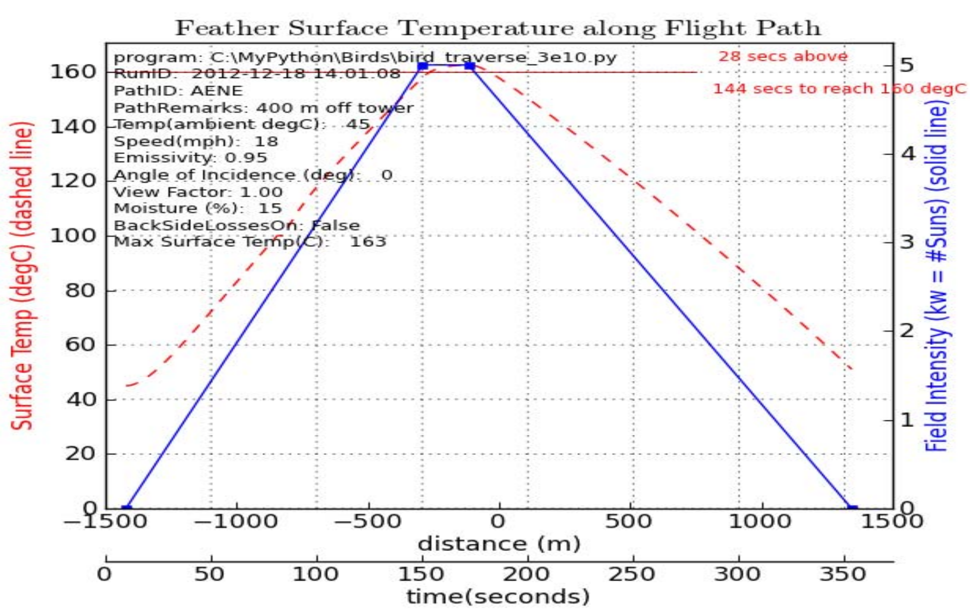


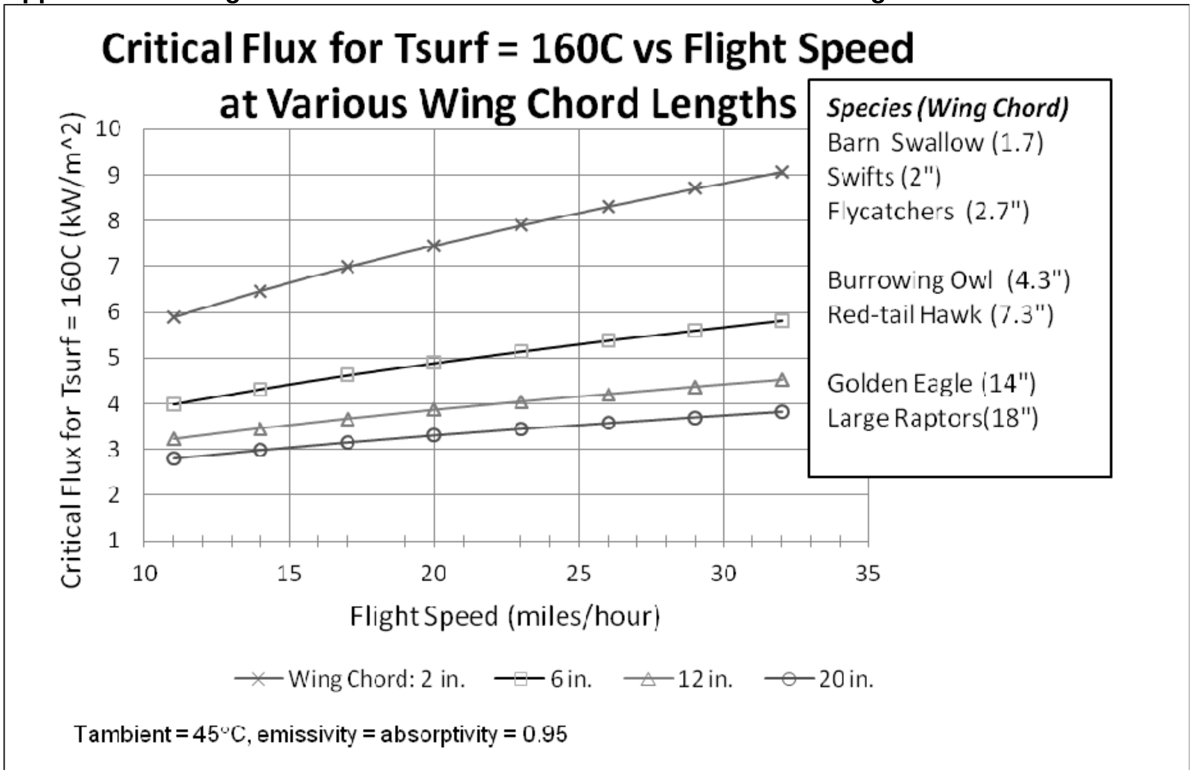
Appendix BIO1 Figure 3 Flight path is straight line tangent to circle with radius of 100 meters around tower



Appendix BIO1 Figure 4 Flight path is tangent to circle with radius of 400 meters



Appendix BIO1 Figure 5 Critical Flux Levels for Tsurf = 160°C vs Wing Chord



Appendix BIO1a provides documentation of the equations, calculations, and source codes for programs used to produce staff's results.

CHARACTERIZATION OF RISK

In flying completely across areas of the facility with flux densities above 5kW/m^2, maximum distances would be between 900 to 1000 meters. At a flight speed of 4.5 meters per second (about 10 miles per hour), the flight would take about 200 seconds and at 18 meters per second (about 40 miles per hour) it would take about 50 seconds to traverse 900 meters. During such flight, the bird would receive exposures ranging from 5 kW/m^2 up to possibly 500 kW/m^2 of varying duration depending on the flight path taken. This exposure including heat loss mechanisms and duration is integrated along the flight path to obtain a time / temperature profile. Integrating flux level and duration along the flight path provides an exposure dose.

As stated previously, when the exposure and duration are sufficient to cause the feather to reach temperatures above 160 ^{o}C, the bird would suffer some level of irreversible damage to feathers that are critical to its ability to fly. This damage can lead to secondary effects such as collision with towers, heliostats and the ground if damage is sufficient to impair normal flight, or even the ability to become and remain air-borne.

Feather damage that results in impairment of flight capability could also decrease the bird's overall probability of survival and life expectancy. For birds of prey, the ability to carry small animals that are caught could be severely compromised leading to potential malnutrition or even starvation of the bird or its young. The carrying of prey significantly increases load-carrying demands placed on the wings and critical flight feathers. For other birds, damaged feathers will impair their ability to forage or to flee predators.

In conducting any risk assessment where fatality is used as the metric to evaluate risk to an exposed population the analyst should always be cognizant that the existence of fatality implies the high likelihood of a significantly higher number of injuries (i.e. morbidity). The ratio of morbidity to mortality can range from less than 5 to one to over 100 to one for different hazards and levels of injury deemed significant. For example, for every death from an explosion, one should expect about 5 serious injuries (K.T. Bogen, E.D. Jones 2005) (Stellman 1998, Table 39.10). For hazards that result in direct trauma to the exposed receptor there is a general relationship of level of damage and level of energy or power to which the receptor is exposed (Frank P. Lees 1980). McCrary did not, nor would it have been practical, to survey a region of sufficient size surrounding the project to account for scavenging of injured birds or latent fatality offsite. Thus staff cannot, based on available data, define morbidity due to exposure to concentrated solar radiation from actual survey data. Staff believes that the hazard to birds from this facility is most analogous to explosive hazards as both have high energy or power levels at a central point with energy levels decreasing exponentially with distance radially from the center. Based on this analogy the level of seriously injured birds for every death is likely to be between 5 and 10.

Thus, the potential damage caused by avian exposure to concentrated solar flux can range from minor impairment (and potentially leading to death) to near immediate fatality depending on the dose received. Low doses of 5 kW/m^2 to 15 kW/m^2 for short exposure periods may not cause effects that are observable to the naked eye but could nonetheless result in significant flight impairment. For example if a significant portion of the feather barbules (the fragile micro structure between barbs) (See Reddy and Yang 2007) were lost the feather's structural integrity would be impaired. Because loss of barbules would significantly compromise integrity of a large portion of the feathers surface area, the differential pressure between the top and bottom of the feather necessary to produce lift and thrust (Videler 2005 Page 55) will also be compromised (Werner and Patone 1998). Such impairment could reduce the bird's level and climbing flight speeds. Longer but still short term exposures to the 10 to 25 kW/m^2 flux densities could cause nearly complete loss of barbules or even complete feather vanes on one or both sides of the rachis and result in loss of flight capability and inability to remain airborne. Staff has identified 4kW/m^2 as a safe level for short exposures (less than 60 seconds). This level of exposure should not result in any damage to flight feathers.

Using the only available data on avian mortality, provided by (McCrary et. al. 1986), staff estimates that the proposed Hidden Hills and Rio Mesa facilities could each result in avian mortality in excess of 22 times that of the Solar One facility previously studied based on linear extrapolation from total relative mirror surface area of the two facilities. This extrapolation is based on mirror area as collision with mirrors played a major role in the total avian fatalities documented at the Solar One facility. It should be noted that the McCrary study provides no data to assess avian morbidity. It should be recognized that estimates of avian mortality that ignore excess morbidity will necessarily underestimate ultimate fatality that will be associated with that excess morbidity (i.e. latent fatality). It should also be noted that damage to flight feathers could be cumulative if flights through concentrated flux are repeated. Such factors would be expected to contribute to substantial underestimation of avian impacts.

In addition to these concerns extrapolation from a 10 MW pilot plant to a 250 MW facility with many thousands of heliostats and a much taller receiver tower "may produce non-linear increases in the rate of avian mortality when compared to Solar One…" according to McCrary. Also, the volume of the air space with solar flux densities greater than 4 kW/m^2 (i.e. the hazardous air space) would increase with increasing power output rating or solar field size, increasing the likelihood of avian exposure. The effect of a larger volume of the proposed projects would have a greater effect on bird mortality and morbidity given that exposure duration at high intensities would be much greater.

To evaluate the potential for non-linear effect of scale-up in facility size from a pilot scale to a commercial scale, staff estimated the relative volume of air space and relative dose for both a facility the size of Solar One and Hidden Hills/Rio Mesa (see **Appendix BIO1 Figures 5** and **6**) below. Staff chose a range of plausible straight-line flight paths past a Rio Mesa-like facility re-scaled to the reduced size of the Solar One heliostat field having a heliostat field of approximately one-fourth the diameter of Rio Mesa. Three paths were taken from this Solar One model: one having a closest approach distance to the tower at the radius of the 5 kW/m^2 isopleth, another at one-half of that closest approach distance, and a third at one-fourth of that closest approach distance, providing three hypothetical flight paths at distances of 120 feet, 60 feet and 30 feet from the assumed center of the receiver tower. Exposure doses were calculated using these three flight paths at Solar One. Staff then calculated the comparative doses associated with the analogous three hypothetical flight paths, again at distances of 120 feet, 60 feet and 30 feet from the center of the receiver tower at the Rio Mesa facility. **Appendix BIO1 Tables 4** and **5** below provide the results of this comparative analysis.

The volume of the flux field at the Hidden Hills / Rio Mesa size facility with concentrated flux above 5 kW/m^2 is about 20 times larger than the similar flux field volume of the Solar One size facility. The magnitude of the doses resulting from flights at the same distances from the receiver towers described above is between 5 and 6 times larger at the Rio Mesa-size than at the Solar One-sized facility. The product of increased dose and volume is about 100 times larger at Hidden Hills / Rio Mesa as compared to Solar One. This analysis confirms the validity of McCrary's concern regarding the potential for non-linear increase in scaling of adverse effects on avian populations associated with exposure to concentrated solar flux from scale up of a small 10 MW pilot plant like Solar One to a 250 MW or greater facility like Hidden Hills / Rio Mesa.

Table 4 Comparison of Dose Resulting From Flight Paths at Equal Distance from the Center of Each Receiver Tower (view factor 1.0)

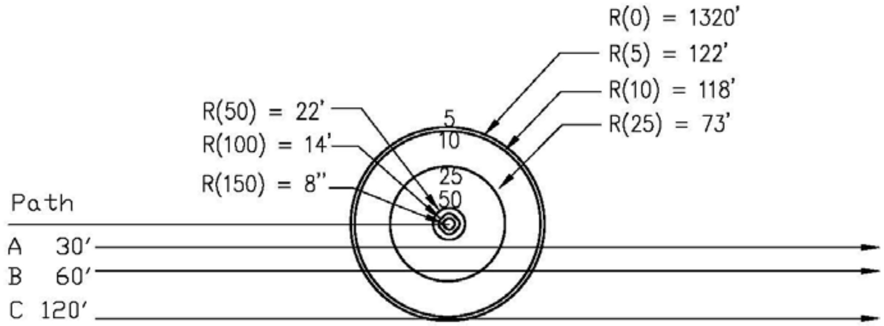
ViewFactor= 1.0 Speed = 18 mph	Path closest approach to tower (feet)	Max flux (kW/m^2)	Exposure time (secs)	Total Dose ($kW\text{-}secs/m^2$)	Dose above Threshold ($kW\text{-}secs/m^2$)
Rio Mesa	30	100	372	2000	1400
	60	50	372	1800	1200
	120	25	372	1500	900
Solar One	30	25	100	400	250
	60	25	100	370	220
	120	5	100	240	80
Solar One Standby Points[1]	NA	1500	0.3	440	440

[1.] assumes flight speed of 18mph through 8ft flight path

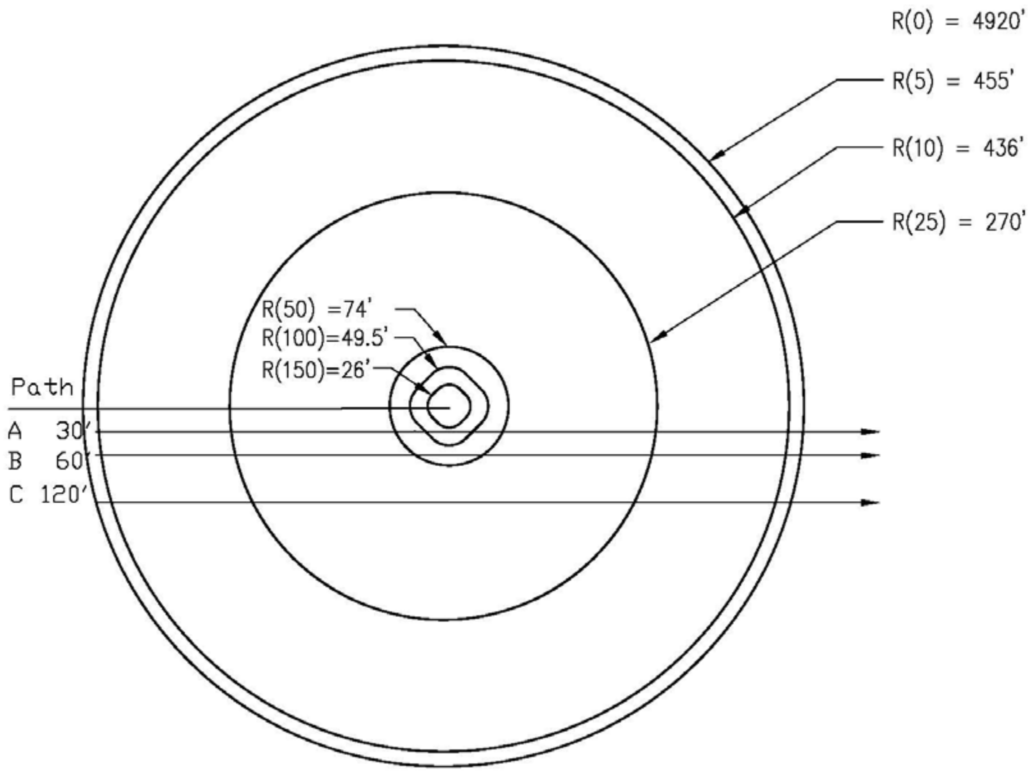
Table 5 Comparison of Dose Resulting From Flight Paths at Equal Distance from the Center of Each Receiver Tower (view factor 0.33)

View Factor=0.33 Speed = 18 mph	Path closest approach to tower (feet)	Max flux (kW/m^2)	Exposure time (secs)	Total Dose ($kW\text{-}secs/m^2$)	Dose above Threshold ($kW\text{-}secs/m^2$)
Rio Mesa	30	100	372	650	380
	60	50	372	580	300
	120	25	372	480	210
Solar One	30	25	100	130	60
	60	25	100	120	50
	120	5	100	80	0

COMPARATIVE FLIGHT PATHS FOR SOLAR ONE & RIO MESA/HIDDEN HILLS



Appendix BIO Figure 5 SOLAR ONE - FLUX ARRAY AT TOWER



Appendix BIO Figure 6 RIO MESA / HIDDEN HILLS - FLUX ARRAY AT TOWER

ANALYSIS OF UNCERTAINTY

There are significant uncertainties associated with staff's analysis of risk to avian plumage potentially resulting from exposure to concentrated solar flux. Evaluation of the relative sensitivity to various inputs to the thermodynamic equilibrium calculation indicates that the orientation of the bird in the flux field causes the greatest effect on the resultant radiant exposure. This is the result of the strong effect of the angle of incidence on effective flux density. This is reflected in the view factor of the incident rays on the surface (i.e., the angle of the rays to the object's surface). The view factor used in staff's model can vary from about 0.25 to 1 depending on the bird's orientation in the radiant field. This can result in a fourfold change in effective exposure level between level flight and flight that causes the feathers to be perpendicular to the incident solar radiation.

The choice of chord length of the potentially exposed bird wing has the next largest effect on the estimated feather surface temperature. Cord lengths for potentially exposed birds range from about 2 to about 20 inches with the longest cord lengths resulting in the most impact. Choice of chord length can change the analysis outcome by about a factor of three.

The choice of flight speed of the bird is also an important variable in estimation of the resultant surface temperature reached. A decrease in flight speed from 40 miles per hour to 20 miles per hour would increase resultant relative surface temperature rise by about 50 percent. This is the result of decreased convective heat transfer from the feather surface to the ambient air at lower flight speeds.

The emissivity (the fraction of the incident radiation that is absorbed or not reflected from the surface) of the feather would also affect the resultant temperature. However, staff used an emissivity of 0.95 as a plausible worst case eliminating the potential variability associated with differences in emissivity of different feathers. It should also be noted that the micro structure of the feathers may allow radiant energy to penetrate deeply into the feather below the boundary of the outer surface. For example the radiant energy could first contact the barbules that are well within the feather. This could substantially reduce the effect of convection and substantially increase the rate of temperature rise on these surfaces. If this does in fact occur, staff's analysis could substantially underestimate the effect of flight feather damage associated with exposure to concentrated flux.

It is also conceivable that conduction of heat down the quill of the feather could result in damage to the follicle resulting in complete loss of the feather and loss of ability to re-grow a new feather during subsequent molting cycles.

Another uncertainty is the effect of exposure of the feather surface to UV radiation with concurrent exposure to high temperatures. Staff was not able to include the potential effect of increased keratin molecular bond scission that could be associated with concurrent exposures. Such exposure could result in adverse effects on keratin integrity at lower surface temperatures than would otherwise be required, accelerating the rate of damage.

Exposure to summer ambient conditions mid-day results in exposure to solar flux of 1 kW/m^2, and is thus the base line beyond which excess damage can occur. Preexisting exposure of 1 kW/m^2 with or without the existence of the proposed facilities places a lower limit on exposure. An exposure to 5 kW/m^2 is the lowest exposure that results in a surface temperature of 160 ^{o}C which can be considered a lowest observed adverse effect level (LOAEL). Use of an uncertainty factor greater than 5 and a LOAEL of 5 kW/m^2 would render the exposure criteria moot as it would require exposure to remain below the preexisting background of 1kW/m^2. Exposures below 4 kW/m^2 did not result in surface temperatures of above 160^o C and can be considered a NOAEL. Use of an uncertainty factor of 2 and a LOAEL of 5 kW/m^2 results in an estimated safe exposure level of 2.5 kW/m^2. Based on this analysis, staff estimates that a one-time exposure to a solar flux density between 2.5 kW/m^2 and 4 kW/m^2, for a duration not exceeding 1 minute or so, would cause little if any damage to flight feathers and can be considered safe.

CONCLUSIONS

Staff's analysis of avian exposure to concentrated solar radiation indicates that a threshold of safe exposure does not exist above a solar flux density of about 4 kW/m^2. The analysis also indicates that both the Hidden Hills and Rio Mesa facilities pose potentially significant risk to avian populations that may encounter the air space in the facilities where concentrated flux density is above staff's estimated safe levels, resulting in avian morbidity and mortality. The available data regarding avian impacts is very limited; however, such data does provide at least some perspective regarding potential for impact.

There are significant questions regarding extrapolation from the available information regarding avian impacts. The most vexing is the complete absence of data that would allow estimation of avian morbidity (i.e. reliable dose response data). Staff's assessment provides estimates of exposure and dose that can lead to injury and late fatality. In addition, there are major unknowns in estimation of differences in avian populations from one site to the next. These limitations in the available data require exercise of considerable judgment in extrapolation of data from one site to another. However, the errors introduced by the lack of site specific data are likely to be small in comparison to the absence of morbidity estimates and effects of dramatically increased potential exposure duration resulting from the increased volume of the air space affected by concentrated solar flux of the proposed project.

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APPENDIX BIO1A - PROCEDURAL MODEL AND CALCULATIONS USED TO ESTIMATE AVIAN EXPOSURE TO CONCENTRATED SOLAR RADIATION

Geoff Lesh, P.E. and Rick Tyler

FOR HIDDEN HILLS BIOLOGY RESOURCES APPENDIX BIO1

INTRODUCTION

A surface exposed to and thus absorbing incident concentrated solar flux will convert the absorbed flux to heat and rise in temperature until it reaches a thermal equilibrium with its surroundings, including the incident flux. The heat loss mechanisms of convection and radiation will increase their rate of removing heat from the surface until they together match the rate of incoming heat from the incoming solar flux, then the temperature will stabilize. The stable temperature at which this thermal equilibrium occurs is determined by the level of incoming solar flux and parameters that affect the loss mechanisms such as flight speed, ambient temperature, and the view factor. Thus it is possible to, within a reasonable degree of accuracy (with some dependence on materials and circumstances), to relate an incoming solar flux level to the steady-state temperature to which a material surface may rise.

To determine this relationship between solar flux and temperature, staff modeled the temperature response of exposed feather surfaces to concentrated solar flux using a dynamic iterative method that allows for the examination of the various mechanisms of cooling that begin to operate when the material is heated. This method allows for the variation of material properties and allows examination of changing external conditions (e.g. flux levels with position). Transient responses of the material being heated (i.e. the time needed for the material to respond to those changes of external conditions) can also be examined to see how quickly the surface temperature rises and falls.

The surface temperature model is driven by the incoming thermal radiation (flux) to the surface. The absorbed flux causes the absorbing material (the feather in this case) to rise in temperature. The rising temperature causes the material to heat to a temperature above its surroundings, and so the material starts to lose heat back to its surroundings through convection and re-radiation. These three mechanisms are well understood and characterized and can be found in nearly any college level textbook on heat transfer and fluid mechanics (Holman 1976) (Incropera 2007) (Cengel 2007) (MERM 2001).

The model assumes that the material being heated maintains its integrity throughout the modeled flight path regardless of temperatures predicted so that potential temperature rise and response to changing input flux can be observed. The observation of steady-state as well as transient responses help to verify that the model is responding according to well established and verified expected thermal behaviors.

In the real world, most organic materials will begin to decompose (pyrolize) at some elevated temperature (about 160 °C for keratin, the material of feathers), and the material's properties (mass, thickness, stiffness, composition, toughness, brittleness, density, dimensions, etc.) will begin to change. Shrinkage and melting of filamentary structures is expected to occur by approximately 300 °C. Upon reaching a temperature of 400 °C the remaining material would be mostly carbon and have little if any remaining structural integrity. Therefore, for the purpose of risk assessment to evaluate potential damage to feathers, accurately predicting temperatures very much over 300 °C is not meaningful. By then the keratin will have pyrolized and out-gassed most of its volatile components leaving behind a mostly carbonaceous material. For more information and references on this see **APPENDIX BIO1**. References listed throughout this document refer to the list of references published at the end of **APPENDIX BIO1.**

The following is an outline of the logical steps through which the computerized model proceeds to predict the temperature response of a feather-covered surface (i.e. bird's wing) as it flies along some chosen path above and across a solar concentrated flux field. Some assumptions regarding the material properties and the actual scenario must be made, and attempts have been made to choose reasonable and realistic values and cases for use in conducting a risk assessment of avian exposure to concentrated flux.

OUTLINE OF STEPS FOLLOWED IN BIRD FLIGHT MODEL (WITH REFERENCES WHERE APPLICABLE)

1) Set path conditions
   a) Pick a straight-line path through the applicant-provided flux map (provided in **Response to Data Request, Set 2A, #159**). Note: The diagram used for cross-field paths and to get location and flux density values along that path is included in the top half of the applicant's Figure 3, page 9 of the data response. Most paths were directed northeast, passing at some selected distance of nearest approach to the tower on its northwest side.
   b) Measure the distances to each of the flux contours across the heliostat field
      i) Assume flux = 0 at edge of field, linearly interpolated elsewhere between flux levels indicated on the diagram. (Note: Where paths penetrated inside an indicated contour, but did not penetrate the next higher contour before passing the tower, flux levels were not taken to increase beyond the last penetrated contour. This assumption would tend to underestimate the actual maximum flux level along the path.)
      ii) Make a linear interpolation table of distance and path / flux level. This table is comprised of two vectors (nSunsVect and distData) included for each path shown in the **pathData()** section of the computer program code. The paths modeled are mostly straight lines crossing the solar field coming within some selected nearest approach distance to the solar receiver tower. One reported path involves a short path upward from the ground near the tower at an angle of approximately 45 degrees, to simulate a bird leaving the ground, and flying up through the flux pattern to a level above the tower.
2) Set environmental and flight conditions
   a) Ambient temperature Tambient = 45°C (113 °F). This is a temperature that is near the expected maximum, but which would still be expected to occur several

times during the summer months. Ultimately, a shift in the assumed ambient temperature affects the flux-exposed equilibrium temperature by an amount similar to the temperature shift for temperature of interest (less than 300 °C). Thus, an ambient temperature shift of 4 °C, would affect the flux level to reach 160 °C on a surface by about 0.2 kW/m^2.

b) Flight speed V = 18 mph is used in the risk assessment. This is a speed, within the lower-middle range of speeds (Alerstam 2007) that would be expected of birds at these solar sites.

c) Angle of incidence of flux to feather surface (angle from perpendicular incidence) “offVert”. Values used were (a) 71 degrees as a likely angle to the underside of a horizontal surface (e.g. bird wing) estimated from applicants flux maps, and (b) 0 degrees as there would always be some portion of the surface of any three-dimensional object (e.g. bird) exposed to the flux at this angle. The term “view factor” is equal to the trigonometric cosine of the incidence angle, (i.e. cosine (offVert angle)) is used to indicate the heating “effectiveness” of incident flux on a surface.

d) Wing chord length (distance from leading to trailing edge of a wing) “L” (6 inches was chosen as representative), is a factor used in determination of the fluid mechanics-related Reynolds number, and thus is a factor in whether airflow over the wing surface is laminar or turbulent, which in turn affects rate of convective cooling of the surface. The L = 6” assumption yields a Reynolds number of approximately 70,000, well within the range spanning bird flight (Videler 2005, p. 17). With the commonly used for air flow over a wing “external flow over a flat plate” analogy model (Ward 1999), the resulting Reynolds number for the underside of the wing remains well below the accepted critical value of 500,000 where air flow would be expected to become turbulent. For all considered cases of bird flight, the air flow passing the underside of the wing is considered to be laminar (Withers 1981). This choice drives the equations used for determining the appropriate convective heat transfer coefficient (Holman 1976) (Incropera 2007) (Cengel 2007) (MERM 2001).

3) Assume feather’s physical properties

a) Thickness = 600 microns (assumed)

b) Optical emissivity = 0.95 (assumes a dark colored bird) (Ward 1999) Staff assumes for this risk assessment that the absorbance coefficient for solar flux will be the same as the emissivity of the surface for re-radiation of infrared radiation. This assumption is based on reported data on values reported for black plumage, the effects of dirt on surfaces, and the properties of the feathers structure (Quintiere 1974, Osorio 2002, Bass 1995).

c) Optical transmissivity = 0 (assumes incident flux does not pass through without being blocked and absorbed)

d) Optical absorption depth = 0.5 (Assume incident flux is absorbed in first half of thickness)

e) Mass density of solid keratin = 1.3e3 kg/m^3 Ref: (Munn 2009)

f) Void density (to account for the open keratin structure of feathers) (assumed to be 50% of volume). Note that the density characteristics affect transient effects (the timing) of the heating effects, but not the steady-state temperatures used for this risk assessment.

g) Mass density per unit area of plumage = half that of solid keratin to account for void volume of feather structure (See note above on effect of void density).

h) Thermal conductivity of keratin = 0.05 W/m-K Ref: (Dawson 1999), (Baxter 1946),(Martinez 2012)

i) Thermal conductivity of plumage = 0.074 W/m-K Ref: (Walsberg 1988)

j) Moisture level delays heating by adding water mass to the plumage that must be heated to 100 °C. Heating beyond 100 °C, is further delayed as the water consumes and carries away heat during its evaporation. This effect is minor (on the order of 2-3 seconds) for the flight paths modeled.

4) Set initial conditions:

a) Tsurf = Tambient (Assume initial surface temperature is at the ambient air temperature.)

b) Qin = 0 (Solar radiation arriving at the top of the wing surface directly from the sun, is not considered in this analysis).

c) t = 0

5) Start clock (intervals of dt). Repeat the following steps for each clock tick interval, until all way across the heliostat field. Output and graph are stored in viewable files. See Hidden Hills **Appendix BIO1 Figures 1** thorough **4** and **Appendix BIO1 Tables 2** and **5** for examples:

a) Calculate new time (t) from clock ticks by adding dt (the time interval)

b) Calculate position along path
X = V * t where t = elapsed time, V = flight speed

c) Calculate flux Level from position by interpolation between flux contours (from applicant)

d) Calculate solar energy received in from Flux Level, emissivity, view factor, transmissivity
Qin = 1000 * (SunsIn+1) * emissivity * viewFactor * (1 - transmissivity)
Ref: MERM 2001, p. 37-2, eqtn. 37.8

e) Calculate hot-side convective energy losses
Qv = h * (Tsurf - Tambient) Ref: MERM 2001, p. 36-3, eqtn. 36.14

f) Calculate hot-side re-radiative losses energy losses
Qrad = SBsigma * emissivity * ($Tsurf^4$ - $Tambient^4$) Ref: MERM 2001 p. 37-4, eqtn 37.14

g) If backside of plumage is uncovered (i.e. feather is solely protruding without being covered on front or back side by either plumage or flesh), calculate conductive-convective combination losses as:

Qcomb = (Tsurf-Tamb) / (thkPlumage * (1-abDepth) / kPlumage + 1/h) going through the feather with heat going out to the air flowing over the backside of the feather (Holman 1976 p. 29); (this option not used for the conservative general case of this analysis) if backside of feather is covered by other feathers or the bird's body, set Qcomb = 0. (option used in this analysis)

h) Calculate energy change during interval as Qnet = Qin – Qv – Qcomb – Qrad

i) Calculate change in surface temperature during interval
dT = Qnet * dt / (CpPlumage * mDryfeather + CpWater * mWater)
ref: MERM 2001, p. 34.15

Note: Possible moisture in the feather is accounted for by making the incoming flux warm its mass as well as the feather's, until 100 °C. At 100 °C, temperature rise is stalled until the water has been vaporized from the liquid state, then is assumed to be released to the atmosphere. A moisture level of constituting 15 percent of the mass of the dry feather is assumed.

j) Calculate new surface temperature Tsurf = Tsurf + dT

k) Repeat the loop until path has traversed the solar field.

BIRD FLIGHT MODEL MATERIAL PROPERTIES ASSUMPTIONS WITH REFERENCES

FOR HIDDEN HILLS BIOLOGY RESOURCES APPENDIX BIO1

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Selected code extractions showing values used, and source references

```
# bird plumage characteristics

    Tskin = 41                    #  degC assumed body temperature of bird

    transmissivity = 0.0          # of bird plumage

    emissivity = 0.95             # of bird feather  ref: Ward 1999, Wolf 2000

    kPlumage = .074               #  W/m-K plumage thermal conductivity   ref: Walsberg 1988

    rhoPlumage = 1.3e3 *.5        #  density in kg/m^3 (keratin density is assumed halved by void
                                                            density)

    thkPlumage =    60e-5         #  meters

    CpPlumage =     1.53e3        #  J/kg-K

    abDepth = .5                  # fraction of plumage thickness that
                                     absorbs the Qin flux

    Tsurf =  Tamb                 # start here for initial temp

    mDryFeather = rhoPlumage * thkPlumage   # feather mass in kg/m^2

    mWater = waterFraction * mDryFeather    # water mass per unit area
                                             (kg/m^2 )  adds mass to feathers

    m = mDryFeather + mWater      #water absorbs heat until 100C

    #initialized constants and parameters

    viewFactor = math.cos(offVert * math.pi/180.)

    L = L / 39.4        # Convert from inches to meters

    Pr = 0.705          # Prantl number (dimensionless) air       ref: MERM App 35.D

    V =  Vmph / 2.237   # convert flight speed from mph to meters/sec

    airVis = 1.78e-5    # air kinematic viscosity at 49°C         ref: MERM App 35.D

    kAir = .028         # air thermal conductivity W/(m-degK)     ref: MERM App 35.D

    Qthresh = 4000.     # in watts/m^2 (staff-determined)

    Reynolds = V * L / airVis     # Ref: MERM 2001, p. 36-4 eq. 36.18

    Nu = 0.664 * Reynolds**0.5 * Pr**(.33333333)    #Nusselt number  Ref: MERM 2001, p. 36-4 eq.
36.18

    h = kAir * Nu / L             # convective heat transfer coeff   Ref: MERM 2001, p. 36-3
eq.36.14
```

```
    SBSigma = 5.6704e-8          #  W/(m^2 * K^4) Stephan-Boltzman constant Ref: MERM 2001, p. 
37-2
```

The following source code listing contains the computer model used for the risk assessment. It is written in the Python Open Source Programming Language, Version 2.7.2. An interpreter for executing the code is available at http://www.python.org/ . This program code was designed and written by staff for this particular project-specific risk assessment, and should not be considered a general purpose heat transfer modeling code. Lines and portions of lines that begin with a '#' mark are comment lines for use in understanding the code. The code is included here for completeness in discussing staff's analytical method and assumptions. No user manual has been written.

Printed in mono-spaced font for readability of computer code.

Source Code

```
# heat rise of bird surface temperature
# bird_traverse_3e10.py  10/28/2012  Geoff Lesh
# added: option for backside losses
def pathData():

    global distVect, nSunsVect, towerLocation, waterFraction, offVert, runID, emissivity,Tamb, ,\
           pathID, pathRemarks

    #findPathID = 'modelRMOff30'
    #findPathID = 'modelRMOff120'
#

    ##if findPathID == 'modelRMOff30':
    #scale =  12/39.4  #meters real world per feet scale
    #pathID = 'modelRMOff30'
    #pathRemarks = 'Modeled RM Off Tower 30 ft'
    #towerDist = 0
    #nSunsVect = (0,   5,      10,     25,     50,     100,100,50,25,10,5,0)
    #distData=   [ -4920,-454,-435,-268,-68,-39,     39,68,268,435,454,4920] # units in feet



    ##if findPathID == 'modelRMOff60':
    #scale =  12/39.4  #meters real world per feet scale
    #pathID = 'modelRMOff60'
    #pathRemarks = 'Modeled RM Off Tower 60 ft'
    #towerDist = 0
    #nSunsVect = (0, 5, 10, 25, 50, 50, 25, 10, 5, 0)
    #distData=   [ -4920,-451,-432,-263,-43,43,263,432,451,4920] # units in feet


    ##if findPathID == 'modelRMOff120':
    #scale =  12/39.4  #meters real world per feet scale
    #pathID = 'modelRMOff120'
    #pathRemarks = 'Modeled RM Off Tower 120 ft'
    #towerDist = 0
    #nSunsVect = (0,   5,      10,     25,     25,10,5,0)
    #distData=   [ -4919,-439,-419,-242,242,419,439,4919] # units in feet


    ##if findPathID == 'modelS1Off30':
    #scale =  12/39.4  #meters real world per feet scale
    #pathID = 'modelS1Off30'
    #pathRemarks = 'Modeled S1 Off Tower 30 ft'
    #towerDist = 0
```

```
    #nSunsVect = (0,  5,     10,    25,    25,10,5,0)
    #distData=   [ -1320,-118,-114,-67,67,114,118,1320] # units in feet

    ##if findPathID == 'modelS1Off60':
     #scale =  12/39.4  #meters real world per feet scale
     #pathID = 'modelS1Off60'
     #pathRemarks = 'Modeled S1 Off Tower 60 ft'
     #towerDist = 0
     #nSunsVect = (0,  5,     10,    25,    25,10,5,0)
     #distData=   [ -1319,-106,-102,-42,42,102,106,1319] # units in feet

    ##if findPathID == 'modelS1Off120':
    #scale =  12/39.4  #meters real world per feet scale
    #pathID = 'modelS1Off120'
    #pathRemarks = 'Modeled S1 Off Tower 120 ft'
    #towerDist = 0
    #nSunsVect = (0.,  5.,    5.,0.)
    #distData=   [ -1315,-22,22,1315] # units in feet

    #scale=1500./7.7   # meters real world per cm on scale This is general scale for path not
having their own scale

    ###flying upward  Note: this path has its own scale!
    #scale=300 / 16.7  #meters Real world per cm on map: map data is in same cm.
    #pathID =  'DAUP'
    #pathRemarks = 'Upward past tower from ground'
    #towerDist = 13.15
    #nSunsVect = (0,5,10,25,50,50,25,10,5,0)
    #distData=   [0,10.8,11.1,11.6,12.3,14,14.4,15.5,15.9,20]  #cm of scale #

    #pathID = 'Constant 1KW'
        #scale=1500./7.7   # meters real world per cm on scale This is general scale for path not
having their own scale
    #pathRemarks = 'Constant 1KW'
    #towerDist = 24.3
    #nSunsVect = (0,1,1,0)
    #distData=   [16.95,17.0, 31.2, 31.25]  #cm of scale #

    #pathID = 'Constant 5KW'
    #pathRemarks = 'Constant 5KW'
    #scale=1500./7.7   # meters real world per cm on scale This is general scale for path not
having their own scale
    #towerDist = 24.3
    #nSunsVect = (0,5,5,0)
    #distData=   [16.95,17.0, 31.2, 31.25]  #cm of scale #

    #pathID = 'Constant 8KW'
    #pathRemarks = 'Constant 8KW'
    #scale=1500./7.7   # meters real world per cm on scale This is general scale for path not
having their own scale
    #towerDist = 24.3
    #nSunsVect = (0,8,8,0)
    #distData=   [16.95,17.0, 31.2, 31.25]  #cm of scale #


    #pathID = 'Constant 10KW'
    #pathRemarks = 'Constant 10KW'
    #scale=1500./7.7   # meters real world per cm on scale This is general scale for path not
having their own scale
    #towerDist = 24.3
    #nSunsVect = (0,10,10,0)
    #distData=   [16.95,17.0, 31.2, 31.25]  #cm of scale #


    #pathID = 'Constant 25W'
```

```
    #pathRemarks = 'Constant 25KW'
    #scale=1500./7.7   # meters real world per cm on scale This is general scale for path not
having their own scale
    #towerDist = 24.3
    #nSunsVect = (0,25,25,0)
    #distData=   [16.95,17.0, 31.2, 31.25]  #cm of scale #

    #pathID = 'Constant 50KW'
    #pathRemarks = 'Constant 50KW'
    #scale=1500./7.7   # meters real world per cm on scale This is general scale for path not
having their own scale
    #towerDist = 24.3
    #nSunsVect = (0,50,50,0)
    #distData=   [16.95,17.0, 31.2, 31.25]  #cm of scale #

    #pathID = 'Constant 100KW'
    #pathRemarks = 'Constant 100KW'
    #scale=1500./7.7   # meters real world per cm on scale This is general scale for path not
having their own scale
    #towerDist = 24.3
    #nSunsVect = (0,100,100,0)
    #distData=   [16.95,17.0, 31.2, 31.25]  #cm of scale #

    #pathID = 'Constant 150KW'
    #pathRemarks = 'Constant 150KW'
    #scale=1500./7.7   # meters real world per cm on scale This is general scale for path not
having their own scale
    #towerDist = 24.3
    #nSunsVect = (0,150,150,0)
    #distData=   [16.95,17.0, 31.2, 31.25]  #cm of scale #


    #pathID = 'AASE'
    #scale=1500./7.7   # meters real world per cm on scale
    #pathRemarks = 'closest pass to tower'
    #towerDist = 21.55
    #distData=   [15.3, 19.4, 20.2, 20.4, 21.2, 21.25, 21.3, 21.65, 21.75, 21.85, 21.95, 22.9,
24.5, 29.5]  #cm of scale # path A1 next to tower
    #nSunsVect = (0,5,10,25,50,100,150,150,100,50,25,10,5,0)
# path A1 next to tower

    #pathID = 'ABNE'
    #pathRemarks = '100 m off tower (tangent)'
    #scale=1500./7.7   # meters real world per cm on scale This is general scale for path not
having their own scale
    #towerDist = 20.0
    #nSunsVect = (0,5,10,25,25,10,5,0)                                           # path ABNE 100
m off tower
    #distData=   [11.7, 17.7, 18.5, 19.0, 21.2, 21.7, 22.5, 31.0]  #cm of scale #        path
ABNE 100 m off tower

    pathID = 'ACNE' #
    pathRemarks = '200 m off tower'
    scale=1500./7.7   # meters real world per cm on scale This is general scale for path not
having their own scale
    towerDist = 20.1
    nSunsVect = (0,5,10,10,5,0)                                          # path acNE 200 m off tower
    distData=   [12.2,18.2,19.4,19.7,22.7,29.9]  #cm of scale #        path acNE 200 m off tower

    #pathID = 'ADNE'
    #pathRemarks = '300 m off tower'
    #scale=1500./7.7   # meters real world per cm on scale This is general scale for path not
having their own scale
    #towerDist = 21.0
```

```
    #nSunsVect = (0,5,10,10,5,0)                                      # path ADNE 300 m off
tower
    #distData=   [13.7,19.3,22.3,23.,23.5,31.0]  #cm of scale #        path ADNE 300 m off tower

    #pathID = 'AENE'
    #pathRemarks = '400 m off tower'
    #scale=1500./7.7   # meters real world per cm on scale This is general scale for path not
having their own scale
    #towerDist = 24.3
    #nSunsVect = (0,5,5,0)                                      # path AENE 400 m off tower
    #distData=   [17., 22.8, 23.7, 31.2]  #cm of scale #        path AENE 400 m off tower

    if 1:
        distOffSet=distData[0]   # gets subtracted from initial and all values of distData
        towerLocation= (towerDist - distOffSet) * scale
        checkdata = len(distData)== len(nSunsVect)
        print 'Checkdata:  %s'%checkdata
        if not checkdata:
            print 'distData size: %s'%len(distData)
            print 'nSunsVect size: %s'%len(nSunsVect)
            raise Exception( 'Data vector lengths do not match.  Quitting. See output file.'  )
            #sys.exit()
        else:
            for i in zip(distData,nSunsVect):
                print i
            distVect  = tuple( scale * (i - distOffSet) for i in distData)  # in meters
            #distVect = tuple( scale * (i - towerDist) for i in distData)   # in meters centered
at tower

def userData():
    global Tamb, Tskin, dt, emissivity, offVert, L, V, nSteps, waterFraction,
maxDistance,waterFraction, offVert, RunID, emissivity,Tamb, V ,\
           pathID, Vmph, maxTime, transmissivity,backSideLossesOn
    nSteps= 44000
    dt = .01               # seconds, recheck frequency = clock tick
    Tamb = 49.             # degC
    waterFraction = .15    # mass of water

    offVert = 0.           # degrees  angle of incidence  Usually 0 or 71
    L = 6.                 # inches wing length front to back
    Vmph = 18.             # mph bird flight speed
    maxDistance = 3000     # meters
    maxTime =  800         # seconds
    backSideLossesOn = False  # True turns on heatloss through backside as Qcomb + QradBackside

def setConstants():  # initialize

    #initialize   constants  and data vectors
    viewFactor = math.cos(offVert * math.pi/180.)
    L = L / 39.4         # Convert from inches to meters
    Pr = 0.705           # Prandtl number for air (dimensionless)
    heatVapWater = 2257 # kJ/kg Heat of vaporization of water
    V =  Vmph / 2.237    # convert from mph to meters/sec
    airVis = 1.78e-5     # Air kinematic viscosity (m^2/s)
    kAir = .028          # air thermal conductivity (W/(m-degK))
    Qthresh = 4000.      # watts/m^2
    Reynolds = V * L / airVis     # Reynolds number  (dimensionless)
    Nu = 0.664 * Reynolds**0.5 * Pr**(.33333333)    #Nusselt number (dimensionless)
    h = kAir * Nu / L             # convective heat transfer coeff (W/m^2 - K)
    SBSigma = 5.6704e-8           # Stephan-Boltzman constant (W/(m^2-K^4))
    CpWater = 4.1813e3            # heat capacity of liquid water (J/kg-K)
    HvWater = 2257e3              # entalpy of vaporization for water (J/kg)

    # bird plumage characteristics
    Tskin = 41                    #  bird body temperature degC
```

```
    transmissivity = 0.0          #  of bird feather (dimensionless)
    emissivity = 0.95             #  of bird feather (dimensionless)
    kPlumage = .074               #  (W/m-K) plumage thermal conductivity
    rhoPlumage = 1.3e3 *.5        #  density in kg/m^3
    thkPlumage =    60e-5         #  meters          ref:
    CpPlumage =     1.53e3        #  J/kg-K          ref:
    abDepth = .5                  # fraction of plumage thickness absorbing the flux (assumed)
    Tsurf =  Tamb                 # start here for initial temp
    mDryFeather = rhoPlumage * thkPlumage   # feather mass in kg/m^2
    mWater = waterFraction * mDryFeather    # water mass per unit area (kg/m^2 )adds mass to
plumage


        t=0               # initialize start time
        timeTo160 = -99
        timeAbove160 = 0
        timeTo300 = -99
        timeAbove300 = 0
        #maxTsurf = 0
        lHit160 =  False
        lHit300 = False
        if mWater > 0:
            lFeatherIsDry = False
        else:
            lFeatherIsDry = True
        doseTotal = 0
        doseBefore160 = 0
        doseAbove160 = 0
        doseAbove300 = 0
        doseAboveThresh = 0

def qDotIn(d):
    global i, distVect, nSunsVect
    intensity = np.interp(d,distVect,nSunsVect)
    return intensity

def mainLoop():
    # input data
    ## could add 1 sun to backside then add convection and conduction

    for i in range(1,nSteps):  # i is clock ticks
        t = i*dt   #new time
        d = t*V    #new distance


        Qrad = SBSigma * emissivity * ((Tsurf+273)**4 - (Tamb+273)**4)# (Watts/m^2)re-Rad of
                                                                         energy absorption

        Qv =   h * (Tsurf - Tamb)                    # 'Front' surface convection in Watts/m^2
        #Qc =   kPlumage * (Tsurf - Tskin)           # in Watts conduction to body (not used with
                                                       Qcomb)

        if backSideLossesOn:
            Qin = 1000 * (SunsIn+1) * emissivity * viewFactor * (1 - transmissivity) # in Watts
            Qcomb = (Tsurf-Tamb) / (thkPlumage * (1-abDepth)/kPlumage + 1/h) # combined
'backside' conduction + convection in Watts/m^2
            Tbackside = Qcomb/h + Tamb # temperature of back side of feather
            QradBackSide = SBSigma * emissivity * ((Tbackside + 273)**4 - (Tamb + 273)**4)  # in
Watts/m^2  Rad of energy absorption
            Qnet = Qin - Qv  - Qrad - Qcomb - QradBackSide                               # net
heat gain during clock tick (W/m^2)

        elif not backSideLossesOn:
            Qin = 1000 * SunsIn * emissivity * viewFactor * (1 - transmissivity)           # in
Watts
```

```
            Qnet = Qin - Qv - Qrad                                                  # net
heat gain during clock tick (W/m^2)
            Tbackside = Tsurf
            Qcomb = 0

        if Tsurf >= 100. and not lFeatherIsDry:    #evaporate any remaining water and subtract
its mass
            dmWater = Qnet / HvWater               # potential water that could be evaporated off
            if dmWater <= mWater:                  # all remaining heat to be used to remove
water so temp won't rise (i.e. too much water)
                Qnet -= dmWater * HvWater          #Qnet is zeroed
                mWater -= dmWater                  # adjust for water removed

            else:
                Qnet -= mWater * HvWater           # remaining water is evaporated with energy
left over (limited to mWater not dmWater)
                mWater = 0
                lFeatherIsDry = True               # feather is now dry

        dTemp = Qnet * dt / ( CpPlumage * mDryFeather* abDepth + CpWater * mWater * abDepth )
#change in temp of feather surface (front side) during clock tick (assumes all mass participates)
            #fixme

        Tsurf += dTemp  #new temp

        doseTotal += Qin * dt

        if Tsurf > 160:
            doseAbove160 += Qin * dt
        if Tsurf > 300:
            doseAbove300 += Qin * dt
        if Qin > Qthresh:
            doseAboveThresh += Qin * dt

        #t +=  dt  #new time
        tSecsVect.append(t)
        TsurfVect.append(Tsurf)
        pathDistVect.append(d)
        IntensityVect.append(SunsIn)


        if lHit160 and Tsurf >= 160:
            timeAbove160 +=dt

        if lHit300 and Tsurf >= 300:
            timeAbove300 +=dt


        if Tsurf>=160 and not lHit160:
            lHit160=True
            timeTo160 = t

        if not lHit160:
            doseBefore160 += Qin * dt

        if Tsurf >= 300 and not lHit300:
            lHit300 = True
            timeTo300 = t


        print '%6.1f  , %6.1f,    %6.1f,   %9.1f,   %9.1f,  %9.1f, %9.1f, %9.1f, %9.1f, %9.1f'\
              %(t, d, SunsIn, Tsurf, Tbackside, Qin, Qnet, Qv, Qcomb, Qrad)

    maxSurfTemp =  max(TsurfVect)
    textLines=[]
```

```
    textLines.append(['RunID: %s'%runID])
    textLines.append(['PathID: %s'%pathID])
    textLines.append(['PathRemarks: %s'%pathRemarks])
    textLines.append(['Temp(ambient degC): %4.0f'%Tamb])
    textLines.append(['Speed(mph): %3.0f'%Vmph])
    textLines.append(['Emissivity: %4.2f'%emissivity])
    textLines.append(['Angle of Incidence (deg): %3.0f'%offVert])
    textLines.append(['View Factor: %4.2f'%viewFactor])
    textLines.append(['Moisture (%%): %3.0f'%(waterFraction * 100)])

    textLines.append(['PlumageThk (mils): %8.1f'%(thkPlumage * 39400)])  #converting from meters
to mils
    textLines.append(['BackSideLossesOn: %s'%(backSideLossesOn)])  #converting from meters to
mils
    textLines.append(['Max Surface Temp(C): %5.0f'% maxSurfTemp])

    print
    for  line in textLines: #
        print line[0]

    print
    print    'Time to  Time above  Time to  Time above (secs)'
    print    '   160C        160C     300C        300C'
    print    ' %5.0f       %5.0f    %5.0f       %5.0f'%(timeTo160, timeAbove160, timeTo300,
timeAbove300)
    print
    print 'h (convection coeff)(W/m^2-K): %7.1f'%h
    print 'Reynolds number:              %9.1f'%(Reynolds)
    print 'Max Surface Temp reached:         %5.0f'% maxSurfTemp
    print 'Flight Speed (ft/min):          %7.1f (%7.1f mph)'% (Vmph*5280/60., Vmph)
    print 'Total flight time (secs):       %7.0f'%(t)
    print 'Dose_total (kW-secs/m^2):       %7.1f'% (doseTotal/60000.*60)
    print 'DoseBefore160 (kW-secs/m^2):    %7.1f'% (doseBefore160/60000.*60)
    print 'DoseAbove160 (kW-secs/m^2):     %7.1f'% (doseAbove160/60000.*60)
    print 'DoseAbove300 (kW-secs/m^2):     %7.1f'% (doseAbove300/60000.*60)
    print 'DoseAboveThresh (kW-secs/m^2):  %7.1f'% (doseAboveThresh/60000.*60)


def makePlot():
    global pathDistVect, IntensityVect, TsurfVect, tSecsVect, towerLocation,
distVect,waterFraction, offVert, runID,emissivity,Tamb, V ,\
           pathID,Vmph,pathRemarks, viewFactor, timeTo160, timeAbove160, timeTo300,
timeAbove300,maxSurfTemp, fname, textLines


    newIntensity = [a for a in IntensityVect]
    pathDistVectMod = [a- towerLocation for a in  pathDistVect]
    distVectMod = [a- towerLocation for a in  distVect]  # these are the markers for the field
map countour measurements
    #tSecsVectMod =  [a- towerLocation/V for a in  tSecsVect]
    maxIntensity = max(newIntensity)
    plt = matplotlib.pyplot

    host = host_subplot(111, axes_class=AA.Axes)
    plt.subplots_adjust(right=0.75)
    plt.subplots_adjust(bottom= 0.180)

    par1 = host.twinx()
    par2 = host.twiny()

    offset = 60
    new_fixed_axis = par2.get_grid_helper().new_fixed_axis
    par2.axis["bottom"] = new_fixed_axis(loc="bottom",
                                    axes=par2,
                                    offset=(0, -35))
```

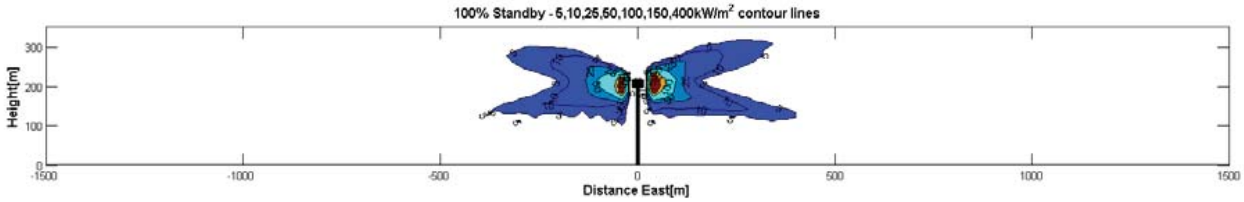
```
    par2.axis["bottom"].toggle(all =  True)
    par2.axis["top"].toggle(all =  False)


    host.set_ylim(0, maxSurfTemp*1.05)
    par1.set_ylim(0,1.05*maxIntensity)
    host.set_xlabel("distance (m)")
    host.set_ylabel("Surface Temp (degC) (dashed line)")
    par2.grid(True)
    par1.set_ylabel("Field Intensity (kw = #Suns) (solid line)")
    par2.set_xlabel("time(seconds)")

    p1, = host.plot(pathDistVectMod, TsurfVect,'r--')
    p2, = par1.plot(pathDistVectMod,newIntensity)# , label="kW (= Suns)")
    p3, = par2.plot(tSecsVect, TsurfVect, alpha=0)# ,label="time")
    p4, = par1.plot(distVectMod, nSunsVect, 's', markersize=4,
markerfacecolor='blue',markeredgecolor='blue')
    if timeTo160 > 0:
        jjl=host.axhspan(160,160,0.0,0.75,color='r', linewidth=.5)
        jj2=par2.text(tSecsVect[int(len(tSecsVect)*.83)],156,'%4.0f secs to reach 160
degC'%timeTo160,color='r', horizontalalignment='left',
                verticalalignment='top', fontsize = 'x-small')#,transform = host.transAxes)
        jj2=par2.text(tSecsVect[int(len(tSecsVect)*.83)],164,'%4.0f secs
above'%timeAbove160,color='r', horizontalalignment='left',
                verticalalignment='bottom', fontsize = 'x-small')#,transform = host.transAxes)


    if timeTo300 > 0: #p = plt.axhspan(0.25, 0.75, facecolor='0.5', alpha=0.5)
        Tval=300
        jjl=host.axhspan(Tval,Tval,0.0,0.75,color='r', linewidth=.5)
        jj2=par2.text(tSecsVect[int(len(tSecsVect)*.83)],Tval-4,'%4.0f secs to reach
300degC'%timeTo300,color='r', \
                      horizontalalignment='left',
            verticalalignment='top', fontsize = 'x-small')#,transform = host.transAxes)
        jj2=par2.text(tSecsVect[int(len(tSecsVect)*.83)],Tval+4,'%4.0f secs
above'%timeAbove300,color='r', horizontalalignment='left',
            verticalalignment='bottom', fontsize = 'x-small')#,transform = host.transAxes)

    #par1.set_ylim(0, 4)
    #par2.set_ylim(1, 65)


    host.axis["left"].label.set_color(p1.get_color())
    par1.axis["right"].label.set_color(p2.get_color())

    par2Span=(host.axis()[1]-host.axis()[0])/V
    par2.set_xlim(0,par2Span)

   ##plt.title(r'$\mathrm{Histogram\ of\ IQ:}\ \mu=100,\ \sigma=15$')
    plt.title(r'$\mathrm{Feather\ Surface\ Temperature\ along\ Flight\ Path\ }$')



    for  line in enumerate(textLines): #
        ##incr x, incr y
        host.text(0.01, .98-line[0]*.036,line[1][0], \
            horizontalalignment='left',
            verticalalignment='top',
            fontsize = 9,
            transform = host.transAxes)


    fullFname=str('c:\\mypython\\birds\\%s.png'%fname)
    myStr='saved to '+ fullFname
```

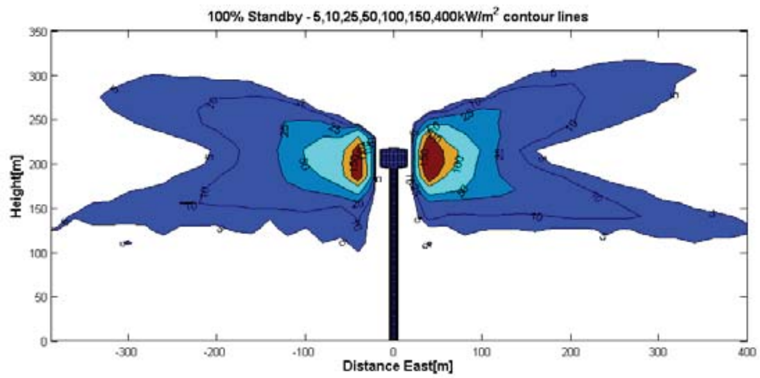
```
    print myStr
    plt.savefig('c:\\mypython\\birds\\%s.png'%fname)
    #plt.show()
    appfile= "c:\\program files\\quicktime\\pictureviewer.exe "

    subprocess.Popen([appfile, fullFname] )
    #plt.show()  #Tk causes prolems? after second plot won't close!

if __name__ == "__main__":

    try:
        import math
        import sys
        import datetime
        import math
        import numpy as np
        import matplotlib
        import matplotlib.pylab
        from mpl_toolkits.axes_grid1 import host_subplot
        import mpl_toolkits.axisartist as AA
        from datetime import datetime
        import subprocess
        runID = '%20s'%str(datetime.now())[:19] #'Dummy' #fixme
        fname=runID.replace(':','')
        fname2=fname.replace('.','')
        fname='Bird'+fname2

        textFileName=str('c:\\mypython\\birds\\%s.txt'%fname)
        print 'output is being redirected to : %s'%textFileName
        sys.stdout = open(textFileName,'w')

        print datetime.now().ctime()
        print 'This text file: %s'%textFileName
        print 'program: sys.argv[0] = %s'%sys.argv[0]



        userData()
        setConstants()
        pathData()
        mainLoop()
        sys.stdout = sys.__stdout__
        print 'Time(s)   Dist(m)    Tsurf(C)     Intensity(suns)'
        for a in zip(tSecsVect,pathDistVect,TsurfVect, IntensityVect):
            print '%6.1f  , %6.1f  , %6.1f  ,   %5.1f'%a # (a[0],a[1],a[2])

        print

        for  line in textLines: #
            print line[0]

        print
        print    'Time to  Time above  Time to  Time above (secs)'
        print    '   160C        160C     300C        300C'
        print ' %5.0f       %5.0f    %5.0f       %5.0f'%(timeTo160, timeAbove160, timeTo300,
timeAbove300)
        print
        print 'Max Surface Temp(C):             %5.0f'% maxSurfTemp
        print 'Reynolds number:               %9.1f'%(Reynolds)
        print 'h (convection coeff)(W/m^2-K): %7.1f'%h

        print 'Flight Speed (ft/min):           %7.1f (%3.1f mph)'% (Vmph*5280/60., Vmph)
        print 'Total flight time (secs):     %7.0f'%(t)
        print 'Dose_total (kW-secs/m^2):       %7.1f'% (doseTotal/60000.*60)
        print 'doseBefore160 (kW-secs/m^2):    %7.1f'% (doseBefore160/60000.*60)
```

```
        print 'DoseAbove160 (kW-secs/m^2):     %7.1f'% (doseAbove160/60000.*60)
        print 'DoseAbove300 (kW-secs/m^2):     %7.1f'% (doseAbove300/60000.*60)
        print 'DoseAboveThresh (kW-secs/m^2):  %7.1f'% (doseAboveThresh/60000.*60)
        print 'BackSideLossesOn: %s'%(backSideLossesOn)

        makePlot()
        print 'This text file: %s'%textFileName

        print 'program: sys.argv[0] = %s'%sys.argv[0]

    finally:
        sys.stdout = sys.__stdout__  #restore stdout back to normal
        print "done."
```

APPENDIX BIO2 - FIGURE 1

Palen Solar Electric Generating System - Full standby (as modeled by the Rio Mesa Electric Generating System)





Side views of maximal flux quantifier vertical cross section plot at 20m resolution

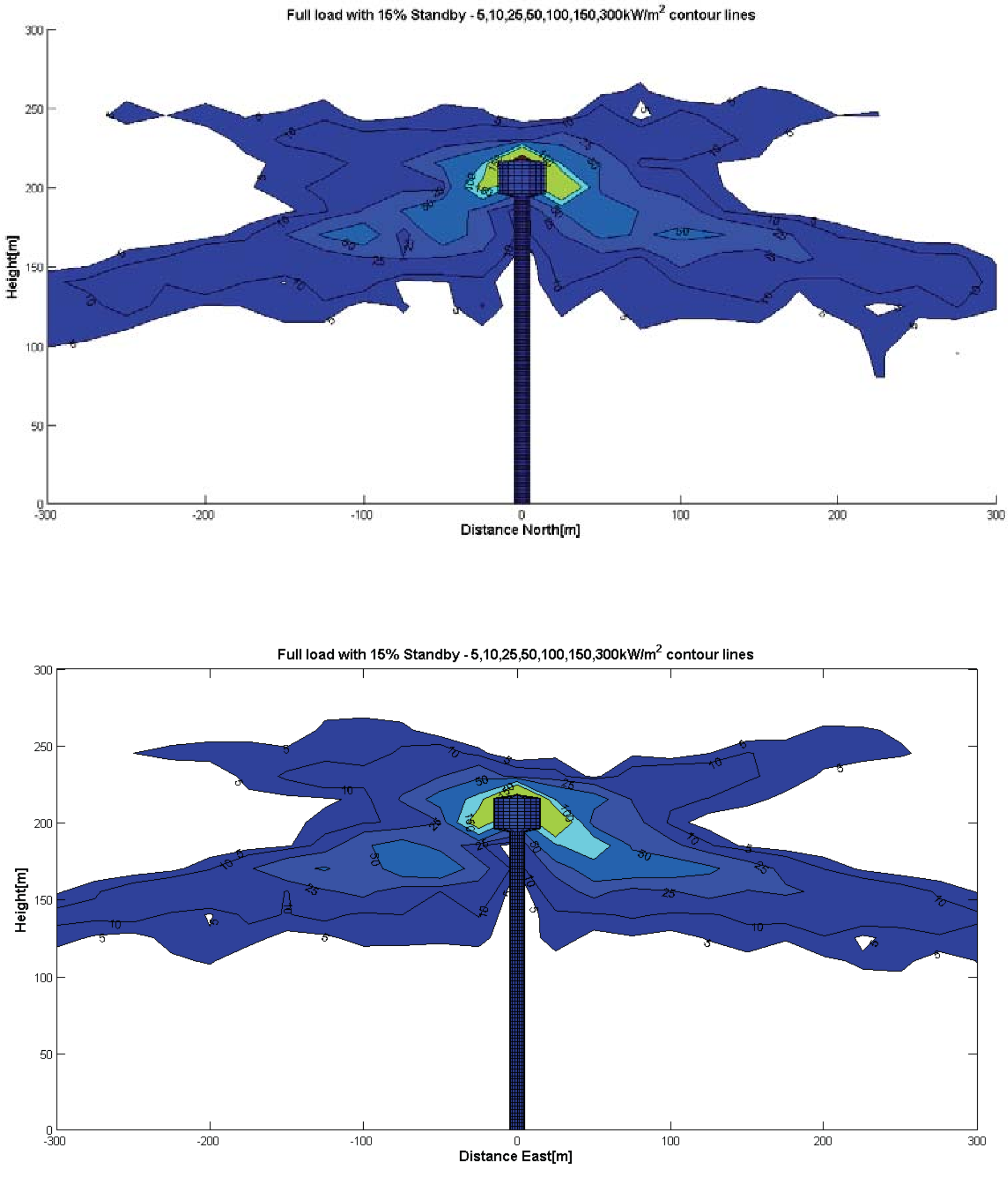
Top: view from east; bottom:zoom in of view from east.

Views from other direction are expected to be similar

SOURCE:Applicant's Response to Data Requests, Set 2A, #159_Page 9, July 20, 2012 (TN - 66279)

APPENDIX BIO2 - FIGURE 2

Palen Solar Electric Generating System - Full load with 15% standby (as modeled by the Rio Mesa Electric Generating System)



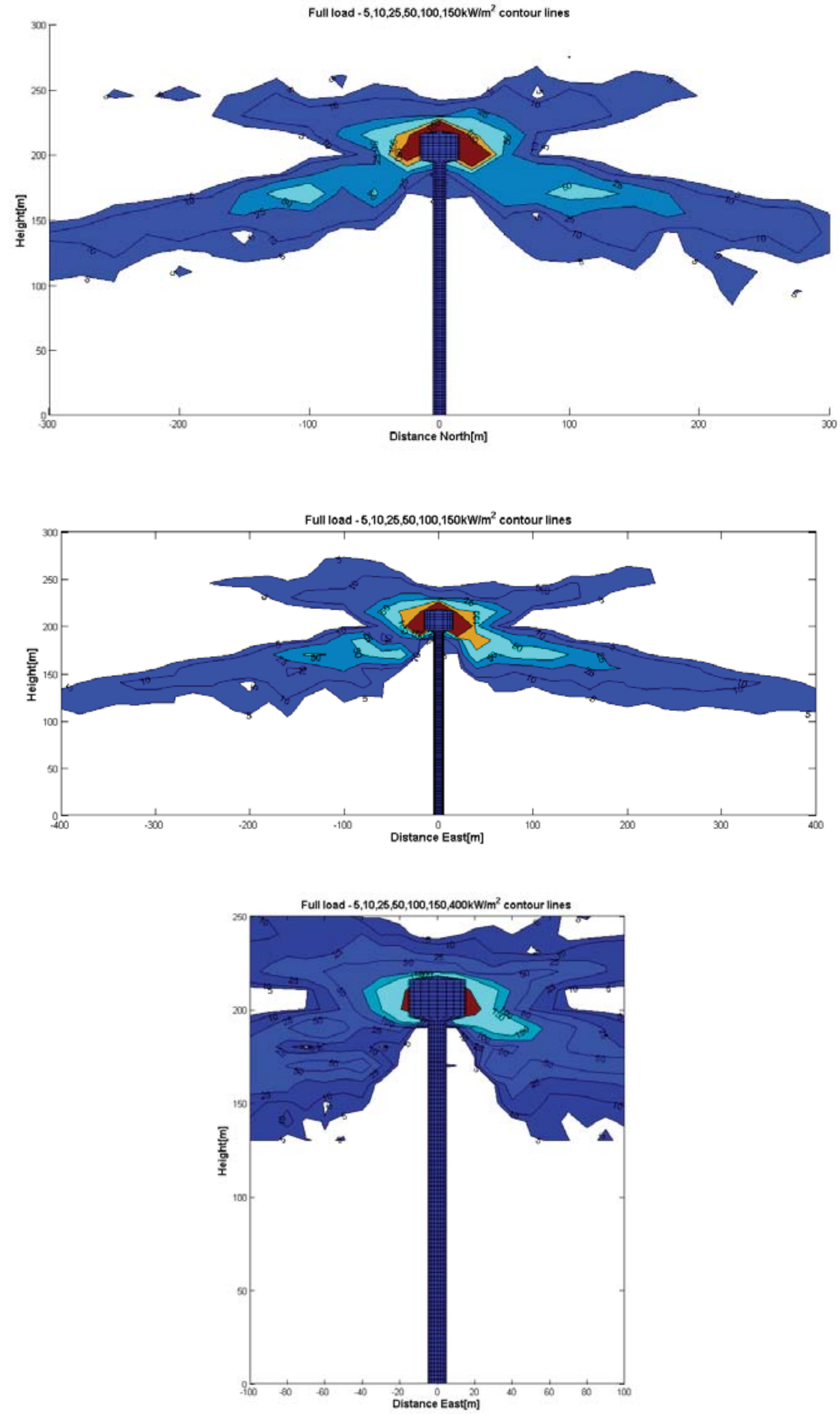
View of vertical cross section through the tower of maximal flux quantifier at full load with 15% of solar field at standby.

Top: view from east (25m resolution),

Bottom: view from south(25m resolution).

APPENDIX BIO2 - FIGURE 3

Palen Solar Electric Generating System - Full load with 0% standby (as modeled by the Rio Mesa Electric Generating System)



Profile views of Maximal Flux Quantifier at full load (with no standby)

Top: View from East (25m resolution)

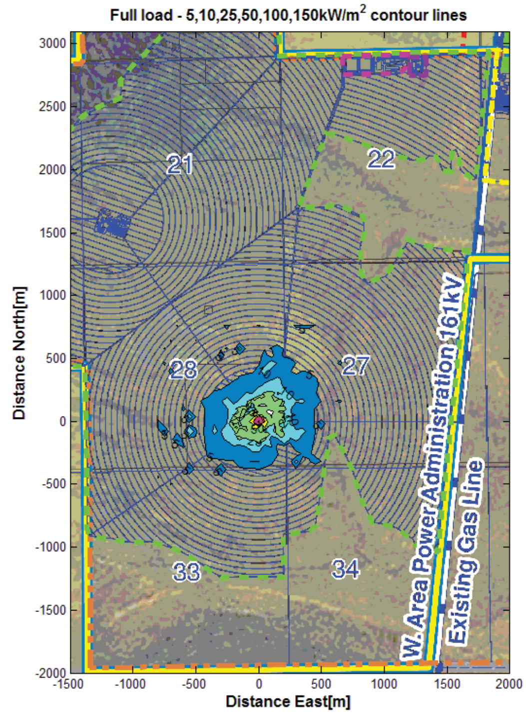
Middle: View from South (25m resolution)

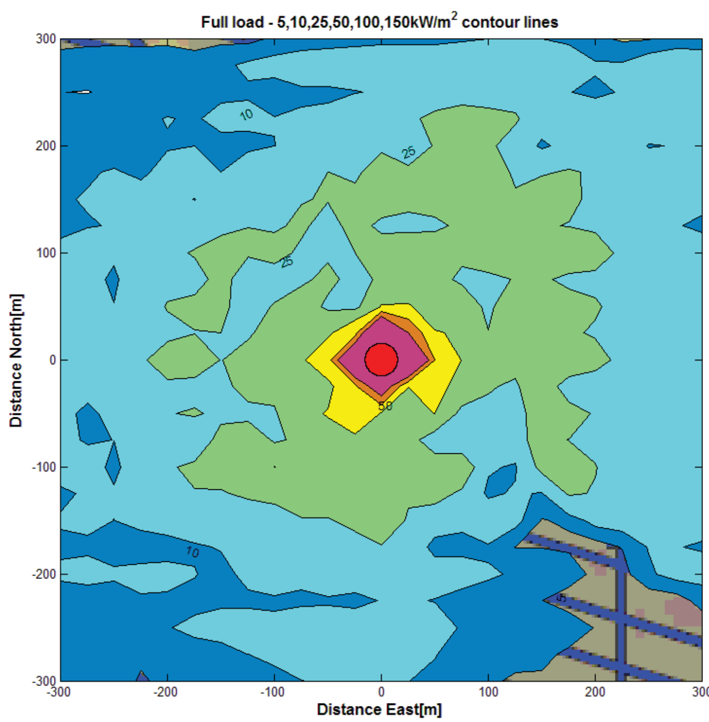
Bottom: Enlarged view from South (10m resolution)

SOURCE:Applicant's Response to Data Requests, Set 2A, #159_Page 6, July 20, 2012 (TN - 66279)

APPENDIX BIO2 - FIGURE 4

Palen Solar Electric Generating System - Plan View of Flux at Full load with 0% standby over RMS 1 Solar Field (as modeled by the Rio Mesa Electric Generating System)





The above plan views show the maximal flux quantifier over the solar field at full load (no standby).

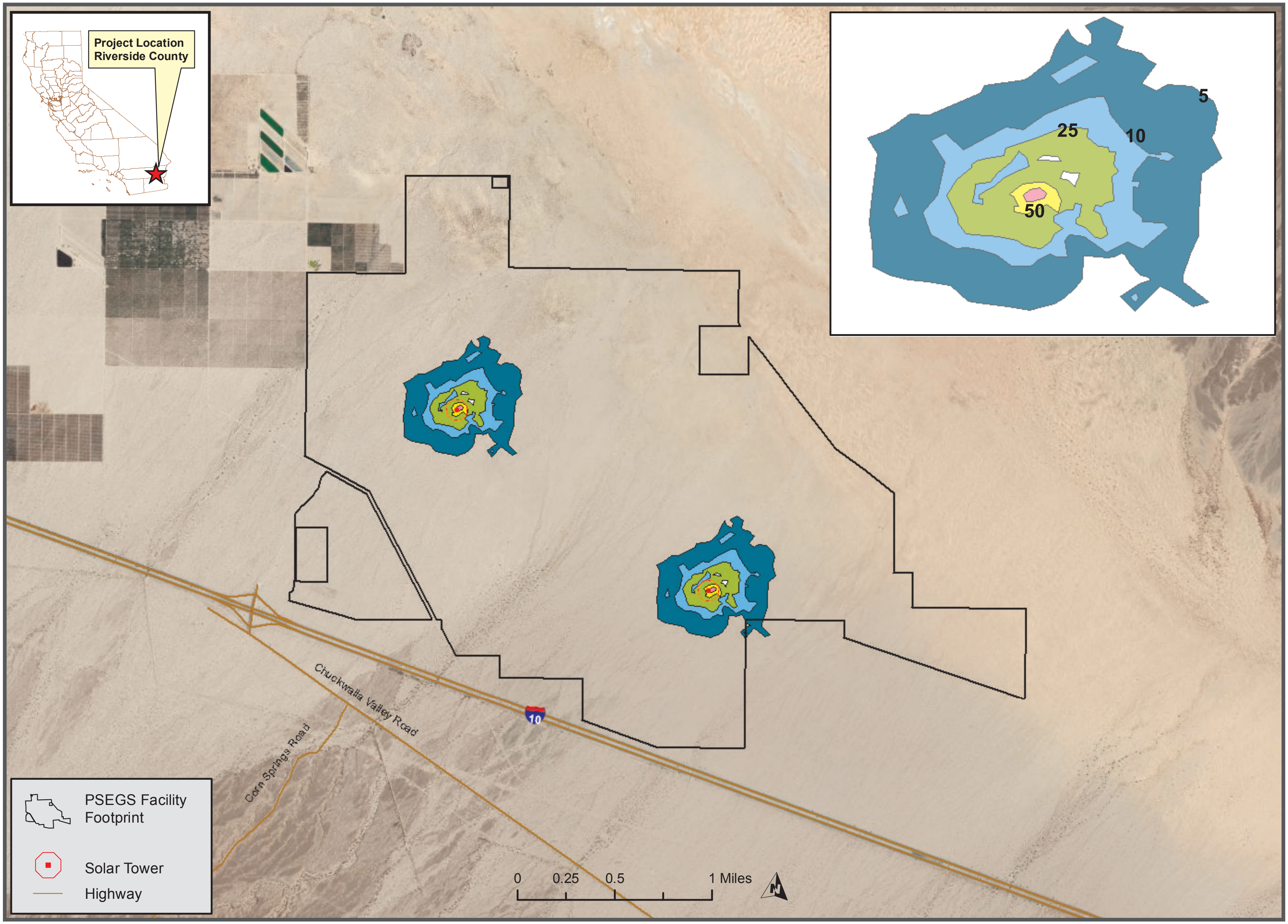
Top Image: Overview of the RMS site

Bottom Image: Enlargement of inner rectangle. Red circle represents the receiver location

SOURCE:Applicant's Response to Data Requests, Set 2A, #159_Page 7, July 20, 2012 (TN - 66279)

APPENDIX BIO2 - FIGURE 5

Palen Solar Electric Generating System - Full Standby (as modeled by the Rio Mesa Electric Generating System)



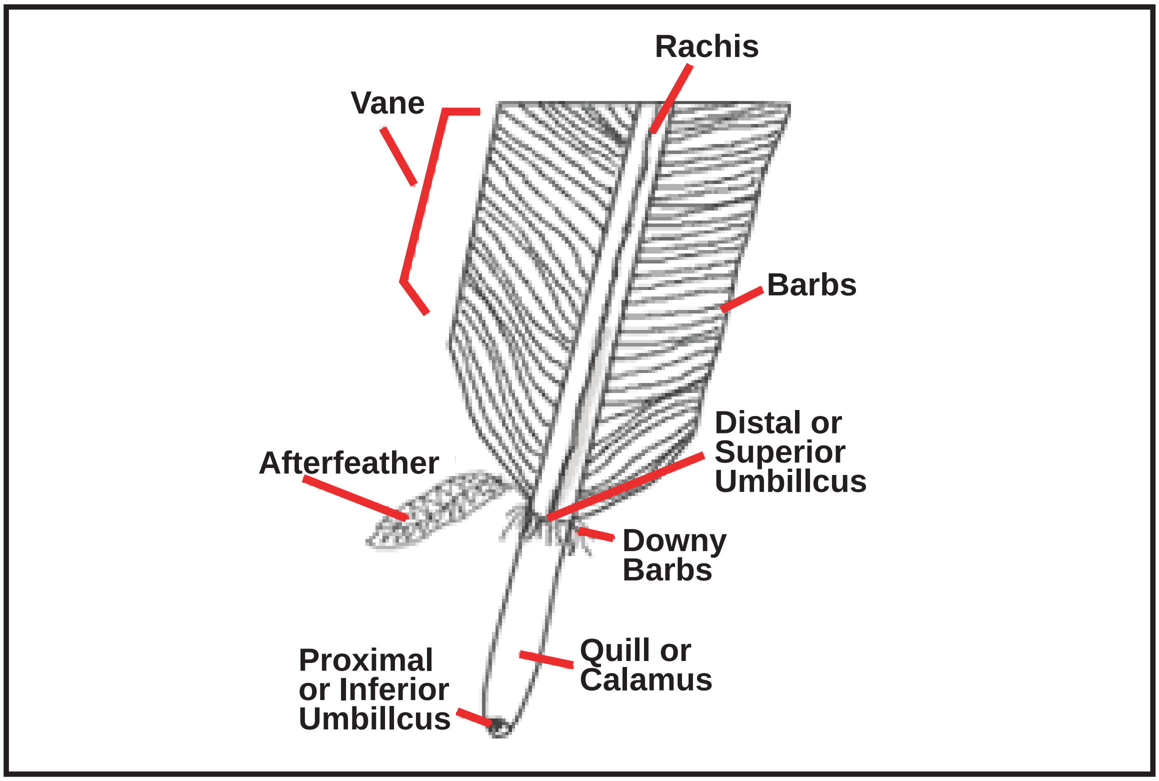
APPENDIX BIO2

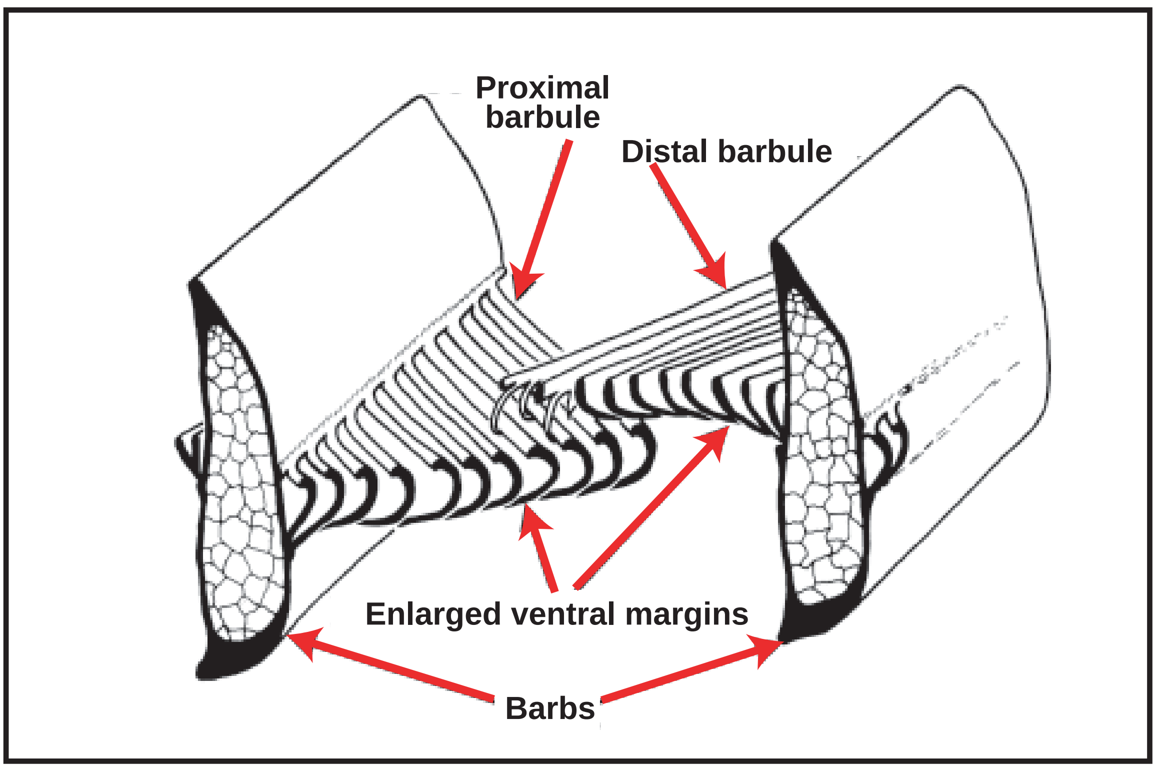
CALIFORNIA ENERGY COMMISSION, SITING, TRANSMISSION AND ENVIRONMENTAL PROTECTION DIVISION

SOURCE: Applicant's Response to Data Requests, Set 2A, #159_Page 9, July 20, 2012 (TN - 66279)

APPENDIX BIO2 - FIGURE 6

Palen Solar Electric Generating System - Bird Feather Types (as modeled by the Rio Mesa Electric Generating System)





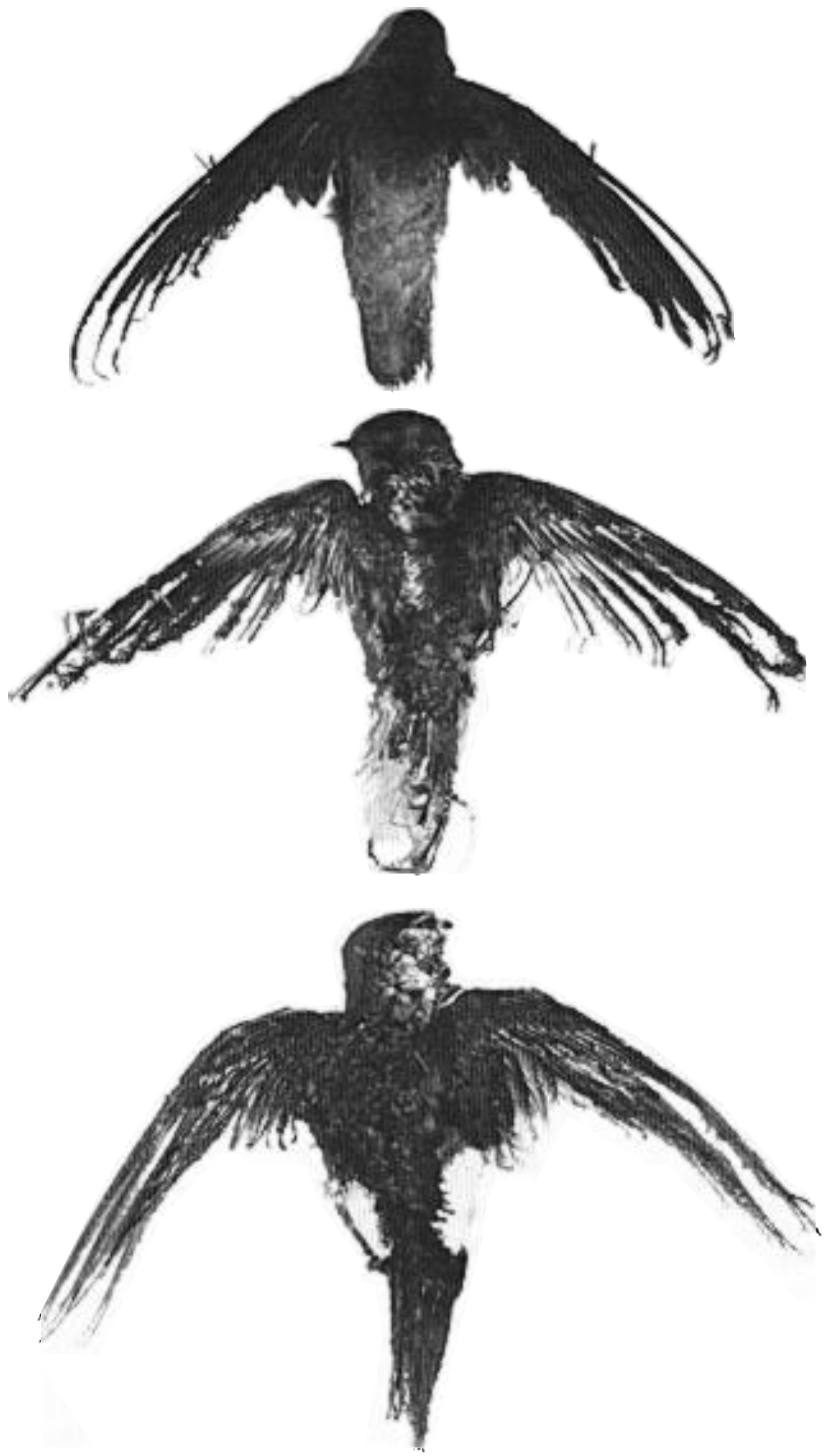
CALIFORNIA ENERGY COMMISSION - SITING, TRANSMISSION AND ENVIRONMENTAL PROTECTION DIVISION

SOURCE: *Upper Figure:* Bird Feather Types, Anatomy, Growth, Color, and Molting by Doctors Foster and Smith at http://www.peteducation.com/article.cfm?c=15+1829&aid=2776

Lower Figure: Muller and Patone 1998 - Muller W. and G. Patone. 1998. Air Transmissivity of Feathers. The Journal of Experimental Biology 201, pages 2591-2599. (TN - 66279)

APPENDIX BIO2 - FIGURE 7

Palen Solar Electric Generating System - Effects of Concentrated Solar Flux at Solar One Facility, Daggett, California (as modeled by the Rio Mesa Electric Generating System)



CALIFORNIA ENERGY COMMISSION - SITING, TRANSMISSION AND ENVIRONMENTAL PROTECTION DIVISION

SOURCE: McCrary et al. 1986 – McCrary, M. D., R. L. McKernan, R. W. Schreiber, W. D. Wagner, and T. C. Sciarrotta, Avian Mortality at a Solar Energy Plant, In: Journal of Field Ornithology 57(2): 135-141 (TN - 66279)

APPENDIX A

Geomorphic Assessment and Sand Transport Impacts Analysis of the Palen Solar Power Project, Appendix C (Biology Report), dated August 18, 2010

Geomorphic Assessment and Sand Transport Impacts Analysis of the Palen Solar Power Project

Appendix C (Biology Report)

Prepared for | CALIFORNIA ENERGY COMMISSION
& ASPEN ENVIRONMENTAL

Prepared by | PWA Philip Williams & Associates, Ltd.

August 18, 2010

Geomorphic Assessment and Sand Transport Impacts Analysis of the Palen Solar Power Project Appendix C (Biology Report)

Prepared for | California Energy Commission
& Aspen Environmental

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ENVIRONMENTAL HYDROLOGY

PWA Ref. # 2006.02
CEC WA # 1920.022
August 18, 2010

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1. OBJECTIVES OF THIS APPENDIX

The Palen Solar Power Project (Project or Proposed Project) is a proposed energy plant that will use solar arrays to focus sunlight and generate electricity through steam turbines (Solar Millennium 2009a). The array and associated infrastructure will be built in the Chuckwalla Valley of the Mojave Desert. This area supports a series of sand dune habitats that are reliant on the delivery of fine sand from wind (aeolian) and water (fluvial) sources. The objectives of this Appendix are as follows:

1. Provide a brief description of the Project area's sand dunes and a discussion of the sand transport processes that created and now maintain the existing dunes.

2. Provide a discussion of potential direct and indirect impacts of the Proposed Project and its two alternatives (attached) on the existing sand dune system and the processes that support them.

3. Describe mitigation for those impacts, or a well-supported conclusion that those impacts cannot be mitigated.

Note on this Appendix Version

This appendix has been modified and consolidated from several earlier PWA reports to reflect a new sand transport model that we have used to analyze alternatives, as well as new Project alternatives. This is the version that will form the basis of Dr. Andrew Collison's expert testimony in the CEC Hearing for Palen Solar Power Plant. The earlier versions are as follows:

Collison, A. 2010a Appendix A (Soil & Water Report) Geomorphic Assessment of Genesis Solar Project Site.
Collison, A., Nilsen, C., and Gregory, J. 2010 Revised wind shadow calculations for Palen Solar Energy Project, June 2nd 2010

2. SUMMARY OF KEY FINDINGS

The Proposed Project area covers several different land units including (from southwest to northeast) a currently stable coarse gravel alluvial fan surface with some relict sand dunes that have largely deflated (blown away), a more active wind-blown sand area with relatively shallow sand deposits, and an area of deeper and more active vegetated sand dunes that is Mojave Fringe Toed Lizard (MFTL) habitat. The northeastern portion of the Project site lies within the Chuckwalla sand transport corridor, a regionally-significant geomorphic feature that provides sand necessary to support sand dune habitat including MFTL habitat both on and off site. The sand corridor stretches down the Chuckwalla Valley to Blythe and the Colorado River. The Project site is crossed by a series of small distributary alluvial fan channels, and two large wash complexes formed by concentrated drainage under I-10.

The Applicant's Proposed Project as described in their Application for Certification (Solar Millennium 2009a) intrudes into the Chuckwalla sand transport corridor by more than a mile, cutting its width in half, and would create a "sand shadow" downwind. **Sand shadows are areas where the upwind supply of sand is cut off by wind fences and other infrastructure, but where existing sand can be eroded downwind, resulting in the loss of the fine sand upon which dune habitats are dependent.** Previous studies have shown that such sand shadows result in dune deflation, substrate coarsening and complete loss of MFTL habitat within a few years (4-17 years) (Griffith et al. 2002; Turner et al. 1984). If fully implemented the Proposed Project would create a total of 970 acres of direct impact to dune areas within the sand transport corridor and 1,113 acres of indirect (sand shadow) impacts downwind of the Project where we would expect to see deflation and dune loss within the life of the Project. This is considered to be a regionally-significant impact to sand transport processes that support sand dunes downwind in the Chuckwalla Valley.

As described in the Staff Assessment/Draft Environmental Impact Statement (SA/DEIS) (CEC-BLM 2010) staff analyzed two alternatives to the Proposed Project, a 2,987-acre Reconfigured Alternative developed by the Applicant and a 2,106-acre Reduced Acreage Alternative developed by staff. Impacts to sand dunes and the sand transport corridor were actually increased with the Reconfigured Alternative 1 (1,150 acres of indirect impact and 1,120 acres of direct impact to the sand transport corridor/MFTL habitat) and while staff's Reduced Acreage Alternative minimized impacts to sand dunes and the sand transport corridor (292 acres of indirect and 299 acres of direct impact to the sand transport corridor) it also reduced the output of the Project to 375 MW rather than 500 MW. Note that the staff Reduced Acreage Alternative does not include a disturbance area around the solar arrays as the other alternatives do, so the direct impact is likely somewhat higher than this number and the indirect impact is somewhat lower, but the total impact is correct.

Subsequent to publication of the SA/DEIS the Applicant developed two new reconfigured alternatives, Reconfigured Alternative 2 and Reconfigured Alternative 3 (Solar Millennium 2010l) to reduce the degree of Project intrusion into the most active part of the sand transport corridor. This report analyzes and compares the impacts of these two new reconfigured Project alternatives with the Proposed Project, the original Reconfigured Alternative and the staff Reduced Acreage Alternative. The Applicant's Reconfigured Alternative 2 has 144 acres of indirect impact and 680 acres of direct impact to the sand transport corridor if both phases are implemented. The Applicant's Reconfigured Alternative 3 has less indirect impact that Alternative 2 (94 acres) but more direct impact (790 acres) in the sand transport corridor if both phases are implemented. The impacts of the different alternatives are shown graphically in Figure 29, page 37.

The Proposed Project and the original Reconfigured Alternative 1 would have extremely high impacts to the sand transport corridor and Mojave fringe-toed lizard habitat that was judged to be significant and non-mitigable in the SA/DEIS. The staff Reduced Acreage Alternative and the

Reconfigured Alternatives 2 and 3 are superior to the Proposed Project in terms of direct and indirect impacts to sand transport and to sand dune habitat. The staff Reduced Acreage Alternative has the lowest total impacts, but with a lower power generating capacity. Selecting between the two Applicant Reconfigured Alternatives is also difficult from a sand transport and dune impact perspective since Alternative 2 offers the lowest direct impact but the highest indirect impact, whereas Alternative 3 offers a lower indirect impact and a higher direct impact. All three alternatives, the staff Reduced Acreage Alternative, and the Reconfigured Alternatives 2 and 3, reduce the impacts to sand transport and sand dunes to less than half of the Proposed Project.

Conceptual approaches have been put forwards by the applicant to mitigate for off-site sand shadow impacts by collecting and trucking sand around the Project and releasing it into the area downwind. However, the applicant has not been able to point to examples of such approaches working in other desert areas and at present the plan appears experimental rather than grounded in established practice. While such a plan has the potential to work more information would need to be provided to assess its potential for success.

3. RELATIONSHIP BETWEEN HYDRO-GEOMORPHIC PROCESSES AND BIOLOGICAL RESOURCES

This Appendix focuses on several hydro-geomorphic processes that play a significant role in the health of the ecosystem of the Project site and its surroundings. These processes are wind transportation of sand relative to the creation, preservation and destruction of sand dunes, and water transport of sediment through the alluvial fan drainage system.

Sand dune fauna such as MFTL rely on a regular supply of fine wind blown sand for their habitat (Figure 1). Active sand dunes (dunes that have an active layer of mobile sand) exist in a state of dynamic equilibrium: they are continuously losing sand downwind due to erosion and transport, but that is offset by supplies of new sand from upwind (see Figure 2). If the sand supply is cut off the dunes *deflate*; that is to say they lose sand downwind and shrink in size and depth (see Figure 3 for an example). The finest sand (which is most easily transported) is lost first with coarser sand and gravel being left behind to form an armor or lag. This combination of lag and thin sand deposits does not support many dune-dependent species. For example, Turner et al (1984) conducted experiments on paired plots of sand dunes up and downwind of wind barriers to look at abundance of MFTL. They showed that downwind sand dunes experienced deflation within 4-17 years of the erection of a relatively small wind barrier (a single line of tamarisk trees) and that while MFTL were abundant upwind of the barriers they were virtually absent downwind. Thus barriers pose a direct threat to sand transport and habitat.

Maintaining MFTL habitat requires the regular addition of wind-blown sand from a reliable source. Most of the sand dune habitat in the Mojave Desert follows discrete pathways referred to as sand transport corridors. These have been approximately mapped by Muhs et al. (2003) and are shown relative to the Project site in Figures 4 and 5. The presence and location of sand transport corridors are controlled by the availability of sand that can be eroded and transported by wind, the prevailing wind direction, and topography (especially the presence of fault-controlled troughs). Most sand corridors trend approximately northwest to southeast along troughs. Additional sand is added to corridors from local wind corridors that can be thought of as ‘sand corridor tributaries’ and by fluvial sources. Alluvial fan channels transport sand from the mountain fronts to the troughs. With increasing distance away from the mountain front the sand is preferentially sorted[1] and reduced in size by abrasion. At a sufficient distance down fan sediment becomes fine enough to be picked up and transported by wind action. This both creates local dune habitat around ephemeral channels and supplies material downwind to accumulate in larger sand corridors.

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1 “Preferential sorting”. Alluvial fans are made up of distributary drainage systems that spread water into increasing numbers of smaller channels as water moves downstream (the opposite of most temperate drainage networks). As water spreads out down fan the channels lose sediment transport capacity and the coarsest particles are deposited first, with successively smaller particles being passed downstream.

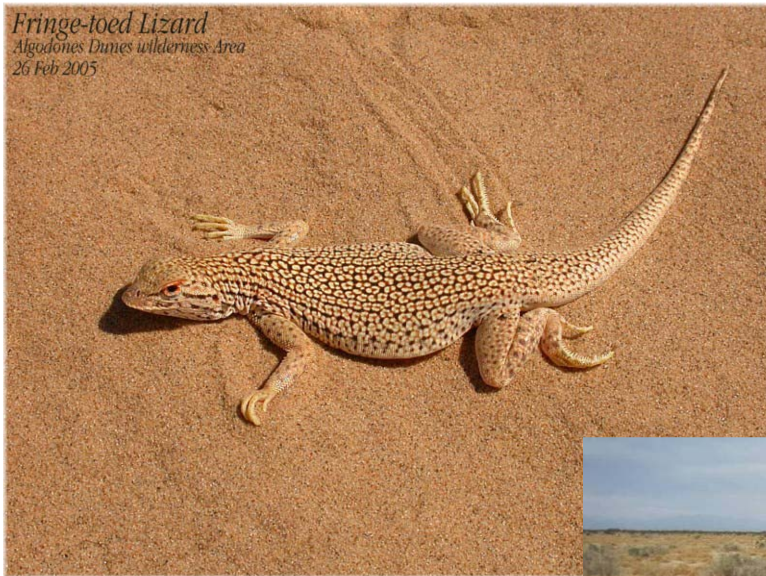


Figure 1. Mojave Fringe Toed Lizard showing its preferred habitat of fine, loose sand. Source: Southwest Images.

Figure 2. Good MFTL habitat showing 'plump', vegetated dunes connected by relatively deep, loose sand sheets.

Figure 3. Deflated former vegetated dune showing remnants of eroding dune under creosote bushes surrounded by an armored lag of coarse gravel and shallow, compacted sand. This habitat does not support MFTL.

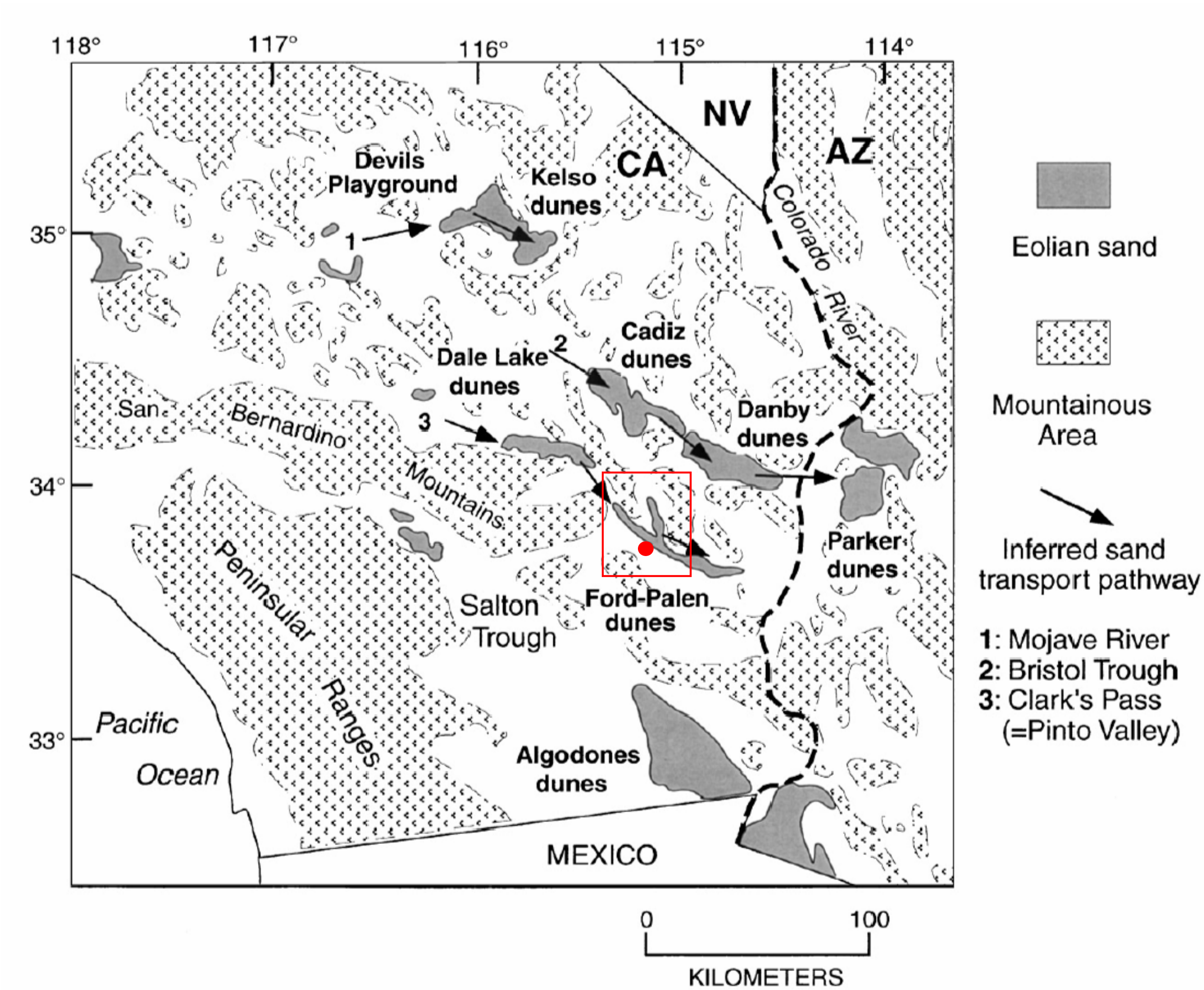
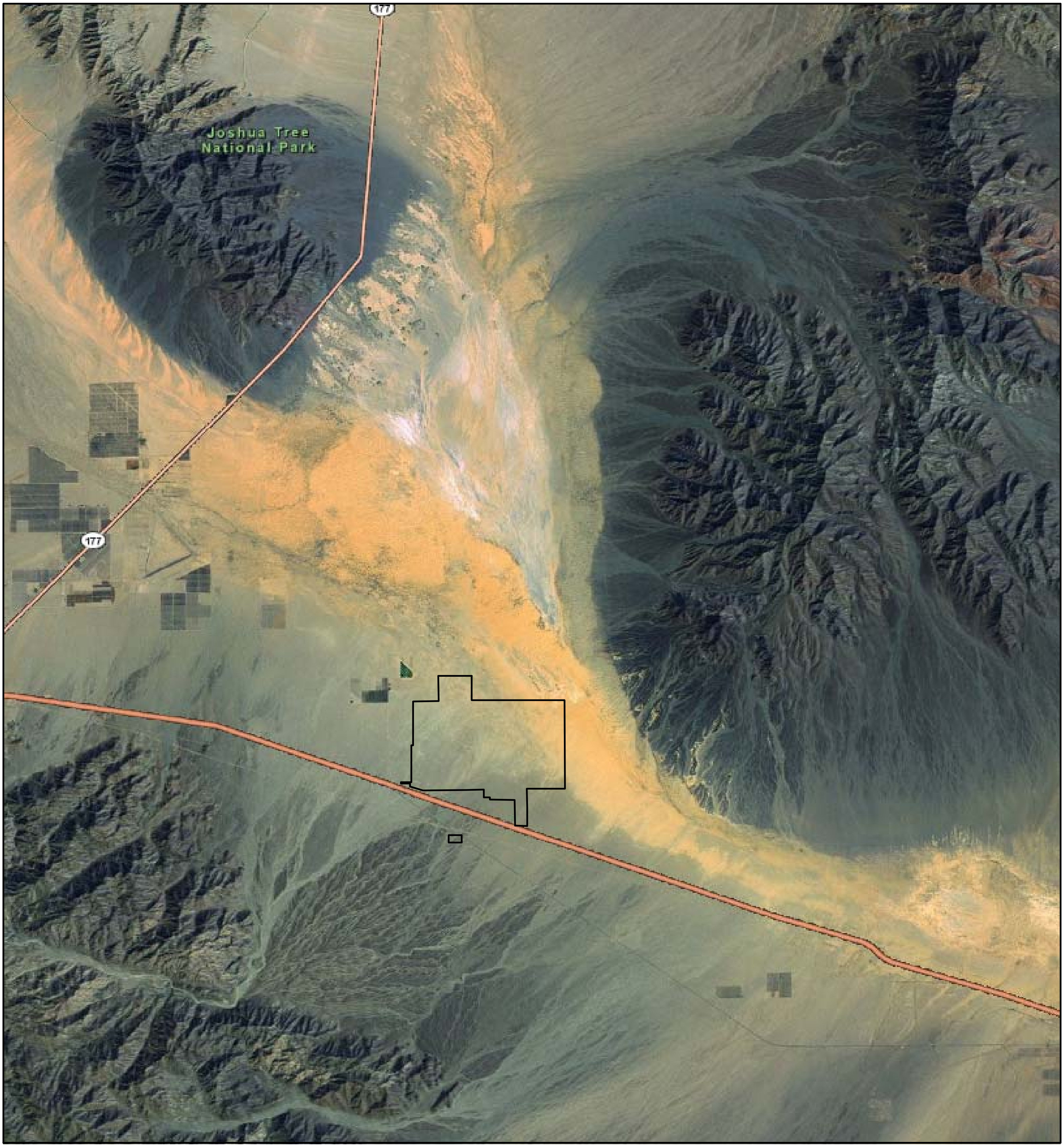


Figure 4. Eolian sand transport corridors of southern California (original figure from Muhs et. al., 2003). Approximate Project location shown by red dot. Area shown in Figure 5 illustrated by red box.



N

0 1 2 4 6
Miles

figure 5

CEC Palen

Overview of the project site showing the sand transport corridor

PWA Ref# - 2006.02

PWA

The activity and location of sand transport corridors is not fixed in time or space. Fluvial delivery of sediment from mountain fronts to the alluvial fans, troughs and playas tends to occur in wet winters associated with El Niño events that occur on average every 3-5 years. Due to the wet conditions wind transport may be less active during these years, so sediment may be temporarily stored in downstream channel areas or playas. During La Niña events (also approximately every 3-5 years) winters tend to be drier, promoting wind transport and aeolian processes. Fluvially-delivered sand deposited in channels or playas during an El Niño event can be transported by the wind during a subsequent La Niña event. In an analogous manner, sand corridors can expand, contract or migrate with changing weather and climate. Wetter than average conditions may allow vegetation to encroach on the edges of a sand transport corridor, thinning it. Dryer or windier condition may add more sand to the corridor and bury vegetation, widening the corridor. Changes in prevailing wind direction or strength may change the location or intensity of sand transport.

The Proposed Project is located close to or inside of a major sand transport corridor identified by Muhs et. al. (2003), referred to as the Chuckwalla sand corridor. Muhs et al. also show a smaller ‘tributary’ sand corridor immediately east of the Project site. The sand corridors are prominent in aerial photos (see Figures 6 and 7). Sand delivered from upwind passes through dune areas including MFTL habitat and is deposited, replenishing sand that has been lost downwind. In addition to the obvious biological impact of constructing a project in a dune area (direct loss of habitat), construction activities have two potential offsite impacts on sand transport corridors. Firstly, if the project footprint is constructed in a dune area it will cut off a supply of sand that would otherwise have been transported downwind to other dune areas. Dunes downwind of a constructed site will deflate over time as sand output is not matched by sand input. Secondly, new sand that would have been transported across the project footprint from upwind will potentially be cut off by drainage ditches, wind fences and above ground infrastructure. Thus, if a project is built into a wind corridor it will create a ‘sand shadow’ area where dune deflation occurs over time.

4. DESCRIPTION OF THE PALEN PROJECT SITE

I visited the Project site for a day on February 5th 2010, following a reconnaissance visit on January 12th 2010. I made a third field visit on April 29th 2010. Conditions on January 12th were warm and dry, with no recent rain. The February 5th visit was conducted the morning following a rainstorm, while the April 29th visit was conducted immediately after a sand storm. On the February 5th visit I drove the western boundary of the property along the BLM dirt road up to the northwest corner making stops at points of interest, and hiked a loop of approximately 6 miles along the northern Project boundary to the northeast corner of the proposed impact area, returning westwards along a more southerly alignment. After this I drove the BLM road from the northwest corner southeast to the southern site boundary near I10. Finally I visited a large ephemeral wash that passed under I-10 to assess the effects of concentrating several small washes into a single channel. During the visit I logged my position on an aerial photo using a GPS linked to Google Earth, made field observations and took photos.

The site is located on an alluvial fan that drains from southwest to northeast towards Palen Dry Lake. The average slope across the site is 2 percent. There is a gradient of three major desert surfaces progressing from southwest to northeast that I detected on foot and confirmed by aerial photo. The boundaries between these areas are somewhat interwoven and gradual, but can be seen on aerial photos and in the field. There is broad agreement between the major units I mapped and the units as delineated by Dr. Kenney (Kenney 2010a, 2010b) for the Project applicant, as can be seen in our respective figures. The main area of disagreement is over the eastern boundary of Zone 1, and the degree of difference in sand transport activity between Zones 1 and 2. In addition to mapping the major units I mapped a series of smaller land units related to fluvial drainage features.

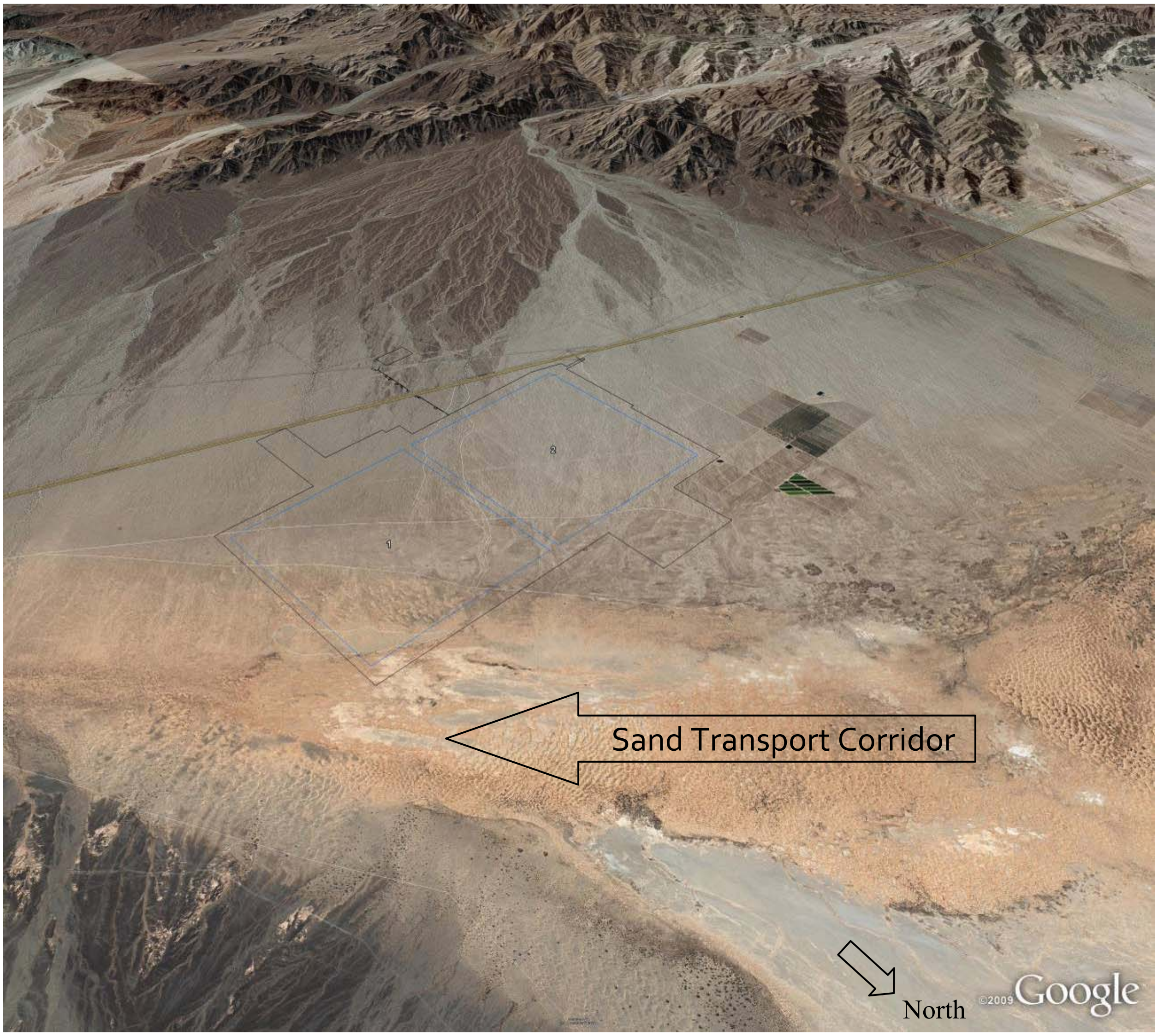


Figure 6. Setting of the Palen Project site showing the major topographic units. Project boundary shown in gray, proposed solar arrays shown in blue, pale lines are the authors land unit boundaries. The intrusion of the eastern array into the sand transport corridor (red dunes and surrounding grey dunes) can clearly be seen.

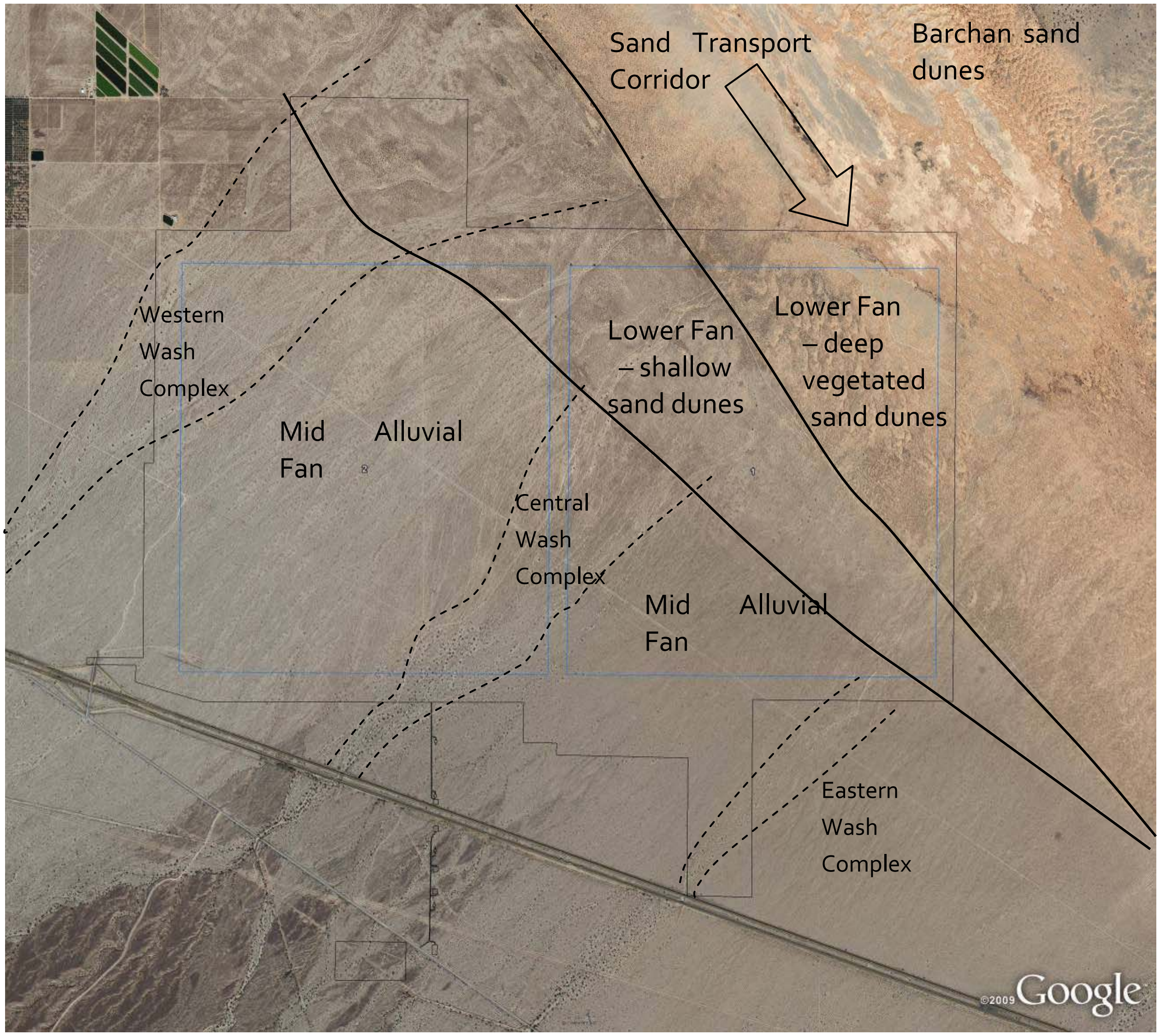


Figure 7. Distribution of major and minor land units on the Palen site. Proposed Project Alternative boundary shown in gray, proposed solar arrays shown in blue.

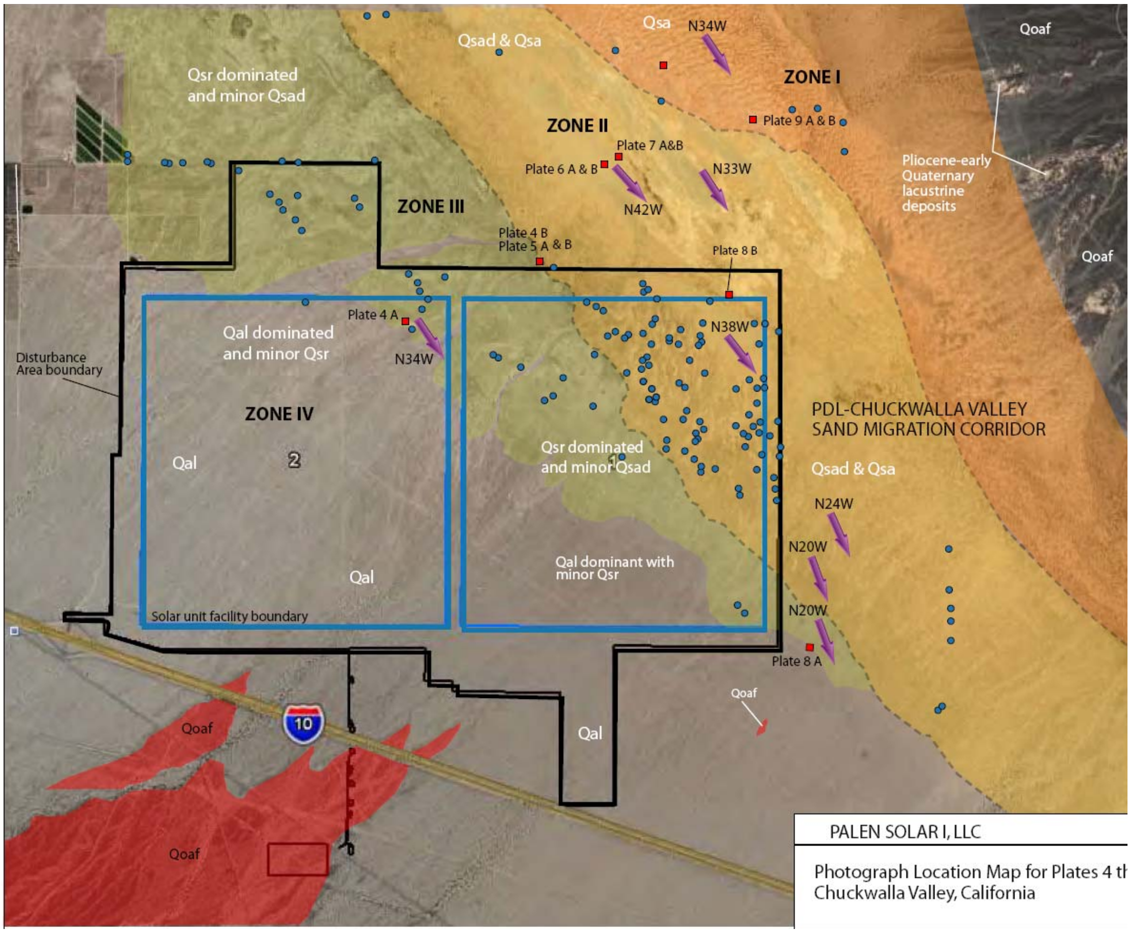


Figure 8. Sand Migration Corridor Zones and the association with MFTL observations (blue dots), from Kenney, Plate 3, 2010a.

4.1 MAJOR LAND UNITS

4.1.1 Mid Alluvial Fan Area – Degraded Vegetated Dunes with Coarse Alluvial Surfaces (corresponds to Zone 4 of Figure 8)

(Note that the Project is relatively low on the alluvial fan, and that the mid fan is the highest part of the alluvial fan occupied by the Project site. The High Alluvial Fan area is found southwest of I-10.)

In the southern and western sector of the Project site the surface is a mixture of degraded vegetated dunes with thin coarse sand, and patches of alluvial gravel and desert varnish. This surface has been formed primarily by deposition of sand and gravel from alluvial fans (fluvial action) over hundreds of thousands of years, overlain with patches of vegetated sand dunes that formed from wind action during periods of greater sand availability. The sand dunes on the mid fan have subsequently degraded due to wind erosion and deflation (sand is being removed by the wind but not replaced). Deflation of the relict dunes is leaving behind the more resistant alluvial deposits as a protective lag of gravel[2]. In many places the lag has formed desert varnish (a black coloration on the exposed surface of gravel particles). The presence of desert varnish suggests that parts of this surface have been stable and exposed in its current condition for many hundreds to thousands of years. There is little available fine loose sand for either transport to dunes down wind or to support MFTL habitat. What sand is present is coarse (1-2 mm) and there is abundant fine gravel (2 mm and larger). The vegetation cover is largely sparse creosote bushes and degraded dunes, with ironwood trees in the larger washes. This surface has a relatively stable current condition and is likely to have fewer off-site impacts compared with other parts of the site. A potential exception to this is wind erosion of the freshly exposed soil once the coarser material is removed during grading, though standard dust abatement techniques should be able to mitigate for this.

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2 An alternative explanation for the formation of gravel pavements is that particles rise to the surface of alluvial fans as fine sand and dust are deposited around them and washed below them by rainfall. While the formation mechanisms are different it is widely agreed that areas mapped as Quaternary alluvial fans are geomorphically old features formed primarily from water-borne alluvium that have changed little in the last few thousand years.

Figure 9. Typical degraded dune and coarse gravel lag on the mid fan surface. View is from the west looking across the proposed western solar array site to Palen Dry Lake.

Figure 10. Close up of dune and lag mixture

Figure 11. Stable mid fan area with gravel lag

4.1.2 Lower Alluvial Fan – Shallow Vegetated Sand Dunes and Sand Transport Corridor (Zone 3 of Figure 8)

Moving north and east the fan surface has sandier conditions and transitions from creosote bushes to grasses. This area has shallow vegetated sand dunes and sand sheets that are less degraded and that have more abundant sand than the dunes in the mid fan. The dunes appear to be in relative equilibrium – losses of sand due to wind erosion are matched by deposition of sand from upwind. The sand is finer than in the mid fan area, with some areas that appear suited to MFTL habitat (confirmed by the presence of MFTL as shown in the Applicant's figure (Figure 8, and Kenney 2010a, Plate 3). There are abundant large rodent holes in the sand, unlike in the Mid Fan, implying that there is sufficient depth of sand for burrows. There is evidence of moderate levels of wind-borne sand transport, and this surface appears to form the outer zone of the sand transport corridor (as shown in Kenney, 2010a, reproduced here in Figure 8). Its southwest boundary appears to coincide with the southwest boundary of the Chuckwalla sand transportation corridor drawn by Dr. Miles Kenney in his assessment of sand transport and deposition in the Chuckwalla Valley. (Note that while the western boundary of the sand transport corridor coincides with the boundary between the Mid and Lower Alluvial Fan, the wind transport corridor extends east into the Lower Fan – Deep Vegetated Sand Dunes and Dry Lake areas as well, and is not confined to the Lower Alluvial Fan.) The boundary was mapped in the field in two locations which appear on the aerial photo to trace a line of different vegetation and topography. This surface is less stable than the mid fan, appears to have a higher potential habitat value for MFTL, and appears less well suited for development of infrastructure.

Figure 12. Vegetated dunes in the shallow vegetated sand dune and sand transport corridor area

Figure 13. Sandier conditions showing rodent burrows and fine surface sand. View is from center of proposed eastern solar array looking east towards Palen Lake.

4.1.3 Lower Alluvial Fan – Deeper Vegetated Sand Dunes and Sand Transport Corridor (Zone 2 of Figure 8)

Moving north and east the vegetated dunes become deeper and the sand more abundant. This area has hummocky vegetated dunes with greater topographic expression than the zone to the west, implying that they are more actively supplied by sand. This area appears very well suited for MFTL habitat, and coincides with observed MFTL activity (see Figure 8). This zone of the sand transport corridor is more active than the Shallow Vegetated Sand Dunes, though less active than the area of unvegetated barchan[3] dunes to the east (off the Project area).

Figure 14. Conditions in the Lower Fan – deeper vegetated sand dune surface showing potential Fringe Toed Lizard habitat. View is from center of proposed eastern solar array looking north.

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[3] Barchans are very large, active, crescent shaped sand dunes without vegetation

Figure 15. More abundant sand showing in the side of the dirt road.

5. ASSESSING THE IMPACTS OF THE PROJECT ON SAND TRANSPORT TO DUNE HABITAT

5.1 BACKGROUND AND DEFINITION OF SAND SHADOWS

The applicant has assumed that all areas within the Project boundary are directly impacted, so this Appendix has focused primarily on off-site indirect impacts. The primary off-site impact is disruption of sand transport to the sand transport corridor. The Project has the potential to disrupt the Chuckwalla wind transport corridor because it includes a perimeter sand fence that is 30 feet high and that is designed to stop sand from entering the solar array. Most sand transport (as opposed to dust transport) occurs close to the ground through the processes of rolling and saltation (bouncing of sand particles). For example, Bagnold (1941) found that the mean elevation of saltating sand grains with a diameter of 0.25 mm was less than 1 cm off the ground, and more recent research has found that 90% of sand transport occurs within 30 cm of the ground surface. We would therefore expect the sand fence to pose an effective barrier to sand transport, and create a sand shadow downwind.

A sand shadow is an area downwind of a sand barrier where the wind is able to remove fine sand but there is no replacement by sand from upwind. Over time existing sand dunes in a shadow area will be deflated – they will shrink and become thinner and coarser as the fine sand is blown away by the wind. Deflated dunes have little or no habitat value for MFTL and other fine sand dependent species.

5.2 DESCRIPTION OF THE PWA SAND TRANSPORT MODEL

In order to quantitatively assess the area of sand shadow associated with different Project alternatives PWA developed a numerical model of sand transport. The model predicts areas of sand shadow in response to inputs of prevailing wind direction, distribution of wind around that mean, and the location of sand barriers.

5.2.1 Model Theory

Sand transport occurs when wind speed exceeds a threshold velocity that varies with material size but is often assumed to be around 14 mph. Sand is transported in whatever direction the wind is traveling once it exceeds the threshold velocity. Over time a prevailing direction emerges, and sand dunes reflect that prevailing direction (for example, coppice[4] dunes develop tails that are oriented away from the prevailing wind that transports sand). However, the prevailing wind is the resultant vector of numerous wind events with different orientations. This is illustrated in Figure 16, which shows the distribution of wind with differing speeds and the resulting prevailing wind transport direction for Blythe. Because of the variations in wind direction over a year sand transport can be thought of as two processes: primary sand migration that follows the prevailing wind direction, and sand diffusion on either side around that main direction. Sand diffusion means that the edge of a wind shadow will not be sharply defined into zones of complete sand transport and zones of zero transport; it will have a gradation from areas where there is a complete loss of sand to areas where there will be no reduction in sand.

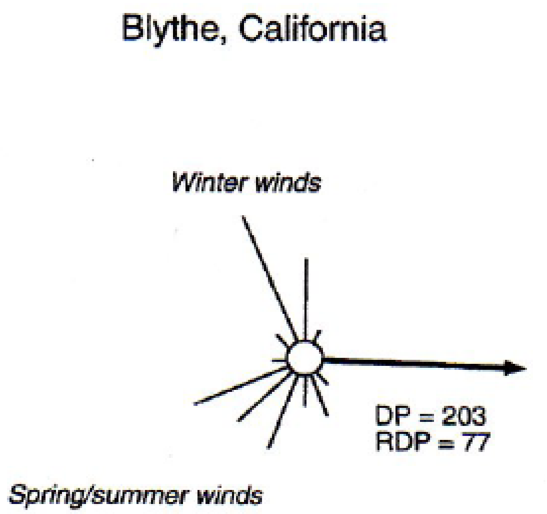

Figure 16. Example wind vectors for Blythe airport. Dominant winds (lines without arrows) are mostly from the northwest in winter and the southwest in summer, but the resulting prevailing wind for sand transport (bold arrow) is to the east. Source: Muhs et. al. (2003). DP stands for "Drift Potential", the sum of winds from a given direction that exceed the threshold velocity. RDP stands for "Resultant Drift Potential" which is the vector (direction and magnitude) that results from summing all the DPs.

5.2.2 Computational Framework for the Sand Transport Model

We have developed a sand transport model for the Palen site to simulate this combination of downwind transport and lateral diffusion. The model superimposes a 200 x 200 cell framework over the Project site and its surroundings and calculates the percentage of sand that will move from each cell to its neighbors based on the distribution of effective wind directions (Figure 17).

[4] Coppice dunes are small dunes that form around vegetation with a 'teardrop' shape that is oriented with the blunt end facing into the prevailing wind. They indicate the prevailing direction of wind transport.

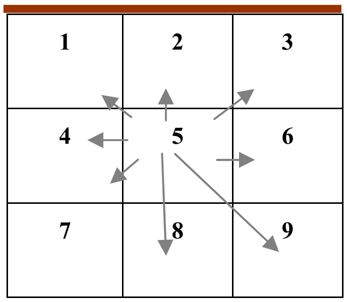

Figure 17. Calculation matrix for sand transport model. Length of arrows indicates proportion of sand moving to each cell from cell 5. In the example shown wind transport is mostly from the north and the northwest, but some diffusion occurs in other directions to represent occasional winds in these directions. The calculation is carried out for each cell in turn traveling downwind (north to south). The brown line is the upwind boundary condition.

Sand is added to the cells at the upwind boundary (brown line in Figure 17). Sand is transported from each cell in turn to each of its eight surrounding cells based on the intensity and duration of winds >14 mph in each direction. For example, if 50% of the effective wind energy is from the northwest, 50% of the sand in cell 5 will be transferred to cell 9 in the example above.

5.2.3 Assigning primary and secondary sand transport directions to the model

There is no weather station at the Palen site to parameterize the model, but we have conducted simulations that combine the Applicant's field evidence on the primary sand transport directions (Kenney 2010a) with a distribution of secondary wind directions based on the data for Blythe airport Muhs et. al. (2003). We assigned two primary wind directions to the model to reflect conditions at the Palen site, with sand primarily coming from the northwest and the north. Thus the primary sand transport is to the south and southeast (from cell 5 to cells 8 and 9 for the example in Figure 17). We analyzed the Blythe airport weather station wind drift potential data to estimate a diffusion function to account for wind transport in other directions. We measured all the drift potential[5] vectors and calculated the percentage that were in the two primary wind directions and the percentages that were in all other directions. For Blythe airport the split is 69% from the two primary directions (northwest and southwest in the case of Blythe) with 29% of the drift potential being made up of wind from other directions. Blythe and Palen have different prevailing wind directions due to topographic influences from their respective valleys, but we assumed the same approximate split between the duration and intensity of primary wind transport and secondary transport. We adopted these proportions to the cells in the Palen model so that approximately 70% of sand is transported to the two cells representing the two primary wind directions with approximately 30% going to the surrounding 6 cells – see Figure 18.

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[5] Drift potential is the duration of wind transport multiplied by the velocity for times when the velocity exceeds 14 mph (the typical transport threshold of sand).

5%	**5%**	**5%**
5%	**0%**	**10%**
5%	**16%**	**49%**

Figure 18. Example calculation matrix for the sand transport model showing sand proportions transported in each direction. The black arrow shows the resultant transport vector of 114 degrees (N38W) representing conditions at the north end of the Project site.

By changing the sediment split between cells the model can simulate any prevailing sand transport direction (see examples in Figure 18 and 19) while maintaining a sediment diffusion process around that mean to account for sand transport on days when the wind comes from a different direction.

5%	**5%**	**5%**
5%	**0%**	**5%**
8%	**27%**	**39%**

Figure 19. Example calculation matrix with resultant vector of 160 degrees (N20W) representing conditions at the south end of the Project site.

The prevailing wind direction in the sand transport corridor appears to bend around the site in response to topographic effects from the Palen Mountains to the east and the Chuckwalla Mountains to the southwest, being a mixture of northerly and northwesterly winds at the northern part of the site, becoming more dominated by northerly winds in the south part of the site, and picking up westerly winds again south of the Project site as the sand corridor bends east towards Blythe. Rather than assume a single average prevailing wind direction across the entire site we divided it onto five sectors from north to south, each with a different prevailing wind direction. The prevailing sand transport direction was estimated by taking the nearest indicator from the Worley Parsons report (based on the orientation of sand dunes). Where there was more than one indicator in a sector we took the average direction of all the nearby indicators, and between groups of indicators we interpolated the average of the neighboring groups. The prevailing sand transport directions for each sector are shown in Figures 20a and 20b along with the data on which they are based (Kenney, 2010a). For each sector we assigned matrix weights based on the approach shown in Figures 18 and 19 above, calculating the mixture of east, southeast and south sediment transport values that resulted in the observed prevailing transport direction and assigning values of approximately 5% to all other cells (some individual cells were set up to 10% to achieve the desired resultant vector).

The sand transport values used in the model are as follows:

Sector	Prevailing direction	Evidence for prevailing direction (all data from Kenney, 2010a)	Primary sand directions in model (% of sand traveling in each direction)[‡]
Sector 1	N38W	Mean of three closest indicators (N38W, N33W and N42W)	49% SE 16% S 10% E
Sector 2	N31W	Mean of two closest values (N38W and N24W)	51% SE 19% S
Sector 3	N24W	Single closest indicator N24W	43% SE 24% S 7% SW
Sector 4	N20W	Two adjacent indicators (both N20W)	39% SE 27% S 8% SW
Sector 5	N46W	Closest adjacent indicator (N46W)	43% SE 19% E 13% S

Table 1. Prevailing sand transport directions assumed in the model

[‡] sand is sent evenly to the remaining cells (not shown in the table) so that the total adds up to 100%

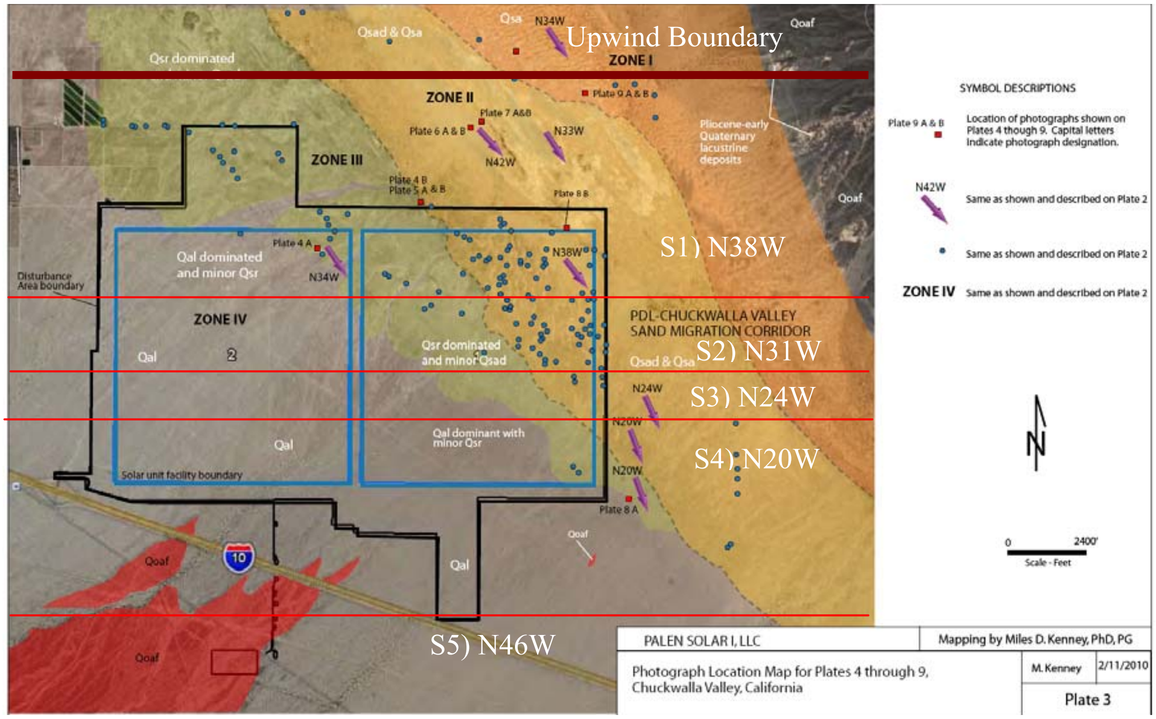


Figure 20a. Sand transport corridor and wind direction indicators (Kenney, 2010a, Plate 3). Lines in red show sectors used in the wind transport model to define different prevailing wind directions, and values in white show assumed dominant wind direction for each sector (S1-S5). Note: some vector indicators are shown in Kenney, 2010a, Plate 1, (Figure 20b of this report).

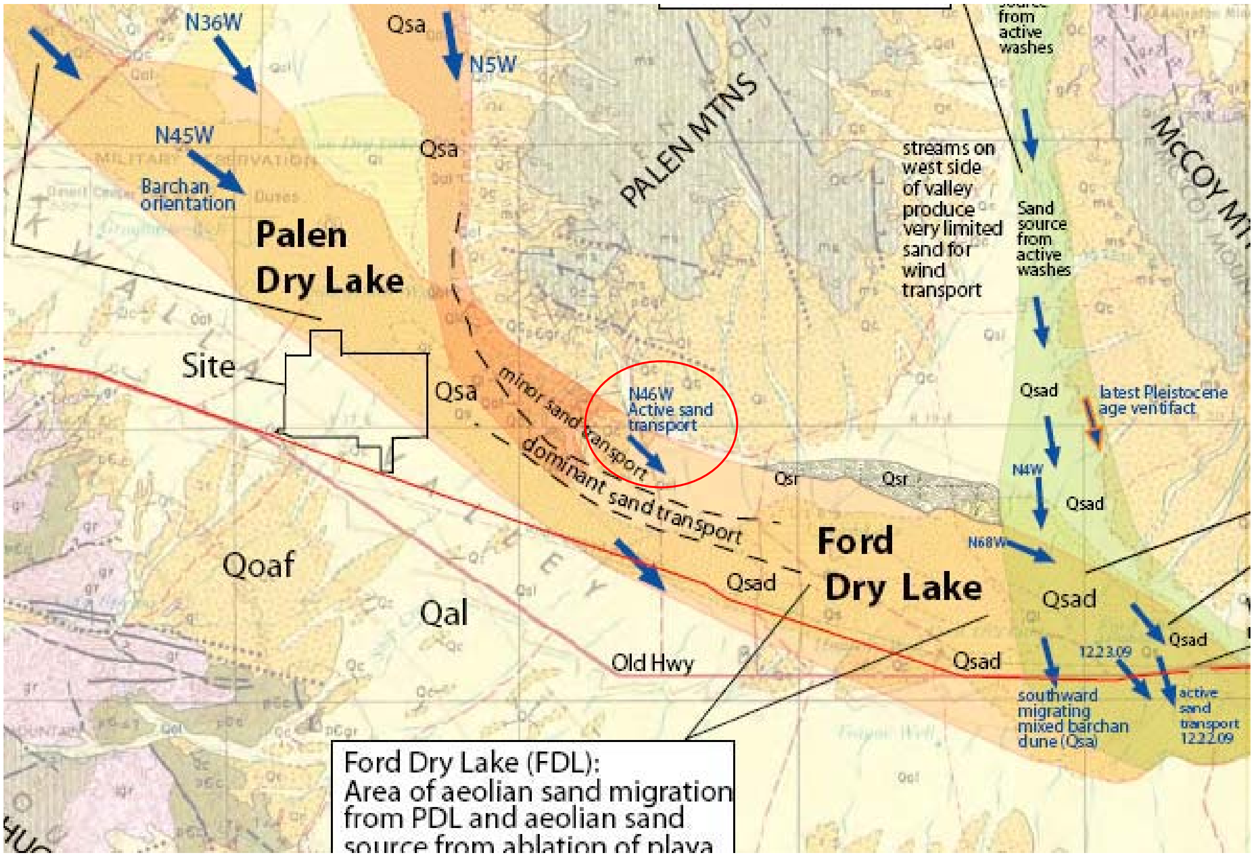


Figure 20b. Sand transport corridor and wind direction indicators (Kenney, 2010a, Plate 1). Vectors shown in red were used in the model.

5.2.4 Upwind boundary condition

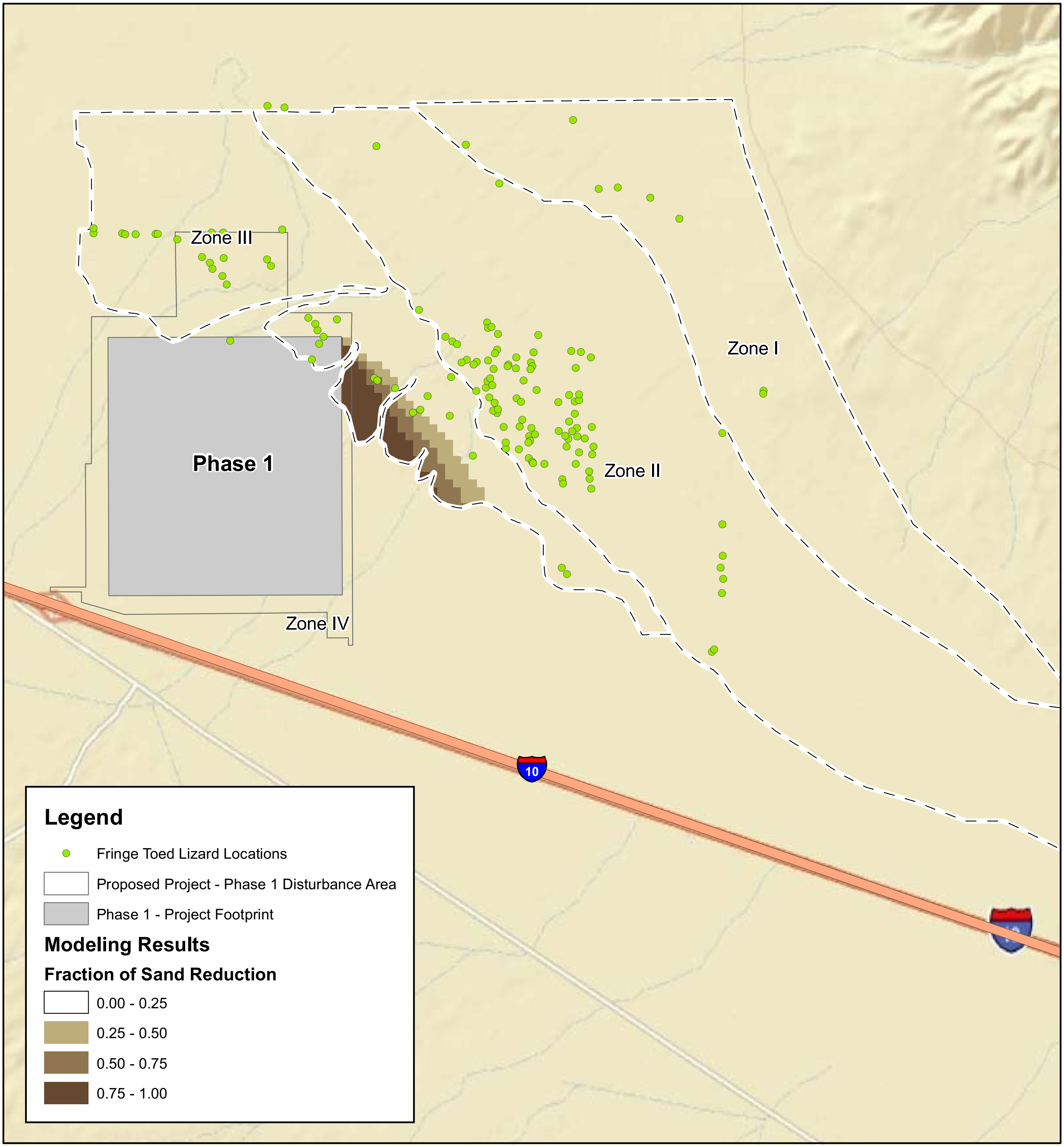
We simulated a uniform input of sand across the northern (upwind) edge of the model to assess the percentage reduction in sand once the wind encountered an obstacle. Although the actual volume of sand will vary across the boundary, this simulation is concerned with the *percentage* reduction downwind, not the actual volume of sand. We assume that in the pre-project condition sand is transported across the site without obstruction, to establish a base condition.

5.3 SIMULATION OF PROJECT ALTERNATIVES

We simulated five Project alternatives: the Proposed Project, the original Reconfigured Alternative and staff's Reduced Acreage Alternative, as well as the two new alternatives developed by the applicant, Reconfigured Alternative 2 and Reconfigured Alternative 3. The latter two reconfigured alternatives as well as the staff Reduced Acreage Alternative were developed to reduce both the direct and indirect impacts of the project on biological resources including the sand dunes and Mohave fringe-toed lizard habitat. The Proposed Project and Reconfigured Alternatives 2 and 3 were further assessed in two phases. For all scenarios we imported the Project footprint into the model in GIS. The wind fences at the project boundaries were assumed to be a complete barrier to sand transport, with zero sand being transported across a project cell. We assumed no movement of sand along a fence oblique to wind movement. Direct impacts are considered to be impacts from the project footprint, or sand shadows from the wind fences that lie within the project disturbance boundary. Indirect impacts are considered to be sand shadows that extend beyond the project disturbance boundary. In all cases the model predicted a sand transport shadow downwind of the Project based on the prevailing wind directions, with diffusion gradually transporting sand into the shadow (due to variations around the prevailing wind direction). At a certain point downwind the shadow disappears because diffusion is able to bring sediment back into the area downwind of the obstruction. We calculated the percentage of sand reduction between pre-project and post-project conditions. By overlying the percent sand reduction on the Sand Transport Zones map (Kenney, 2010a) we are able to calculate both an area of impact and a percentage of impact for each alternative. This is shown in detail in Table 2. We further subdivided the MFTL habitat based on the sand transport zones devised by Dr. Miles Kenney (shown in Figure 8) where Zone 1 has the greatest rate of sand transport and Zone 3 the lowest rate. We did not consider Zone 4 in the analysis since both Energy Commission staff and the Applicant concur that wind transport is not a significant process in this zone, and MFTL habitat does not appear to be found in this zone. The greatest abundance of MFTL has been observed in Zone 2 due to the combination of active wind transport and vegetation cover, with fewer MFTL in Zones 1 (abundant sand but little vegetation) and 3 (plentiful vegetation but less active sand transport). We also excluded from the analysis areas where the reduction in sand delivery was less than 25%. We included the direct impact to the sand dunes associated with each Project footprint. It should be noted that in some alternatives the indirect impact in Zone 3 increases compared with the proposed project. This is because the alternatives generally pulled the project footprint out of Zone 2 and into Zones 3 and 4. Thus some reductions in direct impact to Zone 2 were partially offset by increases in indirect impacts in Zone 3. It should also be noted that in the two phase alternatives that we analyzed, some portion of the indirectly impacted area in Phase 1 is often subsequently occupied and directly impacted in Phase 2. The different alternatives and their predicted sand shadows are shown visually in Figures 21-28.

	Percentage reduction of sand input	Impact Area (acres)			
		Zone I	Zone II	Zone III	Sum of Impacts
Proposed Project Alternative Phase 1	25 - 50%	-	-	64	191
	50 - 75%	-	-	55	
	75 - 100%	-	-	72	
	Direct Impact	-	-	51	51
Proposed Project Alternative (Phases 1&2)	25 - 50%	-	310	-	1,113
	50 - 75%	-	260	-	
	75 - 100%	-	490	53	
	Direct Impact	-	430	540	970
Staff Reduced Alternative	25 - 50%	-	38	49	292
	50 - 75%	-	12	48	
	75 - 100%	-	5	140	
	Direct Impact	-	9	290	299
Applicant's Reconfigured Alternative 1	25 - 50%	-	260	-	1,150
	50 - 75%	-	230	-	
	75 - 100%	-	380	280	
	Direct Impact	-	520	600	1,120
Applicant's Reconfigured Alternative 2 Phase 1	25 - 50%	-	-	46	117
	50 - 75%	-	-	36	
	75 - 100%	-	-	35	
	Direct Impact	-	-	84	84
Applicant's Reconfigured Alternative 2 (Phases 1&2)	25 - 50%	-	80	3	144
	50 - 75%	-	39	6	
	75 - 100%	-	11	5	
	Direct Impact	-	140	540	680
Applicant's Reconfigured Alternative 3 Phase 1	25 - 50%	-	-	81	280
	50 - 75%	-	-	69	
	75 - 100%	-	-	130	
	Direct Impact	-	-	51	51
Applicant's Reconfigured Alternative 3 (Phases 1&2)	25 - 50%	-	68	6	94
	50 - 75%	-	10	9	
	75 - 100%	-	1	1	
	Direct Impact	-	150	640	790

Table 2. Direct and indirect impacts to the sand transport corridor/MFTL habitat areas under the Proposed Project and alternatives. Indirect impacts (white cells) are due to reduced sand transport from upwind. Direct impacts (grey cells) are due to project footprint in the dune areas.



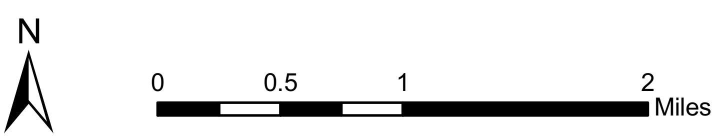


figure 21

CEC Palen

Reduction in Sand Input - Proposed Project, Phase 1

PWA Ref# - 2006.02

PWA

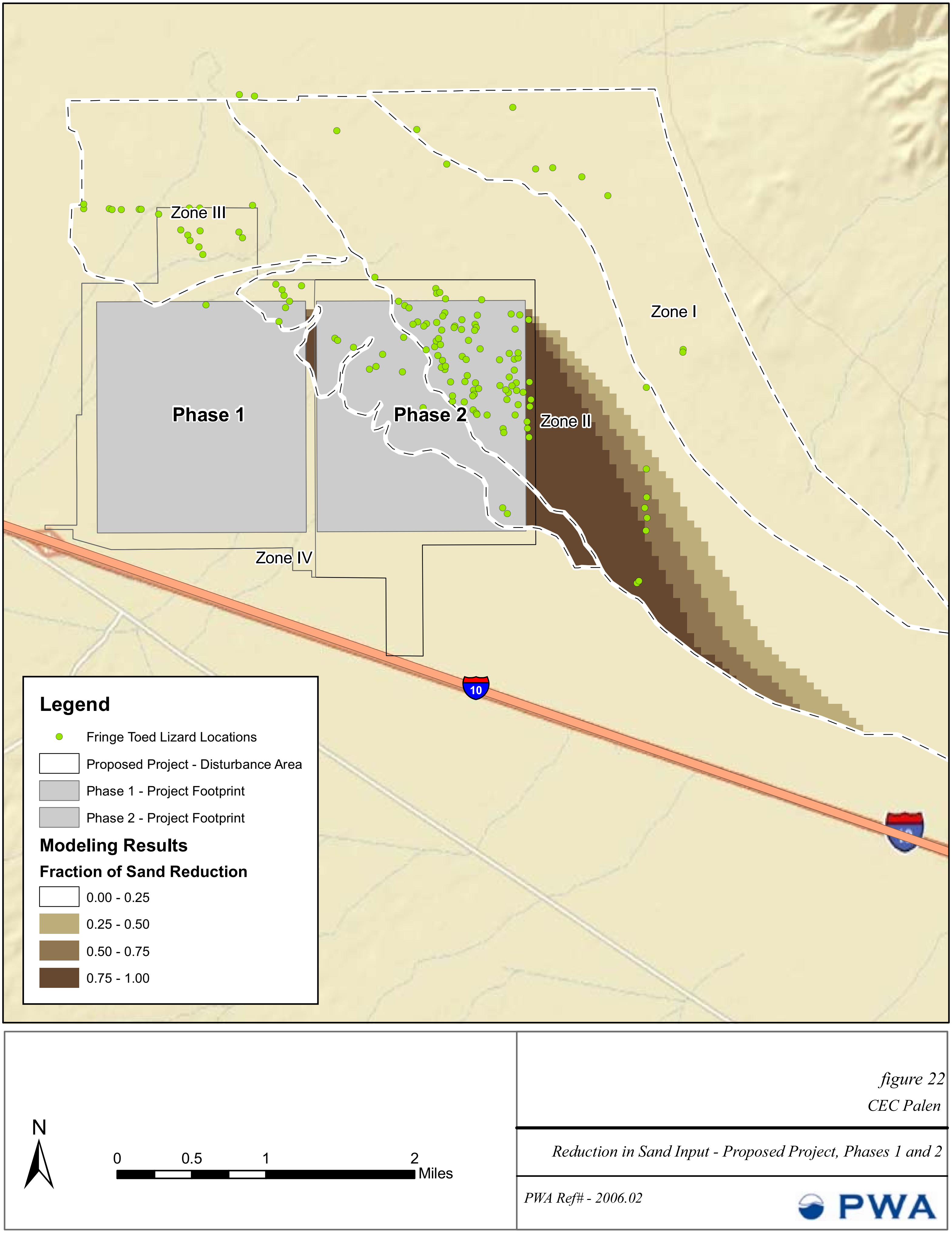


figure 22

CEC Palen

Reduction in Sand Input - Proposed Project, Phases 1 and 2

PWA Ref# - 2006.02

PWA

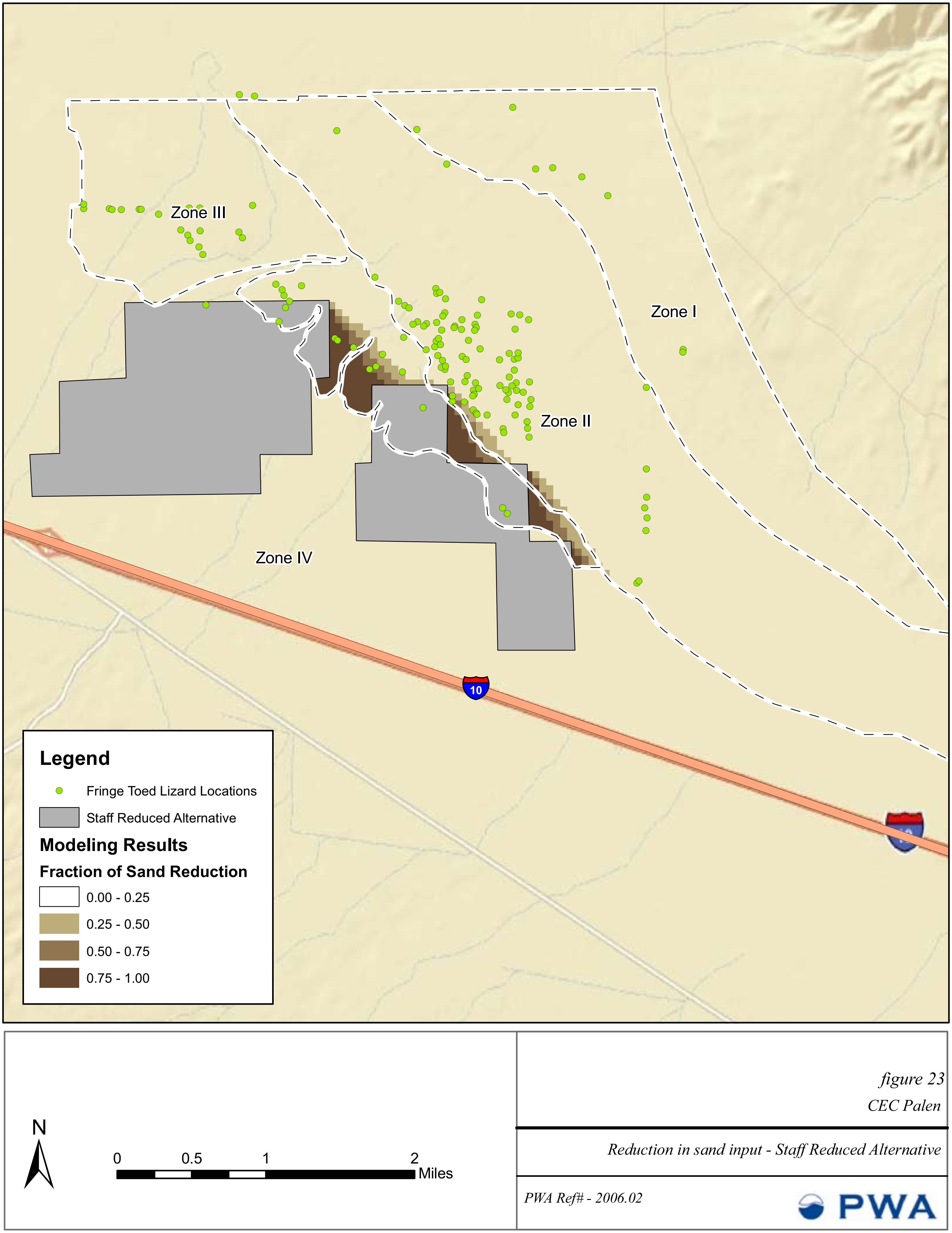


figure 23

CEC Palen

Reduction in sand input - Staff Reduced Alternative

PWA Ref# - 2006.02

PWA

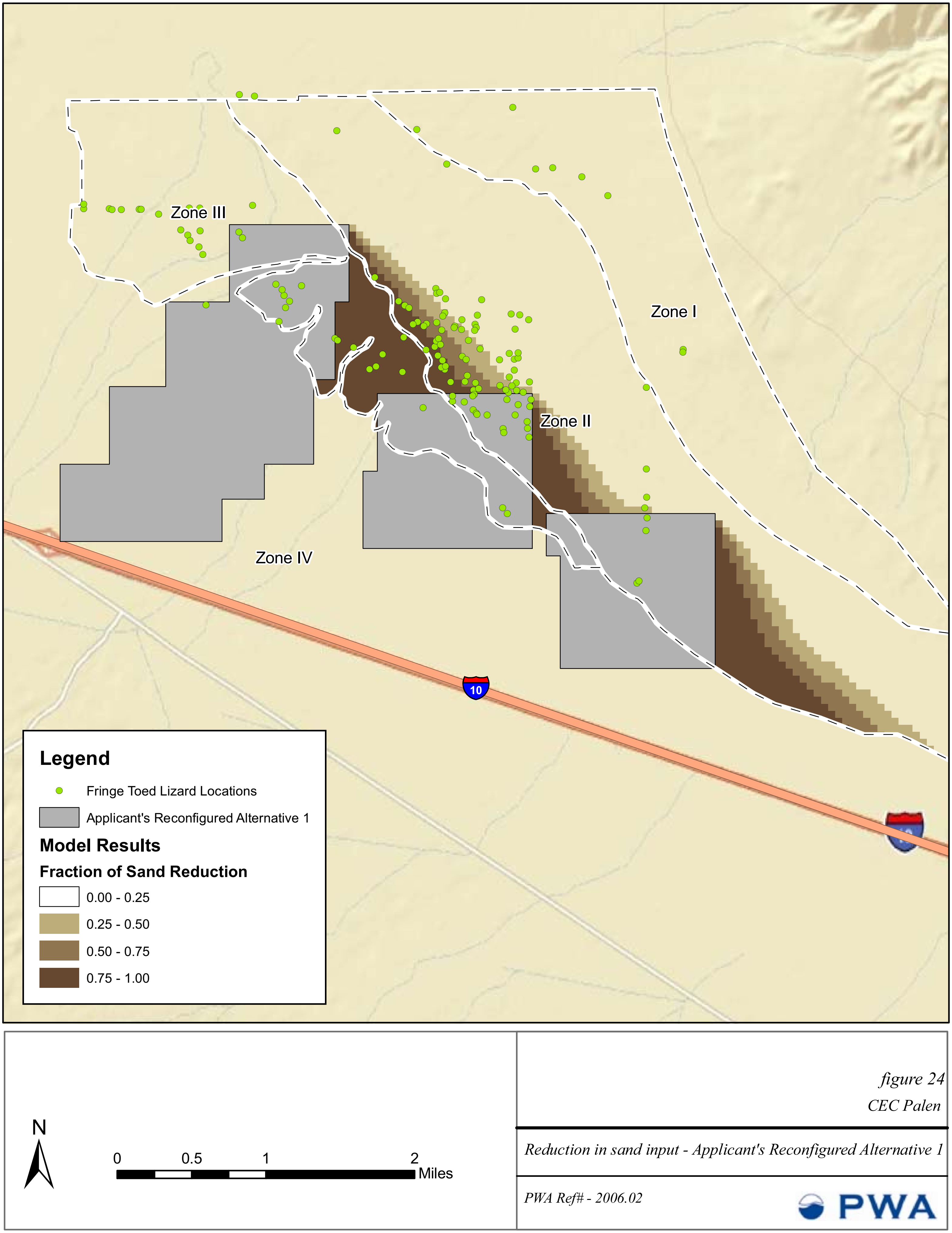


figure 24

CEC Palen

Reduction in sand input - Applicant's Reconfigured Alternative 1

PWA Ref# - 2006.02

PWA

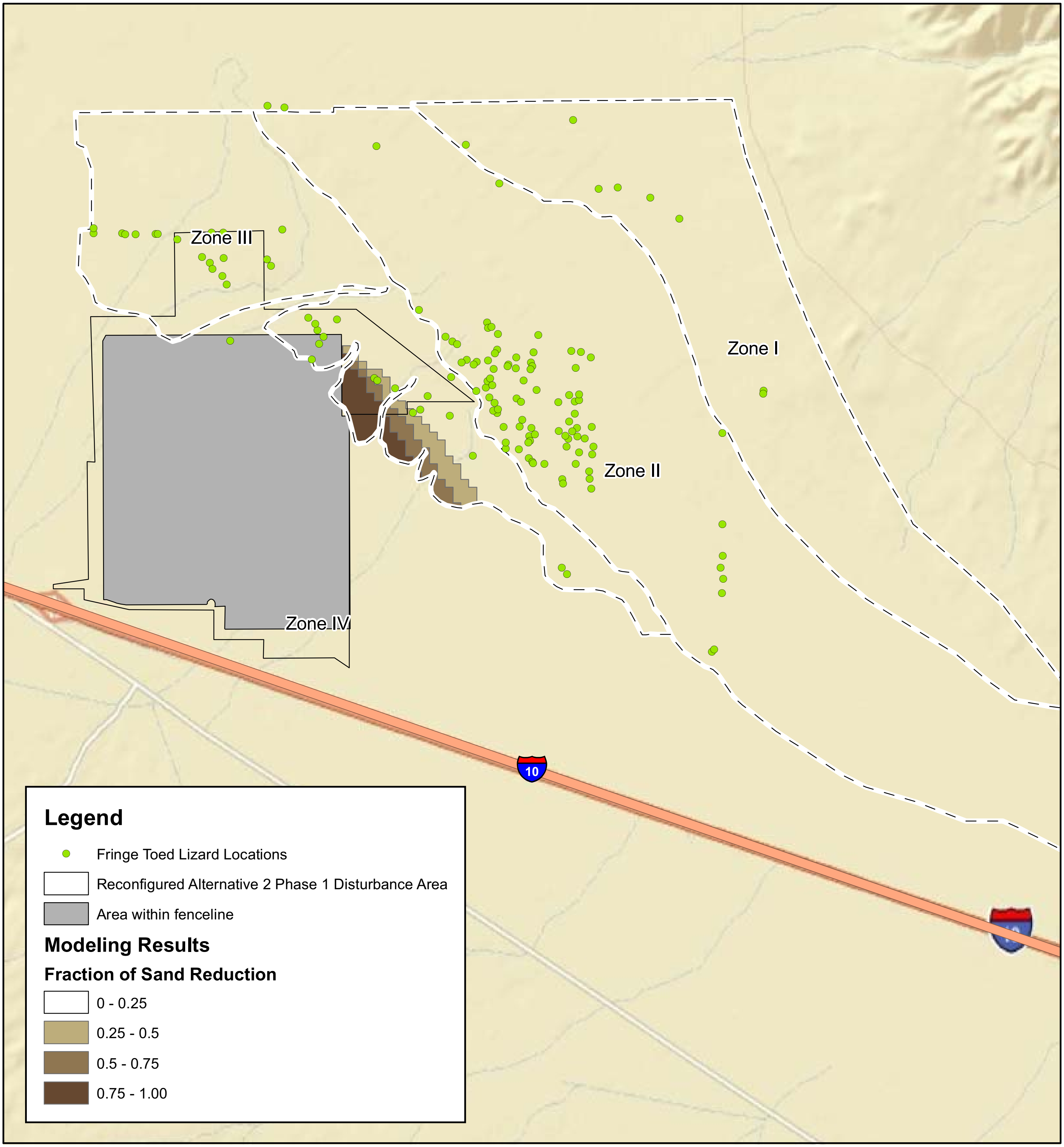


figure 25

CEC Palen

Reduction in sand input -
Applicant's Reconfigured Alternative 2 Phase 1

PWA Ref# - 2006.02

PWA

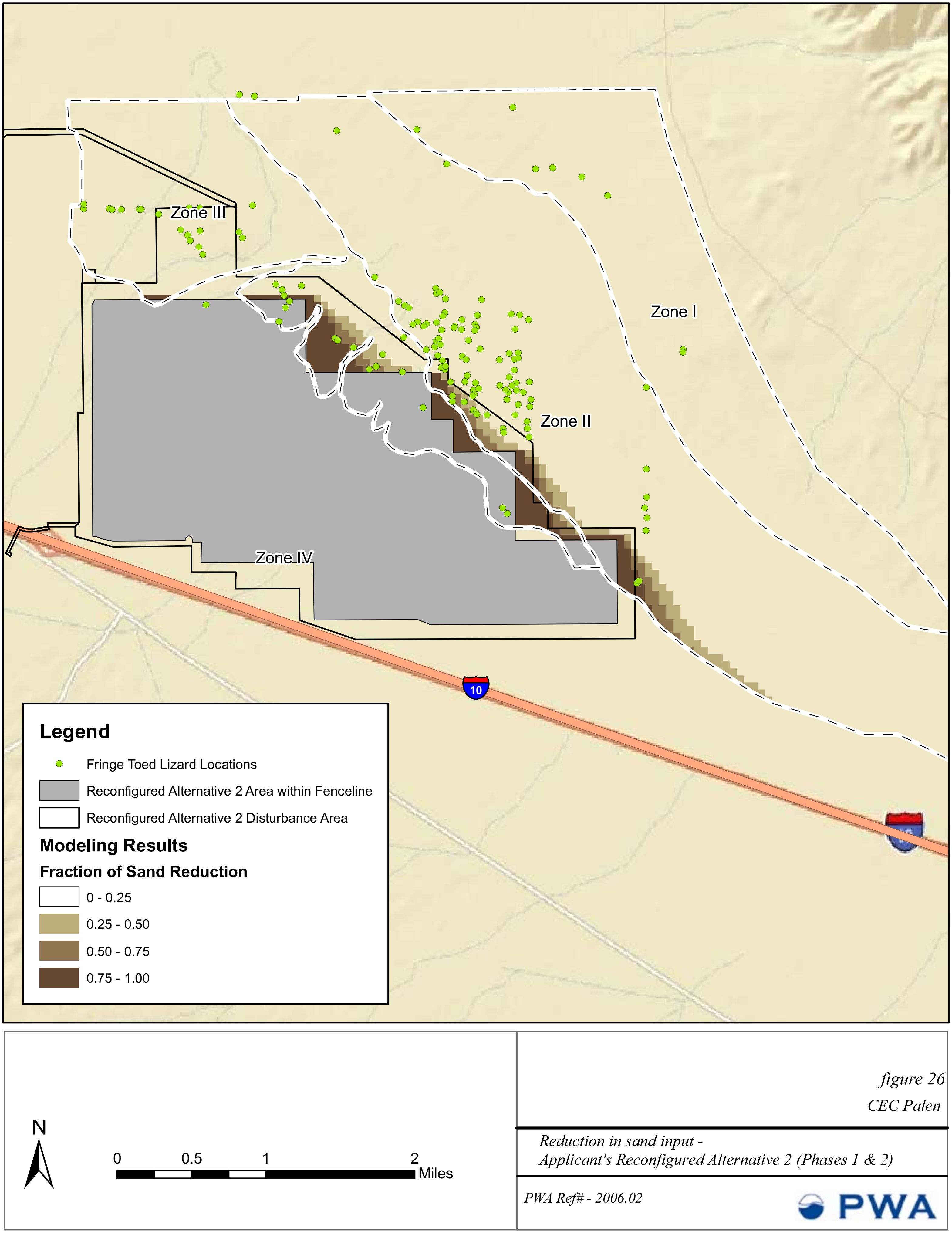


figure 26

CEC Palen

Reduction in sand input -
Applicant's Reconfigured Alternative 2 (Phases 1 & 2)

PWA Ref# - 2006.02

PWA

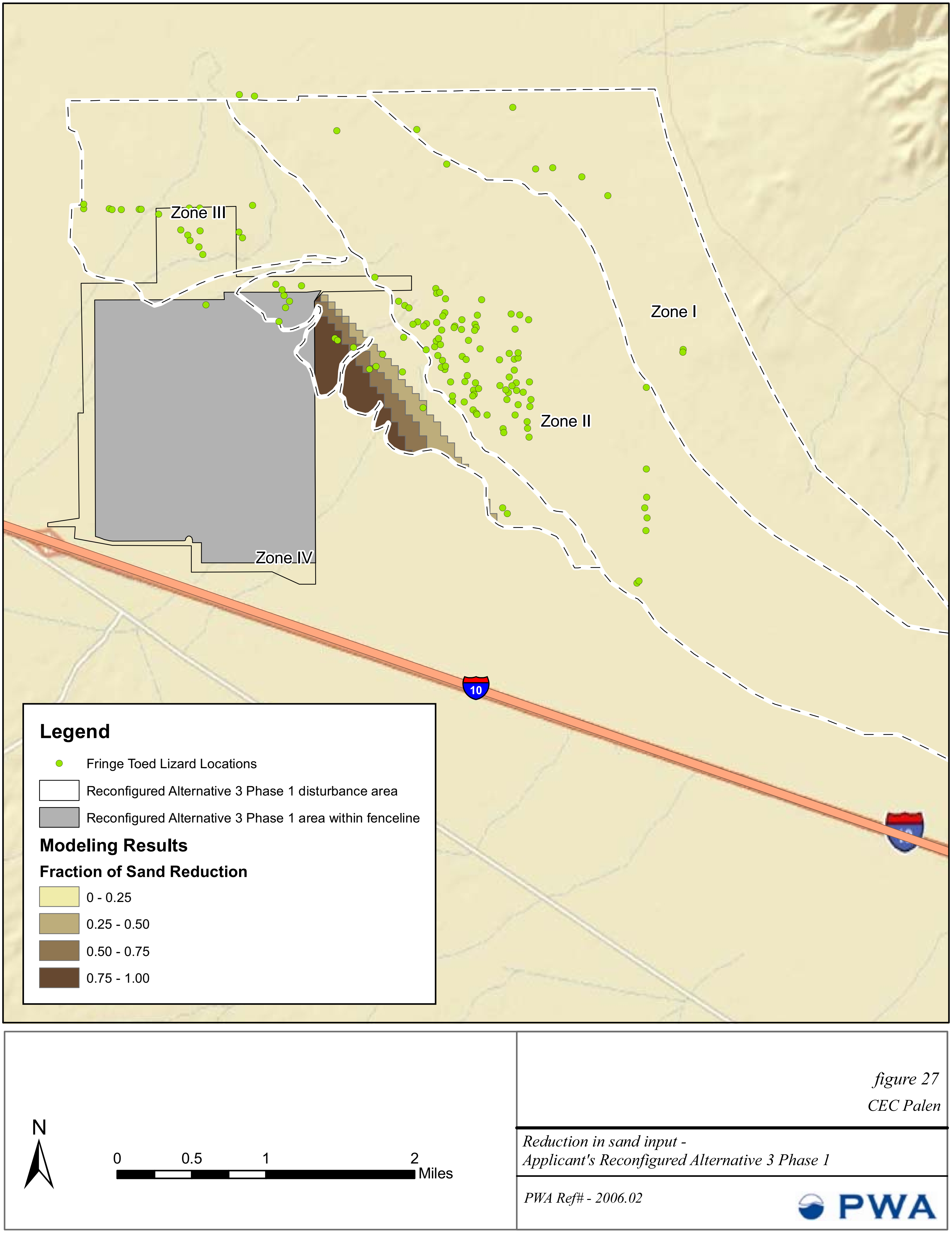


figure 27

CEC Palen

Reduction in sand input -
Applicant's Reconfigured Alternative 3 Phase 1

PWA Ref# - 2006.02

PWA

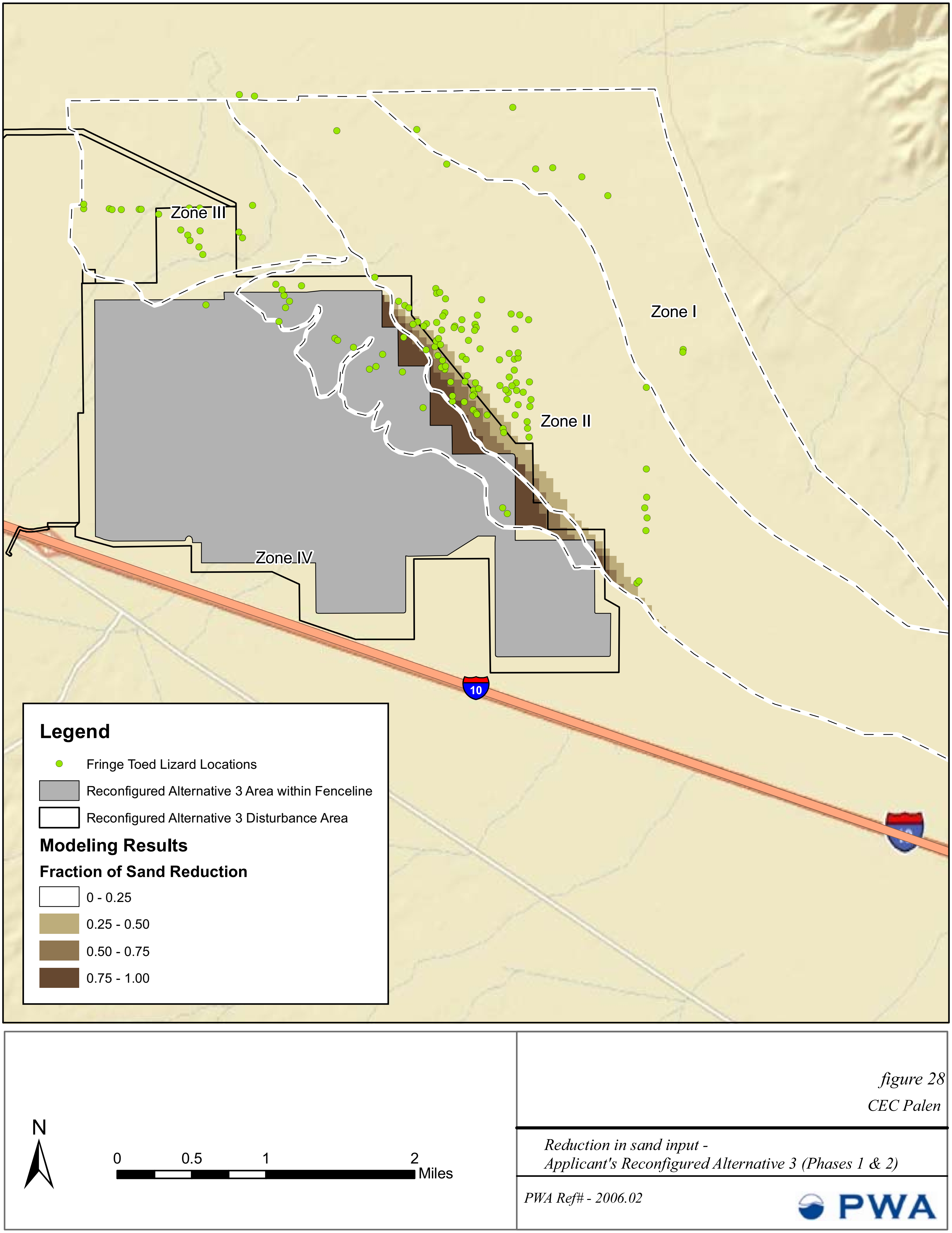


figure 28

CEC Palen

Reduction in sand input -
Applicant's Reconfigured Alternative 3 (Phases 1 & 2)

PWA Ref# - 2006.02

PWA

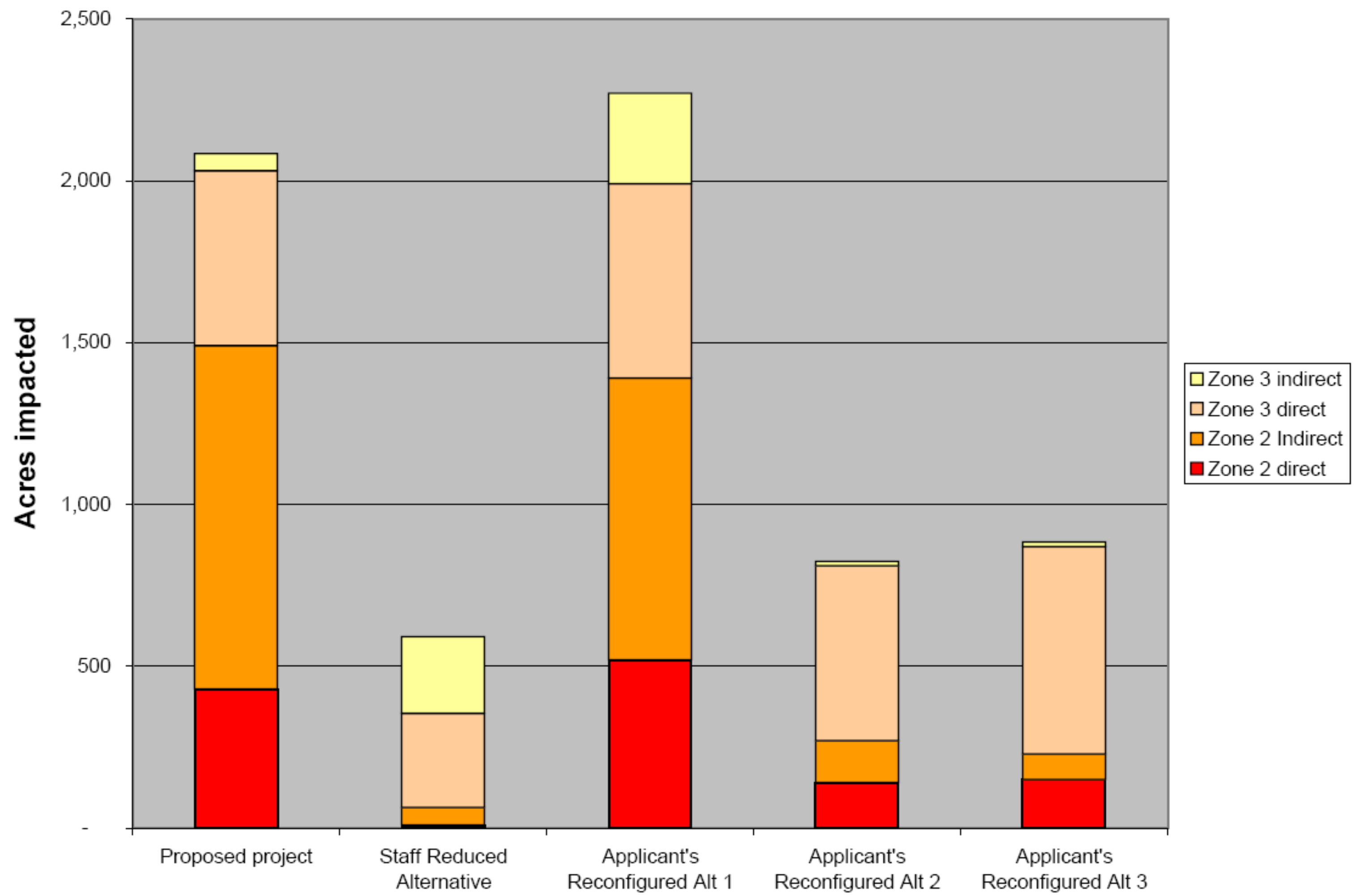


figure 29
CEC Palen

Summary of Alternatives' Impacts on Sand Transport Corridor

PWA Ref# 2006.02

PWA

5.4 DISCUSSION OF RESULTS

Table 2 provides a detailed break down of the direct and indirect impacts of the project alternatives. Note that comparing the Staff Reduced Acreage Alternative with the other alternatives is challenging because it only includes the solar arrays and does not include a disturbance area between the arrays and the property line, as the Proposed Project and the Applicant's Reconfigured Alternatives 2 and 3 do.

The proposed project was analyzed in two phases. Phase 1 (Figure 21) directly impacts 51 acres of sand corridor and indirectly impacts 191 acres. Phase 2 of the Proposed Project (Figure 22) has the highest indirect and direct impacts of any complete project in Zones 2-3, with a total of 970 acres of direct impact and 1,113 acres of indirect (sand shadow) impacts. Most of the indirect impacts are in the most sensitive Zone 2 (where the greatest population of MFTL is found).

The Staff Reduced Acreage Alternative (Figure 23) has the lowest direct or indirect impact on the sand transport corridor of any of the alternatives, with 292 acres of indirect and 299 acres of direct impact. Most of the indirect impacts are focused in the less sensitive Zone 3. Note that if the Staff Reduced Acreage Alternative was assessed with a disturbance area around the solar arrays (as the Proposed Project and the Applicants Reconfigured Alternatives 2 and 3 have been) the direct impact area would increase slightly and the indirect impact area would decrease (because some areas shown in our assessment as indirect impact would lie within the disturbance boundary). The total impact area would be the same.

The Applicant's Reconfigured Alternative 1 (Figure 24) has lower impacts than the Proposed Project, but retains high direct (1,120 acres) and indirect impacts (1,150 acres). Most of the indirect (sand shadow) impacts are in the more sensitive Zone 2 with the direct impacts split almost evenly between Zones 2 and 3.

In response to Staff feedback on the proposed project the Applicant developed two further Reconfigured Alternatives. These alternatives were assessed in two phases. Though not as low in impacts as the Staff Reduced Acreage Alternative, both applicant alternatives represent a substantial improvement over the proposed project, with greatly reduced direct and indirect impacts to the sand transport corridors. Phase 1 of the Applicant's Reconfigured Alternative 2 (Figure 25) has 117 acres of indirect impact and 84 acres of direct impact to the sand transport corridor, with Phase 2 (Figure 26) bringing this to 144 acres of indirect impact and 680 acres of direct impact. Most of the indirect impact is in the more sensitive Zone 2. Most of the direct impact is in the less sensitive Zone 3.

Phase 1 of the Applicant's Reconfigured Alternative 3 directly impacts 51 acres of the sand transport corridor and indirectly impacts 280 acres (Figure 27). Adding Phase 2 lowers the indirect impact to 94 acres but raises the direct impact to 790 acres (Figure 28). The shift between direct and indirect impact between Phases 1 and 2 is because much of the indirectly impacted area in Phase 1 is subsequently built on (directly impacted) in Phase 2. Most of the indirect impact is in Zone 2, but most of the direct impact is in Zone 3.

The alternatives are summarized in Figure 29 which shows impact by Zone of the sand transport corridor. The Proposed Project and the Applicant's Reconfigured Alternative 1 have extremely high impacts that have been judged to be significant and non-mitigable in the Draft Staff Assessment. The Reduced Acreage, Reconfigured Alternative 2 and Reconfigured Alternative 3 are all superior to the proposed project in terms of direct and indirect impacts. The Reduced Acreage Alternative has the lowest impacts and is the superior alternative based purely on impacts to dune habitat. There is little difference between the two applicant reconfigured alternatives from a sand transport and dune impact perspective since Alternative 2 offers the lowest total impact but the highest impact in the most sensitive Zone 2, whereas Alternative 3 offers a lower total impact but a higher impact to Zone 2.

5.5 COMPARISON OF THE STAFF-CALCULATED INDIRECT IMPACT AREAS AND THE APPLICANT'S INDIRECT IMPACT AREAS

In response to a data request from CEC dated July 9th 2010 the applicant submitted their own estimate of indirect impacts from wind transport (Kenney, July 20th 2010b, "Geomorphic evaluation of aeolian sand mitigation for reconfigured alternatives 2 and 3"). The resulting sand shadows are shown in Figure 30 and 31 and are somewhat smaller than the areas calculated in this report. Dr. Kenney's analysis used the same prevailing wind data that this report relies upon (his own data), but is different from our analysis in several ways. Firstly it sets the bar for impact much lower than our analysis. Figures 32 and 33 show the wind shadows estimated by Dr. Kenney superimposed on the sand reduction calculations we produced. This shows that Dr. Kenney's threshold for a shadow registering as an impact is approximately an 85% sand reduction or greater, whereas we consider an area impacted if it experiences a reduction in sand of 25% or more. Secondly, measuring the orientation of Dr. Kenney's sand shadows relative to the closest wind vectors (Figure 34) shows that in many cases he used orientations that are more northerly (making the shadow smaller) than the orientation of his field data.

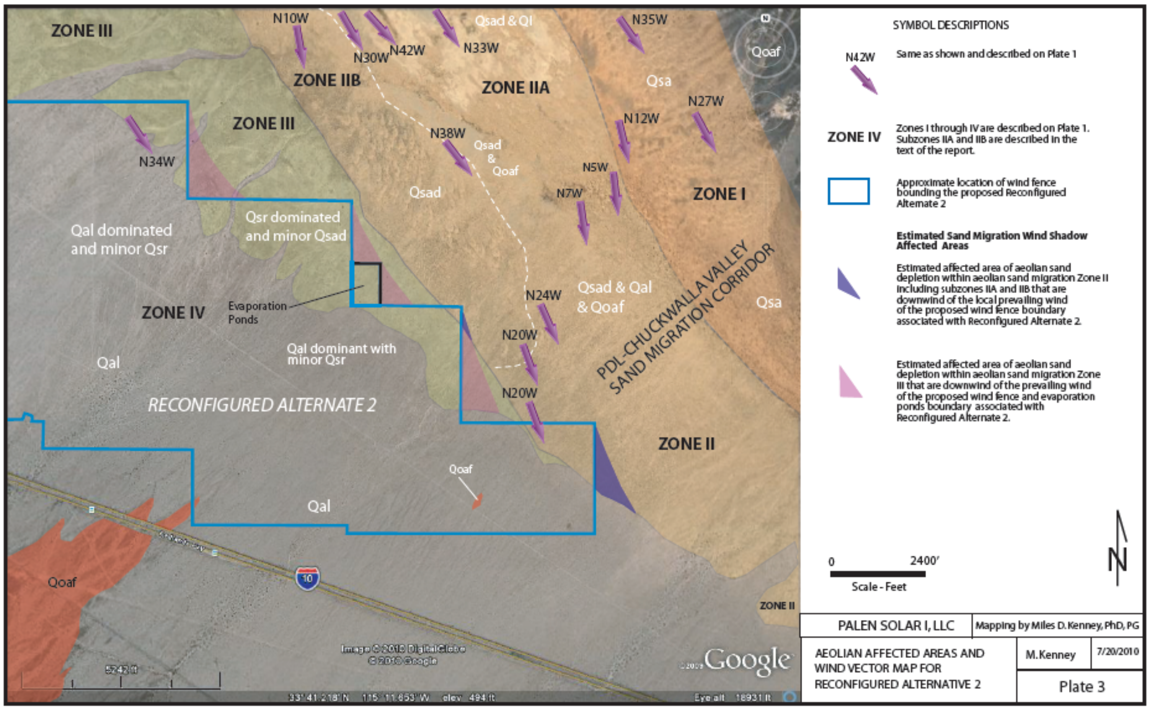


Figure 30. Indirect sand shadow impacts for Applicant's Alternative 2 as calculated by the applicant (Kenney, 2010b)

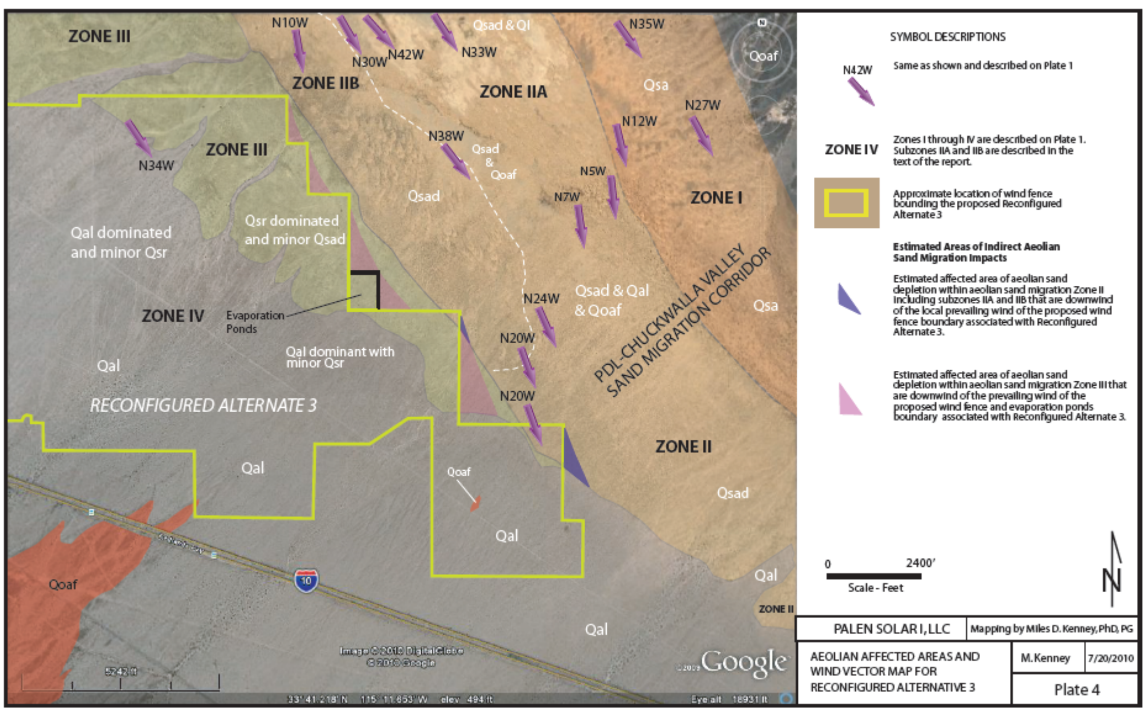


Figure 31. Indirect sand shadow impacts Applicant's Alternative 3 as calculated by the applicant (Kenney, 2010b)

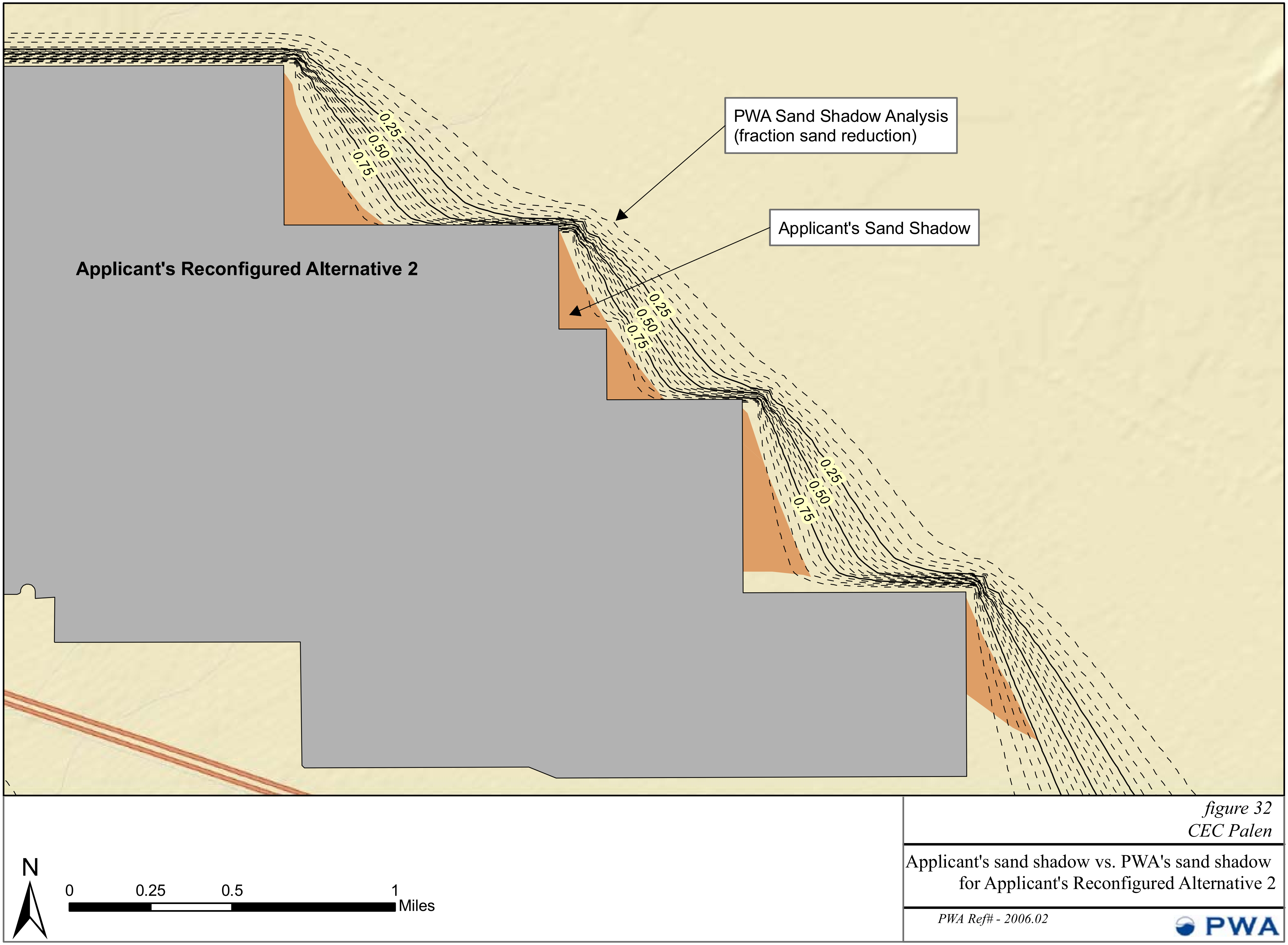


figure 32
CEC Palen

Applicant's sand shadow vs. PWA's sand shadow for Applicant's Reconfigured Alternative 2

PWA Ref# - 2006.02

PWA

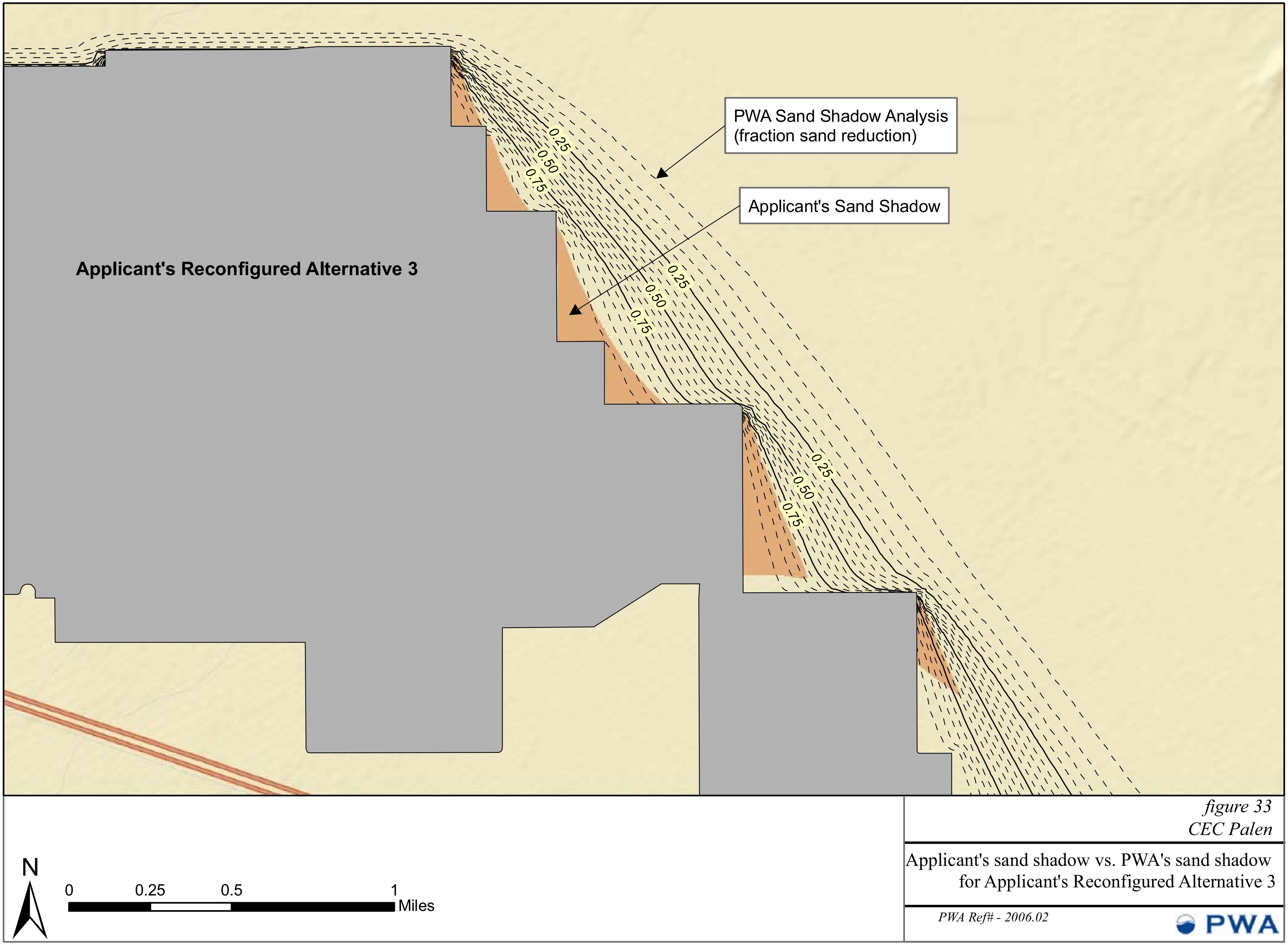
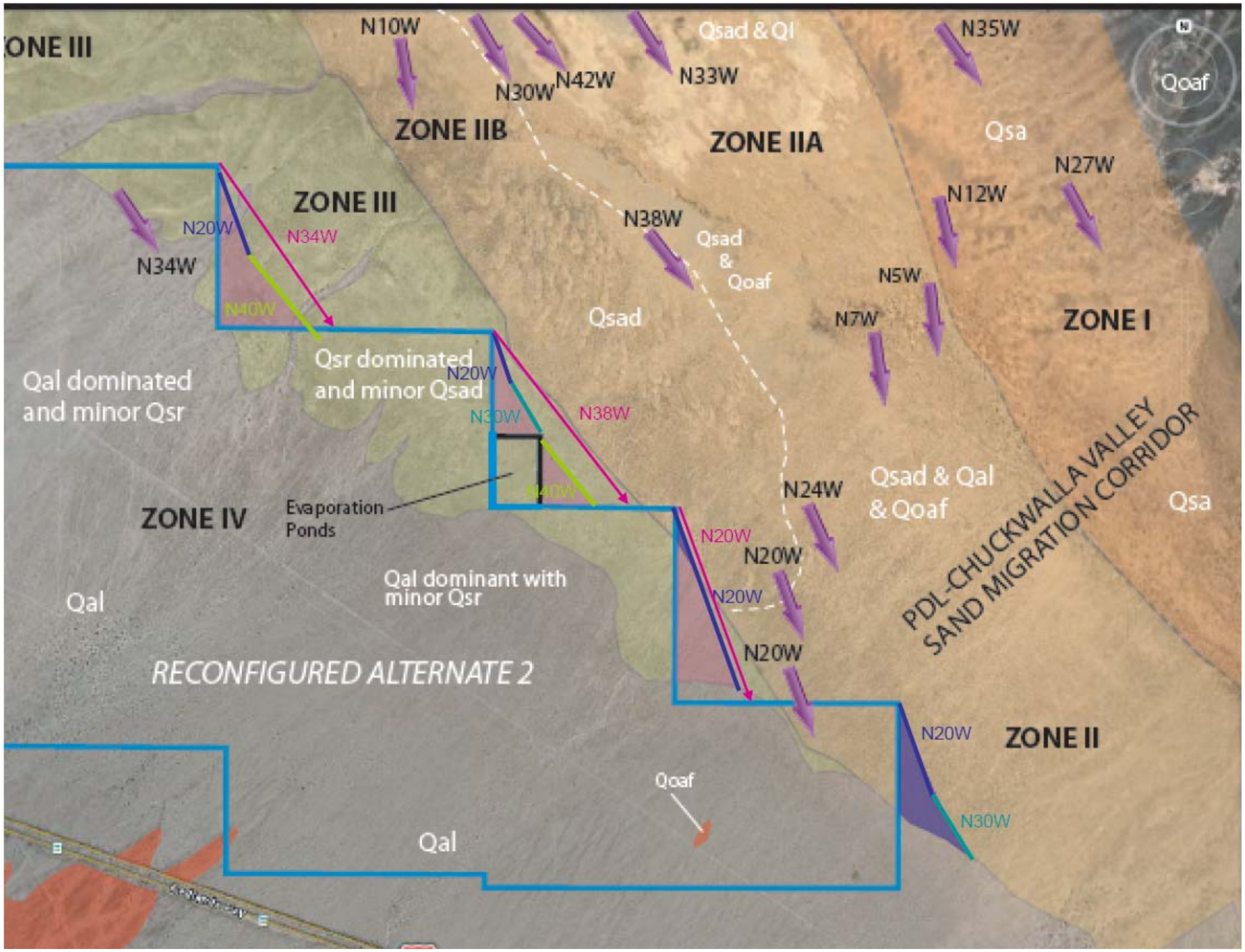


figure 33
CEC Palen

Applicant's sand shadow vs. PWA's sand shadow for Applicant's Reconfigured Alternative 3

PWA Ref# - 2006.02

PWA



Source: Kenney, 2010b Geomorphic evaluation of aeolian sand mitigation for reconfigured alternatives 2 and 3

Note: Applicant's sand shadow mitigation areas are shown in pink. Colored lines and labels are the orientations of the applicant's shadows. Wide purple arrows with black text are the applicant's measured sand dune orientations (surrogate for prevailing wind direction). Thin purple arrows are the orientation of the applicant's nearest sand dune overlain on the sand shadow.

figure 34
CEC Palen

Applicant's wind shadows showing underlying data

PWA Ref# 2006.02

In several submissions (e.g. Galati & Blek 2010j) and at staff workshops the Applicant has contested the wind shadow area estimates produced by PWA. The Applicant has asserted that PWA overestimated the area for two reasons: assuming a single prevailing wind direction that was from a more westerly direction that actually occurs, and ignoring the greater concentration of sand coming down Zone 1. The first claim is incorrect, as explained in the model description above. The model assumes the same prevailing wind direction as recorded by the applicant, primarily with a north and northwesterly direction. Furthermore, Figures 5 and 35 show that the dominant sand corridor is approaching the site from the northwest rather than the north as the Applicant claims. Regarding the second reason, neither the applicant nor staff have measured sand transport rates across the field site so the applicant's assertion that 80-90% of sand transport occurs in Zone 1 is speculative and impossible to verify. However, analysis of aerial photos from different years suggests that the boundary between Zones 1 and 2 is variable and that the width and the activity level of the sand transport corridor is more variable than the Applicant has considered. For example, Figures 5 and 35 show more sand activity in Zone 2 than is apparent on current images in Google Earth, and suggests that the eastern edge of Zone 1 was further west than conditions when mapped by the applicant (Kenney, 2010a). The differences in the apparent sand activity rate and location may reflect changes in the sand transport corridor in response to El Nino and La Nina events. It is erroneous to assume that the wind corridor as observed by the applicant in Winter 2010 (an El Nino winter with wetter conditions than average and therefore less wind activity) will have the same width and level of sand transport in a drier than average La Nina. Within the lifetime of the project there are likely to be five or six wetting and drying cycles of this nature, with associated expansion and contraction of the corridor. Finally, the distribution of levels of sand activity across the different zones is not the issue, since MFTL habitat is not correlated to increasing sand transport rates. MFTL favor a mixture of vegetation (to provide food and cover) and sand dunes. This mixture is most prevalent in Zone 2 (Zone 2B of Kenney 2010b). Dr. Kenney presumably believes that the combination of much greater sand concentrations in Zone 1 with stronger winds from the north would push more sand from Zone 1 into Zone 2, offsetting the losses sand from the project. However, if large volumes of sand were being pushed from Zone 1 to Zone 2 the boundary, and indeed the whole corridor, would bulge further south than it does. As can be seen in Figure 35, the corridor trends approximately northwest to southeast across the project site and then curves more to the east at the southern project boundary.

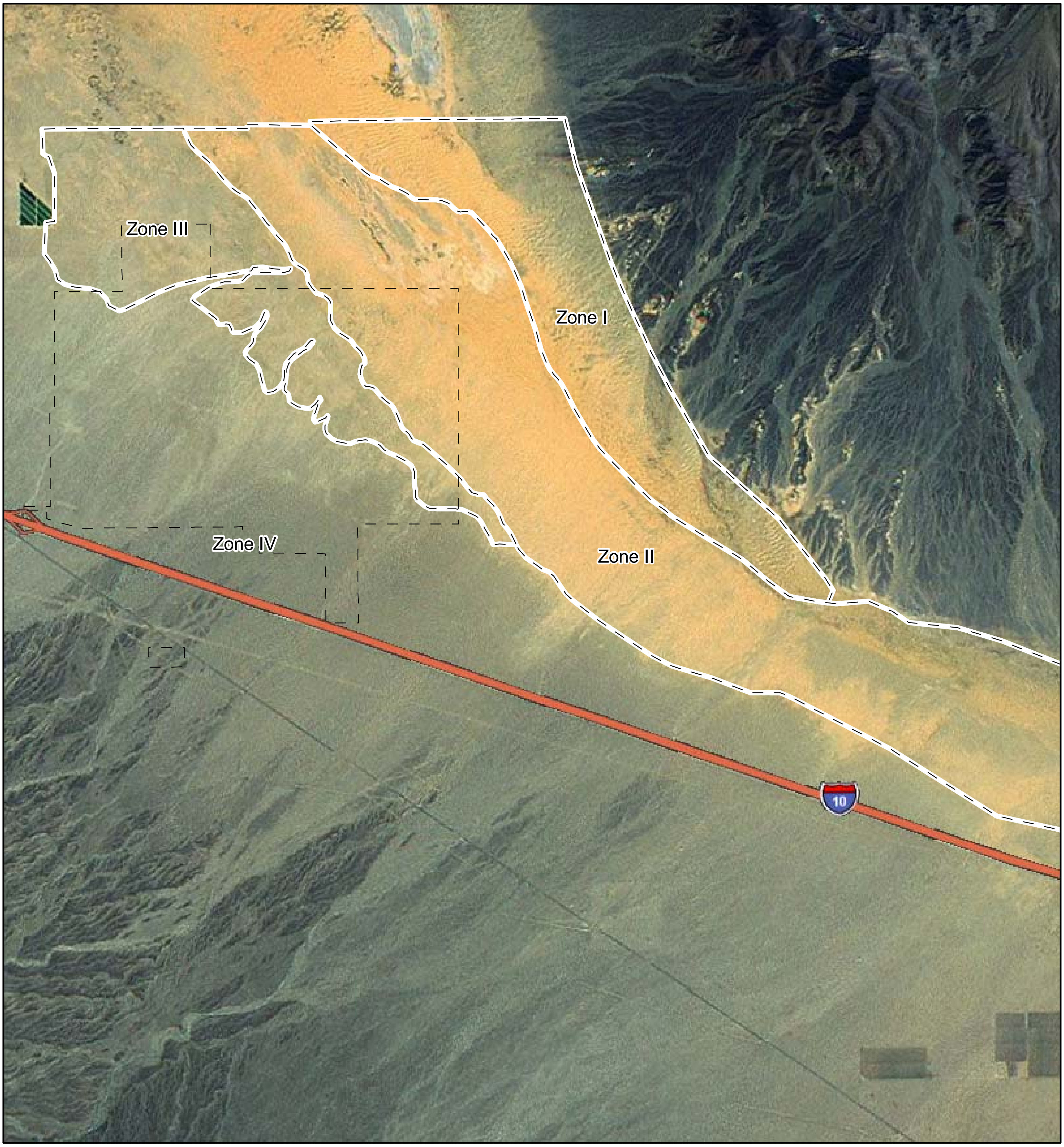


figure 35

CEC Palen

Aerial photo from springtime suggesting that Zone 1 may be further west than mapped by the applicant.

PWA Ref# - 2006.02

PWA

5.6 POTENTIAL MITIGATION OF INDIRECT IMPACTS TO THE CHUCKWALLA WIND TRANSPORT CORRIDOR

The Applicant has proposed in staff workshops and elsewhere (Galati & Blek 2910j) mitigating the indirect impacts to sand transport by collecting sand on the upwind (northern) sand fence and transporting it to a location where it can be entrained near the downwind (eastern) sand fence. Staff requested specific information about any proposed sand management activities such as clearing accumulated sand from the base of wind fencing (CEC 2010a) but has not yet received information on this subject from the Applicant. In descriptions of the proposed sand replenishment programs (Galati & Blek 2010j) the Applicant has not provided specific examples of sand replenishment schemes in the Mojave Desert or similar environments that are considered successful (or unsuccessful examples from which we can learn lessons) so assessing the likelihood of such a scheme working is difficult. We are conscious from talking to biologists with experience of sand mitigation projects that there are many practical issues that would need to be resolved before implementing such an experimental program (e.g. preventing vegetation from stabilizing sand piles, weed management, direct impacts to Mojave fringe-toed lizards and other dune-dependent species). If the Applicant were to propose such a program staff would need additional information to assess potential impacts to biological resources, including an estimate of the anticipated frequency and volume of sand removal, the location proposed for receipt of the accumulated sand, and descriptions of measures that would be taken to protect surrounding biological resources from impacts associated with such a sand removal program.

6. IMPACTS TO DRAINAGE FEATURES

Overlain on the major landscape units of the project site are a series of drainage lines that cross the site from southwest to northeast. I-10 is an important local control on drainage across the project site since it intercepts a large number of ephemeral washes draining southwest towards the site from the upper alluvial fan. These channels are captured by a series of berms and interceptor channels that run parallel with I-10, periodically funneling the collected water under I-10 at bridges and creating larger washes that pass onto the mid-fan. Thus the site has two types of wash: 'undersized' minor washes whose headwaters have been captured by the I-10 interceptor drains and that only drain a small area of their former drainages between I-10 and the project boundary, and two major wash complexes that have been 'oversized' by capturing additional flow from all the small drainages upslope of I-10 and that pass under the freeway and onto the Project site.

6.1 MINOR EPHEMERAL WASHES

Approximately a hundred minor washes cross the site from southwest to northeast, draining the area down-fan of I-10 towards Palen Dry Lake (many channels do not reach the lake but dissipate out on the vegetated sand dune surface). These channels are typically very subtle, with a width of 2-10 feet and a depth of 3-9 inches. They are found approximately every 100 feet when traversing along a contour on the mid-fan surface. There are sinuous and braided channels, with many channels showing evidence of recent flow on February 5th. Evidence of flow and small amounts of sediment transport included dampness, washed out dirt roads where they crossed channels, fresh veneers of sediment deposits, and small knickpoints and scour features of a few inches depth indicating local erosion. Based on the position of the damp ground flow was probably in the order of 1-2 inches deep through the small channels.

Figure 36. Minor ephemeral wash

6.2 MAJOR EPHEMERAL WASHES

There are 2 major ephemeral wash complexes that cross the site from southwest to northeast, draining the area down-fan of I-10 towards Palen Dry Lake. A third wash complex lies just to the southeast. Both major washes were traced from the western project boundary to Palen Dry Lake. The major washes are found as complexes of 10-20 braided channels, with each channel being approximately 10-50 feet wide. The wash complexes widen out from their constriction at I-10 and are approximately 1,500 feet wide after a mile, after which they become very dispersed, lose definition and resemble minor washes. Within a mile of I-10 the major washes have created sandy zones approximately 1,500 feet wide overlain on the less sandy alluvial gravel or thin sand sheets. These areas appear to be potential MFTL habitat, with vegetated dunes. The washes appear to be a local, smaller version of the regional wind-borne sand transport corridors discussed earlier, supplying sand to a narrow surrounding zone. The northern wash travels further between its construction on I-10 and the project site (1.4 miles) and is more dispersed than the central wash, which crossed into the proposed solar array blocks within 0.7 mile from I-10. Thus the central wash carries more sand and has created a wider sand corridor around it in the project area than the northern wash.

Figure 37. One of the main channels in the northern major wash complex. Photo is from close to the western project boundary looking east across the project site towards Palen Dry Lake.

Figure 38. The same major wash as Figure 37 in the middle of the proposed western solar array, showing the channel losing capacity as it flows towards Palen Dry Lake.

Figure 39. The central major wash complex in the center of the site has generated a corridor of sandy dune conditions around it, and supports trees.

6.3 PROJECT IMPACTS TO THE ALLUVIAL DRAINAGES

The minor washes on the project site have already likely been degraded compared with their original condition by the loss of headwater area when I-10 was constructed. They presumably transport water and sediment in smaller volumes and at lower frequencies than before, reducing the habitat quality for organisms that rely on water and fine sediment and favoring more drought tolerant species. On the other hand flow concentration into a smaller number of larger channels has likely improved conditions for water and fine sediment-loving species in the major wash complexes, which have probably become wetter and more sediment rich since I-10 was constructed (see Figure 39). This combination of 'winning' and 'losing' habitat patterns is likely to be somewhat repeated with the proposed project, with the drainage plan capturing the minor drainages, passing them through or around the solar arrays, and dissipating the concentrated flow on the alluvial fan downslope. In the immediate area downslope of the project site it is likely that there will be some disruption to the drainage plan and sediment supply, with flow being initially more concentrated near the dissipaters until it has a chance to spread out and resume a more natural drainage pattern. There is also the potential for sediment to be trapped in the channels or dissipaters where they pass round sharp corners. However, if properly executed and maintained the drainage plan should restore pre-project water and sediment delivery patterns to levels below a significant impact within a few hundred feet of the dissipaters. For most of the project site this distance lies within the disturbance limits and should not be a significant impact to habitat off-site.

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8. LIST OF PREPARERS

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CULTURAL RESOURCES

Matthew Braun, Thomas Gates and Michael McGuirt

THIS SECTION WILL BE PROVIDED IN THE

FINAL STAFF ASSESSMENT – Part B

HAZARDOUS MATERIALS MANAGEMENT

Testimony of Alvin Greenberg, Ph.D.

SUMMARY OF CONCLUSIONS

California Energy Commission staff (staff) evaluated the proposed Palen Solar Electric Generating System (PSEGS) modified project (amendment dated December 17, 2012) in terms of hazardous materials use. Staff's Final Staff Assessment (FSA) indicates that with the implementation of staff's proposed mitigation measures, hazardous materials use at the modified project site would not present a potential for significant impact to the public. Staff proposes Hazardous Materials Management Conditions of Certification to address the safe handling of hazardous materials and site security. With adoption of the proposed conditions of certification, the PSEGS project will comply with all applicable laws, ordinances, regulations, and standards and will not result in any unmitigated significant adverse impacts.

The proposed Hazardous Materials Management Conditions of Certification are slightly modified from the existing conditions of certification to account for the discontinuation of the project's use of heat transfer fluid (HTF) and propane, and the addition of natural gas and a gas pipeline.

INTRODUCTION

The purpose of this hazardous materials management analysis is to determine if the PSEGS has the potential to cause significant impacts to the public as a result of the use, handling, storage, or transportation of hazardous materials at the proposed site. If significant adverse impacts to the public are identified, staff must also evaluate the potential for facility design alternatives and additional mitigation measures to reduce those impacts to the extent feasible.

This analysis does not address the potential exposure of workers to hazardous materials used at the proposed facility. Employers must inform employees of hazards associated with their work and provide them with special protective equipment and training to reduce the potential for health impacts associated with the handling of hazardous materials. The **WORKER SAFETY AND FIRE PROTECTION** section of this document describes applicable requirements for the protection of workers from these risks.

In this analysis, staff examines plausible potential loss of containment incidents (spills) for the hazardous materials to be used at the proposed facility. The worst case plausible event, regardless of cause, is considered and analyzed to see whether the risk to local populations would be significant. Hazardous material handling and usage procedures are designed to reduce the likelihood of a spill, to reduce its potential size, and to prevent or reduce the potential for impacts of accidental releases off-site. These measures also address the potential for spills to mix with runoff water and be carried offsite. Generally, staff seeks to confirm that the project owner has proposed secondary containment basins for containing liquids, and that volatile chemicals would have restricted movement into the atmosphere after containment.

Various hazardous materials including mineral and lubricating oils, cleaning detergents, water treatment chemicals, welding gasses, and natural gas will be transported to, and will be present at, the proposed PSEGS project site. This document addresses all potential impacts associated with the transportation, use and handling of hazardous materials.

METHODOLOGY AND THRESHOLDS FOR DETERMINING ENVIRONMENTAL CONSEQUENCES

Staff reviewed and assessed the potential for the transportation, handling, and use of hazardous materials to impact the surrounding community. All chemicals were evaluated. Staff's analysis addresses the potential impacts on all members of the population including the young, the elderly, and people with existing medical conditions that may make them more sensitive to the adverse effects of hazardous materials. To accomplish this goal, staff utilizes exposure criteria (both acute and chronic) that are protective of the public.

In order to assess the potential for released hazardous materials to travel off-site and affect the public, staff analyzed several aspects of the proposed use of these materials at the facility. Staff recognizes that some hazardous materials must be used at power plants. Therefore, staff conducted its analysis by examining the choice and amount of chemicals to be used, the manner in which the project owner will use the chemicals, the manner by which they will be transported to the facility and transferred to facility storage tanks, and the way the project owner plans to store the materials on-site.

Staff reviewed the project owner's proposed engineering and administrative controls concerning hazardous materials usage. Engineering controls are the physical or mechanical systems, such as storage tanks or automatic shut-off valves, that can prevent the spill of hazardous material from occurring, or which can either limit the spill to a small amount or confine it to a small area. Administrative controls are procedures that will serve to prevent accidents and reduce the potential for impact if they do occur. Both engineering and administrative controls can act to prevent or minimize the need for emergency response actions.

Staff reviewed and evaluated the project owner's proposed use of hazardous materials as described by the project owner in its Petition to Amend (Palen 2012a, Section 5.6). Staff's assessment followed the five steps listed below:

- Step 1: Staff reviewed the chemicals and the amounts proposed for on-site use as listed in Table 5.6-3 of the Petition to Amend (Palen 2012a) and determined the need and appropriateness of their use.
- Step 2: Those chemicals proposed for use in small amounts or whose physical state is such that there is virtually no chance that a spill would migrate off-site and impact the public were removed from further assessment.
- Step 3: Measures proposed by the project owner to prevent spills were reviewed and evaluated. These included engineering controls such as automatic shut-off valves and different-sized transfer-hose couplings and administrative controls such as worker training and safety management programs.

- Step 4: Measures proposed by the project owner to respond to accidents were reviewed and evaluated. These measures also included engineering controls such as catchment basins and methods to keep vapors from spreading and administrative controls such as training emergency response crews.
- Step 5: Staff analyzed the theoretical impacts on the public of a worst-case spill of hazardous materials, as reduced by the mitigation measures proposed by the project owner. When mitigation methods proposed by the project owner are sufficient, no further mitigation is recommended. If the proposed mitigation is not sufficient to reduce the potential for adverse impacts to an insignificant level, staff will propose additional prevention and response controls until the potential for causing harm to the public is reduced to an insignificant level. It is only at this point that staff can recommend that the facility be allowed to use hazardous materials.

LAWS, ORDINANCES, REGULATIONS, AND STANDARDS

The following federal, state, and local laws and policies apply to the protection of public health and hazardous materials management. Staff's analysis examines the project's compliance with these requirements.

Hazardous Materials Management Table 1
Laws, Ordinances, Regulations, and Standards

Applicable LORS	Description
Federal	
The Superfund Amendments and Reauthorization Act of 1986 (42 USC §9601 et seq.)	Contains the Emergency Planning and Community Right To Know Act (also known as SARA Title III).
The Clean Air Act (CAA) of 1990 (42 USC 7401 et seq. as amended)	Established a nationwide emergency planning and response program and imposed reporting requirements for businesses that store, handle, or produce significant quantities of extremely hazardous materials.
The CAA section on risk management plans (42 USC §112(r)	Requires states to implement a comprehensive system informing local agencies and the public when a significant quantity of such materials is stored or handled at a facility. The requirements of both SARA Title III and the CAA are reflected in the California Health and Safety Code, section 25531, et seq.
49 CFR 172.800	The U.S. Department of Transportation (DOT) requirement that suppliers of hazardous materials prepare and implement security plans.
49 CFR Part 1572, Subparts A and B	Requires suppliers of hazardous materials to ensure that all their hazardous materials drivers are in compliance with personnel background security checks.
The Clean Water Act (CWA) (40 CFR 112)	Aims to prevent the discharge or threat of discharge of oil into navigable waters or adjoining shorelines. Requires a written spill prevention, control, and countermeasures (SPCC) plan to be prepared for facilities that store oil that could leak into navigable waters.
Federal Register (6 CFR Part 27) interim final rule	A regulation of the U.S. Department of Homeland Security that requires facilities that use or store certain hazardous materials to submit information to the department so that a vulnerability assessment can be conducted to determine what certain specified security measures shall be implemented.

Applicable LORS	Description
State	
Title 8, California Code of Regulations, section 5189	Requires facility owners to develop and implement effective safety management plans that ensure that large quantities of hazardous materials are handled safely. While such requirements primarily provide for the protection of workers, they also indirectly improve public safety and are coordinated with the Risk Management Plan (RMP) process.
California Health and Safety Code, section 41700	Requires that "No person shall discharge from any source whatsoever such quantities of air contaminants or other material which causes injury, detriment, nuisance, or annoyance to any considerable number of persons or to the public, or which endanger the comfort, repose, health, or safety of any such persons or the public, or which cause, or have a natural tendency to cause injury or damage to business or property."
California Safe Drinking Water and Toxic Enforcement Act (Proposition 65)	Prevents certain chemicals that cause cancer and reproductive toxicity from being discharged into sources of drinking water.
Hazardous Material Business Plan, Cal HSC Sections 25500 to 25541; 19 CCR Sections 2720 to 2734	Requires the submittal of a chemical inventory and planning and reporting for management of hazardous materials.
Hazardous Substance Information and Training Act, 8 CCR Section 339; Section 3200 et seq., 5139 et seq., and 5160 et seq.	Requires listing and implementation of specified control measures for management of hazardous substances.
California HSC Sections 25270 through 25270.13	Requires the preparation of a Spill Prevention, Control, and Countermeasures (SPCC) Plan if 10,000 gallons or more of petroleum is stored on-site. The above regulations would also require the immediate reporting of a spill or release of 42 gallons or more to the California Office of Emergency Services and the Certified Unified Program Authority (CUPA).
NFPA 56 (adopted 2012)	NFPA 56 is the Standard for Fire and Explosion Prevention During Cleaning and Purging of Flammable Gas Piping Systems.
Local	
Riverside County Fire Code, Riverside County Code Chapter 8.32: Ordinance No. 787	Adopts the California Fire Code, 2007 Edition, with some of its appendices, into Riverside County regulations.
Disclosure of Hazardous Materials and the Formulation of Business Emergency Plans: Riverside County Ordinance 651	Requires disclosure where businesses handle hazardous materials and requires the development of response plans; designates Riverside County Department of Environmental Health as responsible for administration and enforcement of local codes.

The Certified Unified Program Authority (CUPA) with the responsibility to review the Hazardous Materials Business Plan (HMBP) is the Riverside County Environmental Health Department (RCEHD). With regard to seismic safety issues, the site is located in a Seismic Zone 4. Construction and design of buildings and vessels storing hazardous materials will meet the appropriate seismic requirements of the 2010 California Building Code (Palen 2012a, Section 5.6.3.3).

PROPOSED MODIFIED PROJECT

On December 17, 2012, Palen Solar Holdings, LLC (PSH) filed a petition with the Energy Commission requesting to modify the Palen Solar Power Project (PSPP), now called PSEGS. The major modification is replacing the parabolic trough solar collection system using heat transfer fluid with Bright Source's solar tower technology. Heliostats—elevated mirrors guided by a tracking system mounted on a pylon—focus the sun's rays on a solar receiver steam generator located atop a 750-foot tower near the center of each solar field to create steam to drive a turbine that provides electricity.

Two adjacent solar fields producing 250 MW each are proposed for a combined nominal output of approximately 500 MW. Each of the 250 MW solar fields would have a dedicated tower, solar field/heliostat array of approximately 85,000 heliostats, and a dedicated steam turbine generator/power block. Both solar fields would share common facilities, including a common area containing an administration building, warehouse, evaporation ponds, maintenance complex, a meter/valve station for incoming natural gas service to the site, an onsite switchyard, and a 10-mile single-circuit 230-kV generation tie-line. Other onsite facilities would include access and maintenance roads (either dirt, gravel, or paved), perimeter fencing, tortoise fencing, and other ancillary security facilities.

SETTING AND EXISTING CONDITIONS

Several factors associated with the area in which a project is to be located affect the potential for an accidental release of a hazardous material that could cause public health impacts. These include:

- local meteorology;
- terrain characteristics; and,
- location of population centers and sensitive receptors relative to the project.

METEOROLOGICAL CONDITIONS

Meteorological conditions, including wind speed, wind direction, and air temperature, affect both the extent to which accidentally released hazardous materials would be dispersed into the air and the direction in which they would be transported. This affects the potential magnitude and extent of public exposure to such materials, as well as their associated health risks. When wind speeds are low and the atmosphere stable, dispersion is severely reduced, but can lead to increased localized public exposure.

Recorded wind speeds and ambient air temperatures are described in the **AIR QUALITY** section (5.2.2.2) and Appendix E.1 of the Application for Certification (Solar Millennium 2009a).

TERRAIN CHARACTERISTICS

The location of elevated terrain is often an important factor in assessing potential exposure. An emission plume resulting from an accidental release may impact high elevations before impacting lower elevations. The topography of the site is mostly flat (ranges between 130 and 200 feet above sea level), with elevated terrain beginning to the northeast and southwest within 3-4 miles of the site (Solar Millennium 2009a, Section 2.4.1).

LOCATION OF EXPOSED POPULATIONS AND SENSITIVE RECEPTORS

The general population includes many sensitive subgroups that may be at greater risk from exposure to emitted pollutants. These sensitive subgroups include the very young, the elderly, and those with existing illnesses. In addition, the location of the population in the area surrounding a project site may have a major bearing on health risk. There are no sensitive receptors within a 3-mile radius of the project site. The nearest sensitive receptor is the Eagle Mountain Elementary School located about 10 miles west of the project site. There are two residences (which may or may not be occupied) within one mile of the project site, located about 25 feet and 3,500 feet northwest of the project fence line, respectively (Solar Millennium 2009a, Section 5.10.2 and Figure 5.10-2). In order to ensure a level of protection consistent with Energy Commission policies, staff assumes that these two residences either are occupied or can be occupied in the future.

ASSESSMENT OF IMPACTS AND DISCUSSION OF MITIGATION

SMALL QUANTITY HAZARDOUS MATERIALS

In conducting the analysis, staff determined in Steps 1 and 2 that some hazardous materials, although present at the proposed facility, pose a minimal potential for off-site impacts since they will be stored in a solid form or in smaller quantities, have low mobility, or have low levels of toxicity. These hazardous materials, which were eliminated from further consideration, are briefly discussed below.

During the construction phase of the project, hazardous materials proposed for use include the same type and amount as in the approved PSPP project. These include paint, solvents, gasoline, diesel fuel, motor oil, lubricants, and welding gases (CEC 2010f and Palen 2012a page 4.3-1). No acutely toxic hazardous materials will be used on-site during construction, and none of these materials pose significant potential for off-site impacts as a result of the quantities on-site, their relative toxicity, their physical state, and/or their environmental mobility. Any impact of spills or other releases of these materials will be limited to the site because of the small quantities involved, their infrequent use (and therefore reduced chances of release), and/or the temporary containment berms used by contractors. Petroleum hydrocarbon-based motor fuels, mineral oil, lube oil, and diesel fuel are all very low volatility and represent limited off-site hazards even in larger quantities.

During operations, hazardous chemicals such as cleaning agents, water treatment chemicals, welding gasses, oils, and other various chemicals (see **HAZARDOUS MATERIALS APPENDIX B** for a list of chemicals proposed to be used and stored at PSEGS during operations) would be used and stored in relatively small amounts and represent limited off-site hazards because of their small quantities, low volatility, and/or low toxicity. The modified project will be limited to using, storing, and transporting only those hazardous materials listed in **HAZARDOUS MATERIALS APPENDIX B** of this section as per staff's proposed Condition of Certification **HAZ-1**. The quantities listed in

HAZARDOUS MATERIALS APPENDIX B are the amount that would be present on the entire site and would be equally divided between the two power blocks.

After removing from consideration those chemicals that pose no risk of off-site impact in Steps 1 and 2, staff continued with Steps 3, 4, and 5 to review the remaining hazardous materials: sulfuric acid, sodium hydroxide, natural gas and aqueous ammonia.

LARGE QUANTITY HAZARDOUS MATERIALS

Sulfuric Acid and Sodium Hydroxide

Because of their very low vapor pressures, these hazardous materials can pose a risk to the off-site public and on-site workers only through direct contact. Because they will be delivered in self-contained "totes" (see discussion below regarding totes) and will not be stored at any one location in a quantity greater than 400 gallons, staff concludes that the risk of impact to the off-site public is less than significant.

Natural Gas

Natural gas poses a fire and/or possible explosion risk because of its flammability. Natural gas is composed of mostly methane, but also contains ethane, propane, nitrogen, butane, isobutene, and isopentane. It is colorless, odorless, tasteless, and lighter than air. Natural gas can cause asphyxiation when methane is 90 percent in concentration. Methane is flammable when mixed in air at concentrations of 5-14 percent, which is also the detonation range. Natural gas, therefore, poses a risk of fire and/or possible explosion if a release occurs under certain specific conditions. However, it should be noted that, due to its tendency to disperse rapidly, natural gas is less likely to cause explosions than many other fuel gases such as propane or liquefied petroleum gas, but can explode under certain confined conditions (as demonstrated by the natural gas detonation in Belgium in July 2004 and in San Bruno, California in September 2010).

While natural gas will be used in significant quantities, it will not be stored on-site. It will be delivered by the Southern California Gas Company (SoCal Gas) via a new pipeline that will extend southward from the site and interconnect with an existing SoCal Gas transmission pipeline located just south of I-10. The new gas pipeline will be approximately 8-inches in diameter and be approximately 2,956 feet long and will be constructed within a previously-surveyed corridor as shown on Figure 2.1-6, dated and docketed on March 15, 2013 (Palen 2013e). SoCal Gas will construct, own, and operate the new gas pipeline as part of its extensive gas supply system.

The risk of a fire and/or explosion on-site can be reduced to insignificant levels through adherence to applicable codes and the development and implementation of effective safety management practices. The National Fire Protection Association (NFPA) code 85A requires both the use of double-block and bleed valves for gas shut off and automated combustion controls. These measures will significantly reduce the likelihood of an explosion in gas-fired equipment. Additionally, start-up procedures would require air purging of the gas turbines prior to start up, thereby precluding the presence of an explosive mixture. The safety management plan proposed by the project owner would address the handling and use of natural gas, and would significantly reduce the potential for equipment failure because of either improper maintenance or human error.

Staff concludes that since the natural gas pipeline will be owned and operated by SoCal Gas, existing LORS are sufficient to ensure minimal risks of pipeline failure.

On June 28, 2010, the United States Chemical Safety and Hazard Board (CSB) issued Urgent Recommendations to the United States Occupational Safety and Health Administration (OSHA), the NFPA, the American Society of Mechanical Engineers (ASME), and major gas turbine manufacturers to make changes to their respective regulations, codes, and guidance to require the use of inherently safer alternatives to natural gas blows for the purposes of pipe cleaning. Recommendations were also made to the fifty states to enact legislation applicable to power plants that prohibits flammable gas blows for the purposes of pipe cleaning. In accordance with those recommendations, staff proposes new Condition of Certification **HAZ-4** which prohibits the use of flammable gas blow for pipe cleaning at the facility either during construction or after the start of operations. All fuel gas pipe purging activities shall vent any gases to a safe location outdoors, away from workers and sources of ignition. Fuel gas pipe cleaning and purging shall adhere to the provisions of NFPA 56, the Standard for Fire and Explosion Prevention During Cleaning and Purging of Flammable Gas Piping Systems, with special emphasis on sections 4.3.1 (written procedures for pipe cleaning and purging) and 6.111 (prohibition on the use of flammable gas for cleaning or purging at any time).

Aqueous Ammonia

Aqueous ammonia will be used to control the emission of oxides of nitrogen (NO_x) from the combustion of natural gas at the PSEGS. The accidental release of aqueous ammonia without proper mitigation can result in significant down-wind concentrations of ammonia gas. The modified project would have 19-percent aqueous ammonia solution in two stationary 400 gallon above-ground storage totes at each power block for a total maximum volume on-site of 1,600 gallons (Palen 2012a, page 4.3-2).

The use of aqueous ammonia can result in the formation and release of toxic gases in the event of a spill even without interaction with other chemicals. This is a result of its moderate vapor pressure and the volume of aqueous ammonia that will be used and stored on-site. However, the use of aqueous ammonia poses far less risk than the use of the far more hazardous anhydrous ammonia (ammonia that is not diluted with water).

To assess the potential impacts associated with an accidental release of aqueous ammonia, staff uses four bench mark exposure levels of ammonia gas occurring offsite. These include:

- the lowest concentration posing a risk of lethality of 2,000 ppm;
- the immediately dangerous to life and health level of 300 ppm;
- the emergency response planning guideline level 2 of 150 ppm, which is also the RMP level 1 criterion used by United States Environmental Protection Agency (US EPA) and California; and,

- the level considered by the Energy Commission staff to be without serious adverse effects on the public for a one-time exposure of 75 ppm (considered by staff to be a level of significance – see **HAZARDOUS MATERIALS APPENDIX A**).

If the potential exposure associated with a potential release exceeds 75 ppm at any public receptor, staff assumes that the potential release poses a risk of significant impact. Staff also assessed the probability of occurrence of the release and/or the nature of the potentially exposed population in determining whether the likelihood and extent of potential exposure are sufficient to support a finding of potentially significant impact.

At this site, several factors influenced staff's conclusion that the risk of off-site impacts of a release of aqueous ammonia would be extremely low and thus air dispersion modeling would not be required:

1. The maximum of each tote is 400 gallons and totes are self-contained units that do not involve the transfer of aqueous ammonia from a tanker truck to a large storage tank. They are delivered already containing the aqueous ammonia.

2. Each tote will have secondary spill containment to limit the spread of any spilled aqueous ammonia, thus limiting the size of the pool of ammonia available for evaporation and dispersion.

3. Previous modeling at other power plants by staff of far greater amounts of aqueous ammonia spilling into secondary containment areas show very limited dispersion of ammonia and the distance to a level less than 75 ppm is usually only a few hundred feet from the source.

4. Totes have an excellent safety record of structural integrity and minimal spills and the chance that more than one would fail at the same time is extremely remote.

5. The nearest off-site public receptors are two homes located about 25 feet and 3,500 feet northwest of the project fence line. These are respectively approximately one mile (5,280 ft.) and one and two-thirds miles (8,720 ft.) from the nearest tote of aqueous ammonia at a power block. Also, a vehicle traveling on I-10 would get no closer than three quarters of a mile (4,000 ft) from the nearest ammonia tote at a power block (Palen 2012a, Figure 2 and Appendix A page 10).

Therefore, staff concludes that any spill of aqueous ammonia from any one of the four totes on the site would not result in an airborne concentration of 75 ppm or greater ammonia at any off-site location and thus would pose a less than significant risk to the public.

MITIGATION

Staff believes that this project's use of hazardous materials poses a less than significant risk, but only if mitigation measures are used. The potential for accidents resulting in the release of hazardous materials is greatly reduced by the implementation of a Safety Management Program that includes both engineering and administrative controls. Elements of facility controls and the safety management plan are summarized below.

Engineering Controls

Engineering controls help to prevent accidents and releases (spills) from moving off-site and affecting communities by incorporating engineering safety design criteria in the design of the project. The engineered safety features proposed by the project owner for use at the PSEGS project include:

- Storage of small quantity hazardous materials in original, properly labeled containers ("totes");
- construction of secondary containment areas surrounding each of the bulk hazardous materials storage areas or totes designed to contain accidental releases that might happen during storage or delivery plus the volume of rainfall associated with a 25-year, 24-hour storm;
- physical separation of stored chemicals in isolated containment areas in order to prevent accidental mixing of incompatible materials, which could result in the evolution and release of toxic gases or fumes; and,
- installation of a fire protection system for hazardous materials storage areas.

Administrative Controls

Administrative controls also help prevent accidents and releases (spills) from moving off-site and affecting neighboring communities by establishing worker training programs, process safety management programs, and complying with all applicable health and safety laws, ordinances, and standards.

A worker health and safety program will be prepared by the project owner and include (but not be limited to) the following elements (see the **WORKER SAFETY AND FIRE PROTECTION** section for specific regulatory requirements):

- worker training regarding chemical hazards, health and safety issues, and hazard communication;
- procedures to ensure the proper use of personal protective equipment;
- safety operating procedures for the operation and maintenance of systems utilizing hazardous materials;
- fire safety and prevention; and,
- emergency response actions including facility evacuation, hazardous material spill clean-up, and fire prevention including the preparation of a Spill Prevention, Control, and Countermeasure (SPCC) Plan.

At the facility, the project owner will be required to designate an individual with the responsibility and authority to ensure a safe and healthful work place. The project health and safety official will oversee the health and safety program and have the authority to halt any action or modify any work practice to protect the workers, facility, and the surrounding community in the event of a violation of the health and safety program.

Existing Condition of Certification **HAZ-1** ensures that no hazardous material would be used at the facility except as listed on pages 4.3-2 through 4.3-5 of the Petition to Amend (Palen 2012a)), which have been reviewed by staff to determine the need and appropriateness of their use. Condition of Certification **HAZ-1** also requires changes to the allowed list of hazardous materials and their maximum amounts to be approved by the Energy Commission Compliance Project Manager (CPM). Only those that are needed and appropriate would be allowed to be used. If staff feels that a safer alternative chemical can be used, staff would recommend or require its use, depending upon the impacts posed.

Additional administrative controls are required by revised Condition of Certification **HAZ-2** (preparation of a HMBP and a SPCC Plan) and existing Condition of Certification **HAZ-3** (development of a Safety Management Plan).

On-Site Spill Response

In order to address the issue of spill response, the facility will prepare and implement an emergency response plan that includes information on hazardous materials contingency and emergency response procedures, spill containment and prevention systems, personnel training, spill notification, on-site spill containment, and prevention equipment and capabilities, as well as other elements. Emergency procedures will be established which include evacuation, spill cleanup, hazard prevention, and emergency response. The presence of oil in a quantity greater than 1,320 gallons might invoke a requirement to prepare an SPCC Plan. The quantity of oil contained in any one of the planned 230/500 kV transformers would be in excess of the minimum quantity that requires such a plan. In addition, pursuant to California HSC Sections 25270 through 25270.13, the PSEGS would be required to prepare an SPCC because it will store 10,000 gallons or more of petroleum on-site. The above regulations would also require the immediate reporting of a spill or release of 42 gallons or more to the California Office of Emergency Services and the CUPA.

Plant personnel will be trained as a hazardous materials response team which would be the first responder to hazardous materials incidents. In the event of a large incident involving hazardous materials, backup support would be provided by the Riverside County Fire Department which has a hazmat response unit capable of handling any incident at the proposed PSEGS, but would respond in an inadequate time of about 1.5-2 hours (Solar Millennium 2009a, Section 5.6.4.2 and RCFD 2010).

TRANSPORTATION OF HAZARDOUS MATERIALS

Various containerized and bulk hazardous materials would be transported to the facility via the truck. While many types of hazardous materials will be transported to the site, staff believes that transport of aqueous ammonia poses the predominant risk associated with hazardous materials transport. It should be noted that previous modeling of spills involving much larger quantities of aqueous ammonia than will be used, stored and transported to the proposed PSEGS has demonstrated that significant airborne concentrations would occur only at short distances from the spill.

Staff believes it is appropriate to rely upon the extensive regulatory program that applies to the shipment of hazardous materials on California highways to ensure safe handling in general transportation (see Federal Hazardous Materials Transportation Law 49 USC §5101 et seq, DOT regulations 49 CFR subpart H, §172–700, and California Department of Motor Vehicles (DMV) regulations on hazardous cargo). These regulations also address the issue of driver competence.

Based on the environmental mobility, toxicity, the quantities at the site, and the use of totes, staff concludes that the risk associated with the transportation of hazardous materials to the proposed modified project is less than significant.

SEISMIC ISSUES

It is possible that an earthquake could cause the failure of hazardous materials storage tanks. An earthquake could also cause failure of the secondary containment system (berms and dikes), as well as the failure of electrically controlled valves and pumps. The failure of all of these preventive control measures might then result in leaks of chemicals or of natural gas that may cause fires or impact the environment.

Information obtained after the January 1994 Northridge earthquake showed that some damage was caused both to several large storage tanks and to smaller tanks associated with the water treatment system of a cogeneration facility. The tanks with the greatest damage, including seam leakage, were older tanks, while the newer tanks only sustained displacements and failures of attached lines. Staff reviewed the impacts of the February 2001 Nisqually earthquake near Olympia, Washington, a state with similar seismic design codes as California. No hazardous materials storage tanks failed as a result of that earthquake. Staff has also reviewed the impacts of the recent earthquakes in Haiti (January 12, 2010; magnitude 7.0) and Chili (February 27, 2010; magnitude 8.8). The building standards in Haiti are extremely lax while those in Chile are as stringent and modern as California seismic building codes. Yet, the preliminary reports show a lack of impact on hazardous materials storage and pipelines infrastructure in both countries. For Haiti, this most likely reflects a lack of industrial storage tanks and gas pipelines; for Chili, this most likely reflects the use of strong safety codes.

Staff also conducted an analysis of the codes and standards which should be followed when designing and building storage tanks and containment areas to withstand a large earthquake. Staff notes that the previously approved project (PSPP) would have been designed and constructed to the standards of the 2010 California Building Code for Seismic Risk Zone 4 (Solar Millennium 2009a, Section 5.6.3.3) and the modified project (PSEGS) will also meet these seismic design criteria.

Therefore, on the basis of what occurred in Northridge (with older tanks) and the lack of failures during the Nisqually earthquake (with newer tanks) and in the 2010 Chilean earthquake (with rigorous seismic building codes), and given that the construction of PSEGS would comply with stringent California Building Codes, staff determines that tank failures during seismic events are not probable and do not represent a significant risk to the public.

SITE SECURITY

The North American Electric Reliability Corporation (NERC) published *Security Guidelines for the Electricity Sector* in 2002 (NERC 2002) as well as issued a Critical Infrastructure Protection standard for cyber security (NERC 2009), and the U.S. Department of Energy published a draft *Vulnerability Assessment Methodology for Electric Power Infrastructure* in 2002 (DOE 2002). The energy generation sector is one of 14 areas of critical Infrastructure listed by the U.S. Department of Homeland Security (DHS). On April 9, 2007, the U.S Department of Homeland Security published, in the Federal Register (6 CFR Part 27), an Interim Final Rule (Chemical Facility Anti-Terrorism Standards or CFATS) requiring facilities that use or store certain hazardous materials to conduct vulnerability assessments and implement certain specified security measures. This rule was implemented with the publication of Appendix A, the list of chemicals on November 2, 2007, and the PSEGS is not proposing to use any material on the list in an amount which would trigger the need for compliance with the CFATS regulation.

However, even though the CFATS regulation does not apply, staff believes that all power plants under the jurisdiction of the California Energy Commission should implement a minimum level of security consistent with the guidelines listed here.

In order to ensure that this facility (or a shipment of hazardous material) is not the target of unauthorized access, staff's existing Condition of Certification **HAZ-5** and revised Condition of Certification **HAZ-6** address both construction security and operations security plans. These plans would require the implementation of site security measures that are consistent with both the above-referenced documents and California Energy Commission guidelines.

The goal of these conditions of certification is to provide the minimum level of security for power plants needed to protect California's electrical infrastructure from malicious mischief, vandalism, or domestic/foreign terrorist attacks. The level of security needed for this power plant is dependent upon the threat imposed, the likelihood of an adversarial attack, the likelihood of success in causing a catastrophic event, and the severity of consequences of that event.

In order to determine the level of security, staff used an internal vulnerability assessment decision matrix modeled after the U.S. Department of Justice Chemical Vulnerability Assessment Methodology (July 2002), the NERC 2002 guidelines, the U.S. Department of Energy VAM-CF model, and U.S. Department of Homeland Security regulations published in the Federal Register (Interim Final Rule 6 CFR Part 27). Staff concluded that the PSEGS would fall into the "low vulnerability" category, so staff proposes that certain security measures be implemented but does not propose that the project owner conduct its own vulnerability assessment.

These security measures include perimeter fencing and/or breach detectors, possibly guards, alarms, site access procedures for employees and vendors, site personnel background checks, and law enforcement contact in the event of a security breach. The requirement for the standard security measure of topping the 8-foot high perimeter fence with barbed wire has been removed at the request of the applicant and Energy Commission staff biologists in order to reduce the risk to birds in the area flying into the barbed wire or kit foxes climbing the fences. The project owner would have three choices to implement additional perimeter security:

1. on-site breach detectors to be located inside the perimeter;

2. CCTV capable of viewing the entire length of the perimeter fence; and

3. Routine and random guard patrols on a road inside and along the perimeter fence.

Site access for vendors would be strictly controlled. Consistent with current state and federal regulations governing the transport of hazardous materials, hazardous materials vendors would have to maintain their transport vehicle fleets and employ only drivers who are properly licensed and trained. The project owner would be required, through its contractual language with vendors, to ensure that vendors, if required by law, supplying hazardous materials strictly adhere to the U.S. Department of Transportation requirements that hazardous materials vendors prepare and implement security plans per 49 CFR 172.802 and ensure that all hazardous materials drivers are in compliance with personnel background security checks per 49 CFR Part 1572, Subparts A and B. The compliance project manager (CPM) may authorize modifications to these measures, or may require additional measures in response to additional guidance provided by the U.S. Department of Homeland Security, the U.S. Department of Energy, or NERC, after consultation with appropriate law enforcement agencies and the project owner.

NON-OPERATION AND FACILITY CLOSURE IMPACTS AND MITIGATION

Closure of the proposed PSEGS (temporary or permanent) would follow a facility closure plan approved for the original PSPP project. The facility closure plan is designed to minimize public health and environmental impacts. Non-operation and facility closure procedures would be consistent with all applicable LORS and would include monitoring of hazardous materials storage vessels, safe cessation of processes which use hazardous materials, disposal of hazardous materials and hazardous wastes, and documentation of practices and inventory (Solar Millennium 2009a, Section 5.6.3.4). Staff expects that impacts from non-operation and facility closure process would represent a fraction of the impacts associated with the construction or operation of the proposed PSEGS. Therefore, based on staff's analysis for the construction and operation phases of this project, staff concludes that hazardous materials-related impacts from non-operations and facility closure would be insignificant.

RED BLUFF SUBSTATION

Environmental Setting

The SCE Red Bluff Substation, expected to be completed in December 2013, is located in eastern Riverside County, California on undeveloped BLM desert, adjacent to the existing DPV1 500 kV transmission line and the proposed DPV 2 500 kV transmission line. Expansive, primarily undeveloped desert and mountainous areas characterize this portion of the Colorado Desert. Interstate 10 and SR 177 (Rice Road) are the primary highways providing vehicular access throughout this region.

A number of hazardous chemicals are being used during construction of the SCE Red Bluff Substation in small quantities. The existing safeguards and measures imposed on construction greatly reduce the opportunity for, or the extent of, exposure to hazardous materials or other hazards. To date, no incidents of releases have been reported.

Exposed Populations and Sensitive Receptors

The general population in the area of the Red Bluff Substation includes many sensitive subgroups that may be at a greater health risk from exposure to emitted pollutants. These sensitive subgroups include the very young, the elderly, and those with existing illnesses. In addition, the location of the population in the area surrounding a project site may have a large bearing on health risk. There are no sensitive receptors within 1,000 feet of the SCE Red Bluff Substation site. The nearest residences are located north of the I-10.

Environmental Impacts

A hazardous material is generally described as any substance or mixture of substances that have properties that are capable of having an adverse effect on human health and the environment. Hazardous materials handling is regulated at the federal, state, and local level. Regulations cover the transportation, labeling, handling, storage, disposal, and accidental releases of hazardous materials. Included within these regulations are reporting requirements for hazardous materials storage and usage, worker exposure protection, and reporting and spill response requirements. Hazardous material handling also covers response to incidental discovery of buried or unknown hazardous materials present in the subsurface environment.

Construction activities for the Red Bluff Substation include the handling and use of hazardous materials associated with general construction activities, such as heavy equipment operations. Hazardous materials including fuels, oils, and other vehicle and equipment maintenance fluids may be used during the on-going construction phase of the project and are stored at the project substation sites and construction staging areas. Improperly maintained vehicles and equipment could leak fluids during the on-going construction activities and while parked. There is a potential for incidents involving release of gasoline, diesel fuel, oil, hydraulic fluid, and/or lubricants from vehicles or other equipment at the staging areas and/or the project sites. Spills and leaks of hazardous materials during construction activities could potentially result in soil or groundwater contamination and improper handling of hazardous materials could expose project workers or the nearby public to hazards. To date, no reported leaks or spills occurred.

Conclusion

Implementing mitigation measures avoided potential significant hazard impacts from work associated with the SCE Red Bluff Substation.

CUMULATIVE IMPACT ANALYSIS

The **Executive Summary** provides detailed information on the potential cumulative solar and other development projects in the project area. Together, these projects comprise the cumulative scenario which forms the basis of the cumulative impact analysis for the proposed modified project. In summary, these projects are placed into three categories:

- Existing energy projects on BLM, State, and private lands: Four projects are identified in the **Executive Summary Attachment A – Table 1**.
- Foreseeable future energy projects in the immediate area and in the desert region: Thirty-eight foreseeable projects are identified in the **Executive Summary Attachment A – Table 2**.
- Existing and foreseeable non-energy projects on BLM, State, and private lands **Executive Summary Attachment A – Tables 1 and 2**: One hundred and nine projects are identified in the **EXECUTIVE SUMMARY**.

All of the above projects are defined within a geographic area that has been identified by the Energy Commission as covering an area large enough to provide a reasonable basis for evaluating cumulative impacts for all resource elements or environmental parameters. Most of these projects have, are, or will be required to undergo their own independent environmental review under the California Environmental Quality Act (CEQA). Even if the cumulative projects described in the **EXECUTIVE SUMMARY** have not yet completed the required environmental processes, they were considered in the cumulative impacts analyses in this section.

EFFECTS OF PAST AND PRESENT PROJECTS

For this analysis, staff notes that many – if not all - of these projects or developments in the area or region have, or will use, store, and/or transport, small quantities of hazardous materials. However, for the reasons stated below, staff has found that when combined with the proposed PSEGS, none would have a cumulative impact on the region. The use of hazardous materials in large quantities is neither frequent nor concentrated in this area and the distances between the projects are very great. Operating, under construction, or proposed power plants in the region that store, use, and/or transport hazardous materials in the area have had any direct hazardous materials management impacts mitigated to a level of less than significance.

Staff has analyzed the potential for hazardous materials cumulative impacts at many other power plant projects located in California and in the region of the proposed PSEGS. A significant cumulative hazardous materials impact is defined as the simultaneous uncontrolled release of hazardous materials from multiple locations in a form (gas or liquid) that could cause a significant impact where the release of one hazardous material alone would not cause a significant impact. Existing locations that use or store gaseous or liquid hazardous materials, or locations where such facilities might likely be built, were both considered. Staff believes that while cumulative impacts are theoretically possible, they are not probable because of the many safeguards implemented to both prevent and control an uncontrolled release. The chances of one uncontrolled release occurring are remote. The chance of two or more occurring simultaneously, with resulting airborne plumes mingling to create a significant impact, are even more remote. Staff believes the risk to the public is insignificant.

The project owner will develop and implement a hazardous materials handling program for the PSEGS independent of any other projects considered for potential cumulative impacts. Staff believes that the facility, as proposed by the project owner and with the additional mitigation measures proposed by staff, poses a minimal risk of accidental release that could result in off-site impacts. It is unlikely that an accidental release that has very low probability of occurrence (about one in one million per year) would independently occur at this site and another facility at the same time. Therefore, staff concludes that the facility would not contribute to a significant hazardous materials-related cumulative impact.

Contribution of the Palen Solar Electric Generating System to Cumulative Impacts

Construction: The construction of PSEGS is not expected to result in short term adverse impacts related to hazardous materials use during construction activities. It is expected that some of the cumulative projects described above which are not yet built may be under construction the same time as the PSEGS, however, short term impacts related to Hazardous Materials Management during construction of those cumulative projects are not expected to occur.

Operation: The operation of the PSEGS is not expected to result in long term adverse impacts during operation of the project related to Hazardous Materials Management even though it is expected that some of the cumulative projects described above may be operational at the same time as the PSEGS.

Facility Closure: Closing the PSEGS facility is not expected to result in adverse impacts related to Hazardous Materials Management similar to construction impacts. It is unlikely that the construction or facility closure of any of the cumulative projects would occur concurrently with the facility closure of this project, because the facility closure is not expected to occur for approximately 40 years. As a result, it is not expected that significant impacts related to Hazardous Materials Management during closure of the PSEGS generated by the cumulative projects will occur.

OVERALL CONCLUSIONS

The potential for off-site impacts resulting from hazardous materials use at the PSEGS is less than significant due to the nature of the materials used and the engineering and administrative controls that would be implemented to prevent and control accidental releases of hazardous materials. Because of this determination, and the additional fact that there are no existing or future foreseeable facilities in the immediate proximity (less than 1 mile) using large amounts of hazardous chemicals, there is little (if any) possibility that vapor plumes would mingle (combine) to produce an airborne concentration that would present a significant risk should an accidental release occur.

COMPLIANCE WITH LORS

Staff concludes that construction and operation of the PSEGS project would be in compliance with all applicable laws, ordinances, regulations, and standards (LORS) regarding long-term and short-term project impacts in the area of hazardous materials management.

NOTEWORTHY PUBLIC BENEFITS

The construction and operation of a solar power plant such as the proposed PSEGS, requires, in general, smaller quantities of hazardous materials and materials that are less dangerous to the public than a natural-gas fired power plant. Building solar power plants to supply the required energy in California therefore benefits the public by reducing the risks otherwise associated with the use and transport of very large quantities of aqueous ammonia or more hazardous materials such as anhydrous ammonia. Furthermore, the proposed modified project would use less hazardous materials than the approved project in that solar tower technology avoids the use of extremely large amounts of heat transfer fluid and two very large propane storage tanks, thus eliminating risks to the public posed by the potential for fire and explosion.

RESPONSE TO COMMENTS

PSA WORKSHOP, JULY 17, 2013:

Comment: At the PSA workshop on July 17, 2013, a comment made on Hazardous Materials Management by Deputy Chief Cooley of the Riverside County Fire Department. Chief Cooley supported staff's proposal to prohibit gas blows and require adherence to NFPA 56. This comment was reiterated in writing when the County of Riverside provided comments on Worker Safety/Fire Protection (CR 2013c).

Response: Staff agrees and has proposed a revision to new Condition of Certification **HAZ-4**.

Comment: A second comment was made by the County (CR 2013c) regarding a request that Condition of Certification **HAZ-2** be revised to make clear that the project owner is to not only provide the Hazardous Materials Business Plan and Spill Prevention, Control, and Countermeasure Plan to Riverside County Department of Environmental Health and to the Riverside County Fire Department, but that the project owner shall also pay the usual and customary fee for review of those plans, and the usual and customary fee for any necessary and required inspections regarding same.

Response: Staff agrees and has proposed that these requirements be included in Condition of Certification **HAZ-2**.

GALATI BLEK LLP, MARIE FLEMING/PALEN SOLAR HOLDINGS LLC, FINAL COMMENTS ON THE PSA, TN # 200077, JULY 29, 2013:

HAZ-2: PSH proposed modifications to this condition to ensure that recommendations from Riverside County are only incorporated into the plans if they are required by LORS in order to avoid disputes over the content of plans that are within the ultimate jurisdiction of the CPM.

Response: Staff concurs and has proposed a modification of Condition of Certification **HAZ-2**.

HAZ-4: Staff explained at the Workshops that it would be modifying Condition of Certification **HAZ-4** to reference compliance with NFPA 56 relating to the cleaning of the gas pipeline. PSH does not object to complying with NFPA 56.

Response: Staff appreciates the petitioner's support.

HAZ-6: PSH proposed two modifications. The first is to remove the requirement for barbed wire fencing in order to avoid take of migratory birds. At the Workshops, Staff agreed to this modification but will propose additional security measures to replace the barbed wire, and will include these options in the FSA. The second modification proposed by PSH was to remove the requirement for 100 percent camera coverage around the perimeter fence as the project will not have a fence around the power block. Staff stated that the additional security measures discussed above will also address the security camera coverage.

Response: Staff has removed the requirement that security fencing be topped with barbed wire in Condition of Certification **HAZ-6** and has proposed different options for the project owner to implement for enhanced perimeter security. Staff has also revised the wording of **HAZ-6** to reflect the other revisions requested by the petitioner.

CONCLUSIONS

Staff's evaluation of the proposed modified project (with proposed additions and revisions to the mitigation measures) indicates that hazardous material use, storage, and transportation would not pose a significant impact on the public. Staff's analysis also shows that there would be no significant cumulative impact. With adoption of the proposed Hazard Materials Management Conditions of Certification, the PSEGS would comply with all applicable LORS. Other proposed Conditions of Certification address the issues of site security matters.

Staff recommends that the Energy Commission impose the proposed Hazard Materials Management Conditions of Certification to ensure that the PSEGS is designed, constructed, and operated in compliance with applicable LORS, and would protect the public from significant risk of exposure to an accidental release of hazardous materials. If all mitigation proposed by the project owner and by staff are implemented, the use, storage, and transportation of hazardous materials would pose a less than significant risk to the public.

Staff concludes that there is insignificant potential for hazardous materials release to have an impact beyond the facility boundary, and therefore concludes there is also insignificant potential for significant impacts to the environment. For any other potential impacts upon the environment, including vegetation, wildlife, air, soils, and water resulting from hazardous materials usage and disposal at the proposed facility, the reader is referred to the **BIOLOGY**, the **AIR QUALITY**, the **SOIL AND WATER**, and the **WASTE MANAGEMENT** sections of this FSA.

Staff proposes six Hazard Materials Management Conditions of Certification. Existing Condition of Certification **HAZ-1** ensures that no hazardous material would be used at the facility except as listed in **APPENDIX A** of this section, unless there is prior approval by the Energy Commission Compliance Project Manager. Revised Condition of Certification **HAZ-2** ensures that local emergency response services are notified of the amounts and locations of hazardous materials at the facility and safety plans. Existing Condition of Certification **HAZ-3** requires the development of a Safety Management Plan that addresses the delivery of all liquid hazardous materials during the construction, commissioning, and operation of the project would further reduce the risk of any accidental release not specifically addressed by the proposed spill prevention mitigation measures, and further prevent the mixing of incompatible materials that could result in the generation of toxic vapors. Revised new Condition of Certification **HAZ-4** addresses the use of natural gas and prohibits its use to clear pipes. Site security during both the construction and operation phases is addressed in existing Condition of Certification **HAZ-5** and revised Condition of Certification **HAZ-6.**

PROPOSED CONDITIONS OF CERTIFICATION

Staff has proposed modifications to the **Hazardous Materials Management** Conditions of Certification as shown below. (**Note:** Deleted text is in ~~strikethrough~~; new text is **<u>bold and underlined</u>**)

HAZ-1 The project owner shall not use any hazardous material not listed in **Appendix ~~A~~<u>B</u>**, below, or in greater quantities or strengths than those identified by chemical name in **Appendix ~~A~~<u>B</u>**, below, unless approved in advance by the Compliance Project Manager (CPM).

<u>Verification:</u> The project owner shall provide to the CPM, in the Annual Compliance Report, a list of hazardous materials contained at the facility.

HAZ-2 The project owner shall concurrently provide a Hazardous Materials Business Plan (HMBP)~~,~~ and **<u>a</u>** Spill Prevention, Control, and Countermeasure Plan (SPCC), ~~and a Process Safety Management Plan (PSMP)~~ to the Riverside County Department of Environmental Health (RCDEH), the Riverside County Fire Department (RCFD), and the CPM for review. After receiving comments from the RCDEH, RCFD, and the CPM, the project owner shall ~~reflect~~ <u>include in the final documents</u> all recommendations that ensure LORS compliance ~~in the final documents~~. Copies of the final HMBP~~,~~ **<u>and</u>** SPCC Plan~~, and PSMP~~ shall then be provided to the RCDEH and RCFD for information and to the CPM for approval. **<u>The project owner shall also pay the usual and customary fee for RCDEH and RCFD review of those plans, and the</u>**

<u>usual and customary fee for any necessary and required inspections regarding same.</u>

<u>Verification:</u> At least 30 days prior to receiving any hazardous material on the site for commissioning or operations, the project owner shall provide a copy of a final Hazardous Materials Business Plan, Spill Prevention, Control, and Countermeasures Plan, ~~and the Process Safety Management Plan~~ to the CPM for approval.

<u>The project owner shall also provide proof that the plans were submitted to the RCDEH and RCFD for review and that the usual and customary fees for those reviews have been paid.</u>

<u>The project owner shall also provide proof in the Annual compliance Report that the usual and customary fee for any necessary and required inspections by the RCEHD and the RCFD have been paid.</u>

HAZ-3 The project owner shall develop and implement a Safety Management Plan for the delivery and handling of liquid and gaseous hazardous materials. The plan shall include procedures, protective equipment requirements, training, and a checklist. It shall also include a section describing all measures to be implemented to prevent mixing of incompatible hazardous materials. This plan shall be applicable during construction, commissioning, and operation of the power plant.

<u>Verification:</u> At least 30 days prior to the delivery of any liquid or gaseous hazardous material to the facility, the project owner shall provide a Safety Management Plan as described above to the CPM for review and approval.

~~**HAZ-4** The project owner shall place an adequate number of isolation valves in the Heat Transfer Fluid (HTF) pipe loops so as to be able to isolate a solar panel loop in the event of a leak of fluid such that the volume of a total loss of HTF from that isolated loop will not exceed 1,250 gallons. These valves shall be actuated manually, remotely, or automatically. The engineering design drawings showing the number, location, and type of isolation valves shall be provided to the CPM for review and approval prior to the commencement of the solar array piping construction.~~

~~**Verification:** At least 30 days prior to the commencement of solar array piping construction, the project owner shall provide the design drawings as described above to the CPM for review and approval.~~

<u>HAZ-4: The project owner shall not allow any fuel gas pipe cleaning activities on-site, either before placing the pipe into service or at any time during the lifetime of the facility, that involves "flammable gas blows" where natural (or flammable) gas is used to blow out debris from piping and then vented to atmosphere. Instead, an inherently safer method involving a non-flammable gas (e.g. air, nitrogen, steam) or mechanical pigging shall be used as per NFPA 56. A written procedure shall be developed and implemented as per NFPA 56, section 4.3.1</u>

Verification: At least 30 days before any fuel gas pipe cleaning activities begin, the project owner shall submit a copy of the Fuel Gas Pipe Cleaning Work Plan (as described in NFPA 56, section 4.3.1) which shall indicate the method of cleaning to be used, what gas will be used, the source of pressurization, and whether a mechanical PIG will be used, to the CBO for information and to the CPM for review and approval.

HAZ-5 Prior to commencing construction, a site-specific Construction Site Security Plan for the construction phase shall be prepared and made available to the CPM for review and approval. The Construction Security Plan shall include the following:

1. perimeter security consisting of fencing enclosing the construction area;
2. security guards;
3. site access control consisting of a check-in procedure or tag system for construction personnel and visitors;
4. written standard procedures for employees, contractors and vendors when encountering suspicious objects or packages on-site or off-site;
5. protocol for contacting law enforcement and the CPM in the event of suspicious activity or emergency; and
6. evacuation procedures.

Verification: At least 30 days prior to commencing construction, the project owner shall notify the CPM that a site-specific Construction Security Plan is available for review and approval.

HAZ-6 The project owner shall also prepare a site-specific **Operations** security plan for the ~~commissioning and~~ operational phase~~s~~ that ~~will~~**shall** be **made** available to the CPM for review and approval. The project owner shall implement site security measures that address physical site security and hazardous materials storage. The level of security to be implemented shall not be less than that described below (as per NERC 2002).

The Operation Security Plan shall include the following:

1. permanent full perimeter fence or wall, at least eight feet high; ~~and topped with barbed wire or the equivalent;~~
2. main entrance security gate, either hand operated or motorized;
3. evacuation procedures;
4. protocol for contacting law enforcement and the CPM in the event of suspicious activity or emergency;
5. written standard procedures for employees, contractors, and vendors when encountering suspicious objects or packages on-site or off-site;

6.

   A. a statement (refer to sample, **ATTACHMENT A**), signed by the project owner certifying that background investigations have been conducted on all project personnel. Background investigations shall be restricted to determine the accuracy of employee identity and employment history and shall be conducted in accordance with state and federal laws regarding security and privacy;

   ~~1.~~ B. a statement(s) (refer to sample, **ATTACHMENT B**), signed by the contractor or authorized representative(s) for any permanent contractors or other technical contractors (as determined by the CPM after consultation with the project owner), that are present at any time on the site to repair, maintain, investigate, or conduct any other technical duties involving critical components (as determined by the CPM after consultation with the project owner) certifying that background investigations have been conducted on contractors who visit the project site. **Background investigations shall be restricted to determine the accuracy of employee identity and employment history and shall be conducted in accordance with state and federal laws regarding security and privacy.**;

7. site access controls for employees, contractors, vendors, and visitors;

8. a statement(s), **if required,** (refer to sample, **ATTACHMENT C**), signed by the owners or authorized representative of ~~propane~~ **hazardous materials** transport vendors, certifying that they have prepared and implemented security plans in compliance with 49 CFR 172.802, and that they have conducted employee background investigations in accordance with 49 CFR Part 1572, subparts A and B;

9. closed circuit TV (CCTV) monitoring system, recordable, and viewable in the power plant control room and security station (if separate from the control room) with cameras able to pan, tilt, and zoom, have low-light capability, and are able to view the outside entrance to the control room, ~~the propane/LPG tank,~~ ~~and~~ the front gate, and key areas of the power block areas; and

10. additional measures to ensure adequate perimeter security consisting of either:

    A. security guard(s) present 24 hours per day, 7 days per week and conducting both routine and random patrols; **or**

    B. perimeter breach detectors; ~~power plant personnel on-site 24 hours per day, 7 days per week~~; or

    C. CCTV able to view 100% of the perimeter fence.

~~perimeter breach detectors the CCTV able to view 100% of the entrance gates and the power block areas.~~

The project owner shall fully implement the security plans and obtain CPM approval of any substantive modifications to those security plans. The CPM may authorize modifications to these measures, or may require additional measures, **<u>such as protective barriers for critical power plant components (e.g. transformers, gas lines, compressors, etc.)</u>** or cyber security depending upon circumstances unique to the facility or in response to industry-related standards, security concerns, or additional guidance provided by the U.S. Department of Homeland Security, the U.S. Department of Energy, or the North American Electrical Reliability Council, after consultation with both appropriate law enforcement agencies and the project owner.

<u>Verification:</u> At least 30 days prior to the initial receipt of ~~HTF or propane/LPG~~ **<u>hazardous materials</u>** on-site **<u>for commissioning or operations</u>**, the project owner shall notify the CPM that a site-specific Operations Site Security Plan is available for review and approval. In the annual compliance report, the project owner shall include a statement that all current project employee and appropriate contractor background investigations have been performed, and that updated certification statements have been appended to the operations security plan. In the annual compliance report, the project owner shall include a statement that the operations security plan includes all current hazardous materials transport vendor certifications for security plans and employee background investigations.

SAMPLE CERTIFICATION (Attachment A)

Affidavit of Compliance for Project Owners

I,

____

(Name of person signing affidavit)(Title)

do hereby certify that background investigations to ascertain the accuracy of the identity and employment history of all employees of

____

(Company name)

for employment at

____

(Project name and location)

have been conducted as required by the California Energy Commission Decision for the above-named project.

____

(Signature of officer or agent)

Dated this ____________________ day of ____________________, 20 _______.

THIS AFFIDAVIT OF COMPLIANCE SHALL BE APPENDED TO THE PROJECT SECURITY PLAN AND SHALL BE RETAINED AT ALL TIMES AT THE PROJECT SITE FOR REVIEW BY THE CALIFORNIA ENERGY COMMISSION COMPLIANCE PROJECT MANAGER.

SAMPLE CERTIFICATION (Attachment B)

Affidavit of Compliance for Contractors

I,

____

(Name of person signing affidavit)(Title)

do hereby certify that background investigations to ascertain the accuracy of the identity and employment history of all employees of

____

(Company name)

for contract work at

____

(Project name and location)

have been conducted as required by the California Energy Commission Decision for the above-named project.

____

(Signature of officer or agent)

Dated this ____________________ day of ____________________, 20 _______.

THIS AFFIDAVIT OF COMPLIANCE SHALL BE APPENDED TO THE PROJECT SECURITY PLAN AND SHALL BE RETAINED AT ALL TIMES AT THE PROJECT SITE FOR REVIEW BY THE CALIFORNIA ENERGY COMMISSION COMPLIANCE PROJECT MANAGER.

SAMPLE CERTIFICATION (Attachment C)

Affidavit of Compliance for Hazardous Materials Transport Vendors

I,

____

(Name of person signing affidavit)(Title)

do hereby certify that the below-named company has prepared and implemented security plans in conformity with 49 CFR 172.802 and has conducted employee background investigations in conformity with 49 CFR 172, subparts A and B,

____

(Company name)

for hazardous materials delivery to

____

(Project name and location)

as required by the California Energy Commission Decision for the above-named project.

____

(Signature of officer or agent)

Dated this ____________________ day of ____________________, 20 ________.

THIS AFFIDAVIT OF COMPLIANCE SHALL BE APPENDED TO THE PROJECT SECURITY PLAN AND SHALL BE RETAINED AT ALL TIMES AT THE PROJECT SITE FOR REVIEW BY THE CALIFORNIA ENERGY COMMISSION COMPLIANCE PROJECT MANAGER.

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Palen 2013e– Palen Solar/Galati Blek LLP, Marie Fleming (TN 69931). Palen Solar's Relocated Natural Gas Pipeline Drawing. Submitted to CEC/Docket Unit on March 15, 2013

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HAZARDOUS MATERIALS Appendix A Table-1
Acute Ammonia Exposure Guidelines

Guideline	Responsible Authority	Applicable Exposed Group	Allowable Exposure Level	Allowable* Duration of Exposures	Potential Toxicity at Guideline Level/Intended Purpose of Guideline
IDLH[2]	NIOSH	Workplace standard used to identify appropriate respiratory protection.	300 ppm	30 minutes	Exposure above this level requires the use of "highly reliable" respiratory protection and poses the risk of death, serious irreversible injury, or impairment of the ability to escape.
IDLH/10[1]	EPA, NIOSH	Work place standard adjusted for general population factor of 10 for variation in sensitivity	30 ppm	30 minutes	Protects nearly all segments of general population from irreversible effects.
STEL[2]	NIOSH	Adult healthy male workers	35 ppm	15 minutes, 4 times per 8-hour day	No toxicity, including avoidance of irritation.
EEGL[3]	NRC	Adult healthy workers, military personnel	100 ppm	Generally less than 60 minutes	Significant irritation, but no impact on personnel in performance of emergency work; no irreversible health effects in healthy adults. Emergency conditions one-time exposure.
STPEL[4]	NRC	Most members of general population	50 ppm 75 ppm 100 ppm	60 minutes 30 minutes 10 minutes	Significant irritation, but protects nearly all segments of general population from irreversible acute or late effects. One-time accidental exposure.
TWA[2]	NIOSH	Adult healthy male workers	25 ppm	8 hours	No toxicity or irritation on continuous exposure for repeated 8-hour work shifts.
ERPG-2[5]	AIHA	Applicable only to emergency response planning for the general population (evacuation) (not intended as exposure criteria) (see preface attached)	200 ppm	60 minutes	Exposures above this level entail** unacceptable risk of irreversible effects in healthy adult members of the general population (no safety margin).

1) (EPA 1987) 2) (NIOSH 1994) 3) (NRC 1985) 4) (NRC 1972) 5) (AIHA 1989)

* The (NRC 1979), (WHO 1986), and (Henderson and Haggard 1943) all conclude that available data confirm the direct relationship to increases in effect with both increased exposure and increased exposure duration.

** The (NRC 1979) describes a study involving young animals, which suggests greater sensitivity to acute exposure in young animals. The WHO (1986) warned that the young, elderly, asthmatics, those with bronchitis, and those that exercise should also be considered at increased risk based on their demonstrated greater susceptibility to other non-specific irritants.

REFERENCES FOR HAZARDOUS MATERIALS APPENDIX A, TABLE 1

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ABBREVIATIONS FOR HAZARDOUS MATERIALS APPENDIX A, TABLE 1

ACGIH, American Conference of Governmental and Industrial Hygienists

AIHA, American Industrial Hygienists Association

EEGL, Emergency Exposure Guidance Level

EPA, Environmental Protection Agency

ERPG, Emergency Response Planning Guidelines

IDLH, Immediately Dangerous to Life and Health Level

NIOSH, National Institute of Occupational Safety and Health

NRC, National Research Council

STEL, Short Term Exposure Limit

STPEL, Short Term Public Emergency Limit

TLV, Threshold Limit Value

WHO, World Health Organization

HAZARDOUS MATERIALS
APPENDIX B

Hazardous Materials Proposed for Use at the PSEGS

(Total Amounts to be Located on the Entire Site)

Hazardous Materials Management
Appendix B
Hazardous Materials at the PSEGS
(Based on Title 22 Hazard Characterization)

Material	Hazard Characteristics	Purpose	Storage Location	Maximum Stored	Storage Type
Nalco Elimin-OX (Oxygen scavenger)	Ignitability	Oxygen scavenger for boiler chemistry	Power Block: Containers near power tower	1,600 gal[1]	400 gallon totes
Aqueous Ammonia (19% concentration)	Reactivity, toxicity	pH control for boiler chemistry	Power Block: Containers near power tower	1,600 gal[1]	400 gallon totes
Sulfuric Acid 93% (66° Baumé)	Corrosivity, reactivity, toxicity	pH control	Power Block and Common Area: Containers located in Water Treatment Building	2,400 gal[1]	400 gallon totes
Sulfuric Acid (Batteries)	Corrosivity, reactivity, toxicity	Electrical power	Power Block: Contained within the main electrical room and the power tower Common Area: Contained within main electrical room	12,000 gal	Batteries
Sodium Hydroxide (50% concentration)	Corrosivity, reactivity, toxicity	pH control	Power Block and Common Area: Containers located in Water Treatment Building	2,400 gal[1]	400 gallon totes
Diesel Fuel (No. 2)	Ignitability	Emergency generator	Power Block: Near fire pump, beneath emergency diesel generator, and adjacent to the mirror wash machines water filling station Common Area: beneath emergency diesel generator and near fire pump	40,000 gal	Aboveground storage tanks and in equipment
Paint, solvents, adhesives, cleaners, sealants, lubricants	Toxicity	Equipment Maintenance,	Power Block: Maintenance Shop	500 gal	1 gal and 5 gal containers

Source: Palen 2012a, pages 4.3-2 through 4.3-5

Note 1: Assumes 2 totes at each power block

Hazardous Materials Usage and Storage During Operation Based on Material Properties					
Material	**Hazard Characteristics**	**Purpose**	**Storage Location**	**Maximum Stored**	**Storage Type**
Cleaning Chemicals and Detergents	Toxicity, irritant	Periodic cleaning of steam turbine	Power Block: Maintenance shop	3,000 gal	Misc. Manufacturer's containers
Nalco 5200M (Anti- scalant	Irritant, mildly toxic	Wastewater treatment anti-scalant	Power Block: Containers near WWTS Common Area: Containers in Water Treatment Building (storage)	1,500 gal	300 gal totes
Nalco 3DT-187 (Corrosion Inhibitor)	Irritant, mildly toxic	Wet-Surface Air Cooler (WSAC) Corrosion inhibitor	Power Block: Containers near WSAC Common Area: Containers in Water Treatment Building (storage)	2,100 gal	300 gallon totes
Nalco 73801WR (Dispersant)	Irritant, mildly toxic	WSAC Dispersant	Power Block: Containers near WSAC Common Area: Containers in Water Treatment Building (storage)	2,100 gal	300 gallon tote
Nalco TRAC107 (Corrosion Inhibitor)	Irritant, mildly toxic	Closed cooling water Corrosion Inhibitor	Power Block: Contained within CCW system Common Area: Containers in water treatment building (storage)	500 gal	55 drums
Avista Vitec (Scale Inhibitor)	Irritant, mildly toxic	Reverse osmosis scale inhibitor	Power Block and Common Area: Containers in Water Treatment Building	900 gal	300 gallon totes
Sodium Bisulfite	Irritant, mildly toxic	Dechlorination	Power Block and Common Area: Containers in Water Treatment Building	900 gal	300 gallon totes

Hazardous Materials Usage and Storage During Operation Based on Material Properties					
Material	**Hazard Characteristics**	**Purpose**	**Storage Location**	**Maximum Stored**	**Storage Type**
Nalco 7468 (Anti- foaming agent)	Irritant, mildly toxic	Wastewater treatment system anti-foaming agent	Power Block: Containers near WWTS Common Area: Containers in Water Treatment Building (storage)	1,500 gal	300 gallon totes

Hazardous Materials Usage and Storage During Operation Based on Material Properties					
Material	**Hazard Characteristics**	**Purpose**	**Storage Location**	**Maximum Stored**	**Storage Type**
Lubricating Oil	Mildly toxic	Miscellaneous equipment lubrication	Power Block: Contained within equipment, drums during replacement Common Area: Contained within equipment, spare capacity stored in Maintenance shop	30,000 gal	Contained within equipment and misc. drums during replacement
Mineral Transformer Insulating Oil	Mildly toxic	Provides overheating and insulation protection for transformers	Power Block: Contained within transformers Common Area: Contained within transformers	112,000 gal	Transformers
Hydraulic Oil	Mildly toxic	Miscellaneous equipment control oil	Power Block: Contained within equipment, drums during replacement Common Area: Contained within equipment, spare capacity stored in Warehouse	6,000 gal	Contained within equipment and misc. drums during replacement
Sodium Hypochlorite 12% (trade) solution	Irritant, Corrosivity, reactivity	Biocide	Power Block: Containers in water treatment building Common Area: Potable water treatment area	2,400 gal	300 gal totes

Source: Palen 2012a, pages 4.3-2 through 4.3-5

LAND USE

Testimony of James Adams

SUMMARY OF CONCLUSIONS

The proposed Palen Solar Electric Generating System (PSEGS) would be located on 3,794 acres of public land administered by the U.S. Bureau of Land Management (BLM), within the federal California Desert Conservation Area (CDCA) Plan area. The acreage for the PSEGS would be 572 acres less than the original footprint of the Palen Solar Power Project (PSPP or approved project). The project area is in the “Multiple-Use Class M” land use category. The Class M land use category may allow electrical generation plants in accordance with federal, state, and local laws subject to approval of a CDCA Plan amendment by the BLM.

The proposed power plant and overhead transmission line to serve the project require the BLM’s approval of a right-of-way (ROW) grant and two CDCA Plan amendments; one amendment for the solar facility and one to allow the project’s electric transmission line to be constructed outside a designated corridor. With the BLM’s approval of the ROW grant and plan amendments, the PSEGS and the portion of the transmission line outside of the designated corridor would be consistent with the CDCA Plan. The project owner filed a revised plan of development with the BLM on February 13, 2013. Staff proposes Conditions of Certification BIO-9 through BIO-11 to mitigate the loss of desert tortoise habitat and ensure that the PSEGS is compatible with the Northern and Eastern Colorado Desert Coordinated Management Plan (NECO) area.

Unlike the approved project, the PSEGS does not involve the use of private land. Therefore, land use related state and local laws, ordinances, regulations, and standards (LORS) identified for the PSPP are not applicable to the PSEGS, and only federal LORS would apply. As conditioned, the PSEGS would comply with applicable land use-related LORS.

Staff concludes the PSEGS would not disrupt or divide an established community, or convert farmland to non-agricultural use or forest land to non-forest use. The PSEGS is not within a habitat conservation plan approved by the U.S. Fish and Wildlife Service (USFWS), or a natural community conservation plan approved by the California Department of Fish and Wildlife. The PSEGS would either not contribute to cumulative impacts or its incremental impacts would be less than cumulatively considerable.

The Visual Resources staff concludes that the PSEGS would result in significant unmitigable direct and cumulative impacts to existing scenic resource values as seen from several viewing areas in the project vicinity and Chuckwalla Valley area (approximately 30 mile radius from the PSEGS), including: Interstate 10 (I-10), State Route 177 (SR-177), Corn Springs Road, Joshua Tree National Park, Palen McCoy Wilderness, and Chuckwalla Mountains Wilderness. Staff concludes the PSEGS would create a land use incompatibility because of significant and unavoidable visual impacts to recreational users of park and wilderness areas.

According to 2010 census data, there are no occupied residences and no minority or below poverty level populations' living within the six-mile buffer of the PSEGS site. Therefore there is no environmental justice population as defined by *Environmental Justice: Guidance Under the National Environmental Policy Act* that would trigger further scrutiny for purposes of an environmental justice analysis.

INTRODUCTION

In this section, staff discusses if the PSEGS would result in substantial adverse impacts under the California Environmental Quality Act, and if the project would be inconsistent with applicable laws, ordinances, regulations, and standards (LORS) pertaining to land use, agriculture, and forest resources.

LAWS, ORDINANCES, REGULATIONS, AND STANDARDS (LORS)

Land Use Table 1 lists the land use LORS applicable to the proposed project. The proposed project's consistency with these LORS is analyzed under "Assessment of Impacts and Discussion of Mitigation" in **Land Use Table 2**. The same federal LORS applicable to the PSPP would be applicable to the PSEGS. Because the PSEGS does not involve the use of private land and would be located entirely on BLM land, the State Subdivision Map Act and Riverside County Land Use LORS are not applicable to the PSEGS Land Use Table 1

Land Use Table 1
Laws, Ordinances, Regulations and Standards (LORS)

Applicable LORS	Description
Federal	
Federal Land Policy and Management Act (FLPMA), 1976 – 43 CFR 1600, Sec. 501. [43 U.S.C. 1761]	Establishes public land policy; guidelines for administration; and provides for the management, protection, development, and enhancement of public lands. In particular, the FLPMA's relevance to the proposed project is that Title V; Section 501 establishes BLM's authority to grant rights-of-way for generation, transmission, and distribution of electrical energy (FLPMA 2001).
Bureau of Land Management -California Desert Conservation Area (CDCA) Plan, 1980 as Amended (BLM 1980)	The 25 million-acre CDCA contains over 12 million acres of public lands spread within the area known as the California Desert, which includes the following three deserts: the Mojave, the Sonoran, and a small portion of the Great Basin. The 12 million acres of public lands administered by the BLM are half of the CDCA. The CDCA Plan is a comprehensive, long-range plan with goals and specific actions for the management, use, development, and protection of the resources and public lands within the CDCA, and it is based on the concepts of multiple use, sustained yield, and maintenance of environmental quality. The plan's goals and actions for each resource are established in its 12 elements. Each of the plan elements provides both a desert-wide perspective of the planning decisions for one major resource or issue of public concern as well as more specific interpretation of multiple-use class guidelines for a given resource and its associated activities.
Northern and Eastern Colorado Desert (NEC0) Coordinated	The NECO plan is a landscape-scale planning effort for most of the California portion of the Sonoran Desert ecosystem. The planning area encompasses over five million acres. The NECO Plan amended the CDCA plan in 2002 The CDCA Plan/NECO is related to the BLM/U.S. Department of Energy

Applicable LORS	Description
Management Plan	(DOE).Final Programmatic Environmental Impact Statement for Solar Energy Development in Six Southwestern States, which was published in July 2012. It gives guidance as to how and where solar projects can be built on BLM lands.

PROPOSED MODIFIED PROJECT

The PSEGS proposal includes replacing the parabolic trough solar collection system with solar tower technology. Access to the site would use the same primary access road as the approved project. The project would continue to interconnect to the regional transmission grid at Southern California Edison's (SCE) Red Bluff Substation, which is currently under construction. The PSEGS would be comprised of two adjacent solar fields and associated facilities with a total combined nominal output of approximately 500 MW. Palen Solar Holdings (PSH) proposes to develop the PSEGS in two operational units, each consisting of one solar field, one tower, and a power block capable of producing approximately 250 MW of electricity.

SETTING

The PSEGS is to be constructed on a relatively flat, largely undeveloped portion of the Colorado Desert (a subdivision of the Sonoran Desert) in the Chuckwalla Valley between the Palen Mountains and U.S. Interstate 10 (I-10) (Corn Springs Road exit) in Riverside County, California.

The project site is dominated by sand, Sonoran creosote brush scrub, and has several desert dry wash and unvegetated ephemeral dry wash areas. High voltage electric transmission lines cross the area.

The project owner has requested a right of way grant on approximately 5,200 acres of land administered by the U.S. Bureau of Land Management (BLM). The construction and operation of the PSEGS would involve approximately 3,794 acres. As noted earlier, the BLM and the Department of Energy (DOE) published a Final Programmatic Environmental Impact Statement for Solar Energy Development in Six Southwestern States in July 2012. The small town of Desert Center is located at the far southwestern edge of the Riverside East Solar Energy Zone (SEZ), along Interstate (I-10), which runs east-west along the southern boundary of the Riverside East SEZ (USBLM/US DOE 2012). The PSEGS would be located within this SEZ.

ASSESSMENT OF IMPACTS AND DISCUSSION OF MITIGATION

Energy Commission staff has analyzed the information provided in the Application for Certification (AFC) and the Petition to Amend as well as information from other sources to determine consistency of the proposed PSEGS project with applicable land use LORS and the PSEGS potential to have significant adverse land use-related impacts.

METHODS AND THRESHOLDS FOR DETERMINING SIGNIFICANCE

Significance criteria used in this document are based on Appendix G of the CEQA Guidelines and performance standards or thresholds identified by Energy Commission staff, as well as applicable LORS utilized by other governmental regulatory agencies.

An impact may be considered significant if the proposed project results in:

- Conversion of Farmland or Forest Land;
  - Conversion of Prime Farmland, Unique Farmland, or Farmland of Statewide or Local Importance (Farmland) as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to non-agricultural use.[1]
  - Conflict with existing zoning for agricultural use, or a Williamson Act contract.
  - Conflict with existing zoning for, or cause rezoning of, forest land [as defined in Pub. Resources Code §12220 (g)), timberland (as defined by Pub. Resources Code §4526), or timberland zoned Timberland Production [as defined by Gov. Code §51104(g)].
  - The loss of forest land or conversion of forest land to non-forest use.
  - Other changes in the existing environment which, due to their location or nature, could result in conversion of Farmland to non-agricultural use[2] or conversion of forest land to non-forest use.
- physical disruption or division of an established community;
- conflict with any applicable habitat conservation plan, natural community conservation plan, or biological opinion;
- conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction, or that would normally have jurisdiction, over the project adopted for the purpose of avoiding or mitigating environmental effects. This includes, but is not limited to, a General Plan, redevelopment plan, or zoning ordinance; or
- incremental impacts that, although individually limited, are cumulatively considerable when viewed in connection with other project-related effects or the effects of past projects, other current projects, and probable future projects.[3]

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[1] FMMP defines "land committed to non-agricultural use" as land that is permanently committed by local elected officials to non-agricultural development by virtue of decisions which cannot be reversed simply by a majority vote of a city council or county board of supervisors.

[2] A non-agricultural use in this context refers to land where agriculture (the production of food and fiber) does not constitute a substantial commercial use.

[3] Cumulative impacts refer to two or more individual effects which, when considered together, are considerable or which compound or increase other environmental impacts. The individual effects may be changes resulting from a single project or a number of separate projects and can result from individually minor, but collectively significant actions taking place over a period of time (CEQA Guidelines §15355; 40 CFR 1508.7)

In general, a power plant and its related facilities may also be incompatible with existing or planned land uses, resulting in potentially significant impacts, if they create unmitigated noise, dust, or a public health or safety hazard or nuisance; result in adverse traffic or visual impacts; or preclude, interfere with, or unduly restrict existing or future uses.

DIRECT/INDIRECT IMPACTS AND MITIGATION

This section discusses the applicable potential project impacts and associated methods and thresholds of significance referenced above.

Agriculture and Forest

A. Would the project convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Farmland), as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to nonagricultural use?

The PSEGS would not convert farmland. The project site and vicinity are characterized largely as undeveloped desert. Figure 2.1-3 in the Petition to Amend shows adjacent parcels to the north and west of the project site that are being farmed (Palen 2102a). The PSEGS would not convert farmland and would not result in a significant adverse impact under this CEQA criterion.

The BLM's Master Title Plats[4] showing Township 5 South Range 17 East, and Township 6 South Range 17 East of the San Bernardino Meridian, California, which includes the project area, provide notations that the townships are not suitable for agriculture. However, more recent land use shows parcels are being farmed near the PSEGS site.

B. Would the project conflict with existing zoning for agricultural use, or a Williamson Act contract?

The PSEGS would not convert prime farmland, conflict with existing county zoning for agricultural use or a Williamson Act contract, or result in the conversion of farmland to a non-agricultural use. The PSEGS would not conflict with this CEQA criterion and would not result in a significant impact. The PSEGS would be constructed entirely on BLM land and county zoning would not apply. Also, there are no Williamson Act contracts on BLM lands.

[4] The BLM's Master Title Plats are the foundation of their land records. It is a drawing of the most recent survey or protraction (unsurveyed lands) by township. It is a graphic plat illustrating current federal ownership, agency jurisdiction, and rights reserved to the Federal government on private land within a township (USDOI2010).

C. Would the project conflict with existing zoning for, or cause rezoning of, forest land [as defined in Public Resources Code section 12220(g)], timberland (as defined by Public Resources Code section 4526), or timberland zoned Timberland Production [as defined by Government Code section 51104(g)]?

The PSEGS would not conflict with zoning for, or cause rezoning of forest land, timberland or timberland zoned Timberland Production. The project area and vicinity are characterized as undeveloped desert though there are some agricultural activities near the PSEGS site.

The project area is located on BLM administered land designated "Multiple-Use Class M." This class provides for energy and utility development in accordance with federal, state and local law. The project's proposed use on this acreage is a use that would be consistent with uses permitted in Multiple-Use Class M and would not conflict with the CDCA Plan with the approval of an amendment by the BLM. With the BLM's approval, the PSEGS would not be in conflict with this CEQA criterion and would not result in a significant adverse impact.

D. Would the project result in the loss of forest land or conversion of forest land to non-forest use?

The PSEGS would not result in the loss of forest land or conversion of forest land to non-forest use.[5] The project area and vicinity are characterized as undeveloped desert. The PSEGS would not create a loss or conversion of forest land and would not result in a significant adverse impact under this CEQA criterion.

E. Would the project involve other changes in the existing environment which, due to their location or nature, could result in conversion of Farmland, to non-agricultural use or conversion of forest land to non-forest use?

The PSEGS would be constructed on an undeveloped portion of the Colorado Desert in the eastern Chuckwalla Valley. The project area consists of relatively undisturbed, unimproved desert dominated by sand and Sonoran creosote brush scrub. The area also has desert dry wash woodland, unvegetated ephemeral dry wash areas, and stabilized and partially stabilized desert dunes, and transmission power lines. The PSEGS would not involve other changes in the existing environment creating a conversion of farmland or forest land and would not result in a significant impact under this CEQA criterion.

[5] In determining whether impacts to forest resources, including timberland, are significant environmental effects, lead agencies may refer to information compiled by the California Department of Forestry and Fire Protection regarding the state's inventory of forest land, including the Forest and Range Assessment Project and the Forest Legacy Assessment project; and forest carbon measurement methodology provided in Forest Protocols adopted by the California Air Resources Board (CCR2010).

Physical Disruption Or Division Of An Established Community

The PSEGS would not physically divide an established community. The project site is in an undeveloped portion of the Colorado Desert in eastern Chuckwalla Valley. The unincorporated community of Desert Center (population 150) is the closest community to the project. Desert Center is approximately 10 miles west of the project site. The PSEGS would not conflict with this CEQA criterion and would not create a significant impact.

Conflict With Any Applicable Habitat Conservation Plan Or Natural Community Conservation Plan

The 3,794 acre PSEGS site is not within an approved U.S. Fish and Wildlife Service habitat conservation plan under section 10 of the Endangered Species Act, or within an approved California Department of Fish and Wildlife natural community conservation plan under section 2800 of the Natural Communities Conservation Act. The PSEGS would not conflict with this CEQA criterion and would not result in a significant impact.

Conflict With Any Applicable Land Use Plan, Policy Or Regulation

California Desert Conservation Area

In 1976, Congress passed the Federal Land Policy Management Act (FLPMA). In the FLPMA, Congress required the preparation of a comprehensive long-range plan for the California Desert Conservation Area (FLPMA section 601).

The CDCA Plan is a comprehensive, long-range plan with goals and specific actions for the management, use, development, and protection of the resources and public lands within the CDCA, and it is based on the concepts of multiple use, sustained yield, and maintenance of environmental quality. The plan's goals and actions for each resource are established in its 12 elements.

The CDCA Plan area totals 25 million acres of which 12 million acres are administered by the BLM. The project site is located within the CDCA Plan "Multiple-Use Class M (Moderate Use)" land use category. This class may provide for electrical generation plants in accordance with state, federal, and local laws. New gas, electric, and water transmission facilities and cables for interstate communication may be allowed only within designated corridors. The Class M category is also designed to conserve desert resources and to mitigate damage to those resources that permitted uses may cause. (USDOI1980, pg. 13 and pg. 15) [See **Land Use Figure 1**– Current BLM Multiple Use Classes].

Although the site is classified as Multiple-Use Class M, a land use amendment to the CDCA would be required because the proposed use, a solar thermal electric generating facility, is not identified in the current CDCA Plan. The BLM's approval of a ROW grant and plan amendments for the power plant and the transmission line would make the project conform to the CDCA Plan. With the BLM's approval of the ROW grant and plan amendments, the PSEGS and transmission line would not result in a conflict with the CDCA Plan under this CEQA criterion and would not result in a significant adverse impact.

Northern and Eastern Colorado Desert Coordinated Management Plan

The PSEGS area is within the Northern and Eastern Colorado Desert Coordinated Management Plan (NECO) area. The NECO is an amendment to the CDCA Plan to make it compatible with desert tortoise conservation and recovery. The NECO is a landscape-scale planning effort for most of the California portion of the Sonoran Desert ecosystem that promotes desert tortoise conservation and recovery. The project area is within the Desert Tortoise Eastern Colorado Recovery Unit.

In 1990, the desert tortoise was listed as a threatened species under the federal Endangered Species Act. By law, land managing agencies are required to review their current land use plans, adjust them as necessary, and consult on their adequacy with the U.S. Fish and Wildlife Service (USFWS) [USDOI2002, pg. 1-1].

The NECO designates a portion of the PSEGS area as a Multiple-species Wildlife Habitat Management Area (WHMA). The WHMA was established to provide long-term conservation of various species of special concern. The entire PSEGS site is within a multi-species WHMA. The BLM designates portions of land under its control as Desert Wildlife Management Areas (DWMA). Approximately 1,400 feet of the proposed generation tie-line is within the Chuckwalla DWMA. The southwestern portion of the project site, natural gas line corridor, and proposed generation tie-line corridor overlaps with 226 acres of the Chuckwalla Desert Tortoise Critical Habitat Unit.

As indicated in the **BIOLOGICAL RESOURCES** section, without mitigation the PSEGS could contribute to the cumulatively significant loss of biological resources within the Chuckwalla Valley and the NECO area. The **Biological Resources** analysis proposes Conditions of Certification **BIO-9** through **BIO-11** to mitigate the loss of desert tortoise habitat. Condition of Certification **BIO-7** would require the project owner to prepare and implement a Biological Resources Mitigation Implementation and Monitoring Plan (BRMIMP). The BRMIMP comprehensively describes avoidance, minimization, and mitigation measures. Staff concludes that with the proposed conditions of certification the PSEGS would be compatible with the NECO PSEGS.

Land Use Compatibility

A power plant and its related facilities may also be incompatible with existing or planned land uses, resulting in potentially significant impacts, if they create unmitigated noise, dust, or a public health or safety hazard or nuisance; result in adverse traffic or visual impacts; or preclude, interfere with, or unduly restrict existing or future uses. Staff has conferred with staff in the following technical areas: **Noise and Vibration**, **Public Health**, **Hazardous Materials Management**, **Traffic and Transportation**, and **Visual Resources** and concludes that the PSEGS would have no significant direct or cumulative impacts in any of these technical areas except **Visual Resources,** and perhaps **Traffic and Transportation.** The **Traffic and Transportation** analysis notes that traffic impacts are undetermined and will be addressed in the Final Staff Assessment.

The **Visual Resources** staff concludes that the PSEGS would result in significant unmitigable direct and cumulative impacts to existing scenic resource values as seen from several viewing areas in the project vicinity and Chuckwalla Valley area (approximately 30 mile radius from the PSEGS), including: Interstate 10 (I-10), State Route 177 (SR-177), Corn Springs Road, Joshua Tree National Park, Palen McCoy Wilderness, and Chuckwalla Mountains Wilderness. Staff concludes the PSEGS would be an incompatible land use for recreationists using these park and wilderness areas.

CUMULATIVE IMPACTS

Under CEQA Guidelines, "a cumulative impact consists of an impact which is created as a result of the combination of the project evaluated in the EIR [environmental impact report] together with other projects causing related impacts" [Cal. Code Regs., tit. 14, §15130(a)(1)]. Cumulative impacts of the project must be discussed if the incremental effect of a project, combined with the effects of other projects is "cumulatively considerable" [Cal. Code Regs., tit. 14, §15130(a)]. Such incremental effects are to be viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects" [Cal. Code Regs., tit. 14, §15164(b)(1)]. Together, these projects comprise the cumulative scenario which forms the basis of the cumulative impact analysis.

The discussion of cumulative impacts shall reflect the severity of impacts and their likelihood of occurrence, but the discussion need not provide as great detail as is provided for the effects attributable to the project alone. The discussion of cumulative impacts shall be guided by standards of practicality and reasonableness, and should focus on the cumulative impact to which the identified other projects contribute rather than the attributes of other projects which do not contribute to the cumulative impact [Cal. Code Regs., tit. 14, §15130(b)].

Geographic Scope of Analysis

Executive Summary Attachment A – Tables 1, 2, and 3, identifies existing projects, foreseeable projects in the project area, and projects submitted and on hold, respectively. The projects discussed below are contained in the **Executive Summary Attachment A – Tables 1, 2,** and **3**. The cumulative land use analysis considers past, current and probable future projects that are relatively near the proposed project that would contribute to cumulative impacts by impacting agricultural or forest lands, disrupting or dividing an established community, conflicting with applicable land use plans, policy or regulation, or conflicting with an applicable habitat conservation plan or natural community conservation plan.

Existing Projects

The eastern Chuckwalla Valley is characterized by undisturbed desert open space and wilderness, distinctive flora such as creosote bush scrub and Joshua tree, sand dunes, and mountainous terrain with large rock outcroppings. Urban and suburban development is absent and infrastructure other than energy transmission infrastructure is very limited. Farming is limited and primarily dedicated to jojoba and palm tree production. Much of the land has been identified as desert tortoise habitat by the U.S.

Fish and Wildlife Service. Land south of I-10 is within the NECO desert tortoise southern recovery unit (*Eastern Colorado Recovery Unit*).

Desert Center, population 150, is a focused specialty center primarily serving the commercial needs of highway travelers on I-10 and State Highway 177. It is an aggregation of highway service commercial-related uses clustered around the Desert Center-Rice Road interchange. The community also includes two mobile home parks, industrial/storage facilities, and a Caltrans equipment yard.

The Chuckwalla Valley State Prison is located on 1,720 acres on Wiley's Well Road in Blythe. The state prison provides for long-term housing and services for male felons classified as medium and low-medium inmates. It is located about 20 miles east of the PSEGS site.

The Devers-Palo Verde No.1 (DPV1) is an existing 500 kilovolt (kV) transmission line that parallels I-10. The transmission line is within a developed transmission line right of way within a federally approved utility corridor[6] The DPV1 was approved by the California Public Utilities Commission (CPUC) in 1979 and constructed in 1982. It is located about two miles south of the PSEGS site.

The Blythe 230 kV Transmission Line is two 230 kV transmission lines that span approximately 70 miles between the Julian Hinds Substation and the Bucks Substation. The transmission line was completed in June 2010. The transmission line was constructed within the existing federally approved utility corridor along I-10 about two miles south of the PSEGS site.

The Blythe Energy Project is a 520 MW combined-cycle natural gas-fired electricity generating facility located north of I-10 and seven miles west of the California/Arizona border. It is connected to the Bucks Substation and is located about 31 miles east of the PSEGS site.

A Section 368 Energy Corridor[7] parallels I-10 and includes the existing federal utility corridor designated in the CDCA Plan. The no default corridor width shown for the Chuckwalla Valley segment of the Section 368 Corridor is 10,560 feet (USDOI2009, Table A).

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[6] The utility corridor is one of 16 utility corridors designated in the California Desert Conservation Area Plan of 1980, as amended.

[7] Section 368 of the Energy Policy Act of 2005 (the Act), Public Law 109-58 (H.R. 6), enacted August 8, 2005, directs the Secretaries of Agriculture, Commerce, Defense, Energy, and the Interior (the Agencies) to designate under their respective authorities corridors on federal land in 11 western states (Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming) for oil, gas, and hydrogen pipelines and electricity transmission and distribution facilities (energy corridors). Section 368 requires the Agencies to conduct any "environmental reviews" necessary to complete the designation of Section 368 energy corridors. The evaluation of future project-related environmental impacts must await site-specific proposals and the required site-specific environmental review (WECPEIS2010).

Foreseeable Projects in the Project Area

The U.S.DOE, Office of Energy Efficiency and Renewable Energy and the BLM, in response to direction from Congress under Title II, Section 211 of the Energy Policy Act of 2005, as well as Executive Order 13212, Actions to Expedite Energy-Related Projects (May 18, 2001), has published a Programmatic Environmental Impact Statement that evaluates utility-scale solar energy development; to develop and implement agency-specific programs that would establish environmental policies and mitigation strategies for solar energy projects; and to amend relevant BLM land use plans with the consideration of establishing a new BLM solar energy development program (SEDPEISIC2010).

On March 11, 2009, Secretary of Interior Salazar announced Secretarial Order No. 3285, a policy goal of identifying and prioritizing specific locations best suited for large-scale production of solar energy on tracts of BLM-administered land. The BLM identified a 202,295-acre area in eastern Riverside County as "Riverside East." Riverside East includes the Chuckwalla Valley and lands on the north side of I-10 and west of the city of Blythe.

The Devers-Palo Verde 2 Transmission Line Project, approved by the CPUC in January 2007, involves the construction of two 500 kilovolt electric transmission lines. The route for the Devers-Palo Verde 2 (DPV2) Transmission Line parallels the existing DPV1 transmission line route along I-10. Construction began in June 2011. The new line would be about two miles south of the PSEGS site.

The Red Bluff Substation is located in the Desert Center area near I-10 within the Devers-Palo Verde transmission line corridor and will be operational in December 2013. The substation is about six miles west of the PSEGS site and will be owned and operated by SCE. The 230/500 kV substation would allow electricity to be carried by the Devers-Palo Verde 2 transmission line. The substation also would allow interconnection of the proposed PSEGS project and other proposed renewable energy projects in the Desert Center area.

The proposed Desert Southwest Transmission Line project consists of construction of an approximate 118-mile 500 kV transmission line and a new substation/switching station. The BLM Palm Springs-South Coast Field Office approved a ROW grant for the transmission line to cross public land between Blythe and the western end of the Coachella Valley about 24 miles east of the PSEGS site.

The proposed Chuckwalla Solar 1, a 200 MW solar photovoltaic generating project, is to be constructed one mile north of Desert Center. The project is to be constructed on 4,083 acres of federal land administered by the BLM. A plan for development (POD) has been submitted to the BLM for their approval. The proposed PSEGS site is approximately six miles east of the project.

The proposed Desert Lily Soleil Project, a 100 MW photovoltaic generating project on 1,216 acres, is to be located six miles north of Desert Center. The project includes a five to eight mile transmission line to the proposed SCE Red Bluff Substation. A POD has been submitted to the BLM for their approval. The PSEGS is approximately seven miles east of the project.

The proposed Desert Sunlight Solar Farm, a 550 MW solar photovoltaic generating project, is to be located approximately five miles north of Desert Center. The project is to be constructed on 4,410 acres of BLM administered land. A record of decision and a CDCA Plan amendment have been approved by the BLM. The PSEGS site is approximately 13.5 miles east of the project.

The proposed Genesis Solar Energy Project, a 250 MW solar parabolic trough generating project, is located north of the Ford Dry Lake exit on I-10. The project's facility footprint would be 1,800 acres. The project was approved by the Energy Commission on October 12, 2010 and is under construction. The PSEGS site is approximately 12.5 miles west of the Genesis project site.

Blythe Energy Project ll is a 520 MW combined-cycle power plant that would be located within the Blythe Energy Project site boundary located on 30 acres of a 76 acre site. It was approved by the Energy Commission on September 23, 2010. The project would be about 31 miles east of the PSEGS site.

Projects Submitted and on Hold

Staff has identified a few projects where documents have been submitted to the BLM but the projects are on hold. The Eagle Mountain Landfill Project would be developed on a 4,000-acre portion of the Kaiser Eagle Mountain Mine about 17 miles north of the PSEGS site. It is currently before the U.S. Court of Appeals. Graham Pass Wind Project is a proposed 175 MW facility that would be located 15 miles south of the PSEGS site. Mule Mountain III would be a 200 MW solar photovoltaic project that would be located 22 miles southeast of the PSEGS site. Both projects are pending before the BLM.

CUMULATIVE IMPACTS ANALYSIS

The potential for the PSEGS to cause significant cumulative impacts has been considered using the following criteria from the CEQA Guidelines.

Agriculture and Forest Resources

A. Would the incremental effect of the project, combined with the effects of the other projects within the geographic scope convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Farmland), as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to nonagricultural use?

The PSEGS would have no direct impact on farmland and it would not contribute to cumulative impacts on this resource.

B. Would the incremental effect of the project, combined with the effects of the other projects within the geographic scope conflict with existing zoning for agricultural use, or a Williamson Act contract?

The PSEGS would not conflict with existing zoning for agricultural use and there are no Williamson Act contracts on BLM land. The PSEGS would not contribute to cumulative impacts on agricultural uses.

C. Would the incremental effect of the project, combined with the effects of the other projects within the geographic scope conflict with existing zoning for, or cause rezoning of, forest land [as defined in Public Resources Code section 12220(g)], timberland [as defined by Public Resources Code section 4526), or timberland zoned Timberland Production (as defined by Government Code section 51104(g)]?

The PSEGS would not conflict with existing zoning for or cause rezoning of forest land or timberland and would not contribute to cumulative impacts on these resources.

D. Would the incremental effect of the project, combined with the effects of the other projects within the geographic scope result in the loss of forest land or conversion of forest land to non-forest use?

The PSEGS would not result in the loss or conversion of forest land and would not contribute to cumulative impacts on this resource.

E. Would the incremental effect of the project, combined with the effects of the other projects within the geographic scope involve other changes in the existing environment which, due to their location or nature, could result in conversion of Farmland, to non-agricultural use or conversion of forest land to non-forest use?

The PSEGS would not involve changes in the environment that would result in the conversion of farmland or forest land and would not contribute to cumulative impacts on these resources.

Physical Disruption or Division Of An Established Community

Would the incremental effect of the project, combined with the effects of the other projects within the geographic scope physically divides an established community?

The PSEGS would not physically divide an established community and would not contribute to cumulative impacts under this criterion.

Conflict With Any Applicable Habitat or Natural Community Conservation Plan

Would the incremental effect of the project, combined with the effects of the other projects within the geographic scope conflict with any applicable habitat conservation plan or natural community conservation plan?

The 3,794-acre PSEGS site is not within an approved U.S. Fish and Wildlife Service habitat conservation plan under section 10 of the Endangered Species Act, or within an approved California Department of Fish and Wildlife natural community conservation plan under section 2800 of the Natural Communities Conservation Act and would not contribute to cumulative impacts under this criterion.

Conflict With Any Applicable Land Use Plan, Policy or Regulation

Would the incremental effect of the project, combined with the effects of the other projects within the geographic scope conflict with any applicable land use plan, policy or regulation of an agency with jurisdiction over the project adopted for the purpose of avoiding or mitigating an environmental effect?

As noted earlier, the PSEGS is in the NECO Management Plan area. The NECO is an update to the CDCA Plan to make it compatible with desert tortoise conservation and recovery. The southwestern portion of the PSEGS site, natural gas line corridor, and proposed generation tie-line corridor overlap with 226 acres of the Chuckwalla Desert Tortoise Critical Habitat Unit. The **Biological Resources** analysis proposes Conditions of Certification **BIO-9** through **BIO-11** to mitigate for loss of desert tortoise habitat. With the three identified conditions of certification, staff concludes that the PSEGS would be consistent with the NECO and its impacts under this criterion would not be cumulatively considerable.

CUMULATIVE IMPACTS CONCLUSION

The PSEGS would not divide an established community, convert farmland or forest land, is not within a habitat conservation plan or a natural community conservation plan, and would not contribute to cumulative impacts to these resources. The **Biological Resources** analysis proposes Conditions of Certification **BIO-9** through **BIO-11** to mitigate for loss of desert tortoise habitat. With the three identified conditions of certification, the PSEGS would be consistent with the NECO and its impacts under this criterion would not be cumulatively considerable.

COMPLIANCE WITH LORS

Land Use Table 2 provides an analysis of the PSEGS's consistency with applicable land use-related LORS.

Land Use Table 2
PSEGS's Consistency with Applicable Land Use LORS

LORS		Consistency Determination	Basis for Consistency or Inconsistency	Proposed Condition of Certification
Source	**Policy and Strategy Descriptions**			
Federal				
Federal Land Policy and Management Act 1976 The California Desert Conservation Area Plan 1980 as amended	In 1976 Congress passed the Federal Land Policy Management Act - a law to direct the management of the public lands of the United States. In section 601, Congress required the preparation of a comprehensive long-range plan for the California Desert Conservation Area (CDCA). The purpose of this plan was to establish guidance for the management of the public lands in the California Desert administered by the U.S. Bureau of Land Management.			
Chapter 2 Multiple-Use Classes: - Multiple-Use Class M (Moderate Use)	Multiple-Use Class M (Moderate Use) is based upon a controlled balance between higher intensity use and protection of public lands. This class provides for a wide variety of present and future uses such as mining, livestock grazing, recreation, energy, and utility development. Class M management is also designed to conserve desert resources and to mitigate damage to those resources which permitted uses may cause. All types of electrical generation plants may be allowed in accordance with state, federal, and local laws. New gas, electric, and water transmission facilities and cables for interstate communication may be allowed only within designated corridors. Existing facilities within designated corridors may be maintained and upgraded or improved in accordance with existing rights of way grants or by amendments to right of way grants. Existing facilities outside designated corridors	The PSEGS would be consistent if the BLM approves two project-specific CDCA Plan amendments.	The PSEGS is to be constructed on federal land administered by the BLM. Sites associated with power generation or transmission not identified in the CDCA Plan is considered through the CDCA Plan amendment process (USDOI1980). All requests for amendments must be submitted to the District Manager of the California Desert District (USDOI1980). The project owner has submitted an application to the BLM requesting a project-specific CDCA Plan	Condition of Certification LAND-1

LORS		Consistency Determination	Basis for Consistency or Inconsistency	Proposed Condition of Certification
Source	Policy and Strategy Descriptions			
	may only be maintained but not upgraded or improved.		amendment and right of way grant	
Chapter 3 Plan Elements - Energy Production And Utility Corridors Element	Sites associated with power generation or transmission not identified in the Plan will be considered through the CDCA Plan Amendment process. Utility needs which do not conform to an adopted corridor system will be processed by means of a Plan Amendment in conjunction with necessary permit hearings required by other agencies. The scope of the CDCA allows the designation of corridors which address the following types of utility facilities: • New electrical transmission towers and cables of 161 kV (kilovolt) or above; and • All pipelines with diameters greater than 12 inches. The following criteria are used in determining decisions contained in this element. These criteria also will be used when evaluating future applications: (1) Minimize the number of separate rights of way by utilizing existing rights of way as a basis for planning corridors; (2) Encourage joint use of corridors for transmission lines, canals, pipelines, and cables; (3) Provide alternative corridors to be considered during processing of applications; (4) Avoid sensitive resources wherever possible; (5) Conform to local plans whenever possible; (6) Consider wilderness values and be consistent with final wilderness recommendations;	The project would be consistent if the BLM approves a project-specific CDCA Plan amendment.	The route for the transmission line between the PSEGS and the SCE Red Bluff Substation has been identified and the substation will be operational by December 2013. Sites associated with power generation or transmission not identified in the CDCA Plan are considered through the CDCA Plan amendment process (USDOI1980). All requests for amendment must be submitted to the District Manager of the California Desert District (USDOI1980).	Condition of Certification LAND-1

LORS		Consistency Determination	Basis for Consistency or Inconsistency	Proposed Condition of Certification
Source	**Policy and Strategy Descriptions**			
	(7) Complete the delivery-systems network; (8) Consider ongoing projects for which decisions have been made, for example, the Intermountain Power Project; and (9) Consider corridor networks which take into account power needs and alternative fuel resources.			

NOTEWORTHY PUBLIC BENEFITS

Staff has not identified any noteworthy public benefits related to land use.

FACILITY CLOSURE

At some point in the future, the proposed facility would cease operation and close down. At that time, it would be necessary to ensure that closure occurs in such a way that public health and safety and the environment are protected from adverse impacts.

The planned lifetime of the project is estimated at 30 years. **Three years prior to initiating a permanent facility closure, the project owner must submit for CPM review and approval, a Final Closure Plan, which includes any long-term, post-closure site maintenance and monitoring**. This review and approval process would be public and allow participation by interested parties and other regulatory agencies. At the time of closure, all applicable land use related LORS would be identified and the closure plan would discuss conformance of dismantling and demolition, restoration, and remediation activities with these LORS. All of these activities would fall under the authority of the Energy Commission. For more information on facility closure, please see the General Conditions provided in this Final Staff Assessment.

RESPONSE TO COMMENTS

VEENA DOIJODE, E-MAIL COMMENT LETTER, TN # 70449, APRIL 22, 2013:

Comment: The commenter would like the Energy Commission to assess the impact to their parcel close to the project as they intend to grow palm dates on this land.

Response: Staff has reviewed an aerial image of the project area that shows the commenter's property is about five miles southeast of the PSEGS site. The PSEGS would be constructed on undeveloped desert land administered by the BLM and would not convert farmland or conflict with existing zoning for agricultural use. The solar technology would not affect agricultural activities. Staff concludes that the construction and operation of the PSEGS would not prevent local landowners from growing palm dates or other agricultural products.

COUNTY OF RIVERSIDE, JOHN J. BENOIT, COMMENTS ON THE PRELIMINARY STAFF ASSESSMENT FOR THE PROPOSED PSEGS, TN # 200094, JULY 30, 2013:

Comment: The county has identified General Plan Land Use Element Policies LU 2.1.c and LU 7.1 regarding biological resources and LU 8.1, 13.1, 13.3, 20.1, 20.2, and 20.4 regarding visual resources.

Response: Staff has addressed these policies in the **BIOLOGICAL RESOURCES** and **VISUAL RESOURCES** analyses in this FSA.

CONCLUSIONS

This analysis focused on whether the PSEGS would result in substantial adverse impacts under the California Environmental Quality Act, and if the project would be inconsistent with applicable land use laws, ordinances, regulations, and standards. Staff concludes the following:

1. The PSEGS would be located on public land (federal land) administered by the U.S. Bureau of Land Management (BLM)

2. The approximately 3,794 acre PSEGS site is within the federal California Desert Conservation Area (CDCA) Plan area. The project area is in the “Multiple-Use Class M” land use category. The Class M land use category allows electrical generation plants in accordance with federal, state, and local laws subject to the approval of a CDCA Plan amendment by the BLM.

3. Staff concludes that with implementation of Conditions of Certification **BIO-9** through **BIO-11** the PSEGS would be compatible with the NECO.

4. The proposed power plant and the overhead transmission line to serve the project each require the BLM’s approval of a ROW grant and two CDCA Plan amendments. With the BLM’s approval of the ROW grant and plan amendments, the PSEGS and transmission line would be consistent with the CDCA Plan.

5. The PSEGS does not divide or disrupt the physical arrangement of an established community.

6. The PSEGS is not located within a habitat conservation plan approved by the U.S. Fish and Wildlife Service, or a natural community conservation plan approved by the California Department of Fish and Wildlife.

7. The PSEGS does not convert prime farmland, conflict with existing county zoning for agricultural use or a Williamson Act contract, or result in the conversion of farmland to a non-agricultural use.

8. The PSEGS does not conflict with zoning for or cause rezoning of forest land, timberland or timberland zoned Timberland Production. The project does not result in the loss of forest land or conversion of forest land to non-forest use.

The **Visual Resources** staff concludes that the PSEGS would result in significant unmitigable direct and cumulative impacts to existing scenic resource values as seen from several viewing areas in the project vicinity and Chuckwalla Valley area (approximately 30 mile radius from the PSEGS), including: Interstate 10 (I-10), State Route 177 (SR-177), Corn Springs Road, Joshua Tree National Park, Palen McCoy Wilderness, and Chuckwalla Mountains Wilderness. Staff concludes the PSEGS would create a land use incompatibility because of significant and unavoidable visual impacts to recreational users of park and wilderness areas.

PROPOSED CONDITION OF CERTIFICATION

Staff has made minor edits to the one existing land use condition of certification from the Commission Decision for the Palen Solar Power Project should the Commission approve the project amendment. (Note: Deleted text is in ~~strikethrough~~; new text is **bold** and **underlined**.)

LAND-1 Prior to the start of construction, the ~~Applicant~~ **project owner** shall provide to the Compliance Project Manager (CPM) documentation of the U.S. Bureau of Land Management (BLM) Right-of-Way grant and the BLM-approved project-specific amendment to the California Desert Conservation Area Plan (CDCA) permitting the construction/operation of the proposed Palen Solar ~~Power Project~~ **Electric Generating System**.

Verification: Prior to the start of construction, the ~~Applicant~~ **project owner** shall submit to the CPM a copy of the BLM approved **Right-of-Way grant and** project specific amendment to the CDCA Plan permitting the Palen Solar ~~Power Project~~ **Electric Generating System**.

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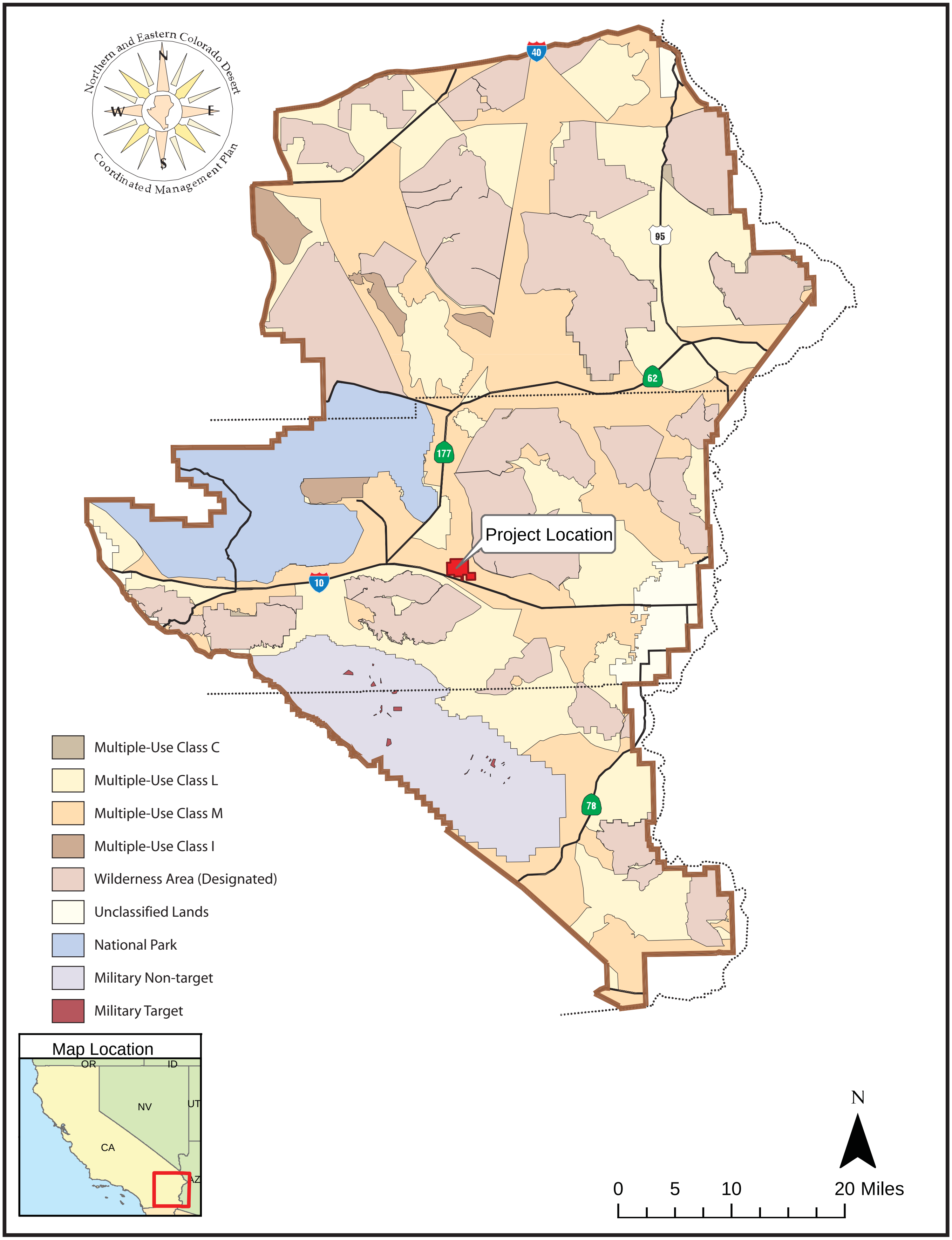
LAND USE- FIGURE 1

Palen Solar Electric Generating System - Current BLM Plan Multiple Use Classes



CALIFORNIA ENERGY COMMISSION - SITING, TRANSMISSION AND ENVIRONMENTAL PROTECTION DIVISION

SOURCE: AFC Figure 5.7-2 and California Desert Conservation Area Plan

NOISE AND VIBRATION

Testimony of Shahab Khoshmashrab

SUMMARY OF CONCLUSIONS

Because construction and operational noise would be the same or lower than the approved project, the modified Palen Solar Electric Generating System (PSEGS), if built and operated in conformance with the existing conditions of certification, would comply with all applicable noise and vibration laws, ordinances, regulations and standards, and would produce no significant adverse noise impacts on people within the affected area, directly, indirectly, or cumulatively. The existing conditions of certification provide appropriate mitigation, in the form of good design practice and selection of appropriate project equipment that would avoid any significant adverse impacts.

INTRODUCTION

The construction and operation of any power plant creates noise or unwanted sound. The character and loudness of this noise, the times of day or night that it is produced, and the proximity of the facility to sensitive receptors all combine to determine whether the facility would meet applicable noise control laws and ordinances and whether it would cause significant adverse environmental impacts. In some cases, vibration may be produced as a result of power plant construction practices such as blasting or pile driving. The ground-borne energy of vibration has the potential to cause structural damage and annoyance.

The purpose of this analysis is to identify and examine the likely noise and vibration impacts from the construction and operation of the proposed modified project, and to recommend procedures to ensure that the resulting noise and vibration impacts would be adequately mitigated to comply with applicable laws, ordinances, regulations and standards (LORS). For an explanation of technical terms used in this section, please refer to **Noise Appendix A** immediately following.

METHODS AND THRESHOLDS FOR DETERMINING SIGNIFICANCE

CALIFORNIA ENVIRONMENTAL QUALITY ACT

The California Environmental Quality Act (CEQA) requires that significant environmental impacts be identified and either eliminated or mitigated to the extent feasible. Section XI of Appendix G of CEQA's guidelines (Cal. Code Regs., tit. 14, App. G) describes some characteristics that could signify a potentially significant impact. Specifically, a significant effect from noise may exist if a project would result in:

1. exposure of persons to, or generation of, noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies;

2. exposure of persons to or generation of excessive ground borne vibration or ground borne noise levels;

3. substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project; or,

4. substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project.

The Energy Commission staff, in applying Item 3, above, to the analysis of this and other projects, has concluded that a potential for a significant noise impact exists where the noise of the project plus the background exceeds the background by more than 5 dBA at the nearest sensitive receptor.

Staff has concluded that an increase in background noise levels up to and including 5 dBA in a residential setting is insignificant; an increase of more than 10 dBA, however, is clearly significant. An increase of between 5 and 10 dBA should be considered adverse, but could be either significant or insignificant, depending upon the particular circumstances of a particular case.

Factors to be considered in determining the significance of an adverse impact as defined above include:

1. the resulting noise level;

2. the duration and frequency of the noise;

3. the number of people affected; and,

4. the land use designation of the affected receptor sites.

Noise due to construction activities is usually considered to be insignificant in terms of CEQA compliance if:

- the construction activity is temporary; and,
- the use of heavy equipment and noisy[1] activities is limited to daytime hours.

Staff uses the above method and threshold to protect the most sensitive populations.

[1] Noise that draws a legitimate complaint. For the definition of “legitimate complaint”, please see Condition of Certification **NOISE-4**.

LAWS, ORDINANCES, REGULATIONS, AND STANDARDS (LORS)

Noise and Vibration Table 1
Laws, Ordinances, Regulations and Standards (LORS)

Applicable LORS	Description
Federal	
Occupational Safety & Health Act (OSHA): 29 U.S.C. § 651 et seq.	Protects workers from the effects of occupational noise exposure
U.S. Environmental Protection Agency (USEPA)	Assists state and local government entities in development of state and local LORS for noise
State	
California Occupational Safety & Health Act (Cal-OSHA): 29 U.S.C. § 651 et seq., Cal. Code Regs., tit. 8, §§ 5095-5099	Protects workers from the effects of occupational noise exposure
Local	
Riverside County General Plan, Noise Element	Establishes goals, objectives, and procedures to protect the public from noise intrusion.
Riverside County Noise Ordinance, Ordinance 847 (Regulating Noise)	Specifies sound level limits. Limits hours of construction

FEDERAL

Under the Occupational Safety and Health Act of 1970 (OSHA) (29 U.S.C. § 651 et seq.), the Department of Labor, Occupational Safety and Health Administration, (OSHA) adopted regulations (29 C.F.R. § 1910.95) designed to protect workers against the effects of occupational noise exposure. These regulations list permissible noise exposure levels as a function of the amount of time during which the worker is exposed (see **Noise Appendix A, Table A4**, immediately following this section). The regulations further specify a hearing conservation program that involves monitoring the noise to which workers are exposed, assuring that workers are made aware of overexposure to noise, and periodically testing the workers' hearing to detect any degradation.

Guidelines are available from the U.S. Environmental Protection Agency (USEPA) to assist state and local government entities in developing state and local LORS for noise. Because there are existing local LORS that apply to this project, the USEPA guidelines are not applicable.

There are no federal laws governing off-site (community) noise.

The Federal Transit Administration (FTA) has published guidelines for assessing the impacts of ground-borne vibration associated with construction of rail projects, which have been applied by other jurisdictions to other types of projects. The FTA-recommended vibration standards are expressed in terms of the "vibration level," which is calculated from the peak particle velocity measured from ground-borne vibration. The FTA measure of the threshold of perception is 65 vibrational decibel (VdB), which correlates to a peak particle velocity of about 0.002 inches per second (in/sec). The FTA measure of the threshold of architectural damage for conventional sensitive structures is 100 VdB, which correlates to a peak particle velocity of about 0.2 in/sec.

STATE

California Government Code Section 65302(f) encourages each local governmental entity to perform noise studies and implement a noise element as part of its general plan. In addition, the California Office of Planning and Research has published guidelines for preparing noise elements, which include recommendations for evaluating the compatibility of various land uses as a function of community noise exposure.

The State of California, Office of Noise Control, prepared the Model Community Noise Control Ordinance, which provides guidance for acceptable noise levels in the absence of local noise standards. This model also defines a simple tone, or “pure tone,” as one-third octave band sound pressure levels that can be used to determine whether a noise source contains annoying tonal components. The Model Community Noise Control Ordinance further recommends that, when a pure tone is present, the applicable noise standard should be lowered (made more stringent) by 5 A-weighted decibels (dBA).

The California Occupational Safety and Health Administration (Cal-OSHA) has promulgated occupational noise exposure regulations (Cal. Code Regs., tit. 8, §§ 5095-5099) that set employee noise exposure limits. These standards are equivalent to federal OSHA standards (see **NOISE APPENDIX A, TABLE A4**).

LOCAL

The project is located within Riverside County. The Noise Element of the Riverside County General Plan (Riverside County 2007) and the Riverside County Noise Ordinance (Riverside County 2008) apply to this project.

Riverside County Noise Element

The County Noise/Land Use Compatibility Guidelines, provided in the Noise Element, are used to evaluate potential noise impacts and provide criteria for environmental impact findings and conditions for project approval. Land use compatibility defines the acceptability of a land use in a specified noise environment. For residential land uses, these guidelines categorize noise levels of up to 60 dBA day/night average sound level (Ldn) or CNEL as “normally acceptable” and up to 70 dBA Ldn or CNEL as “conditionally acceptable”.

Riverside County Noise Ordinance

The Noise Ordinance allows for different levels of acceptable noise depending upon land use. Section 4 of Ordinance No. 847 (Regulating Noise) limits noise on any property that causes the exterior noise level on any other occupied property to 55 dBA during the daytime hours and 45 dBA during the nighttime hours, for noise-sensitive receptors[2] within a very low density rural area, such as the area surrounding the project site.

[2] A sensitive noise receptor, also referred to as a noise-sensitive receptor, is a receptor at which there is a reasonable degree of sensitivity to noise (such as residences, schools, hospitals, elder care facilities, libraries, cemeteries, and places of worship).

This Noise Ordinance also limits the hours of construction activities to the hours of 6:00 a.m. to 7:00 p.m., June through September, 6:00 a.m. to 6:00 p.m., October through May, Mondays through Fridays, and to 9:00 a.m. to 5:00 p.m. on Saturdays.

PROPOSED MODIFIED PROJECT

The modifications proposed in the petition include replacing the parabolic trough solar collection system, steam turbine generator, and associated heat transfer fluid with BrightSource's solar tower technology. Heliostats—elevated mirrors guided by a tracking system mounted on a pylon—focus the sun's rays on a solar receiver steam generator (SRSG) located atop a 750-foot-tall tower near the center of each solar field to create steam to drive a turbine that generates electricity.

The modified project includes two power blocks similar in size and types of equipment as the approved project. However, the farthest power block to the nearest noise-sensitive receptor (LT1, a residence described in more detail below) would be located farther away from this receptor than the farthest power block for the approved project. The nearest power block to this receptor would be located approximately at the same distance to this receptor as the nearest block for the approved project. For this reason, project noise would be slightly lower at LT1 for the modified project as compared to the approved project.

The only notable difference between the tower technology and the parabolic trough technology is that one of the major sources of noise for the tower technology, the SRSG, would be located atop a 750-foot-tall tower. This may cause a different sound dispersion profile than the approved project (due to the height of the source) within a couple of thousands of feet. However, due to the long distance of LT1 to the nearest tower, approximately 6,000 feet, the project's overall noise would be heard much the same as the approved project at this receptor.

Construction noise impact from the modified project is expected to be the same as the approved project.

SETTING AND EXISTING CONDITIONS

The PSEGS site is located in Riverside County, approximately 0.5 mile north of Interstate 10 (I-10) near the Corn Springs Road intersection. The site is in a remote area of primarily undeveloped land, with open space and some land developed as a nursery. The small community of Desert Center is located approximately 10 miles west of the site, along I-10.The predominant noise source in proximity to the project site is vehicular traffic on I-10.

The land use of the PSEGS site is undeveloped open space, and the surrounding land uses include undeveloped land and some agricultural land to the west of the project site.

There is one residence, LT1, located approximately 25 feet from the northwest corner of the project right-of-way boundary, but over 1 mile from the nearest power block. The power block would be the major source of the power plant's noise during the facility's operation. Another residence is located approximately 3,500 feet northwest of the site boundary and well over a mile from the nearest power block (Solar Millennium 2009a, AFC § 5.8.2.3; **Project Description Figure 4**).

Ambient Noise Monitoring

In order to establish a baseline for the comparison of predicted project noise with existing ambient noise, the project owner presented the results of an ambient noise survey in 2009 (Solar Millennium 2009a, AFC § 5.8.2.4; Tables 5.8-5, 5.8-6). Because the noise environment is still the same, a new ambient noise survey is not necessary, and staff uses the 2009 survey to evaluate the noise and vibration impacts of the modified project at the project's noise-sensitive receptors.

Ambient noise levels were measured near the western boundary of the PSEGS site, near the two residences to the northwest of the project site, from May 18 to May 19, 2009. One long-term measurement was taken near the two residences over a 25-hour period between 6:51 p.m., May 18, and 7:51 p.m., May 19, 2009. The survey was performed using acceptable equipment and techniques. The noise survey monitored existing noise levels near the nearest sensitive receptors, shown in **Noise Figure 1**:

1. Location LT1: closest residence to the project site. This is a residence located approximately 25 feet from the northwest corner of the project right-of-way boundary, but over 1 mile from the nearest power block. A location near this residence (LT, as shown in **Noise Figure 1**) was monitored continuously between 6:51 p.m., May 18, and 7:51 p.m., May 19, 2009.

2. Location LT2: the second closest residence to the project site. This is a residence located approximately 3,500 feet northwest of the site boundary and well over a mile from the nearest power block. A location near this residence (LT, as shown in **Noise Figure 1**) was monitored continuously between 6:51 p.m., May 18, and 7:51 p.m., May 19, 2009.

Because of the similarity of the noise environments between these residences and the long-term survey location, staff finds it reasonable to use the results of this survey as the baseline for the existing ambient noise levels at these noise-sensitive receptors.

Noise Table 2 summarizes the ambient noise measurements (Solar Millennium 2009a, AFC § 5.8.2.4; Table 5.8-6).

Noise Table 2
Summary of Measured Noise Levels

Measurement Sites	Measured Noise Levels, dBA	
	Average During Daytime Hours L_{eq}	Average During Nighttime Hours L_{eq}
LT1, Nearest Residence	43[1]	34[2]
LT2, Second Nearest Residence	43[1]	34[2]

Source: Solar Millennium 2009a, AFC § 5.8.2.4; Table 5.8-6
1 - Staff calculations of average of the daytime hours
2 - Staff calculations of average of the nighttime hours

ASSESSMENT OF IMPACTS AND DISCUSSION OF MITIGATION

DIRECT IMPACTS AND MITIGATION

Noise impacts associated with the project can be created by short-term construction activities and normal long-term operation of the project.

Construction Impacts and Mitigation

Construction noise is usually a temporary phenomenon. Construction of the PSEGS project is expected to be typical of similar projects in terms of equipment used and other types of activities (Solar Millennium 2009a, AFC § 5.8.3.2; Palen 2012a, § 6.4.2).

Construction of an industrial facility such as a power plant is typically noisier than permissible under usual noise ordinances. In order to allow the construction of new facilities, construction noise during certain hours of the day is commonly exempt from enforcement by local ordinances.

Construction noise from the modified project is expected to be the same as the approved project. There are no new pieces of equipment or methods of construction that were not analyzed previously for the approved project. Therefore, in this FSA, staff uses the same data and analysis as those described for the approved project, to evaluate the project’s impacts at the nearest noise-sensitive receptors.

In the AFC, the project owner predicted a construction noise level of 59 dBA at the nearest residential receptor, LT1. It is shown here in **Noise Table 3**.

Noise Table 3
Predicted Construction Noise Level

Receptor	Highest Construction Noise Level L_{eq} (dBA)[1]	Measured Existing Ambient, Average Daytime L_{eq} (dBA)[2]	Cumulative, Using Highest Noise Level of 48 dBA	Change
LT1	59	43	59	+16
LT2	46	43	48	+5

Sources:
1 - Solar Millennium 2009a, AFC § 5.8.3.1, and staff's calculations
2 - **Noise Table 2**, above

The applicable local noise LORS do not limit the loudness of construction noise, but staff compares the projected noise levels with ambient levels

The project owner commits to performing noisy construction work during the times specified in the Riverside County Noise Ordinance, to the hours of 6:00 a.m. to 7:00 p.m., June through September, and 6:00 a.m. to 6:00 p.m., October through May, Mondays through Fridays, and 9:00 a.m. to 5:00 p.m. on Saturdays, with no construction allowed on Sundays and Federal holidays (Solar Millennium 2009a, AFC § 5.8.3.1; Palen 2012a, § 6.4.3). To ensure that these hours are, in fact, enforced, staff proposes Condition of Certification **NOISE-6**.

Therefore, the noise impacts of the PSEGS project construction activities would comply with the noise LORS.

Since construction noise typically varies with time, it is most appropriately measured by, and compared with, the L_{eq} (energy average) metric. Even though project construction would likely last 33 months (Palen 2012a, § 6.3.2), the construction activities within an area that would potentially considerably impact the nearest residential receptor would not last more than several months. The nearest location to the nearest residence (LT1) where there would be more than minimal activities is the northwestern extent of the solar arrays of Unit #2, near the residence. Construction noise from site grading and array installation would not exceed 59 dBA L_{eq} at the residence, temporarily resulting in a 16 dBA increase in the ambient noise level at LT1 (see **Noise Table 3** above); this is a considerable increase. However, this impact would be only for the short time that construction activities occur in that portion of the site. Noise levels would decrease the farther away construction activities occur from the residence.

The second nearest residence (LT2) is also located northwest of the project site, but it is further away from the site than LT1 is. The above activities in the northwestern extent of the solar arrays of Unit #2 would likely generate a noise level of 46 dBA L_{eq} at the LT2. This will result in a temporary increase in the ambient noise level at LT2 of 5 dBA (see **Noise Table 3** above). Staff considers an increase of 5 dBA to be less than significant.

Therefore, because of the temporary nature of these activities and because construction would be limited to the daytime hours, the noise effects of plant construction are considered to be less than significant at the above receptors.

To ensure the project construction would create less than significant adverse impacts at the most noise-sensitive receptors, in addition to Condition of Certification **NOISE-6**, staff proposes Conditions of Certification **NOISE-1** and **NOISE-2**, which would establish a public notification and noise complaint process to resolve any complaints regarding construction noise.

In light of the following proposed conditions of certification, the noise impacts of the PSEGS project construction activities would be less than significant.

Steam Blows

Typically, the loudest noise encountered during construction, inherent in building any project incorporating a steam turbine, is created by the steam blows. After erection and assembly of the feed water and steam systems, the piping and tubing that comprise the steam path have accumulated dirt, rust, scale, and construction debris such as weld spatter, dropped welding rods, and the like. If the plant were started up without thoroughly cleaning out these systems, all this debris would find its way into the steam turbine, quickly destroying the machine.

In order to prevent this, before the steam system is connected to the turbine, the steam line is temporarily routed to the atmosphere. Traditionally, high pressure steam is then raised in the boiler or a temporary boiler and allowed to escape to the atmosphere through the steam piping. This flushing action, referred to as a *high pressure steam blow*, is quite effective at cleaning out the steam system. A series of short steam blows, lasting 2 or 3 minutes each, are performed several times daily over a period of 2 or 3 weeks. At the end of this procedure, the steam lines are connected to the steam turbine, which is then ready for operation. Alternatively, high pressure compressed air can be substituted for steam.

High pressure steam blows, if unsilenced, can typically produce noise levels as high as 129 dBA at a distance of 50 feet; this would amount to roughly 88 dBA at LT1 and 84 at LT2. Unsilenced steam blows could be disturbing at the nearest noise-sensitive receptors, depending on the frequency, duration, and noise intensity of venting. With a silencer installed on the steam blow piping, noise levels are commonly attenuated to 89 dBA at 50 feet.

A quieter steam blow process, referred to as *low pressure steam blow* and marketed under names such as QuietBlow™ or Silentsteam™, has become popular. This method utilizes lower pressure steam over a continuous period of about 36 hours. Resulting noise levels reach about 86 dBA at 50 feet.

To minimize the impact of steam blows, staff has proposed Condition of Certification **NOISE-7**, which limits steam blow noise to 89 dBA measured at a distance of 100 feet. A noise level of 89 dBA at 100 feet results in about 53 dBA at LT1, which is tolerable. This condition of certification also limits steam blows to between 8:00 a.m. and 5:00 p.m.

Linear Facilities

Construction of linear facilities typically moves along at a rapid pace, thus not subjecting any one receptor to noise impacts for more than 2 or 3 days. Further, construction activities would be limited to daytime hours. To ensure that these hours are, in fact, adhered to in compliance with the LORS, staff proposes Condition of Certification **NOISE-6**.

Vibration

The only construction operation likely to produce vibration that could be perceived off site would be pile driving. The project owner anticipates that pile driving would not be required for construction of the PSEGS project (Solar Millennium 2009a, AFC § 5.8.3.2; Palen 2012a, § 6.4.2). Therefore, no vibration impacts are expected.

Worker Effects

The project owner has acknowledged the need to protect construction workers from noise hazards and has recognized applicable LORS that would protect construction workers (Solar Millennium 2009a, AFC §§ 5.8.1, 5.8.4). To ensure that construction workers are, in fact, adequately protected, staff has proposed Condition of Certification **NOISE-3**.

Operation Impacts and Mitigation

The primary noise source of the PSEGS plants would be the power blocks, where the steam turbine generators, the air-cooled condensers, electric transformers, and various pumps and fans would be located. The modified project's major noise sources are similar to those for the approved project, and thus, the noise modeling used for the approved project is still applicable. Staff uses the results of that modeling for this analysis. The project's two power blocks (one for each 250 MW unit) would be centrally located in the middle of each solar unit; these blocks would be surrounded by the solar reflector fields. The overall noise generated by these various noise sources would be based on the configuration of the sources, the number and power rating of the equipment, and any noise-reducing measures incorporated. Staff compares the projected project noise with applicable LORS, in this case the Riverside County noise LORS. In addition, staff evaluates any increase in noise levels at sensitive receptors due to the project in order to identify any significant adverse impacts.

The project would avoid the creation of annoying tonal (pure-tone) noises by balancing the noise emissions of various power plant features during plant design (Condition of Certification **NOISE-4**).

For the approved project, the project owner performed noise modeling to determine the project's noise impacts on sensitive receptors (Solar Millennium 2009a, AFC § 5.8.3.3). Based on that modeling, the project owner predicted the operational noise levels at the nearest sensitive receptors; they are shown in **Noise Table 4** below. As explained above, the modified project's major noise sources are similar to those for the approved project, and thus, the noise modeling used for the approved project is still applicable. Staff uses the results of that modeling for this analysis (**Noise Table 4**).

The Noise Ordinance allows for different levels of acceptable noise depending upon land use. Section 4 of Ordinance No. 847 (Regulating Noise) limits noise on any property that causes the exterior noise level on any other occupied property to 55 dBA during the daytime hours and 45 dBA during the nighttime hours, for noise-sensitive receptors within a very low density rural area, such as the area surrounding the project site. The project owner predicts the project's operational noise level at receptor LT1, the nearest receptor, to be 42 dBA L_{eq} (Solar Millennium 2009a, AFC § 5.8.3.3). This level is less than the above LORS requirements.

The above predicted operational noise level also complies with the Riverside County's guideline that considers a noise level of up to 60 dBA day/night average (Ldn) or CNEL (Community Noise Equivalent Level) to be normally acceptable.

To ensure compliance, staff proposes Condition of Certification **NOISE-4**. Also to ensure compliance, staff proposes Conditions of Certification **NOISE-1** and **NOISE-2**, which would establish a public notification and noise complaint process requiring the project owner to resolve any problems caused by operational noise.

With the implementation of the following conditions of certification, noise due to the operation of the PSEGS project would be in compliance with applicable LORS.

As explained, the PSEGS project would operate during the daylight hours. Thus, staff compares the project's noise levels to the existing daytime ambient noise levels at the project's noise-sensitive receptor. (Please see below for limited nighttime activities.)

Typically, daytime ambient noise consists of both intermittent and constant noises. The noise that stands out during this time is therefore best represented by the average noise level, referred to as L_{eq}. Staff's evaluation of the above noise surveys shows that the daytime noise environment in the project area consists of both intermittent and constant noises. Thus, staff compares the project's noise levels to the daytime ambient L_{eq} levels at the project's noise-sensitive receptors.

The project owner has predicted the operational noise level at LT1; it is shown here in **Noise Table 4**.

Noise Table 4
Predicted Operational Noise Levels at the Identified Sensitive Residential Receptors

Receptor	Project Alone Operational Noise Level (dBA)[1]	Measured Existing Ambient, Daytime L_{eq} (dBA)[2]	Cumulative L_{eq} (dBA)	Increase in Existing Ambient (dBA)
LT1	42	43	46	+3
LT2	33[3]	43	43	0

Sources:
1 - Solar Millennium 2009a, AFC § 5.8.3.2
2 - **Noise Table 2**, above
3 - Staff's calculations based on the noise modeling in the AFC.

Combining the ambient noise level of 43 dBA L_{eq} (**Noise Table 4**, above) with the project noise level of 42 dBA at LT1 would result in 46 dBA L_{eq}, 3 dBA above the ambient. As described above (in **METHODS AND THRESHOLDS FOR DETERMINING SIGNIFICANCE**), staff regards an increase of up to 5 dBA as a less-than-significant impact. Therefore, staff considers the above noise impact at LT1 to be less than significant.

Combining the ambient noise level of 43 dBA L_{eq} (**Noise Table 4**, above) with the project noise level of 33 dBA at LT2 would result in 43 dBA L_{eq}; the project would not cause an increase in the ambient noise level. Therefore, there would be no impact at this location.

Adverse impacts on residential receptors can also be identified by comparing predicted power plant noise levels with the nighttime ambient background noise levels at the nearest sensitive residential receptors. The project would have limited nighttime activities related to maintenance. The project owner's projection of the noise level from these activities at LT1 is 22 dBA (Solar Millennium 2009a, AFC § 5.8.3.3). This is significantly lower than the average nighttime ambient noise level of 34 at LT1 (**Noise Table 2**, above), and thus, the project's nighttime activities would have a less than significant impact on the project's most noise-sensitive receptor. Subsequently, these activities would likely have no impact on LT2, due to its further distance from the project site than LT1.

Staff proposes Condition of Certification **NOISE-4** to ensure that the noise level due to project operation would not exceed the above level (in **Noise Table 4**, second column).

Tonal Noises

One possible source of annoyance could be strong tonal noises. Tonal noises are individual sounds (such as pure tones) which, while not louder than permissible levels, stand out in sound quality. To ensure that tonal noises do not cause public annoyance, staff proposes Condition of Certification **NOISE-4**, which would require mitigation measures, if necessary, to ensure the project would not create tonal noises.

Linear Facilities

All water pipes and gas pipes would be underground and therefore silent during plant operation. Noise effects from electrical interconnection lines typically do not extend beyond the lines' right-of-way easements and would be inaudible to receptors.

Vibration

Vibration from an operating power plant could be transmitted through two primary means: ground (ground-borne vibration), and air (airborne vibration).

The operating components of the PSEGS plant would consist of high-speed steam turbine generators and various pumps and fans. All of these pieces of equipment would be carefully balanced in order to operate; permanent vibration sensors would be attached to the turbines and generators. Based on experience with numerous previous projects employing similar equipment, staff agrees with the project owner that ground-borne vibration from the PSEGS project would be undetectable by any likely receptor.

Airborne vibration (low frequency noise) can rattle windows and objects on shelves and can rattle the walls of lightweight structures. However, none of the project equipment is likely to produce noticeable low frequency noise beyond the project site boundaries. This makes it highly unlikely that the PSEGS would cause perceptible airborne vibration effects at any offsite noise-sensitive receptor.

Worker Effects

The project owner acknowledges the need to protect plant operating and maintenance workers from noise hazards and commits to compliance with all applicable LORS (Solar Millennium 2009a, AFC § 5.8.4; Palen 2012a, § 6.4.3). Signs would be posted in areas of the plant with noise levels exceeding 85 dBA (the level that OSHA recognizes as a threat to workers' hearing), and hearing protection would be required and provided. To ensure that plant operation and maintenance workers are adequately protected, Energy Commission staff has proposed Condition of Certification **NOISE-5**. For further discussion of proposed worker safety conditions of certification, please see **WORKER SAFETY AND FIRE PROTECTION** section of this document.

Facility Closure

All operational noise from the project would cease when the PSEGS project closes, and no further adverse noise impact from its operation would be possible. The remaining potential temporary noise source would be the dismantling of the project structures and equipment, as well as any site restoration work that may be performed. Since this noise would be similar to that caused by the original construction, it could be similarly treated – that is, noisy work would be performed during daytime hours with machinery and equipment that are properly equipped with mufflers. Any noise LORS in existence at that time would apply. Unless modified, applicable conditions of certification included in the Energy Commission decision would also apply.

CUMULATIVE IMPACTS

Since the original project was approved, there are no new projects or new "reasonably foreseeable probable future projects" within a distance that would cause cumulative noise and vibration impacts when combined with the modified project.

Furthermore, the change in technology (from parabolic trough to solar tower) will not result in cumulative impacts that were not analyzed in the original project.

NOTEWORTHY PUBLIC BENEFITS

The proposed modified project would affect the daytime ambient noise levels in the project area. While this change would be barely noticeable at the project's most noise-sensitive receptor, and thus not significant, development of the proposed modified project would not result in any noteworthy public benefits.

RESPONSE TO COMMENTS

Staff received no comments relating to **Noise and Vibration**.

CONCLUSIONS

Staff concludes that the PSEGS project, if built and operated in conformance with the existing conditions of certification, would comply with all applicable noise and vibration LORS and would produce no significant direct or cumulative adverse noise impacts on people within the project area, directly or indirectly.

EXISTING CONDITIONS OF CERTIFICATION

All the **Noise and Vibration** conditions of certification remain unchanged (see below).

PUBLIC NOTIFICATION PROCESS

NOISE-1 At least 15 days prior to the start of ground disturbance, the project owner shall notify all residents within one mile of the project site and the linear facilities, by mail or by other effective means, of the commencement of project construction. At the same time, the project owner shall establish a telephone number for use by the public to report any undesirable noise conditions associated with the construction and operation of the project. If the telephone is not staffed 24 hours a day, the project owner shall include an automatic answering feature, with date and time stamp recording, to answer calls when the phone is unattended. This telephone number shall be posted at the project site during construction where it is visible to passersby. This telephone number shall be maintained until the project has been operational for at least one year.

Verification: Prior to ground disturbance, the project owner shall transmit to the compliance project manager (CPM) a statement, signed by the project owner's project manager, stating that the above notification has been performed and describing the method of that notification. This communication shall also verify that the telephone number has been established and posted at the site, and shall provide that telephone number.

NOISE COMPLAINT PROCESS

NOISE-2 Throughout the construction and operation of the project, the project owner shall document, investigate, evaluate, and attempt to resolve all project-related noise complaints. The project owner or authorized agent shall:

- use the Noise Complaint Resolution Form (below), or a functionally equivalent procedure acceptable to the CPM, to document and respond to each noise complaint;
- attempt to contact the person(s) making the noise complaint within 24 hours;
- conduct an investigation to determine the source of noise in the complaint;
- if the noise is project related, take all feasible measures to reduce the source of the noise; and
- submit a report documenting the complaint and actions taken. The report shall include: a complaint summary, including the final results of noise

reduction efforts and, if obtainable, a signed statement by the complainant stating that the noise problem has been resolved to the complainant's satisfaction.

Verification: Within five days of receiving a noise complaint, the project owner shall file a Noise Complaint Resolution Form, shown below, with both the local jurisdiction and the CPM that documents the resolution of the complaint. If mitigation is required to resolve the complaint and the complaint is not resolved within a three-day period, the project owner shall submit an updated Noise Complaint Resolution Form when the mitigation is performed and complete.

EMPLOYEE NOISE CONTROL PROGRAM

NOISE-3 The project owner shall submit to the CPM for review and approval a noise control program. The noise control program shall be used to reduce employee exposure to high (above permissible) noise levels during construction in accordance to the applicable OSHA and Cal-OSHA standards.

Verification: At least 30 days prior to the start of ground disturbance, the project owner shall submit the noise control program to the CPM. The project owner shall make the program available to Cal-OSHA upon request.

NOISE RESTRICTIONS

NOISE-4 The project design and implementation shall include appropriate noise mitigation measures adequate to ensure that the operation of the project will not cause the noise levels due to plant operation alone, during the daytime hours of 7 a.m. to 10 p.m., to exceed an average of 48 dBA L_{eq} measured at or near monitoring location LT1.

No new pure-tone components shall be caused by the project. No single piece of equipment shall be allowed to stand out as a source of noise that draws legitimate complaints[3].

A. When the project first achieves a sustained output of 85 percent or greater of rated capacity, the project owner shall conduct a 25-hour community noise survey at monitoring location LT1, or at a closer location acceptable to the CPM. This survey shall also include measurement of one-third octave band sound pressure levels to ensure that no new pure-tone noise components have been caused by the project.

[3] A legitimate complaint refers to a complaint about noise that is caused by the PSEGS project as opposed to another source (as verified by the CPM). A legitimate complaint constitutes a violation by the project of any noise condition of certification (as confirmed by the CPM), which is documented by an individual or entity affected by such noise.

The measurement of power plant noise for the purposes of demonstrating compliance with this Condition of Certification may alternatively be made at a location, acceptable to the CPM, closer to the plant (e.g., 400 feet from the plant boundary) and this measured level then mathematically extrapolated to determine the plant noise contribution at the affected residence. The character of the plant noise shall be evaluated at the affected receptor locations to determine the presence of pure tones or other dominant sources of plant noise.

B. If the results from the noise survey indicate that the power plant noise at the affected receptor site exceeds the above value during the above time period, mitigation measures shall be implemented to reduce noise to a level of compliance with this limit.

C. If the results from the noise survey indicate that pure tones are present, mitigation measures shall be implemented to eliminate the pure tones.

Verification: The survey shall take place within 30 days of the project first achieving a sustained output of 85 percent or greater of rated capacity. Within 15 days after completing the survey, the project owner shall submit a summary report of the survey to the CPM. Included in the survey report shall be a description of any additional mitigation measures necessary to achieve compliance with the above listed noise limit and a schedule, subject to CPM approval, for implementing these measures. When these measures are in place, the project owner shall repeat the noise survey.

Within 15 days of completion of the new survey, the project owner shall submit to the CPM a summary report of the new noise survey, performed as described above and showing compliance with this condition.

OCCUPATIONAL NOISE SURVEY

NOISE-5 Following the project’s attainment of a sustained output of 85 percent or greater of its rated capacity, the project owner shall conduct an occupational noise survey to identify any noise hazardous areas in the facility.

The survey shall be conducted by a qualified person in accordance with the provisions of Title 8, California Code of Regulations, sections 5095-5099 (Article 105) and Title 29, Code of Federal Regulations, section 1910.95. The survey results shall be used to determine the magnitude of employee noise exposure.

The project owner shall prepare a report of the survey results and, if necessary, identify mitigation measures to be employed in order to comply with the applicable California and federal regulations.

Verification: Within 30 days after completing the survey, the project owner shall submit the noise survey report to the CPM. The project owner shall make the report available to OSHA and Cal-OSHA upon request.

CONSTRUCTION RESTRICTIONS

NOISE-6 Heavy equipment operation and noisy construction work relating to any project features within one-quarter of a mile of an existing residence shall be restricted to the times delineated below, unless a special permit has been issued by the County of Riverside:

Mondays through Fridays:

June through September:	6 a.m. to 7 p.m.
October through May:	6 a.m. to 6 p.m.

Saturdays:

9 a.m. to 5 p.m.

Sundays and Federal holidays:

No Construction Allowed

Haul trucks and other engine-powered equipment shall be equipped with adequate mufflers. Haul trucks shall be operated in accordance with posted speed limits. Truck engine exhaust brake use shall be limited to emergencies.

Verification: Prior to ground disturbance, the project owner shall transmit to the CPM a statement acknowledging that the above restrictions will be observed throughout the construction of the project.

NOISE-7 If a traditional high-pressure steam blow process is used, the project owner shall equip steam blow piping with a temporary silencer that quiets the noise of steam blows to no greater than 89 dBA measured at a distance of 100 feet. The steam blows shall be conducted between 8:00 a.m. and 5:00 p.m. unless arranged with the CPM such that off-site impacts will not cause annoyance to receptors. If a low-pressure continuous steam blow process is used, the project owner shall submit to the CPM a description of the process, with expected noise levels and planned hours of steam blow operation.

Verification: At least 15 days prior to the first steam blow, the project owner shall notify all residents or business owners within one mile of the project site boundary. The notification may be in the form of letters, phone calls, fliers, or other effective means as approved by the CPM. The notification shall include a description of the purpose and nature of the steam blow(s), the planned schedule, expected sound levels, and explanation that it is a one-time activity and not part of normal plant operation.

REFERENCES

Palen 2012a – Palen Solar Holdings, LLC/Galati Blek, Scott Galati (TN 68910). Palen Solar Holdings LLC's Petition for Amendment, dated December 17, 2012. Submitted to CEC/C. Stora on December 18, 2012.

Riverside County 2007 – Riverside County General Plan, Noise Element.

Riverside County 2008 – Riverside County Municipal Code, Noise Ordinance, Title 9, Chapter 9.52 Noise Regulation.

Solar Millennium 2009a – Solar Millennium (TN 52937). Application for Certification Vol. 1 & 2, dated 8/24/2009.

EXHIBIT 1 - NOISE COMPLAINT RESOLUTION FORM

Palen Solar Electric Generating System
(09-AFC-7C)

NOISE COMPLAINT LOG NUMBER ___________________________

Complainant's name and address:

Phone number: ___________________________

Date complaint received: ___________________________
Time complaint received: ___________________________

Nature of noise complaint:

Definition of problem after investigation by plant personnel:

Date complainant first contacted: ___________________________

Initial noise levels at 3 feet from noise source __________ dBA Date: ____________

Initial noise levels at complainant's property: ___________ dBA Date: ____________

Final noise levels at 3 feet from noise source: __________ dBA Date: ____________

Final noise levels at complainant's property: ____________ dBA Date: ____________

Description of corrective measures taken:

Complainant's signature: ___________________________ Date: _____________

Approximate installed cost of corrective measures: $ _____________
Date installation completed: _____________
Date first letter sent to complainant: _____________ (copy attached)
Date final letter sent to complainant: _____________ (copy attached)

This information is certified to be correct:

Plant Manager's Signature: ___________________________

(Attach additional pages and supporting documentation, as required).

NOISE APPENDIX A –
FUNDAMENTAL CONCEPTS OF COMMUNITY NOISE

To describe noise environments and to assess impacts on noise sensitive area, a frequency weighting measure, which simulates human perception, is customarily used. It has been found that A-weighting of sound intensities best reflects the human ear's reduced sensitivity to low frequencies and correlates well with human perceptions of the annoying aspects of noise. The A-weighted decibel scale (dBA) is cited in most noise criteria. Decibels are logarithmic units that conveniently compare the wide range of sound intensities to which the human ear is sensitive. **Noise Table A1** provides a description of technical terms related to noise.

Noise environments and consequences of human activities are usually well represented by an equivalent A-weighted sound level over a given time period (L_{eq}), or by average day and night A-weighted sound levels with a nighttime weighting of 10 dBA (L_{dn}). Noise levels are generally considered low when ambient levels are below 45 dBA, moderate in the 45 to 60 dBA range, and high above 60 dBA. Outdoor day-night sound levels vary over 50 dBA depending on the specific type of land use. Typical L_{dn} values might be 35 dBA for a wilderness area, 50 dBA for a small town or wooded residential area, 65 to 75 dBA for a major metropolis downtown (e.g., San Francisco), and 80 to 85 dBA near a freeway or airport. Although people often accept the higher levels associated with very noisy urban residential and residential-commercial zones, they nevertheless are considered to be levels of noise adverse to public health.

Various environments can be characterized by noise levels that are generally considered acceptable or unacceptable. Lower levels are expected in rural or suburban areas than what would be expected for commercial or industrial zones. Nighttime ambient levels in urban environments are about 7 decibels lower than the corresponding average daytime levels. The day-to-night difference in rural areas away from roads and other human activity can be considerably less. Areas with full-time human occupation that are subject to nighttime noise, which does not decrease relative to daytime levels, are often considered objectionable. Noise levels above 45 dBA at night can result in the onset of sleep interference effects. At 70 dBA, sleep interference effects become considerable (Effects of Noise on People, U.S. Environmental Protection Agency, December 31, 1971).

In order to help the reader understand the concept of noise in decibels (dBA), **Noise Table A2** has been provided to illustrate common noises and their associated sound levels, in dBA.

Noise Table A1 –
Definition of Some Technical Terms Related to Noise

Terms	Definitions
Decibel, dB	A unit describing the amplitude of sound, equal to 20 times the logarithm to the base 10 of the ratio of the pressure of the sound measured to the reference pressure, which is 20 micropascals (20 micronewtons per square meter).
Frequency, Hz	The number of complete pressure fluctuations per second above and below atmospheric pressure.
A-Weighted Sound Level, dBA	The sound pressure level in decibels as measured on a sound level meter using the A-weighting filter network. The A-weighting filter de-emphasizes the very low and very high frequency components of the sound in a manner similar to the frequency response of the human ear and correlates well with subjective reactions to noise. All sound levels in this testimony are A-weighted.
L_{10}, L_{50}, & L_{90}	The A-weighted noise levels that are exceeded 10%, 50%, and 90% of the time, respectively, during the measurement period. L_{90} is generally taken as the background noise level.
Equivalent Noise Level, L_{eq}	The energy average A-weighted noise level during the noise level measurement period.
Community Noise Equivalent Level, CNEL	The average A-weighted noise level during a 24-hour day, obtained after addition of 4.8 decibels to levels in the evening from 7 p.m. to 10 p.m., and after addition of 10 decibels to sound levels in the night between 10 p.m. and 7 a.m.
Day-Night Level, L_{dn} or DNL	The Average A-weighted noise level during a 24-hour day, obtained after addition of 10 decibels to levels measured in the night between 10 p.m. and 7 a.m.
Ambient Noise Level	The composite of noise from all sources, near and far. The normal or existing level of environmental noise at a given location.
Intrusive Noise	That noise that intrudes over and above the existing ambient noise at a given location. The relative intrusiveness of a sound depends upon its amplitude, duration, frequency, and time of occurrence and tonal or informational content as well as the prevailing ambient noise level.
Pure Tone	A pure tone is defined by the Model Community Noise Control Ordinance as existing if the one-third octave band sound pressure level in the band with the tone exceeds the arithmetic average of the two contiguous bands by 5 decibels (dB) for center frequencies of 500 Hz and above, or by 8 dB for center frequencies between 160 Hz and 400 Hz, or by 15 dB for center frequencies less than or equal to 125 Hz.

Source: Guidelines for the Preparation and Content of Noise Elements of the General Plan, Model Community Noise Control Ordinance, California Department of Health Services 1976, 1977.

Noise Table A2 –
Typical Environmental and Industry Sound Levels

Noise Source (at distance)	A-Weighted Sound Level in Decibels (dBA)	Noise Environment	Subjective Impression
Civil Defense Siren (100')	140-130		Pain Threshold
Jet Takeoff (200')	120		Very Loud
Very Loud Music	110	Rock Music Concert	
Pile Driver (50')	100		
Ambulance Siren (100')	90	Boiler Room	
Freight Cars (50')	85		
Pneumatic Drill (50')	80	Printing Press Kitchen with Garbage Disposal Running	Loud
Freeway (100')	70		Moderately Loud
Vacuum Cleaner (100')	60	Data Processing Center Department Store/Office	
Light Traffic (100')	50	Private Business Office	
Large Transformer (200')	40		Quiet
Soft Whisper (5')	30	Quiet Bedroom	
	20	Recording Studio	
	10		Threshold of Hearing

Source: Handbook of Noise Measurement, Arnold P.G. Peterson, 1980

SUBJECTIVE RESPONSE TO NOISE

The adverse effects of noise on people can be classified into three general categories:

- Subjective effects of annoyance, nuisance, dissatisfaction.
- Interference with activities such as speech, sleep, and learning.
- Physiological effects such as anxiety or hearing loss.

The sound levels associated with environmental noise, in almost every case, produce effects only in the first two categories. Workers in industrial plants can experience noise effects in the last category. There is no completely satisfactory way to measure the subjective effects of noise, or of the corresponding reactions of annoyance and dissatisfaction, primarily because of the wide variation in individual tolerance of noise.

One way to determine a person's subjective reaction to a new noise is to compare the level of the existing (background) noise, to which one has become accustomed, with the level of the new noise. In general, the more the level or the tonal variations of a new noise exceed the previously existing ambient noise level or tonal quality, the less acceptable the new noise will be, as judged by the exposed individual.

With regard to increases in A-weighted noise levels, knowledge of the following relationships can be helpful in understanding the significance of human exposure to noise.

1. Except under special conditions, a change in sound level of one dB cannot be perceived.

2. Outside of the laboratory, a 3 dB change is considered a barely noticeable difference.

3. A change in level of at least 5 dB is required before any noticeable change in community response would be expected.

4. A 10 dB change is subjectively heard as an approximate doubling in loudness and almost always causes an adverse community response. (Kryter, Karl D., The Effects of Noise on Man, 1970).

COMBINATION OF SOUND LEVELS

People perceive both the level and frequency of sound in a non-linear way. A doubling of sound energy (for instance, from two identical automobiles passing simultaneously) creates a 3 dB increase (i.e., the resultant sound level is the sound level from a single passing automobile plus 3 dB). The rules for decibel addition used in community noise prediction are:

Noise Table A3 –
Addition of Decibel Values

When two decibel values differ by:	Add the following amount to the larger value
0 to 1 dB	3 dB
2 to 3 dB	2 dB
4 to 9 dB	1 dB
10 dB or more	0
Figures in this table are accurate to ± 1 dB.	

Source: Architectural Acoustics, M. David Egan, 1988.

SOUND AND DISTANCE

Doubling the distance from a noise source reduces the sound pressure level by 6 dB.

Increasing the distance from a noise source 10 times reduces the sound pressure level by 20 dB.

WORKER PROTECTION

OSHA noise regulations are designed to protect workers against the effects of noise exposure, and list permissible noise level exposure as a function of the amount of time to which the worker is exposed:

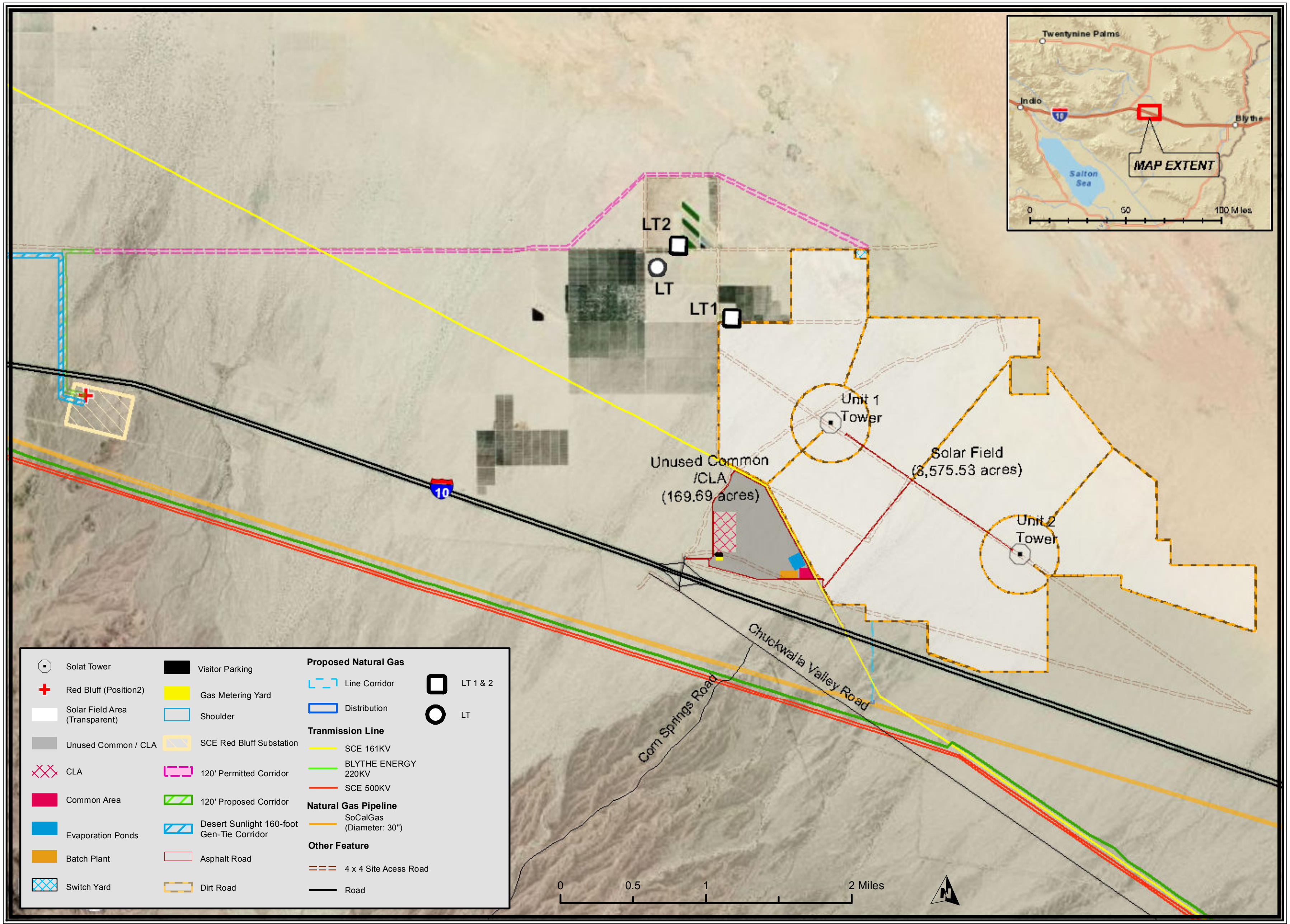
**Noise Table A4 –
OSHA Worker Noise Exposure Standards**

Duration of Noise (Hrs/day)	A-Weighted Noise Level (dBA)
8.0	90
6.0	92
4.0	95
3.0	97
2.0	100
1.5	102
1.0	105
0.5	110
0.25	115

Source: 29 CFR § 1910.95.

NOISE AND VIBRATION - FIGURE 1

Palen Solar Electric Generating System - Facility Boundary Map



NOISE AND VIBRATION

CALIFORNIA ENERGY COMMISSION, SITING, TRANSMISSION AND ENVIRONMENTAL PROTECTION DIVISION

SOURCE: 09 - AFC - 07 - Facility Boundary Map - Figure 2.1-3, BrightSource, OpenStreetMap 2013, BING Aerial

PUBLIC HEALTH

Testimony of Huei-An (Ann) Chu, Ph.D.

SUMMARY OF CONCLUSIONS

California Energy Commission (Energy Commission) staff (staff) analyzed potential public health risks associated with construction and operation of the modified Palen Solar Electric Generating System (PSEGS) and does not expect any significant adverse cancer, or short- or long-term noncancer health effects from project toxic air emissions. Staff's analysis of potential health impacts from the proposed site configuration of the PSEGS was based on a conservative health protective methodology that accounts for impacts to the most sensitive individuals in a given population, including newborns and infants. According to the results of staff's health risk assessment, emissions from PSEGS would not contribute significantly to morbidity or mortality in any age or ethnic group residing in the project area.

With the incorporation of the existing Condition of Certification **PUBLIC HEALTH-1**, the proposed facility would not present a significant health risk to the public. Staff concludes that construction and operation of the PSEGS would be in compliance with all applicable LORS regarding long-term and short-term project impacts in the area of **Public Health**.

INTRODUCTION

On December 17, 2012, Palen Solar Holdings, LLC (PSH), filed a petition with the Energy Commission requesting to modify the approved Palen Solar Power Project (PSPP) and rename the project the Palen Solar Electric Generating System. PSPP was approved as a 500-megawatt (MW) solar thermal power-generating facility utilizing parabolic trough technology. The project owner has requested to amend the approved facility by replacing the approved parabolic trough with BrightSource's solar power tower technology.

The purpose of this Final Staff Assessment (FSA) is to determine if emissions of toxic air contaminants (TACs) from the proposed PSEGS project would have the potential to cause significant adverse public health impacts or to violate standards for public health protection. If potentially significant health impacts are identified, staff would evaluate mitigation measures to reduce such impacts to insignificant levels.

In addition to the analysis contained in this **PUBLIC HEALTH** Section that focuses on potential effects to the public from emissions of toxic air contaminants, other related aspects to the assessment of potential public health and safety impacts from PSEGS are considered elsewhere in this document as listed and briefly described below:

- <u>Air Quality</u> - evaluates the expected air quality impacts from the emissions of criteria air pollutants from both the construction and operation of the PSEGS project; criteria air pollutants are defined as air contaminants for which the state and/or federal governments have established an ambient air quality standard to protect public health;

- Hazardous Materials Management - evaluates the potential impacts on public and worker health from accidental releases of hazardous materials;
- Socioeconomics and Environmental Justice - evaluates project-induced changes on community services including law enforcement and hospitals;
- Soil and Water Resources - evaluates the potential for PSEGS to cause contamination of soil and water resources, to exacerbate flooding, and to cause adverse effects to water supply in consideration of other existing users and projected needs;
- Transmission Line Safety and Nuisance - evaluates potential effects associated with proposed transmission lines accounting for both the physical presence of the lines and the physical interactions of their electric and magnetic fields; The potential effects include aviation safety, interference with radio-frequency communication, audible noise, fire hazards, hazardous shocks, nuisance shocks, and electric and magnetic field (EMF) exposure.
- Worker Safety and Fire Protection - assess the worker safety and fire protection measures proposed by the project owner including determining whether the project would have any adverse impacts on fire protection and emergency medical services that are also relied upon by the public;
- Waste Management - evaluates issues associated with wastes generated from the proposed modified project construction and operation including ensuring that wastes would be managed in an environmentally safe manner.

METHODOLOGY AND THRESHOLDS FOR DETERMINING ENVIRONMENTAL CONSEQUENCES

METHODOLOGY

The analysis of PSEGS effects must comply with the California Environmental Quality Act (CEQA) which requires that the significance of individual effects be determined by the Lead Agency, in this case the California Energy Commission.

CEQA also requires a list of criteria that are used to determine the significance of identified impacts. A significant impact is defined by CEQA as “a substantial, or potentially substantial, adverse change in any of the physical conditions within the area affected by the project” (State CEQA Guidelines Section 15382).

Thresholds for determining significance in this section are based on Appendix G of the CEQA Guidelines (CCR 2006) and performance standards or thresholds identified by the Energy Commission staff. The analysis includes staff’s evaluation of the environmental effects of the proposed PSEGS on land uses (i.e. rural land and desert around the site).

The **PUBLIC HEALTH** section of this staff assessment discusses toxic emissions to which the public could be exposed during project construction and routine operation. Following the release of toxic contaminants into the air or water, people may come into contact with them through inhalation, dermal contact, or ingestion via contaminated food or water.

Air pollutants for which no ambient air quality standards have been established are called noncriteria pollutants. Unlike criteria pollutants such as ozone, carbon monoxide, sulfur dioxide, or nitrogen dioxide, noncriteria pollutants have no ambient (outdoor) air quality standards that specify levels considered safe for everyone.

Since noncriteria pollutants do not have such standards, a health risk assessment (HRA) is used to determine if people might be exposed to those types of pollutants at unhealthy levels. The standard approach currently used for HRA involves four steps: 1) hazard identification; 2) exposure assessment; 3) dose-response assessment; and 4) risk characterization. These four steps are briefly discussed below (OEHHA, 2003).

First, hazard identification is conducted to determine the potential health effects that could be associated with project emissions. For air toxics sources, the main purpose is to identify whether or not a hazard exists. If this hazard exists, staff evaluates the exact toxic air contaminant(s) of concern and whether a TAC is a potential human carcinogen or is associated with other types of adverse health effects.

Second, an exposure assessment is conducted to estimate the extent of public exposure to project emissions, including: (1) the worst-case concentrations of project emissions in the environment using dispersion modeling; and (2) the amounts of pollutants that people could be exposed to through inhalation, ingestion, and dermal contact. Therefore, this step involves emissions quantification, modeling of environmental transport and dispersion, evaluation of environmental fate, identification of exposure routes, identification of exposed populations and sensitive subpopulations, and estimation of short-term and long-term exposure levels.

Third, a dose-response assessment is conducted to characterize the relationship between exposure to an agent and incidence of an adverse health effect in exposed populations. The assumptions and methodologies of dose-response assessment are different between cancer and noncancer health effects. In carcinogenic risk assessment, the dose-response relationship is expressed in terms of a potency (or slope) factor that is used to calculate the probability of getting cancer associated with an estimated exposure. It is assumed in cancer risk assessments that risk is directly proportional to dose and that there is no threshold for carcinogenesis below which there is no risk. In non-carcinogenic risk assessment, dose-response data developed from animal or human studies are used to develop acute and chronic noncancer Reference Exposure Levels (RELs). The acute and chronic RELs are defined as the concentration at which no adverse noncancer health effects are anticipated. Unlike cancer health effects, noncancer acute and chronic health effects are generally assumed to have thresholds for adverse effects. In other words, acute or chronic injury from a TAC would not occur until exposure to the pollutant has reached or exceeded a certain concentration (i.e., threshold).

Finally, risk characterization is conducted to integrate the health effects and public exposure information and to provide quantitative estimates of health risks resulting from project emissions. Staff characterizes potential health risks by comparing worst-case exposure to safe standards based on known health effects.

Staff conducts its public health analysis by evaluating and then adopting the information and data provided in the petition by the project owner. Staff also relies upon the expertise of the California Environmental Protection Agency (Cal/EPA) Office of Environmental Health Hazard Assessment (OEHHA) to: (1) identify contaminants that are known to the state to cause cancer or other noncancer health effects; and (2) identify the toxicity and cancer potency factors of these contaminants. Staff relies upon the expertise of the California Air Resources Board (ARB) and the local air districts to conduct ambient air monitoring of toxic air contaminants and the California Department of Public Health to conduct epidemiological investigations into the impacts of pollutants on communities. It is not within the purview or the expertise of the Energy Commission staff to duplicate the expertise and statutory responsibility of these agencies.

Initially, a screening level risk assessment is performed using simplified assumptions that are intentionally biased toward protection of public health. That is, an analysis is designed that overestimates public health impacts from exposure to project emissions. In reality, it is likely that the actual risks from the power plant would be much lower than the risks as estimated by the screening level assessment. The risks for screening purposes are based on examining conditions that would lead to the highest, or worst-case, risks and then using those conditions in the study. Such conditions include:

- using the highest levels of pollutants that could be emitted from the plant;
- assuming weather conditions that would lead to the maximum ambient concentration of pollutants;
- using the type of air quality computer model which predicts the greatest plausible impacts;
- calculating health risks at the location where the pollutant concentrations are estimated to be the highest;
- assuming that an individual's exposure to cancer and noncancer-causing agents occurs continuously for 70 years; and
- using health-based standards designed to protect the most sensitive members of the population (i.e., the young, elderly, and those with respiratory illnesses).

A screening level risk assessment would, at a minimum, include the potential health effects from inhaling hazardous substances. Some facilities may also emit certain substances that could present a health hazard from noninhalation pathways of exposure (OEHHA 2003, Tables 5.1, 6.3, 7.1). When these multi-pathway substances are present in facility emissions, the screening level analysis includes the following additional exposure pathways: soil ingestion, dermal exposure, and mother's milk (OEHHA 2003, p. 5-3).

The health risk assessment process for this project addresses three categories of health impacts: (1) acute (short-term) health effects; (2) chronic (long-term) noncancer effects; and (3) cancer risk (also long-term).

Acute Noncancer Health Effects

Acute health effects are those that result from short-term (one-hour) exposure to relatively high concentrations of pollutants. Such effects are temporary in nature and include symptoms such as irritation of the eyes, skin, and respiratory tract.

Chronic Noncancer Health Effects

Chronic noncancer health effects are those that result from long-term exposure to lower concentrations of pollutants. The exposure period is considered to be approximately from 12 percent to 100 percent of a lifetime, or from 8 to 70 years (OEHHA 2003, p. 6-5). Chronic health effects include diseases such as reduced lung function and heart disease.

The analysis for both acute and chronic noncancer health effects compares the maximum project contaminant levels to safe levels called Reference Exposure Levels, or RELs. These are amounts of toxic substances to which even sensitive people can be exposed and suffer no adverse health effects (OEHHA 2003, p. 6-2). These exposure levels are designed to protect the most sensitive individuals in the population, such as infants, the aged, and people suffering from illness or disease which makes them more sensitive to the effects of toxic substance exposure. The Reference Exposure Levels are based on the most sensitive adverse health effect reported in the medical and toxicological literature and include margins of safety. The margin of safety addresses uncertainties associated with inconclusive scientific and technical information available at the time of the analysis and is meant to provide a reasonable degree of protection against hazards that research has not yet identified. The margin of safety is designed to prevent pollution levels that have been demonstrated to be harmful, and to prevent lower pollutant levels that may pose an unacceptable risk of harm, even if the risk is not precisely identified as to nature or degree. Health protection is achieved if the estimated worst-case exposure is below the relevant reference exposure level. In such a case, an adequate margin of safety exists between the predicted exposure and the estimated threshold dose for toxicity.

Exposure to multiple toxic substances may result in health effects that are equal to, less than, or greater than effects resulting from exposure to the individual chemicals. Only a small fraction of the thousands of potential combinations of chemicals have been tested for the health effects of combined exposures. In conformity with the California Air Pollution Control Officers Association (CAPCOA) guidelines, the health risk assessment assumes that the effects of each substance are additive for a given organ system (OEHHA 2003, pp. 1-5, 8-12). Other possible mechanisms due to multiple exposures include those cases where the actions may be synergistic or antagonistic (where the effects are greater or less than the sum, respectively). For these types of substances, the health risk assessment could underestimate or overestimate the risks.

Cancer Risk and Estimation Process

For carcinogenic substances, the health assessment considers the risk of developing cancer and assumes that continuous exposure to the cancer-causing substance occurs over a 70-year lifetime. The risk that is calculated is not meant to project the actual expected incidence of cancer, but rather a theoretical upper-bound number based on worst-case assumptions.

Cancer risk is expressed in terms of chances per million of developing cancer and is a function of the maximum expected pollutant concentration, the probability that a particular pollutant would cause cancer (called *potency or slope factors* and established by OEHHA), and the length of the exposure period. Cancer risks for each carcinogen are added to yield a total cancer risk. The conservative nature of the screening assumptions used means that the actual cancer risks due to project emissions would be considerably lower than those estimated.

The screening analysis is performed to assess worst-case risks to public health associated with the proposed modified project. If the screening analysis were to predict a risk below significance levels, then no further analysis would be necessary and the source would be considered acceptable with regard to carcinogenic effects. However, if the risk were to be above the significance level, then further analysis, using more realistic site-specific assumptions, would be performed to obtain a more accurate estimate of potential public health risks.

SIGNIFICANCE CRITERIA

Energy Commission staff determines the health effects of exposure to toxic emissions based on impacts to the maximally exposed individual (MEI). This is a person hypothetically exposed to project emissions at a location where the highest project-related impacts were calculated using the worst-case assumptions as described above. Since the exposure of MEI would produce the maximum impacts possible around the source, staff uses this risk estimate as a marker for acceptability of the project's impacts.

As described earlier, noncriteria pollutants for this project are evaluated for short-term (acute) and long-term (chronic) noncancer health effects, and cancer (long-term) risk. The significance of project-related health impacts are determined separately for each of these three health effects categories.

Acute and Chronic Noncancer Health Effects

Staff assesses the significance of noncancer health effects by calculating a *hazard index (HI)*. A hazard index is a ratio comparing exposure from facility emissions to the safe exposure level (i.e. Reference Exposure Level, or REL). A ratio of less than 1.0 suggests that the worst-case exposure would be below the limit for safe levels and would thus be insignificant with regard to health effects. The hazard indices for all toxic substances with the same type of health effect are added together to yield a total hazard index for the source. The total hazard index is calculated separately for acute effects and chronic effects. A total hazard index of less than 1.0 would indicate that cumulative worst-case exposures would be less than the reference exposure levels and not lead to significant noncancer health effects. In such cases, noncancer health impacts from project emissions would be considered unlikely even for sensitive members of the population. Staff would therefore conclude that there would be no significant noncancer project-related public health impacts. This assessment approach is consistent with risk management guidelines of both California OEHHA and U.S. EPA.

Cancer Risk

Staff relies upon regulations implementing the provisions of Proposition 65, the Safe Drinking Water and Toxic Enforcement Act of 1986, (Health & Safety Code, §§25249.5 et seq.) for guidance to determine a cancer risk significance level. Title 22, California Code of Regulations section 12703(b) states that "the risk level which represents no significant risk shall be one which is calculated to result in one excess case of cancer in an exposed population of 100,000, assuming lifetime exposure." This level of risk is equivalent to a cancer risk of 10 in 1 million, which is also written as 10×10^{-6}. In other words, under state regulations, an incremental cancer risk greater than 10 in 1 million from a project should be regarded as suggesting a potentially significant carcinogenic impact on public health. The 10 in 1 million risk level is also used by the Air Toxics "Hot Spots" (AB 2588) program as the public notification threshold for air toxic emissions from existing sources.

An important distinction between staff's and the Proposition 65 risk characterization approach is that the Proposition 65 significance level applies separately to each cancer-causing substance, whereas staff determines significance based on the total risk from all cancer-causing chemicals. Thus, the manner in which the significance level is applied by staff is more conservative (health-protective) than the manner applied by Proposition 65. The significant risk level of 10 in 1 million is consistent with the level of significance adopted by the South Coast Air Quality Management District (SCAQMD) in Rule 1401 (Solar Millennium 2009a, Section 5.10.1.3).

As noted earlier, the initial risk analysis for a project is typically performed at a screening level, which is designed to overstate actual risks, so that health protection could be ensured. Staff's analysis also addresses potential impacts on all members of the population including the young, the elderly, and people with existing medical conditions that may make them more sensitive to the adverse effects of toxic air contaminants and any minority or low-income populations that are likely to be disproportionately affected by impacts. To accomplish this goal, staff uses the most current acceptable public health exposure levels (both acute and chronic) set to protect the public from the effects of air toxics being analyzed. When a screening analysis shows cancer risks to be above the significance level, refined assumptions would be applied for what would likely be a lower, more realistic risk estimate. If, after refined assumptions, the project's risk is still found to exceed the significance level of 10 in 1 million, staff would require appropriate measures to reduce the risk to less than significance levels. If, after all feasible risk reduction measures have been considered and a refined analysis still identifies a cancer risk greater than 10 in 1 million, staff would deem such risk to be significant and would not recommend project approval.

LAWS, ORDINANCES, REGULATIONS, AND STANDARDS

Public Health Table 1
Laws, Ordinances, Regulations, and Standards (LORS)

Applicable LORs	Description
Federal	
Clean Air Act section 112 (Title 42, U.S. Code section 7412)	This act requires new sources that emit more than 10 tons per year of any specified Hazardous Air Pollutant (HAP) or more than 25 tons per year of any combination of HAPs to apply Maximum Achievable Control Technology.
State	
California Health and Safety Code section 25249.5 et seq. (Proposition 65)	These sections establish thresholds of exposure to carcinogenic substances above which Proposition 65 exposure warnings are required.
California Health and Safety Code section 41700	This section states that “no person shall discharge from any source whatsoever such quantities of air contaminants or other material which cause injury, detriment, nuisance, or annoyance to any considerable number of persons or to the public, or which endanger the comfort, repose, health, or safety of any such persons or the public, or which cause, or have a natural tendency to cause injury or damage to business or property.”
California Health and Safety Code Sections 44300 et seq.	Air Toxics Hot Spots Program requires participation in the inventory and reporting program at the local air pollution control district level.
California Health and Safety Code Sections 44360 - 44366	Air Toxics Hot Spots Information and Assessment Act requires that based on results of an HRA conducted per ARB/OEHHA guidelines, toxic contaminants do not exceed acceptable levels.
California Public Resource Code section 25523(a); Title 20 California Code of Regulations (CCR) section 1752.5, 2300–2309 and Division 2 Chapter 5, Article 1, Appendix B, Part (1); California Clean Air Act, Health and Safety Code section 39650, et seq.	These regulations require a quantitative health risk assessment for new or modified sources, including power plants that emit one or more toxic air contaminants (TACs).
Local	
South Coast Air Quality Management District (SCAQMD) Rule 402	Prohibits the discharge of air contaminants or other material which cause injury, detriment, nuisance, or annoyance to the public; endanger the comfort, repose, health or safety of the public; or cause injury or damage to business or property.
SCAQMD Rule 1401	Discusses new source review for air toxics; specifies limits for maximum individual cancer risk, cancer burden, and noncancer acute and chronic hazard index from new permit units, relocations, or modifications to existing permit units which emit toxic air contaminants listed in Table I of the rule.
SCAQMD Rule 1470	Establishes fuel requirements, operating requirements and emission standards for stationary diesel-fueled internal combustion engines greater than 50 brake-horsepower.

PROPOSED MODIFIED PROJECT

The modification of PSEGS includes replacing the parabolic trough solar collection system and associated heat transfer fluid (HTF) with solar tower technology. The solar tower technology would create steam to run an electricity generator by using a field of heliostats—elevated mirrors, each approximately 12 feet tall, mounted on pylons and guided by a sun-tracking system—to focus the sun's rays on a solar receiver steam generator (SRSG) on top of a 750-foot solar tower located near the center of each of two solar fields. The modified PSEGS would be comprised of two adjacent solar fields and associated facilities with a total combined nominal output of approximately 500 MW. The project owner proposes to develop the PSEGS in two operational units, each consisting of one solar field, one tower, and a power block capable of producing approximately 250 MW of electricity.

In summary, the primary modifications to the already-approved PSPP needed for PSEGS related to Public Health are as follows:

- Two 250-MW power-generating units, each consisting of a dedicated field of approximately 85,000 heliostats, a 750-foot solar tower and receiver, a power block, a natural-gas fired auxiliary boiler, a natural gas-fired night preservation boiler, a diesel-fired emergency fire pump system, a diesel-fired emergency electric generator system, and a wet surface air condenser unit;
- An approximately 15-acre common facilities area located in the southwestern corner of the site, with an administrative/warehouse building and two 2-acre evaporation ponds (reduced from four 2-acre evaporation ponds for the PSPP). Additional equipment to be installed and operated include a diesel-fired emergency fire pump system, a diesel-fired emergency electric generator system, mirror washing machines and site support vehicles.
- An approximately 203-acre temporary construction laydown area located in the southwestern portion of the site immediately north of the common facilities area.
- Re-routing of the generation tie-line near the western end of the route and around the newly constructed Red Bluff Substation; the purpose of this re-routing is to align the PSEGS generation tie-line route immediately adjacent to the NextEra Desert Sunlight generation tie-line to minimize crossings over Interstate 10 and to ensure easy entry into the Red Bluff Substation nearest the PSEGS breaker position;
- Elimination of the secondary emergency access road;
- Reduction of the project footprint from 4,366 acres to 3,794 acres;
- Reduction of the amount of grading by 4.3 million cubic yards because the heliostat technology does not require an entirely flat surface;
- An increase in NOx emissions from the use of nighttime preservation and auxiliary boilers.

SETTING AND EXISTING CONDITIONS

This section describes the environment in the vicinity of the proposed modified project site from the public health perspective. Features of the natural environment, such as meteorology and terrain, affect the project's potential for causing impacts on public health. An emissions plume from a facility may affect elevated areas before lower terrain areas, due to a reduced opportunity for atmospheric mixing. Consequently, areas of elevated terrain can often be subjected to increased pollutant impacts. Also, the types of land use near a site influence the surrounding population distribution and density, which, in turn, affects public exposure to project emissions. Additional factors affecting potential public health impacts include existing air quality, existing public health concerns, and environmental site contamination.

SITE AND VICINITY DESCRIPTION

The proposed facility would be located in the Colorado Desert portion of eastern Riverside County, approximately 10 miles east of Desert Center and about 0.5 miles north of Interstate 10. Lands in the vicinity of the project consist predominantly of open desert and agricultural lands. The topography of the site is mostly flat (ranges between 130 and 200 feet above sea level), with elevated terrain beginning to the northeast and southwest within 3-4 miles of the site (Solar Millennium 2009a, Section 2.4.1).

The general population of California includes many sensitive subgroups that may be at greater risk from exposure to emitted pollutants. These sensitive subgroups include the very young, the elderly, and those with existing illnesses. There are no sensitive receptors within a 6-mile buffer zone of the project site. Several residential and worker receptors were identified within the regional area of the project site and are listed in Table 4.1-25 of Supplement Number Two (Palen 2013d, p. 37).

METEOROLOGY

Meteorological conditions, including wind speed, wind direction, and atmospheric stability, affect the extent to which pollutants are dispersed into ambient air and the direction of pollutant transport. This, in turn, affects the level of public exposure to emitted pollutants and associated health risks. When wind speeds are low and the atmosphere is stable, for example, dispersion is reduced and localized exposure may be increased.

This region of Riverside County is characterized by a dry-hot desert climate; summers are hot and dry, winters are moderate with low precipitation, and temperature inversions are strong. The region typically experiences clear skies, two rainy seasons (in winter and late summer), and strong seasonal winds. Winds generally flow from the west and southwest across the region and tend to transport air pollutants from the Los Angeles area into the Mojave Desert Air Basin (MDAB), in which the project is located (Solar Millennium 2009a, section 5.2.2.1).

Atmospheric stability is a measure related to turbulence, or the ability of the atmosphere to disperse pollutants due to convective air movement. Mixing heights (the height above ground level through which the air is well mixed and in which pollutants can be dispersed) are lower during mornings due to temperature inversions and increase during the warmer afternoons. Staff's **AIR QUALITY** section presents more detailed meteorological data.

EXISTING AIR QUALITY

The proposed site is within the South Coast Air Quality Management District (SCAQMD), although it is part of the MDAB. By examining average toxic concentration levels from representative air monitoring sites in the project vicinity with cancer risk factors specific to each contaminant, lifetime cancer risk can be calculated to provide a background risk level for inhalation of ambient air. When examining such risk estimates, staff considers it important to note that the overall lifetime risk of developing cancer for the average female in the United States is about 1 in 3, or 333,333 in 1 million and about 1 in 2, or 500,000 in 1 million for the average male (American Cancer Society, 2011). From 2004 to 2008, the cancer incidence rates in California are 51.28 in 1 million for males and 39.69 for females. Also, for the year 2004, the American Cancer Society estimated that the death rate due to cancer was 23.1 percent, about 1 in 4. From 2004 to 2008, the cancer death rates for California are 19.74 in 1 million for males and 14.34 in 1 million for females (American Cancer Society, 2012).

There are no monitoring stations within the MDAB that measure TACs, and therefore the background cancer risk in the MDAB cannot be determined. The nearest ARB air toxics monitoring station that actively reports values is located in Calexico, approximately 70 miles south of the project site. Staff does not consider this location to be representative of air quality in the area of the proposed site because emissions of toxic substances in Calexico are much greater than emissions in the vicinity of the project. However, data from Calexico serve to show the upper-bound levels of toxic air contaminants found in the general region. In 2008, the background cancer risk calculated by ARB for the Calexico monitoring station was about 135 in 1 million (ARB 2009). The pollutants 1, 3-butadiene and benzene, emitted primarily from mobile sources, accounted together for more than half of the total risk. The risk from 1, 3-butadiene was about 43 in 1 million, while the risk from benzene was about 44 in 1 million. Formaldehyde accounted for about 13 percent of the 2008 average calculated cancer risk based on air toxics monitoring results, with a risk of about 18 in 1 million. Formaldehyde is emitted directly from vehicles and other combustion sources. The risk from hexavalent chromium was about 14 in 1 million, or ~10 percent of the total risk.

The use of reformulated gasoline, beginning in the second quarter of 1996, as well as other toxics reduction measures, have led to a decrease of ambient levels of toxics and associated cancer risk in all areas of California during the past few years. For example, in one large air district, cancer risk was 342 in 1 million based on 1992 data and in 2002, the average inhalation cancer risk decreased to 162 in 1 million (BAAQMD 2004, p. 12). Similar reductions occurred throughout the state's major metropolitan areas.

EXISTING PUBLIC HEALTH CONCERNS

When evaluating a new project, staff sometimes conducts a study and analysis of existing public health issues in the project vicinity. This analysis is prepared in order to identify the current status of respiratory diseases (including asthma), cancer, and childhood mortality rates in the population located near the proposed modified project, which provides a basis on which to evaluate the significance of any additional health impacts from the proposed modified project. Because of the very low population in the immediate vicinity of the project and the fact that no existing health concerns are identified within a 6-mile buffer zone of the project, staff has concluded that an analysis of existing public health issues was not needed.

PSEGS is proposed at a location where the fungus that causes Valley Fever[1] (*Coccidioidomycosis)* may occur naturally. It was reported by the Desert Sun newspaper in a February 23, 2011 article that Riverside County saw an increase in one year in Valley Fever cases, from 67 to 106 cases, which is a 58 percent jump in the number of Valley Fever cases in 2010. The increase might be due to heavy spring rains followed by dry summers and a windy autumn, or because of a change in state reporting in 2010[2] (The Desert Sun, 2011).

ENVIRONMENTAL SITE CONTAMINATION

Site disturbances occur during demolition of existing structures, facility construction from excavation, grading, and earth moving. Such activities have the potential to adversely affect public health through various mechanisms, such as the creation of airborne dust, material being carried off-site through soil erosion, and uncovering buried hazardous substances. The Phase I Environmental Site Assessment conducted for this site in 2009 found no “Recognized Environmental Conditions” per the American Society for Testing and Materials Standards (ASTM) definition. That is, there was no evidence or record of any use, spillage, or disposal of hazardous substances on the site, nor was there any other environmental concern that would require remedial action (Solar Millennium 2009a, Section 5.16.2.3).

To address the possibility that soil contamination would be encountered during construction of the PSEGS, existing condition **WASTE-1** and modified condition **WASTE-2** require a registered professional engineer or geologist to be available during soil excavation and grading to ensure proper handling and disposal of contaminated soil. Staff believes that adherence to current ordinances and to staff’s proposed conditions of certification mentioned above would be adequate to address any soil or groundwater contamination that may exist on this site. See the staff assessment section on **WASTE MANAGEMENT** for a more detailed analysis of this topic.

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[1] Valley Fever is an infection that occurs when the spores of the fungus *Coccidioides immitis* enter human’s through inhalation. When people breathe in these *Coccidioides* spores, they are at risk of developing Valley Fever.

[2] Valley Fever (*Coccidioidomycosis*) became laboratory-reportable in California in 2010 (Hector el al., 2011). California Code of Regulations, Title 17, Section 2505 requires laboratories to report laboratory testing results suggestive of the disease of Valley Fever (*Coccidioidomycosis*) to the local health department. Source: http://www.cdph.ca.gov/HealthInfo/Documents/TITLE_17_SECTION_2505.pdf

ASSESSMENT OF IMPACTS AND DISCUSSION OF MITIGATION

CONSTRUCTION IMPACTS AND MITIGATION

Potential risks to public health during construction may be associated with exposure to toxic substances in contaminated soil disturbed during site preparation (discussed in the “Setting” section above), and diesel exhaust from heavy equipment operation. Criteria pollutant impacts from the operation of heavy equipment and particulate matter from earth moving are examined in staff’s **Air Quality** analysis.

The operation of construction equipment would result in air emissions from diesel-fueled engines. Diesel emissions are generated from sources such as trucks, graders, cranes, welding machines, electric generators, air compressors, and water pumps. Although diesel exhaust contains criteria pollutants such as nitrogen oxides, carbon monoxide, and sulfur oxides, it also includes a complex mixture of thousands of gases and fine particles. These particles are primarily composed of aggregates of spherical carbon particles coated with organic and inorganic substances. Diesel exhaust contains over 40 substances that are listed by the U.S. Environmental Protection Agency (U.S. EPA) as hazardous air pollutants and by the ARB as toxic air contaminants. Diesel exhaust is also characterized by ARB as “particulate matter from diesel-fueled engines.”Exposure to diesel exhaust may cause both short- and long-term adverse health effects. Short-term effects can include increased coughing, labored breathing, chest tightness, wheezing, and eye and nasal irritation. Long-term effects can include increased coughing, chronic bronchitis, reductions in lung function, and inflammation of the lung. Epidemiological studies also strongly suggest a causal relationship between occupational diesel exhaust exposure and lung cancer. Diesel exhaust is listed by the EPA as “likely to be carcinogenic to humans (US. EPA, 2003).”

Based on a number of health effects studies, the Scientific Review Panel (SRP) on Toxic Air Contaminants recommended a <u>chronic</u> REL (see REL discussion in Method of Analysis section above) for diesel exhaust particulate matter of 5 $\mu g/m^3$ and a cancer unit risk factor of $3x10^{-4}$ $(\mu g/m^3)^{-1}$ (SRP 1998, p. 6). (The SRP, established pursuant to California Health and Safety Code section 39670, evaluates the risk assessments of substances proposed for identification as Toxic Air Contaminants by ARB and the Department of Pesticide Regulation [DPR]. The SRP reviews the exposure and health assessment reports and the underlying scientific data upon which the reports are based.) The SRP did not recommend a value for an <u>acute</u> REL since available data in support of a value was deemed insufficient. On August 27, 1998, ARB listed particulate emissions from diesel-fueled engines as a toxic air contaminant and approved SRP’s recommendations regarding health effect levels (OEHHA 2009, Appendix A). In 2000, ARB developed a “Risk Reduction Plan to Reduce Particulate Matter Emissions From Diesel-Fueled Engines and Vehicles” and has been developing regulations to reduce diesel particulate matter emissions since that time.

Construction of the PSEGS, including site preparation, is anticipated to take place over a period of 33 months (Palen 2013d, Section 4.1.6). As noted earlier, assessment of chronic (long-term) health effects assumes continuous exposure to toxic substances over a significantly longer time period, typically from 8 to 70 years.

Applicant Analysis

The project owner conducted a health risk assessment for diesel exhaust from construction activities and the results are listed in the upper portion of **Public Health Table 2**. The project owner did not run the Hotspots Analysis Reporting Program (HARP) model to evaluate construction-related public health impacts, but rather took the maximum three locations from diesel PM modeling and hand calculated the results (Palen 2013p). The maximum modeled annual average concentration of diesel particulate matter at any location calculated by the project owner was 0.041 $\mu g/m^3$. The cancer unit risk value for an assumed 3-year exposure is $9.3x10^{-6}$ per $\mu g/m^3$[3]. This is lower than the cancer unit risk of $3x10^{-4}$ $(\mu g/m^3)^{-1}$ from SRP since the results from SRP are derived for longer-term exposures. The calculated cancer risk is approximately 0.38 in one million[4], which is for below the significance level of 10 in one million (Palen 2013p).

Staff Analysis

Staff also calculated the risk of diesel exhaust from construction activities by assuming an exposure for a 9-year period, which is recommended by OEHHA for short-term exposure (OEHHA, 2003). The cancer risk calculated by staff is approximately 1.58 in one million, which is still below the significance level of 10 in one million. As described above, construction of PSEGS is anticipated to take place over a period of under three years (i.e. 33 months), which is shorter than the 9-year period assumed in the staff's calculations. Therefore, staff's analysis should be regarded as conservative because of the inherently conservative exposure-related assumptions made in the modeling analysis. Staff regards the related conditions of certification in the **AIR QUALITY** section as adequate to ensure that cancer-related public health impacts of diesel exhaust emissions are mitigated during construction to a point where they are not considered significant.

The chronic hazard index for diesel exhaust during construction activities is $8.17x10^{-3}$ as calculated by staff using a chronic noncancer REL of 5 $\mu g/m^3$. This index is lower than the significance level of 1.0. It means that there would be no chronic noncancer impacts from construction activities. The potential levels of criteria pollutants from operation of construction-related equipment are discussed in staff's **AIR QUALITY** section along with mitigation measures and related conditions of certification. The pollutants of most concern in this regard are particulate matter (PM), carbon monoxide (CO), sulfur dioxide (SO_2), and nitrogen dioxide (NO_2).

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[3] The cancer unit risk value of $9.3x10^{-6}$ per $\mu g/m^3$ was calculated by assuming an exposure of 3 years (20 hours per day, 6 days per week, 52 weeks per year). By using this exposure assumption, the lifetime exposure factor could be calculated by the following formula:

The Lifetime Exposure Factor = (3×52×6×20)/(70×52×7×24) =0.031.

The cancer unit risk value then could be calculated by the following formula:

The Cancer Unit Risk Value = The Cancer Unit Risk from SRP × The Lifetime Exposure Factor = $3x10^{-4}$ per $\mu g/m^3$ x0.031=$9.3x10^{-6}$ per $\mu g/m^3$.

[4] The risk of 0.38 in one million was calculated using the following formula:
Cancer Risk = Concentration of Diesel Exhaust × Cancer Unit Risk = 0.041 $\mu g/m^3$ × $9.3x10^{-6}$ per $\mu g/m^3$ = $0.38x10^{-6}$.

Public Health Table 2
Construction Hazard/Risk from Diesel Particulate Matters (DPMs)

	Cancer Unit Risk $(\mu g/m^3)^{-1}$	Cancer Risk (in one million)	Significance Level	Significant?
Project owner's Analysis [a]	9.3×10^{-6}	0.38	10	No
Staff's Analysis [b]	38.7×10^{-6}	1.58	10	No
	Chronic Noncancer REL $(\mu g/m^3)$	**Hazard Index (HI)**		
	5	8.17×10^{-3}	1	No

[a] Assumed for a 3-year exposure period (20 hours per day, 6 days per week, 52 weeks per year). Source: Palen 2013p.
[b] Assumed for a 9-year exposure period.

Mitigation measures are proposed by both the project owner and Air Quality staff to reduce the maximum calculated PM10 and PM2.5 concentrations. These include the use of extensive fugitive dust control measures that are assumed to result in a 50 percent reduction of fugitive dust emissions. In order to mitigate potential impacts from construction-related particulate emissions during the operation of diesel-powered construction equipment, the use of ultra low-sulfur diesel fuel is now required and the installation of an oxidation catalyst and soot filters on diesel equipment is included when possible. The catalyzed diesel particulate filters are passive, self-regenerating filters that reduce particulate matter, carbon monoxide, and hydrocarbon emissions through catalytic oxidation and filtration. The degree of particulate matter reduction is comparable for both mitigation measures in the range of approximately 85% to 92%. Such filters would reduce diesel combustion emissions during construction and further reduce the impacts associated with diesel exhaust. (See the **AIR QUALITY** section of this FSA for staff's proposal to control particulate matter.)

The project owner proposes to use a concrete batch plant during the construction phase of the project. The operation of the concrete batch plant would result in increased TAC emissions during construction as well as increased diesel exhaust and fugitive dust emissions. Emissions of volatile TACs from onsite diesel and gasoline fuel storage would also occur. Staff reviewed the estimated levels of pollutants associated with the concrete batch plant (Galati & Blek 2010i) and has determined that the increased emissions are minimal and would not add significantly to public health impacts during construction. The project owner did not include additional emissions from the concrete batch plant in the HRA. Emissions of TACs from a concrete batch plant usually result in the highest airborne concentrations being close-in. Given the isolated nature of the power plant from residences and commercial operations where the public would congregate for a period of time (as opposed to rapidly moving through the area when traveling on I-10), staff believes that the risks would not be significant to any on-site or off-site receptor.

Construction could disturb a certain percentage of approximately 5,200 acres (Palen 2013d, Section 4.1.1.1) of top soil that could harbor the *Coccidioides* spores possibly exposing humans to the risk of Valley Fever. On-site workers could be exposed from inhaling these fungal spores from wind-blown dust generated from soil excavation construction activities.

To minimize the risk of getting Valley Fever, the Center for Disease Control and Prevention (CDC) recommends the following measures for people such as onsite workers who are at risk of exposure to Valley Fever:

- wear an N95 mask if a person must be in or near a dusty environment, such as a construction zone;
- avoid activities that involve close contact to dust including yard work, gardening, and digging;
- use air quality improvement measures indoors such as HEPA filters;
- take prophylactic anti-fungal medication if deemed necessary by a person's healthcare provider; and
- clean skin injuries well with soap and water, especially if they have been exposed to soil or dust.

The California Department of Public Health (CDPH) also recommends that, "those exposed to dust during their jobs or outside activities in these areas should consider respiratory protection, such as a mask, during such activities." (CDPH, 2010)

The recommendations from CDC and CDPH are all preventive actions, but do not guarantee protection from exposure to Valley Fever. Based on CDC and CDPH's recommendations, staff recommends that project workers in the vicinity of such dust generation areas wet the soil before any excavation activities, wear protective masks and stay indoors during dust storms and close all doors to avoid dust inhalation. Staff also recommends people who live in endemic regions should try to avoid smoky and dusty environments. Staff considers the project owner's dust suppression plans adequate to minimize the risk of the public getting Valley Fever in areas where *Coccidioides* spores are found. Please refer to staff's **WORKER SAFETY AND FIRE PROTECTION** section for more information regarding exposure of the project's workers to Valley Fever.

As for the concerns of Valley Fever affecting the general population, in the **AIR QUALITY** section of this FSA staff recommends some mitigation measures, including **AQ-SC3 (Construction Fugitive Dust Control)** and **AQ-SC4 (Dust Plume Response Requirement)** for the purposes of preventing all fugitive dust plumes from leaving the project boundary. As long as the dust plumes are kept within the project boundary, there won't be any significant concern for Valley Fever adversely affecting the general population and public health.

OPERATION IMPACTS AND MITIGATION

Emissions Sources

The emissions sources at the proposed PSEGS site for both power blocks include two natural gas-fired auxiliary boilers, two natural gas-fired night preservation boilers, two wet surface air condensers (WSAC) units, two diesel-fired emergency electrical generators, two diesel-fired emergency fire pumps, mirror washing machines and site support vehicles. Additional emission sources in the common area include one fire pump engine, one emergency electrical generator, and one mirror washing machine. In summary, a total of 19 emitting units were modeled by the project owner for facility operations, including (Palen 2013d):

- 2 auxiliary boilers
- 2 night preservation boilers
- 8 wet surface air condensers (WSAC) units
- 3 emergency electric generator systems
- 3 emergency fire pump systems
- 1 onsite equipment for mirror washing

In the project owner's "Revised Supplement No. 2, Complete Air Quality & Public Health Sections", emissions of diesel particulate matter (DPM) from mirror washing activities and onsite operations support vehicles were included, and the HRA for facility operations was re-conducted. The project owner also included ammonia emissions in their revised HRA for using selective catalytic reduction (SCR) with the boilers. The following sections present the results of project owner's updated HRA and staff's revised analysis (Palen 2013ff).

As noted earlier, the first step in a health risk assessment is to identify potentially toxic compounds that may be emitted from the facility. Table 4.1-27 of the Supplement Number Two (Palen 2013d) and the revised version (Palen 2013ff) lists toxic air contaminants that may be emitted by the project. **Public Health Table 3** lists each such TAC, their exposure routes and how they would contribute to the total risk obtained from the risk analysis. Toxicity values include RELs which are used to calculate short-term and long-term noncancer health effects, and cancer unit risks, which are used to calculate the lifetime risk of developing cancer, are listed in **Public Health Table 4** (ARB 2011). Emission factors for most TACs were obtained from the U.S. EPA emission factors database (AP-42) and the California Air Toxics Emission Factors (CATEF II) database.

Public Health Table 3
Types of Health Impacts and Exposure Routes Attributed to Toxic Emissions

Substance	Oral Cancer	Oral Noncancer	Inhalation Cancer	Noncancer (Chronic)	Noncancer (Acute)
Acetaldehyde			✔	✔	✔
Acrolein				✔	✔
Ammonia				✔	✔
Benzene			✔	✔	✔
1,3-Butadiene			✔	✔	
Ethylbenzene			✔	✔	
Formaldehyde			✔	✔	✔
Hexane				✔	
Napthalene			✔	✔	
Polycyclic Aromatic Hydrocarbons (PAHs, as BaP)	✔		✔		
Propylene				✔	
Propylene Oxide			✔	✔	✔
Toluene				✔	✔
Xylene				✔	✔
Diesel Exhaust			✔	✔	
Arsenic	✔	✔	✔	✔	✔
Beryllium		✔	✔	✔	
Biphenyl*					
Chromium (Hexavalent)		✔	✔	✔	
Copper					✔
Nickel		✔	✔	✔	✔
Manganese				✔	
Selenium				✔	
Mercury		✔		✔	✔
Zinc*					

*No cancer risk factors or RELs have been established for biphenyl and zinc. Source: ARB 2011

Public Health Table 4
Toxicity Values Used to Characterize Health Risks

Toxic Air Contaminant	Inhalation Cancer Potency Factor $(mg/kg\text{-}d)^{-1}$	Chronic REL ($\mu g/m^3$)	Acute REL ($\mu g/m^3$)
Acetaldehyde	0.010	140	470 (1-hr) 300 (8-hr)
Acrolein	—	0.35	2.5 (1-hr) 0.7 (8-hr)
Ammonia	—	200	3,200
Benzene	0.10	60	1,300
1,3-Butadiene	0.60	20	—
Ethylbenzene	0.0087	2,000	—
Formaldehyde	0.021	9	55 (1-hr) 9 (8-hr)
Hexane	—	7,000	—
Napthalene	0.12	9.0	—
Polycyclic Aromatic Hydrocarbons (PAHs, as BaP)	3.9	—	—
Propylene	—	3000	—
Propylene oxide	0.013	3	3100
Toluene	—	300	37,000
Xylene	—	700	22,000
Diesel Particulate Matter	1.1	5	—
Arsenic	12	0.015	0.2
Beryllium	8.4	0.007	—
Biphenyl*	—	—	—
Chromium (Hexavalent)	510	0.2	—
Copper	—	—	100
Nickel	0.91	0.05	6
Manganese	—	0.09	—
Selenium	—	20	—
Mercury	—	0.03	0.6
Zinc*	—	—	—

*No cancer risk factors or RELs have been established for biphenyl and zinc.
Source: ARB 2011

Emissions Levels

Once potential emissions are identified, the next step is to quantify them by conducting a “worst case” analysis. Maximum hourly emissions are required to calculate acute (one-hour) noncancer health effects, while estimates of maximum emissions on an annual basis are required to calculate cancer and chronic (long-term) noncancer health effects.

The next step in the health risk assessment process is to estimate the ambient concentrations of toxic substances that may result from the project. This is accomplished by using a screening air dispersion model and assuming conditions that result in maximum project impacts. The project owner’s screening analysis was performed using the ARB/OEHHA Hotspots Analysis and Reporting Program modeling program to model operating period public health impacts, version 1.4f (ARB, 2011). Finally, ambient concentrations were used in conjunction with RELs and cancer unit risk factors to estimate health effects which might occur from exposure to facility emissions.

Exposure pathways, or ways in which people might come into contact with toxic substances, include inhalation, dermal (through the skin) absorption, soil ingestion, consumption of locally grown plant foods, and mother's milk.

The above method of assessing health effects is consistent with OEHHA's Air Toxics Hot Spots Program Risk Assessment Guidelines (OEHHA 2003) referred to earlier, and results in the following health risk estimates. In the following sub-sections, staff reviews and summarizes the work of project owner, and evaluated the adequacy of project owner's analysis by conducting another HRA.

Applicant Analysis

The project owner's screening health risk assessment resulted in a maximum acute hazard index of 0.000276 and a maximum chronic hazard index of 0.000683 at the point of maximum impact (PMI). The worst-case cancer risk was found to be 1.08 in one million at the PMI. As **Public Health Table 5** shows, both acute and chronic hazard indices are under the significance level of 1.0, and cancer risk is below the significance level of 10 in 1 million, indicating that no short- or long-term adverse health effects are expected.

Public Health Table 5
Operation Hazard/Risk at Point of Maximum Impact

Type of Hazard/Risk	Hazard Index/Risk	Significance Level	Significant?
Acute Noncancer	0.000276	1.0	No
Chronic Noncancer	0.000683	1.0	No
Individual Cancer	1.08 in 1 million	10 in 1 million	No

Source: Table4.1-29 of project owner's Supplement Number Two – Complete Air Quality and Public Health Sections (Palen 2013ff)

Staff Analysis

To evaluate the project owner's analysis, staff conducted another analysis of cancer risks and acute and chronic hazards due to combustion-related emissions during operation from the proposed PSEGS. The analysis was conducted for the general population, sensitive receptors, nearby residences and the project's work force. The sensitive receptors, as previously noted, are subgroups that may be at greater risk from exposure to emitted pollutants, and include the very young, the elderly, and those with existing respiratory illnesses. Results are shown in **Public Health Table 6**.

Health risks potentially associated with ambient concentrations of carcinogenic pollutants were calculated in terms of excess lifetime cancer risks. The total cancer risk at any specific location is found by summing the contributions from the individual carcinogens. Health risks from noncancer health effects were calculated in terms of hazard index as a ratio of ambient concentration of TACs to RELs for that pollutant.

Cancer Risk at the Point of Maximum Impact (PMI)

The first result of HRA is the numerical cancer risk for the maximally exposed individual (MEI) which is the individual located at the point of maximum impact as well as risks to the MEI at a residence (MEIR). Human health risks associated with emissions from the proposed and similar projects by definition would not be higher at any other location than at the PMI. Therefore, if there is no significant impact associated with concentrations at the PMI location, it can be reasonably assumed that there would not be significant impacts in any other location in the project area. The cancer risk to the MEI at the PMI is referred to as the Maximum Incremental Cancer Risk (MICR). However, the PMI (and thus the MICR) is not necessarily associated with actual exposure because in many cases, the PMI is in an uninhabited area. Therefore, the MICR is generally higher than the maximum residential cancer risk. MICR is based on 24 hours per day, 365 days per year, 70 year lifetime exposure. As shown in **Public Health Table 6**, the total worst-case individual cancer risk calculated by staff is 1.41 in 1 million at the PMI. The PMI is approximately 200 feet west of the project boundary and approximately 250 ft southeast of the project common area. The difference of HRA between the project owners and staff is because the project owner used the Derived (Adjusted) Cancer Risk method to calculate cancer risk while staff used the Derived (OEHHA) Cancer Risk method[5]. As **Public Health Table 6** shows, the cancer risk value at PMI calculated by staff is still below the significance level, 10 in a million, indicating that no significant adverse cancer risk is expected.

Chronic and Acute Hazard Index (HI)

The results of staff's calculations for chronic and acute index reach the same conclusions as the project owner. The screening health risk assessment for the project including emissions from all sources resulted in a maximum chronic Hazard Index (HI) of 6.83×10^{-4} and a maximum acute HI of 8.09×10^{-4}. As **Public Health Table 6** shows, both acute and chronic hazard indices are less than 1.0, indicating that no short- or long-term adverse health effects are expected.

Project-Related Impacts at Area Residences

Several residential and worker receptors were identified by the project owner within the regional area of the project site and were listed in Table 4.1-25 of the Supplement Number Two (Palen 2013d, Section 4.1.12). Staff's specific interest in the risk to the maximally exposed individual in a residential setting (or MEIR) is because this risk most closely represents the maximum project-related lifetime cancer risk. Residential risk is presently assumed by the regulatory agencies to result from exposure lasting 24 hours per day, 365 days per year, over a 70- year lifetime. Residential risks were presented in

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[5] The Derived (OHHHA) Cancer Risk method applies to multipathway risk assessments and is described in detail in the OEHHA Air Toxic Hot Spots Program Guidance Manual for Preparation of Health Risk Assessment (August 2003). In brief, for a multipathway cancer risk assessment, the two dominant (driving) exposure pathways use the high-end point-estimates of exposure, while the remaining exposure pathways use average point estimates listed in the OEHHA HRA Guidance Manual. The Derived (Adjusted) Cancer Risk method is identical to the method used for the Derived (OEHHA) Cancer Risk with one exception. The Derived (Adjusted) method uses the breathing rate at the 80th percentile of exposure rather than the high-end point-estimate when the inhalation pathway is one of the dominant exposure pathways. Source: http://www.arb.ca.gov/toxics/harp/rmpolicyfaq.htm#10

terms of MEIR and HI at residential receptors in **Public Health Table 6**. The cancer risk for MEI of residential receptors, or MEIR, is 0.151 per million, which is below the significance level, indicating that no significant adverse cancer risk is expected. The maximum chronic HI of MEIR is 7.58×10^{-5} and the maximum acute HI is 1.3×10^{-4}. As **Public Health Table 6** shows, both acute and chronic hazard indices are less than 1.0, indicating that no short- or long-term adverse health effects are expected. This MEIR[6] is approximately 1 mile northwest of the project Unit 1 Tower, and just about 300 ft north of the project boundary.

Risk to Workers

Cancer risk to potentially exposed workers was presented in terms of risk to the maximally exposed individual worker (MEIW) at PMI and is also summarized in **Public Health Table 6**. The staff's assessment is for potential workplace risks, due to exposure of shorter duration than for residential risks from 70 years of exposure. Workplace risk is presently assumed by the regulatory agencies to result from exposure lasting 8 hours per day, 245 days per year, over a 40-year period. As shown in **Public Health Table 6**, the cancer risk for workers at MEIW (i.e. 0.214 in 1 million) is below the significance level, indicating that no significant adverse cancer risk is expected.

Risk to Sensitive Receptors

As noted previously, there were no sensitive receptors, such as schools (both public and private), day care facilities, nursing homes, and hospitals, identified within a 6-mile buffer zone of the site (Palen 2013d, Section 4.1.12). Thus, there is no calculation for risk to sensitive receptors.

Public Health Table 6
Results of Staff Analysis: Cancer Risk and Chronic Hazard from PSEGS Operations

Receptor Location	Cancer Risk (per million)	Chronic HI[d]	Acute HI[d]	Significant?
PMI[a]	1.41	6.83×10^{-4}	8.09×10^{-4}	No
Residence MEIR[b]	0.0151	7.58×10^{-5}	1.3×10^{-4}	No
Worker MEIW[c]	0.214	-	-	No
at a Sensitive Receptor	-	-	-	No
Significance level	10	1	1	

[a] PMI = Point of Maximum Impact
[b] MEIR = MEI of residential receptors. Location of the residence of the highest risk with a 70-year residential scenario.
[c] MEIW = MEI for workers. Occupational exposure patterns assuming exposure of 8 hours/day, 245 days/year for 40 years.
[d] HI = Hazard Index

[6]According to Socioeconomics Figure 1 as of April 1, 2010, there were no people counted as part of the Decennial Census, so their residence was either vacant or the occupant did not respond to the census.

In **Public Health Table 6**, it can also be seen that the cancer and noncancer risks from the PSEGS operation would be significantly below their respective significance levels. It means that no health impacts would occur within all segments of the surrounding population. Therefore, staff concludes there is no need for conditions of certification to protect public health, except for Legionella, discussed next.

Wet Surface Air Condensers (WSAC) and Legionella

To conserve water in the site's desert environment, each plant would use an air-cooled condenser for the main steam-cycle. However, a WSAC would be used for auxiliary equipment cooling (Palen 2013d). Since the facility would mainly use dry cooling, there would be no emissions of toxic metals or volatile organic compounds from cooling tower mist or drift. In addition to being a source of potential toxic air contaminants, in particular beryllium and copper due to the project's use of groundwater that contains trace amounts of these substances (Palen 2013d, Table 4.1A-8), the possibility exists for bacterial growth to occur in the eight WSACs (four at each power block) that are part of the project. Legionella is a bacterium that is ubiquitous in natural aquatic environments and is also widely distributed in man-made water systems. It is the principal cause of Legionellosis, otherwise known as Legionnaires' Disease, which is similar to pneumonia. Transmission to people results mainly from inhalation or aspiration of aerosolized contaminated water. Untreated or inadequately treated cooling systems, such as industrial cooling towers and building heating, ventilating, and air conditioning systems, have been correlated with outbreaks of Legionellosis.

Legionella can grow symbiotically with other bacteria and can infect protozoan hosts. This provides Legionella with protection from adverse environmental conditions, including making it more resistant to water treatment with chlorine, biocides, and other disinfectants. Thus, if not properly maintained, cooling water systems and their components can amplify and disseminate aerosols containing Legionella.

The State of California regulates recycled water for use in cooling towers in Title 22, Section 60306, California Code of Regulations. This section requires that, in order to protect workers and the public who may come into contact with cooling tower mists, chlorine or another biocide must be used to treat the cooling system water to minimize the growth of Legionella and other micro-organisms. This regulation does not apply to the PSEGS project since it intends to use well water (not reclaimed water) for cooling purposes (Palen 2013d, Section 4.1.12.9); however, the potential remains for Legionella growth in cooling water at the PSEGS due to nutrients found in groundwater.

The U.S. EPA published an extensive review of Legionella in a human health criteria document (EPA 1999). The U.S. EPA noted that Legionella may propagate in biofilms (collections of microorganisms surrounded by slime they secrete, attached to either inert or living surfaces) and that aerosol-generating systems such as cooling towers can aid in the transmission of Legionella from water to air. The U.S. EPA has inadequate quantitative data on the infectivity of Legionella in humans to prepare a dose-response evaluation. Therefore, sufficient information is not available to support a quantitative characterization of the threshold infective dose of Legionella. Thus, the presence of even small numbers of Legionella bacteria presents a risk, however small, of disease in humans.

In February of 2000 the Cooling Technology Institute (CTI) issued its own report and guidelines for the best practices for control of Legionella (CTI 2000). The CTI found that 40-60 percent of industrial cooling towers tested were found to contain Legionella. More recently, staff has received a 2005 report of testing in cooling towers in Australia that found the rate of Legionella presence in cooling tower waters to be extremely low, approximately 3-6 percent. These cooling towers all had implemented aggressive water treatment and biocide application programs similar to that required by existing condition of certification **PUBLIC HEALTH-1**.

To minimize the risk from Legionella, the CTI recommended: (a) minimization of water stagnation; (b) minimization of process leads into the cooling system that provide nutrients for bacteria; (c) maintenance of overall system cleanliness; (d) application of scale and corrosion inhibitors as appropriate; (e) use of high-efficiency mist eliminators on cooling towers; and (5) the overall general control of microbiological populations.

Good preventive maintenance is very important in the efficient operation of cooling towers and other evaporative equipment (ASHRAE 1998). Preventive maintenance includes having effective drift eliminators, periodically cleaning the system if appropriate, maintaining mechanical components in good working order, and maintaining an effective water treatment program with appropriate biocide concentrations. Staff notes that most water treatment programs are designed to minimize scale, corrosion, and biofouling and not to control Legionella.

The efficacy of any biocide in ensuring that bacterial and in particular Legionella growth, is kept to a minimum is contingent upon a number of factors including, but not limited to, proper dosage amounts, appropriate application procedures and effective monitoring.

In order to ensure that Legionella growth is kept to a minimum, thereby protecting both nearby workers as well as members of the public, staff has proposed Condition of Certification **PUBLIC HEALTH-1** in previous PSA/FSA for PSPP. **PUBLIC HEALTH-1** has already been approved and already existed in the license. The condition requires the project owner to prepare and implement a biocide and anti-biofilm agent monitoring program to ensure that proper levels of biocide and other agents are maintained within the two cooling towers' water at all times, that periodic measurements of Legionella levels are conducted, and that periodic cleaning is conducted to remove bio-film buildup. Staff believes that with the use of an aggressive antibacterial program coupled with routine monitoring and biofilm removal, the chances of Legionella growing and dispersing would be reduced to insignificance. The project owner has stated that an appropriate biocide program and anti-biofilm agent monitoring program would be implemented for the cooling towers (Solar Millennium 2009a, Section 5.10.3.5). Since the condition meets the need of PSEGS, Staff concludes that there is no need to modify **PUBLIC HEALTH-1**.

NON-OPERATION AND FACILITY CLOSURE IMPACTS AND MITIGATION

Closure of the proposed PSEGS would follow a facility closure plan prepared by the project owner and designed to minimize public health and environmental impacts. Staff expects that impacts to public health from the non-operation or facility closure process would represent a fraction of the impacts associated with the construction or operation of the proposed PSEGS. Therefore, based on staff's analysis for the construction and operation phases of this project, staff concludes that public health-related impacts from non-operation or facility closure would be insignificant.

PROJECT-RELATED FUTURE ACTIONS

In order to transmit the power generated at the PSEGS to the electricity grid, a new substation is required. Southern California Edison Company (SCE) is constructing the Red Bluff Substation, which will allow the electricity to be carried by the Devers–Palo Verde No. 1 (DPV1) 500 kV transmission line.

The SCE Red Bluff Substation is expected to be operational in December 2013. Staff concludes that there won't be any overlap of construction phase of SCE Red Bluff Substation and the PSEGS. Therefore, there is no need to discuss the potential impacts of the construction of the SCE Red Bluff Substation. As for the potential impacts of the operation of the SCE Red Bluff Substation, the only health impacts in concern are exposure to electromagnetic fields (EMF) from power transmission and safety concerns for workers. EMF is discussed in the **TRANSMISSION LINE SAFETY AND NUISANCE** section of this FSA. Worker safety is discussed in the **WORKER SAFETY AND FIRE PROTECTION** section of this FSA.

CUMULATIVE IMPACT ANALYSIS

A project may result in a significant adverse cumulative impact where its effects are cumulatively considerable. "Cumulatively considerable" means that the incremental effects of an individual project are significant when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects (California Code of Regulations, Title 14, section 15130).

The geographic scope of analysis for cumulative effects to public health is a 6-mile buffer zone around the project site. This is the same six-mile buffer zone for localized significant cumulative air quality impacts described and evaluated in the **AIR QUALITY** section. Cumulative impacts of the proposed project and other projects within a 6-mile buffer zone were not quantitatively evaluated in the Supplement Number Two (Palen 2013d, Section 4.1.12.12). Staff considered the potential impacts due to construction and operation of the proposed PSEGS with new projects or new "reasonably foreseeable probable future projects" in the area since the original project was approved, and none of them fall within the 6-mile buffer zone. Therefore, staff concludes that there would not be any cumulatively significant impacts associated with public health risks.

COMPLIANCE WITH LORS

Staff has considered the minority population as identified in **Socioeconomics Figure 1** in its impact analysis and has found no potential significant adverse impacts for any receptors, including environmental justice populations. In arriving at this conclusion, staff notes that its analysis complies with all directives and guidelines from the Cal/EPA Office of Environmental Health Hazard Assessment and the ARB. Staff's assessment is biased toward the protection of public health and takes into account the most sensitive individuals in the population. Using extremely conservative (health-protective) exposure and toxicity assumptions, staff's analysis demonstrates that members of the public potentially exposed to toxic air contaminant emissions of this project—including sensitive receptors such as the elderly, infants, and people with pre-existing medical conditions—would not experience any significant chronic or cancer health risk as a result of that exposure. Staff believes that it incorporated every conservative assumption called for by state and federal agencies responsible for establishing methods for analyzing public health impacts. The results of that analysis indicate that there would be no direct or cumulative significant public health and safety impact to any population in the area. Therefore, given the absence of any significant health impacts, there are no disparate health impacts and there are no environmental justice issues associated with **Public Health**. Staff concludes that construction and operation of the PSEGS would be in compliance with all applicable LORS regarding long-term and short-term project impacts in the area of **Public Health**.

NOTEWORTHY PUBLIC BENEFITS

It is noteworthy that a solar electric generating facility such as the proposed PSEGS project would emit significantly less TACs to the environment than other energy sources available in California such as natural gas or biomass, thereby reducing the health risks that would otherwise occur with these non-renewable energy sources. At the same time, the proposed PSEGS would provide much needed electrical power to California residences and businesses, and would contribute to electricity supply. Electrical power is not only necessary to maintain a functioning society, but it also benefits many individuals who rely on powered equipment for their health (such as dialysis equipment and temperature control equipment). For example, it is documented that during heat waves in which elevated air-conditioning use causes an electrical blackout, hospitalizations and deaths due to heat stroke are increased.

Moreover, changing from trough solar collection system to solar tower technology would be more suitable for endemic areas of Valley Fever. This is because the heliostat technology does not require an entirely flat surface and would decrease the disturbance of the top soil.

RESPONSE TO COMMENTS

STATE OF CALIFORNIA, ENERGY RESOURCES CONSERVATION AND DEVELOPMENT COMMISSION/BASIN AND RANGE WATCH, LAURA CUNNINGHAM AND KEVIN EMMERICH, STATUS REPORT NO. 2, TN # 70697, MAY 8, 2013:

Comment: The Intervenor raised concerns in their May 8, 2013 status report regarding air quality and public health during the construction and operational phases of the proposed project to insure air quality impacts don't exceed significant thresholds of PM10/PM2.5 for fugitive and windblown dust.

Response: As for the concerns of Valley Fever on public health, in the **AIR QUALITY** section of this FSA, staff recommends mitigation measures, including **AQ-SC3 (Construction Fugitive Dust Control)** and **AQ-SC4 (Dust Plume Response Requirement)** for the purposes of preventing all fugitive dust plumes from leaving the project boundary. As long as the dust plumes are kept within the project boundary, there won't be any significant concern for Valley Fever adversely affecting public health.

CONCLUSIONS

Staff has analyzed potential public health risks associated with construction and operation of the amended PSEGS and does not expect any significant adverse cancer, short-term, or long-term health effects to any members of the public including low income and minority populations, from project toxic emissions. Staff also concludes that its analysis of potential health impacts from the proposed PSEGS uses a conservative health protective methodology that accounts for impacts to the most sensitive individuals in a given population, including newborns and infants. According to the results of staff's health risk assessment, emissions from the PSEGS project would not contribute significantly to morbidity or mortality in any age or ethnic group residing in the project area. With the incorporation of the existing Condition of Certification **PUBLIC HEALTH-1**, the proposed facility would not present a significant health risk to the public.

PROPOSED CONDITIONS OF CERTIFICATION

Staff recommends the following Condition of Certification for PSEGS, which is essentially identical to the single Condition of Certification recommended for the previously approved PPSP (Note: new text is <u>**bold and underlined)**</u>:

PUBLIC HEALTH-1 The project owner shall develop and implement a Cooling Water Management Plan to ensure that the potential for bacterial growth in cooling water is kept to a minimum. The Plan shall be consistent with either staff's "Cooling Water Management Program Guidelines" or with the Cooling Technology Institute's "Best Practices for Control of Legionella" guidelines but in either case, the Plan must include sampling and testing for the presence of Legionella bacteria at least every six months. After two years of power plant operations, the project owner may ask the <u>**compliance project manager (**</u>CPM<u>**)**</u> to re-evaluate and revise the Legionella bacteria testing requirement.

Verification: At least 60 days prior to the commencement of cooling tower operations, the Cooling Water Management Plan shall be provided to the CPM for review and approval.

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SOCIOECONOMICS

Testimony of Lisa Worrall

SUMMARY OF CONCLUSIONS

California Energy Commission (Energy Commission) staff ("staff") has reviewed the Petition to Amend the Commission Decision for the Palen Solar Power Project (PSPP) in accordance with the requirements of the California Environmental Quality Act (CEQA). The petition proposes to eliminate the use of solar parabolic trough technology approved under the Commission Decision and replace it with BrightSource's LPT solar power tower technology. Staff's analysis considers the changes between the approved project (PSPP) and the amended project, now called the Palen Solar Electric Generating System (PSEGS).

Staff concludes that the construction and operation of the PSEGS would not cause a significant adverse direct or indirect impact on the area's housing, schools, law enforcement services, or parks. The project would not directly or indirectly induce a substantial population growth or displacement of population, or induce substantial increases in demand for housing, parks, or law enforcement services. However, when considered cumulatively with the other proposed and approved projects, temporary lodging may be constrained in the local and regional study areas, thus contributing to a cumulative impact. PSEGS operations would not create a significant adverse socioeconomic cumulative impact on the area's housing, schools, law enforcement services, or parks.

Staff concludes the population residing in the six-mile project buffer does not constitute an environmental justice population as defined by Environmental Justice: Guidance under the National Environmental Policy Act, and would not trigger further scrutiny by the thirteen technical areas for purposes of an environmental justice analysis.[1] Cultural Resources staff has identified tribal entities that use the project area, and as defined by Environmental Justice: Guidance under the National Environmental Policy Act, this environmental justice population would trigger further scrutiny by Cultural Resources staff for purposes of an environmental justice analysis. Refer to the Cultural Resources section for more information. As discussed in the subsection "Project-Specific Demographic Screening," staff notes that the Bureau of Land Management (BLM) July 2013 PSEGS Draft Supplemental Environmental Impact Statement identified an environmental justice population, where Energy Commission staff did not.

[1] The thirteen technical staff/areas are Air Quality, Hazardous Materials Management, Land Use, Noise and Vibration, Public Health, Socioeconomics, Soils and Surface Water Resources, Water Supply, Traffic and Transportation, Transmission Line Safety and Nuisance, Visual Resources, Cultural Resources, and Waste Management.

INTRODUCTION

Staff's socioeconomics impact analysis evaluates project-caused changes on existing population, housing, employment patterns, and community services. Staff analyzes the potential impacts of the construction and operation of the PSEGS on local communities, community resources, and law enforcement services, and also provides a discussion of the estimated beneficial economic impacts of the construction and operation of the proposed project.

METHODOLOGY AND THRESHOLDS FOR DETERMINING SIGNIFICANCE

CEQA requires a list of criteria to determine the significance of identified impacts. A significant impact is defined by CEQA as "a substantial, or potentially substantial, adverse change in any of the physical conditions within the area affected by the project" (Cal. Code Regs., tit., 14 § 15382).

Thresholds serve as the benchmark for determining if a project will result in a significant adverse impact when evaluated against existing conditions (e.g., "baseline" conditions). CEQA Guideline section 15064(e) specifies that: "[e]conomic and social changes resulting from the project shall not be treated as significant effects on the environment." Section 15064(e) states that when "a physical change is caused by economic or social effects of a project, the physical change may be regarded as a significant effect in the same manner as any other physical change resulting from the project. Alternatively, economic and social effects of a physical change may be used to determine that the physical change is a significant effect on the environment. If the physical change causes adverse economic or social effects on people, those adverse effects may be used as a factor in determining whether the physical change is significant." Staff has used Appendix G of the CEQA Guidelines for this analysis, which specifies that a project may have a significant effect on population, housing, law enforcement services, schools, and parks if the project would:

- induce substantial population growth in an area, either directly or indirectly;
- displace substantial numbers of people and/or existing housing, necessitating the construction of replacement housing elsewhere; or
- adversely impact acceptable levels of service for police protection, schools, and parks and recreation.

Staff's assessment of impacts on population, housing, police protection, schools, and parks and recreation is based on professional judgments, input and data from local and state agencies, and the industry-accepted, two-hour commute range for construction workers and one-hour commute range for operational workers. Typically, long-term employment of people from regions outside the study area could potentially result in significant adverse socioeconomic impacts.

Criteria for subject areas such as utilities, fire protection, emergency medical services, water supply, and wastewater disposal are analyzed in the Reliability, Worker Safety and Fire Protection, and Soils and Water Resource sections of this document.

LAWS, ORDINANCES, REGULATIONS, AND STANDARDS

Socioeconomics Table 1 contains socioeconomics laws, ordinances, regulations, and standards (LORS) applicable to projects proposed on non-federal land. The PSEGS is proposed on BLM land, as was the approved PSPP's administration and warehouse space, therefore the provisions of Education Code section 17620 would not apply, and no school impact fees would be collected for the PSEGS, as was the case for the approved PSPP (CEC 2010g).

Socioeconomics Table 1
Laws, Ordinances, Regulations, and Standards (LORS)

Applicable LORS	Description
State	
California Education Code, section 17620	The governing board of any school district is authorized to levy a fee, charge, dedication, or other requirement for the purpose of funding the construction or reconstruction of school facilities.
California Government Code, sections 65996-65997	Except for a fee, charge, dedication, or other requirement authorized under section 17620 of the Education Code, state and local public agencies may not impose fees, charges, or other financial requirements to offset the cost for school facilities.
California Revenue and Taxation Code, section 73	Allows property tax exclusion for certain types of solar energy systems. Assembly Bill 1451 extended the current property tax exclusion for new construction of solar energy systems to expire on January 1, 2017. If a project has started construction prior to the expiration date it would be eligible for the exclusion. After the exclusion sunsets, any solar energy system constructed remains exempt from property tax for so long as the property does not change ownership.

PROPOSED MODIFIED PROJECT

The changes from the approved PSPP to the PSEGS relevant to Socioeconomics involve the construction and operations workforce numbers (including the peak and average number of workers), duration of construction, and estimated fiscal benefits. The construction schedule for PSEGS would be 33 months rather than the approved PSPP's 39-month schedule. The construction workforce for the PSEGS would increase over the approved PSPP by 1,166 workers during peak construction, for a peak of 2,311 workers. The average number of construction workers for the PSEGS would increase by 432 workers, for an average of 998 construction workers. The changes to the fiscal benefits are presented in Socioeconomics Table 14. The PSEGS is in the same location as the approved PSPP, but reduced in acreage. Therefore, the regional and local study areas are not changed from the approved PSPP.

SETTING

Staff defines the study area related to the project's operational impacts on population, housing, and parks as the local study area, and the project's construction impacts on population, housing, and parks as the regional study area – both study areas are defined below. The study area for law enforcement is the local jurisdictional boundaries for the Riverside Sheriff's Department. The study area for impacts to schools is the Palo

Verde and Desert Center School districts. The study area for indirect and induced economic impacts is defined as Riverside County. The study area for environmental justice impacts is within a six-mile buffer of the project site.

Regional Study Area

For the purposes of assessing project impacts during construction, staff defines the regional study area as within a two-hour commute of the project. The regional study area is roughly defined by the distance construction workers are typically willing to commute daily to a project site, and includes Riverside County, California, San Bernardino County, California, and La Paz County, Arizona.

The proposed PSEGS includes the construction and operation of a solar generating facility located in the Southern California inland desert, approximately 10 miles east of the small community of Desert Center, in eastern Riverside County, California.

To characterize the population and housing profile of the regional study area, current and forecasted population trends as well as current housing trends for the study area are summarized in Socioeconomics Table 2. The regional study contains a high number of housing units, with San Bernardino and Riverside Counties contributing the largest number of vacant units in the PSEGS study area. Among all counties within the study area, La Paz County has the highest vacancy rate (43 percent).

Socioeconomics Table 2
Population and Housing Profile of the Regional Study Area

Population							
Area	**2000[1]**	**2010[2]**	**2020[4] Projected**	**2030[4] Projected**	**2040[4] Projected**	**2050[4] Projected**	**2060[4] Projected**
Riverside County, California	1,545,387	2,189,641	2,593,211	3,046,064	3,462,256	3,828,798	4,216,816
	1,545,387	2,189,641	2,592,000[5]	3,324,000[5]	—	—	
San Bernardino County, California	1,709,434	2,035,210	2,273,017	2,626,945	2,988,648	3,248,440	3,433,047
La Paz County, Arizona	19,579	22,632	21,988[6]	23,615[6]	25,351[6]	27,710[6]	—

Housing[3]				
Area	**2010Total Housing Units**	**2010 Occupied Housing Units**	**2010 Vacant Housing Units**	**2010 Vacancy Rate**
Riverside County, California	800,707	686,260	114,447	14%
San Bernardino County, California	699,637	611,618	88,019	13%
La Paz County, Arizona	16,049	9,198	6,851	43%

Notes: — Data not available
Source: [1]US Census 2000; [2]US Census 2010a; [3]US Census 2010b; [4]CA DOF 2013; [5]SCAG 2012; [6]AZ Dept. of Admin 2012.

Local Study Area

Staff defines the local study area during project operation as within a one-hour commute of the project. An analysis at a local level presents a challenge because the proposed PSEGS is in a sparsely populated area, with the largest urban center being the city of Riverside, located approximately 100 miles west of the site. A reasonable study area for localized socioeconomic impacts would include the two nearest communities: the City of Blythe, California (approximately 25 miles east of the PSEGS site), and the City of Ehrenburg, Arizona (approximately 30 miles east of the PSEGS site). The most recently published population and housing data for these communities are presented below in Socioeconomics Table 3. As Desert Center is the closest community to the project site, population and housing data for Desert Center have been included in the table even though this community is sparsely populated.

Socioeconomics Table 3
Population and Housing Profile of the Local Study Area

<table>
<tr><th colspan="7">Population</th></tr>
<tr><th>Area</th><th colspan="2">2000</th><th colspan="2">2010</th><th>2020</th><th>2030</th></tr>
<tr><td>Blythe, California</td><td colspan="2">12,155</td><td colspan="2">20,817</td><td>22,700</td><td>24,300</td></tr>
<tr><td>Desert Center, California</td><td colspan="2">—</td><td colspan="2">204</td><td>—</td><td>—</td></tr>
<tr><td>Ehrenburg, Arizona</td><td colspan="2">1,357</td><td colspan="2">1,470</td><td>—</td><td>—</td></tr>
<tr><td>Quartzsite, Arizona</td><td colspan="2">3,354</td><td colspan="2">3,677</td><td>—</td><td>—</td></tr>
<tr><th colspan="5">Housing</th><th></th><th></th></tr>
<tr><th>Area</th><th>Total Housing Units</th><th>Occupied Housing Units</th><th>Vacant Housing Units</th><th>Vacancy Rate</th><th>For Sale</th><th>For Rent</th></tr>
<tr><td>Blythe, California</td><td>5,473</td><td>4,513</td><td>960</td><td>18%</td><td>26%</td><td>10%</td></tr>
<tr><td>Desert Center, California</td><td>140</td><td>85</td><td>55</td><td>39%</td><td>24%</td><td>11%</td></tr>
<tr><td>Ehrenburg, Arizona</td><td>948</td><td>645</td><td>303</td><td>32%</td><td>16%</td><td>7%</td></tr>
<tr><td>Quartzsite, Arizona</td><td>3,378</td><td>2,027</td><td>1,351</td><td>40%</td><td>6%</td><td>8%</td></tr>
<tr><td colspan="7">Notes: — Data not available
Sources: US Census 2000; US Census 2010a; US Census 2010b; CA DOF 2013; SCAG 2012, AZ Dept. of Admin 2012.</td></tr>
</table>

Using the 2010 US Census and US Census Bureau's American Community Survey in Staff Assessments

The detailed social, economic, and housing information previously collected only in the decennial census was not collected for the 2010 Census (US Census 2011a). This information is now collected through the U.S. Census Bureau's American Community Survey (ACS). Decennial census data are from a 100 percent count collected once every ten years and represent information from a single reference point (April 1). The main function of the decennial census is to provide counts of people for the purpose of congressional apportionment and legislative redistricting. ACS estimates are collected from a sample of the population based on information compiled continually and aggregated into one, three, and five-year estimates ("period estimates") released every year. The primary purpose of the ACS is to measure the changing social and economic characteristics of the U.S. population. As a result, the ACS does not provide official counts of the population in between censuses. Instead, the Census Bureau's Population Estimates Program will continue to be the official source for annual population totals, by age, race, Hispanic origin, and sex.

ACS collects data at every geographic level from the largest level (nation) to the smallest level available [block group (BG)].2 Census Bureau staff recommends the use of data from units no smaller than the census tract level.3,4 Data from the five-year estimates are used for staff's analysis as it provides the greatest detail at the smallest geographic level. Because ACS estimates come from a sample population, a certain level of variability is associated with these estimates. This variability is expressed as a margin of error (MOE). The MOE is used to calculate the coefficient of variation (CV). CVs are a standardized indicator of the reliability of an estimate. While not a set rule, the U.S. Census Bureau considers the use of estimates with a CV of more than 15 percent a cause for caution when interpreting patterns in the data (US Census 2009). In situations where CVs for estimates are high, the reliability of an estimate improves by using estimates for a larger geographic area (e.g., city or community versus census tract), or by aggregating estimates of adjacent geographic areas, such as cities.

[2] Census Block Group - A statistical subdivision of a census tract. A BG consists of all tabulation blocks whose numbers begin with the same digit in a census tract; for example, for Census 2000, BG 3 within a census tract includes all blocks numbered between 3000 and 3999. The block group is the lowest-level geographic entity for which the Census Bureau tabulates sample data from the decennial census. http://www.census.gov/dmd/www/glossary.html.

[3] Census Tract - A small, relatively permanent statistical subdivision of a county or statistically equivalent entity, delineated for data presentation purposes by a local group of census data users or the geographic staff of a regional census center in accordance with Census Bureau guidelines. Census tracts are designed to be relatively homogeneous units with respect to population characteristics, economic status, and living conditions at the time they are established. Census tracts generally contain between 1,000 and 8,000 people, with an optimum size of 4,000 people. Census tract boundaries are delineated with the intention of being stable over many decades, so they generally follow relatively permanent visible features. http://www.census.gov/dmd/www/glossary.html.

[4] Using the American Community Survey (ACS) and The New American Factfinder (AFF). Census Workshop presented by Barbara Ferry, U.S. Census Partnership Data Services Specialist, hosted by Sacramento Area Council of Governments, May 11–12, 2011.

Project-Specific Demographic Screening

Staff's demographic screening is based on information contained in two documents: Environmental Justice: Guidance Under the National Environmental Policy Act (CEQ 1997) and Final Guidance for Incorporating Environmental Justice Concerns in EPA's Compliance Analyses (US EPA 1998). The intention is to identify potentially sensitive populations, which could be disproportionately impacted by the proposed action. Due to the changes in the data collection methods used by the U.S. Census Bureau, the screening process relies on 2010 U.S. Census data to determine the number of minority populations and data from the 2007–2011 ACS to evaluate the presence of individuals and households living below the federal poverty level.

Staff's demographic screening is designed to identify the presence of minority and below-poverty-level populations residing within a six-mile area of the proposed project site. The six-mile buffer is based on air quality modeling, which shows that project-related impacts from pollutants decrease to less than significant within six miles of the emission site. Staff uses the six-mile buffer to determine the area of potential project impacts and to obtain data to gain a better understanding of the demographic makeup of the communities potentially impacted by the project. Once Socioeconomics staff identifies the presence of an environmental justice population, staff from the thirteen affected technical areas evaluates the project for potential disproportionate impacts on the environmental justice population. When staff's screening analysis does not identify the population in the six-mile buffer as an environmental justice population, as defined by Environmental Justice: Guidance Under the National Environmental Policy Act, no further scrutiny of this population is required for purposes of an environmental justice analysis.

Staff reviewed the Bureau of Land Management (BLM) July 2013 PSEGS Draft Supplemental Environmental Impact Statement, specifically the section on Environmental Justice. Staff notes that the BLM used the 2007 – 2011 ACS Zip Code Tabulation Area (ZCTA) 92239 to determine the presence or absence of an environmental justice population, where Energy Commission staff used 2010 census data for the geographies identified in Socioeconomics Table 4. The BLM document identified an environmental justice population residing in the project area, where Energy Commission staff did not. To provide the reader a comparison of the geographies used to identify an environmental justice population, staff's Socioeconomics Figure 2 shows the different census geographies used by the BLM and staff. The BLM found no disproportionate adverse impacts from the PSEGS to the BLM-identified environmental justice population.

Minority Populations

According to Environmental Justice: Guidance Under the National Environmental Policy Act, minority individuals are defined as members of the following groups: American Indian or Alaskan Native; Asian or Pacific Islander; Black, not of Hispanic origin; or Hispanic. An environmental justice population is identified when the minority population of the potentially affected area is greater than 50 percent or meaningfully greater than the minority population in the general population or other appropriate unit of geographical analysis. Socioeconomics Figure 1 shows that, based on census data, there are no people within a six-mile buffer of the project site. Socioeconomics Table 4 presents the minority population data for the community of Desert Center, plus Riverside County, and the Chuckwalla Census County Division (CCD) for reference. The 2010 decennial census data show there is no population (minority or otherwise) in the six-mile project buffer. Therefore, there is no environmental justice population as defined by Environmental Justice: Guidance Under the National Environmental Policy Act that would trigger further scrutiny for purposes of an environmental justice analysis.

Socioeconomics Table 4
Minority Population in the Project Area

	Six-Mile Buffer Around Project Site	Desert Center CDP	Chuckwalla Valley CCD	Riverside County
Total	0	204	9,843	2,189,641
Not Hispanic or Latino: White alone	0	156	4,349	869,068
Minority	0	48	5,494	1,320,573
Percent Minority	0	24	56	60
Notes: CDP – Census Designated Place, CCD – Census County Division. Source: US Census Bureau 2010c.				

Below-Poverty-Level Populations

The poverty status of households and individuals is determined based on a set of income thresholds, set by the U.S. Census Bureau, that vary by family size and composition. If the total income of the family is less than the family's threshold, that family and every individual in it is considered in poverty. The official poverty thresholds do not vary by geography (e.g., state, county, etc.), but are updated annually to allow for changes in the cost of living. The population for whom poverty status is determined does not include institutionalized people, people in military quarters, people in college dormitories, and unrelated individuals under 15 years old.

Staff identified the below-poverty-level population in the project area using county level data from the 2007-2011 ACS Five-Year Estimates from the U.S. Census (US Census 2011b).[5] Approximately 14 percent, or 8,482 people, in Riverside County lives below the federal poverty threshold. Socioeconomics Table 5 presents poverty data for Riverside County, plus California for reference purposes. Poverty data for the Chuckwalla Valley CCD and Desert Center CDP were not included because the CV values were greater than 20, indicating that the data were unreliable and may not accurately reflect local characteristics.

[5] Staff determined that the data at the county level are the lowest level available that retain reasonable accuracy. The data represent a period estimate, meaning the numbers represent an area's characteristics for the specified time period.

Socioeconomics Table 5
Poverty Data in the Project Area

Area	Total			Income in the past 12 months below poverty level			Percent below poverty level		
	Estimate*	MOE	CV	Estimate	MOE	CV	Estimate	MOE	CV
Riverside County	2,119,466	±1,760	0.05	301,763	±8,482	1.71	14.20	±0.4	1.71
California	36,211,794	±3,530	0.01	5,211,481	±39,013	0.46	14.40	±0.1	0.42

Note: *Population for whom poverty status is determined.
Source: U.S. Census 2011b.

Additional Environmental Justice Population Considerations

Final Guidance for Incorporating Environmental Justice Concerns in EPA's Compliance Analyses (US EPA 1998) also encourages outreach to community-based organizations and tribal governments early in the screening process to identify the presence of distinct minority communities residing within, or in close proximity to, the proposed project site. It also encourages identification of minority groups that utilize or hold sacred certain natural and cultural resources that may be affected by the proposed action.

For information regarding the Energy Commission's outreach program and consultations with local Native American communities, see the **EXECUTIVE SUMMARY**, **INTRODUCTION**, and **CULTURAL RESOURCES** sections of this document. Cultural Resources staff has identified tribal entities that use the project area. Therefore, this environmental justice population, as defined by Environmental Justice: Guidance Under the National Environmental Policy Act, would trigger further scrutiny by Cultural Resources staff for purposes of an environmental justice analysis. Refer to the Cultural Resources section for more information.

ASSESSMENT OF IMPACTS AND DISCUSSION OF MITIGATION

INDUCE SUBSTANTIAL POPULATION GROWTH

For the purpose of this analysis, staff defines "induce substantial population growth" as workers moving into the project area because of project construction and operation, thereby encouraging construction of new homes or extension of roads or other infrastructure. To determine whether the project would induce population growth, staff analyzes the availability of the local workforce and the population within the region. Staff defines "local workforce" for the PSEGS project to be the Riverside/San Bernardino/Ontario Metropolitan Statistical Area (MSA),[6] which includes both Riverside and San Bernardino counties. While the City of Ehrenberg, within La Paz County, Arizona, is located within the proposed PSEGS regional study area and could contribute to the local workforce, detailed labor skill data are unavailable for this limited portion of the regional and local study area. As shown above in Socioeconomics Table 2, due to the size of the La Paz County population, presenting local workforce data for the entire state of Arizona would not be representative of the available workforce within the county. However, it should be noted that construction workforce from within this county

[6] Metropolitan Statistical Areas are geographic entities defined by the U.S. Office of Management and Budget (OMB) for use by Federal and State statistical agencies in collecting, tabulating, and publishing socioeconomic statistics.

and local communities would contribute to the local workforce, as identified in detail below. Staff has focused this analysis on the cities and communities along the Interstate-10 corridor, as this route provides the most reasonable access to the PSEGS site. Access to the site from other parts of Riverside, San Bernardino, and La Paz Counties is not as convenient.

Construction

The project owner expects that construction of the proposed PSEGS would be similar to the approved PSPP. Construction of the PSEGS would last for 33 months, while construction of the approved PSPP was 39 months. The construction workforce would increase from an average of approximately 566 daily construction workers, peaking with a daily workforce of 1,145, to an average of approximately 998 workers, with a peak workforce of 2,311 workers (Palen 2012a). This peak employment number is used to analyze worst-case construction population and employment impacts. Socioeconomics Table 6 shows Year 2010–2020 occupational employment projections for the Riverside/San Bernardino/Ontario MSA by construction labor skill. The number of construction workers by trade for the PSEGS peak month (month 22) is presented in Socioeconomics Table 6 and compared with the construction workforce needed for the approved PSPP (Solar Millennium 2009a, p. 5.11-26; Palen 2012a). The peak number of construction workers by trade is reported in parenthesis where different from the PSEGS peak construction month. Staff has updated Socioeconomics Table 6 to reflect the applicant's response to Data Request #4.

Socioeconomics Table 6
Total Labor by Skill in Riverside/San Bernardino/Ontario MSA and Construction Worker by Craft, Peak Month

Trade	Total Workers for Construction by Craft (peak month)		Riverside/ San Bernardino/ Ontario MSA	
	Approved PSPP Project	PSEGS	2010	2020
Surveyor	12	4 (16*)	440	520
Operator[1]	90	106	2,510	3,030
Laborer[2]	185	86 (122*)	11,870	13,380
Truck Driver[3]	35	26 (34*)	22,530	28,960
Oiler[4]	4	0	52,650	57,040
Carpenter	100	75 (125*)	10,140	10,450
Boilermaker[4]	11	264	52,650	57,040
Paving Crew	0	0 (8*)	400	490
Pipe Fitter	326	508	3,160	3,570
Pipe Layer	0	3	590	730
Electrician	150	359	4,000	4,520
Cement Finisher	100	9 (18*)	2,420	2,570
Ironworker[5]	59	126 (132*)	700	670
Millwright	25	141 (149*)	140	140
Tradesman[2]	10	Included with laborer	11,870	13,380
Project Manager[6]	3	19	5,000	5,490
Construction Manager[6]	3	79	5,000	5,490
PM Assistant[6]	4	43	5,000	5,490
Support[7]	4	130	13,430	15,360
Support Assistant[8]	4	178	38,240	43,010
Engineer	10	104	7,270	8,120
Timekeeper	3	10	1,840	2,120
Administrator[9]	6	29	4,540	5,240
Welder	1	Included with boilermaker & pipefitter	2,650	3,090
Instrument Tech[10]		12	620	680

Notes:
1 - The “Operating Engineers and Other Construction Equipment Operators” category was used.
2 - The “Construction Laborers” category was used.
3 - The “Heavy and Tractor Trailer Truck Drivers” category was used.
4 - The “Construction Trades Workers” category was used.
5 - The “Structural Iron and Steel Workers” categories were used.
6 - The “Construction Mangers” category was used.
7 - The “Bookkeeping, Accounting, and Auditing Clerks” category was used.
8 – The “Other Office and Administrative Support Workers” category was used.
9 - The “First-Line Supervisors of Office and Administrative Support Workers” category was used.
10 - The “Control and Valve Installers and Repairers, except mechanical door” category was used.
*Largest number of workers by trade. Where no number is included in parenthesis, number reported is the largest number of workers for the trade and during the peak project month, month 22.
Sources: Solar Millennium 2009a, Tables 5.11-8 and 5.11-17; EDD 2012; Palen 2012a; Palen 2013mm.

As shown in Socioeconomics Table 6, there is more than adequate local availability of construction workforce within the Riverside/San Bernardino/Ontario MSA for the approved PSPP and, given the relatively small increase in total number of workers for the PSEGS, it is reasonable to assume there would be adequate local availability of workforce for the PSEGS.

The amendment did not include the project owner's estimations of the proportion of construction workers who would temporarily relocate closer to the project site versus those who would commute daily. Staff for the approved PSPP assumed that up to 15 percent of construction workers would seek local lodging during the workweek, and up to 85 percent would commute daily. Staff is using the same assumptions for the PSEGS and agrees that 15 and 85 percent are reasonable. Therefore, for the PSEGS peak construction, up to 347 workers would seek local lodging, which represents an increase of 175 workers over the approved PSPP project.

Hotel/Motel. Socioeconomics Table 7 identifies over 12,900 motel/hotel rooms within a two-hour commute of the project site in selected cities in Riverside County and the nearby communities of Ehrenberg and Quartzsite in Arizona.

Socioeconomics Table 7
Hotel/Motel Supply Within the PSEGS Regional and Local Study Areas

Geographic Area	Hotels/Motels	Total Number of Rooms
Bermuda Dunes, California	1	Data not available
Blythe, California	21	1,032
Cathedral City, California	3	234
Coachella, California	0	0
Desert Center, California	0	0
Indian Wells, California	5	1,508
Indio, California	13	808
Mecca, California	0	0
Mesa Verde, California	0	0
Palm Desert, California	14	2,300
Palm Springs, California	55	5,232
Palo Verde, California	0	0
Rancho Mirage, California	6	1,598
Ripley, California	0	0
Thermal, California	0	0
Thousand Palms, California	1	116
Ehrenberg, Arizona	1	84
Quartzsite Arizona	1	50
Totals	121	12,962
Sources: BS 2011a, adapted from Table 5.10-6, pg. 5.10-16.		

Housing Vacancy. As shown in Socioeconomics Table 3, the closest community to the PSEGS site, Desert Center, had a 39 percent vacancy rate with 55 vacant housing units available in 2010. The city of Blythe had a larger vacant housing supply with 960 units, for an 18 percent vacancy rate. A five percent vacancy is largely accepted as a minimum benchmark for a sufficient amount of housing available for occupancy (Virginia Tech 2006). Socioeconomics Table 8a presents a more detailed look at housing supply within a two-hour commute of the PSEGS and Socioeconomics Table 8b presents a more detailed look at the type of vacancy available. In 2010, a total of 43,559 vacancies, representing a 28 percent vacancy rate, were available in the cities and communities within the regional study area. As presented in Socioeconomics Table 8b, the vacant housing supply shows a total of 6,585 of the vacancies were available for rent, 4,007 vacancies were available for sale, and 28,536 vacancies were for seasonal, recreational or occasional use. The housing counts in the study area indicate a greater supply of available housing units than demand.

Socioeconomics Table 8a
Housing Unit Supply Within the PSEGS Regional and Local Study Areas

Geographic Area	Total	Occupied	Vacant	Percent Vacant
Bermuda Dunes, CDP, California	3,639	2,942	697	19
Blythe, California	5,473	4,513	960	18
Cathedral City, California	20,995	17,047	3,948	19
Coachella, California	9,903	8,998	905	9
Desert Center CDP, California	140	85	55	39
Indian Wells, California	5,137	2,745	2,392	46
Indio, California	28,971	23,378	5,593	19
Mecca, CDP, California	2,020	1,854	166	8
Mesa Verde CDP, California	360	312	48	13
Palm Desert, California	37,073	23,117	13,956	38
Palm Springs, California	34,794	2,274	12,048	35
Palo Verde CDP, California	211	84	127	60
Ripley, CDP, California	295	218	77	26
Thermal, CDP, California	761	684	77	10
Thousand Palms, CDP, California	3,705	2,849	856	23
Ehrenberg, CDP, Arizona	948	645	303	32
Quartzsite, Arizona	3,378	2,027	1,351	40
Total	157,803	93,772	43,559	28
Counties				
Riverside County, California	800,707	686,260	114,447	14
La Paz County, Arizona	16,049	9,198	6,851	43

*CDP – Census Designated Place
Source: US Census Bureau 2010b.

Socioeconomics Table 8b
Vacancy Status Within the PSEGS Regional and Local Study Areas

Geographic Area	Vacant		For Rent		For Sale		Seasonal, Recreational, or Occasional Use		Other Vacant	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Bermuda Dunes, CDP, California	697	19	298	43	80	11	250	36	69	10
Blythe, California	960	18	248	26	100	10	448	47	167	17
Cathedral City, California	3,948	19	786	20	472	12	2,138	54	552	14
Coachella, California	905	9	197	22	388	43	104	12	216	24
Desert Center CDP, California	55	39	13	24	6	11	23	42	13	24
Indian Wells, California	2,392	46	85	4	124	5	2,028	85	155	6
Indio, California	5,593	19	1,166	21	810	14	2,986	53	631	11
Mecca, CDP, California	166	8	100	60	9	5	17	10	40	24
Mesa Verde, CDP, California	48	13	33	69	5	10	5	10	5	10
Palm Desert, California	13,956	38	1,616	12	798	6	10,418	75	1,124	8
Palm Springs, California	12,048	35	1,744	14	974	8	8,151	68	1,179	10
Palo Verde CDP, California	127	60	10	8	7	6	91	72	19	15
Ripley, CDP, California	77	26	49	64	2	3	4	5	22	29
Thermal, CDP, California	77	10	30	39	2	3	6	8	39	51
Thousand Palms, CDP, California	856	23	85	10	102	12	565	66	104	12
Ehrenberg, CDP, Arizona	303	32	47	16	22	7	215	71	19	6
Quartzsite, Arizona	1,351	40	78	6	106	8	1,087	81	80	6
Total	43,559	28	6,585	15	4,007	9	28,536	66	4,434	10
Counties										
Riverside County, California	114,447	14	25,547	16	18,417	16	50,538	44	21,945	19
La Paz County, Arizona	6,851	43	586	5	370	5	5,318	78	577	8

*CDP – Census Designated Place; ** Other Vacant includes “rented, not occupied, sold, not occupied, migratory workers, and other vacant”
Source: US Census Bureau 2010b

Campground/RV Parks. Socioeconomic Table 9 shows abundant RV park spaces in the Blythe, Ehrenberg, and Quartzsite areas. However, RV parks in Blythe tend to be located along the Colorado River and receive higher levels of use during the summer, thereby possibly reducing availability for construction workers.

Socioeconomics Table 9
RV Parks Near the PSEGS Site

Geographic Area	RV Spaces
Blythe, California	795
Ehrenberg, Arizona	94
Quartzsite, Arizona	1,876
Sources: BS 2011a, adapted from Table 5.10-7, pg. 5.10-17; URS 2012a.	

For the approved PSPP, staff contacted a small sample of these RV parks and learned that while they have a large number of spaces, many are occupied by year-round residents or are privately owned, and would not be available for use by construction workers (GSEP2009a, p. 5.8-6). Additional RV parks are located in Ehrenberg, Arizona, and Quartzsite, Arizona, approximately 4 miles and 20 miles east of Blythe, respectively. The town of Quartzsite web site states there are more than 70 RV parks in the vicinity of the community that are typically occupied between October and March, with visitors attracted to the gem, mineral, and swap meet shows which are popular tourist attractions in the area (GSEP2009a, p. 5.8-6).

Lodging Availability and PSEGS Workforce

To better understand the housing choices of construction workers who may relocate to the PSEGS area, staff contacted Mr. Bill Perez, Executive Secretary with the San Bernardino and Riverside counties Building and Construction Trades Council (local BCTC). Staff asked Mr. Perez to discuss the construction workforce employed at solar power plant projects in Riverside County and the construction workforce to be employed by the PSEGS (CEC 2013w). Mr. Perez commented that a good number of Craft Workers are local residents in Riverside and San Bernardino counties and carpool daily to project sites, generally three to four persons per vehicle. Mr. Perez reported that construction workers for energy projects in Riverside County are staying in Indio and Blythe in California and Ehrenberg in Arizona. Mr. Perez thought that the construction workers for PSEGS who seek lodging closer to the project would stay in Indio, Blythe and Ehrenberg, but would not necessarily go as far east as Quartzsite. Mr. Perez noted that the construction workers for the current energy projects in construction in Riverside County have not found any problems in securing lodging.

According to Mr. Perez, the seasonal vacancy rates, especially in Blythe have not posed a problem for construction workers seeking lodging for the solar power plant projects. Mr. Perez explained that there are only two times when out-of-the-area visitors would seek local lodging: in January when Quartzsite holds a rock and gem show and during dove season in September. Lodging during these times is a little more difficult, but can be found. When construction workers secure lodging for extended construction periods they are not subject to the higher seasonal room rates. Construction workers often share rooms to reduce costs and as they rent rooms for long periods, they can often negotiate room rates.

Staff inquired about the construction workforce that would be employed at the PSEGS and what service amenities workers would look for when seeking lodging. Mr. Perez explained that construction workers typically seek lodging close to a freeway with easy on-off access, and convenience stores, gas stations, and dining options. Construction workers who commute to a project site typically do not look for amenities like movie theaters or retail shopping because they return to their primary residences on the weekend. Mr. Perez stated that construction workers employed on the PSEGS would not seek lodging in Palm Springs, Palm Desert, La Quinta or Indian Wells because of the high cost of lodging. Mr. Perez explained that construction workers for the PSEGS would not seek lodging around Thermal, Mecca or other communities near the Salton Sea because these areas are too far from Interstate 10. Staff inquired about Desert Center as an option for construction workers and Mr. Perez did not think the construction workers would stay there because there is no longer a gas station in the community. Mr. Perez did mention that a potential lodging option for some construction workers could be a private recreational vehicle park off Rice Road.

Conclusion. Based on this available local study area data and discussions with Mr. Perez, staff concludes that any construction workers seeking RV and campground lodging could find limited availability during January and September. However, ample local housing (hotel/motel and housing units) would be available to any construction worker seeking to relocate during construction. Because of the availability of short-term housing in the local study area, staff concludes that construction of the PSEGS would not temporarily induce substantial growth or a concentration of population in the local study area.

Operation

The proposed PSEGS is expected to require 100 operational employees, compared with the 134 permanent operational employees that were required for the approved PSPP (Solar Millennium 2009a, p. 5.11-29; Palen 2012a). Socioeconomics Table 10 shows Year 2010-2020 occupational employment projections for the Riverside/San Bernardino/Ontario MSA by operational labor skill, and the estimated total number of operational workers needed for the PSEGS, along with the number needed for the approved PSPP. Socioeconomics Table 10 has been updated to include the applicant's responses to Data Request #4.

Socioeconomics Table 10
Total Labor by Skill in Riverside/San Bernardino/Ontario MSA and Required Operations Workers

Trade	Total Workers for Project Operation		Riverside/ San Bernardino/ Ontario MSA	
	Approved PSPP Project	**PSEGS**	**2010**	**2020**
Solar Field and Power Block Workers				
Operating Engineers and Other Construction Equipment Operators	—	24	2,510	3,030
Technicians				
Electrical and Electronics Repairers, Powerhouse, Substation and Relay	—	10	100	120
Control and Valve Installers and Repairers	—	2	620	680
Maintenance Workers, Machinery	—	4	610	660
Operators				
First-Line Operators	—	3	4,450	4,780
Power Plant Operators	—	12	130	150
Warehouse and Maintenance Personnel				
Janitors and Cleaners	—	1	17,120	19,110
Stock Clerks and Order Filler	—	2	22,090	25,720
Electrical and Electronics Repairers, Power house, Substation and Relay	—	2	100	120
Mobile Heavy Equipment Mechanics	—	4	1,680	1,790
Maintenance Workers, Machinery	—	4	610	660
Administrative Personnel				
General and Operation	—	1	16,920	18,030
Electrical Engineer	—	1	660	740
Mechanical Engineer	—	1	1,050	1,150
Secretaries and Administrative Assistants	—	2	12,670	13,420
Office and Administrative Support Workers	—	2	7,570	8,520
First-Line Supervisors of Mechanics, Installers, and Repairers	—	5	3,690	4,170
Miscellaneous Support				
Bus & Truck Mechanics and Diesel Engine Specialists	—	2	3,170	3,790
First-Line Supervisors of Mechanics, Installers, and Repairers	—	2	3,690	4,170
Electrical and Electronics Repairers, Power house, Substation & Relay	—	4	100	120
Control and Valve Installers and Repairers	—	2	620	680
Maintenance Workers, Machinery	—	2	610	660
Mobile Heavy Equipment Mechanics	—	2	1,680	1,790
Secretaries and Administrative Assistants	—	2	12,670	13,420
Office and Administrative Support Workers	—	2	7,570	8,520
Power Plant Operators	—	2	130	150
Total	*134*	*100*	*95,040*	*105,860*
Sources: Solar Millennium 2009a, Table 5.11-8; Palen 2012a; Palen 2013ss; EDD 2012.				

Data for the Riverside/San Bernardino/Ontario MSA indicate that in the Year 2010, the employment sectors for the trades listed in Socioeconomics Table 10 contained a total of 95,040 workers, with Year 2020 forecasts for these employment sectors estimated at a total of 105,860 employees. The applicant for the approved PSPP estimated that 75 percent of operational workers would come from within the regional study area workforce, resulting in a potential influx of approximately 34 workers in the communities in the local study areas (Solar Millennium 2009a). With the reduction of operational workers for the PSEGS, staff estimates 25 permanent workers could choose to live closer to the PSEGS site. Housing data show that the vacancy rates for the cities of Blythe, California, Ehrenberg, Arizona, and Quartzsite, Arizona, are 18, 32, and 40 percent, respectively. Even with seasonal variations in vacancy rates, 2010 Census data shows there was a total of 373 housing units available for rent and 228 housing units available for sale in Blythe, Ehrenberg, and Quartzsite combined. Given the possible addition of 25 permanent workers, ample local housing is available should these operational employees choose to relocate to the local study area. Additionally, as shown in Socioeconomics Table 2, the regional study area provides a high number of available housing opportunities. The addition of up to 25 workers for the PSEGS operations to either the local or regional study area would not induce substantial growth or concentration of population in excess of available housing or forecasted growth.

Staff concludes that inducement of substantial population growth would be a less than significant impact, under CEQA, which is consistent with the conclusion for the approved PSPP.

Displace Existing Housing and Substantial Numbers of People

The proposed PSEGS site is vacant, undeveloped land, vegetated with desert scrub throughout and includes some sand dunes in the northeast (Solar Millennium 2009a, p. 5.7-12). No housing structures exist on the property. Two residences exist west of the PSEGS site, but the residents and the homes would not be displaced by the construction or operation the project (Solar Millennium 2009a, p. 5.7-14). As such, no housing or persons would be displaced by the PSEGS.

Staff concludes that the required construction workforce for the PSEGS would be found in the regional study area, consistent with the approved PSPP. An estimated 15 percent of workers could seek local lodging during the workweek. There appears to be sufficient lodging in the local and regional study area to house the 347 (at peak month) PSEGS construction workers without triggering the need for new housing. Vacancy rates within the local study area offer the 25 PSEGS operations employees wishing to relocate sufficient available housing. Therefore, staff concludes that no significant construction or operation-related impacts are expected for the regional and local study area housing supply, availability, or demand, and the PSEGS would not displace any populations or existing housing, and it would not necessitate construction of replacement housing elsewhere.

Result in Substantial Physical Impacts to Government Facilities

Physical impacts to public services and facilities are usually associated with population in-migration and growth in an area, which can increase the demand for a particular service, leading to the need for expanded or new facilities. Public service providers serving the PSEGS site are located within Riverside County. Therefore, the study area for the public services analysis is limited to Riverside County.

As discussed under the subject headings below, the PSEGS would not cause significant impacts to service ratios, response times, or other performance objectives relating to law enforcement, schools, or parks.

Please refer to the Worker Safety and Fire Protection section of this document for a detailed discussion of fire protection and emergency medical services.

Police Protection

The PSEGS, like the approved PSPP, would be served by the Riverside County Sheriff's Department Colorado River Station at 260 North Spring Street in Blythe, California. The Colorado River Station provides service to the unincorporated area from Red Cloud Road on the west, to the Arizona state line on the east, and from county line to county line on the north and south (Solar Millennium 2009a, p. 5.11-20). Communities included in this service area are Desert Center, Eagle Mountain, East Blythe, Hayfield, Midland, Nicholls Warm Springs, Ripley, and the Colorado River. The project owner has not provided any information related to police protection, such as updated response times to the project site and proposed security measures for either construction or operations of the PSEGS.

Staff received comments on the PSEGS project in response to staff's outreach to the Riverside County Sheriff's Department at the Colorado River Station and incorporated their comments in this document (RCSD 2013a). The sheriff's department has 27 sworn officers and 10 non-sworn officers with 2 to 3 officers on duty per shift. The Colorado River Station is approximately 40 miles from the PSEGS site.

The response time to the PSEGS site for a priority call is estimated at 30 minutes or more and a non-priority call is estimated at 45 minutes or more. There is a low probability that additional law enforcement services are needed during project construction and operation. The sheriff's department estimated that there is a moderate probability that during construction the project-related traffic could affect circulation and access on roads near the project site to the extent that emergency response times might be affected. The Traffic and Transportation section of this document proposes Condition of Certification TRANS-1, which requires the preparation and implementation of a traffic control plan to address the movement of workers, vehicles, and materials, including arrival and departure schedules and designated workforce and delivery routes.

The sheriff's department requested that total perimeter fencing should be provided, including illumination of access points. In addition, gates at the project site should not be obstructed. The sheriff's department requested that a No Trespass sign with the location address posted and visible should be installed and a "No Trespassing" letter should be on file at the sheriff station during construction and operation of the project. Staff is proposing Condition of Certification SOCIO-1 to address this request.

Construction. The project owner did not provide security details for construction; however, the Hazardous Materials Management section of this document proposes Conditions of Certification HAZ-4 and HAZ-5, which require the preparation of a Construction Site Security Plan and an Operation Security Plan to ensure site security. The plans also include a protocol for contacting law enforcement and the Energy Commission Compliance Project Manager (CPM) in the event of suspicious activity or emergency. Site security would minimize the potential need for the Riverside County Sheriff's Department assistance.

During the peak construction month, up to 347 workers for the PSEGS could seek local lodging. This number is considered less than significant as these workers would most likely already live within the regional study area and would be part of the Riverside County Sheriff's Department population served. Also, the service standard for the Riverside County Sheriff's Department is one officer per 1,000 populations. If all 347 workers were to temporarily relocate within this service area, the number of workers would still be less than significant because they would not trigger a need for additional sheriff staffing or services. While the PSEGS would increase the number of individuals within the local study area during construction, the increase would not be substantial and would not necessitate new or expanded law enforcement facilities or staff levels within the PSEGS regional or local study areas.

Operation. The project owner did not provide security details for operation of the site, but as was discussed for construction, an operations security plan would be required for the PSEGS. As discussed above, the operational workforce for the PSEGS is expected to be hired from within the regional workforce. It is possible that up to 25 operational employees for the PSEGS could choose to relocate to the PSEGS local area from more distant regional study area locations. Should operational employees permanently relocate to the local study area and purchase homes, they would contribute to the local community through the payment of property taxes based on the assessed value of the home at the time of sale. As it is likely a number of these employees already reside in Riverside County, relocation to the local area would not result in an increase over the total population policed by the Riverside County Sheriff's Department. Therefore, staff concludes that operation of the proposed PSEGS would not require the need for new or expanded law enforcement facilities or staff levels within the PSEGS regional or local study areas.

Schools

The proposed PSEGS site area is served by the Palo Verde Unified School District, serving the city of Blythe and other remote areas of Riverside County, and the Desert Center Unified School District in Desert Center (Solar Millennium 2009a, pp. 5.11-22–5.11-23). Socioeconomics Table 11 identifies the schools plus the current and previous year's student enrollment data in each of the respective school districts. As shown, Palo Verde Unified School District (PVUSD), approximately 40 miles east of the PSEGS site, offers a full range of educational opportunities with three elementary schools, one middle school, one high school, and a continuation high school. Desert Center Unified School District, approximately 10 miles west of the PSEGS site, offers one elementary school.

Socioeconomics Table 11
Summary of Schools and Enrollment in Palo Verde and Desert Center School Districts

School Name	**Community**	**Grades**	**Students**	**Pupil-to-Teacher Ratio**	**Average Class Size**
Palo Verde Unified School District					
Felix J. Appleby Elementary School	Blythe	K-5			
2012–2013			571	—	—
2011–2012			531	19.7	19.7
Margaret White Elementary School	Blythe	K-5			
2012–2013			668	—	—
2011–2012			683	27.3	28.5
Ruth Brown Elementary School	Blythe	K-5			
2012–2013			633	—	—
2011–2012			713	27.4	28.5
Blythe Middle School	Blythe	6-8			
2012–2013			502	—	—
2011–2012			502	15.9	18.0
Palo Verde High School	Blythe	9-12			
2012–2013			955	—	—
2011–012			955	22.1	25.3
Twin Palms Continuation School	Blythe	9-12			
2012–2013			102	—	—
2011–2012			92	18.4	17.4
District Total	Blythe	K-12			
2012–2013			3,448	—	—
2011–2012			3,486	22.0	22.4
Desert Center Unified School District					
Eagle Mountain Elementary School	Desert Center	K-8			
2012–2013			15	—	—
2011–2012			20	0	0
Riverside County					
Riverside County	County	K-12			
2012–2013			425,564	—	—
2011–2012			425,651	24.2	27.3
Source: CDE 2013					

Construction. Staff assumes the construction workforce for the PSEGS would be hired from within the available regional workforce, with up to 15 percent of workers potentially seeking temporary local housing during the workweek. This temporary local housing need would not result in substantial population in-migration occurring from PSEGS construction into the PVUSD. Staff does not expect that any construction workers seeking local temporary housing would bring school-aged children seeking enrollment within the PVUSD, as staff assumes workers would only seek local lodging during the workweek and return to their permanent homes on the weekend. Therefore, staff concludes that construction of the PSEGS would not require the need for new or expanded PVUSD school facilities or staff levels.

Operation. The PSEGS is proposed on BLM land, as was the approved PSPP's administration and warehouse space, therefore the provisions of Education Code section 17620 would not apply, and no school impact fees would be collected for the PSEGS, as was the case for the approved PSPP (CEC 2010g).

The operational workforce for the PSEGS is expected to be hired from the available regional workforce. Up to 25 operational employees for the PSEGS, a decrease from the estimated 34 employees for the approved PSPP could choose to relocate to the PSEGS local area from more distant regional study area locations. At the time the approved PSPP was under Energy Commission review, the PVUSD school district expected to have the necessary capacity to accommodate new students resulting from project operation (Solar Millennium2009a, p. 5.11-23). Based on the school data in Socioeconomics Table 11, staff concludes that any contribution of school-aged children from workers relocating for the PSEGS would account for a small increase in the overall PVUSD student body. With the decrease in the required operational PSEGS workforce from 34 to 25, staff does not anticipate the impacts to school capacity to worsen. Staff concludes that operation of the proposed PSEGS would not necessitate new or expanded school facilities or staff levels within the PSEGS regional or local study areas, which was also the conclusion for the approved PSPP project.

Parks and Recreation

The PSEGS site is currently undeveloped, is not designated for active recreational use, and does not appear to be frequented as a recreational area (Solar Millennium 2009a, p. 5.7-13). The nearest park facilities to the PSEGS site are located within the City of Blythe, approximately 40 miles east of the PSEGS site. The City of Blythe Parks Department is responsible for the maintenance and upkeep of the area's seven parks and one pocket park (City of Blythe, 2009).

Construction. Staff assumes the construction workforce for the PSEGS would be hired from within the available regional workforce, with up to 15 percent of workers potentially seeking temporary local area housing during the workweek to avoid commuting. This temporary local housing need would not result in substantial population in-migration occurring from PSEGS construction into either the local or regional study areas. As discussed above, staff concludes that camping and RV facilities would experience peak attendance from tourists during the summer and higher occupancy during the winter, thereby possibly reducing availability for construction workers seeking local area housing. Therefore, staff concludes that as a result of the PSEGS, construction employment, like the approved PSPP construction employment, would not require new or expanded recreational facilities or staff levels within the PSEGS regional or local study areas.

Operation. The operational workforce for the PSEGS is expected to come from within the available regional workforce. It is possible that up to 25 operational employees for the PSEGS could choose to relocate to the PSEGS local area from more distant regional study area locations. If any operational employees were to permanently relocate to the local study area, it is assumed that some percentage of this population would purchase homes and contribute to the local community through the payment of property taxes. Should operational employees permanently relocate to the local study area and purchase homes, they would contribute to the local community through the payment of property taxes based on the assessed value of the home at the time of sale. Staff concludes that permanent employment associated with the PSEGS, like the approved PSPP, would not necessitate new or expanded parks and recreational facilities or staff levels within the PSEGS regional or local study areas.

NON-OPERATION AND CLOSURE

As described in the **PROJECT DESCRIPTION** section of the **EXECUTIVE SUMMARY**, it is assumed the planned operational life of the PSEGS is at least 30 years from project start-up, but the facility conceivably could operate for a longer or shorter period depending on economic or other circumstances (Solar Millennium 2009a, p. 3-2). If the PSEGS remains economically viable, it could operate for more than 30 years, which would defer environmental impacts associated with closure and with the development of replacement power generating facilities. However, if the facility were to become economically non-viable before 30 years of operation, permanent closure could occur sooner. In any case, a Facility Closure Plan would be prepared three years prior to initiating a permanent facility closure and put into effect when permanent closure occurs. If the PSEGS facility ceases operation temporarily, whether by plan or due to an unplanned incident (non-operation), a Repair/Restoration Plan for conducting the activities necessary to restore the facility to availability and reliable and/or improved performance would be prepared. In general, the Facility Closure Plan would address any long-term, post-closure site maintenance and monitoring for the PSEGS and all associated facilities, including activities necessary for site restoration/revegetation. If removal of all equipment and facilities is needed, recycling of facility components, collection and disposal of hazardous wastes and resale of unused chemicals to other parties would be addressed in the Facility Closure Plan. Closure alternatives other than full site restoration, costs associated with the planned closure activities, funding sources for these activities; and conformance with applicable LORS would also be included in the Facility Closure Plan (Solar Millennium 2009a, p. 3-2).

It is assumed that the number and type of workers required for non-operation and closure activities would be similar to those described above for construction of the PSEGS. Also, staff assumes that, as for the construction of the PSEGS, 15 percent of the non-operation and closure workforce would temporarily relocate closer to the project site for non-operation and closure activities. The remaining 85 percent would be drawn from the regional and local study areas. As most workers are expected to reside within the study area, no impacts to existing population levels are expected to occur. Staff expects that, like the PSEGS construction workforce, the workforce for non-operation and closure would have no impacts on housing, population, and police services. No significant impacts to the study area population would result from proposed PSEGS non-operation and closure activities.

CUMULATIVE IMPACTS

A project may result in significant adverse cumulative impacts when its effects are "cumulatively considerable." Cumulatively considerable means that the incremental effects of an individual project are significant when viewed in connection with the effects of past projects, the effects of other current projects, or the effects of probable future projects (Cal. Code Regs., tit. 14, §15130). Cumulative socioeconomics impacts could occur when more than one project has an overlapping construction schedule that creates a demand for workers that cannot be met by the local labor force, resulting in an influx of non-local workers and their dependents. Operational cumulative socioeconomic impacts could occur when the development of multiple projects significantly impacts the population of an area, resulting in a housing shortage, change in local employment conditions, and an increased demand on public services.

Projects considered for the socioeconomic cumulative analysis are shown in Socioeconomics Table 12a and Socioeconomics Table 12b. Although not all of those projects are expected to complete the environmental review process, or to be funded and constructed, the list is indicative of the large number of large residential, commercial, and energy projects currently proposed in California.

The projects are defined within a geographic area that has been identified by staff as covering an area large enough to provide a reasonable basis for evaluating cumulative impacts for all resource elements. Most of these projects have, are, or would be required to undergo their own independent environmental review under CEQA and/or the National Environmental Protection Act (NEPA).

GEOGRAPHIC EXTENT OF CUMULATIVE IMPACT ANALYSIS

The area of cumulative effect for socioeconomic resources is Riverside and San Bernardino Counties, California, and La Paz County, Arizona. The analysis of cumulative effects considers a number of variables including geographic (spatial) limits, time (temporal) limits, and the characteristics of the resource being evaluated. The geographic scope of cumulative impact analysis is based on the workforce boundaries of the cumulative development projects.

EFFECTS OF PAST AND PRESENT PROJECTS

A wide variety of past and present development projects contribute to the cumulative conditions for socioeconomics. As shown in Socioeconomics Table 2, from 2000 to 2010 the populations of Riverside and San Bernardino Counties increased by 41.7 and 19.1 percent, respectively, while the population within La Paz County increased by 15.6 percent during the same time. This is an example of the steady growth rate that has occurred throughout the regional study area. As a result, past and present residential, commercial, and industrial development has contributed to the overall socioeconomic growth within the study area.

EFFECTS OF FUTURE FORESEEABLE PROJECTS

Socioeconomics would be affected by reasonably foreseeable future projects such as large electrical generation and distribution infrastructure development projects proposed along the I-10 corridor (**Executive Summary Attachment A – Figure 1**) and solar and wind applications proposed on approximately 1,000,000 acres of BLM land in the California Desert District Planning Area. Also, a large number of solar generation and distribution infrastructure development projects proposed on non-federal land in the I-10 corridor would affect socioeconomics (Socioeconomics Tables 12a and 12b).

Contribution of the Palen Solar Electric Generating System to Cumulative Impacts

Construction. Foreseeable development in the project area includes primarily renewable energy electrical generation and transmission infrastructure projects, with some residential and commercial development. Given the large number of renewable energy projects occurring within the PSEGS regional study area, it is possible that some overlap of construction phasing could occur between the PSEGS and the cumulative development projects. Socioeconomics Table 12a presents the most recently published data (Year 2010–2020 projections) on labor force characteristics for the cumulative regional study area pertaining to solar energy project construction labor skill sets and compares those to major cumulative projects located near the PSEGS along the I-10 corridor, including the Blythe Solar Power Project (BSPP), Genesis Solar Power Project (GSEP), Rice Solar Energy Project (RSEP), and the Desert Sunlight PV Project (DSPV). Socioeconomics Table 12b presents a complete list of projects considered part of the socioeconomics cumulative analysis, including the map ID/feature that correlates with **Executive Summary Attachment A – Figure 1**, which shows the location of the projects.

All cumulative projects identified in **Socioeconomics Tables 12a** and **12b** would be expected to draw on the large regional construction workforce in and around Riverside/San Bernardino/Ontario MSA. **Socioeconomics Table 12a** also identifies the labor force by skill for the MSA and the number of workers by skill to construct each project. Even in a worst-case scenario, should construction of these projects occur during overlapping peak work months, construction labor requirements would not exhaust the supply of construction labor by craft in the Riverside/San Bernardino/Ontario MSA. Other MSAs that could be a source of additional labor supply include the San Diego-Carlsbad-San Marcos MSA, El Centro MSA, and Santa Ana-Anaheim-Irvine Metropolitan Division. It is staff's opinion that there would be quite a few construction workers that would move from one project to another as their job at each project is completed. This could reduce the number of different construction workers seeking lodging closer to their project site.

Socioeconomics Table 12a
Cumulative Project Construction Employment Needs and Labor Supply

Trade	Total # of Workers for Project Construction by Craft – Peak Month						*TOTAL*	Riverside/San Bernardino/ Ontario MSA	
	Approved PSPP Project (Month 17)	PSEGS (Month 22)	BSPP (Month 16)	GSEP (Month 16)	RSEP (Month 12)	DSPV (Months 6-8)		2010	2020
Surveyor	12	4 (16*)	—	0	0	—	*4 (16*)*	440	520
Operator	90	106	—	0	0	—	*106*	2,510[1]	3,030[1]
Laborer	185	86 (122*)	—	198	52	—	*336*	11,870[2]	13,380[2]
Truck Driver	35	26 (34*)	—	0	0	—	*26 (34*)*	22,530[3]	28,960[3]
Oiler	4	0	—	0	0	—	*0*	52,650[4]	57,040[4]
Carpenter	100	75 (125*)	—	44	50	—	*169*	10,140	10,450
Boilermaker	11	264	—	0	0	—	*264*	52,650[4]	57,040[4]
Paving Crew	0	0 (8*)	—	0	0	—	*0 (8*)*	400	490
Pipe Fitter	326	508	—	200	80	—	*780*	3,160	3,570
Pipe Layer	0	3	—	0	0	—	*3*	590	730
Electrician	150	359	—	105	56	—	*520*	4,000	4,520
Cement Finisher	100	9 (18*)	—	4	6	—	*19*	2,420	2,570
Ironworker	59	126 (133*)	—	70	32	—	*228*	700[5]	670[5]
Millwright	25	141 (149*)	—	22	16	—	*179*	140	140
Tradesman	10	Included with laborer	—	382[6]	105[7]	—	*487*	11,870[2]	13,380[2]
Project Manager	3	19	—	0	0	—	*19*	5,000[8]	5,490[8]
Construction Manager	3	79	—	0	5	—	*84*	5,000[8]	5,490[8]
PM Assistant	4	43	—	0	0	—	*43*	5,000[8]	5,490[8]
Support	4	130	—	0	0	—	*130*	13,430[9]	15,360[9]
Support Assistant	4	178	—	0	0	—	*178*	38,240[10]	43,010[10]
Engineer	10	104	—	60	36	—	*200*	7,270	8,120
Timekeeper	3	10	—	0	0	—	*10*	1,840	2,120
Administrator	6	29	—	0	0	—	*29*	4,540[11]	5,240[11]
Welder	1	Included with boilermaker & pipefitter	—	0	0	—	*0*	2,650	3,090
Instrument Tech	0	12	—	0	0	—	*12*	620[12]	680[12]
Total Peak Month	*1,145*	*2,311*	*499*	*1,085*	*438*	*622*	*4,955*[13]	N/A	N/A
Local Housing Need[14]	*172*	*347*	*75*	*163*	*66*	*93*	*744*	N/A	N/A

Notes: — Data not available, N/A Not applicable. *Largest number of workers by trade. Where no number is included in parenthesis, number reported is the largest number of workers for the trade and during the peak project month, month 22.
1 The Operating Engineers and Other Construction Equipment Operators" category was used. 2 "Construction Laborers" category was used. 3 The "Heavy and Tractor Trailer Truck Drivers" category was used. 4 The "Construction Trades Workers" category was used. 5 The "Structural Iron and Steel Workers" categories were used. 6 Includes: insulators, painters,

teamsters, and 'Solar Field Craft". The solar field craft workers include an estimated five solar field installation crews, with each crew including a Foreman, Equipment Operators, Laborers, Electricians, Ironworkers, Carpenters, Masons, and Pipefitter/Welders. 7 Includes Teamsters, Heliostat Assembly Craft, Construction Staff, Subcontractors, and Technical Advisors. 8 The "Construction Managers" category was used. 9 The "Bookkeeping, Accounting, and Auditing Clerks" category was used. 10 The "Other Office and Administrative Support Workers" category was used. 11 The "First-Line Supervisors of Office and Administrative Support Workers" categories were used. 12 The "Control and Valve Installers and Repairers, except mechanical door" category was used. 13 Total reflects the combined total peak month numbers for the PSEGS, BSPP, GSEP, RSEP, and DSPV projects. 14 Assumes 15% of peak month workforce may seek temporary local housing during workweek.
Source: Solar Millennium 2009a and b; GSEP 2009a; SR 2009a; BLM 2010c; NEBSEC 2013a;Palen 2012a; and Palen 2013mm.

Socioeconomics Table 12b
Cumulative Projects for Socioeconomics

ID	Feature	Project Name	Location	Ownership	Status	Project Description	Distance (MILE)
4	Line	Devers-Palo Verde No. 2 Transmission Line Project	From the Midpoint Substation to Devers Substation	SCE	CPUC petition to modify request to construct CA-only portion approved by CPUC 11/2009	New 500 kV transmission line parallel to the existing Devers-Palo Verde Transmission Line from Midway Substation, approximately 10 miles southeast of Blythe, to the SCE Devers Substation, near Palm Springs. The ROW for the 500 kV transmission line would be adjacent to existing DPV ROW	2
3	Line	Green Energy Express Transmission Line Project	Eagle Mountain Sub to So. California	Green Energy Express	Approved	70 mile double circuit 500 kV transmission line from Eagle Mt. Sub to So. California	2
5	Line	Blythe Energy Project Transmission Line	From the Blythe Energy Project to Julian Hinds Substation	Blythe Energy, LLC	Existing	Transmission line modifications including upgrades to Buck Substation, approximately 67.4 miles of new 230 kV transmission line between Buck Substation and Julian Hinds Substation, upgrades to the Julian Hinds Substation, installation of 6.7 miles of new 230 kV transmission line between Buck Substation and SCE's DPV 500 kV transmission line	2
14	Polygon	SCE Red Bluff Substation	South of I-10 at Desert Center	SCE	Approved	A proposed new 500/220 kV substation, 2 new parallel 500 kV transmission lines of about 2,500 to 3,500 feet each	6
12	Polygon	Chuckwalla Solar I	1 mile north of Desert Center	Chuckwalla Solar I	POD in to BLM	200 MW solar PV project on 4,083 acres	6
8	Polygon	Desert Lily Soleil Project	6 miles north of Desert Center	EnXco	POD in to BLM	100 MW PV plant on 1,216 acres of BLM land	7
11	Polygon	Desert Center 50	Desert Center	US Solar Holdings	Under review	A planned 49.5 MW fixed flat panel photovoltaic solar power plant	8

ID	Feature	Project Name	Location	Ownership	Status	Project Description	Distance (MILE)
7	Polygon	Desert Harvest Solar Project	6 miles north of Desert Center	EnXco	Final document submitted on 11/7/2012	Project would be a 150-megawatt solar photovoltaic facility sited on 1,208 acres of BLM-managed lands north of the community of Desert Center in Riverside County, CA. An associated 220-kilovolt generation-intertie transmission line would be sited within a 204-acre right-of-way on BLM-managed land and 52 acres of non-BLM managed land, which would extend from the solar facility site to the planned Red Bluff Substation.	12
17	Polygon	Genesis Solar Energy Project	North of I-10, 25 miles west of Blythe, 27 miles east of Desert Center	NextEra (FPL)	Approved, under construction	250 MW solar power project on 1,950 acres north of the Ford Dry Lake. 6 mile natural gas pipeline and 5.5 mile gen-tie line to the Blythe Energy Center to Julian Hindes Transmission Line	12
3	Polygon	Desert Sunlight Project	6 miles north of Desert Center	First Solar	Approved	550 MW PV project on 4,144 acres of BLM land, requiring a 12 mile transmission to the planned Red Bluff Substation	14
26	Polygon	Graham Pass Wind Project	Riverside County	Graham Pass Inc	Pending	175 MW Wind Project	15
18	Polygon	EnXco	North of Wiley's Well Rd, east of Genesis Solar Project	EnXco	POD in to BLM	300 MW solar PV project	17
6	Point	Eagle Mountain Pumped Storage Project	Eagle Mountain iron ore mine, north of Desert Center	Eagle Crest Energy	FERC draft EIS published in 12/2010	1,300 MW pumped storage project on 2,200 acres of public and private land, designed to store off-peak energy to use during peak hours	20
25	Polygon	Mule Mountain III	Chuckwalla Valley	EnXco	Pending	200 MW Solar PV	22
6	Line	Desert Southwest Transmission Line	118 miles primarily parallel to DPV	Imperial Irrigation District	Approved	118 mile 500 kV transmission line from a new substation/switching station near the Blythe Energy Project to the existing Devers Substation located approximately 10 miles north of Palm Springs	24
13	Polygon	McCoy Solar Energy Project	North of I-10, south of McCoy Wash, east of McCoy Mountains, Riverside County	McCoy Solar, LLC	Record of Decision signed on March 13, 2013	750 megawatt (MW) photovoltaic (PV) solar energy generating facility and related infrastructure in unincorporated Riverside County, CA. About 7,700 acres of BLM land and 470 acres of private land.	25

ID	Feature	Project Name	Location	Ownership	Status	Project Description	Distance (MILE)
10	Polygon	McCoy Soleil Project	10 miles northwest of Blythe	EnXco	Plan of Development to Palm Springs BLM	300 MW solar power tower project located on 1,959 acres. Requires a 14 mile transmission line to proposed SCE Colorado Substation south of I-10	25
15	Polygon	Blythe Solar Power Project	North of I-10, north of Blythe Airport	Solar Millennium	Approved	1,000 MW solar trough facility on 7,540 acres	26
22	Polygon	Desert Quartzite	South of I-10, 8 miles southwest of Blythe	First Solar	POD in to BLM	600 MW solar PV project located on 7,724 acres, adjacent to DPV transmission line and SCE Colorado Substation	28
5	Polygon	Big Maria Vista Solar Project	North of I-10, 12 miles N/W Blythe	Bullfrog Green Energy	POD in to BLM	500 MW PV project on 2,684 acres	29
27	Polygon	Palo Verde Mesa Solar Project	N/W Of Blythe	Renewable Resources Group	NOP Filed	486 MW Solar	29
19	Polygon	Blythe Energy Project II	Near Blythe Airport	Blythe Energy	Approved	520 MW combined-cycle power plant located entirely within the Blythe Energy Project site boundary, located on 30 acres of a 76 acre site	31
20	Point	Blythe Solar Power Generation Station I	Blythe	Southwestern Solar Power	Approved	A planned 4.76 MW solar PV facility, including 69 PV panels that stand 50 feet tall and 72 feet ride	33
28	Point	Blythe Mesa Solar I	Blythe	Renewable Resources Group	Under review	A planned 485 MW solar PV project on private land in Blythe	33
1	Polygon	Rice Solar Energy Project	Rice Valley, Eastern Riverside County	Rice Solar Energy	Approved, construction date unknown at this time	150 MW solar power tower project with liquid salt storage. Project located on 1,410 acres and includes a power tower approximately 650 feet tall and 10 miles long interconnection with the WAPA Parker-Blythe transmission line	35
23	Point	Colorado River Substation Expansion	10 miles southwest of Blythe	SCE	Approved 7/2011	500/230kV substation, constructed in an area approximately 1000 ft by 1900 ft	36
22	Point	Twelve Residential Developments	Blythe	Various	Approved or under construction	12 residential development projects have been approved by the Blythe Planning Department: Vista Palo Verde, Van Weelden, Sonora South, Ranchette Estates, Irvine Assets, Chanslor Village, St. Joseph's Investments, Edgewater Lane, The Chanslor Place Phase IV, Cottonwood Meadows, Palo Verde Oasis. A total of 1,005 single family residences are proposed	36

ID	Feature	Project Name	Location	Ownership	Status	Project Description	Distance (MILE)
26	Point	Four Commercial Projects	Blythe	Various	Approved	Four commercial projects have been approved by the Blythe Planning Department, including the Agate Road Boat & RV Storage, Riverway Ranch Specific Plan, Subway Restaurant and Motel, and Agate Senior Housing Development. Dates of construction are unknown at this time	36
34	Point	Mount Signal Solar Farm #1	Calexico	82LV 8ME	EA pending	600 MW solar PV project located on 1,440 acres	51
33	Point	Travertine Point Specific Plan	St. Rte 86, between 81st Ave and Coolidge Spring Rd, Riverside and Imperial County	County of Riverside	Lead agency approved the project on 1/15/2013, and will have significant impacts	The project proposes the construction of a total of 16,665 residential units and 5,029,500 square feet of non-residential development. This includes approximately 1,410 acres of TMDCI lands of which 647 acres are in Imperial County.	52
33	Polygon	Ogilby Solar	Chocolate Mountain	Pacific Solar Investments	Revised POD 8/26/11	1,500 MW Solar Thermal Trough	53
4	Polygon	Quartzsite Solar Energy	10 miles north of Quartzsite	Solar Reserve	Draft EIS released	100MW, 653 foot tall power tower located on 1,500 acres of BLM land	57
21	Polygon	Nextlight Quartzsite	Quartzsite, AZ	Nextlight Renewable Power	Pending	50 MW CSP Trough	58
15	Point	East County Detention Center	Existing Riverside County Jail, Indio	Riverside County	EIR filed, review period ends 6/4/2013	1,273 bed expansion of existing 353 bed detention center	58
28	Polygon	La Posa Solar Thermal	Stone Cabin, AZ	Pacific Solar Investments	Pending	2,000 MW Solar	60
1	Point	La Paz Solar Tower	La Paz County, AZ	EnviroMission	Pre-construction	200 MW power station on 11.0 acres	61
30	Polygon	Wildcat Quartzsite	Quartzsite, AZ	Wildcat Quartzsite Solar	Pending	800 MW CSP Tower	62

ID	Feature	Project Name	Location	Ownership	Status	Project Description	Distance (MILE)
14	Point	Hwy 111 Beautification and Improvement Project	Hwy 111, Riverside County	California State Transportation Commission	Lead agency approved the project on 3/5/2013, and will not have significant impacts	The project will widen Highway 111 from four to six lanes for a distance of approximately 4 miles	66
Fig 1B-1	Polygon	Imperial Solar Energy Center West	El Centro	CSOLAR Development	ROW granted	250 MW solar facility located on 65 acres of BLM land	73
Fig 1B-2	Polygon	Ocotillo Sol	9 miles southwest of El Centro	SDG&E	NOI published	18 MW project on 115 acres	74
5	Point	College of the Desert West Valley Campus Facilities Master Plan & Phase I Project	Indian Canyon Drive and Tramview Road, Palm Springs	Desert Community College District	Draft EIR Submitted 3/15/2013	West Valley Campus Facilities Master Plan and Phase 1 Project. Total planned development of 650,000 sf on 119+ acres. Also includes 30 on-campus dwelling units and 10,000 sf of campus related retail. Phase 1 development of 50,000 sf.	77
Fig 1B-3	Polygon	Ocotillo Wind Energy Facility	5 miles west of Ocatillo	Ocotillo Express	ROW approved	115 MW wind facility located on 12,436 acres of BLM land	80

While there is sufficient labor supply for the PSEGS and the other cumulative projects, the large number of construction workers needed for the projects when considered cumulatively, particularly if peak construction periods overlap, could impact the amount of hotel/motel and housing units in the local and regional study area. By itself, the PSEGS would not significantly impact the availability of local lodging supply. When considered cumulatively with the other projects, temporary lodging may be constrained in the local and regional study areas, thus contributing to a cumulative impact. Mr. Perez explained construction workers preference for lodging with easy access to Interstate 10, dining options, and convenience stores. As more construction workers come to work on the various cumulative projects, lodging availability in the more ideally-located communities (e.g. Indio, Blythe, Ehrenberg), could be more difficult to find, necessitating construction workers to turn to less ideally-located communities. A less ideally-located community would include communities further away from the project, communities without easy access to Interstate 10, or communities where lodging is higher priced. Also, more construction workers could choose to commute daily from their residence instead of moving closer to their job site.

Staff reviewed Google Earth and generated a table (Appendix A) that correlates the center point of each community by distance and travel time to PSEGS. With the use of both these tools, staff identified the communities of Mesa Verde, Desert Center, Ripley, Coachella, Bermuda Dunes, Thousand Palms, Thermal, Mecca, and Quartzsite as possible areas for lodging. However, when staff researched hotels and motels in these communities, the only lodging shown was one motel in Thousand Palms, an expensive hotel in Bermuda Dunes, and numerous hotels and motels of varying prices in Indian Wells, Indio, Palm Springs, Palm Desert, and La Quinta. Housing data for these communities is provided in **Socioeconomics Tables 8a** and **8b**.

Staff concludes that added with other projects with overlapping construction schedules, the PSEGS would contribute to a shortage of local and regional lodging. Approximately 1,005 single-family residential units (from 12 projects - ID/feature 23/point) are approved for construction in the city of Blythe and three residential developments are currently under construction. Riverside County approved a large residential development project with 16,665 units along the northwestern shores of Salton Sea (ID/feature 34/point). With these two projects, 17,670 residential units would be added to the PSEGS regional study area over time. Staff does not know when these projects anticipate completion of construction, but it is reasonable to assume that at least some of the units between the two projects would have completed construction during the PSEGS construction. Staff does not anticipate that new housing would need to be created to meet the temporary lodging needs of the PSEGS and the other cumulative projects.

Even with the temporary population increase in the local and regional study area, cumulative construction activities would not necessitate new or expanded public services (police, schools, parks and recreation) in the local study area based on information from the local BCTC and the Riverside County Sheriff’s Department. Mr. Perez with the local BCTC commented that construction workers for power plant projects tend to return to their residences on the weekend and when at the project site, they work their hours and go back to their temporary lodging in the evening. The Riverside County Sheriff’s Department commented that there is a low probability that additional law enforcement services are needed during PSEGS construction and operation, so it is likely that with the addition of the other projects in the cumulative setting, new or expanded law enforcement services would not be necessary. Construction workers do not tend to bring their families with them to their jobsite so new or expanded schools are not anticipated for the PSEGS and the other projects in the cumulative setting. Staff does not anticipate that new or expanded parks and recreation services are necessary for the PSEGS and other cumulative projects. Construction workers are not likely to spend much time visiting and using these resources.

Short-term, construction-related spending activities of the PSEGS, as for the approved PSPP, are expected to have cumulative economic benefits for the study area (refer below to Socioeconomics Table 14). The cumulative benefits would increase when revenues accrued as a result of the proposed PSEGS are combined with spending and any local revenues accrued as a result of current and future reasonably foreseeable cumulative development projects.

Operation. Operation of the PSEGS is expected to result in the potential permanent relocation of up to 25 workers into the local study area, versus 34 workers estimated for the approved PSPP. Socioeconomics Table 13 presents the most recently published data (Year 2010–2020 projections) on labor force characteristics for the cumulative regional study area pertaining to solar energy project operational labor skill sets and compares those to major cumulative projects located near the PSEGS along the I-10 corridor, including the GSEP, BSPP, RSEP, and the DSPV.

Socioeconomics Table 13
Cumulative Project Operational Employment Needs and Labor Supply

Trade	Total # of Workers for Project Operation						TOTAL	Riverside/San Bernardino/ Ontario MSA	
	Approved PSPP Project	**PSEGS**	**BSPP**	**GSEP**	**RSEP**	**DSPV**		**2010**	**2020**
Solar Field and Power Block Workers									
Operating Engineers and Other Construction Equipment Operators	—	24	—	—	—	—	24	2,510	3,030
Technicians									
Electrical and Electronics Repairers, Powerhouse, Substation and Relay	—	10	—	—	—	—	10	100	100
Control and Valve Installers and Repairers	—	2	—	—	—	—	2	620	680
Maintenance Workers, Machinery	—	4	—	—	—	—	4	610	660
Operators									
First-Line Operators	—	3	—	—	—	—	3	4,450	4,780
Power Plant Operators	—	12	—	—	—	—	12	130	150
Warehouse and Maintenance Personnel									
Janitors and Cleaners	—	1	—	—	—	—	1	17,120	19,110
Stock Clerks and Order Filler	—	2	—	—	—	—	2	22,090	25,720
Electrical and Electronics Repairers, Power house, Substation and Relay	—	2	—	—	—	—	2	100	120
Mobile Heavy Equipment Mechanics	—	4	—	—	—	—	4	1,680	1,790
Maintenance Workers, Machinery	—	4	—	—	—	—	4	610	660
Administrative Personnel									
General and Operation	—	1	—	—	—	—	1	16,920	18,030
Electrical Engineer	—	1	—	—	—	—	1	660	740
Mechanical Engineer	—	1	—	—	—	—	1	1,050	1,150

Secretaries and Administrative Assistants	—	2	—	—	—	—	2	12,670	13,420
Office and Administrative Support Workers	—	2	—	—	—	—	2	7,570	8,520
First-Line Supervisors of Mechanics, Installers, and Repairers	—	5	—	—	—	—	5	3,690	4,170
Miscellaneous Support									
Bus & Truck Mechanics and Diesel Engine Specialists	—	2	—	—	—	—	2	3,170	3,790
First-Line Supervisors of Mechanics, Installers, and Repairers	—	2	—	—	—	—	2	3,690	4,170
Electrical and Electronics Repairers, Power house, Substation & Relay	—	4	—	—	—	—	4	100	120
Control and Valve Installers and Repairers	—	2	—	—	—	—	2	620	680
Maintenance Workers, Machinery	—	2	—	—	—	—	2	610	660
Mobile Heavy Equipment Mechanics	—	2	—	—	—	—	2	1,680	1,790
Secretaries and Administrative Assistants	—	2	—	—	—	—	2	12,670	13,420
Office and Administrative Support Workers	—	2	—	—	—	—	2	7,570	8,520
Power Plant Operators	—	2	—	—	—	—	2	130	150
Total	*134*	*100*	*20*	*50*	*47*	*15*	*232*[2]	*122,820*	*136,130*
Local Housing Need[1]	*34*	*25*	*5*	*33*	*12*	*4*	*58*	*N/A*	*N/A*

Notes: — Data not available. N/A Not applicable.
[1] BSPP and PSEGS use a 25% relocation assumption in their respective AFCs. As no assumed percentage was included in the RSEP AFC or in the DSPV information provided by BLM, this table assumes 25% of operational employees would permanently relocate to the cumulative project area. The GSEP AFC specifically indicates that up to 33 workers would relocate. *Total reflects the combined total peak month numbers for the PSEGS, BSPP, GSEP, RSEP, and DSPV projects.
Source: Solar Millennium 2009a and b; GSEP 2009a; SR 2009a; BLM 2010c; NEBSEC 2013a; Palen 2012a; and Palen 2013ss.

Socioeconomics Tables 8a and 8b show there is enough housing in the local study area to house the 25 operational workers estimated to relocate closer to the project and enough housing for the other operations workers for the cumulative projects. The combined 17,600 housing units in Blythe and near the northwestern end of the Salton Sea could also be a source of housing for the operations workers for the cumulative projects. Staff does not anticipate a housing supply shortage for the operations workers for the cumulative projects. The small increase in the overall Palo Verde Unified School District student body from the PSEGS would not pose a significant cumulative impact and when added to the other cumulative projects, it is not anticipated that the increased student enrollment would necessitate the provision of new or expanded school services. The Riverside County Sheriff's Department commented that there is a low probability that additional law enforcement services are needed for project operations, so it is likely that with the addition of the other projects in the cumulative setting, new or expanded law enforcement services would not be necessary. Staff does not anticipate that the addition of the 25 PSEGS operations workers in the local study area plus the operations workers for the other cumulative projects would result in the need for new or expanded parks and recreation services, particularly when existing and planned housing (cumulative projects) would have considered these services. Also, operations workers for the PSEGS and the other cumulative projects may not all settle in the local study area, and instead settle in the regional study area, especially as operations workers are known to commute up to an hour in each direction to work on a power plant.

Closure. The closure of the PSEGS is expected to result in similar cumulative impacts related to socioeconomics as PSEGS construction impacts, as described above. It is unknown if the construction or closure of any of the cumulative projects would occur concurrently with the closure of this project, because the closure is not expected to occur until at least 30 years from project start-up. Based on the cumulative impact analysis for PSEGS construction activities, the impacts of the closure of the PSEGS would not be expected to contribute to cumulative impacts related to socioeconomics. Staff assumes that like the PSEGS, the non-operation and closure workforce would be drawn from the regional and local study areas, and at most, 15 percent of the workforce would temporarily relocate closer to the site for closure activities.

COMPLIANCE WITH LORS

CALIFORNIA REVENUE & TAXATION CODE, SECTION 73

Solar thermal projects are subject to property taxes and current law would qualify the PSEGS for the exclusion of certain parts from valuation per the Revenue and Taxation Code, section 73, if the project were under construction by January 1, 2017. However, because the PSEGS is located entirely on BLM lands and under Title 43, United States Code, section 1701, and the federal government is immune from state and local taxes, property taxes would not be collected. The federal government can provide payments to compensate states and local governments for burdens created as a result of immunity (payment in lieu of taxes, or PILT) [43 U.S.C., § 1701, subd. (a)(13)].

NOTEWORTHY PUBLIC BENEFITS

For the purpose of this analysis, staff defines noteworthy public benefits to include changes in local economic activity and local tax revenue that would result from project construction and operation. Impact estimates reflect two different scenarios representing the construction and operation phases of the project. Economic impacts associated with the construction phase include substantial expenditures on materials and labor that would occur during the 33-month construction phase.

The economic model most commonly used is the IMPLAN input-output model, developed by the Minnesota IMPLAN Group (MIG). The model relies on complex input-output tables and social accounting matrices. These are quantitative representations of the purchaser-supplier relationships between producers and intermediate and final consumers. Based on these tables, the analyst can estimate the economic activity that would result from a given expenditure, or other economic event. The resulting economic impact estimates are divided into three categories. These are the direct, indirect, and induced economic impacts. Within each of these categories, the model estimates associated changes in employment, labor income, and economic output.[7] Direct economic effects represent the employment, labor income, and spending associated with construction or operation of the project itself. Indirect economic effects represent the expenditures on intermediate goods made by suppliers who provide goods and services to the project. Induced economic effects represent household spending that occurs due to the increased wages, salaries, and proprietor’s income generated in the direct and indirect rounds.

Socioeconomics Table 14 provides a summary of economic and employment benefits of the PSEGS compared with the approved PSPP. As the PSEGS is completely on BLM land and the federal government is immune from state and local taxes, property taxes would not be collected. However, through payment in lieu of taxes the federal government can provide payments to compensate state and local governments for burdens created as a result of immunity (43 U.S.C., § 1701, subd. (a)(13)). The petition to amend has identified that an estimated $4.3 million in annual property tax would be assessed on the project if it were sited on non-BLM land. Payment in lieu of taxes would be at the discretion of the BLM.

[7] The Minnesota IMPLAN Group (2012) defines Economic Output as “the value of industry production.” In the manufacturing sector, output is equal to total sales, minus inventory changes. For the service sectors, output is equal to total sales. In the retail and wholesale trade sectors, output is equal to the gross margin (i.e., total sales, minus the cost of goods sold).

Socioeconomics Table 14
PSEGS Economic Benefits

Fiscal Benefits	**Approved PSPP Project** (2009 dollars)	**PSEGS**
Estimated annual property taxes	$200,000[1]	$0 to 4.3 million[2]
State and local sales taxes: Construction	$805,000	$7 million
State and local sales taxes: Operation	$437,500	$70 million
School Impact Fee	$0	Not applicable
Non-Fiscal Benefits		
Capital Cost	$248,700,000	$533.8 million[3]
Construction materials and supplies	$30.0 million	$71,400,000
Operations and maintenance supplies	$5.0 million	$589,600
Direct, Indirect, and Induced Benefits		
Estimated Direct Employment		
Construction	566 jobs (annual full-time equivalent over full 39-month construction phase)	840 jobs
Income	$218.7 million (total over full 39-month construction phase)	$462.4 million
Operation	134 jobs	100 jobs
Income	$5.8 million (annual)	12.3 million (annual)
Estimated Indirect Employment		
Construction	291 jobs	172 jobs
Income	$14.0 million	$11 million
Operation	40 jobs	8 jobs
Income	$3.0 million	$36,605
Estimated Induced Employment		
Construction	196 jobs	3,274 jobs
Income	$13.0 million	$159.1 million
Operation	37 jobs	69 jobs
Income	$2.0 million	$2,778,257

Notes:

1 At present, there is no property tax assessed on solar components (mirrors, solar boiler, heat exchangers) by law (section 73 of the California Taxation and Revenue Code). Components included under the exemption include storage devices, power conditioning equipment, transfer equipment, and parts. The first operational year and subsequently thereafter would generate an estimated $200,000 in annual property taxes.

2 As the PSEGS is completely on BLM land and the federal government is immune from state and local taxes, property taxes would not be collected. However, the federal government can provide payments to compensate states and local governments for burdens created as a result of immunity (43 U.S.C., § 1701, subd. (a)(13)). An estimated $4.3 million would ordinarily be assessed which the federal government could pay to Riverside County, either in full, in part, or not at all.

3 The applicant estimated the capital cost for construction as $2 million. Staff questions the applicant's estimate as the combined estimate for local materials and supply purchases and the total construction payroll (capital costs) add up to $533.8 million.

Source: Solar Millennium, 2009a; Palen 2012a.

RESPONSE TO COMMENTS

Staff received the following agency and public comments related to socioeconomics for the PSEGS (summarized below). Staff's responses to the comments are provided below the list of comments and where noted in the responses, comments have been addressed in this text.

COUNTY OF RIVERSIDE, JOHN J. BENOIT, COUNTY OF RIVERSIDE COMMENTS ON THE PRELIMINARY STAFF ASSESSMENT, TN 200094, JULY 30, 2013:

Comment: If private land within the county must be permanently restricted for mitigation purposes, the economic impact resulting from the removal of those lands must be accounted for and further mitigation may be necessary to offset any identified adverse impacts to the county or the environment.

Response: The Biological Resources staff notes that acquisition lands for mitigation could be private or under the public domain, and are not limited to Riverside County, but rather, are recommended to occur within the desert tortoise's Colorado Desert Recovery Unit. Also, mitigation lands are not typically selected during the permitting phase. According to the Biological Resources staff, ownership and zoning of land are a subpart of the selection criteria; however, biological characteristics, including habitat connectivity, are also considered when evaluating a mitigation proposal from a project owner (see Condition of Certification BIO-12).

It is beyond the scope of the Socioeconomic analysis to assess the fiscal impact to Riverside County from the possible removal of private lands for purposes of environmental mitigation.

Comment: Due to the remoteness of the site, housing workers on both a short-term and long-term basis may be an issue.

Response: Staff has addressed this concern and incorporated additional information into the analysis (see the Induce Substantial Population Growth, Displace People or Housing, and Cumulative Impacts subsections).

Comment: The population projections presented in the PSA are the most recent California Department of Finance population forecasts released in January 2013, and are the most recent forecasts for the County overall. Southern California Association of Governments (SCAG) Regional Transportation Plan/Sustainable Communities Strategy growth forecasts are available at geographic levels as small as the Traffic Analysis Zone, providing for more detailed analyses. For Riverside County as a whole, the Department of Finance and SCAG forecasts are consistent. Use of the SCAG forecasts may provide a more accurate localized analysis of project impacts.

Response: Staff reviewed the SCAG data and incorporated additional information into the analysis (see Socioeconomics Tables 2 and 3).

Comment: The series of numbers in Socioeconomics Table 6 under the columns labeled "2010" and "2020" could not be deciphered.

Response: Staff has corrected the data in Socioeconomics Table 6.

Comment: The county questions the selection of cities and CDPs presented in Socioeconomics Table 8 (renumbered as Socioeconomics Table 8a) as being representative of localities in the study area most likely to be impacted and questions why the city of Coachella and the communities of Thermal, Mecca, Bermuda Dunes, and Thousand Palms have not been included. The county also questioned why the Palo Verde CDP was included as it is in Imperial County and the Riverside County communities of Mesa Verde and Ripley were not included.

Response: Staff has incorporated a classification of vacancy status for each of the cities and communities presented in the regional and local study areas (see Socioeconomics Tables 8a and 8b).

Comment: The county presented a table with vacancy data for Blythe, Cathedral City, Desert Center, Indian Wells, Indio, Palm Desert, Palm Springs and Palo Verde CDP. The county comments that the vacancy rates they presented in the table represent a comparison of the total number of vacant units to the vacant units available for rent or purchase. The table specifically presents the total housing units, occupied housing units, vacant housing units, units for rent, units for sale, and the vacancy rate. The county also calculated a vacancy rate for sale units and one for rental units. The county comments that 67 percent of the vacant units in the region are for seasonal, recreation, or occasional use so the conclusions in the PSA that there is ample housing available may be an over estimate.

Response: Staff reviewed the data presented in the county's table and agrees with the majority of the data except for the county's calculation of the vacancy rate for sale units and rental units. With the exception of "Other Vacant," the data presented in Socioeconomics Table 8b is a direct reporting of 2010 decennial Census data.

Comment: The county comments that it is inappropriate to assume that the housing units presented in Socioeconomics Table 7 (hotel and motel lodging) are in the rate categories of the income level of the typical construction worker. A number of cities listed in Socioeconomics Table 8 (renumbered as Socioeconomics Table 8a) have some of the highest real estate and rental prices in the country and it is likely that a significant percentage of the vacancies are not within reach of the average solar worker.

Response: Staff realizes that there may be lodging in some of the cities and communities in the PSEGS regional study area that is more expensive than construction workers may choose to spend. Staff has addressed this issue and incorporated additional information into the analysis (see the Induce Substantial Population Growth subsection).

Comment: The cumulative effect of construction workers temporarily relocating to sites under construction that would adversely impact low-income housing and possibly create a shortage of available housing for low- and moderate- income residents in areas such as Coachella, Chuckwalla, and Palo Verde valleys.

Response: Staff's research shows that construction workers who temporarily relocate to job sites prefer hotels/motels over apartments or single-family homes. At the July 25th PSA workshop, staff asked Riverside County to provide some evidence of displacement of low-income residents by construction workers to verify or corroborate the county's concerns. The county indicated that they did not have evidence that would support their concerns. To assume that construction workers would displace low-income residents by taking up temporary residence in low-income housing is speculative and appears to be unsupported by staff's research with Mr. Perez.

Comment: The county questions staff's use of the six-mile buffer based on urban air quality modeling methods to determine "social justice" impacts.

Response: As discussed in the Socioeconomics analysis, staff defines the study area related to project impacts on population, housing, and parks as within a one-hour commute of the project. An analysis at a local level presents a challenge because the proposed PSEGS is in a sparsely populated area, with the largest urban center being the city of Riverside, located approximately 100 miles west of the site. A reasonable study area for localized socioeconomic impacts would include the two nearest communities: the city of Blythe, California (approximately 25 miles east of the PSEGS site), and the city of Ehrenburg, Arizona (approximately 30 miles east of the PSEGS site). The study area for law enforcement is the local jurisdictional boundary for the Riverside Sheriff's Department. The study area for impacts to schools is the Palo Verde and Desert Center School districts. The study area for indirect and induced economic impacts is defined as Riverside County. For the purposes of assessing project impacts during construction, staff defines the regional study area as within a two-hour commute of the project. As Desert Center is the closest community to the project site, population and housing data for Desert Center have been included in the table even though this community is sparsely populated.

The study area for environmental justice impacts is a six-mile buffer of the project site. When an environmental justice population is present, the following technical areas include in their analyses an assessment of impacts to environmental justice communities: Air Quality, Hazardous Materials Management, Land Use, Noise and Vibration, Public Health, Socioeconomics, Soil and Water Resources, Water Quality, Traffic and Transportation, Transmission Line Safety and Nuisance, Visual Resources, Cultural Resources, and Waste.

Final Guidance for Incorporating Environmental Justice Concerns in EPA's Compliance Analyses (US EPA 1998) encourages outreach to community-based organizations and tribal governments early in the screening process to identify the presence of distinct minority communities residing both within, and in proximity to the proposed project, and to identify those minority groups who utilize or are dependent upon natural and cultural resources that could be potentially affected by the proposed action. The Public Adviser's Office is responsible for outreach to local communities affected by a project. Consultations with local Native American communities are initiated by the Cultural Resources staff. In some cases, impacts have occurred to Native American populations who use the natural and cultural resources found in the six-mile buffer but who do not live there.

Air quality staff identifies the maximum impacts of the project and compares them with the most stringent ambient air quality standards. The ambient air quality standards provide public health protection, including protecting the health of "sensitive" populations such as asthmatics, children, and the elderly. Staff always finds the maximum air quality impact occurs well within the 6-mile radius. The impact would be much less beyond the 6-mile radius. If the maximum project impact (which always occurs within 6-mile radius) is less than significant, there would be no environmental justice issue for air quality (CEC 2013x).

Comment: Adequacy of services provided by Riverside Sheriff's Department, Colorado River Station should construction workers relocate to the area for construction.

Response: Staff has addressed this concern and incorporated additional information into the analysis (see the Police Protection subsection).

Comment: The county states that staff's conclusion regarding the availability of local housing within a two-hour commute rate is flawed because the data does not accurately reflect the true vacancy rates, does not take into account the actual affordability of available housing within reach of the solar workforce, does not include the communities within the study's commute rate most likely to be impacted, and does not adequately examine the potential environmental and social justice impacts on some of the county's most vulnerable communities from workers displacing low-income renters. The assumption that adequate available housing for all types of construction workers is unproven and the potential economic impact on Riverside County's most economically fragile communities remains unexamined.

Response: Staff has addressed this concern and incorporated additional information into the analysis (see Socioeconomics Tables 8a and 8b and the Induce Substantial Population Growth subsection.

Comment: The purchase of homes by "some percentage" of the project's operational staff would only result in a net benefit to the county if the sale results in greater property tax revenue than presently received. Given the trends in real estate values over the last seven years, it remains highly likely that the sale of an existing home may actually result in a reduction of assessed value and a net loss of revenue to the county. Staff should not automatically assume that home buying by permanent operational staff will result in a net benefit to the county.

Response: Staff has updated this text to acknowledge that residential property taxes are based on the assessed value at the time of sale (see the Police Protection and Parks and Recreation subsections).

TOURISM ECONOMICS COMMISSION, PAUL SMITH AND MORONGO BASIN CONSERVATION ASSOCIATION, PAT FLANAGAN, COMMENTS ON THE PSA, TN #: 200074, JULY 29, 2013:

Comment: The assessment did not take into account the economic effects on the tourism and business in the desert from the PSEGS project alone and in conjunction with other solar projects cumulatively planned along the Interstate 10 corridor.

Response: Socioeconomics Table 14 presents an estimate of the economic benefits from the PSEGS, including the indirect and induced jobs and income from the project. Visual Resources staff states that the Palen Solar Electric Generating Systrem project would result in a substantial adverse impact to existing scenic resource values as seen from Joshua Tree National Park (see the Visual Resources section of the FSA). Quantifying the economic effect from a reduction in scenic value to the Joshua Tree National Park and Morongo Basin communities is beyond the scope of the Socioeconomics analysis.

CONCLUSIONS

No direct or indirect significant adverse socioeconomics impacts would occur as a result of the construction or operation of the proposed PSEGS, like the approved PSPP. However, when considered cumulatively with the other proposed and approved projects, temporary lodging may be constrained in the local and regional study areas, thus contributing to a cumulative impact. Staff does not anticipate that new housing would need to be created to meet the temporary lodging needs of the PSEGS and the other cumulative projects. Even with the temporary population increase in the local and regional study area, cumulative construction activities would not necessitate new or expanded public services (police, schools, parks and recreation) in the local study area.

PSEGS operations would not create a significant adverse socioeconomic cumulative impact. New or expanded law enforcement services would not be necessary and the increased student enrollment would not necessitate the provision of new or expanded school services. Staff does not anticipate that the addition of the 25 PSEGS operations workers in the local study area plus the operations workers for the other cumulative projects would result in the need for new or expanded parks and recreation services, particularly when existing and planned housing (cumulative projects) would have considered these services.

The proposed PSEGS, like the approved PSPP, would benefit the local and regional study areas in terms of an increase in local expenditures and payrolls during construction and operation of the facility, as well as a possible benefit to public finance and local economies through taxation. These activities would have a positive effect on the local and regional economy.

PROPOSED CONDITIONS OF CERTIFICATION

Staff has a new condition for Socioeconomics. There were no pervious conditions for Socioeconomics for the PSPP project. (Note: New text is **<u>bold and underlined</u>**)

<u>SOCIO-1 The project owner shall submit a “No Trespassing” letter to the satisfaction of the Colorado River Station of the Riverside County Sheriff’s Department. The “No Trespassing” letter shall remain on file throughout construction and operation of the project.</u>

<u>Verification: At least 30 days prior to the start of construction, the project owner shall provide a copy of the letter to the Colorado River Station of the Riverside County Sheriff’s Department for review and to the CPM for review and approval.</u>

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SOCIOECONOMICS APPENDIX A

Start Location	County	Travel Time (minutes)	Distance (miles)
Desert Center CDP	Riverside	13	12.1
Mesa Verde CDP	Riverside	29	31.8
Ripley CDP	Riverside	37	40.8
Blythe	Riverside	39	38.5
Ehrenberg CDP	La Paz	45	51.3
Palo Verde CDP	Imperial	52	51.8
Indio	Riverside	53	59.9
Quartzsite town	La Paz	55	61.3
Coachella	Riverside	57	61.7
Bermuda Dunes CDP	Riverside	58	63.8
Desert Palms CDP	Riverside	58	64.9
Thermal CDP	Riverside	60	65.5
Mecca CDP	Riverside	63	52.6
Thousand Palms CDP	Riverside	63	69.8
Vista Santa Rosa CDP	Riverside	63	64.4
Cibola CDP	La Paz	64	52.3
Palm Desert	Riverside	67	69.2
Cathedral City	Riverside	67	75.6
Rancho Mirage	Riverside	69	72.7
La Quinta	Riverside	69	66.8
Poston CDP	La Paz	70	71.8
La Paz Valley CDP	La Paz	70	71.0
Indian Wells	Riverside	70	69.9
Oasis CDP	Riverside	70	74.6
Garnet CDP	Riverside	72	80.8
Indio Hills CDP	Riverside	72	77.0
Sky Valley CDP	Riverside	72	77.0
Desert Shores CDP	Imperial	75	82.8
Desert Edge CDP	Riverside	75	82.1
Desert Hot Springs	Riverside	76	84.9
Vicksburg CDP	La Paz	77	86.5
Palm Springs	Riverside	77	79.3
Brenda CDP	La Paz	78	79.8
Salton Sea Beach CDP	Imperial	78	85.5
Whitewater CDP	Riverside	79	90.0
North Shore CDP	Riverside	79	60.8
Cabazon CDP	Riverside	82	94.8
Salton City CDP	Imperial	84	92.5
Morongo Valley CDP	San Bernardino	85	96.4
Twentynine Palms	San Bernardino	86	89.7
Salome CDP	La Paz	86	99.2
Big River CDP	San Bernardino	90	91.7
Bombay Beach CDP	Imperial	90	76.4
Bluewater CDP	San Bernardino	91	95.9

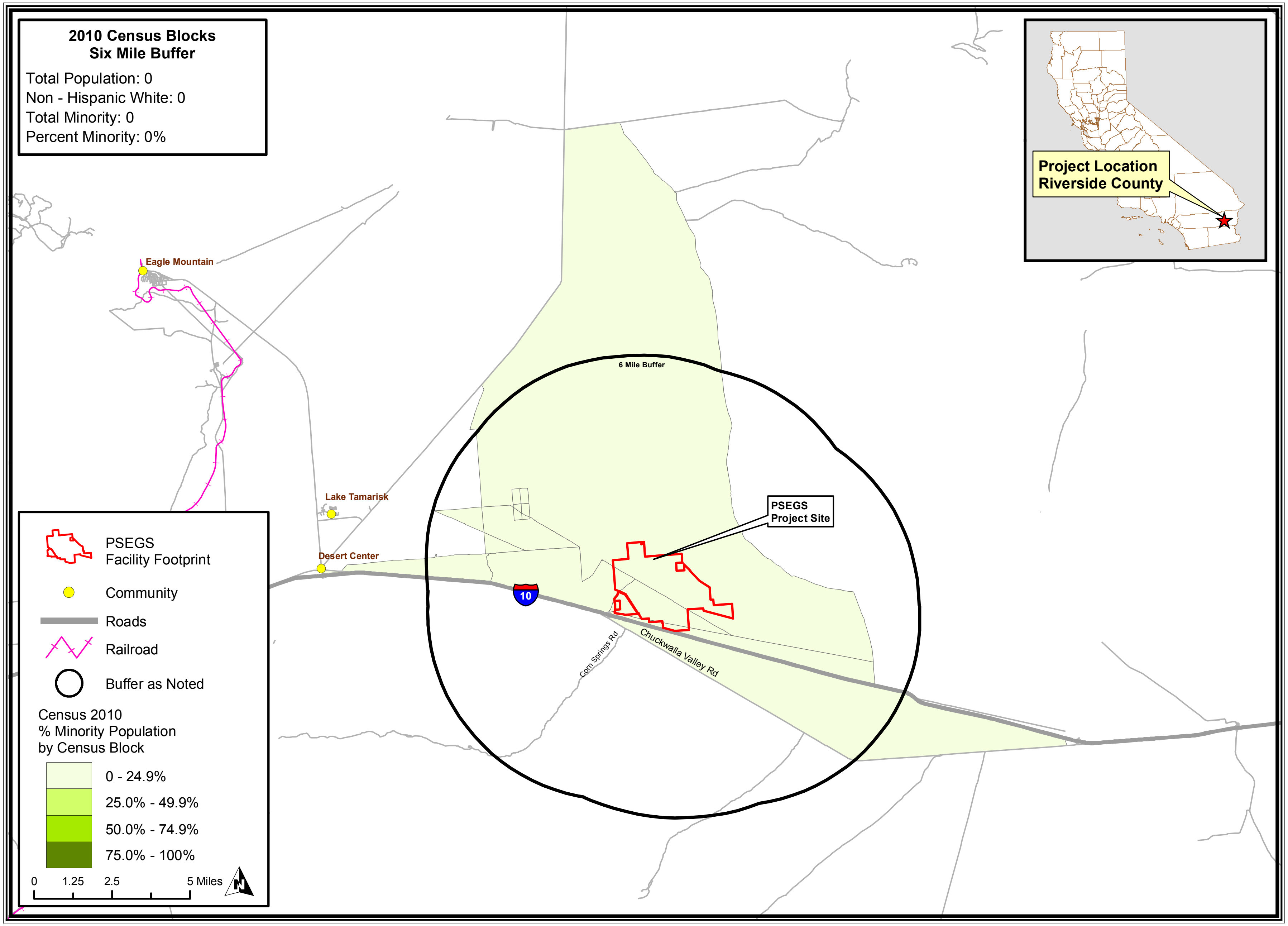
Start Location	County	Travel Time (minutes)	Distance (miles)
Utting CDP	La Paz	91	102.1
Parker town	La Paz	92	90.2
Bluewater CDP	La Paz	93	88.8
Wenden CDP	La Paz	94	104.4
Calimesa	Riverside	94	112.1
Beaumont	Riverside	94	107.1
Yucca Valley town	San Bernardino	94	104.6
Cienega Springs CDP	La Paz	96	92.9
Bouse CDP	La Paz	98	102.5
Cherry Valley CDP	Riverside	99	109.9
Joshua Tree CDP	San Bernardino	100	103.6
Banning	Riverside	102	107.5
Redlands	San Bernardino	103	121.0
Yucaipa	San Bernardino	104	116.7
San Jacinto	Riverside	105	116.2
Parker Strip CDP	La Paz	105	101.2
Moreno Valley	Riverside	106	120.8
Niland CDP	Imperial	107	93.5
Westmorland	Imperial	107	120.7
Mentone CDP	San Bernardino	108	120.1
Oak Glen CDP	San Bernardino	110	116.1
Lakeview CDP	Riverside	110	121.9
March ARB CDP	Riverside	111	129.5
Anza CDP	Riverside	111	103.2
Loma Linda	San Bernardino	111	127.2
Highland	San Bernardino	111	127.7
Homestead Valley CDP	San Bernardino	112	117.9
Sunwest CDP	La Paz	114	113.8
Nuevo CDP	Riverside	114	124.6
Hemet	Riverside	114	121.1
Colton	San Bernardino	115	130.9
Grand Terrace	San Bernardino	115	131.4
Green Acres CDP	Riverside	115	124.2
Calipatria	Imperial	115	100.3
San Bernardino	San Bernardino	115	134.7
Mountain Center CDP	Riverside	116	108.0
Brawley	Imperial	117	119.2
Sunnyslope CDP	Riverside	117	135.3
Homeland CDP	Riverside	117	126.1
Winchester CDP	Riverside	117	125.5
Bloomington CDP	San Bernardino	117	134.9
Crestmore Heights CDP	Riverside	118	134.0
Valle Vista CDP	Riverside	118	123.5
Mead Valley CDP	Riverside	119	134.7

Start Location	County	Travel Time (minutes)	Distance (miles)
Rubidoux CDP	Riverside	119	134.3
Riverside	Riverside	119	134.9
Romoland CDP	Riverside	119	127.5
Woodcrest CDP	Riverside	120	135.1
East Hemet CDP	Riverside	120	122.5
Needles	San Bernardino	120	124.8
Glen Avon CDP	Riverside	120	138.1
Lake Riverside CDP	Riverside	121	109.4
Muscoy CDP	San Bernardino	121	137.3
Winterhaven CDP	Imperial	121	116.5
Perris	Riverside	122	138.0
Highgrove CDP	Riverside	122	134.4
Idyllwild-Pine Cove CDP	Riverside	122	111.5
Aguanga CDP	Riverside	122	114.4
Rialto	San Bernardino	123	137.5
Good Hope CDP	Riverside	124	140.2
Pedley CDP	Riverside	124	137.6
Fontana	San Bernardino	125	140.1
Holtville	Imperial	125	125.6
Home Gardens CDP	Riverside	126	143.4
El Sobrante CDP	Riverside	127	142.4
Meadowbrook CDP	Riverside	127	142.9
Ontario	San Bernardino	127	145.8
Mira Loma CDP	Riverside	127	142.6
Lake Mathews CDP	Riverside	127	138.9
Menifee	Riverside	127	144.7
Imperial	Imperial	129	137.5
Warm Springs CDP	Riverside	129	146.0
French Valley CDP	Riverside	130	134.6
Eastvale CDP	Riverside	130	147.1
Coronita CDP	Riverside	130	148.4
Norco	Riverside	130	147.6
Rancho Cucamonga	San Bernardino	131	149.2
Corona	Riverside	131	147.1
El Cerrito CDP	Riverside	131	148.1
Running Springs CDP	San Bernardino	132	143.5
Crestline CDP	San Bernardino	132	145.0
Montclair	San Bernardino	132	152.6
Canyon Lake	Riverside	132	146.9
Lake Elsinore	Riverside	133	147.0
Heber CDP	Imperial	133	136.1
El Centro	Imperial	134	133.9
Murrieta	Riverside	134	153.6

Start Location	County	Travel Time (minutes)	Distance (miles)
Seeley CDP	Imperial	135	142.0
Upland	San Bernardino	135	151.7
San Antonio Heights CDP	San Bernardino	136	156.4
Lucerne Valley CDP	San Bernardino	136	147.0
Lytle Creek CDP	San Bernardino	136	152.2
Temescal Valley CDP	Riverside	137	154.7
Calexico	Imperial	137	138.3
Oak Hills CDP	San Bernardino	137	157.3
Chino	San Bernardino	138	152.2
Wildomar	Riverside	139	155.3
Temecula	Riverside	141	143.3
Lakeland Village CDP	Riverside	142	151.7
Chino Hills	San Bernardino	142	160.9
Lake Arrowhead CDP	San Bernardino	144	151.4
Hesperia	San Bernardino	145	163.2
Wrightwood CDP	San Bernardino	146	162.7
Piñon Hills CDP	San Bernardino	146	162.8
Mountain View Acres CDP	San Bernardino	147	167.1
Victorville	San Bernardino	149	170.1
Phelan CDP	San Bernardino	151	164.1
Ocotillo CDP	Imperial	152	162.1
Spring Valley Lake CDP	San Bernardino	152	169.9
Adelanto	San Bernardino	154	172.4
Apple Valley town	San Bernardino	154	175.5
Big Bear Lake	San Bernardino	162	160.2
Silver Lakes CDP	San Bernardino	166	185.5
Big Bear City CDP	San Bernardino	166	161.7
Barstow	San Bernardino	172	199.5
Lenwood CDP	San Bernardino	173	199.0
Alamo Lake CDP	La Paz	179	136.9
Fort Irwin CDP	San Bernardino	210	237.1
Baker CDP	San Bernardino	223	199.0
Searles Valley CDP	San Bernardino	254	264.9

SOCIOECONOMICS - FIGURE 1

Palen Solar Electric Generating System - Census 2010 Minority Population by Census Block - Six Mile Buffer

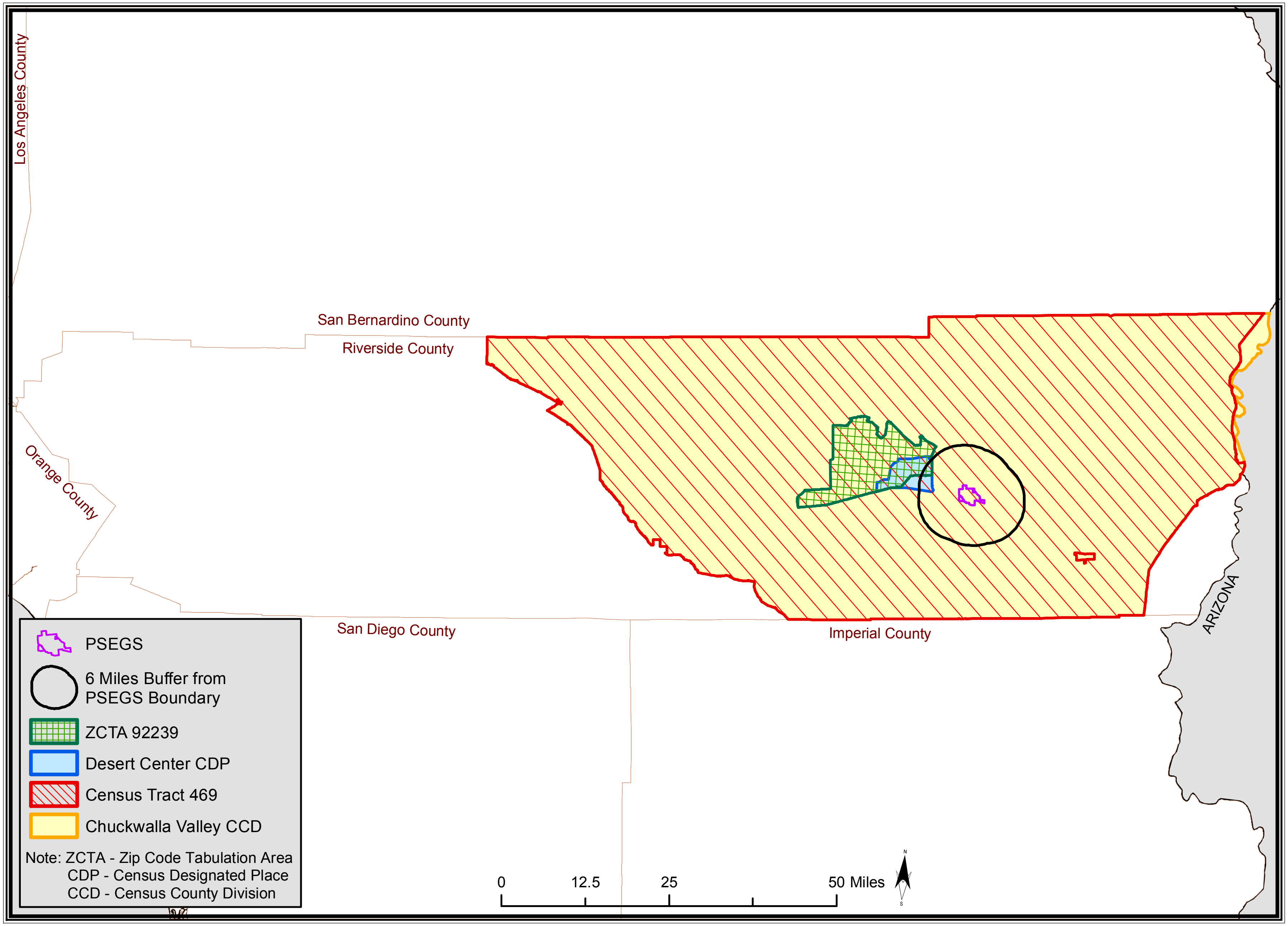


SOCIOECONOMICS

CALIFORNIA ENERGY COMMISSION, SITING, TRANSMISSION AND ENVIRONMENTAL PROTECTION DIVISION

SOURCE: AECOM, Census 2010 PL 94-171 Data

SOCIOECONOMICS - FIGURE 2
Palen Solar Electric Generating System - Zip Code Tabulation Area



SOCIOECONOMICS

CALIFORNIA ENERGY COMMISSION, SITING, TRANSMISSION AND ENVIRONMENTAL PROTECTION DIVISION
SOURCE: Census 2010, ESRI

SOIL AND WATER RESOURCES

Testimony of Marylou Taylor, P.E.

SUMMARY OF CONCLUSIONS

Based on the information provided, California Energy Commission (Energy Commission) staff (staff) determined that construction, operation, and closure of the proposed modified Palen Solar Electric Generating System (PSEGS) could potentially impact soil and water resources. Where these potential impacts have been identified, staff has proposed mitigation measures to reduce identified impacts to levels that are less than significant. The mitigation measures, as well as specifications for laws, ordinances, regulations and standards (LORS) conformance, are included herein as conditions of certification. The Soil and Water Resources Conditions of Certification address the California Environmental Quality Act (CEQA) requirements for the Energy Commission's analysis, and if the conditions of certification are implemented, the project would conform to all applicable LORS and state policies.

A summary of proposed modifications to the **Soil and Water Resources** Conditions of Certification is shown in **Soil & Water Resources Table 1**.

Soil & Water Resources Table 1
Summary of Proposed Modifications to Conditions of Certification

Condition of Certification	Proposed Modification(s) to Condition
SOIL&WATER-1	DRAINAGE EROSION AND SEDIMENTATION CONTROL PLAN (DESCP): Edit to items C and N.
SOIL&WATER-2	PROJECT GROUNDWATER WELLS, PRE-WELL INSTALLATION: No change.
SOIL&WATER-3	CONSTRUCTION AND OPERATION WATER USE: Reduce maximum limit of water usage and construction duration to match the project description.
SOIL&WATER-4	GROUNDWATER LEVEL MONITORING, MITIGATION AND REPORTING: No change.
SOIL&WATER-5	COMPENSATION FOR WELL IMPACTS: No change.
SOIL&WATER-6	WASTE DISCHARGE REQUIREMENTS: Delete a typo. Revise requirements specified in Appendix B, C, and D to match the modified project.
SOIL&WATER-7	SEPTIC SYSTEM AND LEACH FIELD REQUIREMENTS: No change.
SOIL&WATER-8	REVISED PROJECT DRAINAGE REPORT AND PLANS: Delete.
SOIL&WATER-9	DETAILED FLO-2D ANALYSIS: Delete.
SOIL&WATER-10	DRAINAGE CHANNEL DESIGN: Delete.
SOIL&WATER-11	CHANNEL EROSION PROTECTION: Delete.
SOIL&WATER-12	CHANNEL MAINTENANCE PROGRAM: Delete.
SOIL&WATER-13	CLOSURE PLAN: Text changed to match language in the GENERAL CONDITIONS section.
SOIL&WATER-14	MITIGATION OF IMPACTS TO THE PALO VERDE MESA GROUNDWATER BASIN: No change.
SOIL&WATER-15	GROUNDWATER PRODUCTION REPORTING: No change.

Condition of Certification	Proposed Modification(s) to Condition
SOIL&WATER-16	GROUND SUBSIDENCE MONITORING AND ACTION PLAN: Change “applicant” to “project owner”.
SOIL&WATER-17	ESTIMATION OF SURFACE WATER IMPACTS: Edit to verification.
SOIL&WATER-18	GROUNDWATER QUALITY MONITORING AND REPORTING PLAN: Change “applicant” to “project owner”.
SOIL&WATER-19	NON-TRANSIENT, NON-COMMUNITY WATER SYSTEM: No change.
SOIL&WATER-20	STORM WATER DAMAGE MONITORING AND RESPONSE PLAN: New.

Socioeconomics staff has determined that the population in the six mile buffer does not constitute an environmental justice population as defined by “Environmental Justice: Guidance under the National Environmental Policy Act” and would not trigger further scrutiny for purposes of an environmental justice analysis.

INTRODUCTION

On December 15, 2010, the Energy Commission approved the 500-megawatt (MW) Palen Solar Power Project (PSPP) for construction and operation. On December 17, 2012, Palen Solar Holdings, Inc. (project owner) filed a petition to modify the PSPP and requested that the project name be changed to Palen Solar Electric Generating System (PSEGS). The proposed PSEGS contains several modifications, the most notable being the change in solar thermal technology of power generation, from parabolic trough technology to solar tower technology. All proposed modifications are described in the **PROJECT DESCRIPTION** section of this Final Staff Assessment (FSA).

This analysis addresses potential impacts to soil and water resources through the construction and operation of the modified PSEGS project. Where impacts are found to be the same or less than impacts of the approved PSPP project, staff applied the existing Conditions of Certification, as contained in the Commission Decision dated December 15, 2010 (CEC 2010f), to reduce those impacts to less than significant.[1] Aspects of the modified project that are new or substantially different from the approved project have been identified and examined for potential impacts. To reduce these impacts to less than significant, staff recommends new conditions of certification. In this analysis, the term “approved project” refers to the PSPP and the term “modified project” refers to the proposed modified PSEGS.

METHODOLOGY AND THRESHOLDS FOR DETERMINING ENVIRONMENTAL CONSEQUENCES

Significance criteria are based on those listed in CEQA Appendix G. Soil and water resources impacts would be significant if the project would:

- violate any water quality standards or waste discharge requirements;
- substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the

[1] The analysis presented in the PSPP Revised Staff Assessment (CEC 2010c) has been included in the text of this FSA, where applicable, for the reader's reference.

local groundwater table level (e.g., the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted);

- substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial erosion or siltation onsite or offsite;
- substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in flooding onsite or offsite;
- create or contribute runoff water that would exceed the capacity of existing or planned storm water drainage systems or provide substantial additional sources of polluted runoff;
- otherwise substantially degrade surface water or groundwater quality;
- place structures within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map;
- place structures within a 100-year flood hazard area that would impede or redirect flood flows;
- expose people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam;
- result in substantial soil erosion or the loss of topsoil;
- have impacts that are individually limited, but cumulatively considerable ("Cumulatively considerable" means that the incremental effects of a project are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects); or
- have environmental effects which will cause substantial adverse effects on human beings, either directly or indirectly.

Although the CEQA Guidelines provide a checklist of suggested issues that should be addressed in an environmental document, neither the CEQA statute nor the CEQA guidelines prescribe thresholds of significance or particular methodologies for performing an impact analysis. This is left to lead agency judgment and discretion, based on factual data and guidance from regulatory agencies and other sources where available and applicable. Staff assessed whether the PSEGS project would comply with the LORS and policies described in **Soil & Water Resources Table 2** and whether there would be a significant impact under the CEQA. Where a potentially significant impact was identified, staff proposed mitigation to ensure the impacts would be less than significant.

LAWS, ORDINANCES, REGULATIONS, AND STANDARDS (LORS)

Soil & Water Resources Table 2
Laws, Ordinances, Regulations, and Standards (LORS) and Policies

Applicable LORS	Description
Federal	
Clean Water Act of 1977 (Including 1987 Amendments) Sections 401, 402 and 404	The primary objective of the Clean Water Act (CWA) is to restore and maintain the chemical, physical, and biological integrity of the Nation's surface waters. Section 401: Requires certification that the proposed project is in compliance with established water quality standards. Section 402: Direct and indirect discharges and storm water discharges into waters of the United States must be made pursuant to a National Pollutant Discharge Elimination System (NPDES) permit. Section 404: Activities resulting in the dredging or filling of jurisdictional waters of the U.S. require authorization under a Section 404 permit issued by the U.S. Army Corp of Engineers (USACE).
State	
State of California Constitution Article X, Section 2	Prohibits the waste or unreasonable use of water, regulates the method of use and method of diversion of water and requires all water users to conserve and reuse available water supplies to the maximum extent possible.
SWRCB Order 2009-0009-DWQ	The State Water Resources Control Board (SWRCB) regulates storm water discharges associated with construction affecting areas greater than or equal to 1 acre to protect state waters. Under Order 2009-0009-DWQ, the SWRCB has issued a NPDES General Permit for storm water discharges associated with construction activity.
SWRCB Order 97-03-DWQ	The SWRCB regulates storm water discharges associated with several types of facilities, including steam electric generating facilities. Under Order 97-03-DWQ, the SWRCB has issued a NPDES General Permit for storm water discharges associated with industrial activity.
California Water Code Section 461	Stipulates that the primary interest of the people of the State of California is the conservation of all available water resources and requires the maximum reuse of reclaimed water as an offset to using potable resources.
California Water Code Section 1200 "Water Rights"	California's water rights law is a hybrid system in that the use of certain types of water requires a permit from the SWRCB, while other types of uses are governed by common law.
The Porter-Cologne Water Quality Control Act of 1967, California Water Code Section 13000 et seq.	Requires the SWRCB and the nine Regional Water Quality Control Boards (RWQCBs) to adopt water quality standards to protect State waters. Those standards include the identification of beneficial uses, narrative and numerical water quality criteria, and implementation procedures.
California Code of Regulations Title 22, Article 3, Sections 64400.80 through 64445	This section requires monitoring for potable water wells, defined as non-transient, non-community water systems (serving 25 people or more for more than six months). Regulated wells must be sampled for bacteriological quality once a month and the results submitted to the California Department of Public Health (CDPH).
California Code of Regulations Title 23, Division 3, Chapter 9	This chapter requires the Colorado River Basin RWQCB (CRBRWQCB) to issue a report of waste discharge for discharges of waste to land pursuant to the Water Code.

Applicable LORS	Description
California Code of Regulations Title 23, Division 3, Chapter 15	Regulates all discharges of hazardous waste to land that may affect water quality.
State Policies and Guidance	
SWRCB Res. 68-16	Anti-Degradation Policy: This policy restricts degradation of surface and ground waters. In particular, this policy protects water bodies where existing quality is higher than necessary for the protection of beneficial uses.
SWRCB Res. 75-58	Power Plant Cooling Water Policy: The purpose of the policy is to provide consistent statewide water quality principles and guidance for adoption of discharge requirements, and implementation actions for power plants that depend on inland waters for cooling.
SWRCB Res. 77-01	Water Reclamation Policy: Under this policy, the SWRCB and CRBRWQCBs shall encourage reclamation and reuse of water in water-short areas.
SWRCB Res. 92-49	Policies and Procedures for Investigations and Clean-up and Abatement of Discharges Under CWC Section 13304: Under this policy, clean-up and abatement actions are to implement applicable provisions of Title 23 CCR Chapter 15, to the extent feasible.
SWRCB Res. 2009-0011	Water Quality Control Policy for Recycled Water: The purpose of this Policy is to increase the use of recycled water from municipal wastewater sources that meets the definition in CWC Section 13050(n), in a manner that implements state and Federal water quality laws.
Public Resources Code Section 25300 et. seq.	The Energy Commission adopted a policy stating they would approve the use of “fresh inland” water for cooling purposes by power plants only where alternative water supply sources and alternative cooling technologies are shown to be “environmentally undesirable” or “economically unsound.”
State Water Policy	The Energy Commission has five authoritative sources for statements of policy relating to water use in California applicable to power plants. They are the California Constitution, the Warren-Alquist Act, the Commission’s restatement of the state’s water policy in the 2003 Integrated Energy Policy Report (“IEPR”), the State Water Resources Control Board resolutions (in particular Resolutions 75-58 and 88-63), and a letter from the Board to the Energy Commission interpreting Resolutions 75-58 and 88-63 [collectively referred to as the state’s water policies - see Genesis Solar Project (09-AFC-08)].
Local	
Riverside County Ordinance Code, Title 13, Chapter 13.20	Establishes requirements to construct and operate groundwater wells.
Riverside County Ordinance Code, Title 8, Chapter 8.124	Establishes requirements to construct and operate sanitary wastewater disposal systems.
Riverside County Title 15 Chapter 15.24 Uniform Plumbing Code	Adopts by reference the California Plumbing Code, including the appendix and standards, for the installation and inspection of plumbing systems as a means of promoting the public's health, safety and welfare.

Applicable LORS	Description
Riverside County Title 15 Chapter 15.80 Regulating Flood Hazard Areas and Implementing the National Flood Insurance Program	This ordinance was developed to comply with Title 44 CFR Part 65 regarding requirements for the identification and mapping of areas identified as Federal Emergency Management Agency (FEMA) Special Flood Hazard Areas.

PROPOSED MODIFIED PROJECT

Characteristics of the modified project that have the potential to impact soil and water resources differently than the approved project are shown in **Soil & Water Resources Table 3**.

Soil & Water Resources Table 3
PSPP vs. PSEGS Features Impacting Soil and Water Resources

Feature	PSEGS – Modified Project (500 MW)	PSPP – Approved Project (500 MW)
Solar technology	solar tower - two adjacent solar fields, each consisting of a power block and approximately 85,000 heliostats for heating a receiver on top of a 750 foot tall solar power tower	parabolic trough – two adjacent solar fields, each consisting of a power block and rows of parabolic mirrors for heating heat transfer fluid (HTF)
Project footprint	approximately 3,794 acres	approximately 4,365 acres
Water use during construction	400 acre-feet per year (total of 1,130 acre-feet)	1,917 acre-feet per year (total of 5,750 acre-feet)
Water use during operations	up to 201 acre-feet per year	up to 300 acre-feet per year
Evaporation ponds	two 2-acre ponds	four 4-acre ponds
Land Treatment Units (LTUs)	not required	required to treat HTF-contaminated soils
Solar field grading	maintaining existing vegetation to the extent possible; limited grading for roads, power blocks, and common facilities area (total earthwork approximately 213,000 cubic yards)	grading of entire solar fields to create flat, uniform topography and elimination of all vegetation (total earthwork approximately 4,500,000 cubic yards)
Storm water drainage control	maintain natural drainage patterns for the majority of the site; diversion channels bypass storm water runoff around power blocks and common facilities area	eliminate all onsite natural drainage and construct three large drainage control channels to bypass all offsite storm water runoff around the solar fields
Common facilities area	a common facilities area of approximately 15 acres located in the southwestern corner of the site containing: main office building, warehouse and maintenance buildings, and evaporation ponds	a common facilities area of approximately 50 acres located in a southwestern edge of the site containing: main office building, warehouse and maintenance buildings, and laydown area
Temporary construction laydown area	203 acres located in the southwestern portion of the site immediately north of the common facilities area	various locations around the site, including the common facilities area and near each power block
Length of construction	33 months	39 months

Feature	PSEGS – Modified Project (500 MW)	PSPP – Approved Project (500 MW)
Off-site linear facilities	The modified project includes a slight re-routing of the generation tie-line and the redundant telecommunication line near the western end of the approved route, around the newly constructed Red Bluff Substation. The modified project also includes a natural gas pipeline from a new extension of the existing Southern California Gas (SoCal Gas) distribution system.	

Source: Palen 2012a §5.2, CEC 2010f

Refer to the **PROJECT DESCRIPTION** section of this FSA for more information on PSEGS major features. **Project Description Figure 5** shows the location of the proposed modified project with respect to the approved project, as well as the offsite linear facilities. Additional information relevant to the soil and water resources analysis is summarized below. For a complete detailed description of the proposed modified project, refer to the Petition for Amendment (Palen 2012a) and the project owner's related supplemental material.

PROJECT CONSTRUCTION

Construction of the approved project was to be accomplished in two, overlapping phases, requiring 39 months for completion, with completion of the west solar field within six months after the east solar field. For the modified project, the two phases would be constructed over a similar time frame, with construction of Solar Plant 1 beginning only a few months prior to that for Solar Plant 2. Commercial operation for both plants is expected to begin at the same time[2]. The entire construction period would be 33 months versus the 39 for the approved project (Palen 2013h §5).

Soil Erosion and Storm Water Control

During construction, portions of the PSEGS site would be graded, including portions along the ephemeral washes. Grading is not intended to level the site, but rather to prepare the site for installation of the heliostats and ease future maintenance activities. As such, the drainages would remain, to the extent feasible, and natural drainage waters are expected to continue to flow in and through these ephemeral washes. Any grading required would be designed to maintain existing drainage pathways, where possible (Palen 2013e §3.4).

Power Plant Sites

Major items at each PSEGS solar plant would include a steam turbine system, an air-cooled steam condenser system, and a 750-foot-tall solar power tower topped with a solar receiver steam generator (SRSG). Other associated items include various raw water/wastewater treatment facilities with water storage tanks, auxiliary boilers, mirror washing related equipment, a wet surface air cooler (WSAC), a gas metering set, and a plant services building with parking. Heavy to medium grading would be performed within each plant’s solar power tower and power block areas. The earthwork within the power blocks would be excavated and compacted to the recommendations of the final geotechnical report. The deepest excavations would occur for foundations and sumps.

[2] The first construction phase would include construction of the generation tie-line, access road, common facilities area, common facilities, temporary construction laydown area, both power blocks including laydown area, and a portion of Solar Field 2. The second construction phase would include the construction of Solar Field 1 and the remainder of Solar Field 2 (Palen 2013a).

Within each of these individual areas, earthwork cuts and fills would be balanced to the greatest degree possible (Palen 2012a §§2.2, 2.13).

Prior to construction, the project owner would prepare a Storm Water Pollution Prevention Plan (SWPPP) to control storm water and soil erosion during the facility's construction using best management practices (BMPs).[3] To redirect storm water flow around these facilities, diversion channels, bypass channels, or drainage swales would be used. Stone filters and check dams would be placed strategically, as needed, throughout the project site to provide areas for sediment deposition and to promote the sheet flow of storm water prior to leaving the project site boundary. Native materials (rock and gravel) would be used where available for the construction of the stone filter and check dams. Stone filters and check dams are not intended to alter drainage patterns, but to minimize soil erosion and promote sheet flow (Palen 2012a §2.13).

Permanent diversion channels would be built around both Solar Plant 1 and Solar Plant 2 power blocks during the early stages of power plant construction to provide storm water management of the power block area during construction activities. These channels would be designed with a minimum ground surface slope of 0.5 percent to allow positive, puddle-free drainage. To reduce erosion, storm drainage channels may be lined with a nonerodible material such as compacted riprap, geosynthetic matting, or engineered vegetation (Palen 2013e §3.4.3).

Solar Fields – Heliostats

The approved project would have required extensive grading to maintain a consistent grade for interconnecting piping and three major drainage channels to manage storm water around the entire solar field. The modified project would instead require much less grading because the heliostat technology does not require an entirely flat surface (Palen 2012a §2.13).

The modified project would be designed to provide the minimum requirements for access of installation equipment and materials during site construction and operations. Most of the natural drainage features would be maintained and any grading required would be designed to promote sheet flow where possible. Areas disturbed by grading and other ground disturbance would be protected from erosion by implementation of appropriate BMPs (Palen 2012a §2.13).

Solar field development would maintain unobstructed sheet flow, with storm water mostly traveling in existing natural contours and flowpaths. Relatively small rock filters and local diversion berms through the heliostat fields may be installed as required to discourage water from concentrating and to maintain sheet flow. Mowing of vegetation, rather than removal, would allow for clearance for heliostat function while leaving soil surface and root structures intact (Palen 2013e §4.4).

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[3] Storm water and soil erosion BMPs are methods that have been determined to be the most effective, practical means of preventing or reducing pollution from nonpoint sources. BMPs can be classified as "structural" (i.e., devices installed or constructed on a site) or "non-structural" (procedures, such as modified landscaping practices). There are a variety of BMPs available, depending on pollutant removal capabilities. (See California Stormwater BMP Handbook at www.casqa.org.)

Each solar field would consist of approximately 85,000 heliostats - elevated mirrors each with a total reflecting surface of 204.7 square feet. Each heliostat assembly would be mounted on a single support pylon and guided by a computer-programmed aiming control system to track the movement of the sun. Communication between the heliostats and the operations center would be done via surface-mounted anchored cable or wireless remote system (Palen 2012a § 2.2).

The siting of pylons would be guided by global positioning system (GPS) technology. Installation of the heliostat assemblies would use vibratory technology to insert the pylons into the ground and a rough terrain crane able to mount heliostat assemblies on several pylons before moving to the next location. Depths are not expected to be greater than 12 feet. Vegetation clearing, grubbing,[4] and contour smoothing in the heliostat fields would occur where necessary to allow for equipment access and storm water management. In areas where these activities are not required for access or construction, the vegetation would not be removed, but would be mowed (if needed) to a height of approximately 12 to 18 inches (Palen 2012a §2.13).

Solar Fields – Roads

PSEGS would contain six types of roads (Palen 2012a Appendix 2-D, Palen 2013a Appendix A, Palen 2013e) as shown on **Soil & Water Resources Figure 1**:

- 24-ft wide asphaltic paved road provides access to the site from Interstate 10
- 20-ft wide asphaltic paved roads located within the solar field connect the power blocks/towers to each other
- 20-ft wide dirt (aggregate base) road located at the boundary of the two solar fields from where the 20-ft paved road ends to the northeast boundary of the site.
- 12-ft wide asphaltic paved roads located around the perimeter of the common area facilities
- 12-ft wide dirt (aggregate base) roads located around the perimeter of the site, around the perimeter of the power blocks, and spike access from power blocks to the site perimeter
- 10-ft wide circular dirt (cleared and smoothed) roads placed approximately 152 feet apart located concentrically around the power blocks areas provide maintenance access to the heliostats

Most of the natural drainage features would be maintained and any grading required would be designed to promote sheet flow where possible (Palen 2013e §3.4).

[4] Grubbing of vegetation includes the removal of any remaining roots or stumps after cutting vegetation to clear land.

Common Area

A 15-acre common facilities area would be established in the southwestern corner of the site to accommodate an administration building, warehouse, and maintenance complex; evaporation ponds; asphalt-paved visitor and employee parking area; and landscape areas. Construction of these common area facilities would require heavy to medium grading and would occur concurrently with the construction of Solar Plants 1 and 2 (Palen 2012a §2). The common facilities area would also be used for a temporary construction area, as described in "Laydown Areas" below.

The administration complex would occupy approximately 4.8 acres and would be served by power from the local 33-kV distribution system and water from water supply wells located in the common area. Similar to the power plant sites, storm water management for the administration complex would include a permanent diversion channel comprising an engineered earthen berm and adjacent swale with rock slope protection. The surface areas within the common area that are used for construction activities would be stabilized and dust suppression maximized with a layer of crushed stone in areas subject to heavy daily traffic (Palen 2012a §2).

Laydown Areas

The 203-acre temporary construction laydown area on the west side of the site would be used for equipment laydown, construction parking, construction trailers, a tire cleaning station, heliostat assembly facility, a temporary concrete batch plant, and other construction support facilities. The surface areas within the temporary construction area that are used frequently would be stabilized and dust suppression maximized with a layer of crushed stone in areas subject to heavy daily traffic. The temporary construction laydown area has been sized large enough to allow the staging of deliveries and truck and worker ingress and egress to the site to avoid stacking on the I-10/Corn Springs interchange (Palen 2012a §2.6).

Additionally, 11.2 acres of temporary construction laydown areas would be located at each solar plant site for construction parking and equipment laydown. To redirect storm water flow around these construction laydown areas, diversion berms or drainage swales would be used. Stone filters and check dams would be placed, as needed, to provide areas for sediment deposition (Palen 2013g). Areas compacted during construction activities would be restored, as appropriate, to approximate preconstruction compaction levels to minimize the opportunity for any increase in surface runoff (Palen 2013e §3.4).

Linear Facilities

Off-site

The approved project did not include a natural gas supply pipeline, but rather was approved to use liquefied petroleum gas contained within a tank for its auxiliary fuel. The modified project would use natural gas to fire its auxiliary and nighttime preservation boilers. The natural gas supply for PSEGS would be provided by Southern California Gas (SoCal Gas), which would upgrade and extend an existing distribution line from its main transmission gas pipeline located approximately 1.8 miles west and south of the site. The modified project also includes a slight re-routing of the generation tie-line and the redundant telecommunication line near the western end of the approved route, around the newly constructed Red Bluff Substation (Palen 2012a §2).

On-site

During construction, trenches would be excavated for the installation of underground systems, equipment and materials including onsite electrical transmission system conductors and onsite natural gas system. The natural gas supply lines would be extended onsite to serve both Solar Plants.

The approved project proposed overhead transmission lines to transport electricity generated at the power blocks to the onsite switchyard. The modified project proposes underground electric cables for this purpose. The cable from Solar Plant 2 would be routed to Solar Plant 1 adjacent to major access roads. Cables serving each Solar Plant would then be routed to the onsite switchyard (Palen 2013r §20).

The typical trench would be 2-3 feet wide at the base and 3-6 feet deep, but a few trenches may have widths and/or depths up to 12 feet. In addition, buried conductors would require manholes located at intervals of approximately 1,000 to 2,000 feet for cable pulling during construction. The manholes would be approximately 8-10 feet in depth. Trench sides would be sloped or shored in accordance with applicable safety requirements to prevent trench walls from collapsing (Palen 2012a §2.13).

Total Soil Disturbance

Construction of the PSEGS would affect the areas shown on **Project Description Figure 6**. Soil disturbance would occur as a result of grubbing, grading, and excavation activities. After construction, some of these areas would be covered with impervious material (i.e. concrete foundations, asphalt pavement, heliostat assemblies) and temporary construction areas would be restored to pre-project grade and stabilized to prevent erosion and promote natural re-vegetation.[5] **Soil & Water Resources Table 4** summarizes the estimated graded areas and impervious areas.

[5] As required by Condition of Certification **BIO-8**, Item 22 (see the **BIOLOGICAL RESOURCES** section of this FSA).

Soil & Water Resources Table 4
Estimated Graded Areas and Impervious Areas

Graded Areas		Percent of Total Project Area[(1)]
Dirt Roads	244 acres	9.2%
Power Blocks	102 acres	
Switch Yard	3 acres	
Total	349 acres	
Impervious Areas		21.7%
Heliostats[(2)]	799 acres	
Paved Roads	25 acres	
Power Blocks		
Common Area		
Total	824 acres	
Temporary (during construction)		1.0%
Construction Laydown Area	28 acres	
Concrete Batch Plant	4 acres	
Underground electric cables	5 acres	
Natural Gas Line (onsite)	2 acres	
Total	39 acres	
Offsite Linear Facilities	339 acres	--

(Source: Palen 2012a, Palen 2013a, Palen 2013r)
Notes 1 - Solar fields (3576 acres) + Common Area (15 acres) + Laydown Area (203 acres) = 3794 acres (Does not include offsite linear facilities.)
2 - Accounts for surface area of all mirrors in horizontal position. Assuming 170,000 heliostats total, each with a 204.7 square feet reflecting surface.

Water Use

The approved project would have used up to 1,917 acre-feet per year (afy) during construction (for a total of 5,750 acre-feet during the 39 months) from up to 10 groundwater wells. The modified project would use up to the same number of groundwater wells as the approved project. However, because less extensive grading would be required for the solar field, the modified project would only use up to 400 afy (for a total of 1,130 acre-feet) during the construction period (Palen 2012a §2.4).

The modified project would require water for various construction-related activities. These activities include:

- Dust control for areas experiencing construction work as well as mobilization and demobilization;
- dust control for roadways;
- water for grading activities associated with both cut and fill work;
- water for soil compaction in the utility and infrastructure trenches;
- water for soil compaction of the site grading activities;
- water for soil stockpile sites;
- water for the various building pads;

- water for hydrostatic testing for tanks and pipelines; and
- water for concrete pours on-site.

Wastewater Management

Wastewater generated during construction would consist of similar types and quantities as the approved project (Palen 2012a §5.2). Anticipated sources of wastewater would include sanitary wastes, wash water, concrete washout water, paint wash water, piping and vessel hydrostatic test water, and drilling slurries and drilling fluids (Palen 2013e §3.11). Sanitary waste would be contained in portable facilities and routinely disposed of at an offsite treatment/disposal facility by a sanitary service. Excess concrete and concrete washout slurries would be discharged to a temporary washout facility (Palen 2013e §4.3).

PROJECT OPERATION

PSEGS would be designed for an operating life of 25 to 30 years. It is anticipated that the facilities would normally operate at high average annual capacity factors during periods of sunlight (Palen 2012a § 3.1.4). Commercial operation for both Solar Plants 1 and 2 is estimated to begin in late 2016[6] (RCSD 2013a).

Soil Erosion

The project owner submitted a Preliminary Draft Construction Drainage, Erosion, and Sediment Control Plan/Storm Water Pollution Prevention Plan ([DESCP/SWPPP] Palen 2013e) that lists standard Best Management Practices (BMPs). Disturbed areas would be stabilized with effective soil cover (such as aggregate, paving, or vegetation) as soon as feasible, but no later than 14 days after construction or disturbance is complete in that portion of the site. To reduce erosion potential, BMPs would be implemented in accordance with the approved DESCP. Vegetation would remain, but would be cut (when necessary) to a height that would allow clearance for heliostat function while leaving the root structures intact. Occasional cutting of the vegetation would be performed as needed to permit unobstructed heliostat mirror movement.

Storm Water Control

The approved project would have constructed three large drainage control channels to bypass all offsite storm water runoff around the solar fields. The modified project would instead construct much smaller diversion channels to bypass runoff around Solar Plant 1, Solar Plant 2, and the administration complex. These channels would be maintained during the operational life of PSEGS. Periodic maintenance would be conducted as required after major storm events and when the volume of accumulated material behind the check dams exceeds 50 percent of the diversion channel's designed volume (Palen 2013e §3.4).

[6] If approved, the start of construction would likely begin in spring 2014 to allow desert tortoises to be cleared from the site. Commercial operation would likely begin in late 2016 due to the delay for tortoise clearing

Areas compacted during construction activities would be restored, as appropriate, to approximate preconstruction compaction levels to minimize the opportunity for any increase in surface runoff. A majority of solar field development would maintain unobstructed sheet flow along existing natural contours and flowpaths. Relatively small rock filters and local diversion berms through the heliostat fields may be installed as required to discourage water from concentrating. Stone filters and check dams are not intended to alter drainage patterns, but to minimize soil erosion and promote sheet flow (Palen 2013e §4).

Grading and mowing during construction, and continued vegetation control during operations, could affect a large portion of the onsite ephemeral drainages over the life of the project. Despite these ongoing activities, the natural hydrologic processes would be maintained. These existing flow patterns are intermittent with variable channels, and ephemeral flows would continue to follow the same direction toward Palen Dry Lake (Palen 2013e §4.4).

Each PSEGS Solar Plant would keep the potentially polluted contact[7] storm water from the power blocks and equipment areas, general facility drainage, process wastewater, and sanitary waste completely separated from non-contact storm water runoff, as described in the Wastewater Management discussion below.

Water Use

The approved project would have used up to 300 afy during operation from up to 10 groundwater wells. The modified project would utilize the same number of groundwater wells but would only use up to 201 afy during operation. The onsite groundwater production wells would supply both solar plants and the common area with make-up water, mirror-wash water, and domestic water. Each solar plant would include a water treatment and deionizing facility in the power block area. Water for domestic uses by project employees would be provided by onsite groundwater treated to potable water standards. The estimated annual water use for this purpose is 4 afy (Palen 2012a §2.4).

Wastewater Management

PSEGS would keep the potentially polluted waste water (contact runoff, general facility drainage, process wastewater, and sanitary waste) completely separated from non-contact storm water runoff (Palen 2012a §2.8).

General Facility Drainage

Each Solar Plant would collect contact runoff from the power block to prevent this potentially contaminated water from comingling with non-contact storm water runoff. The contact runoff would be collected along with wastewater from the plant's raw water use (such as sample drains, containment area washdown, and facility equipment wash water) through a system of floor drains, hub drains, sumps, and piping and routed to the oil/water separator. From there, the water would flow to the waste collection tank then to a thermal evaporator system with the process wastewater (Palen 2012a §2.8).

[7] Contact runoff refers to storm water in contact with exposed polluted or hazardous materials and/or surfaces that can potentially result in contaminated runoff (containing trace oil, chemicals, metals, toxic substances, or other materials).

Process Wastewater

The primary wastewater collection system would collect process wastewater from all of the solar plant equipment, including blowdown[8] from the SRSG, natural-gas-fired boiler, demineralization, auxiliary cooling system, and water treatment equipment. Additional sources of wastewater include oil/water separator effluent from power block storm water runoff and general facility drainage. To the extent practical, process wastewater would be recycled and reused. A thermal evaporator system (vapor recompression evaporation system) would treat the collected wastewater by concentrating the soluble materials through evaporation. Distillate collected from the system would be recycled and routed to the well water storage tank for reuse. Concentrated waste brine from the evaporator would be transported to the evaporation ponds by tank truck (Palen 2012a §2.8).

The evaporation ponds for the approved project were located within the solar block area, with two 4-acre ponds in the approximate center of each solar field. For the modified project, the two 2-acre ponds would be located in the common area in the southwest portion of the project site. Each 2-acre pond would be divided into two cells and would be capable of evaporating the total waste stream from the entire facility for the life of the project. Two ponds allow the use of one pond when the other requires maintenance. The evaporation ponds would be double-lined with high-density polyethylene (HDPE) liners to prevent infiltration of process water into the soil below (Palen 2012a §2.8).

Sanitary Waste

Each solar plant and the administration complex would include a septic tank and leach field system for sanitary water streams, including showers and toilet. When needed, septic tank contents would be removed from site by a sanitary service. Based on the current estimate of approximately 3,010 gallons of sanitary wastewater production per day, a total leach field area of approximately 6,000 square feet would be required, spread out among three or more locations (Palen 2012a §2.8).

Mirror Washing

Regular mirror washing is anticipated to be needed once a week, and additional mirror washing may occur on an as-needed basis as determined by a reflectivity monitoring program. Mirror washing would occur primarily at night and involves a water truck spraying treated water on the mirrors in a drive-by fashion. Wash water falls from the mirrors to the ground and, due to the small volume, soaks in with no appreciable runoff. Remaining rinse water from the mirror washing operation is expected to evaporate on the mirror surface (Palen 2012a §2.4).

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[8] Blowdown is the portion of water drained from a process to remove mineral build-up from concentrated recirculating water. These minerals would cause scaling on equipment surfaces and can damage the system.

CONTAMINATED SOIL AND WATER

A Phase I Environmental Site Assessment (ESA) performed in May 2009 for the project area concluded that no recognized environmental conditions (REC) were associated with the project site.[9] Because the ESA is required to be updated within a year if a new project is proposed, the project owner has provided an updated records search for the Phase I ESA and indicates there are still no REC's documented at the site. (Palen 2013cc §70). Although the potential of encountering contaminated soil would be low, staff would require that an experienced and qualified Professional Engineer or Professional Geologist be available for consultation during site characterization, soil grading or soil excavation to determine appropriate actions to be taken in the event contaminated soil is encountered. (Refer to the **WASTE MANAGEMENT** section of this FSA for additional information related to contaminated soil).

SETTING AND EXISTING CONDITIONS

The project is located between the communities of Blythe, California (approximately 35 miles southeast) and Desert Center, California (approximately 10 miles west).

The project site is located in the Mojave Desert Geomorphic Province. The Mojave Desert is a broad interior region of isolated mountain ranges separated by expanses of desert plains. It has an interior enclosed drainage and many playas. There are two important fault trends that control topography—a prominent NW-SE trend and a secondary east-west trend (apparent alignment with Transverse Ranges is significant). The Mojave province is wedged in a sharp angle between the Garlock Fault (southern boundary Sierra Nevada) and the San Andreas Fault, where it bends east from its northwest trend. The northern boundary of the Mojave is separated from the prominent Basin and Range by the eastern extension of the Garlock Fault.

PHYSIOGRAPHY

Physiographically, the project site lies near the toe of alluvial fans emanating from the Chuckwalla Mountains to the south, the Coxcomb Mountains to the north, and the Palen Mountains to the northeast, and is bisected by a broad valley-axial drainage that extends southward between these mountains and drains to the Palen Lake playa located a short distance north of the site (see **Soil & Water Resources Figure 2**). The elevation of Chuckwalla Valley ranges from under 400 feet at Ford Dry Lake to approximately 1,800 feet above mean sea level (amsl) west of Desert Center and along the upper portions of the alluvial fans that ring the valley flanks. The surrounding mountains rise to approximately 3,000 and 5,000 feet amsl.

[9] AECOM, Inc. "Phase I Environmental Site Assessment of Proposed Solar Power Plant Site Located in Eastern Riverside County, California". Prepared for Solar Millennium, LLC. May 2009.

The ground surface in the region of the project site generally slopes gently downward to the southeast at a gradient of less than 1 percent. Ground surface elevations at the project site itself range from approximately 680 feet amsl in the southwest to 425 feet amsl in the northeast. Steeper grades are present at isolated sand dunes along the northern portion of the site. Toward the north and central portions of the site, the ground becomes hummocky as it transitions to the flat playa located along the northern portion of the site.

CLIMATE AND PRECIPITATION

The climate in the Chuckwalla Valley, which is classified as a “low desert,” is characterized by high aridity and low precipitation. The region experiences a wide variation in temperature, with very hot summer months with an average maximum temperature of 108 degrees Fahrenheit (ºF) in July and cold dry winters with an average minimum temperature of 66.7 ºF in December. The Blythe area receives approximately 3.5 inches of rainfall per year. The majority of the rainfall occurs during the winter months, but rainfall during the late summer is not uncommon. The summer rainfall events tend to be a result of tropical storms that have a short duration and a higher intensity than the winter rains. Annual precipitation ranges from 0.02 to 0.47 inches per month for a total annual precipitation of just under four inches per year. **Soil & Water Resources Table 5** and **Soil & Water Resources Table 6** display the average monthly and annual minimum and maximum temperatures and precipitation (rainfall) from 1913 to 2008 collected from the Blythe Airport, located approximately 35 miles southeast of the project site. **Soil & Water Resources Table 7** presents average monthly evapotranspiration rates for various stations located in the region.

Average annual precipitation in the project area, based on the gauging station at Blythe Airport, is 3.59 inches, with August recording the highest monthly average of 0.64 inches and June recording the lowest monthly average of 0.02 inches. Per the National Oceanic and Atmospheric Administration (NOAA) Atlas 14 for the Southern California area, 3.51 inches of rain fall in the 100-year, 24-hour storm event.

Soil & Water Resources Table 5
Climate Temperature Data for Blythe Airport, California

Month	Temperatures °F					Mean Number of Days			
	Monthly Averages			Record Extremes		Max. Temp.		Min. Temp.	
	Daily Max.	Daily Min.	Monthly	Record High	Record Low	90°F & Above	32°F & Below	32°F & Below	0°F & Below
Jan	66.7	41.5	54.1	89	20	0	0	2.7	0
Feb	72	45.4	58.7	93	22	0.2	0	0.8	0
Mar	78.4	50.2	64.3	100	30	3.1	0	0.1	0
Apr	86.4	56.5	71.5	107	38	11.6	0	0	0
May	95.2	64.4	79.8	114	43	23.8	0	0	0
Jun	104.5	72.7	88.6	123	46	29	0	0	0
Jul	108.4	81	94.7	123	62	30.9	0	0	0
Aug	106.6	80.2	93.4	120	62	30.6	0	0	0
Sep	101.3	73	87.2	121	51	28.4	0	0	0
Oct	89.8	60.9	75.3	111	27	17.6	0	0	0
Nov	75.8	48.6	62.2	95	27	0.8	0	0.1	0
Dec	66.7	41.2	53.9	87	24	0	0	1.8	0
Year	87.7	59.6	73.6	123	20	175.9	0	5.5	0

Source: Western Regional Climate Center (WRCC) 2009.

Soil & Water Resources Table 6
Precipitation Data for Blythe Airport, California

Month	Rainfall (inches) [1913-2008]			
	Mean	Highest Month	Lowest Month	Highest Daily
Jan	0.47	2.48	0	1.64
Feb	0.44	3.03	0	1.66
Mar	0.36	2.15	0	1.52
Apr	0.16	3	0	2.67
May	0.02	0.22	0	0.22
Jun	0.02	0.91	0	0.91
Jul	0.24	2.44	0	1.4
Aug	0.64	5.92	0	3
Sep	0.37	2.14	0	1.9
Oct	0.27	1.89	0	1.61
Nov	0.2	1.84	0	1.04
Dec	0.39	3.33	0	1.42
Year (1)	3.59	—	—	3

1 - Totals may not match the data in specific columns due to rounding errors.
Source: WRCC 2009.

Soil & Water Resources Table 7
Monthly Average Evapotranspiration (ETo) Rates

Month	CIMIS Station #127 Station: Salton Sea West	CIMIS Station #128 Station: Salton Sea East	CIMIS Station #135 Station: Blythe NE	CIMIS Station #151 Station: Ripley	CIMIS Station #162 Station: Indio	CIMIS Station #175 Station: Palo Verde II	Regional
Jan (in/mo)	2.40	2.40	2.32	2.44	2.44	2.41	1.55
Feb (in/mo)	3.20	3.20	3.09	3.31	3.31	3.23	2.52
Mar (in/mo)	5.13	5.13	5.00	5.25	5.25	5.59	4.03
Apr (in/mo)	6.78	6.78	6.61	6.85	6.85	7.22	5.70
May (in/mo)	8.62	8.62	8.54	8.67	8.67	8.78	7.75
Jun (in/mo)	9.18	9.18	9.69	9.57	9.57	9.42	8.70
Jul (in/mo)	9.19	9.19	10.13	9.64	9.64	9.58	9.30
Aug (in/mo)	8.63	8.63	8.91	8.67	8.67	8.61	8.37
Sep (in/mo)	6.97	6.97	6.85	6.85	6.85	6.58	6.30
Oct (in/mo)	5.22	5.22	4.64	5.00	5.00	4.74	4.34
Nov (in/mo)	3.08	3.08	2.95	2.95	2.95	2.94	2.40
Dec (in/mo)	2.25	2.25	2.07	2.20	2.20	2.25	1.55
Year (in/yr)	70.65	70.65	70.8	71.4	71.4	71.35	62.50

California Irrigation Management Information System (CIMIS) monitoring station closest to project site are listed.
Regional evapotranspiration values correspond to CIMIS Reference ETo Zone 16, which includes Westside of San Joaquin Valley and Mountains East & West of Imperial Valley.
Source: Solar Millennium 2010a and CIMIS 2010.

SOILS

Soil characteristics of the project area were identified using the State Soil Geographic (STATSGO) database developed by the U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS) for use in regional, multi-state, river basin, state, and multicounty resource planning. STATSGO spatial data were compiled by combining geologically and topographically related soil series found in county soil surveys into larger map units known as soil associations. These associations provide sufficient detail to establish the physical type and characteristics of soils in the project area. Soil associations of the project site are shown on **Soil & Water Resources Figure 3**, and the soil types are described in **Soil & Water Resources Table 8**. The eastern portion of the Project area is comprised of Hyder-Cipriano-Cherioni Association soil (map ID s1141) and the western portion is Rosita-Dune Land-Carista Association soil (map ID s1136).

Soil & Water Resources Table 8
Soil Mapping Units and Descriptions

Soil Series	Slope (% grade)	Characteristics
s1136 Rositas-Dune land-Carsitas		
Rositas	0 to 30	The Rositas series consists of very deep, somewhat excessively drained soils formed in sandy eolian material blown from recent alluvium. Rositas soils are on dunes and sand sheets. Somewhat excessively drained; negligible to medium runoff; rapid permeability. Rositas soils are used for growing citrus fruits, grapes, alfalfa, and truck crops. Native vegetation creosote bush, white bursage, desert buckwheat and mesquite.
Dune land		Dune land is not a soil series name but a landform (geomorphic term) indicating an aeolian collection of primarily sand-sized sediment. Due to the nature of this landform, soil formation does not commonly occur where an active dune exists.
Carsitas		Carsitas soils are nearly level to strongly sloping and are on alluvial fans, moderately steep valley fills and dissected remnants of alluvial fans, at elevations of about 220 feet below sea level to 800 feet above sea level. The climate is one of long, hot dry summers and short mild dry winters with an average annual precipitation of less than 5 inches. Torrential summer thundershowers occasionally produce enough runoff to flood the soil for brief periods. Vegetation is a sparse growth of creosote bush, white bursage, barrel cactus, mesquite, and palo verde. Where irrigation water is available, the soils are used for growing citrus fruits and grapes.
Soil Series	**Slope (% grade)**	**Characteristics**
s1141 Vaiva-Quilotosa-Hyder-Cipriano-Cherioni		
Vaiva	1 to 65	The Vaiva series consists of very shallow and shallow, well drained soils formed in slope alluvium from granite and gneiss. Vaiva soils are on hills and mountains with slopes of 1 to 65 percent. The mean annual precipitation is about 7 inches and the mean annual air temperature is about 71 degrees F. Vegetation is saguaro, littleleaf palo verde, creosote bush, ocotillo, ironwood, triangle bursage, staghorn cholla, spicebush, false mesquite, wolfberry, bush muhly, brittlebush and ratany.
Quilotosa	3 to 65	The Quilotosa series consists of very shallow and shallow, somewhat excessively drained soils that formed from granitic and metamorphic rocks. Quilotosa soils are on hills and mountains and have slopes of 3 to 65 percent. The mean annual precipitation is about 7 inches and the mean annual air temperature is about 70 degrees F. Vegetation is saguaro, littleleaf palo verde, brittlebush, creosote bush, ocotillo, ironwood, triangle bursage, white bursage, cholla, forbs and grasses.
Hyder	1 to 65	The Hyder series consists of very shallow to shallow, somewhat excessively drained soils that formed in alluvium from rhyolite and related volcanic rocks. Hyder soils are on mountains and hills. Somewhat excessively drained; medium to rapid runoff; moderate or moderately rapid permeability. The native vegetation is creosote bush, white bursage, brittlebush, buckhorn cholla, and littleleaf palo verde.

Soil Series	Slope (% grade)	Characteristics
Cipriano	0 to 55	The Cipriano series consists of shallow and very shallow to hardpan, somewhat excessively drained soils that formed in fan alluvium from volcanic rock. Cipriano soils are on fan terraces. Somewhat excessively drained: slow to medium runoff; moderate permeability. Present vegetation is creosote bush, palo verde, stagholll and chainfi'uit eholla, saguaro, ocotillo, and triangle bursage with some fluffgrass and six weeks grama.
Cherioni	0 to 70	The Cherioni series consists of very shallow and shallow, somewhat excessively drained soils that formed in slope alluvium on volcanic bedrock. Cherioni soils are on fan terraces or hills. Somewhat excessively drained; medium to rapid runoff; moderate permeability. Present vegetation is creosote bush, palo verde, saguaro, cholla, ocotillo, triangleleaf bursage and ratany.

A preliminary site reconnaissance was conducted at the project site by CH2MHill in 2008, during which two soil samples were collected. Based on the reconnaissance and the two samples, soils on-site were described as consisting of sandy material and classified as poorly graded sand with silt. Across most of the subject property, the soils would be expected to range from silty sand to poorly graded sand with silt.

Typical fines content in these soils would be expected to be in the range of 5 to 35 percent. Characterization of soils was made through field observations and laboratory testing by AECOM (Solar Millennium 2010a). Laboratory textural analysis and field observations characterized the on-site soils as being predominantly sands. Soil profiles observed in the test pits were typically sands and laboratory analysis measured sand content from 83 to 94 percent. Silt content measured in the soils ranged from 2 to 8 percent, and clay content from 2 to 11 percent. Observed profiles exhibited a range of effervescence from no effervescence to slight in the top layers to increasing effervescence with increasing depth indicating the presences of carbonates.

GEOLOGY

The project site is situated within the central portion of Chuckwalla Valley, an east-southeast trending valley in California’s Mojave Desert Geomorphic Province. The Mojave Desert Geomorphic Province is a wedge-shaped interior region separated from the Sierra Nevada and Basin and Range Provinces to the northwest by the Garlock Fault and its eastward extensions, and is bounded to the southwest by the Transverse Range and Colorado Desert Provinces, the San Andreas Fault, and its southern extensions. The Mojave Desert Geomorphic Province is characterized by northwest-southeast as well as east-west trending structures and mountain ranges, separated by desert valleys and plains with many enclosed drainages and playas.

Regional & Local Geology

The region has undergone a complex geologic history that includes sedimentation, volcanic activity, folding, faulting, uplift, and erosion. The project area is underlain by Holocene to Miocene basin fill deposits (Stone 2006). These deposits include younger alluvium, older (Pleistocene) alluvium, the Pliocene Bouse Formation, and the Miocene fanglomerate. The uppermost alluvium in the basin consists of Holocene to Pleistocene alluvial fan, valley axial (fluvial), playa (dry lake), and Aeolian (wind blown) deposits.

Quaternary Alluvium

Quaternary alluvial fill in the basin consists of Holocene to Pleistocene alluvial fan and valley axial (fluvial or stream) deposits, as well as lacustrine (lake) and playa (ephemeral lake) deposits (CDWR 2004). These deposits consist of gravel, sand, silt, and clay (CDWR 1963). In general, coarser alluvial fan deposits are expected near the valley edges and grade into finer distal fan deposits that interfinger with fine-grained lacustrine and playa deposits near the center of the basin. These deposits are typically heterogeneous. Valley axial drainages tend to be more uniform and continuous, and contain a greater proportion of sand and fine gravel. Portions of the basin are also occupied by aeolian (wind blown) sand deposits, but the identified aeolian deposits occur at the ground surface and are of limited thickness. The Quaternary sediments include the Pleistocene-age Pinto Formation, which consists of coarse fanglomerate (cemented, consolidated, or semiconsolidated alluvial fan gravels) containing boulders and lacustrine clay with some interbedded basalt (CDWR 2004).

Pliocene Bouse Formation

The Pliocene Bouse Formation underlies the Quaternary sediments. The Bouse Formation includes a marine to brackish-water estuarine sequence deposited in an arm of the proto-Gulf of California (Stone 2006; Wilson and Owen-Joyce 1994). This formation has alternatively been interpreted as, or may include, lacustrine sediments deposited in a closed, brackish basin (Stone 2006). The Bouse Formation is widely reported in the Colorado Valley and tributary basins in southeastern California and descriptions of this formation come from occurrences outside of Chuckwalla Valley. It is reported to be composed of a basal limestone (marl) overlain by interbedded clay, silt, sand, and tufa. The top of the Bouse Formation is relatively flat-lying with a reported dip of approximately 2 degrees south of Cibola (Metzger et al. 1973).

Miocene Fanglomerate

The Bouse Formation is unconformably underlain by a fanglomerate composed chiefly of angular to subrounded and poorly sorted partially to fully-cemented pebbles with a sandy matrix (Metzger et al. 1973). The fanglomerate is likely Miocene-age; however, it may in part be Pliocene-age (Metzger et al. 1973). The Fanglomerate represents composite alluvial fans built from the mountains towards the valley and the debris of the fanglomerate likely represents a stage in the wearing-down of the mountains following the pronounced structural activity that produced the basin and range topography in the area (Metzger et al. 1973). Bedding surfaces generally dip from the mountains towards the basin. The fanglomerate reportedly dips between 2 and 17 degrees near the mountains due to structural warping (Metzger et al. 1973). The amount of tilting indicates a general decrease in structural movements since its deposition (Metzger et al. 1973).

Bedrock

Bedrock beneath the project site consists of metamorphic and igneous intrusive rocks of pre-Tertiary age that form the basement complex (CDWR 1963), including Proterozoic schist and gneiss, Paleozoic sedimentary rocks, and Mesozoic sedimentary and metavolcanic rock sequences (Stone 2006). In some areas of the Chuckwalla Valley, volcanic rocks of Tertiary age overlie the basement complex (CDWR 1963). The bedrock topography in the study area, as interpreted by modeling of Bouger gravity data obtained from the United States Geological Survey (USGS) and interpreted by Worley-Parsons (2009), is illustrated in **Soil & Water Resources Figure 4**.

Mapped Geologic Units at the Project Site

Solar Millennium, the project owner of PSPP, reported that there are three mapped geologic units within the project limits (Solar Millennium 2010a). These units are listed and described below:

- Dune Sand (Qs), fine grained sand and silt deposited by wind. These deposits occur on the surface primarily in the northern portion of the site, but buried dune deposits were observed in test pits in the southern part of the site. However, for the purpose of this investigation, no distinction between alluvium and dune sands was made on the boring and test pit logs.
- Alluvium (Qal), fine to medium sand with silt and gravel. In general the alluvium will be coarser grained towards the south and fine towards the lake bed, but interfingering of alluvial layers and fine grained lake deposits should be anticipated at depth.
- Lake deposits (Ql), alternating layers of fine grained clay, silt, and sand deposits with varying mixtures of fine gravel.

Soil & Water Resources Figures 5A and 5B present a generalized geologic map of the project site.

Regional Tectonic Setting

The Mojave Desert comprises an area bounded by the seismically active Salton Trough to the west and southwest, and the Garlock Fault to the north. To the east and southeast it is bounded by the Sonoran Desert subprovince, a relatively stable tectonic region located in southeastern California, southwestern Arizona, southern Nevada, and northern Mexico (Balderman et al. 1978). Chuckwalla Valley is located in the eastern Mojave Desert province in an area that is relatively stable tectonically. Faults in the area occur primarily in Tertiary and pre-Tertiary strata and are related to compressional tectonism along a convergent Andean and island arc margin in the Mesozoic, and extensional detachment and block faulting during Tertiary time. No faults of Quaternary age are known to exist near the project site.

Local Faulting

The project site lies within the eastern part of Riverside County in a part of California considered to be very seismically quiescent. Although there are several bedrock faults off-site in the mountains surrounding Chuckwalla Valley, these do not exhibit recent activity and are presumed to be Tertiary or pre-Tertiary in age (Stone 2006). In addition, gravity anomalies suggest the presence of several subsurface faults beneath Chuckwalla Valley in the vicinity of the project area (Stone 2006; Rotstein et al. 1976). The gravity anomalies reflect abrupt changes in basement elevation strongly suggestive of dip-slip movements. In addition, some of these faults may have undergone right-lateral strike slip movements. These faults are presumed Tertiary and likely inactive with very low chance of earthquakes.

GEOMORPHOLOGY

This section describes the nature of, origin, processes, and development of dunes that are a critical habitat to the Mojave fringe-toed lizard (MFTL) that occupies areas on and adjacent to the right of way (ROW) for the project.

The proposed modified project footprint covers several different land units including (from southwest to northeast) a stable coarse gravel alluvial fan surface, a more active wind-blown sand area with relatively shallow sand deposits, and an area of deeper and more active vegetated sand dunes (see **Biological Resources Figure 5**) that appears to be MFTL habitat (for a discussion on the MFTL habitat, please see **BIOLOGICAL RESOURCES** of this FSA). The site is crossed by a series of small distributary alluvial fan channels, and two large wash complexes formed by concentrated drainage under the Interstate-10 freeway (I-10).

Most of the proposed western solar array lies in a relatively stable area of alluvial fan, where the offsite geomorphic impacts would be relatively minor except for impacts to the large wash complex that crosses the south east corner of the western array. This wash supports a corridor of sand dunes and associated MFTL habitat around it, and it would be necessary to either avoid or mitigate for impacts to this area. The proposed eastern solar array is located in a much more geomorphically active area, and cuts into the combined PDL-Chuckwalla and Palen wind-borne sand transport corridor (see **BIOLOGICAL RESOURCES**, Appendix A of this FSA).

HYDROGEOLOGY

Groundwater Basins

The site is located within the Chuckwalla Valley Groundwater Basin (CVGB) (CDWR Basin No. 7-5), which has a surface area of 940 square miles underlying Chuckwalla Valley (CDWR 2004). The CVGB is an unadjudicated groundwater basin and owners of property overlying the basin have the right to pump groundwater from the basin for reasonable and beneficial use, provided that the water rights were never severed or reserved. In addition, groundwater production in the basin is not managed by an entity and no groundwater management plan has been submitted to the California Department of Water Resources.

The site location in the basin is shown on **Soil & Water Resources Figure 2**. The CVGB is bounded by the consolidated rocks of the surrounding mountains. Three water-bearing Quaternary- and Tertiary-age sedimentary units overlie non-water bearing bedrock in the CVGB (CDWR 2004; CDWR 1963). Department of Water Resources (DWR) reports the maximum thickness of these deposits as about 1,200 feet in the CVGB (CDWR 1979); however, modeling of Bouger gravity data obtained from USGS suggest greater depths to bedrock exist in some parts of the basin (See **Soil & Water Resources Figure 4**).

The basin is bounded upgradient by two other groundwater basins that include the eastern part of the Orocopia Valley (CDWR Basin No. 7-31) and Pinto Valley (CDWR Basin No. 7-6) groundwater basins and down gradient by the Palo Verde Mesa (CDWR Basin No. 7-5) Groundwater basin. A brief overview of the adjoining basins follows:

Eastern Orocopia Valley (7-31)

This basin underlies Orocopia Valley, northeast of the Salton Sea, in central Riverside County. It is bounded by impermeable rocks of the Cottonwood and Eagle Mountains on the north and of the Orocopia and Chocolate Mountains on the south (see **Soil & Water Resources Figure 2)**. The basin is bounded by a section of the San Andreas Fault zone and semi-permeable rocks of the Mecca Hills on the west and by a bedrock constriction on the east. The western portion of the valley drains westward toward the Salton Sea, but the eastern part drains eastward into Hayfield (dry) Lake and Chuckwalla Valley. Average annual precipitation ranges to 4 inches (CDWR 2003).

Pinto Valley (7-6)

This groundwater basin underlies Pinto Valley in northern Riverside County (see **Soil & Water Resources Figure 2)**. It is bounded by nonwater-bearing rocks of the Coxcomb Mountains on the east and northwest, the Pinto Mountains on the north, of the Eagle Mountains on the south, and the Hexie Mountains on the west (Bishop 1963; Jennings 1967). The valley is drained eastward by the Fried Liver, Smoketree, and Porcupine Washes (Jennings 1967). Average annual precipitation ranges to 6 inches (CDWR 2003).

Palo Verde Mesa (7-39)

This basin underlies Parker Valley in eastern Riverside County (see **Soil & Water Resources Figure 2)**. The basin is bounded by nonwater-bearing rocks of the Big Maria and Little Maria Mountains on the north, the McCoy and Mule Mountains on the west, the Palo Verde Valley on the east, and of the Palo Verde Mountains on the south (CDWR 1979; Jennings 1967). The northwest boundary and parts of the western boundary are drainage divides (Metzger 1973; Jennings 1967). The valley is drained by the McCoy Wash to the Colorado River. Average annual precipitation ranges to 6 inches (CDWR 2003).

Groundwater Inflow/Outflow

Natural groundwater recharge to the CVGB includes recharge from precipitation and subsurface inflow from the Pinto Valley Groundwater Basin to the northwest and the Orocopia Valley Groundwater Basin to the Southwest (CDWR 2004; Eagle Crest 2009). Underflow from the Cadiz Valley Groundwater Basin has also been hypothesized by DWR (2004); however, recent work has reportedly confirmed that the Cadiz Valley Groundwater Basin does not contribute inflow to the CVGB (BV and WCC 1998). CVGB also shares a boundary with the Ward Valley Groundwater Basin, but groundwater is not reported to flow across this boundary (Bedinger et al. 1989). Other sources of recharge to the basin include agricultural return flow and return flow from treated wastewater disposal.

Groundwater Inflow

Recharge from Precipitation

In this part of California, almost all moisture from rain is lost through evaporation or evapotranspiration and runoff occurs principally during intense thunderstorms (CRBRWQCB 2006). Most recharge from precipitation occurs when runoff from the surrounding mountains exits bedrock canyons and flows across the coarse sediments deposited in the proximal portions of the alluvial fans that ring Chuckwalla Valley. To a lesser extent, recharge occurs from infrequent precipitation or runoff on the valley floor (CDWR 2004). The area of the Chuckwalla Valley watershed encompasses Chuckwalla Valley (601,543 acres) and the surrounding bedrock mountains (258,825 acres), for a total area of approximately 860,368 acres. Available estimates of recharge in CVGB are variable and in some cases based on incomplete or incorrect data. DWR has not published an estimated recharge rate for the basin (CDWR 2004). In 1986, Woodward Clyde calculated recharge from precipitation for the Chuckwalla Valley watershed to be 29,530 afy (Woodward Clyde 1986). This equates to an average recharge rate of approximately 0.036 feet per year (0.4 inches). Woodward Clyde reported this number as approximately 12.8 percent of an average annual precipitation of 3.39 inches per year across the watershed; however, this was the average annual precipitation in Blythe at the time, and does not consider that the orographic effect of the surrounding mountains which results in precipitation rates of over 6 inches per year in the higher elevation portions of the watershed (Hely and Peck 1964). In 1992, the average recharge to CVGB was reportedly estimated by the United States Bureau of Land Management (BLM) and the County of Riverside to be 5,540 to 5,600 afy based upon an assumed 10 percent infiltration of precipitation (Eagle Crest 2009); however, this number evidently considered only a portion of the watershed as it would equate to an average annual precipitation depth of only about 1 inch per year across the watershed. Recent studies have demonstrated recharge rates for nearby desert basins ranging from approximately 3 to 5 percent of the total incident precipitation on the basin catchment area (Whitt and Jonker 1998). A review of recharge studies in the arid southwest performed by USGS (2007b) cited a wide range of recharge rates, but rates in similar basins ranged from about 3 to 7 percent.

For this study, recharge from precipitation was estimated by overlaying isohyetal maps prepared by Hely and Peck on the Chuckwalla watershed boundaries and calculating the volume of average annual precipitation for each of four precipitation zones for the valley and bedrock portions of the watershed. The calculated average annual precipitation volume for the watershed is 258,000 acre-feet (af). Recharge for the CVGB estimated as a fraction of 3, 5 and 7 percent of total incident precipitation is therefore calculated to be 8,588, 14,313, and 20,038 afy, respectively.

An analysis of infiltration and runoff rates for the CVGB is provided in **Soil & Water Resources Table 9.**

Soil & Water Resources Table 9
Estimates of Runoff and Infiltration in Chuckwalla Valley Groundwater Basin

Layer (a)	Area (acres)	Mean Annual Precipitation (inches) (b)	Total Volume of Rainwater from Mean Annual Precipitation (af)	Runoff Curve Classification	Runoff Curve Number (b)	Runoff (percent of Precipitation)	Total Annual Volume of Infiltration – Hely & Peck (af)	Total Annual Volume of Infiltration (af) based on 3 % (c)	Total Annual Volume of Infiltration (af) based on 5%(c)	Total Annual Volume of Infiltration (af) based on 7%c)
unit1-cw	30,303	5	12,626	Alluvium, Steep Slope	74	3.50 percent	442	379	631	884
	211,498	4	70,499	Alluvium, Flat Slope	69	2.00 percent	1,410	2,115	3,525	4,935
	41,073	3.5	11,980	Alluvium, Steep Slope	74	3.50 percent	419	359	599	839
	12,077	4	4,026	Alluvium, Steep Slope	74	3.50 percent	141	121	201	282
	910	4	303	Alluvium, Steep Slope	74	3.50 percent	11	9	15	21
	194	4	65	Alluvium, Steep Slope	74	3.50 percent	2	2	3	5
	81,233	5	33,847	Alluvium, Steep Slope	74	3.50 percent	1,185	1,015	1,692	2,369
bedrock chuckwalla	32,001	5	13,334	Mountains	93	29.10 percent	3,880	400	667	933
	21,456	5	8,940	Mountains	93	29.10 percent	2,602	268	447	626
	11,050	5	4,604	Mountains	93	29.10 percent	1,340	138	230	322
	109	5	46	Mountains	93	29.10 percent	13	1	2	3

Layor (a)	Area (acres)	Mean Annual Precipitation (inches) (b)	Total Volume of Rainwater from Mean Annual Precipitation (af)	Runoff Curve Classification	Runoff Curve Number (b)	Runoff (percent of Precipitation)	Total Annual Volume of Infiltration – Hely & Peck (af)	Total Annual Volume of Infiltration (af) based on 3 % (c)	Total Annual Volume of Infiltration (af) based on 5%(c)	Total Annual Volume of Infiltration (af) based on 7%c)
	9,246	4	3,082	Mountains	93	29.10 percent	897	92	154	216
	10,042	4	3,347	Mountains	93	29.10 percent	974	100	167	234
	282	4	94	Mountains	93	29.10 percent	27	3	5	7
	3,480	4	1,160	Mountains	93	29.10 percent	338	35	58	81
	275	4	92	Mountains	93	29.10 percent	27	3	5	6
	90	4	30	Mountains	93	29.10 percent	9	1	2	2
	398	4	133	Mountains	93	29.10 percent	39	4	7	9
	316	4	105	Mountains	93	29.10 percent	31	3	5	7
	39,340	5	16,392	Mountains	93	29.10 percent	4,770	492	820	1,147
	194	5	81	Mountains	93	29.10 percent	24	2	4	6
unit3-cw	28,973	3	7,243	Alluvium, Flat Slope	69	2.00 percent	145	217	362	507
unit2-cw	198,558	3	49,640	Alluvium, Steep Slope	74	3.50 percent	1,737	1,489	2,482	3,475
bedrock chuckwalla	89,161	6	44,581	Mountains	93	29.10 percent	12,973	1,337	2,229	3,121
TOTALS	**822,259**	**---**	**286,250**		**---**	**---**	**33,436**	**8,588**	**14,313**	**20,038**

(a) See Figure DR-S&W-179-1 in Solar Millennium 2010a.
(b) From Hely & Peck 1964.
(c) Based on a percent of Total Volume of Rainwater from Mean Annual Precipitation (Column 4).
Source: Derived from Solar Millennium 2010a.

Based on the above analysis, approximately 36 percent of precipitation in the watershed falls on the bedrock areas that ring the watershed. This is significant because precipitation that falls on the valley floor is not expected to contribute consistently to recharge. Studies published by USGS report approximately 7 to 8 percent of precipitation falling on bedrock mountains in other arid basins goes to mountain front recharge (USGS 2007a). Accordingly, the 36 percent of the precipitation that falls on the bedrock areas would be equivalent to approximately 3 percent of the total precipitation that falls on the Chuckwalla Valley watershed. In the absence of more detailed study, 3 percent of total precipitation falling on the Chuckwalla Valley watershed (8,588 afy) is used as a reasonable lower bound estimate of recharge to the CVGB.

Subsurface Inflow

Under natural conditions, subsurface flow occurs from only two sources, subsurface underflow from the Pinto Valley Groundwater Basin and the Orocopia Valley Groundwater Basin. Underflow from the Colorado River is not expected to occur under natural conditions. Underflow from the Pinto Valley Groundwater Basin has been calculated to be 3,173 afy (GeoPentech 2003, Eagle Crest Energy Company 2009). Inflow from the Orocopia Valley Groundwater Basin has been estimated to be 1,700 afy (LCA 1981). CH2M Hill (1996) estimated the combined subsurface inflow from both basins to be 6,700 afy. However, recent studies by GeoPentech reportedly indicate that subsurface inflow from Orocopia Valley Groundwater Basin may be as low as several hundred afy. Therefore a combined subsurface inflow rate of 3,500 afy was assumed for both basins for water budget purposes.

Wastewater Return Flow

Chuckwalla State Prison was constructed approximately 22 miles southeast of the project site in 1988, and the adjacent Ironwood State Prison became operational in 1994. The prisons use an unlined pond to dispose of treated wastewater, and a large percentage of this discharge is reported to infiltrate into the subsurface and recharge the CVGB. For the years 1998 through 2001, the California Department of Water Resources – Department of Planning and Local Assistance (CDWR-DPLA) reported that deep percolation of applied urban water in the Chuckwalla Planning Area (assumed to be wastewater return flow) was 500 to 800 afy (CDWR-DPLA 2007). According to authorities at the State prison complex (Lanahan 2009), they indicated that approximately 600 afy of treated effluent recharges the basin. Recently published water budget information for the Eagle Crest Pumped Storage Project (Eagle Crest 2009), indicates 795 afy of treated effluent are recharged by the prisons. An additional source of wastewater return flow in the basin is approximately 36 afy from the Lake Tamarisk development near Desert Center (Eagle Crest 2009). Combining these two flows, staff estimates wastewater return of 831 afy which is included in **Soil & Water Resources Table 10**.

Irrigation Return Flow

The amount of applied irrigation water that returns to recharge a groundwater basin depends on the soil, crop type, amount and method of irrigation, and climatic factors. Woodward Clyde (1986) reported an irrigation efficiency of 60 percent (return flow of 40 percent) for jojoba crops in Chuckwalla Valley. DWR-DPLA reported an irrigation efficiency of 72 percent (return flow of 28 percent) for subtropical crops in the Palen

Detailed Analysis Unit (DAU) of the Chuckwalla Planning Area (CDWR-DPLA 2007). In its water budget calculations for the Chuckwalla Planning Area in support of California Water Plan updates, DWR-DPLA calculated an irrigation return flow of approximately 9 to 11 percent for 1998, 2000 and 2001, respectively. A 10 percent return flow is a reasonable factor for deep percolation from irrigation in the basin, and was applied to the assumed agricultural and landscape water demand in the basin for the purposes of a water budget. Current pumpage associated with activities associated with irrigation return flow is estimated to be approximately 7,700 afy in the CVGB that includes 6,400 afy for agriculture, 215 afy for aquaculture pumping, and 1,090 afy for Tamarisk Lake (Worley-Parsons 2009). Return flows are calculated using the 10 percent or approximately 800 afy and are included in **Soil & Water Resources Table 10**.

Groundwater Demand/Outflow

Groundwater provides the only readily available natural water resource in Chuckwalla Valley. While the Colorado River Aqueduct traverses the northern portion of the basin, it does not contribute significant water to the basin (other than leaks and maintenance activities). In addition, any water diverted from the aqueduct would require entitlement. Designated and potential beneficial uses of groundwater in the basin include domestic, municipal, agricultural and industrial use (CRBRWQCB 2006). As such, groundwater demand is a significant contributor to basin outflow. Other sources of basin outflow include subsurface discharge to the Palo Verde Mesa Groundwater Basin, and evapotranspiration at Palen Lake.

Groundwater Extraction

Current and historical groundwater pumpage in CVGB includes agricultural water demand, pumping for Chuckwalla and Ironwood State Prisons, pumping for the Tamarisk Lake development and golf course, domestic pumping, and a minor amount of pumping by Southern California Gas Company. In addition, historical pumpage included water supply for the Kaiser Corporation Eagle Mountain Mine. With the exception of pumping for Chuckwalla Valley and Ironwood State Prisons, most of the current groundwater pumping in the basin occurs in the western portion of the basin, near the town of Desert Center. Current pumpage is estimated to be approximately 7,900 afy in the western CVGB and 2,605 afy in the eastern basin. Agricultural production is limited to the western portion of the basin (Eagle Crest 2009; CDWR-DPLA 2007 and 2009), with the exception of a relatively limited amount of acreage that is associated with the state prisons.

Subsurface Outflow

Subsurface outflow to Palo Verde Mesa Groundwater Basin was estimated by Metzger (1973) to be 400 afy. This calculation was based on a cross sectional profile of the boundary between the two basins derived using geophysical methods and regional data regarding groundwater gradients and hydraulic conductivity. Woodward Clyde (1986) revised this estimate based on the results of pump testing at Chuckwalla State Prison and calculated the basin outflow to be 870 afy. Engineering Science (1990) updated this estimate to 1,162 afy, presumably as a result of return flow from prison wastewater disposal; however, the rationale for this adjustment was not provided. Using more recent gravity data, Wilson and Owens-Joyce (1994) found that the area through which discharge occurs is significantly more limited than previously thought due to the presence of a buried bedrock ridge. As a result, the most recent available water budget for the basin has adopted an outflow rate of 400 afy (Eagle Crest 2009).

Palen Lake Evapotranspiration

Regional groundwater flow and discharge mapping performed by USGS (Bedinger et al. 1989) did not identify Palen Lake as an area where groundwater discharges at the ground surface. Nevertheless, groundwater elevation contour mapping suggests that groundwater may occur near the ground surface beneath approximately the northwestern 25 percent of Palen Lake. It is therefore possible that a portion of Palen Lake is operating as a wet playa. Groundwater levels beneath the southeastern portions of Palen Lake, and a small ancillary playa located approximately one mile southeast of Palen Lake, were reported by Steinemann (1989) as being 20 to 30 feet below ground level, suggesting that Palen Lake would be a dry playa at various times.

Review of aerial photography indicates what appears to be a relatively small area of dissected salt pan near the northern and western sides of the playa. Because the salt pan is dissected, it is not clear whether salt deposition is actively occurring or whether this material is residual deposition from surface water evaporation. Immediately northwest of Palen Lake, between Palen Lake and Desert Center-Rice Road, Pleistocene lake bed deposits crop out at the ground surface in the form of dissected, mesa-like prominences that are 5 to 10 feet high (CDWR 1963). These deposits are capped with a layer of caliche and locally support scattered mesquite trees. There does not appear to be any other evidence of shallow groundwater or evapotranspiration visible in aerial photography.

Groundwater elevation contour mapping (Steinemann 1989) suggests that groundwater may occur near the ground surface beneath approximately the northwestern 25 percent of Palen Lake. A well located approximately two miles north of Palen Lake, is reported to be completed to a depth of 501 feet below ground surface and has a ground surface elevation of 500 feet amsl (WorleyParsons 2009). A screened interval for the well is not reported. Groundwater levels in this well were reported to be approximately 20 to 25 feet below the ground surface (bgs) between 1932 and 1984. Given that the surface elevation at Palen Lake two miles to the south is approximately 460 feet amsl, or 40 feet lower, it appears possible that groundwater levels are very close to the ground surface beneath the northern portion of the playa. In addition, DWR (1963) identified the presence of mesquite trees on low mesa-like promontories of Pleistocene lacustrine sediments at the northwest margin of Palen Lake playa, also suggesting the possible presence of relatively shallow groundwater. These data suggest it is possible that an area in the northern portion of Palen Lake is discharging groundwater by evaporation as a wet playa. Groundwater levels beneath the southeastern portions of Palen Lake, and a small ancillary playa located approximately one mile southeast of Palen Lake, are 20 to 30 feet bgs (Steinemann 1989), indicating these are dry playa areas.

Review of aerial photography indicates an approximately 700-acre area of dissected salt pan in the northwest portion of the playa (Worley-Parsons 2009). This feature is surrounded by an additional approximately 1,300 acres that show evidence of more limited surface salt accumulation. The extent of this area is visible in aerial imagery from November 2005, and was generally confirmed by a reconnaissance performed on December 10 and 30, 2009. Review of the historical progression aerial imagery (Worley-

Parsons 2009) indicates no or limited salt accumulation in this area from 1996 through 2002, light salt accumulation in March of 2005, and the currently observed salt pan area in November 2005. This suggests that salt pan accumulation in the playa is episodic; however, seasonal, intermittent accumulation cannot be ruled out. Historical precipitation records indicate that 2005 rainfall in Blythe was approximately twice the long term annual average, with 5.10 inches occurring in January and February 2005 (WRCC 2009), just before the March 2005 aerial photograph was taken. These storm events would be expected to have resulted in the accumulation of runoff in Palen Lake, and consequently in dissolution and re-crystallization of salt deposits during evaporation of surface water, and by wetting and subsequent drying of salt containing playa sediments. As such, these rainfall events are likely responsible for at least a portion of the observed salt accumulation; however, groundwater discharge by evaporation at the ground surface could also be responsible.

During a December 10, 2009 site visit by Worley-Parsons (2009), conditions at the northwestern edge of the playa were investigated. Intermittent salt deposits were observed to be located both in low lying areas and on the tops of low, dissected, mesa-like promontories of Pleistocene lacustrine sediments approximately three feet high that extend into the playa. Deposition of salt by groundwater evaporation at the surface would be expected to occur on the sides as well as the top of these promontories. The occurrence of salt deposits on the top, but not on the sides, suggests that these deposits are the result of salt dissolution from layers with elevated salt content and redeposition as soil moisture evaporates at the ground surface. The shallow soil beneath the salt deposits was observed to be wetted to a depth of approximately three inches from a recent rain event, but underlying soil to depths of approximately one foot were observed to be generally dry. As such, evidence of salt deposition by evapotranspiration at the playa surface was not observed in this area during Worley-Parsons' reconnaissance (Worley-Parsons 2009).

Mesquite trees were observed in the area north of the playa, but wetland species or other species indicative of or dependant on shallow groundwater were not observed. Mesquite trees are typically thought to be associated with "shallow" groundwater; however, the term shallow should be understood in a relative sense—the depth to groundwater utilized by mesquite trees may be several tens of feet below the ground surface. This would be too deep to support groundwater discharge at the ground surface. Thus, the presence of mesquite is not necessarily indicative of discharging playas.

In December 2009, Worley-Parsons advanced two hand auger borings to approximately 10 feet bgs beneath the salt pan area in the northwest portion of the playa. The moisture content of the soil was observed to increase with depth in both borings, and free groundwater was encountered at a depth of approximately 8 feet below the playa salt pan surface in one of the borings. Subsurface soil encountered consisted of alternating layers of clay/silt mixtures and sandy sediments. A depth of 6 to 10 feet is generally the maximum depth of free water documented beneath discharging playas. This suggests that groundwater could be shallow enough to discharge at the surface by capillary rise and evaporation to occur at least some of the time (Worley-Parsons 2009).

Based on the above data, salt accumulation at Palen Lake is likely the result of dissolution and recrystallization of existing salt deposits during times of surface water inflow, as well as limited episodic and possibly seasonal or intermittent groundwater discharge. The rate of groundwater discharge in a wet playa is dependent on the depth to groundwater and magnitude of upward vertical gradients, the ability of subsurface materials to facilitate capillary rise, climatic conditions, and the presence and extent of free water, wetlands and salt pans on the playa surface (Tyler 2005; Allen and Sharike 2003). In general, groundwater discharge rates are highest when groundwater is shallow, temperatures are high, and when open water or wetlands are exposed at the playa surface.

Increased depth to groundwater, lower temperatures, the presence of coarse grained material that inhibits capillary rise, and the presence of salt pan (which increases albedo) tends to decrease groundwater discharge rates. Based on these factors, discharge of groundwater at Palen Lake appears to be limited based on the depth to groundwater (including absence of vegetation that indicates consistent shallow groundwater), the presence of coarse grained layers that limit capillary rise and the apparent intermittent or episodic nature of discharge.

Groundwater discharge rates were estimated based on reported groundwater discharge rates at other playas, the area of identified salt accumulation, and the evident episodic or intermittent nature of salt accumulation. Measured evapotranspiration rates at Franklin Lake Playa were used to form a basis for this estimate (Czarnecki 1997). Franklin Lake Playa is a well developed and extensively characterized wet playa in the Death Valley area (USGS 2007b). Evapotranspiration rates at Franklin Lake Playa are calculated to be 38 to 41 cm/year (0.108 to 0.116 feet/acre/month) based on the Energy-Balance Eddy-Correlation method, which is reported to be the most reliable method by the USGS. These rates would be a conservative measure of evapotranspiration for active wet playa areas at Palen Lake for the following reasons:

- Franklin Lake Playa is a terminal playa, which is the terminal discharge point of the local groundwater flow system; whereas, Palen Lake is a bypass playa, with most groundwater flowing laterally past the playa.
- Franklin Lake Playa includes extensive groundwater discharge features (e.g., saltpan, puffy ground and halophyte wetlands) that are generally less developed or lacking at Palen Lake, indicating less groundwater discharge would be expected at Palen Lake.
- Evapotranspiration rates at wet playas are temperature dependant, with maximum rates occurring during the summer months. Franklin Lake Playa occurs in Death Valley, where mean annual and summer high temperatures typically exceed those at Palen Lake.
- The available data suggest that groundwater discharge, if it is occurring at Palen Lake, is episodic or intermittent; whereas groundwater discharge at Franklin Lake Playa occurs throughout the year.

The total area of potential groundwater discharge at Palen Lake is estimated to be approximately 2,000 acres, with salt pan occupying approximately 700 acres of this total. Given the differences between Palen Lake and Franklin Lake Playa previously discussed, a groundwater discharge rate that is approximately half that at Franklin Lake Playa was adopted (approximately 0.0583 feet/acre/month of water) and was believed to occur. Over an area of 2,000 acres for three months of the year, this equates to approximately 350 afy.

Groundwater Budget

The perennial yield[10] of CVGB was estimated to be between 10,000 and 20,000 afy (Hanson 1992). A perennial yield of 12,200 afy was adopted in the Environmental Impact Statement for the Eagle Crest Landfill project in 1992 (BLM and County of Riverside 1992); however, the amount of recharge from precipitation used to derive this number appears to be based on recharge to only a portion of the basin, so the perennial yield may be underestimated.

Staff compiled a comprehensive water budget based on published literature, water budget information collected by the DWR for updates to the California Water Plan, information obtained from the California State Prison Authority, and the analysis of basin inflow and outflow discussed in the previous two sections. This information is summarized in **Soil & Water Resources Table 10**, below.

Soil & Water Resources Table 10
Groundwater Budget (afy)

Budget Components	**Totals**
Inflow	
Recharge from precipitation	8,588
Underflow from Pinto Valley and Orocopia Valley Groundwater Basins	3,500
Irrigation return flow	800
Wastewater return flow	831
Total inflow	13,719
Outflow	
Groundwater extraction	–10,361
Underflow to Palo Verde Mesa Groundwater Basin	–400
Evapotranspiration at Palen dry lake	–350
Total outflow	–11,111
Budget balance (net Inflow)	2,608

The analysis suggests that the CVGB is in positive balance (inflow exceeds outflow) by approximately 2,600 afy under average conditions.

[10] Perennial yield is the maximum quantity of water that can be annually withdrawn from a groundwater basin over a long period of time (during which water supply conditions approximate average conditions) without developing an overdraft condition (CDWR 1998).

Water Bearing Units

The following water-bearing formations have been identified in the CVGB. The extent and relationship of these formations is presented in hydrostratigraphic cross sections A-A' included as **Soil & Water Resources Figure 6.** The location of the cross section is shown on **Soil & Water Resources Figure 5A**.

Quaternary Alluvium

Quaternary alluvial fill in the basin consists of Holocene to Pleistocene alluvial fan and fluvial (stream) deposits, as well as lacustrine (lake) and playa (ephemeral lake) deposits (CDWR 2004). These deposits consist of gravel, sand, silt and clay (CDWR 1963). In general, coarser alluvial fan deposits are expected near the valley edges and grade into finer distal fan deposits that interfinger with fine grained lacustrine and playa deposits near the center of the basin. These deposits are typically heterogeneous. Valley axial drainages tend to be more uniform and continuous, and contain a greater proportion of sand and fine gravel. Portions of the basin are also occupied by aeolian (wind blown) sand deposits, but the identified aeolian deposits occur at the ground surface and are of limited thickness. Therefore, they are not believed to be an important water bearing unit.

The Quaternary sediments include the Pleistocene-age Pinto Formation, which consists of coarse fanglomerate (cemented, consolidated or semi-consolidated alluvial fan gravels) containing boulders and lacustrine clay with some interbedded basalt (CDWR 2004). The fanglomerate would likely yield water freely to wells, but the basalt would likely yield only small amounts of water (CDWR 1963). AECOM (2010) did not report the estimated thickness of the Quaternary Alluvium, but suggested the thickness of saturated sediments beneath the site is at least 560 feet and that saturated sediments to a depth of 758 feet consisted of a mixture of fine-grained sands with interbedded silt and clay layers. AECOM (2010) suggested that these sediments are likely to be the older alluvium/Bouse Formation sediments described in Bulletin 91-7 (CDWR 1963).

Pliocene Bouse Formation

The Pliocene Bouse Formation underlies the Quaternary sediments. The Bouse Formation includes a marine to brackish-water estuarine sequence deposited in an arm of the proto-Gulf of California (Metzger 1968; Wilson and Owen-Joyce 1994). This formation has alternatively been interpreted as, or may include, lacustrine sediments deposited in a closed, brackish basin (Stone 2006). The Bouse Formation is widely reported in the Colorado Valley and tributary basins in southeastern California and descriptions of this formation come from occurrences outside of Chuckwalla Valley. It is reported to be composed of a basal limestone (marl) overlain by interbedded clay, silt, sand, and tufa. The top of the Bouse Formation is relatively flat lying with a reported dip of approximately 2 degrees south of Cibola (Metzger et al. 1973). The Bouse Formation in the CVGB is estimated to extend to approximately 1,900 feet bgs (approximately –1,500 feet amsl) beneath the site based on geophysical modeling (see **Soil & Water Resources Figure 4**). These unconsolidated to semi-consolidated sediments are reported to yield several hundred gallons per minute (gpm) to wells perforated in coarse grained units (Wilson and Owen-Joyce 1994).

Miocene Fanglomerate

The Bouse Formation is unconformably underlain by a fanglomerate composed chiefly of angular to subrounded and poorly sorted partially-to fully-cemented pebbles with a sandy matrix (Metzger et al. 1973). The Fanglomerate is likely Miocene-age; however, it may in part be Pliocene-age (Metzger et al. 1973). The Fanglomerate represents composite alluvial fans built from the mountains towards the valley and the debris of the Fanglomerate likely represent a stage in the wearing down of the mountains following the pronounced structural activity that produced the basin and range topography in the area (Metzger et al. 1973). Bedding surfaces generally dip from the mountains towards the basin. The Fanglomerate reportedly dips between 2 and 17 degrees near the mountains due to structural warping (Metzger et al. 1973). The amount of tilting indicates a general decrease in structural movements since its deposition (Metzger et al. 1973). The Fanglomerate is estimated to extend to approximately 2,600 feet bgs (-2,000 feet amsl) beneath the site based on geophysical modeling by Worley-Parsons (2009).

Bedrock

Bedrock beneath the site consists of metamorphic and igneous intrusive rocks of pre-Tertiary age that form the basement complex (CDWR 1963). In some areas of the basin, volcanic rocks of Tertiary age overlie the basement complex (CDWR 1963). These rocks are considered nonwater bearing. The bedrock topography in the study area as interpreted by modeling of Bouger gravity data obtained from USGS is illustrated in **Soil & Water Resources Figure 4** The methods used to model the bedrock topography are discussed in more detail in Genesis Solar Energy Project Application for Certification Appendix D (Worley-Parsons 2009).

Groundwater Occurrence and Movement

In general, groundwater flow in the basin is south-southeastward (**Soil & Water Resources Figure 7**). Groundwater flow is directed southward from the basin's boundary with the Cadiz Valley Basin and east-southeastward from its boundary with the Pinto Valley Basin, toward the eastern basin boundary where it flows into the adjacent Palo Verde Mesa Basin (Steinemann 1989). The groundwater gradient is the steepest in the western half of the basin and is nearly flat in the central portion of the basin (CDWR 1963). Near Ford Dry Lake and east of Ford Dry Lake the gradient becomes steeper as groundwater approaches the narrows in the southeast portion of the basin (Steinemann 1989; DWR 1963).

Groundwater levels exceed 500 feet amsl in the western portions of the basin and fall to less than 275 feet amsl near the eastern end of the basin in the narrows between the Mule and McCoy Mountains (Steinemann 1989). Near Palen Lake, groundwater occurs near the ground surface, resulting in groundwater discharge by evapotranspiration at the land surface. Near Ford Dry Lake, groundwater is reported at depths of 50 feet below ground surface. Beneath the project site, groundwater occurs at depths of approximately 180-200 feet bgs (approximately 400 feet amsl) based on-site-specific investigation (Solar Millennium 2009a).

The DWR reports that groundwater levels in the basin are generally stable (CDWR 2004). **Soil & Water Resources Figure 8** shows hydrographs for selected wells within the Chuckwalla Valley from 1958 to 2009. The wells selected to present the hydrograph data were chosen to present the most complete set of historic water level elevation data across the Chuckwalla Valley. The hydrographs show that the water level has been generally stable over the last 40 years in the central and eastern part of the basin. This area includes the project site. The hydrograph for well 7/20-18H1 in the eastern part of the basin shows a decrease in water level elevation occurred between 1985 and 1990. This well is associated with the Chuckwalla and Ironwood Prisons and the decline in water level is likely due to increased water use at the prisons. The hydrograph for well Township7S Range 18E-14H1 shows a slight (approximately 20 foot) increase in the water level between 1983 and 1992. This well and the three other wells at this location are associated with agriculture activities and the water level increase is likely due to the fallowing of the land.

The hydrographs for wells in the Desert Center area along Highway 177 show local effects of water level decline, attributable to increased agricultural pumping beginning in the early 1980s and ending in the mid 1980s. GEI estimated groundwater pumping in 1986 was about 20,000 afy, significantly up from the 1963 estimate of 9,100 afy from the DWR. Basin wide pumping declined rapidly since 1986 with recent estimates of about 6,000 afy.

The inconsistency in groundwater level measurements makes it difficult to establish a specific year for the groundwater decline to have started. However, the hydrograph for well 4/16-32M1 suggests the decline started in 1980 and the water level had dropped approximately 50 feet at the time of the last water level measurement. The hydrograph for well 5/15-12N1, located approximately four miles to the southwest of well 4/16-32M1, shows only a small decline (approximately five feet) in the water table elevation. The water level readings in well 5/15-12N1 suggest the water level, at this well, has recovered to pre-pumping levels. The data presented in the hydrographs suggest that pumping around Desert Center induced a local cone of depression in that area that did not extend eastward into the area of the project site. The differential response and recovery to pumping in this area would suggest some compartmentalization of the aquifer system that is not unexpected since it is comprised of interconnected and isolated alluvial fan deposits.

Aquifer Characteristics

The basin fill sediments within the CVGB include three aquifers: the alluvium, the Bouse Formation, and the Fanglomerate. Groundwater in the alluvium likely occurs under unconfined conditions but could locally be semi-confined. Groundwater in the Bouse Formation and the Fanglomerate was reported to be under semi-confined to confined conditions based on stratigraphic data and storativity values derived from aquifer pumping tests near the Genesis project site east of the project (Worley-Parsons 2009). **Soil & Water Resources Table 11** summarizes the reported and estimated aquifer properties for these aquifers based on data from specific capacity tests and aquifer pumping tests performed on wells in the CVGB.

Soil & Water Resources Table 11
Aquifer Characteristics

Geologic Unit	Well ID	Well Depth	Specific Capacity (gpm/ft)	Transmissivity (gpd/ft)	Hydraulic Conductivity (ft day)	Storativity	Basis
Alluvium (Western Basin)	OW-2	---		224,400	100	0.05	Aquifer test near Desert Center (Eagle Crest Energy Company 2009)
	CW-1 to CW-4			56,000	50	0.05	Aquifer test of Eagle Mountain Iron Mine wells (Eagle Crest Energy Company 2009)
				1,100-16,000	19.6-42	10^2-10^4	Aquifer test conducted for the Project
	Average			**74,000**	**53**	**0.05**	---
Bouse Formation (Eastern Basin)	TW-1	50		21,542	3 to 16		Aquifer test and lab analysis conducted for the Genesis Solar project
	3	957	5	10,000	4		Specific Capacity Test
	26	1,000	1.5	3,000	1		Specific Capacity Test
	29	985	1.6	3,200	1		Specific Capacity Test
	43	830	35	70,000			Specific Capacity Test
	Average			21,500	12 to 14		—
Bouse Formation/ Fanglomerate (Eastern Basin)	33	1,200	14.8	29,600	8	---	Specific Capacity Test
	34	1,200	26.7	53,400	14	---	Specific Capacity Test
	35	1,200	51.6	103,200	28	---	Specific Capacity Test
	36	1,200	15.6	31,200	8	---	Specific Capacity Test
	37	1,050	12.9	25,806	11	0.0002	Aquifer test conducted at State prison
	39	1,139	11.1	22,222	13	---	Specific Capacity Test
	40	1,200	10.3	20,600	5	---	Specific Capacity Test
	42	1,100	19.7	39,444	15	---	Specific Capacity Test
	Average			40,684	13	0.0002	---
Fanglomerate	14	982	2.6	5,200	14		Specific Capacity Test

Notes:
OW = Observation Well
TW = Test Well
Sources include WCC 1986; Eagle Crest 2009; Worley-Parsons 2009, Solar Millennium 2010a.
Transmissivity from Specific Capacity Tests calculation by multiplying value by 2,000. for confined aquifers and by 1,500 for unconfined aquifers (Driscoll 1986).

Groundwater Quality

Groundwater quality varies markedly in the basin. Groundwater in the western portion of the basin near Desert Center generally contains lower concentrations of total dissolved solids (TDS) than groundwater in the eastern, down gradient portion of the basin near Ford Dry Lake (Steinemann 1989). Groundwater to the south and west of Palen Lake is typically sodium chloride to sodium sulfate-chloride in character (CDWR 2004). The detected concentrations of TDS in the basin range from 274 mg/L to 8,150 mg/L with an average concentration of 2,100 mg/L (Steinemann 1989). In general, the groundwater in the basin has concentrations of sulfate, chloride, fluoride, and dissolved solids too high for domestic use and concentrations of sodium, boron and dissolved solids too high for irrigation use (CDWR 2004). Several of the wells sampled in the basin contain high levels of fluoride and boron.

Groundwater Wells in Proximity to the Proposed modified project

A total of 88 water supply wells were identified in online databases in the CVGB (Solar Millennium 2009a – Appendix J). A field survey was conducted by AECOM (Solar Millennium 2009a) in July 2009 to identify the well location, confirm operational status, and estimate the use within the basin. The wells were categorized as either domestic, industrial, agricultural or municipal wells based on land use or information provided by the property owner.

A total of 15 wells were identified, most of which supported historic agricultural operations and many of which have been discontinued. Available information for water supply wells located within a one-mile radius of the Project site are summarized on **Soil & Water Resources Table 12** and shown on **Soil & Water Resources Figure 9**.

Soil & Water Resources Table 12
Summary of Groundwater Quality Data[1],[2]
(all values reported in mg/L unless otherwise indicated)[3]

Analyte	Well 5/17-33N1 (2009)	Well 5/17-20F1 (May 1957)	Well 5/17-30F1 (January 1960)	Well 5/17-30P1 (October 1958)	All Chuckwalla Valley Wells [1]
Arsenic	0.0157	—	—	—	—
Bicarbonate (HCO_3)	122	104	90	420	21–1,950
Boron	1.82	0.0001	0.0006	0.0004	—
Calcium	31	50	30	12	5–585
Carbonates (CO_3)	ND[3]	ND	ND	ND	0–129
Fluoride	6.1	1.8	—	0.3	0–12
Chloride	200	203	225	150	8–2,780
Iron	ND<0.1	—	—	—	—
Magnesium	4.72	6		2	0–208
Manganese	0.0127	—	—	—	—
Nitrate (NO_3)	0.17[4]	—	—	—	—
Selenium	ND<0.015	—	—	—	—
Sodium	352	225	240	240	2–6,720
Sulfate	380	241	155	89	9–1,110
Total Hardness ($CaCO_3$)	830	150	75	38	3–2,300
TDS	1,010	803	695	783	274–12,300
pH (units)	—	7.4	8.1	8	7–8.7

Notes:
1 - Geochemical data for all wells within the Chuckwalla Groundwater Basin from available information in online databases and historic reports is provided in Solar Millennium 2009a.
2 - Metals data reported from the unfiltered ("total") sample
3 - mg/L = milligrams per liter; ND – not detected at the practical quantitation limit
4 - Nitrate as Nitrogen.

SURFACE WATER HYDROLOGY

The site is located within the Colorado River Basin, Chuckwalla Valley Drainage Basin. There are no perennial streams in Chuckwalla Valley. Chuckwalla Valley is an internally drained basin, and all surface water flows to Palen Dry Lake in the western portion of the valley and Ford Dry Lake in the eastern portion of the valley. Palen Dry Lake is a "wet playa" with significant shallow groundwater discharge at the ground surface by evaporation; whereas, Ford Dry Lake is a "dry playa," with groundwater occurring well below the ground surface. Palen Dry Lake is located in the central portion of Chuckwalla Valley about 1 mile north of the proposed plant location.

The only perennial surface water resources in the eastern portion of Chuckwalla Valley are McCoy Spring, at the foot of the McCoy Mountains approximately 19 miles northeast of the site, and Chuckwalla Spring, approximately 16 miles south of the site at the foot of the Chuckwalla Mountains.

Off-site storm water flows impacting the project site are from a large watershed area to the west and north of the site which covers approximately 44 square miles. Federal Emergency Management Agency (FEMA) flood insurance rate maps have not been prepared for the project site or surrounding lands and the project does not lie within a federally mapped floodplain. The upstream extents of the contributing watersheds extend into the Chuckwalla Mountains to the southwest. The extent of an approximate sub-basin boundaries of the overall watershed impacting the project were delineated utilizing a combination of USGS 7.5 minute quadrangle sheets and site specific aerial topography.

The overall watershed boundaries sub-basin delineations, as well as the 100-year peak discharges for each sub-basin are shown on **Soil & Water Resources Figure 10**. The project owner calculated existing (pre-construction) peak discharges for each sub-basin using the hydrograph package HEC-1 and followed the guidelines presented in the *Riverside County Flood Control and Water Conservation District Hydrology Manual (Riverside County Manual),* and are summarized in **Soil & Water Resources Table 13.**

Soil & Water Resources Table 13
Summary of Offsite Upstream Peak Flows

Upstream Flows	Tributary Area (square miles)	24-hour 100-year (cubic-feet/second)
Copa Ditch	30.77	8,262
Aztec Ditch	30.8	6,490
Tarantula Ditch	35.88	1,466
Sutro Ditch	13.04	3,193

Source: Palen 2013e Attachment G

Dry Washes

There are no perennial streams in the Palen Dry Lake or Ford Dry Lake watersheds which impact the project site. The vast majority of the time, the area is dry and devoid of any surface flow. Water runoff occurs only in response to infrequent intense rain storms. There are approximately a hundred minor washes that cross the site from southwest to northeast, draining the area downstream of I-10 towards Palen Dry Lake. Many of these channels do not reach the dry lake, but fade out on the vegetated sand dune surface. These channels are typically very subtle, with a width of 2-10 feet and a depth of 3-9 inches. They are found approximately every 100 feet when traversing across the project site perpendicular to the predominant flow direction which is to the northeast.

There are two more significant ephemeral wash complexes that cross the site from southwest to northeast, draining the area downstream of I-10 towards Palen Dry Lake. Both washes were traceable from the western project boundary to Palen Dry Lake. These major washes are observed as complexes of braided channels, with each channel being approximately 10-50 feet wide. The wash complexes widen out from their constriction at I-10 and are approximately 1,500 feet wide after approximately a mile, after which they become very dispersed, lose definition and resemble minor washes. Within a mile of I-10, the major washes have created sandy zones approximately 1,500 feet wide on the less sandy alluvial gravel or thin sand sheets.

Springs, Seeps and Playa Lakes

One spring is listed in the CVGB in the vicinity of where the Project site is located, according to the National Water Information System (NWIS) database of Water Resources of the United States, which is maintained by the USGS (http://wdr.water.usgs.gov/nwisqmap/). This spring (called Corn Spring) is also shown on a geologic map of the area (CDMG 1967). Corn Spring is approximately five to six miles southwest of the project site in the center of the Chuckwalla Mountains. The spring discharges into Corn Spring Wash, an ephemeral dry wash where surface water flows towards the northeast and onto the project site. Corn Spring appears to derive its water from precipitation falling onto the Chuckwalla Mountains, and movement of groundwater under pressure along an historic fault that bisects the mountains.

According to the NWIS database, seeps and surface discharge/outfall (along with streams, lakes, wetlands, and diversions) are categorized as “surface water sites” and four sites are located in the CVGB. One of the four locations is the aforementioned Corn Spring Wash, while two other sites are located near the northern edge of the Chuckwalla Mountains approximately eight and 13 miles west of the project site. Water in these three sites appear to originate from infiltration of precipitation that falls on the Chuckwalla Mountains as all three sites are located either within the Chuckwalla Mountains or are less than one mile downslope from the Chuckwalla Mountains.

The fourth “surface water site” listed in the NWIS database for the CVGB is Coxcomb Wash, located approximately eight miles northwest of the project site. Coxcomb Wash is an ephemeral dry wash that flows southeastward from the Coxcomb Mountains. As a result, groundwater extracted from the project site would not affect the flow of water in Coxcomb Wash. The locations of Corn Spring and other “surface water sites” identified in the NWIS database and through the several other data sources are shown on **Soil & Water Resources Figure 11**. The sites are listed on **Soil & Water Resources Table 14**.

Soil & Water Resources Table 14
Springs and Surface Water Sites in Chuckwalla Valley within Nine Miles of the Project Site

Site No.	Location Number	Location Name	Type	Distance from Project (miles)
1	USGS 10253750	Monument Wash near Desert Center, CA	Stream	7.2
2	USGS 10253540	Corn Springs Wash near Desert Center, CA	Stream	6.2
3	USGS 333731115193001	006S016E28DS01S (Corn Spring)	Spring	6.3
4	USGS 10253700	Palen Dry Lake near Desert Center, CA	Stream	13.8
5	USGS 10253800	Coxcomb Wash near Desert, Center CA	Stream	7.1
6	WHIPs ID S-376	Spring Tank	Spring	8.1
7	N/A	Tenaja	Pond	6.8
8	WHIPs ID S-375	Long Tank Tenaja	Pond	8.9
9	N/A	Desert Center Sewer Pond	Pond	8.5

Source: AECOM 2010

Tenajas are defined as seasonal precipitation-fed or ephemeral stream basins which can hold significant quantities of water. By definition (AGI 2005), ephemeral streams are a stream or reach of a stream that “flows briefly only in direct response to precipitation in the immediate locality and whose channel is at all times above the water table.” Two tenaja locations were located in the study area and are noted, but would not be affected by groundwater extraction. Similarly, numerous wildlife water guzzlers (devices used to collect and store water derived from snow and/or rainwater for later use by wildlife in the area) for small and large game are identified, but these man-made structures are designed to store precipitation and would not be affected by groundwater pumping.

Storm Water Flow

Storm water flow across and adjacent to the project occurs in a network of generally shallow and moderately expressed alluvial channels, and during larger events, as more widespread sheetflow. In general, the channels become shallower and less defined the further they are from the Chuckwalla Mountains. I-10 is an important local control on drainage across the project site, as it intercepts a large number of ephemeral washes draining towards the site from upstream (southwest) of the interstate. These channels are captured by a series of berms and interceptor channels that run parallel with I-10, periodically passing the collected water under I-10 at bridges and creating larger washes that pass under the interstate. There are three distinct locations where this occurs upstream of the project: Copa Ditch, Aztec Ditch, and Tarantula Ditch. These flows are relatively concentrated near the southern project boundary, but quickly disperse into a network of smaller and less defined channels under existing conditions (see **Soil & Water Resources Figure 12**).

SURFACE AND GROUNDWATER BENEFICIAL USES

The Basin Plan for the Colorado River Basin Regional Water Quality Control Board (CRBRWQCB) establishes water quality objectives, including narrative and numerical standards that protect the beneficial uses of surface and ground waters in the region. The Basin Plan describes implementation plans and other control measures designed to ensure compliance with statewide plans and policies and provide comprehensive water quality planning.

Beneficial water uses are of two types—consumptive and non-consumptive. Consumptive uses are those normally associated with people's activities, primarily municipal, industrial and irrigation uses that consume water and cause corresponding reduction and/or depletion of water supply. Non-consumptive uses include swimming, boating, waterskiing, fishing, hydropower generation, and other uses that do not significantly deplete water supplies.

1. Past or Historical Beneficial Uses
    a. Historical beneficial uses of water within the Colorado River Basin Region have largely been associated with irrigated agriculture and mining. Industrial use of water has become increasingly important in the Region, particularly in the agricultural areas.
2. Present Beneficial Uses
    a. Agricultural use is the predominant beneficial use of water in the Colorado River Basin Region, with the major irrigated acreage being located in the Coachella, Imperial and Palo Verde Valleys. The second in quantity of usage is the use of water for municipal and industrial purposes. The third major category of beneficial use, recreational use of surface waters, represents another important segment of the Region's economy.
3. Sources of Drinking Water Policy
    a. All surface and ground waters are considered to be suitable, or potentially suitable, for municipal or domestic water supply with the exception of:
        i. Surface and ground waters where: the TDS exceed 3,000 mg/L, and it is not reasonably expected by the regional water board to supply a public water system, or
        ii. There is contamination, either by natural process or by human activity, that cannot be treated for domestic use using either management practices or best economically achievable treatment practices, or
        iii. The water source does not provide sufficient water to supply a single well capable of producing an average, sustained yield of 200 gallons per day.

Existing uses of waters from springs in the Colorado River Basin include the Box Spring, Crystal Spring, Old Woman Spring, Cove Spring, Mitchell Caverns Spring, Bonanza Spring, Agua Caliente Spring, Kleinfelter Spring, Von Trigger Spring, Malpais Spring, and Sunflower Spring. Based on a review of available information included in the USGS NWIS database, USGS quadrangle maps, and data provided by the BLM, none of these springs are within the area that would be influenced by the project. Existing uses of water from springs in the Colorado River Basin include Bousic Spring, Veale Spring, Nett Spring, Gordon Spring, and Arctic Canyon Spring. None of these springs are within the area that would be influenced by the project.

Water quality objectives are established for the reasonable protection of beneficial uses of water or the prevention of nuisance within a specific area.

1) General Surface Water Objectives (CRBRWQCB)

   a. Aesthetic Qualities - All waters shall be free from substance attributable to wastewater of domestic or industrial origin or other discharges which adversely affect beneficial uses not limited to: setting to form objectionable deposits; floating as debris, scum, grease, oil, wax, or other matter that may cause nuisances; and producing objectionable color, odor, taste, or turbidity.

   b. Tainting Substances – Waters shall be free of unnatural materials which individually or in combination produce undesirable flavors in the edible portions of aquatic organisms.

   c. Toxicity – All waters shall be maintained free of toxic substances in concentrations which are toxic to, or which produce detrimental physiological responses in human, plant, animal, or indigenous aquatic life. Compliance with this objective will be determined by use of indicator organisms, analyses of species diversity, population density, growth anomalies, 96-hour bioassay or bioassays of appropriate duration or other appropriate methods as specified by the CRBRWQCB. Effluent limits based upon bioassays of effluent will be prescribed where appropriate, additional numerical receiving water objectives for specific toxicants will be established as sufficient data to become available, and source control of toxic substances will be encouraged. The survival of aquatic life in surface waters subjected to a waste discharge or other controllable water quality factors, shall not be less than that for the same water body in areas unaffected by the waste discharge, or other control water which is consistent with the requirements for "experimental water" as described in Standards Methods for the Examination of Water and Wastewater.

   d. Temperature – temperature shall not be altered

   e. pH – shall range from 6.0 to 9.0

   f. Dissolved Oxygen – shall not be reduced below the following minimum levels at any time: warm – 5.0 mg/L, cold – 8.0 mg/L, and warm and cold – 8.0mg/L

g. Total Dissolved Solids – discharges of wastes or wastewater shall not increase the total dissolved solids content of receiving waters, unless it can be demonstrated to the satisfaction of the Regional Board that such an increase in total dissolved solids does not adversely affect beneficial uses.

h. Bacteria – The geometric mean of the indicated bacterial densities should not exceed one or the other of the following: E. coli – 630 colonies (col) per 100 ml and enterococci – 165 col per 100 ml. Nor shall any sample exceed one other following maximum allowable: E. coli 2000 col per 100 ml and enterococci 500 col per 100 ml.

Any discharge, except from agricultural activities, shall not cause concentration of total dissolved solids in surface waters to exceed the limits in **SOIL & WATER RESOURCES Table 15**.

Soil & Water Resources Table 15
Surface Water TDS Limits

Location	TDS (mg/L)	
	Annual Average	Maximum
Coachella Valley Drains	2,000	2,500
Palo Verde Valley Drains	2,000	2,500

2) General Groundwater Objectives: Establishment of numerical objectives for groundwater involves complex considerations and it is acknowledged that the quality of groundwater varies significantly throughout the CVGB and varies with depth. It is the CRBRWQCB's goal to maintain the existing quality of non-degraded groundwater basins and to minimize the quantities of contaminants reaching any groundwater basin.

   a. Groundwater designated for domestic or municipal supply shall not contain taste or odor producing substances

   b. Groundwater designated for domestic or municipal supply shall not contain coliform organisms in excess of limits specified in the regulations.

   c. Groundwater designated for domestic or municipal supply shall not contain concentrations of chemical constituents in excess of the limits specified in California Code of Regulations, Title 22 regulations.

   d. Discharges of water softeners regeneration brines, other mineralized wastes, and toxic wastes to disposal facilities which ultimately discharge in areas where such waste can percolate to ground waters useable for domestic and municipal purposes, are prohibited.

Wastewater reclamation and reuse is encouraged, however, such use must meet applicable water quality standards.

ASSESSMENT OF IMPACTS AND DISCUSSION OF MITIGATION

This section provides an evaluation of the expected direct, indirect, and cumulative impacts to soil and water resources that could be caused by construction, operation, and maintenance of the PSEGS. Staff's analysis consists of a description of the potentially significant impacts, gathering data related to construction and operation of the project, then reaching a conclusion to determine whether or not the project presents potentially significant impacts. If staff determines there is a significant impact, then staff evaluates the approved PSPP mitigation contained in the Commission Decision (CEC 2010f) for sufficiency and staff may or may not recommend additional or entirely different mitigation measures that are potentially more effective than those in the Commission Decision or proposed by the project owner. Mitigation is designed to reduce the effects of potentially significant PSEGS impacts to a level that is less than significant.

Potential impacts on water resources during construction and operation include, soil erosion, geomorphology, groundwater basin balance, groundwater levels, groundwater quality, surface water hydrology, and surface water quality impacts.

SOIL EROSION

The modified project proposes a substantial reduction in potential soil loss compared to the approved project. The heliostat technology would not require an entirely flat surface that was needed for solar trough technology, so extensive grading would be avoided. The modified project would reduce the project footprint from 4,366 acres to 3,794 acres, a difference of 572 acres. The total earthwork proposed by the modified project would be prominently less at 213,000 cubic yards, which is roughly five percent of the approved project's 4,500,000 cubic yards of total earthwork. Although these differences would inherently reduce the grading impacts compared to the approved project, the substantial changes in earthwork could potentially create issues that were not analyzed during assessment of the approved project. Therefore, the following soil erosion discussion is entirely independent of the analysis found in the Revised Staff Assessment for PSPP.

Construction

Construction of the project is scheduled to last 33 months. Soil losses would be created by construction and grading activities that would expose and disturb the soil and leave soil particles vulnerable to detachment by wind and water. Soil erosion results in the loss of topsoil and increases in sediment loading to nearby water resources. In the absence of proper BMPs, earthwork could cause significant fugitive dust and erosion.

The magnitude, extent, and duration of those impacts would depend on several factors, including weather patterns in the vicinity of the PSEGS site, the types of soil that could be affected, and the method, duration, and time of year of construction activities. Prolonged periods of precipitation, or high intensity and short duration runoff events coupled with earth disturbance activities could result in accelerated onsite erosion. In addition, high winds during grading and excavation activities could cause wind borne erosion leading to increased particulate emissions that adversely impact air quality. The implementation of appropriate erosion control measures would help conserve soil resources, maintain water quality, prevent accelerated soil loss, and protect air quality.

Power Plant Sites, Common Area, and Laydown Area

The potential for erosion by water during construction is expected to increase as a result of the loss of vegetative cover, and increased local sediment transport through creation of localized gullies and rills on newly graded areas. The project owner submitted a Preliminary Draft Construction DESCP/SWPPP (Palen 2013e) that lists standard BMPs applicable to PSEGS construction activities along with drawings (Palen 2013g) that show locations of specific BMPs at each power block, the common area, and temporary construction laydown area. In addition, the DESCP identifies specific measures to reduce water-related erosion including:

- Temporary erosion control measures would be implemented on active and non-active disturbed areas prior to and at regular intervals throughout the defined rainy season, and year-round prior to storm events;
- Erosion in concentrated flow paths would be controlled by lining channels with a non-erodible material such as compacted riprap, geosynthetic matting, or engineered vegetation;
- Diversion berms (for example, earth dikes) or drainage swales would be used, as needed, to redirect storm water run-on or onsite storm water flow around critical facilities or away from disturbed soil areas and stockpiles;
- Disturbed areas would be stabilized with effective soil cover (such as aggregate, paving, or vegetation) as soon as feasible after construction or disturbance is complete and no later than 14 days after construction or disturbance in that portion of the site has temporarily or permanently ceased;
- Sediment controls would be implemented at the draining perimeter of disturbed soil areas, at the toe of slopes, and at outfall areas; and
- Stone filters and check dams would be strategically placed, as needed, throughout the project site to provide areas for sediment deposition and to promote the sheet flow of storm water prior to leaving the project site boundary. Where available, native materials (rock and gravel) would be used for the construction of the stone filter and check dams. Stone filters and check dams are not intended to alter drainage patterns but to minimize soil erosion and promote sheet flow.

The Preliminary Draft DESCP also includes a Monitoring and Reporting Program/Construction Site Monitoring Program to ensure performance standards and to monitor the effectiveness of BMPs.

Solar Fields – Heliostats and Roads

The Preliminary Draft DESCP states that each area of the PSEGS project would be designed to provide the minimum requirements for access of installation equipment and materials. Most of the natural drainage features would be maintained and any grading required would be designed to promote sheet flow where possible. Areas disturbed by grading and other ground disturbance would be protected from erosion by implementation of appropriate BMPs. Some of the measures listed include:

- Existing vegetation would be preserved when feasible. Vegetation would be cut to a height that would not interfere with construction and operation of the heliostat fields, instead of clearing or grading the entire field;
- Clearing and grading activities would be restricted to areas where foundations, drainage facilities, and all-weather roads must be placed;
- Areas compacted during construction activities would be restored, as appropriate, to approximate preconstruction compaction levels to minimize the opportunity for any increase in surface runoff; and
- Effective sediment perimeter controls would be established and maintained at locations where runoff discharges offsite.

Wind Erosion

The Preliminary Draft DESCP also includes standard BMPs for Wind Erosion Control. The following practices were listed to minimize the loss of wind-blown soil from the site:

- Disturbed soil areas of the project site would be watered regularly to control dust and to maintain optimum moisture levels for compaction as needed, but to avoid runoff, the areas would not be watered excessively. Sediment controls may be used at the edges of these areas as necessary to minimize sediment discharge;
- Areas of high erosion may require application of an approved palliative to reduce dust and prevent excess moisture on the road which may attract tortoises;
- At each structure site, the disturbed soil would be watered to form a crust following completion of construction in that location; and
- The construction site would post visible speed limit signs to prevent vehicles from traveling at excessive speeds.

Staff reviewed the Preliminary Draft DESCP and agrees that BMPs during construction would reduce or avoid impacts to soil from erosion. To protect surface waters, standardized storm water and soil erosion BMP[11] have been determined by the California State Water Resources Control Board (SWRCB) and Regional Water Quality Control Boards (RWQCBs) to be the most effective, practical means of preventing or reducing pollution from nonpoint sources. The conceptual plans for erosion control during construction appear reasonable, but there are additional elements that should be incorporated into the final DESCP that would be developed as required in Condition of Certification **SOIL&WATER-1**. The DESCP should reflect the most recent design plans of the proposed PSEGS project. If during the Energy Commission's amendment process any changes to the modified project are proposed, any adjustments that would alter the erosion control drawings, change the BMP strategy, or result in revised hydrology or hydraulic calculations should be reflected and addressed in an updated DESCP.

[11] BMPs can be classified as "structural" (i.e., devices installed or constructed on a site) or "non-structural" (procedures, such as modified landscaping practices). There are a variety of BMPs available, depending on pollutant removal capabilities.

Staff believes that compliance with an approved DESCP accordance with Condition of Certification **SOIL&WATER-1** would reduce the impacts of soil erosion during construction. In addition, the project activities require that it be covered under the federal General Construction Permit (SWRCB Order No. 2009-0009-DWQ), which requires a construction SWPPP. Also, conditions of certification in the **AIR QUALITY** section of this FSA require a construction mitigation plan to prevent significant impacts from fugitive dust and wind erosion during construction. With the implementation of BMPs and associated monitoring activities included in the approved DESCP and SWPPP, impacts on soil would be expected to be less than significant during construction of the proposed PSEGS project.

Operation

Soil losses would be ongoing after the construction of the PSEGS project. Areas disturbed during the construction phase are subject to potential erosion during the operational life of the proposed project. PSEGS would be designed for an operating life of 25 to 30 years.

Onsite Erosion

The estimated total area of land grading and excavation during construction of the PSEGS project would be about 752 acres,[12] as shown in **Soil & Water Resources Table 2**. After project completion, the temporary parking and construction laydown areas would be restored and about 25 acres would become impervious due to the addition of concrete foundations and asphalt paving. The balance of the previously disturbed area, roughly 730 acres, would be susceptible to potential erosion during the operational life of the proposed project. Furthermore, the addition of impervious surfaces to an area previously undeveloped would increase velocities of storm water runoff (see “Surface Water Hydrology” discussion below), which would increase the erosion potential of open soil areas.

The project owner submitted a Preliminary Draft DESCP/SWPPP (Palen 2013e) that states permanent erosion control measures would reduce potential soil related impacts, including gravel, landscaping, and engineering drainage channels. These would be stabilized areas with very little or essentially no risk of erosion. In addition, relatively small rock filters and local diversion berms through the heliostat fields may be installed as required to discourage water from concentrating and to maintain sheet flow. These all would serve to prevent wind and water erosion and maintain some water infiltration capacity of the soil.

Staff agrees that implementation and maintenance of permanent BMPs during operations would reduce or avoid impacts to onsite soil from erosion. The Preliminary Draft DESCP is reasonable in concept; however, it does not sufficiently discuss post construction measures for erosion and sediment control. The document should address exposed soil treatments proposed during operation of the project for both road and non-road surfaces, as described in item H of Condition of Certification **SOIL&WATER-1**. A maintenance schedule should include post-construction maintenance of BMPs applied

[12] This total does not include the surface areas of all the heliostat mirrors because all-terrain vehicles would install pylons and mount heliostat assembles. No grading would be required.

to disturbed areas following construction. These should also reflect requirements regarding ground disturbing activities and erosion control measures specified in Conditions of Certification **BIO-8**.

Staff believes that compliance with Condition of Certification **SOIL&WATER-1** requiring the project owner to develop and implement an approved DESCP would reduce the impacts of soil erosion during operation of the modified project. Additionally, conditions of certification in the **AIR QUALITY** section of this FSA would prevent significant impacts from fugitive dust during operations.

Although modeling and calculations can be used to estimate post-construction flows and provide a basis for structural design parameters, alluvial flows are very complex. Flood flows from the mountains are initially confined in incised channels, but at the site the flood flows are broadly distributed (known as sheet flow) and less confined and can take random paths across the fan. Predicted flow depths and velocities have a potential uncertainty because they do not account for the dynamics of erosion and sedimentation which carry and deposit sediments at various locations along the margin of the alluvial fan where the site is located. Where obstructions such as heliostats and fences are encountered, flows can have erosive effects which could undermine their stability. The consequences of flash flood damage or modified sedimentation and erosion rates may be significant. Staff proposes Condition of Certification **SOIL&WATER-20** requiring a Storm Water Damage Monitoring and Response Plan to reduce these potential impacts.

Offsite Erosion

The project's addition of impervious surfaces could also increase velocities of storm water runoff leaving its boundaries, possibly increasing the potential to erode offsite areas downstream of the project. To address the potential significant offsite erosion from storm damage, staff proposes Condition of Certification **SOIL&WATER-20** requiring a Storm Water Damage Monitoring and Response Plan to reduce these potential impacts in three ways:

1. Establish an ongoing maintenance plan to ensure all storm water management measures are functioning properly, through periodic inspection before the first seasonal storms and after each storm event throughout the year;

2. Establish and implement a response plan after every occurrence of damage (from a storm event or other cause) to clean up and repair damage; and

3. Develop and implement a process to monitor incidents and propose modifications and/or improvements to address ongoing issues.

Staff believes that compliance with an approved DESCP in accordance with Condition of Certification **SOIL&WATER-1** and an approved Storm Water Monitoring and Response Plan in accordance with Condition of Certification **SOIL&WATER-20** would reduce the impacts of soil offsite erosion during operation of the proposed project.

Mitigation

Construction and operation of the modified project could result in significant impacts related to water erosion of soils. Implementation of BMPs and Conditions of Certification would reduce the impacts to insignificant. Implementation of Conditions of Certification **SOIL&WATER-1** and **SOIL&WATER-20**, in addition to conditions of certification required in the **AIR QUALITY RESOURCES** and **BIOLOGICAL RESOURCES** sections of this FSA would ensure there would be no potential for impacts to soils related to water erosion.

Geomorphology

The combined sand corridor is a regionally significant geomorphic feature that transports sand downwind along the valley and to the Colorado River. The approved project would have intruded into the Chuckwalla Valley sand transport corridor by more than a mile, cutting its width in half and that would have created a "sand shadow" downwind – an area of current dune habitat where fine sand would be eroded downwind but not replaced from upwind, leading to loss of the sand dunes. Previous studies have shown that such sand shadows result in deflation, substrate coarsening and potential loss of Mojave Fringe Toad Lizard (MFTL) habitat.

The project owner has proposed as part of the modified project to eliminate the approved project's 30-foot tall wind fence which contributed to disruption of the sand transport corridor. However, the modified project would still have a project boundary fence (security fence) and desert tortoise exclusion fencing. Any fence design could impede sand transport and result in downwind impacts to sand dune habitat. In addition, sand that would have been transported across the project footprint from upwind would also be potentially cut off by storm drainage channels and above ground infrastructure that are proposed as part of the modified project (Palen 2013r §19). A complete analysis of indirect impacts for the modified project is included in the **BIOLOGICAL RESOURCES** section of this FSA.

GROUNDWATER BASIN BALANCE

Because the modified PSEGS project would use a reduced amount of water during both construction and operation activities with the same proposed groundwater supply system as the approved PSPP project, staff believes that this does not constitute a project change from the approved project. Therefore, the following groundwater basin balance discussion has been included in this analysis verbatim from the Revised Staff Assessment for PSPP (CEC 2010c §C.9). Some minor edits were made for clarification.

Staff evaluated whether the amount of groundwater used for both construction and operations would place the groundwater basin into overdraft[13]. For purposes of impact analysis, it is assumed that any withdrawals that exceed the average natural recharge and exceeds a significant percentage of the total amount of groundwater in storage would be a significant impact. The following discussion presents an analysis of the potential for overdraft and significant depletion of groundwater in storage to occur.

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[13] Groundwater overdraft is "the condition of a groundwater basin in which the amount of water withdrawn by pumping exceeds the amount of water that recharges the basin over a period of years during which water supply conditions approximate average conditions." (CDWR 1998).

Construction and Operation

Compared to the approved PSPP project, the modified PSEGS project would reduce water use both during construction (from 5,750 af to 1,130 af) and during operation (from 300 afy to 201 afy). As a result, the overall water use of PSEGS could be roughly half that of PSPP (7,160 af compared to 14,750 af). Because this reduction in groundwater use would reduce the potential effects on groundwater basin balance, the conditions of certification in the Commission Decision (CEC 2010f), which fully mitigated the PSPP groundwater use, would also fully mitigate PSEGS groundwater use. Staff included the following PSPP groundwater analysis as an overly conservative scenario of groundwater basin balance impacts.

A comparison was made between the average annual basin budget with the PSPP project's anticipated water production requirements. **Soil & Water Resources Table 16** presents the anticipated water requirements along with the average annual basin budget for the PSPP's 39-month construction period. Currently, the CVGB balance is positive by approximately 2,608 afy whereby inflow (approximately 13,719 afy) to the basin is slightly greater than estimated outflows (approximately 11,111 afy) to the basin. Approximately 400 afy is attributed to subsurface outflow to the adjacent Palo Verde Mesa Groundwater Basin.

Soil & Water Resources Table 16
Estimated Change to Chuckwalla Valley Groundwater Basin Budget
(Average Year Conditions)

Project Component	Years	Annual Basin Budget Balance	PSPP Requirements (afy)	Net Budget Balance (afy)
Construction	1-3	2,608	1,917	691
Operations	4-33	2,608	300	3,050

Note: See Soil & Water Resources Table 8 for Groundwater Basin Budget

It is anticipated that groundwater extraction during PSPP construction (~1,917 afy) and operation (~300 afy) would not significantly impact the CVGB balance as the ~1,917 afy during construction and the 300 afy during operations would not exceed the positive yearly balance of 2,608 afy. Therefore, the anticipated groundwater extracted during PSEGS construction (~400 afy) and operation (~201 afy) would not significantly impact the CVGB balance.

The project's pumping could have an effect on the adjacent Palo Verde Mesa Groundwater Basin by inducing flows from the Colorado River into that basin. However, given the location of the project, the anticipated annual project water requirements, staff does not anticipate that the project would have a significant impact on the adjacent (Palo Verde Mesa) groundwater basin.

Solar Millennium, the PSPP project owner, did not provide an analysis of the proportion of water originating from storage, from natural recharge and/or the Colorado River underflow. However, water in the Colorado River is fully appropriated and according to a U.S. Supreme Court Decision (issued in *State of Arizona v. State of California* (2006) 547 U.S. 150, 126 S.Ct. 1543 "[c]onsumptive use from the mainstream within a State shall include all consumptive uses of water of the mainstream, including water drawn from the mainstream by underground pumping.") The mainstream was indicated as "the mainstream of the Colorado River downstream from Lee Ferry within the United States, including the reservoirs thereon." The Supreme Court went on to state that the State of California is enjoined "from diverting or purporting to authorize the diversion of water from the mainstream the diversion of which has not been authorized by the United States for use in the respective States; provided, however, that no party named in this Article and no other user of water in said States shall divert or purport to authorize the diversion of water from the mainstream the diversion of which has not been authorized by the United States for its particular use."

The USGS has indicated that the Palo Verde Mesa Groundwater Basin (PVMGB) and the CVGB lie within a basin tributary to the Colorado River and that wells drawing groundwater could be considered withdrawing water from the Colorado River Aquifer (Wilson et al. 1994). In addition, using the groundwater model developed by Worley-Parsons (2009) suggests that the subsurface flow from CVGB to PVMGB could be reduced as much as 32 afy after 33 years of construction and operation of the approved PSPP project. The reduction in flow to the PVMGB could likely increase flow from the Colorado River into the PVMGB. Staff believes the project owner should be required to replace the quantity of water contributed by the Colorado River from the project's proposed groundwater extraction.

Use of Colorado River water must meet requirements of the United States Bureau of Reclamation (USBR). In 2008, USBR proposed a rule that specified a method to determine whether any particular well is drawing water from the river aquifer, thus requiring an entitlement from USBR. The proposed rule was later withdrawn by USBR with no anticipated date of being promulgated.[14] Condition of Certification **SOIL&WATER-14** requires development of a Water Supply Plan that includes water conservation projects such as payment for irrigation improvements in Palo Verde Irrigation District, purchase of water rights within the Colorado River Basin that would be held in reserve, and/or participation in BLM's Tamarisk Removal Program. To support the fact that water conservation measures are available, an example of a Tamarisk Removal Program is provided below.

The purpose of a Tamarisk Removal Program is to provide for an additional mechanism to mitigate for potential impacts to groundwater supply as a result of water use by the project. This component not only provides benefits to the groundwater system (and replacement of Colorado River water), but also provides a potential biological benefit by the removal of an invasive species that out-competes native vegetation and alters the natural desert ecosystem functions and values by limiting the habitats that supports native flora and fauna populations (Shaforth et. al, 2009).

[14] See the discussion of the California Water Code, Section 1200 "Water Rights" under Compliance with LORS and State Policies, below.

Tamarisk (salt cedar) is native to southwestern Asia and was introduced to the United States in the early 1800's for wind breaks. In the western United States, tamarisk is a highly invasive weed that has taken hold in semi-arid and arid watersheds in recent decades (de Gouvenain, 1996). Tamarisk can consume up to 250 gallons of ground water per day per mature tree (Department of Ecology, 2009).

A Tamarisk Removal Program has the potential to conserve a substantial amount of groundwater consumption within the Lower Colorado River area by removing a high water demand habitat that also monopolizes resources and negatively impacts native habitats in the area. A summary of water consumption estimates based on two scenarios is provided in **Soil & Water Resources Tables-17** and **-18**.

Soil & Water Resources Table 17
Water savings assuming mature trees

VARIABLES		CALCULATIONS	
5	acres	Trees/Acre	217.8
250	gallons/tree/day	Trees Removed	1,089
200	sf/tree	Gallons/Day	272,250
43560	sf/acre	Gallons/Year	99,371,250
365	days/year		
325,851	gal/acre-foot	Acre-feet/Year Savings	305

Soil & Water Resources Table 18
Water savings assuming a mixture of mature and immature trees

VARIABLES		CALCULATIONS	
7	acres	Trees/Acre	435.6
100	gallons/tree/day	Trees Removed	3,049
100	sf/tree	Gallons/Day	304,920
43560	sf/acre	Gallons/Year	111,295,800
365	days/year		
325,851	gal/acre-foot	Acre-feet/Year Savings	342

According to the Lower Colorado River Multi-Species Conservation Program – Final Biological Assessment (LCR 2004), the extent of land cover associated with salt cedar (Tamarisk) is over 26,000 acres in the area surrounding the Palo Verde Valley (referred to as Reach 4 of the Lower Colorado River). A Tamarisk Removal Program would only be required to remove 5 acres of mature trees or 7 acres of a mixture of mature/immature trees to achieve a water savings of over 300 afy. Correspondingly, there is more than sufficient salt cedar land cover type for the project owner to implement a water conservation mitigation program using tamarisk removal in the lower Colorado River area.

Program implementation, maintenance, and monitoring could be funded through an Endowment Fund established by the project owner. The fund could be held and managed by the BLM and/or Resource Conservation District based on resources and mechanisms available. The BLM and Resource Conservation District would use the fund to facilitate and manage implementation of the program.

With respect to the quantity of water that must be replaced, staff understands that the quantity of water identified in Condition of Certification **SOIL&WATER-14** is based on a simplified methodology for calculating contribution of water from the Colorado River from the project's proposed groundwater extraction and determining the appropriate mitigation. If the project owner chooses to refine the estimate of the quantity of water contributed by the Colorado River from project groundwater extraction they should be required to implement Condition of Certification **SOIL&WATER-17**. The results of this analysis can be used to refine the estimate of the volume of water that must be replaced in accordance with Condition of Certification **SOIL&WATER-14**.

<u>Mitigation</u>

There is a potential that groundwater production at the project site may induce additional inflow from the Colorado River which would be a significant impact. Implementation of the Condition of Certification **SOIL&WATER-14** is anticipated to reduce the potential for impacts to the Colorado River below the level of significance. The project owner could choose to conduct the analysis described in Condition of Certification **SOIL&WATER-17** to refine the quantity of water contributed by the Colorado River from project groundwater extraction. Because the modified PSEGS project would use a reduced amount of water during both construction and operation activities with the same proposed groundwater supply system as the approved PSPP project, staff believes that Conditions of Certification **SOIL&WATER-14** and **SOIL&WATER-17** as approved in the Commission Decision would also apply to the modified PSEGS project.

GROUNDWATER LEVELS

Because the modified PSEGS project would use a reduced amount of water during both construction and operation activities with the same proposed groundwater supply system as the approved PSPP project, staff believes that this does not constitute a project change from the approved project. Therefore, the following groundwater levels discussion has been included in this analysis from the Revised Staff Assessment for PSPP (CEC 2010c §C.9). Some minor edits were made for clarification.

The project has the potential to lower groundwater levels as a result of water production during both construction and operations. The lowering of groundwater levels could create a significant impact if the lowering of the groundwater levels: 1) impacts existing water wells in the basin; 2) lower the water table in areas where deep-rooted phreatophytes are prevalent[15], and/or 3) induce permanent ground subsidence.

[15] See the **BIOLOGICAL RESOURCES** section of this FSA for impacts related to biological resources.

Drawdown imposed by a well on another nearby pumping well can have adverse effects on the performance of that well and is referred to as interference drawdown or well interference. Specific potential adverse effects evaluated in this study include the following:

1. Interference drawdown can result in the water level of an aquifer being drawn down below the screen of the well (*i.e.*, the well goes dry);

2. Interference drawdown can result in the water level of an aquifer being drawn down to a point where the affected well's capacity to pump water is decreased and the well can no longer produce the amount of water that is needed for a particular use, or the well is at risk of becoming damaged and unusable over time due to exposure of the well's screen above the water table and resulting corrosion;

3. Interference drawdown can result in the water level in the affected well being drawn down to near the intake of the well's pump, requiring lowering of the pump intake in order for the well to remain operational; and/or

4. Interference drawdown can cause a decrease in groundwater level in the affected well such that the well and pump can continue to operate and produce adequate amounts of water, but pumping must occur at either greater frequency or duration, and/or water must be lifted to a greater height, resulting in greater operational and maintenance costs.

   The extent and type of well interference experienced by an affected well is dependent on hydrogeologic conditions in the aquifer as well as the characteristics of the affected well. These include the following:

   - The amount of interference drawdown that is applied [which varies with the distance of the impacted well from the project well(s)];
   - The depth and screened interval of the affected well;
   - The thickness of saturated sediments penetrated by the affected well;
   - Local variations in the transmissivity of the saturated sediments in which the affected well is completed, if any;
   - The condition and efficiency of the affected well;
   - The affected well's pump specifications, including its rating curve, the depth at which the pump intake is set, and the resulting pumping water level in the well during operation; and
   - The minimum required water production rate of the well.

Phreatophyte trees such as Mesquite, Ironwood or Palo Verde have deep root systems that can extend tens of feet below the ground surface to the underlying water table. In addition, wet playas can harbor halophyte plant communities that depend on a shallow water table for their moisture. Lowering of the water table below the root depth of these plants could result in stress or death.

Ground subsidence can occur as a result of water level decline in aquifer systems. When the fluid pressure in an aquifer is reduced as a result of changes in the groundwater level, a shift in the balance of support for the overlying materials causes the “skeleton” of the aquifer system to deform slightly. Reversible deformation occurs in all aquifer systems as a result of the cyclical rise and fall of groundwater levels associated with short and longer term climatic cycles. Permanent ground subsidence can occur when pore water pressures in the aquifer fall below their lowest historical point, and the particles in the aquifer skeleton are permanently rearranged and compressed. Soils particularly susceptible to such consolidation and subsidence include compressible clays in a confined aquifer system. This type of deformation is most prevalent when confined alluvial aquifer systems are overdrafted.

Construction and Operation

Compared to the approved PSPP project, the modified PSEGS project would reduce water use both during construction (from 5,750 af to 1,130 af) and during operation (from 300 afy to 201 afy). As a result, the overall water use of PSEGS could be roughly half that of PSPP (7,160 af compared to 14,750 af). Because this reduction in groundwater use would reduce the potential effects on groundwater levels, the conditions of certification in the Commission Decision (CEC 2010f), which fully mitigated the PSPP groundwater use, would also fully mitigate PSEGS groundwater use. The project owner has not revised the groundwater modeling for the modified PSEGS project’s water use, therefore staff included the following PSPP groundwater analysis as an overly conservative scenario of groundwater level impacts.

The maximum predicted water table drawdown associated with the PSPP project is approximately 26 to 46 feet in the area of the pumping wells occurring at the end of construction (see **Soil & Water Resources Table 19**), and the area where drawdown exceeds 1 foot is limited to within approximately 1 to 3 miles of the project ROW. **Soil & Water Resources Figures 13** and **14** present groundwater level decline contours from the approved PSPP production wells at the end of construction and end of operations, respectively.

Soil & Water Resources Table 19
Results of Numerical Modeling for PSPP Project[1]

Model Runs	Zone 1[2]		Zone 2[2]		Zone 3[2]		Year	Maximum drawdown (feet)				Change in storage (acre-feet)
	T, ft2/d	S	T, ft2/d	S	T, ft2/d	S		Well 1	Well 2	Well 3	Well 4	
Run 7[1]	1,000	0.2	6,300	0.2	26,000	0.2	2013	46.59	25.93	46.67	25.96	5,751
							2043	11.66	7.50	11.88	8.46	14,841
Run 19[3]	26,000	0.2	---	---	---	---	2013	3.1	---	---	---	---
							2029	2.4	---	---	---	---
							2043	2.6	---	---	---	---
Run 20[4]	10,000	0.2	---	---	---	---	2013	2.8	---	---	---	---
							2029	2.1	---	---	---	---
							2043	2.2	---	---	---	---
Run 21[5]	1,000	0.2	---	---	---	---	2013	57.3	---	---	---	---
							2029	42.2	---	---	---	---
							2043	43.7	---	---	---	---

Source: Derived from Solar Millennium 2010a, Solar Millennium 2010i, and Galati&Blek 2010i.
Notes

1 - Refer to Soil & Water Resources Table 21(bottom row) for the water use schedule that was used to run these models.
2 - Figure DR-S&W-207-3 shows the areal distribution of transmissivities used in the model
3 - Used to determine relative sensitivity of the aquifer parameters and a conservative radius of influence for Zone 1 delineation using upper bound transmissivity for a single pumping well
4 - Used to determine relative sensitivity of the aquifer parameters and a conservative radius of influence for Zone 1 delineation using mid-value transmissivity for a single pumping well
5 -Used to determine relative sensitivity of the aquifer parameters and a conservative radius of influence for Zone 1 delineation using lower bound transmissivity for a single pumping well

The nearest potential wetland or halophyte communities would be near Palen Dry Lake. Groundwater dependent vegetation lies approximately 3-6 miles from the project site. A preliminary estimate of the groundwater level decline indicates approximately 0.2 to 0.6 feet of decline at the end of operations (33 years). The **BIOLOGICAL RESOURCES** section of this FSA describes potential impacts to vegetation that may be dependent on shallow groundwater table conditions.

Given the current understanding of the hydrogeology of the Quaternary Alluvium, the Bouse Formation and the Fanglomerate, as well as the current understanding concerning existing wells that may be affected by project-induced drawdown, it is unlikely that groundwater pumping for the project would cause any nearby wells to go dry or be severely impaired or rendered unusable by declining groundwater levels. However, groundwater levels would decline and could affect nearby wells. While preliminary studies and calculations have been made to assess the potential for impact, the quantification of the impact is considered an estimate and cannot be accurately quantified until actual long-term groundwater production occurs. Condition of Certification **SOIL&WATER-2** through **SOIL&WATER-5** are expected to minimize impacts to groundwater levels below the level of significance.

The potential for subsidence from groundwater level declines is believed to be remote. However, it is recommended that a monitoring and mitigation program be implemented to assess long term changes that may occur as a result of groundwater pumping in the area. The project owner should also be required to implement **SOIL&WATER-16** to monitor and mitigate any potential impacts associated with ground subsidence associated with groundwater pumping.

Mitigation

Groundwater levels near the project's water supply wells would decline during the project pumping. Local decline of groundwater levels within the cone of depression could affect nearby wells. While preliminary studies and calculations have been made to assess the potential for impact, the quantification of the impact is considered an estimate and cannot be accurately quantified until actual long-term groundwater production occurs. Conditions of Certification **SOIL&WATER-2** through **SOIL&WATER-5** are expected to minimize impacts to groundwater levels below the level of significance. Staff has required these types of conditions in previous cases and finds that they are effective in addressing any impacts to nearby wells that may occur as a result of project pumping.

The project must implement Condition of Certification **SOIL&WATER-16** that requires a Subsidence Monitoring and Action Plan to assess and mitigate potential effects of non-elastic subsidence associated with groundwater extraction in the vicinity of the proposed production wells.

Because the modified PSEGS project would use a reduced amount of water during both construction and operation activities with the same proposed groundwater supply system as the approved PSPP project, staff believes that Conditions of Certification **SOIL&WATER-2** through **SOIL&WATER-5** and **SOIL&WATER-16** as approved in the Commission Decision would also apply to the modified PSEGS project.

GROUNDWATER QUALITY

Because the modified PSEGS project would use a reduced amount of water during both construction and operation activities with the same proposed groundwater supply system as the approved PSPP project, staff believes that this does not constitute a project change from the approved project. Additionally, the modified PSEGS project would use a reduced number of evaporation ponds using the same type proposed for the approved PSPP project. Therefore, the following groundwater quality discussion has been included in this analysis from the Revised Staff Assessment for PSPP (CEC 2010c §C.9). Some minor edits were made for clarification and additional information added to compare the approved PSPP project and modified PSEGS project.

Construction

There is a potential that significant groundwater quality impacts could occur during construction if contaminated or hazardous materials used during construction were to be released and migrate to the groundwater table. Given the distance to the groundwater table (180 feet bgs) and the proposed implementation of a hazardous material management plan during construction[16], potential impacts to groundwater quality are expected to be maintained below the level of significance.

There is a potential that project extraction of groundwater may induce vertical flow of high saline groundwater from beneath Palen Dry Lake to lower aquifers (being used for water production) located beneath the site. At the present time, no significant differential in groundwater quality has been identified beneath the project. AECOM conducted a hypothetical analysis (AECOM 2010a) where high saline groundwater was present beneath Palen Dry Lake and that the production wells planned for the project would induce a gradient towards the production well. Using variable values of hydraulic conductivity based on-site specific data, the results indicate that it will take between about 43 years to 4,424 years for groundwater to flow from beneath Palen Dry Lake to the project wells. Given that there are probably low permeability sediments present beneath Palen Dry Lake and the analysis did not take into consideration retardation, dispersion or dilution and/or interference from other producers, it is unlikely that significant vertical migration of poor quality water would migrate and degrade higher quality portions of the aquifer. However, due to the uncertainty associated with the amount of information available concerning shallow groundwater quality and vertical migration, Conditions of Certification **SOIL&WATER-2** through **SOIL&WATER-4**, and **SOIL&WATER-18** are expected to minimize impacts to groundwater quality below the level of significance.

Because the modified PSEGS project would use a reduced amount of water during construction activities with the same proposed groundwater supply system as the approved PSPP project, staff believes that Conditions of Certification **SOIL&WATER-2** through **SOIL&WATER-4** and **SOIL&WATER-18** as approved in the Commission Decision would also apply to the modified PSEGS project.

[16] As required by Condition of Certification **HAZ-3** (see the **HAZARDOUS MATERIALS MANAGEMENT** section of this FSA).

Operation

Groundwater Pumping

There is a potential that project extraction of groundwater may induce vertical flow of high saline groundwater from beneath Palen Dry Lake to lower aquifers (being used for water production) located beneath the site. At the present time, no significant differential in groundwater quality has been identified beneath the project. Given the possibility that there is shallow groundwater below the lake and the lake serves as a point of discharge of groundwater, it is reasonable to presume that there could be high concentrations of TDS below the lake (AECOM 2010a). A calculation was conducted by AECOM using estimates of hydraulic conductivity, effective porosity, gradient and distance and where high saline groundwater was present beneath Palen Dry Lake and that the production wells planned for the project would induce a gradient towards the production well. Using the estimated values of the variables based on-site specific data, the hand calculated results indicate that it will take between about 43 years to 4,424 years for groundwater to flow from beneath Palen Dry Lake to the project wells (AECOM 2010a). Given that there are probably low permeability sediments present beneath Palen Dry Lake and the analysis did not take into consideration retardation, dispersion or dilution and/or interference from other producers, it is unlikely that significant vertical migration of poor quality water would migrate and degrade higher quality portions of the aquifer. However, due to the uncertainty associated with the amount of information available concerning shallow groundwater quality and vertical migration, Conditions of Certification **SOIL&WATER-2** through **SOIL&WATER-4**, and **SOIL&WATER-18** are expected to minimize impacts to groundwater quality below the level of significance.

Because the modified PSEGS project would use a reduced amount of water during operation activities with the same proposed groundwater supply system as the approved PSPP project, staff believes that Conditions of Certification **SOIL&WATER-2** through **SOIL&WATER-4** and **SOIL&WATER-18** as approved in the Commission Decision would also apply to the modified PSEGS project.

Evaporation Ponds

The approved PSPP project would have had four double-lined evaporation ponds. Each pond would have had an evaporative surface area of 4 acres resulting in a total of 8 acres of evaporation ponds for each unit or a total of 16 acres of ponds for the entire approved PSPP project. The modified PSEGS project would construct two double-lined evaporation ponds, each with 2 acres of evaporative surface area resulting in a total of four acres of ponds for the entire modified project.

The ponds would be designed and permitted as Class II Surface Impoundments in accordance with CRBRWQCB requirements, as well as the requirements of the California's Department of Resources Recycling and Recovery (CalRecycle). Multiple ponds are planned to allow plant operations to continue in the event that a pond needs to be taken out of service for some reason, *e.g.,* needed maintenance. Each pond would have enough surface area so the evaporation rate exceeds the input rate at maximum design conditions and annual average conditions.

For the approved PSPP project, the average pond depth is 7 feet and residual precipitated solids would have been removed every 4 years to maintain a solids depth no greater than approximately 2 feet for operational and safety purposes. The ponds would have maintained a minimum of 2 feet of freeboard to minimize the potential for overtopping due to a 100-year recurrence interval rainfall event. A total estimated amount of evaporites accumulated is 6,400 tons over 30 years.

For the modified PSEGS project, ponds 6 feet deep would be constructed without the need for periodic removal of solids over the 30 year life of the facility. Ponds are designed for an ultimate salt depth of 3.2 feet and a maximum water depth of 1.0 feet. A 100-yr, 24-hour storm event is estimated by NOAA to yield 0.4 feet (4.22 inches) of rain. A minimum freeboard of 1.0 foot would be maintained during the life of the ponds (Palen 2013a Appendix 2-B).

The pond liner system would consist of a 60 millimeter high density polyethylene (HDPE) primary liner and a secondary 40 millimeter HDPE liner. Between the liners is a synthetic drainage geonet and collection piping that is used as part of the leachate detection system (LDS), which would be directed back to the pond. There would be a hard surface protective layer on top of the 60 millimeter HDPE which would consist of a hard surface such as roller-compacted concrete. The hard surface provides protection against accidental damage to the HDPE from falling objects, varying climatic conditions, and worker activities during cleanout and maintenance. Monitoring of the evaporation ponds would be required to detect the presence of liquid and/or constituents of concern. Although the modified project would create less process wastewater per year compared to the approved project, the constituents of concern would occur in higher concentrations.[17] Due to the aforementioned construction and operational procedures of the surface impoundments (see Condition of Certification **SOIL&WATER-6** and its Appendices B, C, and D) along with Condition of Certification **SOIL&WATER-18**, groundwater quality is not anticipated to be affected as a result of disposal of this waste stream and impacts to groundwater quality would be below the level of significance.

Land Treatment Unit

The approved project proposed use of a Land Treatment Unit (LTU) to treat contaminated soils as a result of accidental spills of heat transfer fluid (HTF) that occur during the course of daily operational or maintenance activities. The Commission Decision required compliance with Condition of Certification **SOIL&WATER-6** (with requirements specified in Appendices B, C, and D) to ensure that the operation of the LTU is in accordance with regulatory requirements and would minimize potential impacts to surface and groundwater quality. In addition, Condition of Certification **SOIL&WATER-18** required the approved project to monitor existing groundwater quality to monitor compliance with the requirements set forth in **SOIL&WATER-6**.

[17] A thermal evaporator system would treat process wastewater, and concentrated waste brine would be transported to the evaporation ponds. See the Process Wastewater discussion under “Proposed Modified Project” above.

The modified PSEGS project does not require use of an LTU for solar tower technology. Although this results in a reduced impact compared to the approved project, the waste discharge requirements specified in Appendices B, C, and D have been revised to reflect the modified project. Staff believes that the revisions in Appendices B, C, and D would not affect the language of existing Conditions of Certification **SOIL&WATER-6** or **SOIL&WATER-18**.

Septic Field

The use and application of septic fields is an established practice as a method of wastewater treatment. The septic system would have no affect on the surface water in or around the project site. The septic system would be installed approximately 5-6 feet deep. In addition, the Riverside County Department of Environmental Health has a Technical Guidance manual for Onsite Wastewater Treatment Systems and this requires a setback of 100 feet between this type of system and the nearest groundwater well.

Individual septic systems and leach fields are planned for each of the two power blocks and the project's administrative, warehouse, and control room and facilities. The proposed septic systems and leach fields for the various facilities are hydraulically down-gradient from the nearest offsite well. Therefore, operation of the septic systems and leach fields from these areas are not expected to impact groundwater quality at the nearest offsite wells.

The septic system and leach fields for the project would be constructed in accordance with the requirements of Riverside County and Condition of Certification **SOIL&WATER-7**:

1. Ordinance 650.5 (amends Ordinance 650 that regulates the discharge of sewage in unincorporated areas of the County of Riverside and incorporates by reference Ordinance 725);

2. Title 15 Section 15.24.010 (the Uniform Plumbing Code) Appendix K for Private Sewage Disposal – General and Disposal Fields; and

3. Title 8 Section 8.124.030 (Approval and Construction Permit for Sewage Discharge) and Section 8.124.050 (Operation Permit for Sewage Disposal).

Because the modified PSEGS project would employ a comparable number of fulltime workers during operation as the approved PSPP project,[18] staff believes that Condition of Certification **SOIL&WATER-7** as approved in the Commission Decision would also apply to the modified PSEGS project.

[18] The approved PSPP project estimated 134 full time employees would be needed with both units operating. The modified PSEGS project estimates to employ up to 100 full time employees.

Mitigation

Groundwater quality in the vicinity of the project site could be impacted as a result of the operation of the surface evaporation impoundments and septic fields. Preliminary studies and calculations have been made to assess the potential for impact. These studies suggest that there is a low potential to impact groundwater quality in the vicinity of the project site. Due to the uncertainty associated with the potential to impact groundwater quality and the regulatory requirements for operation of the surface evaporation impoundments and septic systems, staff recommends implementation of specific monitoring and mitigation requirements.

The Commission Decision required Conditions of Certification **SOIL&WATER-6**, **SOIL&WATER-7** and **SOIL&WATER-18** to minimize impacts below a level of significance. Staff believes these conditions as approved in the Commission Decision would also apply to the modified PSEGS project.

SURFACE WATER HYDROLOGY

The modified project proposes substantial changes to the site hydrology compared to the approved project. The modified project removes the three major drainage channels from the approved project that was designed to route the water through and around the entire field of solar troughs. Instead, the heliostat technology of the modified project would allow most flows to maintain existing, pre-project natural drainage patterns through the solar fields.[19] Although these differences would inherently reduce the impacts of water diversion compared to the approved project, these changes in hydrology could potentially create issues that were not analyzed during assessment of the approved project. Therefore, the following surface water hydrology discussion is entirely independent of the analysis found in the Revised Staff Assessment for PSPP.

Flooding

Flooding is usually defined as the inundation of dry land adjacent to a channel when excess flow exceeds its banks. Because ephemeral streams like those at the site do not have permanent flow, their banks are formed in response to rainfall events which are infrequent and vary in intensity. The extreme changes in flow conditions causes flooding, erosion, and sedimentation that can drastically alter the channel's shape and alignment. Consequently, desert washes can be transient and may vary in course from one storm event to another (resulting in heavy braiding of shallow channels). For purposes of this analysis, impacts of flooding consider the natural behavior of ephemeral streams.

[19] Because the modified project does not propose the major drainage channels, staff recommends deletion of the following Conditions of Certification pertaining to these large channels: SOIL&WATER-8 through SOIL&WATER-12. (See "Proposed Conditions of Certification" below.)

Onsite Area Flooding

Proposed construction of the PSEGS project would alter existing onsite drainage patterns which could potentially cause or increase onsite flooding. For the majority of the project site, existing drainage patterns would generally remain the same. However, changes to a number of areas such as grading, adding impervious surfaces, diverting flows, and impeding flows can increase the amount of storm water runoff volume and rate. An analysis of each impact and the project owner's proposal to address impacts follows below.

Grading and Increase of Impervious Area

Heavy to medium grading would be performed within each solar plant's power block area and the common area complex. Grading would also be needed to create a system of roadways for access to each facility and maintenance of the heliostats, although grading in the solar fields would match natural contours and promote sheet flow where possible. Estimated amount of total grading (both temporary and permanent) would be about 413 acres, as shown in **Soil & Water Resources Table 4**. After project completion, the temporary parking and construction laydown areas would be restored to pre-project grade and stabilized to prevent erosion and promote natural revegetation.[20]

While most of the permanently graded area would remain "dirt" surface, the addition of concrete foundations and asphalt paving would create approximately 25 acres of impervious surface. Because water is not able to infiltrate into impervious surfaces, storm water runoff quickly concentrates and flows downstream, increasing both the volume and velocity of accumulated water. In addition, the heliostat assemblies would essentially function as thousands of rooftops and create approximately 799 acres of impervious surfaces, covering about 21 percent of the project site (see **Soil & Water Resources Table 4**). However, because the heliostats would be installed such that surface runoff flows to the pervious dirt areas of the solar field, impacts are considerably less severe than a contiguous stretch of impervious area.

The project owner submitted Preconstruction Hydrology Calculations (Palen 2013e Attachment G) showing that a 100-year, 24-hour storm event[21] would likely result in flood flows approximately one-to two-feet deep, with spot locations of three to four feet deep (see **Soil & Water Resources Figure 12**). Staff acknowledges the project owner has completed a thorough hydrologic analysis, but notes that predicted flow depths and velocities on undeveloped alluvial fans have potential uncertainty. The consequences of flash flood damage or modified sedimentation and erosion rates may be significant. Staff proposes Condition of Certification **SOIL&WATER-20** (Storm Water Damage Monitoring and Response Plan) to reduce potential impacts caused by large storm event in four ways:

[20] As required by Condition of Certification **BIO-8**, Item 22 (see the **BIOLOGICAL RESOURCES** section of this FSA).

[21] A design storm event is a hypothetical storm event, of a given frequency interval and duration, used to estimate how often storms of a given magnitude will occur, based on historical rainfall information. A 100-year, 24-hour design storm event corresponds to a major storm (the probability of occurrence in any given year is one in 100, or a one percent chance) and is used to represent flows with the potential to cause property damage and other impacts.

1. Establish specifications for heliostat installation based on-site specific studies and reports (e.g. Pylon Insertion Depth and Heliostat Stability Report). This ensures that heliostats are designed to withstand storm water scour of a 100-year storm event;

2. Establish an ongoing maintenance plan to ensure all storm water management measures are functioning properly, though periodic inspection before the first seasonal storms and after each storm event throughout the year;

3. Establish and implement a response plan to clean up damage and prevent release of sediment or pollutants after every occurrence of damage from a storm event or other cause; and

4. Develop and implement a process to monitor incidents and propose modifications and/or improvements to address ongoing issues.

Furthermore, as the modified project plans evolve from the conceptual and preliminary phases, any changes affecting hydrology or hydraulics would require an updated comprehensive analysis for purposes of **SOIL&WATER-20**. For example: the use of certain commercial dust suppressants applied onto dirt roads that would increase the total impervious area of the site.

In addition, standing water onsite might have impacts to biological resources given the scarcity of water in the desert. For example, increasing the amount of standing water due to grading and construction has the potential to attract nuisance predators such as ravens to the site. (See the **BIOLOGICAL RESOURCES** section of this FSA for further discussion on the potential impacts of standing water to biological resources and possible mitigation required.)

Tropical storms in this region are mostly unpredictable, and flash floods can result in an enormous amount of water in a very short time. Because people tend to underestimate the dangers of a flash flood, they may attempt to drive or walk through the swift flows to cross it. However, as little as two feet of water is enough to carry away most passenger vehicles, and swiftly moving water six inches deep can cause a person to lose balance.[22] Although the administration building and both power blocks would be located outside of the large desert washes, the paved main access road connecting the power blocks and several other internal unpaved roads would be placed within washes that are expected to flood during heavy storms. To avoid injury or death during a large flood event, the project would require a Construction Flood Safety Plan and Operations Flood Safety Plan to protect personnel at the project site (see **WORKER SAFETY-1** and **-2** in the **WORKER SAFETY AND FIRE PROTECTION** section of this FSA). These Plans would provide safety procedures for onsite workers during a very large flood event (100-year flooding or larger).

[22] NOAA, March 2005, Publication# PA 200467

Diversion Channels

In three areas (Solar Plant 1, Solar Plant 2, and the administration building), permanent diversion channels would be constructed to redirect storm runoff around these structures and prevent damage from flooding that occurs naturally due to existing topography. Although the administration building and solar blocks would be generally located outside these flooded areas (see **Soil & Water Resources Figure 15**), desert washes can be transient and may vary in course from one storm event to another. The diversion channels around the administration building and each solar block would protect these structures from natural ephemeral flooding. Because of the general flow-through design of the solar fields, the diversion channels would not redirect runoff flows in a way that would adversely flood other areas either onsite or offsite. Also, **SOIL&WATER-20** (Storm Water Damage Monitoring and Response Plan) would require maintenance and monitoring of diversion channels during operations for added protection against storm damage.

In addition to the permanent diversion channels, the draft DESCP shows temporary diversion channels that would redirect flows around construction laydown and temporary parking areas during the construction activities of the modified project (Palen 2013g). Their general location outside the existing desert washes (see **Soil & Water Resources Figure 15**) reduces the potential for these temporary diversion features to cause significant onsite flooding. However, staff believes that the possibility of unplanned rerouting of natural drainage patterns could cause significant onsite flooding, particularly during construction activities when soil is most exposed and BMPs may not be fully functional. Also, some construction practices that typically occur at other construction sites can have unintended impacts in a desert setting with ephemeral washes. For example, a temporary dirt access road used to transport heavy equipment across the site can block the path of a large desert wash (braiding of shallow channels that could be a mile wide and very difficult to identify). Because tropical storms in this regional are mostly unpredictable and can have short bursts of very intense rainfall, a seemingly minor rerouting of storm water flows can result in significant flooding damage. Construction period flooding can result in damages to onsite facilities, interference with the construction schedule, and potential exposure of workers to flood conditions. Staff added language to Item C of Condition of Certification **SOIL&WATER-1** to minimize these impacts.

Offsite Area Flooding

Grading and Increase of Impervious Area

Numerous ephemeral drainages flow through the proposed PSEGS site, originating from the southwest and discharging to the northeast toward the Palen Dry Lake bed. Due to the episodic rainfall of the region and transient nature of the drainages, offsite flows can easily exceed these shallow channels and result in flooding. Modeling of the site in its present undeveloped state results in offsite flows to areas downstream as shown in **Soil & Water Resources Figure 15**. Proposed grading and construction of PSEGS would increase the amount of impervious area onsite. This would increase the amount of storm water peak discharge leaving the site and could exacerbate the naturally occurring floods downstream of the site.

The project owner submitted a Developed Conditions Drainage Assessment (Palen 2013a Appendix A) that modeled post-construction onsite peak flows, runoff volumes, maximum velocities, and maximum depths of potential floods. The analysis represented post-construction site conditions by incorporating the following proposed elements: impervious surfaces (heliostats, buildings, asphalt roadways and parking lots), and graded dirt roads. **Soil & Water Resources Table 20** presents the estimated peak flows leaving the site calculated from cross-sections located along the northeast border (as shown in **Soil & Water Resources Figure 15**). Because cross sections are different widths, the table calculates the average flow per foot across each cross section.

Soil & Water Resources Table 20
Estimated Peak Flows Discharging from PSEGS Site

Floodplain Cross Section		100-year Storm Event					
		Pre-construction		Post-construction		Flow Increase	
No.	Approx. Width	Peak Flow	Flow per foot	Peak Flow	Flow per foot	cfs	Flow per foot
CS-1	6200 ft	7053.8 cfs	1.14	7160.3 cfs	1.15	106.4	0.02
CS-2	1400 ft	299.0 cfs	0.21	520.8 cfs	1.74	221.8	0.16
CS-3	6400 ft	5132.1 cfs	0.80	5342.9 cfs	0.83	210.8	0.03
CS-4	9000 ft	1005.5 cfs	0.11	1059.8 cfs	0.12	54.3	0.01

Source: Palen 2013a Appendix A
cfs = cubic feet per second

Because the peak discharge of the 100-year, 24-hour storm event leaving the site during post construction conditions would be very close to discharge of preconstruction conditions, the impacts of offsite downstream would be reduced. Staff acknowledges the project owner has completed a thorough hydrologic analysis, but notes that predicted flow depths and velocities on undeveloped alluvial fans have potential uncertainty. The consequences of flash flood damage or modified sedimentation and erosion rates may be significant. Staff proposes Condition of Certification **SOIL&WATER-20** requiring a Storm Water Damage Monitoring and Response Plan to reduce these potential impacts.

Flood Hazards

Flood hazards include direct flooding due to overtopping of nearby rivers or streams resulting from severe rainstorms, or secondary flooding due to seismic activity creating tsunamis (tidal waves) or seiches (waves in inland bodies of water).

To identify the different types of flood risks for a given location, flood hazard maps were developed by the Federal Emergency Management Agency (FEMA) to identify areas prone to flooding. Comparing the PSEGS site location to these maps, staff found that:

- PSEGS is not located within the 100-year floodplain as defined by FEMA; and
- PSEGS site is located roughly 150 miles inland with no dams in the region. In addition, no levees or inland bodies of water are located in the area.

The proposed project would not impede or significantly redirect flood flows of the FEMA designated 100-year floodplain. In addition, the project would not be affected by dam failure, tsunami, or seiche. PSEGS would not have significant impacts pertaining to these identified flood hazard areas. (For discussion on additional potential hazards that could be caused by soil failure such as mudflow, landslide and liquefaction, see the **GEOLOGY AND PALEONTOLOGY** section of this FSA.)

Mitigation

The Implementation of Conditions of Certification **SOIL&WATER-1**and **SOIL&WATER-20** are anticipated to minimize impacts related to flood hazards and erosion associated with construction and operation of the modified project to below the level of significance. They also provide the basic information to assist the Energy Commission Compliance Project Manager (CPM) to adequately review and assess the appropriateness of the proposed design within the context of the site specific conditions.

SURFACE WATER QUALITY

Project storm water runoff may encounter soil or chemicals deleterious to aquatic and terrestrial plant and wildlife. The project owner proposes to implement BMPs for managing potentially harmful storm water and protecting water quality. Potentially significant water quality impacts could occur during operations if contaminated or hazardous materials used during operations were to contact storm water. Contact runoff[23] could concentrate various pollutants that would then discharge to an offsite water resource. The modified project would alter natural storm water drainages around the common area and around each solar power block. BMPs would be implemented to reduce potentially significant impacts related to concentrated drainage and ensuing soil erosion and sediment transport offsite. The following discusses the potential impacts and the proposed Conditions of Certification below.

Construction

Potential threats to surface water quality related to construction includes potential increases in sediment loads to adjacent streams and washes, and accidental spills of hydrocarbon fuels and greases associated with construction equipment. The SWRCB and CRBRWQCB have determined that standardized storm water and soil erosion BMPs are the most effective, practical means to protect surface waters by preventing or reducing pollution from nonpoint sources. Staff agrees that carefully chosen BMPs for both construction and operation activities would effectively prevent or reduce sediment discharge into water resources. Potential increased sediment loads would be mitigated through development and implementation of a Drainage Erosion and Sedimentation Control Plan (DESCP) which is required as part of Condition of Certification **SOIL&WATER-1.**

[23] Contact runoff refers to storm water in contact with exposed polluted or hazardous materials and/or surfaces can potentially result in contaminated runoff (containing trace oil, chemicals, metals, toxic substances, or other materials).

To prevent contact runoff from discharging offsite during construction activities, the project owner has identified a combination of standard BMPs within the DESCP for pollution control measures to be implemented during construction. The BMPs would limit or reduce potential pollutants at their source before they come into contact with storm water. These BMPs also involve daily activities of the construction site, are under the control of the construction contractor, and are additional “good housekeeping practices,” which involve maintaining a clean and orderly construction site.

Accidental spills of hydrocarbon fuels and greases associated with construction equipment would also be mitigated by the development and implementation of Condition of Certification **HAZ-3** in the **HAZARDOUS MATERIALS MANAGEMENT** section of this FSA, which includes development of a Safety Management Plan for the delivery and handling of liquid and gaseous hazardous materials. In summary, implementation of BMPs as defined in Condition of Certification **SOIL&WATER-1** and Condition of Certification **HAZ-3** would reduce potential water quality impacts to insignificant.

Operation

Potential threats to surface water quality related to operations includes: potential increases in sediment loads to adjacent washes; accidental spills of hydrocarbon fuels and greases associated with operations equipment; and accidental releases from the surface impoundments that include process wastewater.

To prevent the discharge of untreated industrial wastewater or untreated sanitary wastewater from entering nearby water resources, each PSEGS Solar Plant would keep the potentially polluted waste water (contact runoff, general facility drainage, process wastewater, and sanitary waste) completely separated from non-contact storm water runoff. Sanitary waste would remain contained within the septic system. Industrial wastewater would remain within the power block, processed through the thermal evaporator system, then disposed into the evaporation ponds. Hazardous liquids would be handled to prevent spills and accidental release. Non-contact storm water would be directed away from the power blocks and allowed to flow offsite toward the northeast. All BMPs and conditions of certification would strive to prevent any chemical or hazardous pollutants from mixing with the "clean" storm water. With the implementation of these measures, impacts from sanitary or industrial wastewater would be avoided or reduced to less than significant during operation of the proposed project.

A DESCP would be required (see Condition of Certification **SOIL&WATER-1**) prior to onsite operations and would reduce the potential for increased sediment loads to less than significant. Potential spills would be managed through hazardous materials management in Condition of Certification **HAZ-2** (see the **HAZARDOUS MATERIALS MANAGEMENT** section of this FSA), which includes development of a Spill Prevention, Control and Countermeasure (SPCC) Plan. The SPCC Plan sets forth spill prevention methods as well as actions to be taken in the event of an accidental spill or release of hazardous materials.

The operation of the surface impoundments would include one foot of freeboard to minimize the potential for overtopping during a 100-year precipitation event. In addition, the surface impoundments would operate under the waste discharge requirements that include operational and leak detection monitoring as stipulated in **SOIL&WATER-6** and would reduce the potential for impacts to surface water quality to less than significant. Also, **SOIL&WATER-20** would reduce the potential of pollutants caused by storm damage from leaving the site.

Mitigation

No significant impacts are anticipated related to surface water quality. Implementation of Conditions of Certification **SOIL&WATER-1**, **-6,**and **-20** and **HAZ-2** and **-3** is anticipated to reduce impacts to surface water quality to below the level of significance associated with construction and operation of the modified project. Additional requirements for mitigation of potential surface water quality impacts would also be included as a part of the waste discharge requirements for the surface impoundment that would be included in Condition of Certification **SOIL&WATER-6.**

CUMULATIVE IMPACTS

A project may result in a significant adverse cumulative impact where its effects are cumulatively considerable. "Cumulatively considerable" means that the incremental effects of an individual project are significant when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects (California Code Regulations, Title 14, section 15130).

There is the potential for future development in the Chuckwalla Valley area and throughout the southern California desert region. Cumulative impacts can occur if implementation of the proposed modified project could combine with those of other local or regional projects. The locations of existing and reasonably foreseeable developments in the Chuckwalla Valley area are presented in the following sections.

Geographic Extent

As identified in the **EXECUTIVE SUMMARY** of this FSA, a number of projects within the region of the PSEGS have been approved, are under review, or in operation (see **Executive Summary Attachment A – Figure 1**). The geographic extent used as part of the cumulative impact assessment for soil and water resources includes the CVGB. The extent of the basin is described in the “Setting and Existing Conditions” discussion above, and shown in **Soil & Water Resources Figure 2**. Foreseeable projects that may impact the soil and water resources of the area were deemed to include only those projects located in the CVGB. **Soil & Water Resources Table 21** lists the foreseeable projects analyzed by staff for this FSA, which was updated from estimates calculated in the Revised Staff Assessment for PSPP (CEC 2010c §C.9). Changes to the list of foreseeable projects are based on:

- Delays in project schedules and estimates of delayed construction start dates
- Projects removed that are no longer forseeable
- Projects added that have become reasonably foreseeable

- Updated estimates of water use from published environmental documents

Construction and Operation

The construction of the modified project is expected to result in short term adverse impacts related to construction activities. It is expected that some of the cumulative projects listed in **Soil & Water Resources Table 21** which are not yet built may be under construction the same time as the modified project. In addition, it is expected that some of the future and foreseeable projects may be operational at the same time as the modified project. As a result, there may be substantial long term cumulative impacts during construction and operation of these projects related to soils and water resources.

These impacts may include: soil erosion, geomorphology, changes in the groundwater basin balance, groundwater levels, and groundwater quality, and changes in surface water hydrology and surface water quality.

Soil & Water Resources Table 21
Foreseeable Projects and Anticipated Water Use

Project	Label ID	Use	Water Use – Foreseeable Projects (afy)									Ref
			2014	2015	2016	2017	2018	2019	2020	2021	2022–2046	
Eagle Mountain Pumped Storage	6	Construction	—	308	308	8066	8066	8066	8066	—	—	Final EIR
		Operation	—	—	—	—	—	—	—	2688	1763	
Desert Sunlight	3	Construction	—	—	—	—	—	—	—	—	—	Final EIS
		Operation	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	
Desert Harvest Solar	7	Construction	450	450	—	—	—	—	—	—	—	Final EIS
		Operation	33	33	33	33	33	33	33	33	33	
Desert Lily Soleil	8	Construction	20	20	—	—	—	—	—	—	—	Estimates
		Operation	—	—	5	5	5	5	5	5	5	
Chuckwalla Valley Raceway	9	Construction	11			11						Estimates
		Operation	3	3	3	3	3	3	3	3	3	
Chuckwalla Solar I	12	Construction	20	20	10	—	—	—	—	—	—	Estimates
		Operation	—	5	7	10	10	10	10	10	10	
Genesis Solar Energy	16	Construction	—	—	—	—	—	—	—	—	—	Energy Commission Final Decision
		Operation	202	202	202	202	202	202	202	202	202	
Mule Mountain enXco	18	Construction	20	20	—	—	—	—	—	—	—	Estimates
		Operation	—	—	10	10	10	10	10	10	10	
Mule Mountain Solar	26	Construction	20	20	20	—	—	—	—	—	—	Estimates
		Operation	—	—	—	1	1	1	1	1	1	

Project	Label ID	Use	Water Use – Foreseeable Projects (afy) 2014	2015	2016	2017	2018	2019	2020	2021	2022–2046	Ref
Milpitas Wash	31	Construction	10	10	—	—	—	—	—	—	—	Estimates
		Operation	—	—	1	1	1	1	1	1	1	
PSEGS		Construction	400	400	400	—	—	—	—	—	—	
		Operation	—	—	—	201	201	201	201	201	201	
TOTALS (REVISED)			1189	1491	999	8543	8532	8532	8532	3154	2229	
PSPP RSA TOTALS			3352	2963	2955	9905	9905	9905	9905	4527	3602	

Soil Erosion

Construction of the PSEGS would result in temporary changes at the project site which could incrementally increase local soil erosion and storm water runoff during construction. The PSEGS would be expected to contribute only a small amount to the possible short term cumulative impacts related to soil erosion because the project owner would be required to implement the Conditions of Certification defined in this analysis, which are expected to bring short term impacts below the level of significance.

Operation of the PSEGS would result in permanent changes at the project site. These changes could incrementally increase local soil erosion and storm water runoff. The PSEGS would not be expected to cumulatively contribute to these possible long-term operational cumulative impacts because potential project-related soil erosion and increased sedimentation resulting from storm water runoff are expected to be reduced to a level of insignificance through implementation of the Conditions of Certification specified below.

Geomorphology

There is a concern that implementation of all of the foreseeable projects could have a cumulative impact on the regionally significant geomorphic processes that transport sand downwind along the Chuckwalla Valley and to the Colorado River. Blocking or disrupting the sand transport corridors would impact various sites that provide habitat for biological resources such as MFTL. See the **BIOLOGICAL RESOURCES** section for further analysis of potential cumulative impacts related to geomorphic processes.

Groundwater Basin Balance

Staff evaluated whether the amount of groundwater used for both construction and operations would place the groundwater basin into overdraft and deplete the CVGB. For purposes of impact analysis, it is assumed that any withdrawals that exceed the average natural recharge and exceed a significant percentage of the total amount of groundwater in storage would be a significant impact. Appendix G of the CEQA Guidelines refers to “[substantial interference] with groundwater recharge such that there would be a net deficit in aquifer volume". The following discussion presents an analysis of the potential impacts to the groundwater basin balance and the potential for overdraft to occur.

A comparison was made between the average annual basin budget with the anticipated foreseeable projects' cumulative construction and operation water production requirements. **Soil & Water Resources Table 22** presents the anticipated projects water requirements (Years 2014-2046) along with the average annual basin budget. In 2010, the CVGB balance was positive by approximately 2,608 afy whereby inflow (approximately 13,719 afy) to the basin is slightly greater than estimated outflows (approximately 11,111 afy) to the basin.

Soil & Water Resources Table 22
Estimated Change to Chuckwalla Valley Groundwater Basin Budget
(Average Year Conditions)

Years	Annual Basin Budget Balance[1]	Cumulative Project Requirements (afy)[2]	Net Budget Balance (afy)	Cumulative Budget Balance (af)	Cumulative Positive/Deficit as a Percent of Total Recoverable Storage[3]
2014	2,608	1,189	1,419	1,419	0.009 percent
2015	2,608	1,491	1,117	2,536	0.017 percent
2016	2,608	999	1,609	4,145	0.028 percent
2017	2,608	8,543	-5,935	-1,790	-0.012 percent
2018	2,608	8,532	-5,924	-7,714	-0.051 percent
2019	2,608	8,532	-5,924	-13,638	-0.091 percent
2020	2,608	8,532	-5,924	-19,562	-0.130 percent
2021	2,608	3,154	-546	-20,108	-0.134 percent
2022	2,608	2,229	379	-19,729	-0.131 percent
2046	2,608	2,229	379	-10,633	-0.071 percent

Notes:
1 - See Soil & Water Resources Table 10
2 - See Soil & Water Resources Table 21
3 - Based on a total recoverable storage of 15,000,000 af.

It is anticipated that groundwater extraction of foreseeable projects listed in **Soil & Water Resources Table 21** would peak from 2017 to 2020 mainly due to water needed to fill reservoirs of the Eagle Mountain Pumped Storage project. During this period, groundwater extraction would exceed the basin balance by almost 6000 afy and place the basin into overdraft for five years.

The storage capacity of the CVGB is approximately 15,000,000 af. The amount of cumulative groundwater extraction anticipated for construction of the approved project and the future/foreseeable projects would amount to 0.03 percent of the total stored groundwater, which is not considered a significant impact. The projects are expected to reduce the amount of total stored groundwater by 0.07 percent by the end of the modified project's operational life, which is also not considered a significant impact.

Lastly, the I-10 corridor within the CVGB has been targeted for renewable energy projects that have not been identified or quantified as to quantity of water required for development. Given that perennial surface water sources are non-existent and the only available water source is groundwater, it is likely that these as yet unidentified projects could further develop the groundwater resources and exacerbate the cumulative overdraft conditions identified above. However, given the amount of total recoverable groundwater in storage (approximately 15,000,000 af), the impact would be insignificant.

In addition, the cumulative impact analysis conducted by the Genesis Solar Power Project located to the east of the Project suggested that during the course of operations for all foreseeable projects, the subsurface outflow from the CVGB would decline from approximately 400 afy to approximately 71 afy in 2043 (see Genesis 2010 Table 5-2). This could have an indirect significant impact on the Palo Verde Mesa Groundwater Basin by inducing underflow from the Colorado River to the Palo Verde Mesa Groundwater Basin. Staff believes that inducing flow from the Colorado River into the Palo Verde Mesa Groundwater Basin is a significant impact.

Staff believes that the impact related to outflow could be mitigated such that the project would not contribute to cumulative impacts. **SOIL&WATER-14** and **SOIL&WATER-17** would minimize impacts to the Colorado River below a level of significance.

Groundwater Levels

Compared to the approved PSPP project, the modified PSEGS project would reduce water use both during construction (from 5,750 af to 1,130 af) and during operation (from 300 afy to 201 afy). As a result, the overall water use of PSEGS could be roughly half that of PSPP (7,160 af compared to 14,750 af). The project owner has not revised the groundwater modeling for the modified PSEGS project's water use, therefore staff included the following PSPP groundwater analysis as an overly conservative scenario of groundwater level impacts.

The regional model used by AECOM (2010a) for PSPP is a two-dimensional superposition model developed using MODFLOW code (Harbaugh et al. 2000) for the Parker-Palo Verde-Cibola area, which includes the CVGB and the project site. The model employed a simple vertical geometry and a large grid spacing to evaluate the impacts from groundwater pumping on the Colorado River.

The modeling results suggest (see **Soil & Water Resources Table 23**) that during the life of the foreseeable projects listed in the PSPP RSA (CEC 2010c), groundwater level declines between one and five feet or more could extend a distance of approximately 4 miles from the project ROW. The closest existing well is located within 2 miles of the ROW (see **Soil & Water Resources Figures 16** and **17**). Consequently, staff concluded it is appropriate to assume that the potential impact to water levels in existing wells appears to be cumulatively significant, and require monitoring and mitigation in the event that monitoring indicates significant impacts. PSPP was required to implement Condition of Certification **SOIL&WATER-4** to mitigate any such impacts to groundwater users (wells) due to lowering of the groundwater table. Although PSEGS would result in less water use compared to PSPP, CVGB pumping is still expected to contribute to changes in groundwater levels. The project owner agreed to the same PSPP monitoring, mitigation, and reporting requirements of Condition of Certification **SOIL&WATER-4** be applied to the modified project.

Soil & Water Resources Table 23
Results of Predictive Simulations Numerical Groundwater Model for PSPP and Foreseeable Projects(1)

Model Run 15(1)	T, ft2/d	S	Notes:
Zone 1(2)	1,000	0.2	1. Refer to Soil & Water Resources Table 21 (bottm row) for the water use schedule that was used to run this model. 2. Figure DR-S&W-207-3 shows the areal distribution of transmissivities used in the model
Zone 2(2)	6,300	0.2	
Zone 3(2)	26,000	0.2	

Year	Maximum drawdown (feet)				Change in Storage (af)
	Well 1	Well 2	Well 3	Well 4	
2013	46.59	25.93	46.67	25.96	8,420
2043	11.83	7.50	12.15	8.49	146,837

Source: Derived from Galati&Blek 2010i

Groundwater Quality

There is a potential that significant cumulative groundwater quality impacts could occur during construction and operation if contaminated or hazardous materials used during construction and operations were to be released and migrate to the groundwater table.

The modified project would not be expected to cumulatively contribute to the possible long-term operational cumulative impacts, given the distance to the groundwater table (>100 feet bgs) over the CVGB and the proposed implementation of a hazardous material management plan as well as monitoring plans associated with operation of surface impoundments, septic systems and other various operations. With implementation of the Conditions of Certification specified below, cumulative impacts to groundwater quality are anticipated to be below the level of significance.

Surface Water Hydrology

The cumulative impacts of the foreseeable projects on the local surface water hydrology are directly related to proposed onsite grading and the construction and operation of a network of engineered collector/conveyance channels designed for the purpose of protecting the various projects from flooding. The foreseeable projects would change both the extent and physical characteristics of the existing floodplain within each project site as well as downstream of each project site. Sediment transport and depositional characteristics of each of the project sites would also change.

The PSEGS would not be expected to cumulatively contribute to the possible short-term cumulative impacts related to surface water hydrology because the implementation of the Conditions of Certification below would reduce the cumulative impacts below the level of significance.

Surface Water Quality

It is expected that storm water generated on the various project sites may encounter soil or chemicals deleterious to aquatic and terrestrial plant and wildlife. It is expected that all of the projects would be required to implement BMPs for managing potentially harmful storm water and protect water quality. Potentially significant water quality impacts could occur during operations if contaminated or hazardous materials used during operations were to contact storm water and drain offsite. It is expected that all of the projects would have requirements similar to Hazardous Material Management Plans to reduce this potential impact to insignificant.

All of the foreseeable projects would alter natural storm water drainages and the expected use of BMPs would reduce potentially significant impacts related to concentrated drainage and ensuing soil erosion and sediment transport offsite. The PSEGS would not be expected to cumulatively contribute to the possible short-term cumulative impacts related to surface water quality with implementation of the conditions of certification described below.

NON-OPERATION AND FACILITY CLOSURE

PSEGS is designed for an operating life of 25 to 30 years. Operations can cease as a result from two types circumstances: (1) the facility is closed suddenly and/or unexpectedly because of unplanned events, such as a natural disaster or economic forces or (2) the facility is closed in a planned, orderly manner, such as at the end of its useful economic or mechanical life or due to gradual obsolescence. As described in the **GENERAL CONDITONS** section of the FSA, “non-operation” is time-limited (planned or unplanned) that can encompass part or all of the facility, and “closure” is a facility shutdown with no intent to restart operation.

In the event of a temporary closure, PSEGS would be required to comply with all applicable conditions of certification, including a Site Contingency Plan (see Condition of Certification **COM-12**). Depending on the expected duration of the shutdown, appropriate measures would be taken such as removing chemicals from storage tanks or equipment.

Permanent closure requires compliance with a Facility Closure Plan (see Condition of Certification **COM-15**), which would be submitted to the Energy Commission for approval three years prior to actual closure. Future circumstances that could affect permanent closure are largely unknown at this time; however compliance with all applicable LORS, and any local and/or regional plans would be required. The plan must address all concerns in regard to potential erosion and impacts on water quality, as described in Condition of Certification **SOIL&WATER-13**. Refer to the **GENERAL CONDITIONS** section of this FSA for further discussion on temporary and permanent facility closure.

COMPLIANCE WITH LORS AND STATE POLICIES

FEDERAL

Clean Water Act (CWA) of 1977 (Including 1987 Amendments) Sections 401, 402 and 404

The primary objective of the CWA is to restore and maintain the chemical, physical, and biological integrity of the Nation's surface waters. Pollutants regulated under the CWA include "priority" pollutants, including various toxic pollutants; "conventional" pollutants, such as biochemical oxygen demand, total suspended solids, oil and grease, and pH; and "non-conventional" pollutants, including any pollutant not identified as either conventional or priority.

Clean Water Act Section 401

Section 401 of the CWA requires certification from the Colorado River Basin Regional Water Quality Control Board that the PSEGS project is in compliance with established water quality standards. Projects that have the potential to discharge pollutants are required to comply with established water quality objectives. These requirements include the implementation of BMPs during site grading activities and other activities associated with construction of the facility.

Section 401 provides the SWRCB and the CRBRWQCB with the regulatory authority to waive, certify, or deny any proposed federally permitted activity, which could result in a discharge to waters of the State. To waive or certify an activity, these agencies must find that the proposed discharge will comply with state water quality standards. According to the CWA, water quality standards include beneficial uses, water quality objectives/criteria, and compliance with the United States Environmental Protection Agency's (USEPA) anti-degradation policy.

No license or permit may be issued by a federal agency until certification required by Section 401 has been granted. Under the CWA, United States Army Corp of Engineers (USACE) Section 404 permits are subject to CRBRWQCB Section 401 Water Quality Certification (Title 23 CCR Sections 3830 through 3869). As such, a determination of "federal waters" under Section 404 is required by the USACE.

In August 2010, the USACE determined that "federal waters", also known as waters of the U.S., are not present on the approved PSPP project site. This jurisdictional delineation, which is valid for five years, is valid for the PSEGS because the project footprint is located within the area verified by USACE for PSPP. (For further discussion on waters of the U.S., see the **BIOLOGICAL RESOURCES** section of this FSA.)

The CRBRWQCB has authority under the Porter-Cologne Water Quality Control Act of 1967, Water Code Section 13000 et. seq. (Porter-Cologne) to regulate discharge of waste to waters of the state. The definition of the waters of the state is broader than that for waters of the U.S. in that all waters are considered to be a water of the state regardless of circumstances or condition. The term "discharge of waste" is also broadly defined in Porter-Cologne, such that discharges of waste include fill, any material resulting from human activity, or any other "discharge" that may directly or indirectly impact waters of the state relative to implementation of Section 401 of the CWA.

Porter-Cologne authorizes the CRBRWQCB to regulate discharges of waste and fill material to waters of the state, including "isolated" waters and wetlands, through the issuance of waste discharge requirements (WDRs). Under Porter-Cologne all parties proposing to discharge waste that could affect the quality of waters of the state, other than into a community sewer system, shall file with the appropriate CRBRWQCB a Report of Waste Discharge (ROWD) containing such information and data as may be required by the CRBRWQCB. Condition of Certification **SOIL&WATER-6** includes updated Waste Discharge Requirements for operation of the surface impoundments which reflects the project changes of the modified project.

Clean Water Act Section 402

Direct and indirect discharges and storm water discharges into waters of the U.S. must be made pursuant to a National Pollutant Discharge Elimination System (NPDES) permit (CWA Section 402). NPDES permits contain industry-specific, technology-based limits and may also include additional water quality-based limits, and establish pollutant-monitoring requirements. A NPDES permit may also include discharge limits based on Federal or State water quality criteria or standards.

In 1987, the CWA was amended to include a program to address storm water discharges for industrial and construction activities. Storm water discharge is covered by an NPDES permit, either as an individual or general permit. The CRBRWQCB administers the NPDES permit program under the CWA in the project area. The modified project would obtain to a Construction General Permit to meet the Section 402 NPDES requirements.

Clean Water Act Section 404

Activities resulting in the dredging or filling of jurisdictional waters of the U.S. require authorization under a Section 404 permit issued by the USACE. The USACE may grant authorization under either an individual permit or a nationwide permit (NWP) to address operations that may affect the ephemeral washes on the project site. Section 404 permits are also subject to CWA Section 401 water quality certification through the CRBRWQCB. As explained above under the Clean Water Act Section 401, the USACE made a determination that there were no waters of the U.S. present on the PSPP project site. This determination, which is valid for five years, is valid for the PSEGS because the project footprint is located within the area verified by USACE for PSPP.

STATE

The administering agencies for the State LORS are the Energy Commission, the SWRCB, and the CRBRWQCB.

State of California Constitution Article X, Section 2

Article X, Section 2 prohibits the waste or unreasonable use of water, regulates the method of use and method of diversion of water and requires all water users to conserve and reuse available water supplies to the maximum extent possible. The modified project's use of dry cooling would significantly reduce potential water use and prohibit waste and unreasonable use of groundwater.

California Storm Water Permitting Program

California Construction Storm Water Program. Construction activities that disturb one acre or more are required to be covered under SWRCB's NPDES General Permit for Storm Water Discharges Associated with Construction and Land Disturbance Activities, (Order No. 2009-0009-DWQ NPDES No. CAS 000002).

Activities subject to permitting include clearing, grading, stockpiling, and excavation. The General Construction Permit requires the development and implementation of a SWPPP that specifies BMPs that will reduce or prevent construction pollutants from leaving the site in storm water runoff and will also minimize erosion associated with the construction project. The SWPPP must contain site map(s) that show the construction site perimeter; existing and proposed structures and roadways; storm water collection and discharge points, general topography both before and after construction; and drainage patterns across the site.

The modified project would prepare a SWPPP as a requirement of the Construction General Permit. The project would also prepare a DESCP to meet Energy Commission requirements. The content of a DESCP is very similar to a SWPPP, but the DESCP covers both construction and operation in one document whereas separate SWPPPs are prepared for construction and operation.

California Industrial Storm Water Program. Industrial activities with the potential to impact storm water discharges are required to obtain a NPDES permit for those discharges. In California, SWRCB's NPDES General Permit for Discharges of Storm Water Associated with Industrial Activities (Order 97-03-DWQ,NPDES No. CAS 000001) may be issued to regulate discharges associated with ten broad categories of industrial activities, including electrical power generating facilities. The General Industrial Permit requires the implementation of management measures that will protect water quality. In addition, the discharger must develop and implement a SWPPP and a monitoring plan. Through the SWPPP, sources of pollutants are to be identified and the means to manage the sources to reduce storm water pollution described. The monitoring plan requires sampling of storm water discharges during the wet season and visual inspections during the dry season.

A report documenting the status of the program and monitoring results must be submitted to the CRBRWQCB annually by July 1. The General Industrial Permit, which requires the development and implementation of a SWPPP, is required for the project's operations phase. At the present time, the facility does not have a Standard Industrial Classification (SIC) code that would require compliance with the California's Industrial Storm Water Program.

California Water Code

Section 461. Stipulates that the primary interest of the people of the State of California is the conservation of all available water resources and requires the maximum reuse of reclaimed water as an offset to using potable resources. The modified project does not plan to use reclaimed water. However, dry cooling has been proposed and the project would minimize water usage and recycle water where appropriate.

Section 1200 "Water Rights." All water in California falls within one of three categories: surface water, percolating groundwater, or "subterranean streams that flow through known and definite channels." California's water rights law is a hybrid system in that the use of certain types of water requires a permit from the SWRCB, while other types of uses are governed by common law. Only surface water and subterranean stream water are within the permitting jurisdiction of the SWRCB. Since 1914, appropriation of those waters has required a SWRCB permit, and is subject to various permit conditions.

Interstate water courses (such as the Colorado River) have additional contract requirements that are the equivalent of permits. For example, use of Colorado River water requires a contract with the Secretary of the Interior (through the USBR).

Pre-1914 appropriative and riparian rights do not require a permit. Riparian rights are correlative rights of equal priority among all riparian right holders. The place of use of such water is limited to riparian property (property that is contiguous to a watercourse) that has not had its riparian rights severed. Riparian rights are senior to any appropriative rights, and may not be separated from the riparian parcel and used elsewhere.

Groundwater can be (a) the underground portion of a surface water course (subject to the same rights/permits as the affiliated water course); (b) a wholly underground water course which is treated like a water course; or (c) percolating groundwater. Water subject to appropriation is defined in Water Code Section 1201, as "all water flowing in any natural channel," except water that is or may be needed for use upon riparian land or water that is otherwise appropriated. The SWRCB's authority over groundwater extends only to the underground portion of a surface stream and to the water in un-appropriated subterranean streams that flow through known or defined channels, except as it is or may reasonably be needed for useful and beneficial purposes upon lands riparian to the channel through which it is flowing. The traditional test to establish SWRCB jurisdiction over groundwater was whether there is sufficient evidence of bed and banks and water flowing along a line of a surface stream (Sax 2002).

Recent case law has redefined the boundaries of an underground stream to mean the bedrock bottom and side boundaries that are materially less permeable than the alluvium holding groundwater found within an alluvial valley across which flows a surface stream. If there is insufficient evidence to support a finding that the groundwater fits this definition, the SWRCB has no jurisdiction and no permit is required to appropriate the water.

Percolating groundwater has no SWRCB permit requirement and supports two kinds of rights: (a) overlying rights, a correlative right of equal priority shared by all who own overlying property and use groundwater on the overlying property; and (b) groundwater appropriative rights for use of the overlying property or on overlying property for which the water rights have been severed. The right to use groundwater on property that is not as an overlying right is junior to all overlying rights, but has priority among other appropriators on a first in time use basis. Overlying users cannot take unlimited quantities of water without regard to the needs of other users. Surplus groundwater may be appropriated for use on non-overlying lands, provided such use will not create an overdraft condition.

Riparian water rights, groundwater rights and appropriative rights are all subject to modification to some degree if there is a basin-wide adjudication, which proceeding can be commenced before the SWRCB as an adjudicative body (not a permitting role) or before a Court. In adjudication, unused riparian rights and unused overlying rights can be subordinated to appropriative rights.

Water rights in California can be held by any legal entity. Thus the owner can be an individual, related individuals, non-related individuals, trusts, corporations and/or government agencies. Water rights are considered real property. Riparian rights and overlying groundwater rights are lost if severed from the land, while appropriative rights can be preserved and transferred to other properties. Transfers of water for use elsewhere are permissible without transfers of water rights, subject to many other conditions and approvals, including a "non-injury" to other water rights holders test, assessment of environmental impacts, and for post 1914 appropriative rights, SWRCB approval of any change in place of use, diversion point and/or purpose of use.

The California Water Code allows any local public agency that provides water service whose service area includes a groundwater basin or portion thereof that is not subject to groundwater management pursuant to a judgment or other order, to adopt and implement a groundwater management plan (California Water Code Sections 10750 et. seq.) Groundwater Management Plans often require reports of pumping and some restrictions on usage. There is no Groundwater Management Plan for the Chuckwalla Valley Ground Water Basin (CVGB) listed on the DWR website on Groundwater Management Plans.

The California Legislature has found that by reason of light rainfall, concentrated population, the conversion of land from agricultural to urban uses and heavy dependence on groundwater, the counties of Riverside, Ventura, San Bernardino and Los Angeles have certain reporting requirements for groundwater pumping. Any person or entity that pumps in excess of 25 af of water in any one year must file a "Notice of Extraction and Diversion of Water" with the SWRCB. (See Water Code Sections 4999 et. seq.) The project would be subject to this requirement since it is located in Riverside County and would require more than 25 afy. Condition of Certification **SOIL&WATER-15** would ensure the project owner complies with Section 1200 “Water Rights” requirement.

The project is in Riverside County and the Chuckwalla Valley has no perennial streams. The project site is located on BLM land that overlies the CVGB, which has a surface area of about 822,000 acres. A method was developed by the USGS, in cooperation with the USBR, to identify groundwater wells outside the flood plain of the lower Colorado River that yield water that will be replaced by water from the river. Wells placed into the groundwater beneath the project site that extract groundwater may be considered as drawing water from the Colorado River and require an entitlement to extract groundwater. The specific method to determine whether wells draw water from the Colorado River (referred to as the accounting surface) has not been promulgated by the USBR. Entitlements to extract and use the groundwater beneath the site are granted by the USBR through their designated representative in California, the Colorado River Board of California. After eligibility for groundwater extraction has been approved by the USBR, a contract must be established with the City of Needles to acquire the water. In California, the City of Needles monitors the use of water extracted from the river aquifer and is the designated contracting agent for the USBR.

Porter-Cologne Water Quality Control Act

The Porter-Cologne Water Quality Control Act of 1967, Water Code Section 13000 et. seq. requires the SWRCB and the nine RWQCBs to adopt water quality standards to protect State waters. Those standards include the identification of beneficial uses, narrative and numerical water quality criteria, and implementation procedures. Water quality standards for the proposed modified project area are contained in the Water Quality Control Plan for the Colorado River Basin Region (Basin Plan), which was adopted in 1994 and was amended in 2006. This plan sets numeric and/or narrative water quality criteria controlling the discharge of wastes to the State's waters and land.

Title 23 CCR Division 3, Chapters 9 and 15 regards the establishment of requirements for waste discharge and reporting along with requirements specifying conditions for the protection of water quality. Under Chapter 9, the CRBRWQCB is required to issue a ROWD for discharges of waste to land pursuant to the Water Code. The report requires the submittal of information regarding the proposed discharge and waste management unit design and monitoring program. WDRs issued by the CRBRWQCB provide construction and monitoring requirements for the proposed discharge. Chapter 15 outlines siting, construction, and monitoring requirements for waste discharges to land for landfills, surface impoundments, land treatment units, and waste piles. The Chapter provides closure and post-closure maintenance and monitoring requirements for Class II designated waste facilities that are applicable to this project.

Section 13050. Surface waters (including ephemeral washes) that are affected by the Project are waters of the State and are subject to State requirements and the CRBRWQCB's authority to issue WDRs for construction and industrial storm water activities.

Section 13260 et seq. This section requires filing with CRBRWQCB a ROWD for activities in which waste is discharged that could affect the water quality of the State. The report shall describe the physical and chemical characteristics of the waste and include the results of all tests required by regulations adopted by the board, any test adopted by the California Department of Toxic Substances Control (DTSC) pursuant to Section 25141 of the Health and Safety Code for extractable, persistent, and bioaccumulative toxic substances in a waste or other material, and any other tests that the SWRCB or CRBRWQCB may require. In accordance with Water Code Section 13263, the [State Water Board / Regional Water Board] hereby "prescribes" the waste discharge requirements as adopted by the Energy Commission for the Project. Because the Energy Commission has exclusive permitting authority over the project under Public Resources Code section 25500, the State Board "prescribes" the waste discharge requirements for the sole purpose of authorizing the Regional Board to enforce them and undertake associated monitoring, inspection, and annual fee collection as if the waste discharge requirements were adopted by the Board.

Section 13173 (Designated Wastes). Traditionally the State Water Resources Control Board along with the applicable California Regional Water Quality Control Board (hereafter "Water Boards") develop, adopt, and enforce waste discharge requirements for facilities that discharge waste. When such a facility is an electrical generating facility under the Energy Commission's jurisdiction, however, the Energy Commission permit takes the place of the Water Boards' permit and the WDRs are folded into the Energy Commission's conditions of certification. Nevertheless, Energy Commission staff believe it is important to have the Water Boards retain the authority to enforce these requirements, along with the authority to monitor, inspect, and collect an annual fee, because they are state and local agencies with expertise in this subject area. Therefore, staff recommends that the Energy Commission delegate this authority the Water Boards pursuant to title 20, California Code of Regulations, section 1770(b), and has provided language to that effect in Condition of Certification **SOIL&WATER-6.** The Water Boards may also take action in tandem with delegation by the Energy Commission to prescribe the requirements adopted by the Energy Commission to ensure that their agents are fully informed and authorized to enforce the WDRs in the Commission's decision.

This section defines designated waste as either: a) hazardous waste that has been granted a variance from hazardous waste management requirements pursuant to Section 14142 of the Health and Safety Code, or, b) Non-hazardous waste that consists of, or contains, pollutants that, under ambient environmental conditions at a waste management unit, could be released in concentrations exceeding applicable water quality objectives or could reasonably be expected to affect beneficial uses of the waters of the state contained in the appropriate state water quality control plan.

Section 13240 et seq. (Water Control Plan). The Basin Plan for the Colorado River Basin Region establishes water quality objectives, including narrative and numerical standards that protect the beneficial uses of surface and ground waters in the region. The Basin Plan describes implementation plans and other control measures designed to ensure compliance with statewide plans and policies and provide comprehensive water quality planning. The following chapters are applicable to determining appropriate control measures and cleanup levels to protect beneficial uses and to meet the water quality objectives: Chapter 2, Beneficial Uses; Chapter 3, Water Quality Objectives; and the sections of Chapter 4, Implementation, entitled “Point Source Controls” and “Non-Point Source Controls.”

- Beneficial Uses: Chapter 2 of the Basin Plan describes beneficial uses of surface and ground waters. Beneficial uses of surface waters for the Chuckwalla Valley are not listed in the Basin Plan. The beneficial uses of ground waters of the Chuckwalla Valley Hydrologic Unit (717.00) are: municipal and domestic supply, industrial service supply, and agricultural supply.
- Water Quality Objectives: Region-wide numeric and narrative objectives for general surface waters are described in Chapter 3 of the Basin Plan under the “General Surface Water Quality Objectives” and region-wide objectives for groundwater under the “Ground Water Objectives.”
- Waste Discharge Requirements: Chapter 4 of the Basin Plan describes “Point-Source Controls” for wastewater reclamation and reuse, storm water, and septic systems. The discussion of “Non-Point Source Controls” in the Basin Plan describes the authority given to the CRBRWQCB to certify projects for CWA Section 401 permits.

Section 13243. Under this section, the Regional Water Boards are granted authority to specify conditions or areas where the discharge of waste will not be permitted. The discharge of designated waste can only be discharged to an appropriately designed waste management unit.

Section 13263 (Waste Discharge Requirements). The CRBRWQCB regulates the discharges of fill material, including structural material and/or earthen wastes into wetlands and other waters of the State through WDRs. The CRBRWQCB considers WDRs necessary to adequately address potential and planned impacts to waters of the State and to require mitigation for these impacts to comply with the water quality standards specified in the Basin Plan. Condition of Certification **SOIL&WATER-6** would ensure the applicant complies with this requirement.

Section 13271 (Discharge Notification). CWC section 13271 requires any person who, without regard to intent or negligence, causes or permits any hazardous substance or sewage to be discharged in or on any waters of the state, or discharge or deposited where it is, or probably will be, discharged in or on any waters of the state to notify the Office of Emergency Services (OES) of the discharge as specified in that section. The OES then immediately notifies the appropriate regional board and the local health officer and administrator of environmental health of the discharge.

Section 13550. “The Legislature hereby finds and declares that the use of potable domestic water for non-potable uses, including, but not limited to, cemeteries, golf courses, parks, highway, landscaped areas, and industrial and irrigation uses, is a waste or an unreasonable use of the water within the meaning of Section 2 of Article X of the California Constitution if recycled water is available which meets all of the following conditions, as determined by the State Board.” This section requires the use of recycled water for industrial purposes subject to recycled water being available and upon a number of criteria including: provisions that the quality and quantity of the recycled water are suitable for the use, the cost is reasonable, the use is not detrimental to public health, and the use will not impact downstream users or biological resources.

The project would not be subject to this policy because it has no nearby sources of municipal recycled water. However, the project proposes to supplement its groundwater supply with recycled water produced from onsite wastewater treatment using a thermal evaporator system.

Section 13551. This section prohibits a person or public agency, including a State agency, city, county, city and county, district, or any other political subdivision of the State, from using water from any source of quality suitable for potable domestic use for non-potable uses if suitable recycled water is available as provided in Section 13550. The project would not be subject to this policy because it has no nearby sources of municipal recycled water.

Section 13552. This section specifically identifies the use of potable domestic water for cooling towers as an unreasonable use of water within the meaning of Article X Section 2 of the California Constitution, if suitable recycled water is available and the water meets the requirements set forth in Section 13550. The project would not be subject to this policy because it has no nearby sources of municipal recycled water.

Section 13571. Requires that anyone who constructs, alters, or destroys a water well, cathodic protection well, groundwater monitoring well, or geothermal heat exchange well, file a well completion report with the California Department of Water Resources (CDWR). With no nearby sources of water available and no existing water supply wells on the project site, a water supply well and groundwater monitoring wells would be constructed at the site. These wells are required as part of the evaluation of water resources for the project. A well completion report would be filed with DWR for each well that is constructed. Measures would be undertaken to protect the groundwater wells (whether for water supply or for monitoring purposes) on the project site through the use of physical barriers (e.g., fencing, traffic bollards, etc.). In the event that an existing well is altered or destroyed, a well completion report would be filed with the DWR.

California Code of Regulations

Title 22, Article 3, Sections 64400.80 through 64445. This section requires monitoring for potable water wells, defined as non-transient, non-community water systems (serving 25 people or more for more than six months). The project would be subject to this requirement, because it would employ approximately 100 workers during operations. Regulated wells must be sampled for bacteriological quality once a month and the results submitted to the California Department of Public Health (CDPH). The wells must also be monitored for inorganic chemicals once and organic chemicals quarterly during the year designated by the CDPH. CDPH will designate the year based on historical monitoring frequency and laboratory capacity. Condition of Certification **SOIL&WATER-15** would ensure the project owner complies with requirements of non-transient, non-community water systems.

Title 23, Division 3, Chapter 9. This chapter requires the CRBRWQCB to issue a report of waste discharge for discharges of waste to land pursuant to the Water Code. The report requires submittal of information regarding the proposed discharge and waste management unit design and monitoring program. WDRs issued by the CRBRWQCB provide construction and monitoring requirements for the proposed discharge. The SWRCB has adopted general waste discharge requirements (97-10-DWQ) for discharge to land by small domestic wastewater treatment systems. Condition of Certification **SOIL&WATER-6** would meet the requirements of a report of waste discharge for discharges of waste to land and obtain waste discharge requirements.

With respect to onsite wastewater discharge, the CRBRWQCB adopted in 1984 “Guidelines for Sewage Disposal from Land Developments” that provides exclusion of on-site sanitary wastewater flows less than 5,000 gallons per day. Based on the estimate of approximately 3,010 gallons per day of sanitary wastewater spread out among three or more locations, the exclusion applies. Condition of Certification **SOIL&WATER-7** would ensure the sanitary wastewater disposal systems meet County of Riverside requirements.

Title 23, Division 3, Chapter 15. Regulates all discharges of hazardous waste to land that may affect water quality. Chapter 15 broadly defines a waste management area as “an area of land, or a portion of a waste management facility, at which waste is discharged.” Therefore, unless exempted, all discharges of hazardous waste to land that may affect water quality are regulated by Chapter 15. This chapter outlines siting, construction and monitoring requirements for waste discharges to land for landfills, surface impoundments, land treatment units, and waste piles. The chapter provides closure and post-closure maintenance and monitoring requirements for surface impoundments that are applicable to the project.

State Water Resources Control Board Policies

Anti-Degradation Policy (Resolution No. 68-16). Requires the CRBRWQCB, in regulating the discharge of waste, to: (a) maintain existing high quality waters of the State until it is demonstrated that any change in quality will be consistent with maximum benefit to the people of the State, will not unreasonably affect present and anticipated beneficial uses, and will not result in water quality less than that described in State or Regional Water Boards policies; and (b) require that any activity which produces or may produce a waste or increased volume or concentration of waste and which discharges or proposes to discharge to existing high quality waters, must meet waste discharge requirements which will result in the best practicable treatment or control of the discharge necessary to assure that: a) a pollution or nuisance will not occur and b) the highest water quality consistent with maximum benefit to the people of the State will be maintained. Conditions of Certification **SOIL&WATER-1**, **-6**, **-7**, **-18**, and **-20** would protect the quality of groundwater and surface water.

Power Plant Cooling Water Policy (Resolution No. 75-58). On June 19, 1975, the SWRCB adopted the Water Quality Control Policy on the Use and Disposal of Inland Waters used for Power Plant Cooling. The purpose of the policy is to provide consistent statewide water quality principles and guidance for adoption of discharge requirements, and implementation actions for power plants that depend on inland waters for cooling. State policy encourages the use of wastewater for power plant cooling and sets the following order of preference for cooling purposes: 1) wastewater being discharged to the ocean; 2) ocean water; 3) brackish water or irrigation return flows; 4) inland waste waters of low total dissolved solids (TDS); and 5) other inland waters. The criteria for the selection of water delivery options involves economic feasibility; engineering constraints, such as cooling water composition and temperature; and environmental considerations such as impacts on riparian habitat, groundwater levels, and surface and subsurface water quality.

The project would use dry-cooling methods and does not propose to use groundwater for power plant cooling. The project would use groundwater for mirror washing, auxiliary equipment cooling, process makeup, dust suppression, and potable supply.

Water Reclamation Policy (Resolution No. 77-01). Under this policy, the SWRCB and CRBRWQCBs shall encourage reclamation and reuse of water in water-short areas. Reclaimed water will replace or supplement the use of fresh water or better quality water. The project would not be subject to this policy because it has no nearby sources of municipal recycled water. However, the project proposes to supplement its groundwater supply with recycled water produced from onsite wastewater treatment using a thermal evaporator system.

Policies and Procedures for Investigations and Clean-up and Abatement of Discharges Under CWC Section 13304 (Resolution No. 92-49). This policy establishes requirements for investigation and cleanup and abatement of discharges. Under this policy, clean-up and abatement actions are to implement applicable provisions of Title 23 CCR Chapter 15, to the extent feasible. The policy also requires the application of Section 2550.4 of Chapter 15 when approving any alternative cleanup levels less stringent than background. It requires remediation of the groundwater to the lowest concentration levels of constituents technically and economically feasible, which must at least protect the beneficial uses of groundwater, but need not be more stringent than is necessary to achieve background levels of the constituents in groundwater. The project is not likely to be subject to this requirement because a Phase 1 Environmental Site Assessment conducted in 2009 concluded that no recognized environmental conditions (such as contaminated soil) were associated with the project site.

Water Quality Control Policy for Recycled Water (Resolution No. 209-0011). The Recycled Water Policy is intended to promote sustainable local water supplies. The purpose of this Policy is to increase the use of recycled water from municipal wastewater sources that meets the definition in CWC Section 13050(n), in a manner that implements state and Federal water quality laws. The project would not be subject to this policy because it has no nearby sources of municipal recycled water. However, the project proposes to supplement its groundwater supply with recycled water produced from onsite wastewater treatment using a thermal evaporator system.

Public Resources Code

Section 25300 et seq. In the 2003 "Integrated Energy Policy Report", consistent with SWRCB Policy No. 75-58 and the Warren-Alquist Act, the Energy Commission adopted a policy stating they would approve the use of "fresh inland" water for cooling purposes by power plants only where alternative water supply sources and alternative cooling technologies are shown to be "environmentally undesirable" or "economically unsound." The project does not propose to use groundwater for power plant cooling. The project would use dry-cooling methods and does not propose to use groundwater for power plant cooling. The Project would use groundwater for mirror washing, auxiliary equipment cooling, process makeup, dust suppression, and potable supply.

Project Compliance with State Water Policy

The Energy Commission has five authoritative sources for statements of policy relating to water use in California applicable to power plants. They are the California Constitution, the Warren-Alquist Act, the Commission's restatement of the state's water policy in the 2003 Integrated Energy Policy Report ("IEPR"), the State Water Resources Control Board ("SWRCB" or "Board") resolutions (in particular Resolutions 75-58 and 88-63), and a letter from the Board to the Energy Commission interpreting Resolutions 75-58 and 88-63 [collectively referred to as the state's water policies - see Genesis Solar Project (09-AFC-08)].

California Constitution

California's interest in conserving water is so important to our thirsty state that in 1928, the common law doctrine of reasonable use became part of the state Constitution. Article X, section 2 calls for water to be put to beneficial use, and that "waste or unreasonable use or unreasonable *method of use* be prevented." (Cal. Const., art. X, § 2; emphasis added.) The article also limits water rights to reasonable use, including reasonable methods of use. (*Ibid*.) Even earlier in the 20th Century, a state Supreme Court case firmly established that groundwater is subject to reasonable use. (*Katz v. Walkinshaw* (1903) 141 Cal. 116.) Thus, as modern technology has made dry-cooling of power plants feasible, the Commission may regard wet-cooling as an unreasonable method of use of surface or groundwater, and even as a wasteful use of the state's most precious resource.

Warren-Alquist Act

Section 25008 of the Commission's enabling statutes echoes the Constitutional concern, by promoting "all feasible means" of water conservation and "all feasible uses" of alternative water supply sources. (Pub. Resources Code § 25008.)

Integrated Energy Policy Report

In the 2003 Integrated Energy Policy Report ("IEPR" or "Report"), the Commission reiterated certain principles from SWRCB's Resolution 75-58, discussed below, and clarified how they would be used to discourage use of fresh water for cooling power plants under the Commission's jurisdiction. The Report states that the Commission will approve the use of fresh water for cooling purposes only where alternative water supply sources or alternative cooling technologies are shown to be "'environmentally undesirable'" or "'economically unsound.'" (IEPR (2003), p. 41.) In the Report, the

Commission interpreted “environmentally undesirable” as equivalent to a “significant adverse environmental impact” under CEQA, and “economically unsound” as meaning “economically or otherwise infeasible,” also under CEQA. (IEPR, p. 41.) CEQA and the Commission’s siting regulations define feasible as “capable of being accomplished in a successful manner within a reasonable amount of time,” taking into account economic and other factors. (Cal. Code Regs., tit. 14, §15364; tit. 20, §1702, subd. (f).) At the time of publication in 2003, dry cooling was already feasible for three projects—two in operation and one just permitted. (IEPR, p. 39.)

The Report also notes California’s exploding population, estimated to reach more than 47 million by 2020, a population that will continue to use “increasing quantities of fresh water at rates that cannot be sustained.” (IEPR, p. 39.)

State Water Resources Control Board Resolutions

The SWRCB not only considers quantity of water in its resolutions, but also the quality of water. In 1975, the Board determined that water with total dissolved solids (“TDS”) of 1,000 mg/l or less should be considered fresh water. (Resolution 75-58.) One express purpose of that Resolution was to “keep the consumptive use of fresh water for powerplant cooling to that *minimally essential*” for the welfare of the state. (*Ibid*; emphasis added.) In 1988, the Board determined that water with TDS of 3,000 mg/l or less should be protected for and considered as water for municipal or domestic use. (Resolution 88-63.)

Discussion

The project proposes a dry-cooled facility that would use 201 afy of groundwater from onsite wells. Groundwater is the only available source of water. Pumped water would be used for various purposes, including domestic use by workers, dust suppression, and mirror washing. Water is the only feasible means of cleaning the mirrors, which must be clean to maintain efficiency of output by solar plants. Process makeup water would be recycled to supplement groundwater supplies. Overall use of the water is efficient for this technology, requiring about 40 afy per 100 MW of capacity.

Quality of the groundwater varies significantly throughout the Chuckwalla Valley groundwater basin, and varies with depth. In general, groundwater below the project site would not meet water quality standards for domestic supply without treatment, because of high concentrations of fluoride and sulfate. Staff concludes that the modified PSEGS project complies with the state’s water policies to feasibly use the least amount of the lowest-quality water available.

REGIONAL AND LOCAL

Riverside County Ordinance Codes, Title 13, Chapter 13.20 – Water Wells

Section 13-.20.160 Well Logs. This section requires that a report of well excavation for all wells dug or bored for which a permit has been issued be submitted to the Riverside County Department of Environmental Health within 60 days after completion of drilling.

Section 13.20.190 Water Quality Standards. This section requires that water from wells that provide water for beneficial use shall be tested radiologically, bacteriologically and chemically as indicated by the Riverside County Department of Environmental Health. Laboratory testing must be performed by a State of California-certified laboratory. The results of the testing shall be provided to the County Department of Environmental Health within 90 days of pump installation.

Section 13.20.220 Well Abandonment. This section provides that all abandoned wells shall be destroyed in such a way that they will not produce water or act as a channel for the interchange of water, and will not present a hazard to the safety and well-being of people or animals. Destruction of any well shall follow requirements stipulated in DWR Bulletin No.74-81, provided that at a minimum the top 50 feet shall be sealed with concrete, or other approved sealing material. Applications for well destruction must be submitted 90 days following abandonment of the well and in accordance with Section 14.08.170.

Section 13.20.240 Declaration of Proposed Reuse. Requires that any well that has not been used for a period of one year shall be properly destroyed unless the owner has filled a “Notice of Intent” with the health officer declaring the well out of service and declaring his intention to use the well again.

Condition of Certification **SOIL&WATER-15** would ensure the project owner complies with requirements to construct and operate groundwater wells.

Riverside County Ordinance Code, Title 8, Chapter 8.124 – Sewage Discharge

Section 8.124.030, General Requirements for an Approval and Construction Permit. The type, capacity, location, and layout of each private system shall comply with the rules and regulations of the health officer, and the WDRs of the CRBRWQCB. A private system shall be constructed and maintained on the lot which is the site of the building it serves, unless the health officer in his discretion authorizes a different location.

Section 8.124.050 Operation Permits. Each private system shall be managed, cleaned, regulated, repaired, modified and replaced from time to time by the owner or owner’s representatives, in accordance with the rules, regulations and other reasonable requirements of the health officer in conformity with the WDR issued by the regional board and in a manner which will safeguard against and prevent pollution, contamination or nuisance.

Condition of Certification **SOIL&WATER-7** would ensure the sanitary wastewater disposal systems meet County of Riverside requirements.

Riverside County Title 15 Chapter 15.24 Uniform Plumbing Code

Section 15.24.010. Adopted by Reference, Appendix K, Section K1 amended – Private Sewage Disposal – General. In certain areas of the County which have poor soils or other problems relative to sewage disposal, the sewage disposal system shall be installed and inspected before the building foundation inspection is made.

Section 15.24.010. Adopted by Reference, Appendix K, Section K6(i) amended – Disposal fields. Disposal fields, trenches, and leaching beds shall not be paved over or covered by concrete or any material that can reduce or inhibit any possible evaporation of the sewer effluent unless the area of the disposal fields, trenches, and leaching beds is increased by a minimum of 25%.

Condition of Certification **SOIL&WATER-7** would ensure the sanitary wastewater disposal systems meet County of Riverside requirements.

Riverside County Title 15 Chapter 15.80 Regulating Flood Hazard Areas and Implementing the National Flood Insurance Program

This ordinance was developed to comply with Title 44 CFR Part 65 regarding requirements for the identification and mapping of areas identified as Federal Emergency Management Agency (FEMA) Special Flood Hazard Areas. The ordinance is applicable to development within unincorporated areas of Riverside County and is integrated into the process of application for development permits under other county ordinances including, but not limited to, Ordinance Nos. 348, 369, 457, 460, and 555. When the information required, or procedures involved, in the processing of such applications is not sufficient to assure compliance with the requirements of Chapter 15.80, a separate application must be filed.

Flood insurance rate maps for the project site or surrounding areas have not been prepared by FEMA. According to the Riverside County General Plan (Riverside County 2000) the project site and surrounding lands do not lie within a 100-year or 500-year flood plain. Therefore, the project would not be subject to these requirements.

NOTEWORTHY PUBLIC BENEFITS

No noteworthy public benefits of the proposed modified project were identified associated with soil and water resources.

RESPONSE TO COMMENTS

STATE OF CALIFORNIA, ENERGY RESOURCES CONSERVATION AND DEVELOPMENT COMMISSION/BASIN AND RANGE WATCH, LAURA CUNNINGHAM AND KEVIN EMMERICH, STATUS REPORT NO. 1, TN # 70178, MARCH 29, 2013

Comment #1: The commenter states that project groundwater pumping could impact groundwater-dependent vegetation and asks if staff and project owner would agree to a “stop pumping trigger” of groundwater if negative impacts are detected.

Response: Because the PSEGS project would use a reduced amount of water during both construction and operation activities with the same proposed groundwater supply system as the approved PSPP project, staff believes the current Conditions of Certification for mitigation of groundwater level impacts are appropriate. Therefore this does not constitute a need for a project change from the approved project. Condition of Certification **SOIL&WATER-4** does not include a “stop pumping trigger”, but does require groundwater level monitoring, mitigation, and reporting. To mitigate potential impacts to groundwater-dependent vegetation, PSEGS would be required to comply with Conditions of Certification **BIO-23** (Groundwater Dependent Vegetation Monitoring) and **BIO-24** (Remedial Action and Compensation for Adverse Effects to Groundwater-Dependent Biological Resources).

Comment #2: The commenter states that a regional groundwater study should be completed to evaluate the cumulative impacts to both groundwater and the Colorado River Basin relating to large industrial scale energy projects being built in the region.

Response: Because the PSEGS project would use a reduced amount of water during both construction and operation activities with the same proposed groundwater supply system as the approved PSPP project, staff believes the current Conditions of Certification for mitigation of groundwater level impacts are appropriate. Therefore, this does not constitute a need for a project change from the approved project. To mitigate the project's contribution to impacts to the Colorado River, Condition of Certification **SOIL&WATER-14** and **-17** would require entitlements or offsets to Lower Colorado River water.

VEENA DOIJODE, PUBLIC COMMENT RE: IMPACT TO APN 810311009, TN # 70449, APRIL 22, 2013:

Comment: The commenter requests an impact assessment to a parcel (APN 810311009) located close to the project site. The commenter intends to grow palm dates on this land.

Response: The private parcel referenced in the comment is located 5.3 miles southeast of the PSEGS project site, midway between the PSEGS and the Genesis Solar Electric Generating Project. Because the PSEGS project is being processed as an amendment, staff analyzed baseline conditions from the time the original PSPP project was filed, in 2009. At that time, PSPP groundwater pumping was estimated to lower groundwater levels approximately 0.1 ft in the general area of the parcel in question at the end of 30 years of operation (see **Soil & Water Resources Figure 14**). Because future groundwater levels could not be accurately quantified until actual long-term groundwater production occurs, Conditions of Certification **SOIL&WATER-2** through **SOIL&WATER-5** were required to minimize potential impacts. The modified PSEGS project would use less water during both construction and operation activities with the same proposed groundwater supply system as the approved PSPP project. As a result, staff believes that PSEGS would have less impact to groundwater levels for the parcel in question. Conditions of Certification **SOIL&WATER-2** through **SOIL&WATER-5** as approved in the Commission Decision would also mitigate impacts caused by the modified PSEGS project.

GALATI BLEK LLP MARIE FLEMING/PALEN SOLAR HOLDINGS, LLC'S INITIAL COMMENTS ON THE PRELIMINARY STAFF ASSESSMENT, TN # 71551, JULY 11, 2013:

Comment #1: The commenter states that staff did not include Waste Discharge Requirements (WDRs) in the Preliminary Staff Assessment [PSA (CEC 2013r)].

Response: Proposed WDRs, as a required in **SOIL&WATER-6**, have been included in this FSA as Appendices B, C, and D. Staff continues to coordinate with CRBRWQCB to ensure these WDRs would be appropriate for PSEGS.

Comment #2: The commenter proposes a modification to the verification of **SOIL&WATER-17**.

Response: Staff agrees to the modification.

Comment #3: The commenter states that the requirement in **SOIL&WATER-17**, that all fencing be designed to withstand a 100-year storm event, is not feasible. PSH proposes modifications to implement a fence inspection and repair program instead.

Response: Staff agrees to the modifications.

Note: The commenter resubmitted the same comments on July 29, 2013 (TN# 200077).

STATE OF CALIFORNIA, ENERGY RESOURCES CONSERVATION AND DEVELOPMENT COMMISSION/CENTER FOR BIOLOGICAL DIVERSITY, LISA T. BELENKY, COMMENTS ON THE PRELIMINARY STAFF ASSESSMENT, TN # 200055, JULY 29, 2013:

Comment #1: The commenter states that project groundwater pumping would impact groundwater-dependent vegetation and believes the proposed mitigation measures are "too weak because they would require nearly impossible to obtain proof that specific water drawdown was unequivocally caused by the proposed project".

Response: Because the PSEGS project would use a reduced amount of water during both construction and operation activities with the same proposed groundwater supply system as the approved PSPP project, staff believes the current Conditions of Certification for mitigation of groundwater level impacts are appropriate. Therefore this does not constitute a need for a project change from the approved project. To mitigate potential impacts to groundwater-dependent vegetation, PSEGS would be required to comply with Conditions of Certification **BIO-23** (Groundwater Dependent Vegetation Monitoring) and **BIO-24** (Remedial Action and Compensation for Adverse Effects to Groundwater-Dependent Biological Resources).

Comment #2: The commenter states that cumulative impacts to groundwater-dependent vegetation should be updated to include the Eagle Mountain Pumped Storage Project which received SWQCB approval in July 2013.

Response: The cumulative analysis in the PSA (CEC 2013r) included the Eagle Mountain Pumped Storage Project as a reasonable foreseeable project. Its expected water use was based on information in the project's application to the Federal Energy Regulatory Commission. The cumulative analysis was updated for this FSA, and includes the Eagle Mountain Pumped Storage Project with expected water use based on information in the project's Final Environmental Impact Report (EIR).

Comment #3: The commenter states that additional information is needed on the effects of groundwater pumping on nearby seeps and springs in the adjacent Wilderness and Joshua Tree National Park. Also, because of the substantial evaporation rate at the project site, the environmental review should provide data on how much pumped groundwater will actually be returned to the groundwater basin versus that lost to evaporation.

Response: Because the PSEGS project would use a reduced amount of water during both construction and operation activities with the same proposed groundwater supply system as the approved PSPP project, staff believes the current Conditions of Certification for mitigation of groundwater level impacts are appropriate. Therefore this does not constitute a need for a project change from the approved project.

Comment #4: Comments related to Waters of the State and Cryptobiotic Soils were included under the heading "L. Soils and Water Resources".

Response: These topics are covered in the **BIOLOGICAL RESOURCES** section of this FSA.

COLORADO RIVER BOARD OF CALIFORNIA, TANYA M. TRUJILLO, COMMENT LETTER ON THE PRELIMINARY STAFF ASSESSMENT, TN # 200058, JULY 29, 2013:

Comment: The commenter supports the inclusion of Condition of Certification **SOIL&WATER-14** and suggests that the most efficient process for obtaining a legal and reliable water supply would be for the PSEGS owners to enter into an agreement with an entity that currently holds an existing contract for the use of Colorado River Water.

Response: Staff appreciates the support of CRB for the inclusion of Condition of Certification **SOIL&WATER-14**. Staff acknowledges CRB's request that staff prioritize mitigation that would offset water use from a Colorado River water rights contract holder. Staff believes this may be appropriate but the basis for the recommended condition of certification was for mitigation of potential environmental impacts. Therefore staff must also provide for mitigation options in the condition of certification such as the tamarisk removal or other water conservation programs that could achieve the same or similar benefits as the purchase of actively used Colorado River water rights. Staff will consult with CRB to provide review and comment when the Water Offset Plan required in Condition of Certification **SOIL&WATER-14**.

CONCLUSIONS

Staff's conclusions based on analysis of the information are as follows:

1. The project would be located on an alluvial fan where flash flooding and mass erosion could impact the project. A Draft Drainage, Erosion, and Sedimentation Control Plan (DESCP), as required of Condition of Certification **SOIL&WATER-1**, would mitigate the potential storm water and sediment project-related impacts by implementing Best Management Practices (BMPs) during construction and operations. Condition of Certification **SOIL&WATER-20** would reduce damage caused by potential flash flooding.

2. The PSEGS would have an impact on levels of groundwater in the Chuckwalla Valley Groundwater Basin (CVGB). However, the calculations and assumptions used to evaluate potential groundwater level impacts are imprecise and have limitations and uncertainties associated with them such that the magnitude of potential impacts that could occur cannot be determined precisely. To ensure that the project's proposed use of groundwater does not significantly impact the groundwater levels in the CVGB, staff believes the project owner should be required to develop a monitoring program and identify what changes are occurring in basin water levels. Substantial changes to groundwater levels caused by the project and other pumping in the basin would be documented by this monitoring and reporting program and mitigation would be required in accordance with Conditions of Certification **SOIL&WATER-2, -3**, **-4**, and **-5**.These measures will be sufficient to ensure that significant impacts to groundwater levels do not occur.

3. A cumulative impact analysis indicates that groundwater extraction during construction and operation of this and other foreseeable projects would place the basin into an overdraft condition. This impact may be exacerbated by other unidentified renewable energy projects in the I-10 corridor, which has been targeted as a potential area for further renewable energy development. However, the amount of water that is in storage in the basin greatly exceeds the amount of cumulative overdraft, even taking into account the potential for dramatically increased water demand, rendering the project's relatively small contribution to this cumulative impact less than cumulatively considerable.

4. The cumulative effects may indirectly impact the adjacent Palo Verde Mesa Groundwater Basin by inducing underflow from the Colorado River. To mitigate the project's contribution to impacts to the Colorado River, staff recommends adoption of **SOIL&WATER-14** that would require the project owner to acquire entitlements or offsets to Lower Colorado River water. Staff has also proposed Condition of Certification **SOIL&WATER-17** which allows the project owner to refine estimates of the amount of induced Colorado River underflow through computer modeling analysis and adjust the required acquisition of entitlements or offsets to Lower Colorado River water accordingly.

5. The project owner proposes a dry-cooled facility that when fully operational would use 201 acre-feet a year (afy) of groundwater from onsite wells. Groundwater is the only available source of water. Pumped water would be used for various purposes, including domestic use by workers, dust suppression, and mirror washing. Water is the only feasible means of cleaning the mirrors, which must be clean to maintain efficiency. Process makeup water would be recycled to supplement groundwater supplies. Overall use of the water is efficient for this technology, requiring about 40 afy per 100 MW of capacity.

   The quality of the groundwater varies significantly throughout the CVGB, and varies with depth. In general, groundwater below the project site would not meet water quality standards for domestic supply without treatment, because of elevated levels of total dissolved solids (TDS) and high concentrations of fluoride, chloride, boron, and sulfate. Staff concludes that the Project complies with the state's water policy to feasibly use the least amount of the lowest-quality water available.

6. The PSEGS would generate wastewater that would include: reverse osmosis (RO) reject water, auxiliary equipment blowdown water and sanitary wastewater. The project proposes to use evaporation ponds to treat the RO reject water and auxiliary equipment blowdown water; and sanitary leachfields to treat the sanitary wastewater. Conditions of Certification **SOIL&WATER-6** and **SOIL&WATER-7** would ensure that the operation of the wastewater treatment systems are in accordance with regulatory requirements and minimize potential impacts to surface and groundwater quality. In addition, Condition of Certification **SOIL&WATER-18** would monitor existing groundwater quality to monitor compliance with the requirements set forth in **SOIL&WATER-6** and **SOIL&WATER-7.**

7. The project owner proposes to operate a non-transient, non-community water system during operation of the project. The project owner would be required to submit all requirements, specifications, certifications to permit and operate of a non-transient, non-community water system as per Condition of Certification **SOIL&WATER-19.** In addition, the project owner would be required to comply with groundwater production reporting requirements following Condition of Certification **SOIL&WATER-15.** Lastly, the project owner would be required to monitor and mitigate potential ground subsidence associated with groundwater production following Condition of Certification **SOIL&WATER-16.**

8. The project owner would be required to submit a project closure and non-operation plan prior to site operations to ensure that at the time of project closure, the site is restored to pre-project conditions as required by Condition of Certification **SOIL&WATER-13**.

PROPOSED CONDITIONS OF CERTIFICATION

Staff has proposed modifications to the **Soil & Water Resources** Conditions of Certification as shown below. (**Note:** Deleted text is in ~~strikethrough~~, new text is **<u>bold and underlined</u>**)

DRAINAGE EROSION AND SEDIMENTATION CONTROL PLAN (DESCP)

SOIL&WATER-1 Prior to site mobilization, the project owner shall obtain the Compliance Project Manager (CPM) approval of the Drainage Erosion and Sedimentation Control Plan (DESCP) for managing storm water during Project construction and operations as normally administered by the County of Riverside. The DESCP must ensure proper protection of water quality and soil resources, demonstrate no increase in off-site flooding potential, include provisions for sediment and storm water retention from both the power block, solar fields and transmission right of way to meet any Riverside County requirements, address exposed soil treatments in the solar fields for both road and non-road surfaces, and identify all monitoring and maintenance activities. The plan must also cover all linear project features such as offsite transmission mains. The DESCP shall contain, at minimum, the elements presented below that outline site management activities and erosion and sediment-control Best Management Practices (BMP) to be implemented during site mobilization, excavation, construction, and post construction (operating) activities.

A. Vicinity Map – A map(s), at a minimum scale 1 inch to 500 feet, shall be provided indicating the location of all Project elements (construction sites, laydown area, pipelines) with depictions of all significant geographic features including swales, storm drains, and sensitive areas.

B. Site Delineation – All areas subject to soil disturbance for the proposed Project (Project phases, laydown area, all linear facilities, landscaping areas, and any other Project elements) shall be delineated showing boundary lines of all construction areas and the location of all existing and proposed structures, pipelines, roads, and drainage facilities.

C. Watercourses and Critical Areas – The DESCP shall show the location of all nearby watercourses including swales, storm drains, and ~~drainage ditches~~ **desert washes**. It shall indicate the proximity of those features to the proposed Project construction, laydown, and landscape areas and all transmission and pipeline construction corridors.

1~~a.~~ The DESCP shall describe how the project will avoid or minimize impacts to Palen-McCoy Valley sand corridor,

2~~b.~~ All proposed linear features (with the exception of Power Pylons) shall be constructed flush with the surrounding ground surface and without ground level obstructions.

3~~c~~. Earthwork and temporary construction related activities shall be conducted such that off-site resources are protected from impacts due to redirection of flood flows around and through the site. Construction activities shall proceed in a manner so as to minimize exposure of facilities to construction period flooding. Temporary diversion channels shall be adequately designed for flood conveyance capable of protecting the construction site while not contributing to onsite or offsite erosion.

D. **Drainage Map** – The DESCP shall provide a topographic site map(s), at a minimum scale of 1 inch to 200 feet, showing existing, interim, and proposed drainage swales and drainage systems and drainage-area boundaries. On the map, spot elevations are required where relatively flat conditions exist. The spot elevations and contours shall be extended off-site for a minimum distance of 100 feet.

E. **Drainage of Project Site Narrative** – The DESCP shall include a narrative of the drainage measures necessary to protect the site and potentially affected soil and water resources within the drainage downstream of the site. The narrative shall include the summary pages from the hydraulic analysis prepared by a professional engineer and erosion control specialist. The narrative shall state the watershed size(s) in acres that was used in the calculation of drainage features.

F. **Clearing and Grading Plans** – The DESCP shall provide a delineation of all areas to be cleared of vegetation and areas to be preserved. The plan shall provide elevations, slopes, locations, and extent of all proposed grading as shown by contours, cross sections, or other means. The locations of any disposal areas, fills, or other special features shall also be shown. Existing and proposed topography shall be illustrated by tying in proposed contours with existing topography.

G. **Clearing and Grading Narrative** – The DESCP shall include a table with the estimated quantities of material excavated or filled for the site and all Project elements (Project site, laydown area, transmission and pipeline corridors, roadways, and bridges) whether such excavation or fill is temporary or permanent, and the amount of such material to be imported or exported.

H. **Soil Wind and Water Erosion Control –** The plan shall address exposed soil treatments to be used during construction and operation of the proposed Project for both road and non-road surfaces including specifically identifying all chemical based dust palliatives, soil bonding, and weighting agents appropriate for use at the proposed Project site that would not cause adverse effects to vegetation. BMPs shall include measures designed to prevent wind and water erosion including application of chemical dust palliatives after rough grading to limit water use. All dust palliatives, soil binders, and weighting agents shall be approved by the CPM prior to use.

I. **Best Management Practices Plan –** The DESCP shall identify on the topographic site map(s) the location of the site specific BMPs to be employed during each phase of construction (initial grading, Project element excavation and construction, and final grading/stabilization). BMPs shall include measures designed to control dust, stabilize construction access roads and entrances, and control storm water runoff and sediment transport.

J. **Best Management Practices Narrative –** The DESCP shall show the location (as identified in (I) above), timing, and maintenance schedule of all erosion- and sediment-control BMPs to be used prior to initial grading, during all Project element (site, pipelines) excavations and construction, final grading/stabilization, and operation. Separate BMP implementation schedules shall be provided for each Project element for each phase of construction. The maintenance schedule shall include post-construction maintenance of structural-control BMPs, or a statement provided about when such information would be available.

K. **Project Schedule –** The DESCP shall identify on the topographic site map the location of the site-specific BMPs to be employed during each phase of construction (initial grading, Project element construction, and final grading/stabilization). Separate BMP implementation schedules shall be provided for each Project element for each phase of construction.

L. **Erosion Control Drawings –** The erosion-control drawings and narrative shall be designed, stamped and sealed by a professional engineer or erosion control specialist.

M. **Agency Comments –** The DESCP shall include copies of recommendations, conditions, and provisions from the County of Riverside, California Department of Fish and Game (CDFG), and Colorado River Basin Regional Water Quality Control Board (CRBRWQCB).

N. **Monitoring Plan:** Monitoring activities shall include routine measurement of the volume of accumulated sediment in the onsite drainage ditches, and storm water diversions. ~~The monitoring plan shall be part of the Channel Monitoring and Maintenance Plan, **SOIL&WATER-12.**~~

Verification: No later than 30 days prior to start of site mobilization, the project owner shall submit a copy of the final DESCP to the County of Riverside, the CRBRWQCB, and the CPM for review and comment and to the County of Riverside and the CRBRWQCB if required. The CPM shall consider comments if received by the county and CRBRWQCB before approval of the DESCP.

The DESCP shall be consistent with the grading and drainage plan and relevant portions of the DESCP shall clearly show approval by the chief building official. The DESCP shall be a separate plan from the SWPPP developed in conjunction with any National Pollutant Discharge Elimination System (NPDES) permit for Construction Activity. The project owner shall provide in the monthly compliance report with a narrative on the effectiveness of the drainage, erosion, and sediment-control measures and the results of monitoring and maintenance activities. Once operational, the project owner shall update and maintain the DESCP for the life of the Project and shall provide in the annual compliance report information on the results of monitoring and maintenance activities.

PROJECT GROUNDWATER WELLS, PRE-WELL INSTALLATION

SOIL&WATER-2 The project owner proposes to construct and operate up to ten (10) onsite groundwater water supply wells that produce water from the CVGB. The project owner shall ensure that the wells are completed in accordance with all applicable state and local water well construction permits and requirements. Prior to initiation of well construction activities, the project owner shall submit for review and comment a well construction packet to the County of Riverside and fees normally required for the county's well permit, with copies to the CPM. The Project shall not construct a well or extract and use groundwater until approval has been issued by the County and the CPM to construct and operate the well. Wells permitted and installed as part of pre-construction field investigations that subsequently are planned for use as project water supply wells require CPM approval prior to their use to supply water to the project.

Post-Well Installation. The project owner shall provide documentation as required under County permit conditions to the CPM that the well has been properly completed. In accordance with California's Water Code section 13754, the driller of the well shall submit to the DWR a Well Completion Report for each well installed. The project owner shall ensure the Well Completion reports are submitted. The project owner shall ensure compliance with all county water well standards and the County requirements for the life of the wells, and shall provide the CPM with two (2) copies each of all monitoring or other reports required for compliance with the County of Riverside water well standards and operation requirements, as well as any changes made to the operation of the well.

<u>Verification:</u> The project owner shall do all of the following:

a. No later than 60 days prior to the construction of the onsite groundwater production wells, the project owner shall submit to the CPM a copy of the water well construction packet submitted to the County of Riverside.

b. No later than 30 days prior to the construction of the onsite groundwater production wells, the project owner shall submit a copy of written concurrence received from the County of Riverside that the proposed well construction activities comply with all county well requirements and meet the requirements established by the county's water well permit program. The CPM will provide approval to the project owner of the well location and operation within 10 days of receipt of the County of Riverside's concurrence with the proposed well construction activities.

c. No later than 60 days after installation of each well at the Project site, the project owner shall ensure that the well driller submits a Well Completion Report to the DWR with a copy provided to the CPM. The project owner shall submit to the CPM together with the Well Completion Report a copy of well drilling logs, water quality analyses, and any inspection reports. Additionally no later than 60 days after installation of each well (including closure of any associated mud pits) the project owner shall submit documentation to the CPM and the CRBWQCB that well drilling activities were conducted in compliance with Title 23, California Code of Regulations, Chapter 15, Discharges of Hazardous Wastes to Land, (23 CCR, sections 2510 et seq.) and that any onsite drilling sumps used for Project drilling activities were removed in compliance with 23 CCR section 2511(c).

d. During well construction and for the operational life of the well, the project owner shall submit two copies each to the CPM of any proposed well construction or operation changes.

CONSTRUCTION AND OPERATION WATER USE

SOIL&WATER-3 The proposed Project's use of groundwater during construction shall not exceed ~~1,917~~ <u>**400**</u> afy (total of ~~5,750~~ <u>**1,130**</u> af during the ~~39~~ **34** months) during construction and ~~300~~ <u>**201**</u> afy during operation. Water quality used for project construction and operation shall be reported in accordance with Condition of Certification **SOIL&WATER-18** to ensure compliance with this condition.

Prior to the use of groundwater for construction, the project owner shall install and maintain metering devices as part of the water supply and distribution system to document Project water use and to monitor and record in gallons per day the total volume(s) of water supplied to the Project from this water source. The metering devices shall be operational for the life of the Project.

<u>**Verification:**</u> At least 60 days prior to the start of construction of the proposed Project, the project owner shall submit to the CPM a copy of evidence that metering devices have been installed and are operational.

Beginning six months after the start of construction, the project owner shall prepare a semi-annual summary of amount of water used for construction purposes. The summary shall include the monthly range and monthly average of daily water usage in gallons per day.

The project owner shall prepare an annual summary, which shall include daily usage, monthly range and monthly average of daily water usage in gallons per day, and total water used on a monthly and annual basis in acre-feet. For years subsequent to the initial year of operation, the annual summary shall also include the yearly range and yearly average water use by source. For calculating the total water use, the term "year" shall correspond to the date established for the annual compliance report submittal.

GROUNDWATER LEVEL MONITORING, MITIGATION, AND REPORTING

SOIL&WATER-4 The project owner shall submit a Groundwater Level Monitoring, Mitigation, and Reporting Plan to the CPM for review and approval in advance of construction activities and prior to the operation of onsite groundwater supply wells. The Groundwater Level Monitoring, Mitigation, and Reporting Plan shall provide detailed methodology for monitoring background and site groundwater levels. Monitoring shall include pre-construction, construction, and Project operation water use. The plan shall establish pre-construction and Project related groundwater level and water quality trends that can be quantitatively compared against observed and simulated trends near the Project pumping wells and near potentially impacted existing wells.

A. Prior to Project Construction

1. A well reconnaissance shall be conducted to investigate and document the condition of existing water supply wells located within 3 miles of the project site, provided that access is granted by the well owners. The reconnaissance shall include sending notices by registered mail to all property owners within a 3 mile radius of the project area.

2. Monitor to establish preconstruction conditions. The monitoring plan and network of monitoring wells shall make use of existing wells in the basin that would satisfy the requirements for the monitoring program. The monitoring network shall be defined by the groundwater model developed for the AFC as the area predicted to show a water level change of 1 feet or more at the end of construction and at the end of operation and any monitoring wells that are installed to comply with Waste Discharge Requirements issued by the Energy Commission for the evaporation ponds and land treatment unit associated with the Project. The projected area of groundwater drawdown shall be refined on an annual basis during project construction and every three (3) years during project operations using the data acquired as part of Condition of Certification **SOIL&WATER-4** as well as the numerical groundwater model developed as part of the AFC and subsequent Data Responses by the applicant. If the area predicted to show a water level change of 1 feet increases, the project owner will be required to submit a revised monitoring plan with additional monitoring wells (if required).

3. Identified additional wells shall be located outside of this area to serve as background monitoring wells. Abandoned wells, or wells no longer in use, that are accessible and provide reliable water level data within the potentially impacted area shall also be included as part of the monitoring network. A site reconnaissance shall be performed to identify wells that could be accessible for monitoring. As access to these wells is available, historic water level, water quality, well construction and well performance information shall be obtained for both pumping and non-pumping conditions.

4. As access allows, measure groundwater levels from the off-site and on-site wells within the network and background wells to provide initial groundwater levels for pre-project trend analysis.

5. Construct water level maps within the CVGB within 5 miles of the site from the groundwater data collected prior to construction. Update trend plots and statistical analyses, as data is available.

B. During Construction:

1. Collect water levels from wells within the monitoring network and flows from seeps and or springs on a quarterly basis throughout the construction period and at the end of the construction period. Perform statistical trend analysis for water levels. Assess the significance of an apparent trend and estimate the magnitude of that trend.

C. During Operation:

1. On a quarterly basis for the first year of operation and semi-annually thereafter for the following four years, collect water level measurements from any wells identified in the groundwater monitoring program to evaluate operational influence from the Project. Quarterly operational parameters (i.e., pumping rate) of the water supply wells shall be monitored. Additionally, quarterly groundwater-use in the CVGB shall be estimated based on available data.

2. On an annual basis, perform statistical trend analysis for water levels data and comparison to predicted water level declines due to project pumping. Analysis of the significance of an apparent trend shall be determined and the magnitude of that trend estimated. Based on the results of the statistical trend analyses and comparison to predicted water level declines due to Project pumping, the project owner shall determine the area where the Project pumping has induced a drawdown in the water supply at a level of 5 feet or more below the baseline trend.

3. If water levels have been lowered more than 5 feet below pre-site operational trends, and monitoring data provided by the project owner show these water level changes are different from background trends and are caused by Project pumping, then the project owner shall provide mitigation to the impacted well owner(s). Mitigation shall be provided to the impacted well owners that experience 5 feet or more of Project-induced drawdown if the CPM's inspection of the well monitoring data confirms changes to water levels and water level trends relative to measured pre-project water levels, and the well (private owners well in question) yield or performance has been significantly affected by Project pumping. The type and extent of mitigation shall be determined by the amount of water level decline induced by the Project, the type of impact, and site specific well construction and water use characteristics. If an impact is determined

to be caused by drawdown from more than one source, the level of mitigation provided shall be proportional to the amount of drawdown induced by the Project relative to other sources. In order to be eligible, a well owner must provide documentation of the well location and construction, including pump intake depth, and that the well was constructed and usable before Project pumping was initiated. The mitigation of impacts shall be determined as follows:

a. If Project pumping has lowered water levels by 5 feet or more and increased pumping lifts, increased energy costs shall be calculated. Payment or reimbursement for the increased costs shall be provided at the option of the affected well owner on an annual basis. In the absence of specific electrical use data supplied by the well owner, the project owner shall use **SOIL&WATER-5** to calculate increased energy costs.

b. If groundwater monitoring data indicate Project pumping has lowered water levels below the top of the well screen, and the well yield is shown to have decreased by 10% or more of the pre-Project average seasonal yield, compensation shall be provided for the diagnosis and maintenance to treat and remove encrustation from the well screen. Reimbursement shall be provided at an amount equal to the customary local cost of performing the necessary diagnosis and maintenance for well screen encrustation. Should the well yield reductions be recurring, the project owner shall provide payment or reimbursement for periodic maintenance throughout the life of the Project. If with treatment the well yield is incapable of meeting 110% of the well owner’s maximum daily demand, dry season demand, or annual demand the well owner should be compensated by reimbursement or well replacement as described under Condition 3.c.

c. If Project pumping has lowered water levels to significantly impact well yield so that it can no longer meet its intended purpose, causes the well to go dry, or cause casing collapse, payment or reimbursement of an amount equal to the cost of deepening or replacing the well shall be provided to accommodate these effects. Payment or reimbursement shall be at an amount equal to the customary local cost of deepening the existing well or constructing a new well of comparable design and yield (only deeper).. The demand for water, which determines the required well yield, shall be determined on a per well basis using well owner interviews and field verification of property conditions and water requirements compiled as part of the pre-project well reconnaissance. Well yield shall be considered significantly impacted if it is incapable of meeting 110% of the well owner’s maximum daily demand, dry-season demand, or annual demand – assuming the pre-project well yield documented by the initial well reconnaissance met or exceeded these yield levels.

d. The project owner shall notify any owners of the impacted wells within one month of the CPM approval of the compensation analysis for increased energy costs.

e. Pump lowering – In the event that groundwater is lowered as a result of Project pumping to an extent where pumps are exposed but well screens remain submerged the pumps shall be lowered to maintain production in the well. The Project shall reimburse the impacted well owner for the costs associated with lowering pumps.

f. Deepening of wells – If the groundwater is lowered enough as a result of Project pumping that well screens and/or pump intakes are exposed, and pump lowering is not an option, such affected wells shall be deepened or new wells constructed. The project owner shall reimburse the impacted well owner for all costs associated with deepening existing wells or constructing new wells shall be borne by the project owner.

4. After the first five-year operational and monitoring period the CPM shall evaluate the data and determine if the monitoring program for water level measurements should be revised or eliminated. Revision or elimination of any monitoring program elements shall be based on the consistency of the data collected. The determination of whether the monitoring program should be revised or eliminated shall be made by the CPM.

5. If mitigation includes monetary compensation, the project owner shall provide documentation to the CPM that compensation payments have been made by March 31 of each year of Project operation or, if lump-sum payments are made, payment is made by March 31 following the first year of operation only. Within 30 days after compensation is paid, the project owner shall submit to the CPM a compliance report describing compensation for increased energy costs necessary to comply with the provisions of this condition.

6. At the end of every subsequent five-year monitoring period, the collected data shall be evaluated by the CPM and they shall determine if the sampling frequency should be revised or eliminated.

7. During the life of the Project, the project owner shall provide to the CPM all monitoring reports, complaints, studies and other relevant data within 10 days of being received by the project owner.

Verification: The project owner shall do all of the following:

At least 60 days prior to operation of the site groundwater supply wells, the project owner shall submit to the CPM, a comprehensive report presenting all the data and information required in item A above. The CPM will provide comments to the plan 15 days following submittal, and the final plan shall be approved 15 days prior to operation of the site groundwater supply wells. The project owner shall submit to the CPM all calculations and assumptions made in development of the report data and interpretations.

During Project construction, the project owner shall submit to the CPM quarterly reports presenting all the data and information required in item B above. The quarterly reports shall be provided 30 days following the end of the quarter. The project owner shall also submit to the CPM all calculations and assumptions made in development of the report data and interpretations.

No later than March 31 of each year of construction or 60 days prior to Project operation, the project owner shall provide to the CPM for review and approval, documentation showing that any mitigation to private well owners during Project construction was satisfied, based on the requirements of the property owner as determined by the CPM.

During Project operation, the project owner shall submit to the CPM, applicable quarterly, semi-annual and annual reports presenting all the data and information required in item C above. Quarterly reports shall be submitted to the CPM 30 days following the end of the quarter. The fourth quarter report shall serve as the annual report and shall be provided on January 31 in the following year.

The project owner shall submit to the CPM all calculations and assumptions made in development of report data and interpretations, calculations, and assumptions used in development of any reports.

After the first five year operational and monitoring period, the project owner shall submit a 5 year monitoring report to the CPM that includes all monitoring data collected and a summary of the findings. The CPM will determine if the water level measurements and water quality sampling frequencies should be revised or eliminated.

COMPENSATION FOR WELL IMPACTS

SOIL&WATER-5 Where it is determined that the project owner shall reimburse a private well owner for increased energy costs identified as a result of analysis performed in Condition of Certification **SOIL&WATER-4,** the project owner shall calculate the compensation owed to any owner of an impacted well as described below.

<u>Increased cost for energy</u>	=	change in lift/total system head x total energy consumption x costs/unit of energy

Where:

change in lift (ft)	=	calculated change in water level in the well resulting from project
total system head (ft)	=	elevation head + discharge pressure head

elevation head (ft)	=	difference in elevation between wellhead discharge pressure gauge and water level in well during pumping.
discharge pressure head (ft)	=	pressure at wellhead discharge gauge (psi) X 2.31

The project owner shall submit to the CPM for review and approval the documentation showing which well owners must be compensated for increased energy costs and that the proposed amount is sufficient compensation to comply with the provisions of this condition.

- Any reimbursements (either lump sum or annual) to impacted well owners shall be only to those well owners whose wells were in service within six months of the Commission decision and within a 5-mile radius of the project site.
- The project owner shall notify all owners of the impacted wells within one month of the CPM approval of the compensation analysis for increase energy costs.
- Compensation shall be provided on either a one-time lump-sum basis, or on an annual basis, as described below.

Annual Compensation: Compensation provided on an annual basis shall be calculated prospectively for each year by estimating energy costs that will be incurred to provide the additional lift required as a result of the project. With the permission of the impacted well owner, the project owner shall provide energy meters for each well or well field affected by the project. The impacted well owner to receive compensation must provide documentation of energy consumption in the form of meter readings or other verification of fuel consumption. For each year after the first year of operation, the project owner shall include an adjustment for any deviations between projected and actual energy costs for the previous calendar year.

One-Time Lump-Sum Compensation: Compensation provided on a one-time lump-sum basis shall be based on a well-interference analysis, assuming the maximum project-pumping rate of 300 afy. Compensation associated with increased pumping lift for the life of the project shall be estimated as a lump sum payment as follows:

- The current cost of energy to the affected party considering time of use or tiers of energy cost applicable to the party's billing of electricity from the utility providing electric service, or a reasonable equivalent if the party independently generates their electricity;
- An annual inflation factor for energy cost of 3%; and
- A net present value determination assuming a term of 30 years and a discount rate of 9%;

The project owner shall do all of the following:

1. No later than 30 days after CPM approval of the well drawdown analysis, the project owner shall submit to the CPM for review and approval all documentation and calculations describing necessary compensation for energy costs associated with additional lift requirements.

2. The project owner shall submit to the CPM all calculations, along with any letters signed by the well owners indicating agreement with the calculations, and the name and phone numbers of those well owners that do not agree with the calculations.

Compensation payments shall be made by March 31 of each year of project operation or, if lump-sum payment is selected, payment shall be made by March 31 of the first year of operation only. Within 30 days after compensation is paid, the project owner shall submit to the CPM a compliance report describing compensation for increased energy costs necessary to comply with the provisions of this condition.

WASTE DISCHARGE REQUIREMENTS

SOIL&WATER-6 The project owner shall comply with the requirements specified in Appendix B, C, and D. These requirements relate to discharges, or potential discharges, of waste that could affect the quality of waters of the state, and were developed in consultation with staff of the State Water Resources Control Board and/or the applicable California Regional Water Quality Control Board (hereafter "Water Boards"). It is the Commission's intent that these requirements be enforceable by both the Commission and the Water Boards. In furtherance of that objective, the Commission hereby delegates the enforcement of these requirements, and associated monitoring, inspection and annual fee collection authority, to the Water Boards. Accordingly, the Commission and the Water Board shall confer with each other and coordinate, as needed, in the enforcement of the requirements. The project owner shall pay the annual waste discharge permit fee associated with this facility to the Water Boards. In addition, the Water Boards may "prescribe" these requirements as waste discharge requirements pursuant to Water Code Section 13263 solely for the purposes of enforcement, monitoring, inspection, and the assessment of annual fees, consistent with Public Resources Code Section 25531, subdivision (c).

<u>**Verification:**</u> The Project owner shall follow the groundwater quality monitoring requirements as provided in **SOIL&WATER-18** by providing Groundwater Quality Monitoring and Reporting Plan 90 days prior to operation of water supply wells for construction activities. The plan shall provide methods and procedures for monitoring background water quality, and site groundwater quality related to operation of the waste management units. Well locations, groundwater sampling procedures and analytical methods shall be provided consistent with requirements stipulated in the Waste Discharge Requirements provided in Appendix B, C and D.

No later than 60 days prior to any wastewater discharge or use of land treatment units, the project owner shall provide documentation to the CPM, with copies to the CRBRWQCB, demonstrating compliance with the WDRs established in Appendices B, C, and D. Any changes to the design, construction, or operation of the evaporation basins, treatment units, or storm water system shall be requested in writing to the CPM, with copies to the CRBRWQCB, and approved by the CPM, in consultation with the CRBRWQCB, prior to initiation of any ~~PSPP Soil and Water Opening Testimony Page 5~~ changes. The project owner shall provide to the CPM, with copies to the CRBRWQCB, all monitoring reports required by the WDRs, and fully explain any violations, exceedances, enforcement actions, or corrective actions related to construction or operation of the evaporation basins or treatment units.

SEPTIC SYSTEM AND LEACH FIELD REQUIREMENTS

SOIL&WATER-7 The project owner shall comply with the requirements of the County of Riverside Ordinance Code Title 8, Chapter 8.124 and the California Plumbing Code (California Code of Regulations Title 24, Part 5) regarding sanitary waste disposal facilities such as septic systems and leach fields. The septic system and leach fields shall be designed, operated, and maintained in a manner that ensures no deleterious impact to groundwater or surface water. Compliance shall include an engineering report on the septic system and leach field design, operation, maintenance, and loading impact to groundwater.

Verification: The project owner shall submit all necessary information and the appropriate fee to the County of Riverside and the CRBRWQCB to ensure that the project has complied with county and state sanitary waste disposal facilities requirements. Written assessments prepared by the County of Riverside and the CRBRWQCB regarding the project's compliance with these requirements must be submitted to the CPM for review and approval 30 days prior to the start of power plant operation.

~~REVISED PROJECT DRAINAGE REPORT AND PLANS~~

SOIL&WATER-8: **DELETED** ~~The project owner shall provide a revised Drainage Report which includes the following additional information:~~

~~A. Sizing of the Center Channel which considers the potential failure of the earthen berm located along the Corn Spring Wash crossing under I-10.~~

~~B. Revised onsite hydrology calculations using CN values consistent with the Riverside County Hydrology Manual for graded areas.~~

~~C. Detailed analysis and documentation of onsite swales and drainage channels demonstrating adequate capacity to ensure overtopping will not occur. This is of special concern for collector channels which are located at the top of terraces where there is a large drop (20 feet ±) from the outside of the channel to the lower terrace. It shall be demonstrated that seepage from these channels will not compromise the adjacent slope to the lower terrace.~~

~~D. Detailed scour calculations to justify toe-down depths for all soil cement segments, drop structures, slope protection, and any other features where scour is an issue.~~

~~E. Revised onsite hydrology map showing peak discharge values at locations where the onsite drainage system discharges into the West, Center, or East channels, or directly offsite.~~

~~F. Hydraulic and scour analysis for proposed drainage modifications associated with the construction of linear features including culvert crossings, at-grade crossings, bank protection and other potential features.~~

~~G. Digital copies of all HEC-HMS and HEC-RAS analysis.~~

~~H. A specific discussion of how the proposed onsite drainage design will protect the facility from erosion and the possible failure of the facilities resulting in a release of HTF.~~

~~The project owner shall also provide the 30% Grading and Drainage Plans which include the design based on information provided in the revised Drainage Report outlined above.~~

~~**Verification:** The project owner shall submit a Revised Project Drainage Report with the 30% Grading and Drainage Plans to the CPM for their review and comments 30 days prior to construction activities. The project owner shall address comments provided by the CPM until approval of the report is issued. All comments and concepts presented in the approved Revised Project Drainage Report with the 30%Grading and Drainage Plans shall be included in the final Grading and Drainage Plans. The Revised Project Drainage Report and 30% Grading and Drainage Plans shall be approved by the CPM.~~

~~DETAILED FLO-2D ANALYSIS~~

SOIL&WATER-9: **DELETED** ~~The project owner shall provide a detailed hydraulic analysis utilizing FLO-2D which models pre- and post-development flood conditions for the 10-, 25- and 100-year storm events. The post-development model must include all proposed collector channels, end diffuser structures and berms. The methods and results of the analysis must be fully documented in a Technical Memorandum or in the revised Project Drainage Report required in **SOIL&WATER-8**. Graphical output must include depth and velocity mapping as well as mapping which graphically shows the changes in both of these parameters between the pre- and post development conditions. Color shading schemes used for the mapping must be consistent between all maps as well as clear and easily differentiated between designated intervals for hydraulic parameters. Intervals to be used in the mapping are as follows:~~

- ~~Flow Depth: at 0.20 ft intervals up to 1 ft, and 0.40 ft intervals thereafter.~~
- ~~Velocity: 0.5 ft/s intervals~~

~~A set of figures shall be provided at a scale of no less than 1 inch 200 feet which show the extent and depths of flows entering the North, South and West channels for the 100-year event. A figure at the same scale shall also be provided for depth, velocity and the relative change in these parameters at and downstream of the four end diffuser structures for the 10-, 25- and 100-year events. Digital input and output files associated with the FLO-2D analysis must be included with all submittals. The results of this analysis shall be used for design of the 30% project grading and drainage plans.~~

~~**Verification:** The project owner shall submit a detailed FLO-2D analysis to the CPM for review and comment in addition to the 30% Grading and Drainage Plans and revised Project Drainage Report required in **SOIL&WATER-8**. The project owner shall address comments provided by the CPM until approval of the analysis is issued.~~

~~DRAINAGE CHANNEL DESIGN~~

SOIL&WATER-10: **DELETED**~~All collector and conveyance channels shall be constructed consistent with Riverside County Flood Control and Water Conservation District (RCFCWCD) guidelines where applicable. Grade control structures shall be utilized where needed to meet channel velocity and Froude number requirements. Channels shall be sized along discreet sections based on the results of the detailed FLO-2D analysis described in **SOIL&WATER-9**. All grade control and drop structures shall have adequate toe-down to account for the design drop plus two additional feet to account for potential downcutting of the channel over time. Channel confluence design must be given special consideration, especially as the preliminary Grading and Drainage Plans show 90 degree angles of confluence at nearly all locations. The issues of confluence hydraulics and potential scour shall be specifically addressed in the revised Drainage Report.~~

~~Offsite flows shall discharge directly into collector channels following the natural drainage patterns.~~

~~The proposed collector channel design must be fully documented in the Grading and Drainage plans and must include the following information:~~

~~A. Detailed and accurate cut/fill lines demonstrating in plan view how the channel would tie into existing grade and the solar facility.~~

~~B. Channel cross-sections at 100-foot intervals showing the channel geometry, existing grade, proposed grade at the facility and how the channel would tie in at on both sides.~~

~~C. Detailed channel profiles showing existing and finished grades at channel flow line and left and right banks. All drop structures as well as the toe of soil cement profile must also be shown and fully annotated. The 100-year water surface elevation shall be provided on all profiles.~~

~~D. Typical sections and design details for all discreet channel sections, drop structures, channel confluences, flow dispersion structures and other relevant drainage features.~~

~~E. Details of all drainage modifications associated with the construction of linear features such as culverts, at-grade crossings, bank protection and other potential features.~~

~~F. Consistent nomenclature and stationing on all plans, sections, profiles and details.~~

~~**Verification:** The project owner shall prepare preliminary, 30% channel design drawings and submit two copies for the CPM review and comment. The preliminary design drawings shall be submitted at the same time as the **Revised Project Drainage Report** in **SOIL&WATER-8** and FLO 2D Analysis in **SOIL&WATER-9**. The project owner shall update and modify the design as necessary to obtain the CPM approval.~~

~~CHANNEL EROSION PROTECTION~~

SOIL&WATER-11: **DELETED**~~The project owner shall provide revised preliminary Grading and Drainage Plans which incorporate the items and information as listed below for the channels designated as North, West, South, Southeast and Central on the existing plans (AECOM 2010a).~~

A. ~~Soil cement bank protection must be provided such that the channels are protected from bank erosion and lateral headcutting. The extents of the proposed bank protection must be shown on the revised Grading and Drainage Plans. Typical sections for these channels must show the layout of the bank protection including thickness, width and toe-down location and depth consistent with the scour calculation provided in the revised Drainage Report.~~

B. ~~Soil cement bank protection shall be provided on both channel banks wherever 10-year channel flow velocity exceeds 5 ft/s. It shall be provided on the outer channel bank wherever offsite topography and a detailed FLO-2D analysis indicate surface flow would enter the collector channels.~~

C. ~~Soil cement bank protection shall be provided at all channel confluences of otherwise unlined channels where the result of the detailed hydraulic analysis presented in the revised Drainage Report indicate the increased potential for erosion due to adverse angles of confluence. Detailed plans for each confluence showing the extents of the soil cement based on specific hydraulic conditions shall be provided in the formal Grading and Drainage Plans.~~

D. ~~Other methods of channel stabilization, such as dumped riprap or gabions, will not be permitted. Bio-stabilization measures are not permitted.~~

E. ~~Earthen berms used on the outside of collector channels to guide flow to discreet points of discharge into a channel shall not be utilized in lieu of soil cement on the outside bank of collector channels. Offsite flows shall discharge directly into collector channels.~~

F. ~~Design and construction criteria for the use of soil cement on the site shall be prepared by the Owner/Developer's engineer in conjunction with the design methodology established by the Geotechnical Engineer of Record. The design and construction criteria shall be based on local and/or regional requirements and specifications. The design and construction criteria, the geotechnical design for the soil cement, the site specific specifications for the soil cement, the method of installation for the soil cement, and the local or regional standards being used for the design criteria shall be provided to the CPM for review and comment consistent with the verification requirements for this Condition of Certification. The slope requirements that are proposed for use (3:1 or 4:1), and the associated method of installation (i.e., 8 inch lift versus slope application) shall be fully documented for review and approval by the CPM prior to any field installation of soil cement.~~

G. ~~A soils report indicating the suitability of the Project soils for use in the production of soil cement to the Project specifications shall be submitted with the revised Grading and Drainage Plans.~~

H. ~~The bottom of engineered collector channels may be left earthen or fully lined at the discretion of the engineer. Fully lined channels will have higher allowable velocities and Froude numbers assuming hydraulic jumps are modeled and considered in the channel design.~~

I. ~~Modifications to the existing drainages to allow construction of and future access to linear facilities shall require stabilization of the channels in the vicinity of those modifications. Locations of disturbance to the existing drainages shall be stabilized consistent with sound engineering practice to eliminate future negative impacts upstream and downstream of the linear facility in the form of downcutting, erosion and headcutting. The use of "non-engineered" culvert crossings shall not be allowed. All structures to be utilized in existing drainages along linear facilities shall be documented in the project drainage report and reflected in the project improvement plans. Channel erosion mitigation measures along linear facilities shall be subject to all the requirements of this Condition of Certification where applicable.~~

~~**Verification:** The required information and criteria shall be incorporated into the Grading and Drainage Plans and with all subsequent submittals as required in **SOIL&WATER-8** and **SOIL&WATER-9**. The project owner shall address all comments by the CPM related to the channel erosion protection design through final plan approval.~~

~~CHANNEL MAINTENANCE PROGRAM~~

SOIL&WATER-12: **DELETED**~~The project owner shall develop and implement a Channel Maintenance Program that provides long-term guidance to implement routine channel maintenance projects and comply with conditions of certification in a feasible and environmentally sensitive manner. The Channel Maintenance Program will be a process and policy document prepared by the project owner, reviewed and approved by the CPM. The Channel Maintenance Program shall include the following:~~

~~A.~~ ~~**Purpose and Objectives** – Establishes the main goals of the Program, of indefinite length, to maintain the diversion channel to meet its original design to provide flood protection, support Project mitigation, protect wildlife habitat and movement/ migration, and maintain groundwater recharge.~~

~~B.~~ ~~**Application and Use** - The channel maintenance work area is defined as the Project engineered channel, typically extending to the top of bank, include access roads, and any adjacent property that the Project owns or holds an easement for access and maintenance. The Program shall include all channel maintenance as needed to protect the Project facilities and downstream property owners.~~

~~C.~~ ~~**Channel Maintenance Activities**~~

~~1.~~ ~~**Sediment Removal** - sediment is removed when it: (1) reduces the diversion channel effective flood capacity, to less than the design discharge, (2) prevents appurtenant hydraulic structures from functioning as intended, and (3) becomes a permanent, non-erodible barrier to instream flows.~~

~~2.~~ ~~**Vegetation Management** - manage vegetation in and adjacent to the diversion channel to maintain the biological functions and values proposed in the mitigation. Vegetation management shall include control of invasive or nonnative vegetation as prescribed in Condition of Certification **BIO-14**.~~

~~3.~~ ~~**Bank Protection and Grade Control Repairs** – Bank protection and grade control structure repairs involve any action by the project owner to repair eroding banks, incising toes, scoured channel beds, as well as preventative erosion protection. The project owner shall implement instream repairs when the problem: (1) causes or could cause significant damage to the Project; adjacent property, or the structural elements of the diversion channel; (2) is a public safety concern; (3) negatively affects groundwater recharge; or (4) negatively affects the mitigation vegetation, habitat, or species of concern.~~

~~4.~~ ~~**Routine Channel Maintenance** - trash removal and associated debris to maintain channel design capacity; repair and installation of fences, gates and signs; grading and other repairs to restore the original contour of access roads and levees (if applicable); and removal of flow obstructions at Project storm drain outfalls.~~

5. ~~**Channel Maintenance Program – Exclusions** including: emergency repair and CIP.~~

D. ~~**Related Programmatic Documentation** – the CPM will review and approve the Channel Maintenance Program programmatic documentation. Maintenance activities shall comply with the streambed alteration agreement provisions and requirements for channel maintenance activities consistent with California's endangered species protection regulations and other applicable regulations.~~

E. ~~**Channel Maintenance Process Overview**~~

1. ~~**Program Development and Documentation** – This documentation provides the permitting requirements for channel maintenance work in accordance with the conditions of certification for individual routine maintenance of the engineered channel without having to perform separate CEQA/NEPA review or obtain permits.~~

2. ~~**Maintenance Guidelines** - based on two concepts: (1) the maintenance standard and (2) the acceptable maintenance condition, and applies to sediment removal, vegetation management, trash and debris collection, blockage removal, fence repairs, and access road maintenance.~~

3. ~~**Implementation** – Sets Maintenance Guidelines for vegetation and sediment management. The Project's vegetation management activities are established in Condition of Certification **BIO-14**. Maintenance Guidelines for sediment removal provide information on the allowable depth of sediment for the engineered channel that would continue to provide design discharge protection.~~

4. ~~**Reporting** – the CPM requires the following reports to be submitted each year as part of the Annual Compliance Report:~~

   a. ~~Channel Maintenance Work Plan – Describes the planned "major" maintenance activities and extent of work to be accomplished; and~~

   b. ~~Channel Maintenance Program Annual Report – Specifies which maintenance activities were completed during the year including type of work, location, and measure of the activity (e.g. cubic yards of sediment removed).~~

   c. ~~A report describing "Lessons Learned" to evaluate the effectiveness of both resource protection and maintenance methods used throughout the year.~~

F. ~~**Resource Protection Policies** - establishes policies to ensure that resources would be protected to the fullest extent feasible during routine channel maintenance activities. Policies shall be developed to guide decision-making for channel maintenance activities. BMPs shall be developed to implement these policies.~~

~~**Verification:** At least 60 days prior to the start of any project-related site disturbance activities (excluding linear construction), the project owner shall coordinate with the CPM to develop the Channel Maintenance Program. The project owner shall submit two copies of the programmatic documentation, describing the proposed Channel Maintenance Program, to the CPM (for review and approval). The project owner shall provide written notification that they plan to adopt and implement the measures identified in the approved Channel Maintenance Program. The project owner shall:~~

- ~~Supervise the implementation of a Channel Maintenance Program in accordance with conditions of certification;~~
- ~~Ensure the Project Construction and Operation Managers receive training on the Channel Maintenance Program;~~
- ~~As part of the Project Annual Compliance Report to the CPM, submit a Channel Maintenance Program Annual Report specifying which maintenance activities were completed during the year including type of work, location, and measure of the activity (e.g. cubic yards of sediment removed).~~

CLOSURE ~~AND DECOMMISSIONING~~ PLAN

SOIL&WATER-13 The project owner shall prepare **both a Provisional Closure Plan and a Final Closure Plan** ~~a decommissioning plan~~ that will meet the requirements of the BLM. The project owner shall identify likely **closure** ~~decommissioning~~ scenarios and develop **facility closure** ~~specific decommissioning~~ plans **in accordance with COM-15 "Facility Closure Plans" of the General Conditions.** ~~for each scenario that will identify a~~ **A**ctions to be taken to avoid or mitigate long-term impacts related to water and wind erosion after **the facility's closure need to be identified.** ~~decommissioning.~~ Actions may include such measures as a **facility closure** ~~decommissioning~~ SWPPP, revegetation and restoration of disturbed areas, post-**closure** ~~decommissioning~~ maintenance, collection and disposal of project materials and chemicals, and access restrictions.

Verification: ~~At least 60 days prior to the start of site mobilization or alternate date as agreed to with the CPM, the project owner shall submit decommissioning plans~~ **One (1) year after initiating commercial operation, the project owner must submit a Provisional Closure Plan and cost estimate for permanent closure to the CPM for review and approval. Three (3) years prior to closing, the owner must submit a Final Closure Plan** to the CPM for review and approval. The project owner shall amend these documents as necessary, with approval from the CPM, should the **facility closure** ~~decommissioning~~ scenario change in the future.

MITIGATION OF IMPACTS TO THE PALO VERDE MESA GROUNDWATER BASIN

SOIL&WATER-14 To mitigate the impact from Project pumping, the Project owner shall identify and implement offset measures to mitigate the increase in discharge from surface water to groundwater that affects recharge in the Palo Verde Valley Groundwater Basin (USGS). The project owner shall implement **SOIL&WATER-17** to evaluate the change in recharge over the life of the project including any latency effects from Project pumping. The activities shall include the following water conservation projects: payment for irrigation improvements in Palo Verde Irrigation District, payment for irrigation improvements in Imperial Irrigation District, purchase of water rights within the Colorado River Basin that will be held in reserve, and/or BLM's Tamarisk Removal Program or other proposed mitigation activities acceptable to the CPM.

The activities proposed for mitigation shall be outlined in a Water Offset Plan that will be provided to the CPM for review and approval and which shall include the following at a minimum:

A. Identification of the water offsets as determined in **SOIL&WATER-17**;

B. Demonstration of the Project owner's ability to conduct the activity;

C. Whether any governmental approval of the identified offset will be needed, and if so, whether additional approval will require compliance with CEQA or NEPA;

D. Demonstration of how much water is provided by each of the offset measures;

E. An estimated schedule for completion of the activities;

F. Performance measures that would be used to evaluate the amount of water replaced by the proposed offset measure; and,

G. A Monitoring and Reporting Plan outlining the steps necessary and proposed frequency of reporting to show the activities are achieving the intended benefits of the water supply offsets;

Verification: The project Owner shall submit a Water Offset Plan to the CPM for review and approval thirty (30) days before the start of extraction of groundwater for construction or operation.

The Project owner shall implement the activities reviewed and approved in the Water Offset Plan in accordance with the agreed upon schedule in the Water Offset Plan. If agreement with the CPM on identification or implementation of offset activities cannot be achieved the Project owner shall immediately halt construction or operation until the agreed upon activities can be identified and implemented.

GROUNDWATER PRODUCTION REPORTING

SOIL&WATER-15 The Project is subject to the requirement of Water Code Sections 4999 et. seq. for reporting of groundwater production in excess of 25 acre-feet per year.

<u>Verification</u>: The project owner shall file an annual "Notice of Extraction and Diversion of Water" with the SWRCB in accordance with Water Code Sections 4999 et. seq. The project owner shall include a copy of the filing in the annual compliance report.

GROUND SUBSIDENCE MONITORING AND ACTION PLAN

SOIL&WATER-16 One monument monitoring station per production well or a minimum of three stations shall be constructed to measure potential inelastic subsidence that may alter surface characteristics of the Chuckwalla Valley near the proposed production wells. The project owner shall:

A. Prepare and submit a Subsidence Monitoring Plan (SMP). The plan shall include the following elements:

   1. Construction diagrams of the proposed monument monitoring station including size and description, planned depth, measuring points, and protection measures;

   2. Map depicting locations (minimum of three) of the planned monument monitoring stations;

   3. Monitoring program that includes monitoring frequency, thresholds of significance, reporting format.

B. Prepare quarterly reports commencing three (3) months following commencement of groundwater production during construction and operations.

   1. The reports shall include presentation and interpretation of the data collected including comparison to the thresholds developed in Item C.

C. Prepare a Mitigation Action Plan that details the following:

   1. Thresholds of significance for implementation of proposed action plan;

      a. Any subsidence that may occur will not be allowed to damage existing structures either on or off the site or alter the appearance or use of the structure;

      b. Any subsidence that may occur will not be allowed to alter the natural drainage patterns or permit the formation of playas or lakes;

      c. Any subsidence that violates (a) or (b) will result in the project owner investigating the need to immediately reduce/cease pumping until the cause is identified or subsidence caused by project pumping abates and the structures and/or drainage patterns are stabilized and corrected.

2. Action Plan that details proposed actions by the ~~applicant~~**project owner** in the event thresholds are achieved during the monitoring program.

   The ~~applicant~~**project owner** shall submit the Ground Subsidence Monitoring and Action Plan that is prepared by an Engineering Geologist registered in the State of California 30 days prior to the start of extraction of groundwater for construction or operation.

Verification: The project owner shall do all of the following:

1. At least 30 days prior to project construction, the project owner shall submit to the CPM, a comprehensive report presenting all the data and information required in item A above.

2. The project owner shall submit to the CPM all calculations and assumptions made in development of the SMP.

3. During Project construction and operations, the project owner shall submit to the CPM quarterly reports presenting all the data and information required in item B above.

4. The project owner shall submit to the CPM all calculations and assumptions made in development of the report data and interpretations.

5. After the first five years of the monitoring period, the project owner shall submit a 5-year monitoring report to the CPM that submits all monitoring data collected and provides a summary of the findings. The CPM will determine if the Ground Subsidence Monitoring and Action Plan frequencies should be revised or eliminated.

ESTIMATION OF SURFACE WATER IMPACTS

SOIL&WATER-17 To further assess the impacts from Project pumping, the Project owner shall estimate the increase in discharge from surface water to groundwater that affects recharge in the Palo Verde Valley Groundwater Basin (PVVGB)(USGS). This estimate may be used for determining the appropriate offset volume in accordance with **SOIL&WATER-14**. The Project owner shall do the following to provide an estimate for review and approval by the CPM:

1. The Project owner shall conduct a detailed analysis of the affect from Project pumping on at the end of the 30 year operational period the change in groundwater outflow from the Chuckwalla Valley Groundwater Basin to the Palo Verde Valley and how the change in outflow may affect recharge of surface water to the PVVGB from the Project's groundwater extraction activities. The detailed analysis shall include:

   a. The conceptual model developed in the AFC and the Staff Assessment, for the Chuckwalla Valley Groundwater Basin and the Palo Verde Valley, and any changes resultant from further analysis in support of numerical modeling;

b. The use of an appropriately constructed groundwater model 1.) for the eastern portion of the Chuckwalla Valley Groundwater Basin that describes the effect from Project pumping on the outflow of groundwater to the Palo Verde Valley, and 2.) an appropriately constructed groundwater model of the Palo Verde Valley, inclusive of the mesa and floodplain. The models shall be coupled as appropriate to determine the effect from Project pumping on the surface water recharge in the Palo Verde Valley. Each model shall be constructed in consideration of the following:

    i. Horizontal and vertical geometry information gained through on- and offsite investigations conducted as part of the hydrogeological field investigations for the AFC, and any subsequently documented investigation performed as part of the model development ;

    ii. Aquifer properties developed as part of the AFC and any subsequently documented investigations performed as part of the model development, and an assessment of aquifer properties available from other published sources. The properties used shall be representative of the available data; and

    iii. The modeling effort shall include a sensitivity analysis where in the most sensitive variables will be identified and varied within a reasonable range outside of the calibration value to provide an assessment of the range of potential impacts from the Project pumping on the recharge from the Palo Verde Valley Groundwater Basin.

c. Reporting of the results of the modeling effort

d. Estimation of the increased contribution of surface water discharge to groundwater and the change in recharge to the Palo Verde Valley Groundwater Basin attributable to Project groundwater pumping.

2. The analysis shall include the following elements:

    a. The change in groundwater flux to the regional aquifer from surface water sources attributable to Project pumping in afy for the life of the Project (30 years) until pre-project (within 95%) conditions are achieved;

    b. A sensitivity analysis that would provide a range in the potential changes in flux relative to variation in the key model variables within each model as a result of Project pumping for life of the Project until pre-project (within 95%) conditions are achieved;

3. The project owner shall present the results of the conceptual model, numerical model, transient runs and sensitivity analysis in a report for review and approval by the CPM. The report shall include all pertinent information regarding the development of the numerical models. The report shall include as discussion of the following as appropriate to each model:
    a. Introduction
    b. Previous Investigations
    c. Conceptual Model
    d. Numerical Model and Input Parameters
    e. Sensitivity Analysis
    f. Transient Modeling Runs
    g. Conclusions

Verification: ~~Within thirty (30)~~ **At least ninety (90)** days ~~following certification~~ **prior to initiation of groundwater pumping for grading operations** of the proposed Project, the project owner shall submit to the CPM for their review and approval a report detailing the results of the modeling effort. The report shall include the estimated amount of change in discharge from surface water to groundwater within the Palo Verde Valley due to Project pumping. This estimate shall be used for determining the appropriate volume of water for offset in accordance with **SOIL&WATER-14.**

GROUNDWATER QUALITY MONITORING AND REPORTING PLAN

SOIL&WATER-18 The project owner shall submit a Groundwater Quality Monitoring and Reporting Plan to the CPM for review and approval. The Groundwater Quality Monitoring and Reporting Plan shall provide a description of the methodology for monitoring background and site groundwater quality following the Waste Discharge Requirements of **SOIL&WATER-6**, to assess the effects from pumping on changes in the aquifer water chemistry, and to monitor potential impacts from operation of proposed septic leach fields, if required. The initial background water quality sampling shall be implemented during the background groundwater level monitoring events in accordance with **SOIL&WATER-4**. Prior to project construction, access to offsite wells shall be obtained and samples collected and monitoring wells shall be installed to evaluate background water quality in the shallow and deep regional aquifer in areas that will be affected by Project pumping. These data will be used to establish pre-construction water quality that can be quantitatively compared against data gathered during construction and operation to assess if project pumping or a release from the waste management units (See **SOIL&WATER-6**), or septic systems (if required) has adversely affected the water supply or sensitive receptors.

1. A Groundwater Quality Monitoring and Reporting Plan shall be submitted to the CPM 90 days prior to operation of the water supply wells for construction. The Plan shall include a scaled map showing the site and vicinity, existing well locations, and proposed monitoring locations (both existing wells and new monitoring wells proposed for construction). Additional monitoring wells that shall be installed include wells required in accordance with Condition of Certification **SOIL&WATER-6**, for the evaporation ponds and land treatment unit proposed for the project, and if required for the sanitary leachfield system. The map shall also include relevant natural and man-made features (existing and proposed as part of this project). The plan also shall provide: (1) well construction information and borehole lithology for each existing well proposed for use as a monitoring well; (2) description of proposed drilling and well installation methods; (3) proposed monitoring well design; and, (4) schedule for completion of the work.

2. A Well Monitoring Installation and Groundwater Quality Network Report shall be submitted to the CPM for review and approval in conjunction with Condition of Certification **SOIL&WATER-4** and 60 days prior to operation of the water supply wells.. The report shall include a scaled map showing the final monitoring well network. It shall document the drilling methods employed, provide individual well construction as-builds, borehole lithology recorded from the drill cuttings, well development, and well survey results. The well survey shall measure the location and elevation of the top of the well casing and reference point for all water level measurements, and shall include the coordinate system and datum for the survey measurements. Additionally, the report shall describe the water level monitoring equipment employed in the wells and document their deployment and use.

3. As part of the monitoring well network development, all newly constructed monitoring wells shall be constructed consistent with State and Riverside County specifications.

4. Prior to use of any groundwater for construction, all groundwater quality and groundwater level monitoring data shall be reported to the CPM in the Well Monitoring Installation and Groundwater Quality Network Report that is due in conjunction with the background water level monitoring report under **SOIL&WATER-4** and 60 days prior to construction. The report shall include the following:

    a. An assessment of pre-project groundwater levels, a summary of available climatic information (monthly average temperature and rainfall records from the nearest weather station), and a comparison and assessment of water level data relative to the assumptions and spatial trends simulated by the ~~applicant~~**project owner's** groundwater model.

b. An assessment of pre-project groundwater quality with groundwater samples analyzed for those constituents required under the Waste Discharge Requirements (Appendix B, C and D) and if not included total dissolved solids (TDS), chloride, nitrates, major cations and anions, oxygen-18 and deuterium isotopes, and soluble metals.

c. The data shall be tabulated and include the estimated range (minimum and maximum values), average, and median for each constituent analyzed. If a sufficient number of data points are available from the background sampling, the data shall also be analyzed using the Mann-Kendall test for trend at 90% confidence to assess whether pre-project water quality trends, if any, are statistically significant.

5. During project construction and during the first five years of project operations, the project owner shall semi-annually monitor the quality of groundwater and changes in groundwater elevation and submit data semiannually to the CPM one month following the end of the 1st and 3rd quarter and following the operation reporting requirement under **SOIL&WATER-4**. After five years of project operations, the frequency and scope of the monitoring program shall be reassessed by the CPM. The semi-annual report shall document water level monitoring methods, the water level data, water level plots, and a comparison between pre- and post-project start-up water level trends as itemized below. The report shall also include a summary of actual water use conditions, monthly climatic information (temperature and rainfall) from the nearest meteorological monitoring station, and a comparison and assessment of water level data relative to the assumptions and simulated spatial trends predicted by the ~~applicant~~**project owner's** groundwater model.

   a. Groundwater samples from all wells in the monitoring well network shall be analyzed and reported semi-annually for those constituents required in the Waste Discharge Requirements (Appendix B, C and D) and if not included TDS, chloride, nitrates, cations and anions, oxygen-18 and deuterium isotopes.

   b. For analysis purposes, pre-project water quality shall be defined by samples collected prior to project construction as specified above, and compliance data shall be defined by samples collected after the construction start date to determine the effects from Project pumping and after the installation and operation of the waste management units in compliance with the Waste Discharge Requirements (Appendix B, C and D) and the sanitary leachfields, if required.

   c. Trends in water quality data shall be analyzed using the Mann-Kendall test for trend at the 90% confidence. Trends in the compliance data shall be compared and contrasted to pre-project trends, if any.

d. The contrast between pre-project and compliance mean or median concentrations shall be compared using an Analysis of Variance (ANOVA) or other appropriate statistical method approved by the CRBRWQCB for evaluation of water quality impacts. A parametric ANOVA (for example, an F-test) can be conducted on the two data sets if the residuals between observed and expected values are normally distributed and have equal variance, or the data can be transformed to an approximately normal distribution. If the data cannot be represented by a normal distribution, then a nonparametric ANOVA shall be conducted (for example, the Kruskal-Wallis test). If a statistically significant difference is identified at 90% confidence between the two data sets, the monitoring data are inconsistent with random differences between the pre-project and baseline data indicating a significant water quality impact from project pumping may be occurring.

e. If compliance data to evaluate the effects from Project pumping or potential impacts from operation of sanitary leachfield indicate that the water supply quality has deteriorated in (exceeds pre-project constituent concentrations in TDS, sodium, chloride, or other constituents identified as part of the monitoring plan and applicable Water Quality Objectives are exceeded for the applicable beneficial uses of the water supply) adjacent water supply wells that can be shown to be adversely influenced by Project Pumping for three consecutive years, the Project owner shall provide well-head treatment or a new water supply to either meet or exceed pre-project water quality conditions to any impacted water supply wells.

Verification: The project owner shall complete the following:

At least 90 days prior to construction, a Groundwater Level and Quality Monitoring and Reporting Plan shall be submitted to the CPM for review and approval.

At least 60 days prior to construction, a Well Monitoring Installation and Groundwater Level Network Report shall be submitted to the CPM for review and approval.

At least 60 days prior to use of any groundwater for construction, all groundwater quality and groundwater level monitoring data shall be reported to the CPM.

On a semiannual basis water quality data shall be collected during construction and 5 years following initial operation. The results of the monitoring will be reported on a semiannual basis, one month following the end of the 1st and 3rd quarters.

NON-TRANSIENT, NON-COMMUNITY WATER SYSTEM

SOIL&WATER-19 The Project is subject to the requirement of Title 22, Article 3, Sections 64400.80 through 64445 for a non-transient, non-community water system (serving 25 people or more for more than six months). In addition, the system shall require periodic monitoring for various bacteriological, inorganic and organic constituents.

Verification: The project owner shall submit the equivalent County of Riverside requirements to operate a non-transient, non-community water system with the County of Riverside at least 60 days prior to commencement of operations at the site. In addition, the project owner shall submit to the CPM a monitoring and reporting plan for production wells operated as part of the domestic water supply system prior to plant operations. The plan shall include reporting requirements including monthly, quarterly and annual submissions.

The project owner shall designate a California Certified Water Treatment Plant Operator as well as the technical, managerial and financial requirements as prescribed by State law. The project owner shall supply updates on an annual basis of monitoring requirements, any required submittals equivalent to the County of Riverside requirements including annual renewal requirements.

STORM WATER DAMAGE MONITORING AND RESPONSE PLAN

SOIL&WATER-20 The project owner shall reduce impacts caused by large storms by ensuring heliostats and diversion channels withstand the 100-year storm event, establishing ongoing maintenance and inspection of storm water controls, and implementing a response plan to clean up damage and address ongoing issues.

The project owner shall ensure that the heliostats and diversion channels are designed and installed to withstand storm water scour that may occur as a result of a 100-year, 24-hour storm event. The project owner shall implement a fence inspection and repair program to repair fencing after major storm events. The analysis of the storm event and resulting heliostat stability will be provided within a Pylon Insertion Depth and Heliostat Stability Report to be completed by the project owner. This analysis will incorporate results from site-specific geotechnical stability testing, as well as hydrologic and hydraulic storm water modeling performed by the project owner. The modeling will be completed using methodology and assumptions approved by the CPM.

The project owner shall also develop a Storm Water Damage Monitoring and Response Plan to evaluate potential impacts from storm water, including damage to diversion channels, perimeter fencing, and heliostats that fail due to storm water flow or otherwise break and scatter mirror debris or other potential pollutants on to the ground surface.

The basis for determination of pylon embedment depths shall employ a step-by-step process as identified below and approved by the CPM:

A. **Determination of peak storm water flow within each sub-watershed from a 100-year event:**

- **Use of *Riverside County Flood Control and Water Conservation District Hydrology Manual (Riverside County Manual)* to specify hydrologic parameters to use in calculations; and**

- HEC -1 and Flo-2D models (or other approved models) will be developed to calculate storm flows from the mountain watersheds upstream of the project site, and flood flows at the project site, based upon hydrologic parameters from Riverside County.

B. Determination of potential total pylon scour depth:

- Potential channel erosion depths will be determined using the calculated design flows, as determined in A above, combined with Flo-2D to model onsite sediment transport.
- Potential local scour will be determined using the calculated design flows, as determined in A above, combined with the Federal Highway Administration (FHWA) equation for local bridge pier scour from the FHWA 2001 report, "Evaluating Scour at Bridges."

C. The results of the scour depth calculations and pylon stability testing will be used to determine the minimum necessary pylon embedment depth within the active channels. In the inactive portions of the alluvial fans that are not subject to channel erosion and local scour, the minimum pylon embedment depths will be based on the results of the pylon stability testing.

D. The results of the calculated peak storm water flows and channel erosion and heliostat scour analysis together with the recommended heliostat installation depths shall be submitted to the CPM for review and approval sixty (60) days before the start of heliostat installation.

The Storm Water Damage Monitoring and Response Plan shall be submitted to the CPM for review and approval and shall include the following:

- Detailed maps showing the installed location of all heliostats within each project phase;
- Description of the method of removing all soil spoils should any be generated;
- Each heliostat should be identified by a unique ID number marked to show initial ground surface at its base, and the depth of the pylon below ground;
- Minimum Depth Stability Threshold to be maintained of pylons to meet long-term stability for applicable wind, water (flowing and static), and debris loading effects;
- Above and below ground construction details of a typical installed heliostat;
- BMPs to be employed to minimize the potential impact of broken mirrors to soil resources;

- **Methods and response time of mirror cleanup and measures that may be used to mitigate further impact to soil resources from broken mirror fragments; and**
- **Monitoring, documenting, and restoring the adjacent offsite downstream property when impacted by sedimentation or broken mirror shards.**

A plan to monitor and inspect periodically, before first seasonal and after every storm event:

- **Security and Tortoise Exclusion Fence: Inspect for damage and buildup of sediment or debris**
- **Heliostats within drainages or subject to drainage overflow or flooding: Inspect for tilting, mirror damage, depth of scour compared to pylon depth below ground and the Minimum Depth Stability Threshold, collapse, and downstream transport.**
- **Drainage channels: Inspect for substantial migration or changes in depth, and transport of broken glass.**
- **Constructed diversion channels: Inspect for scour and structural integrity issues caused by erosion, and for sediment and debris buildup.**
- **Adjacent offsite downstream property: Inspect for changes in the surface texture and quality from sediment buildup, erosion, or broken glass.**

Short-Term Incident-Based Response:

- **Security and Tortoise Exclusion Fence: repair damage, and remove built-up sediment and debris.**
- **Heliostats: Remove broken glass, damaged structure, and damaged wiring from the ground, and for pylons no longer meeting the Minimum Depth Stability Threshold, either replace/reinforce or remove the mirrors to avoid exposure for broken glass.**
- **Drainage channels: no short-term response necessary unless changes indicate risk to facility structures.**
- **Constructed diversion channels: repair damage, maintain erosion control measures and remove built-up sediment and debris.**

Long-Term Design-Based Response:

- **Propose operation/BMP modifications to address ongoing issues. Include proposed changes to monitoring and response procedures, frequency, or standards.**
- **Replace/reinforce pylons no longer meeting the Minimum Depth Stability Threshold or remove the mirrors to avoid exposure for broken glass.**

- Propose design modifications to address ongoing issues. This may include construction of active storm water management diversion channels and/or detention ponds.

Inspection, short-term incident response, and long-term design based response may include activities both inside and outside of the project boundaries. For activities outside of the project boundaries the owner shall ensure all appropriate environmental review and approval has been completed before field activities begin.

Verification: At least sixty (60) days prior to installation of the first pylon, the project owner shall submit to the CPM a copy of the Pylon Insertion Depth and Heliostat Stability Report for review and approval prior to construction. At least sixty (60) days prior to commercial operation, the project owner shall submit to the CPM a copy of the Storm Water Damage Monitoring and Response Plan for review and approval prior to commercial operation. The project owner shall retain a copy of this plan onsite at the power plant at all times. The project owner shall prepare an annual summary of the number of heliostats failed due to damage, cause and extent of the damage, and cleanup and mitigation performed for each damaged heliostat. The annual summary shall also report on the effectiveness of the diversion channels against storms, including information on the damage and repair work or associated erosion control elements. The project owner shall submit proposed changes or revisions to the Storm Water Damage Monitoring and Response Plan to the CPM for review and approval.

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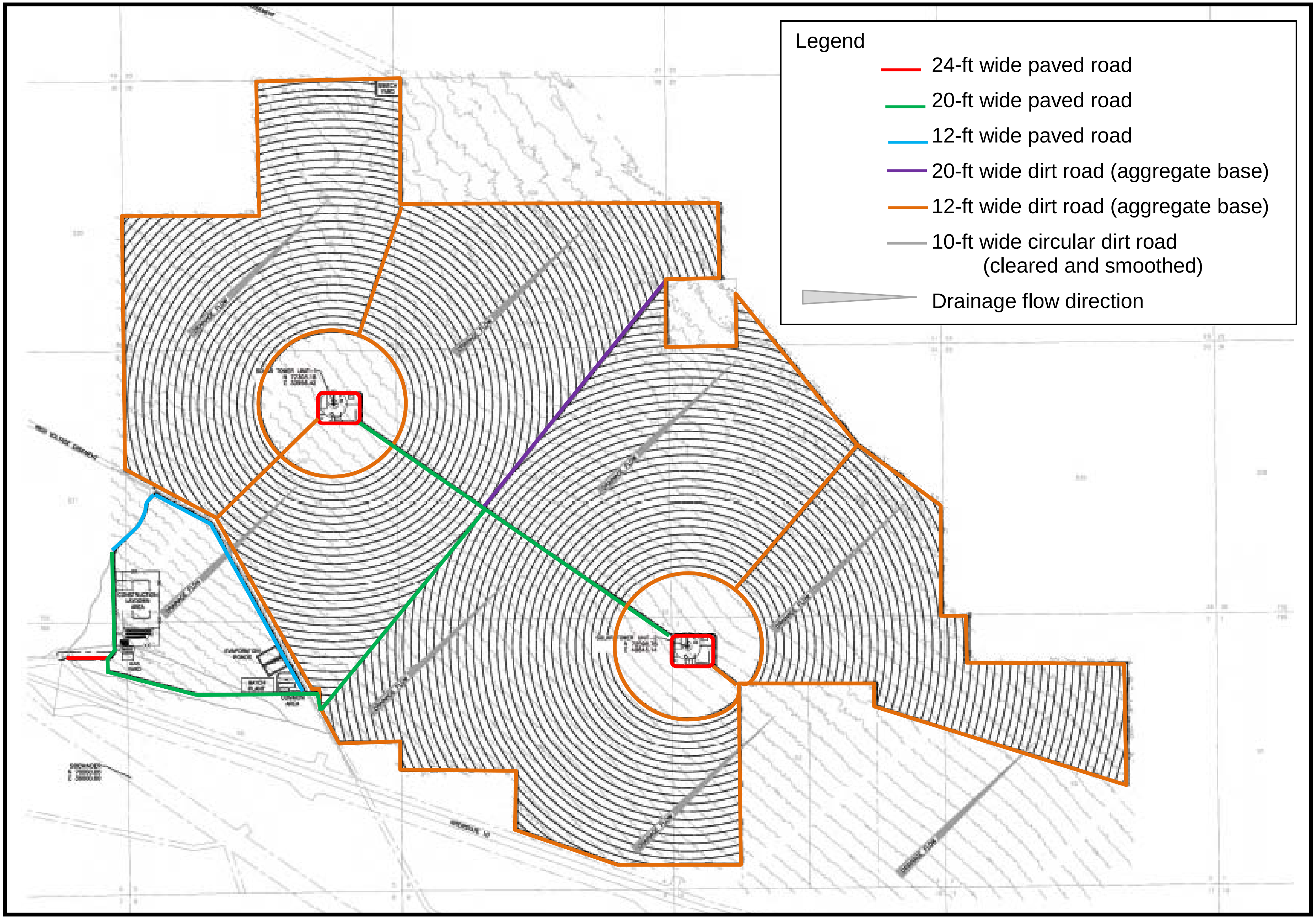
SOIL AND WATER RESOURCES - FIGURE 1

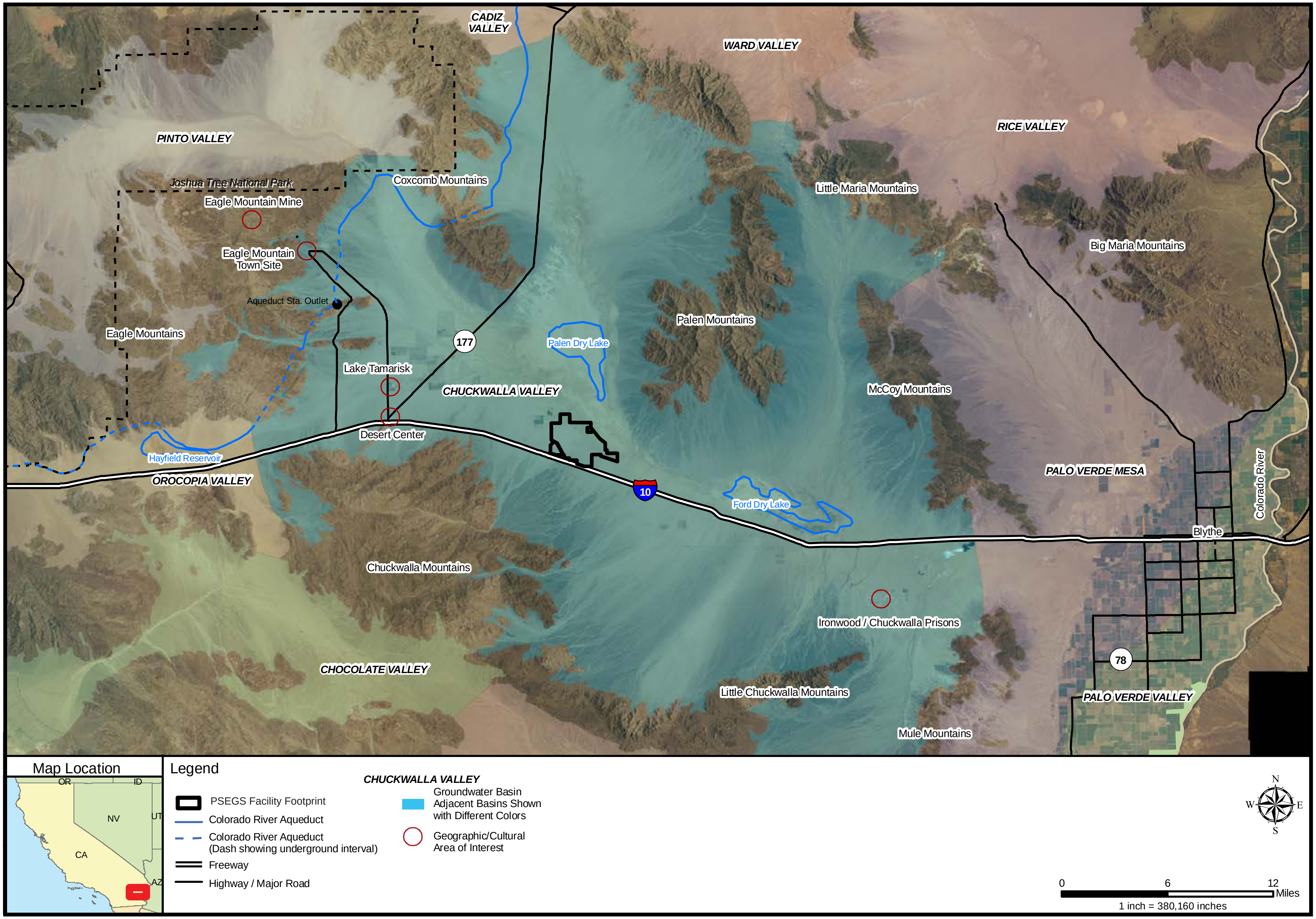
Palen Solar Electric Generating System - Civil Overall Grading and Drainage Plan



SOURCE: Palen 2012a, Palen 2013a

SOIL AND WATER RESOURCES - FIGURE 2

Palen Solar Electric Generating System - Chuckwalla Valley Regional Groundwater Basins



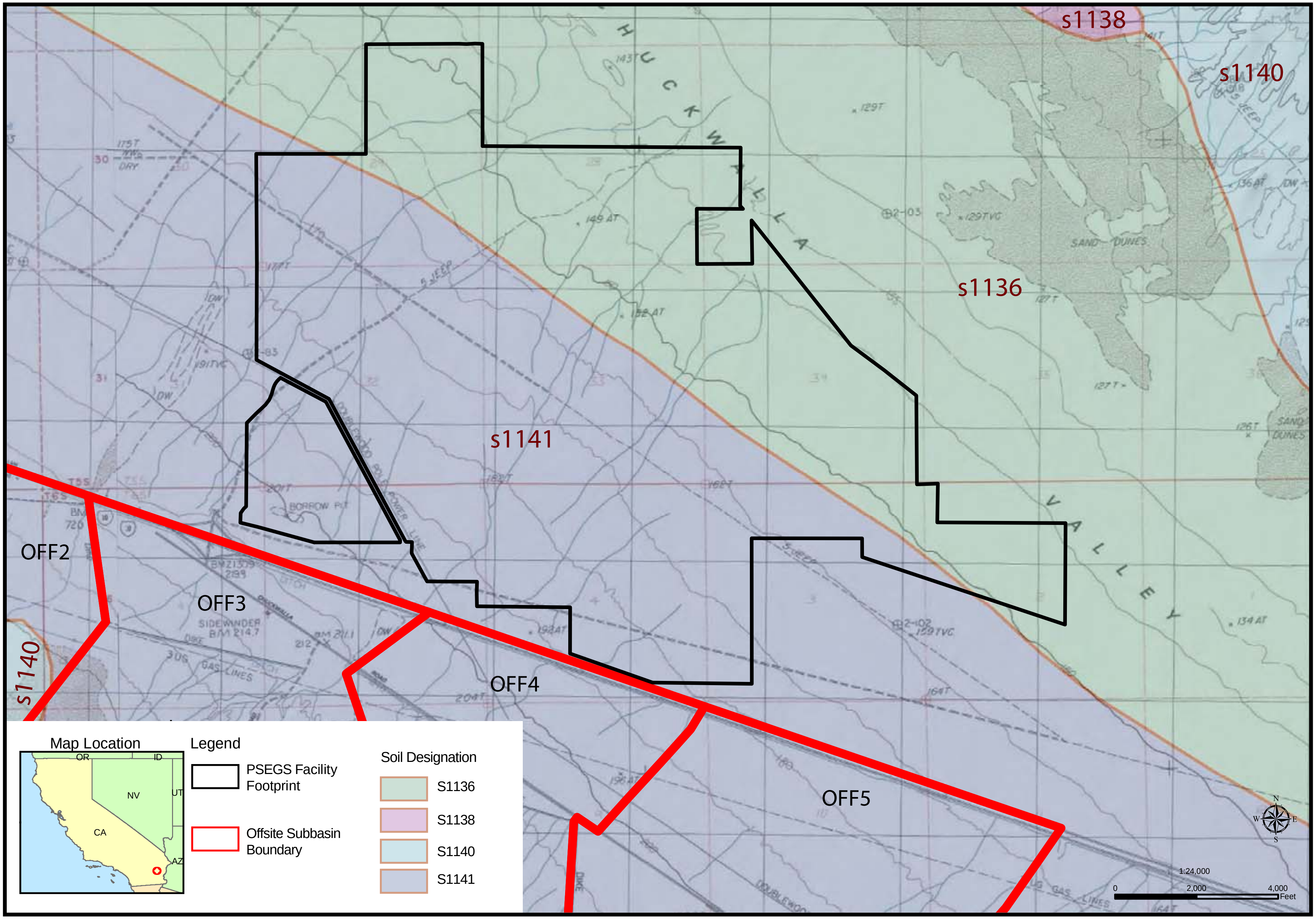
SOIL AND WATER RESOURCES

CALIFORNIA ENERGY COMMISSION - SITING, TRANSMISSION AND ENVIRONMENTAL PROTECTION DIVISION

SOURCE: AECOM 2010

SOIL AND WATER RESOURCES - FIGURE 3

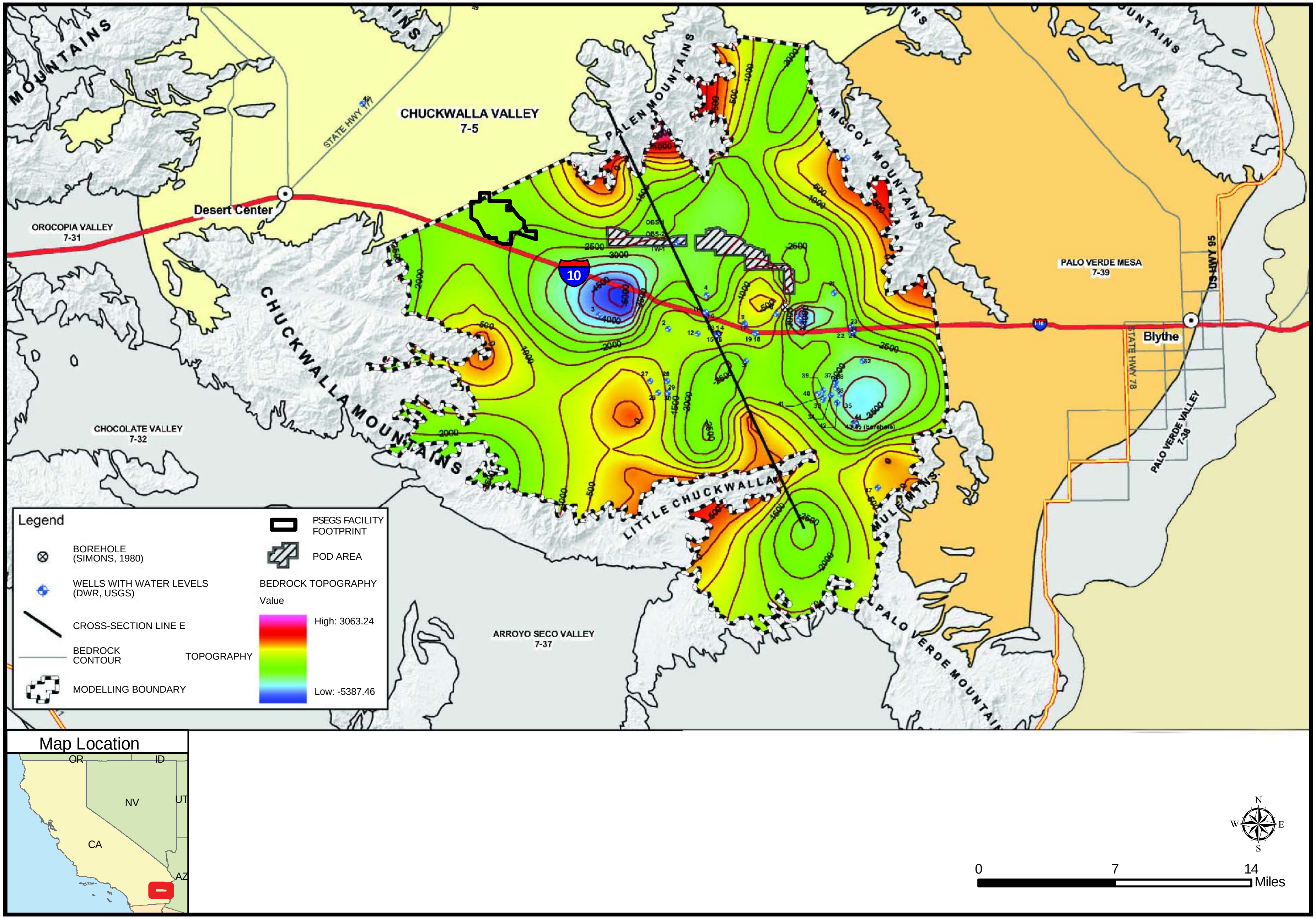
Palen Solar Electric Generating System - Regional Soils Map



SOURCE: BrightSource 2012, Palen 2013a, Appendix A

SOIL AND WATER RESOURCES - FIGURE 4

Palen Solar Electric Generating System - Chuckwalla Valley Groundwater Basin Bedrock Topography - Ford Dry Lake Site



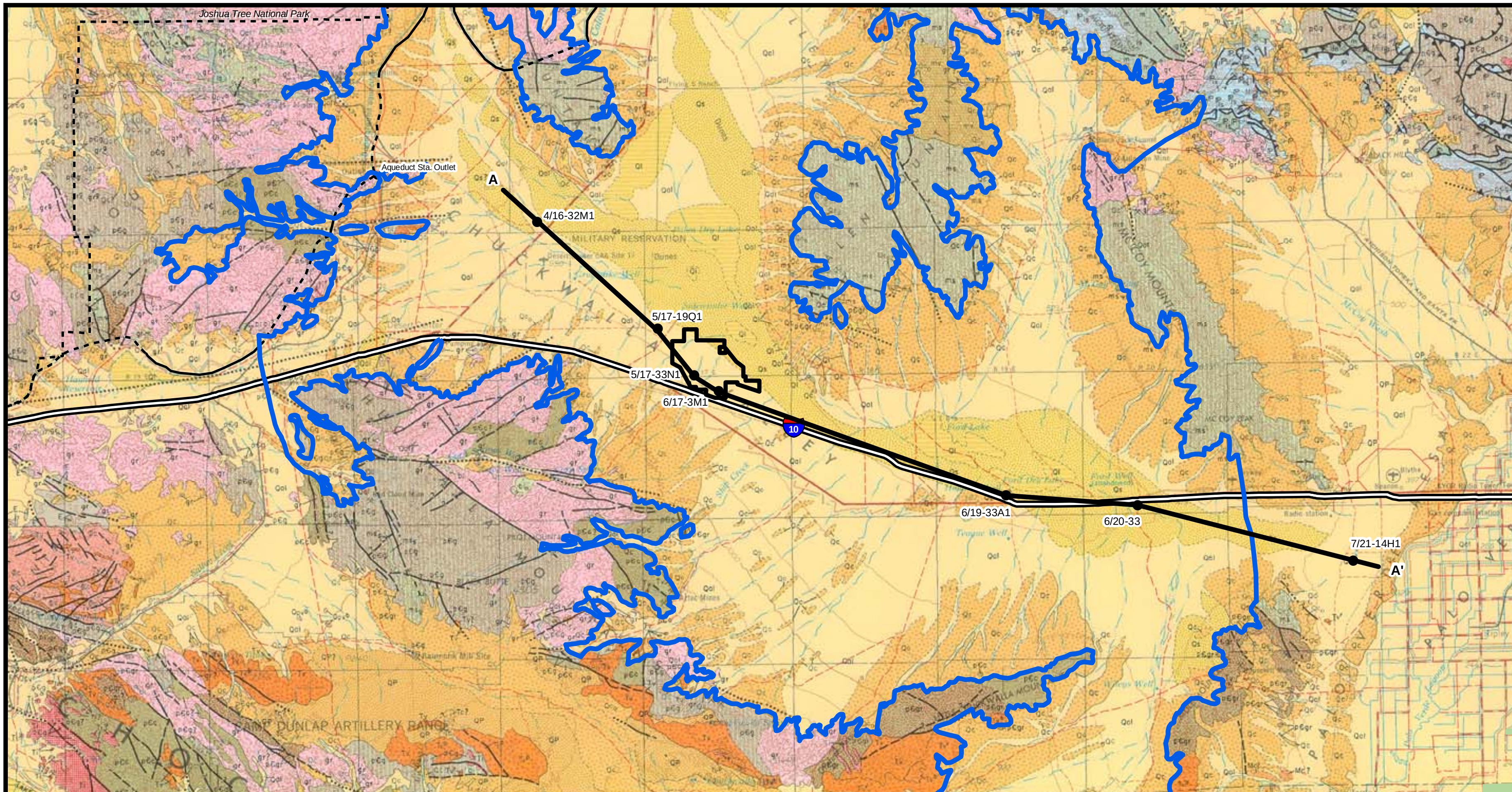
SOIL AND WATER RESOURCES

CALIFORNIA ENERGY COMMISSION - SITING, TRANSMISSION AND ENVIRONMENTAL PROTECTION DIVISION

SOURCE: WorleyParsons 2009

SOIL AND WATER RESOURCES - FIGURE 5A

Palen Solar Electric Generating System - Regional Geology Map



MAP LOCATION

LEGEND

PSEGS Facility Footprint
Colorado River Aqueduct
Colorado River Aqueduct
(Dash showing underground interval)

Groundwater Well
Chuckwalla Valley Groundwater Basin Boundary
Cross-Section Line
Freeway

0 4 8 Miles

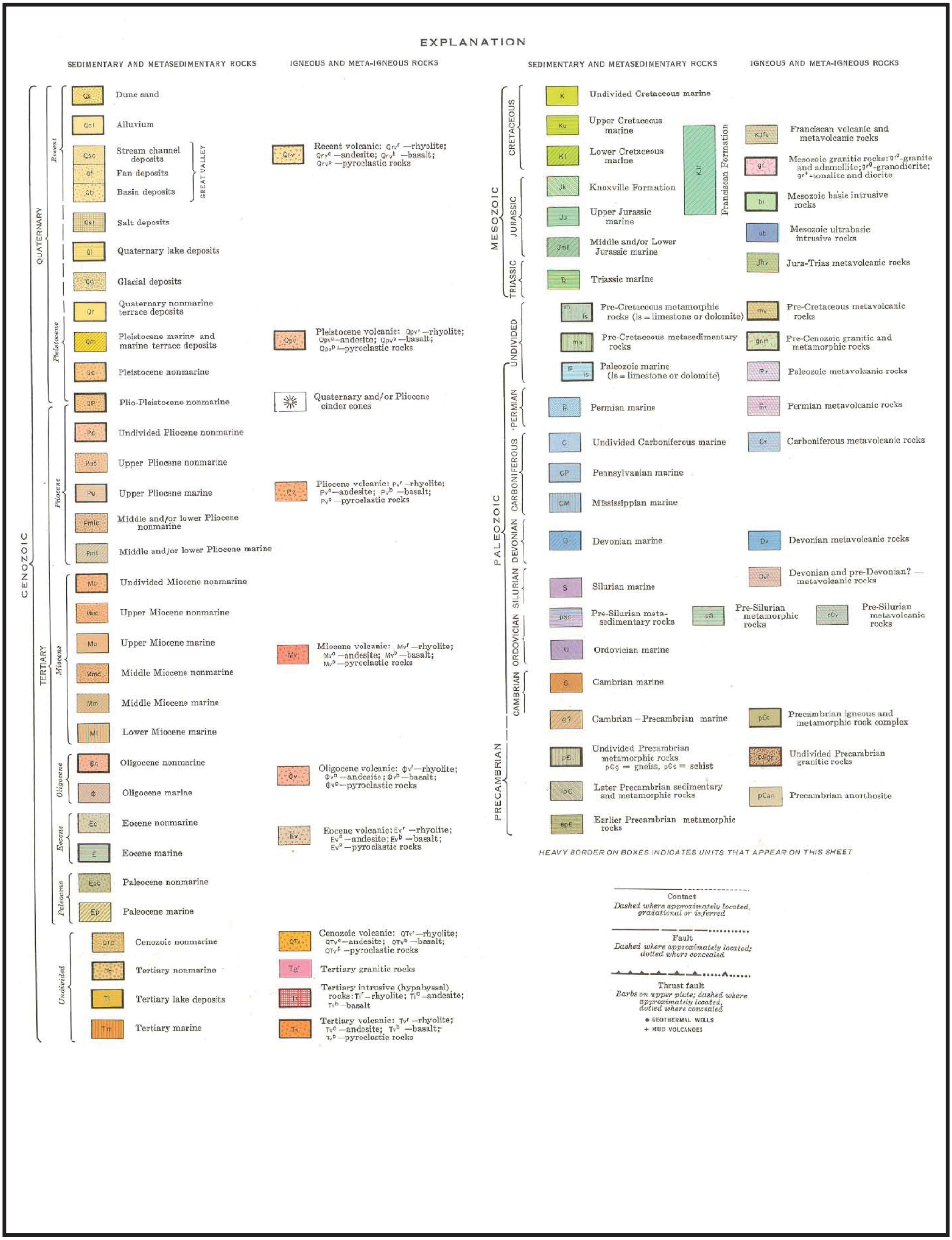
1 inch = 21,120 feet

CALIFORNIA ENERGY COMMISSION - SITING, TRANSMISSION AND ENVIRONMENTAL PROTECTION DIVISION

SOURCE: AECOM 2010

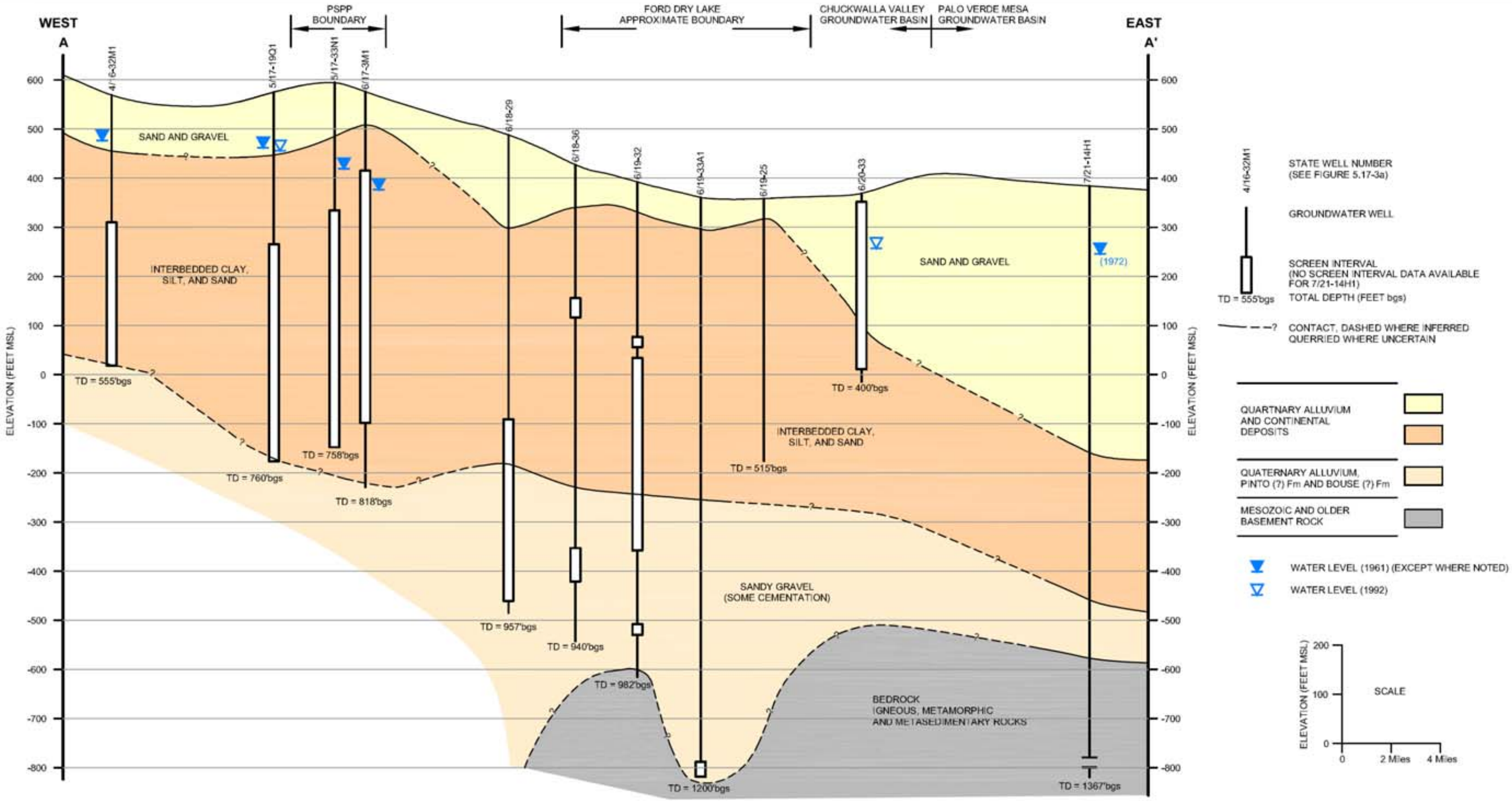
SOIL AND WATER RESOURCES - FIGURE 5B

Palen Solar Electric Generating System - Regional Geology Map Legend



SOIL AND WATER RESOURCES - FIGURE 6

Palen Solar Electric Generating System - Chuckwalla Valley Groundwater Basin Cross Section A-A



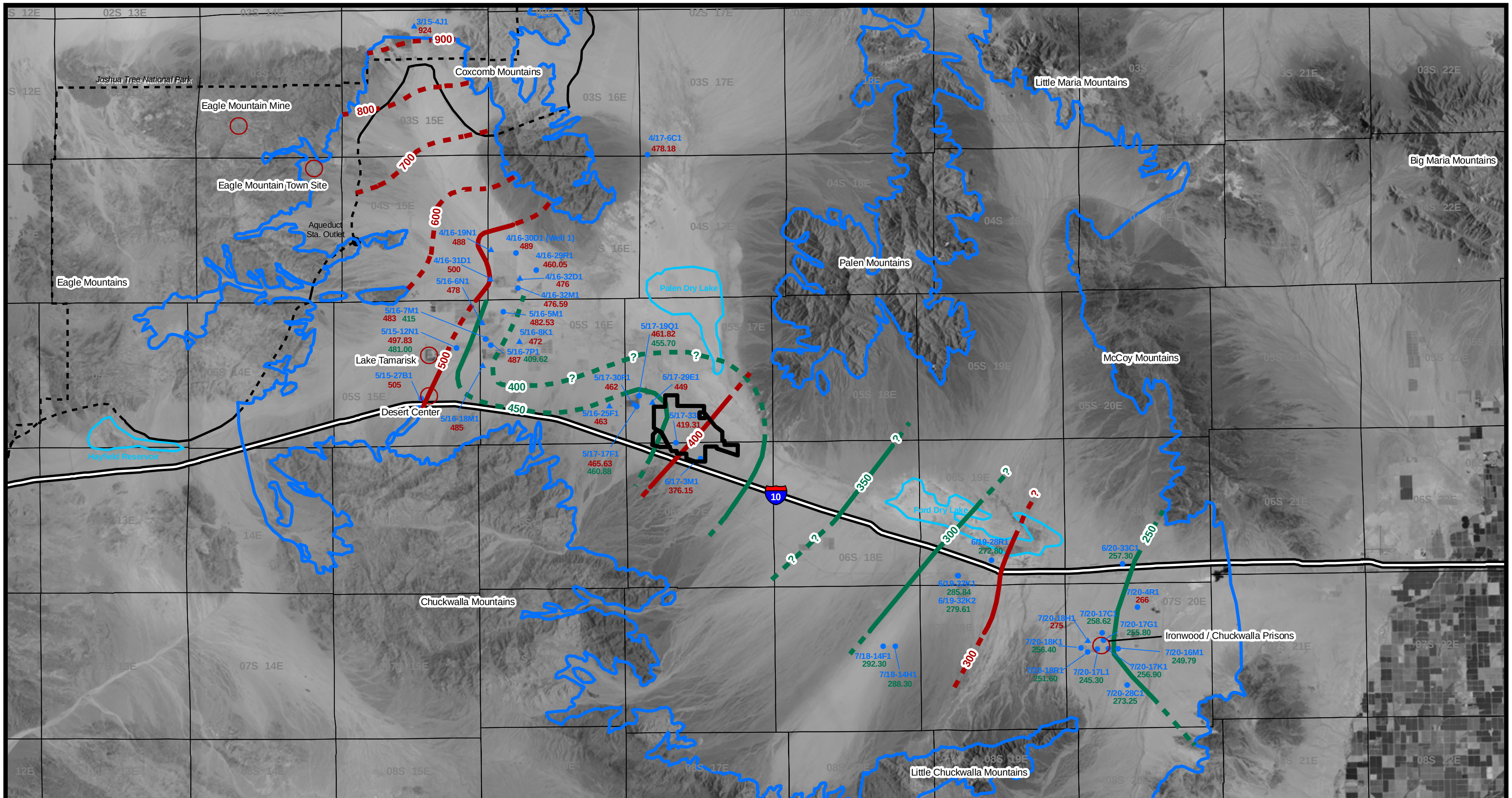
Map Location

CALIFORNIA ENERGY COMMISSION - SITING, TRANSMISSION AND ENVIRONMENTAL PROTECTION DIVISION

SOURCE: AECOM 2010

SOIL AND WATER RESOURCES - FIGURE 7

Palen Solar Electric Generating System - Chuckwalla Valley Groundwater Basin Pre Project Conditions



Map Location

Legend

- PSEGS Facility Footprint
- Colorado River Aqueduct
- Colorado River Aqueduct (Dash showing underground interval)
- Chuckwalla Valley Groundwater Basin Boundary
- Freeway
- Groundwater Well Location based on Latitude and Longitude in USGS Database
- Groundwater Well Location based on the State Well Number (approximate)
- Geographic/Cultural Area of Interest
- 5/17-17F1 State Well Number
- 465.63 1961 Groundwater Elevation (feet msl) (Data from April, May and June)
- 460.88 1992 Groundwater Elevation (feet msl)
- ? 1961 Groundwater Contour, Dashed where inferred; Querried where uncertain.
- ? 1992 Groundwater Contour, Dashed where inferred; Querried where uncertain.

N W E S

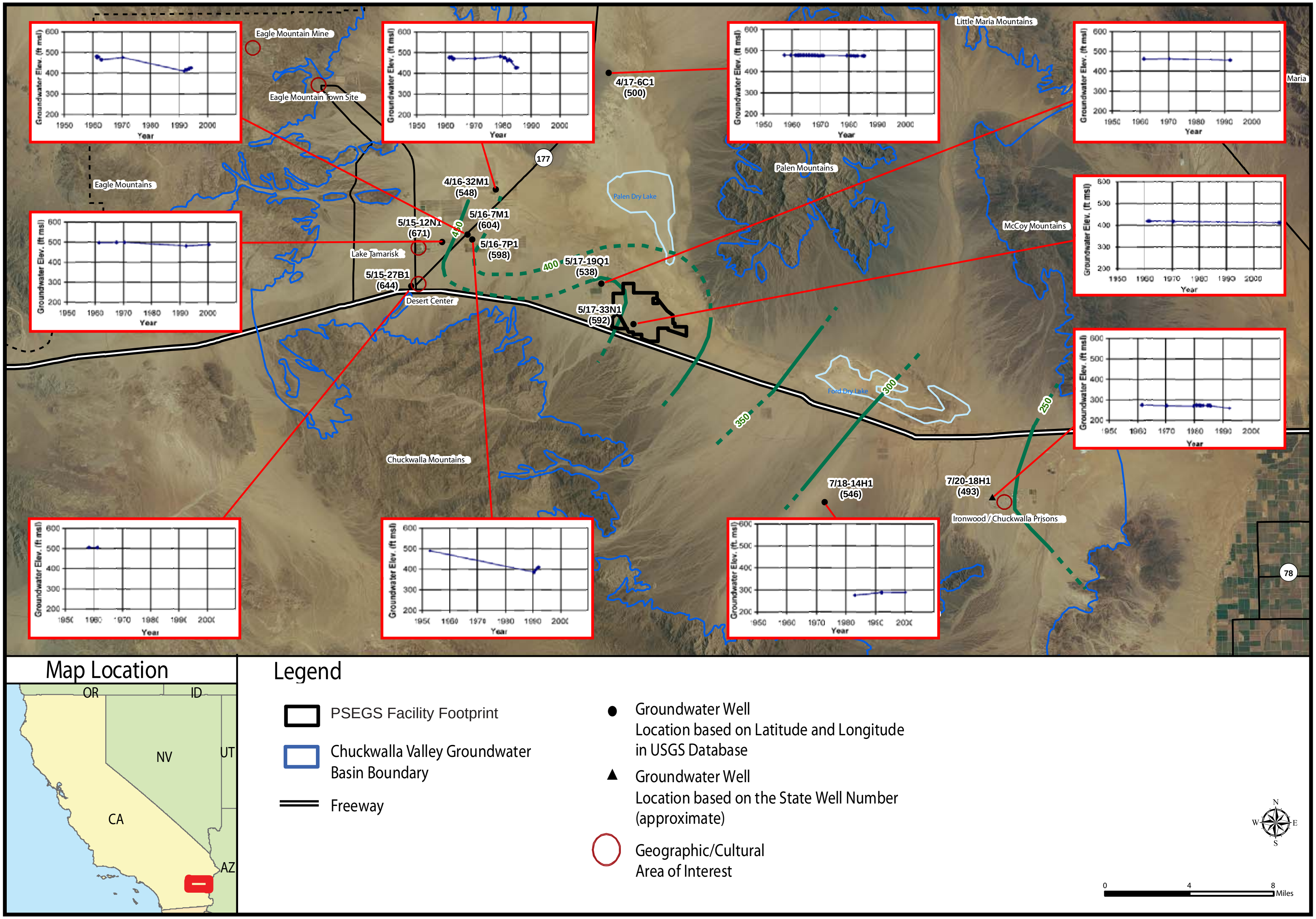
0 4 8 Miles

CALIFORNIA ENERGY COMMISSION - SITING, TRANSMISSION AND ENVIRONMENTAL PROTECTION DIVISION

SOURCE: AECOM 2010

SOIL AND WATER RESOURCES - FIGURE 8

Palen Solar Electric Generating System - Basin Wide Groundwater Hydrographs

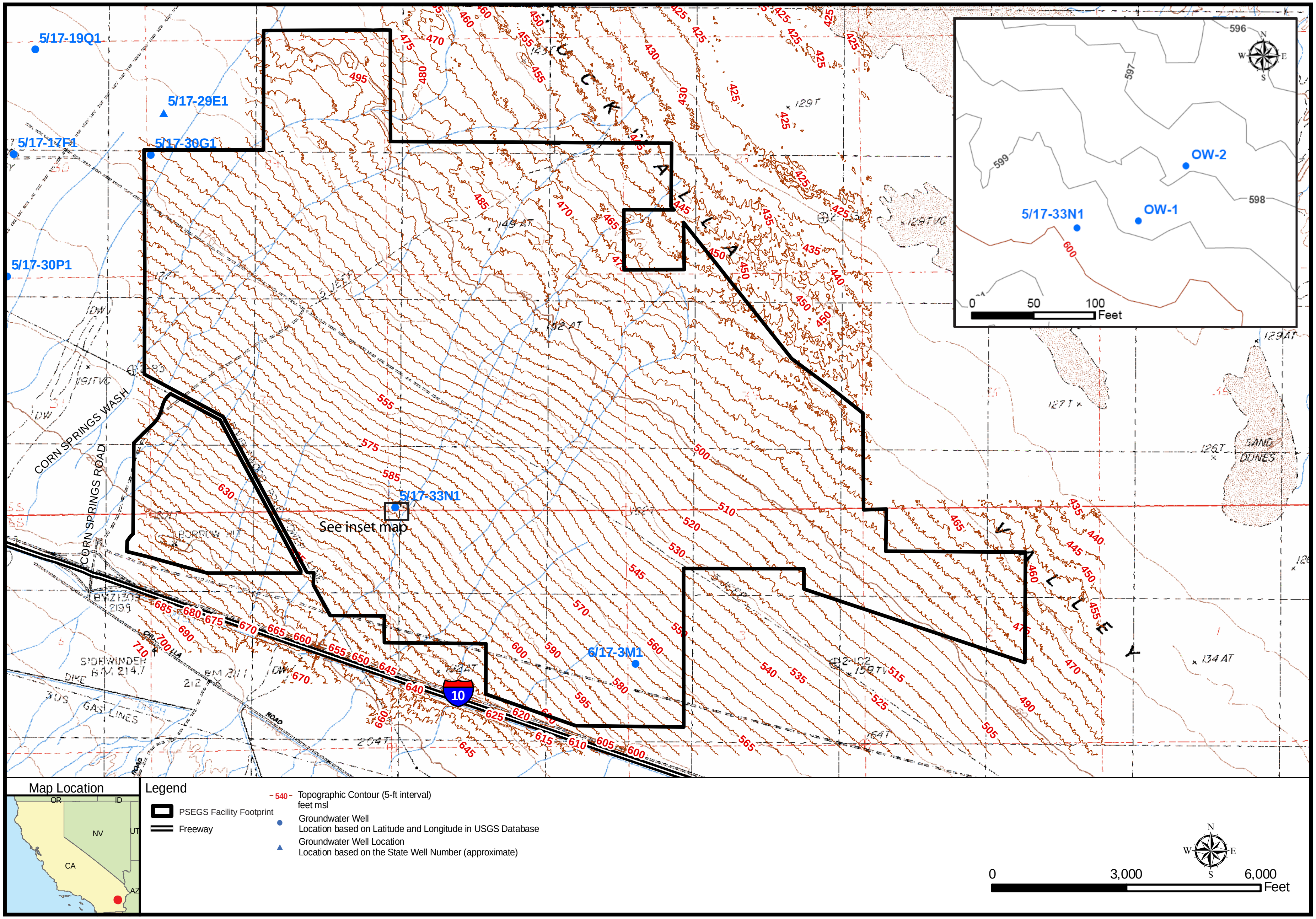


CALIFORNIA ENERGY COMMISSION - SITING, TRANSMISSION AND ENVIRONMENTAL PROTECTION DIVISION

SOURCE: AECOM 2010

SOIL AND WATER RESOURCES - FIGURE 9

Palen Solar Electric Generating System - Chuckwalla Valley Groundwater Basin Well Locations

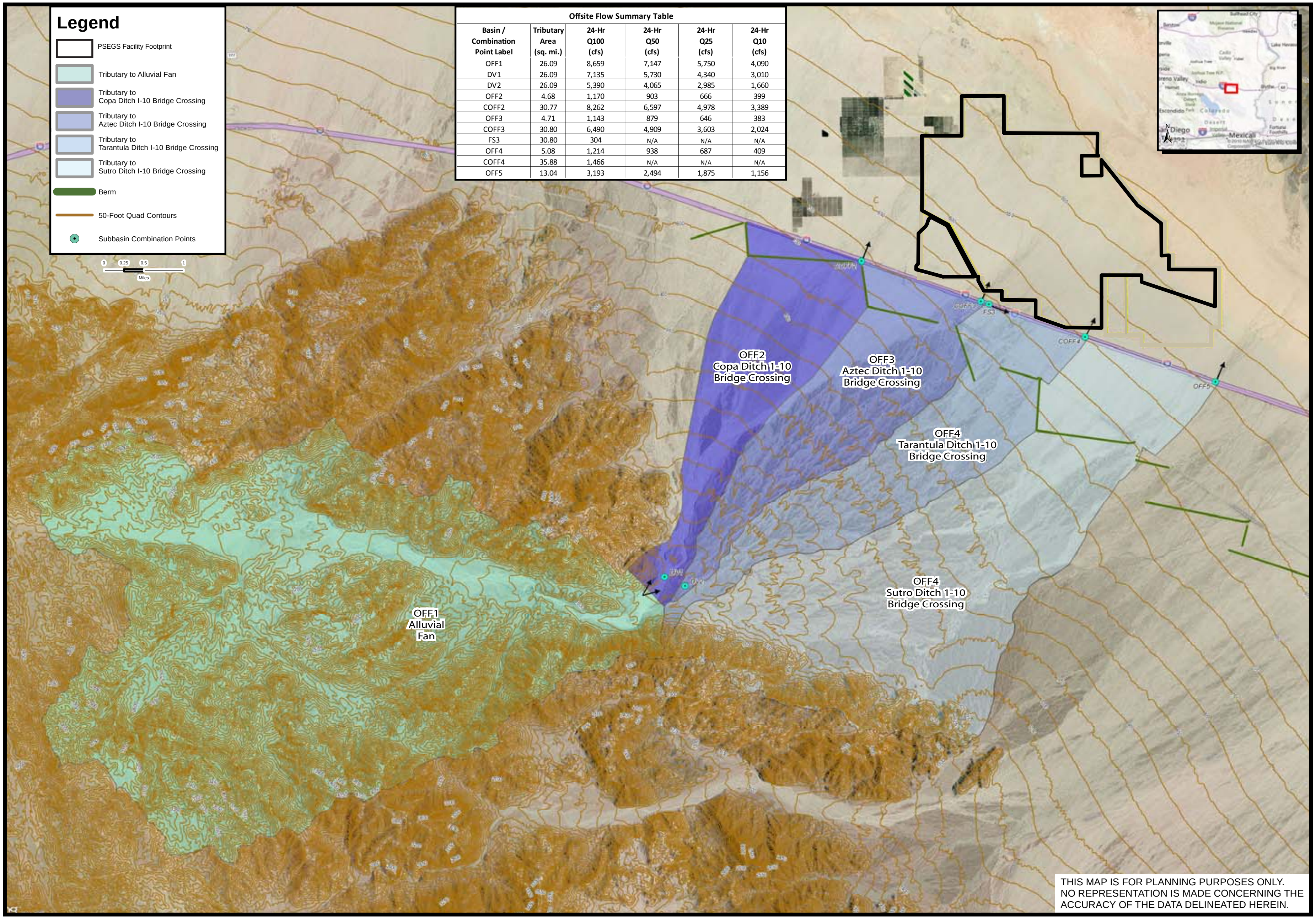


CALIFORNIA ENERGY COMMISSION - SITING, TRANSMISSION AND ENVIRONMENTAL PROTECTION DIVISION

SOURCE: Solar Millennium2009a

SOIL AND WATER RESOURCES - FIGURE 10

Palen Solar Electric Generating Sytem - Existing Condition Basin Map



Offsite Flow Summary Table

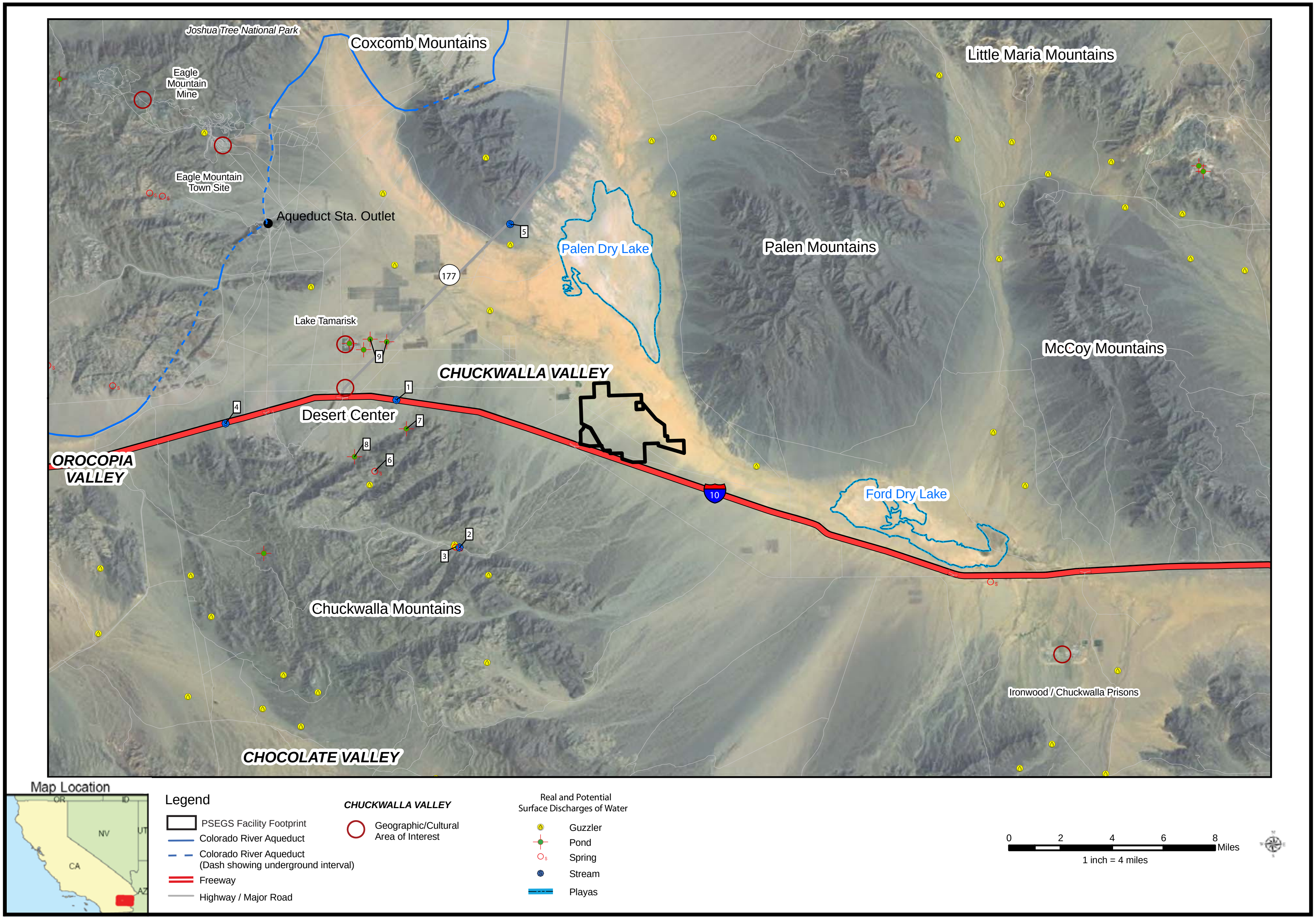
Basin / Combination Point Label	Tributary Area (sq. mi.)	24-Hr Q100 (cfs)	24-Hr Q50 (cfs)	24-Hr Q25 (cfs)	24-Hr Q10 (cfs)
OFF1	26.09	8,659	7,147	5,750	4,090
DV1	26.09	7,135	5,730	4,340	3,010
DV2	26.09	5,390	4,065	2,985	1,660
OFF2	4.68	1,170	903	666	399
COFF2	30.77	8,262	6,597	4,978	3,389
OFF3	4.71	1,143	879	646	383
COFF3	30.80	6,490	4,909	3,603	2,024
FS3	30.80	304	N/A	N/A	N/A
OFF4	5.08	1,214	938	687	409
COFF4	35.88	1,466	N/A	N/A	N/A
OFF5	13.04	3,193	2,494	1,875	1,156

CALIFORNIA ENERGY COMMISSION - SITING, TRANSMISSION AND ENVIRONMENTAL PROTECTION DIVISION

SOURCE: Palen 2013e Attachment G

SOIL AND WATER RESOURCES - FIGURE 11

Palen Solar Electric Generating System - Chuckwalla Valley Springs and Seeps

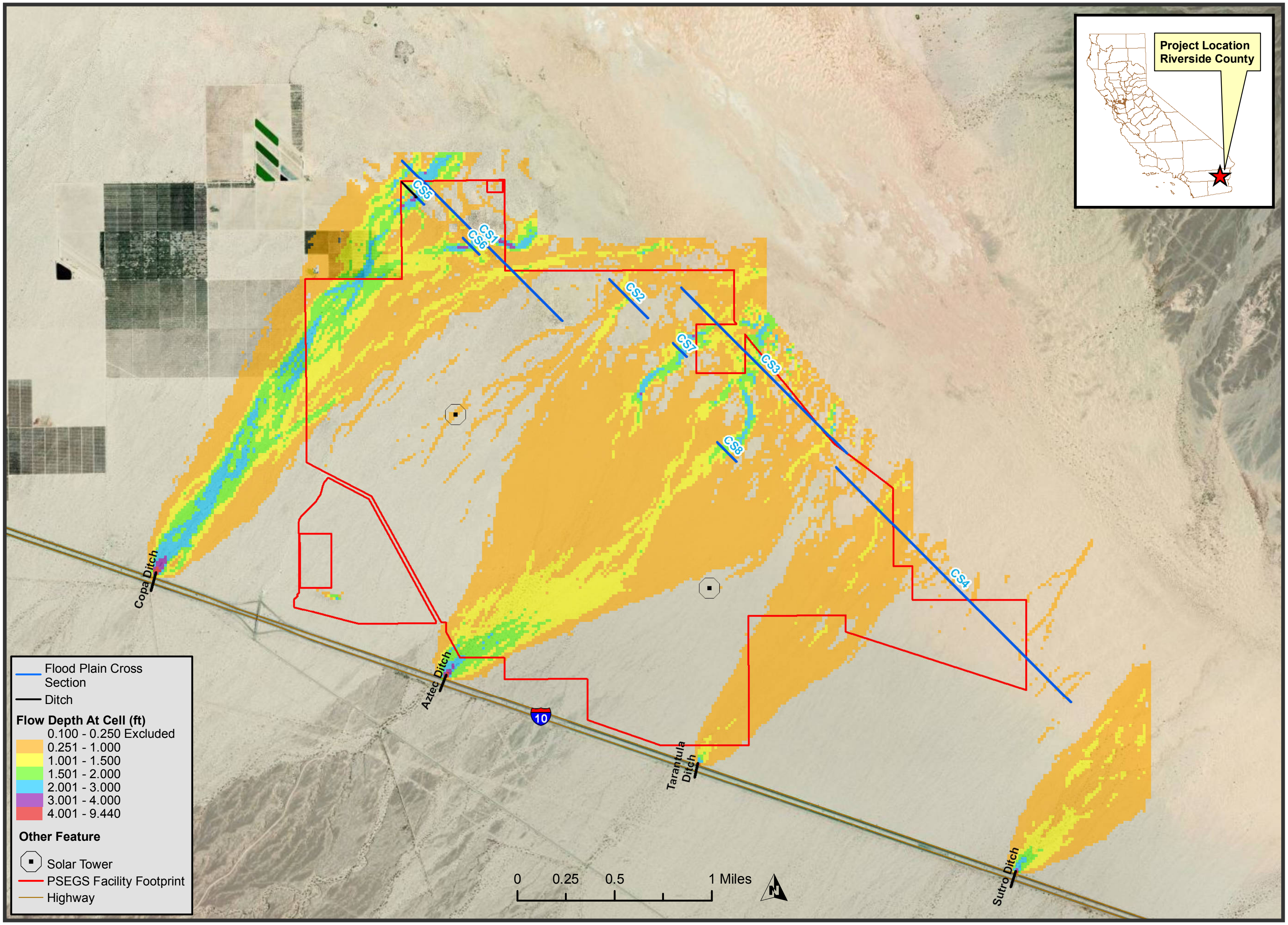


CALIFORNIA ENERGY COMMISSION - SITING, TRANSMISSION AND ENVIRONMENTAL PROTECTION DIVISION

SOURCE: AECOM 2010

SOIL AND WATER RESOURCES - FIGURE 12

Palen Solar Electric Generating System - Pre-Construction Depth Map (24-hour 100-year storm)



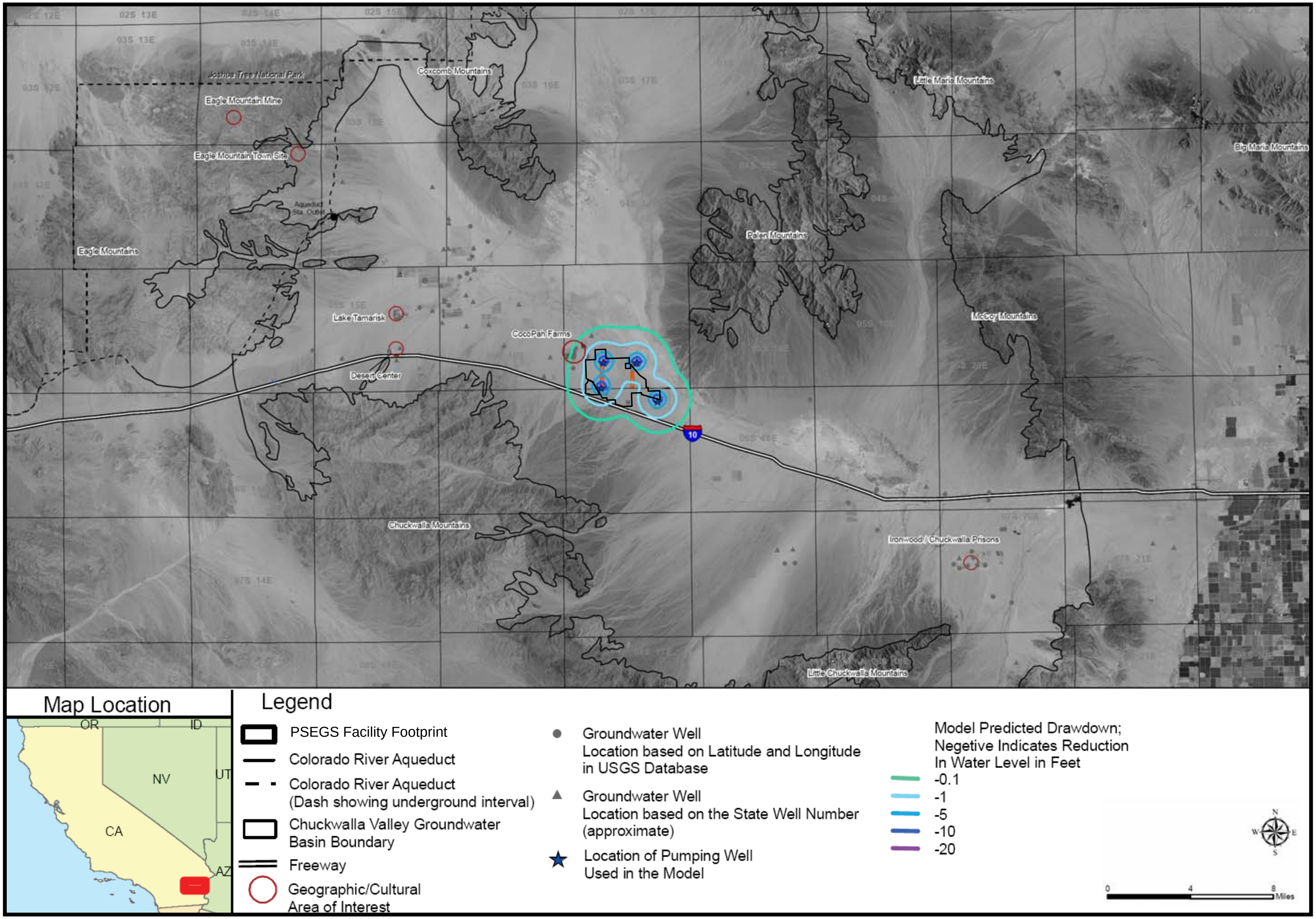
SOIL AND WATER RESOURCES

CALIFORNIA ENERGY COMMISSION, SITING, TRANSMISSION AND ENVIRONMENTAL PROTECTION DIVISION

SOURCE: BrightSource, Bing Aerial

SOIL AND WATER RESOURCES - FIGURE 13

Palen Solar Electric Generating System - Chuckwalla Valley Groundwater Basin Impacts to Groundwater Levels, End of Construction

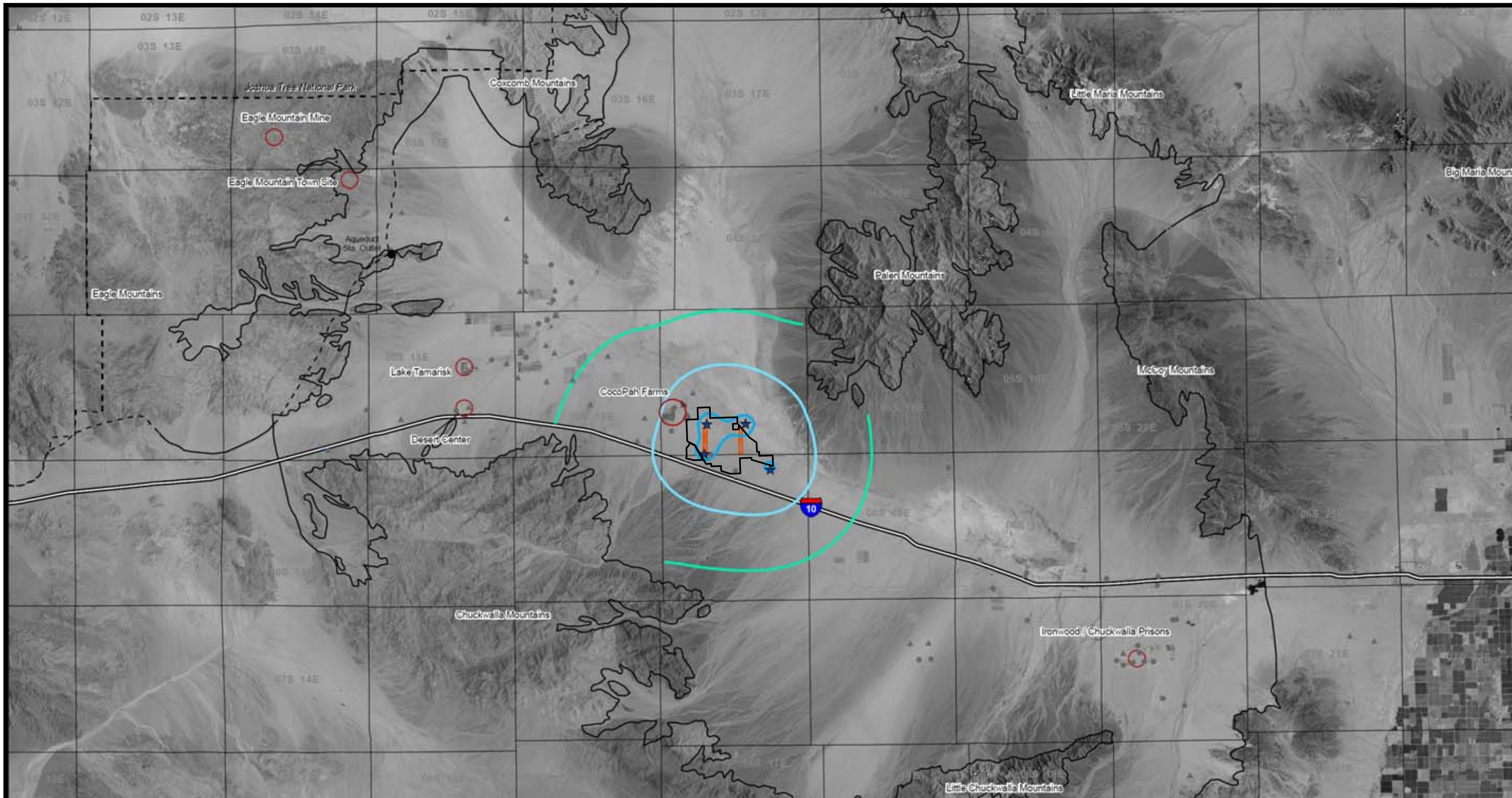


CALIFORNIA ENERGY COMMISSION - SITING, TRANSMISSION AND ENVIRONMENTAL PROTECTION DIVISION

SOURCE: Galati & Blek 2010i (tn: 56542), dated 5/4/2010

SOIL AND WATER RESOURCES - FIGURE 14

Palen Solar Electric Generating System - Chuckwalla Valley Groundwater Basin Impacts to Groundwater Levels, End of Operation



Map Location

Legend

- PSEGS Facility Footprint
- Colorado River Aqueduct
- Colorado River Aqueduct (Dash showing underground interval)
- Chuckwalla Valley Groundwater Basin Boundary
- Freeway
- Geographic/Cultural Area of Interest
- Groundwater Well Location based on Latitude and Longitude in USGS Database
- Groundwater Well Location based on the State Well Number (approximate)
- Location of Pumping Well Used in the Model

Model Predicted Drawdown; Negetive Indicates Reduction In Water Level in Feet

- -0.1
- -1
- -5

N W E S

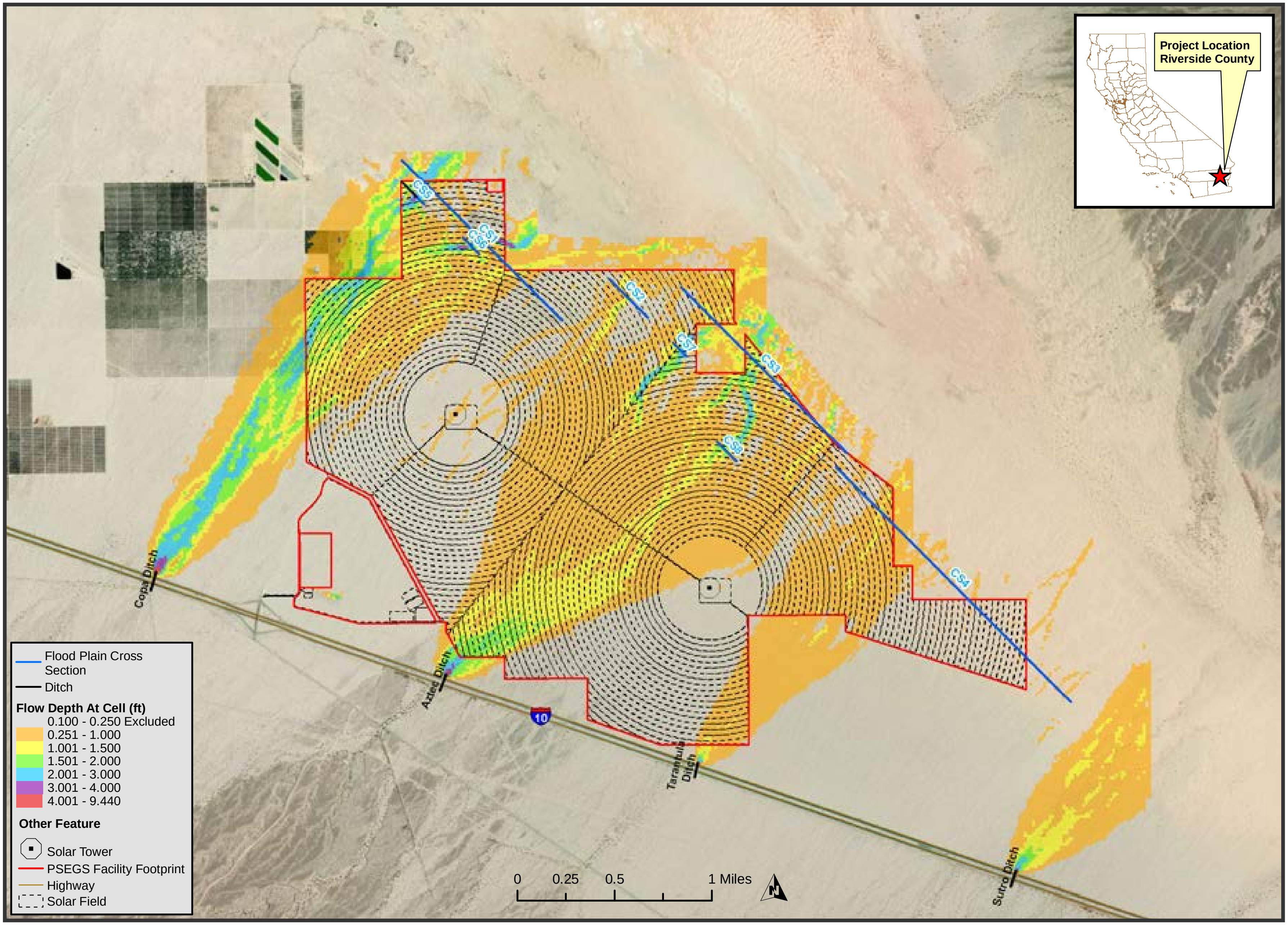
0 4 8 Miles

CALIFORNIA ENERGY COMMISSION - SITING, TRANSMISSION AND ENVIRONMENTAL PROTECTION DIVISION

SOURCE: Galati & Blek 2010i (tn: 56542), dated 5/4/2010

SOIL AND WATER RESOURCES - FIGURE 15

Palen Solar Electric Generating System - Post Construction Depth Map (24-hour 100-year storm)



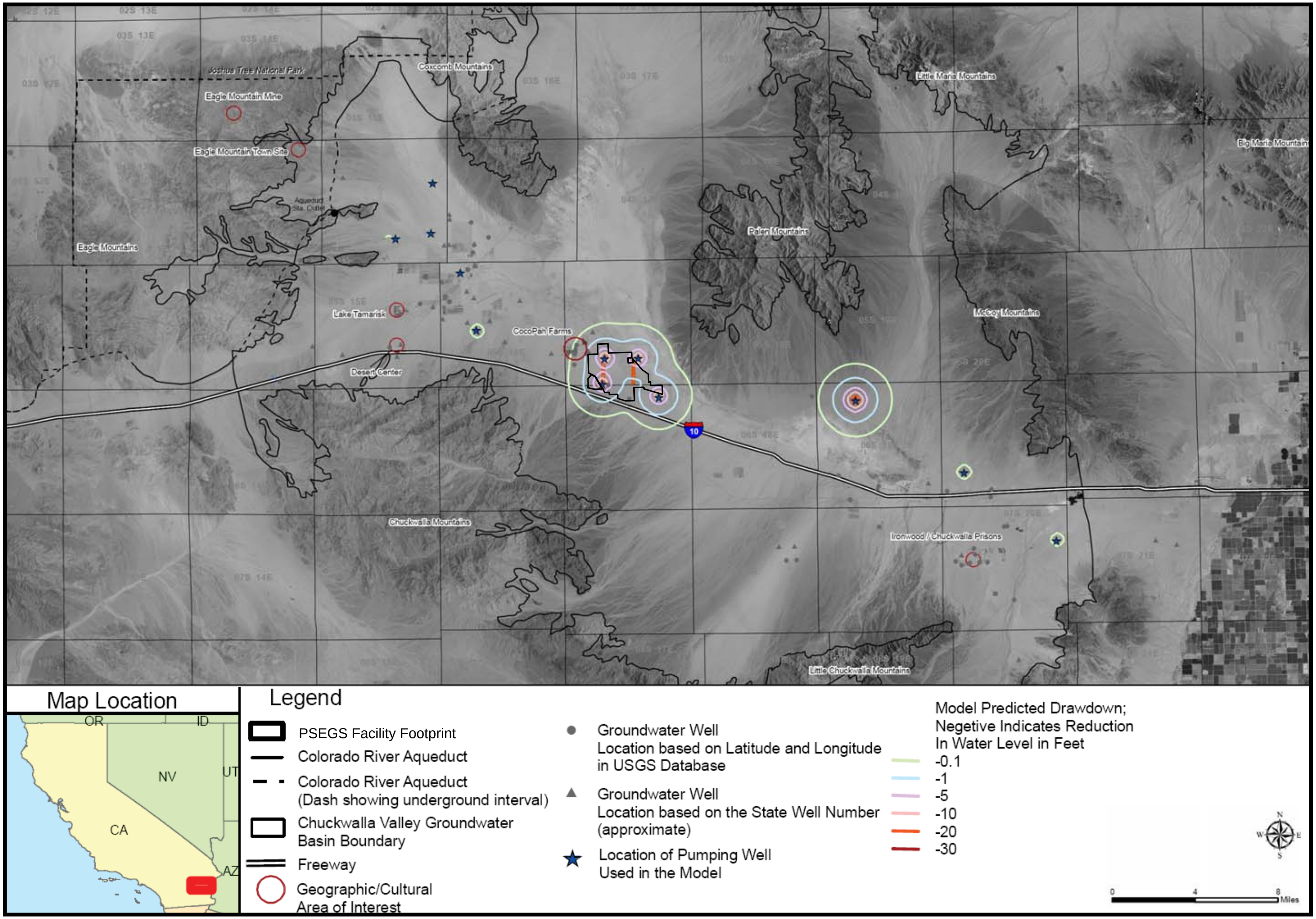
SOIL AND WATER RESOURCES

CALIFORNIA ENERGY COMMISSION, SITING, TRANSMISSION AND ENVIRONMENTAL PROTECTION DIVISION

SOURCE: BrightSource, Bing Aerial

SOIL AND WATER RESOURCES - FIGURE 16

Palen Solar Electric Generating System - Chuckwalla Valley Groundwater Basin Cumulative Impacts to Groundwater Levels, End of Construction

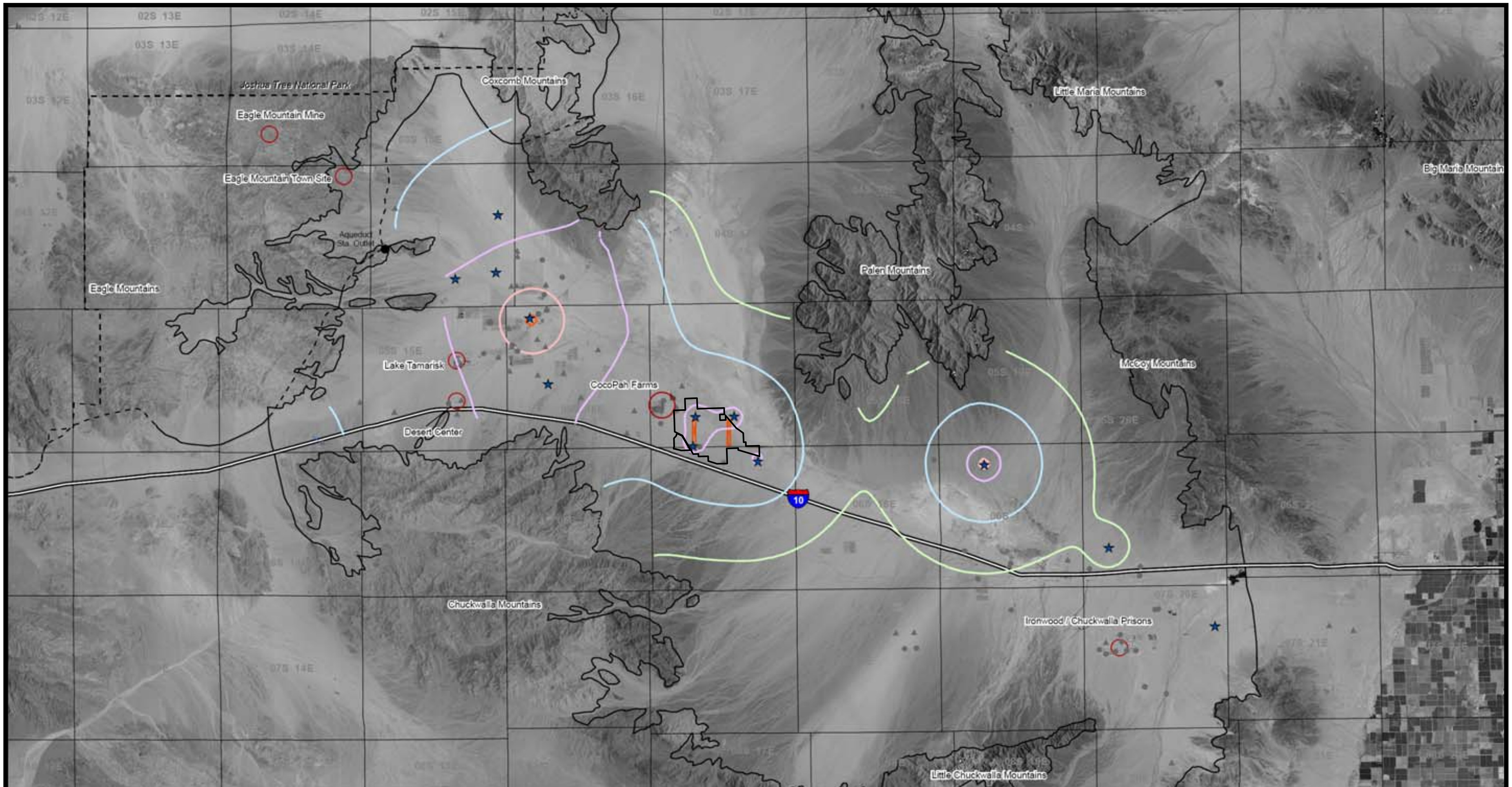


CALIFORNIA ENERGY COMMISSION - SITING, TRANSMISSION AND ENVIRONMENTAL PROTECTION DIVISION

SOURCE: Galati & Blek 2010i (tn: 56542), dated 5/4/2010

SOIL AND WATER RESOURCES - FIGURE 17

Palen Solar Electric Generating System - Chuckwalla Valley Groundwater Basin Cumulative Impacts to Groundwater Levels, End of Operation



Map Location

Legend

- PSEGS Facility Footprint
- Colorado River Aqueduct
- Colorado River Aqueduct (Dash showing underground interval)
- Chuckwalla Valley Groundwater Basin Boundary
- Freeway
- Geographic/Cultural Area of Interest
- Groundwater Well Location based on Latitude and Longitude in USGS Database
- Groundwater Well Location based on the State Well Number (approximate)
- Location of Pumping Well Used in the Model

Model Predicted Drawdown; Negetive Indicates Reduction In Water Level in Feet

- -0.1
- -1
- -5
- -10
- -20

N W E S

0 4 8 Miles

CALIFORNIA ENERGY COMMISSION - SITING, TRANSMISSION AND ENVIRONMENTAL PROTECTION DIVISION

SOURCE: Galati & Blek 2010i (tn: 56542), dated 5/4/2010

SOIL AND WATER RESOURCES - APPENDIX A

Acronyms Used in the Soil and Water Resources Section

af	acre-feet
AFC	Application for Certification
afy	acre-feet per year
amsl	above mean sea level
bgs	below ground surface
BLM	United States Bureau of Land Management
BMPs	Best Management Practices
CalRecycle	California's Department of Resources Recycling and Recovery
CCR	California Code of Regulations
CDPH	California Department of Public Health
CDWR-DPLA	California Department of Water Resources – Department of Planning and Local Assistance
CEQA	California Environmental Quality Act
cfs	cubic feet per second
CIMIS	California Irrigation Management Information System
CPM	Compliance Project Manager
CRB	Colorado River Board
CRBRWQCB	Colorado River Basin Regional Water Control Board
CVGB	Chuckwalla Valley Groundwater Basin
CWA	Clean Water Act
CWC	California Water Code
DAU	Detailed Analysis Unit
DESCP	Drainage Erosion and Sediment Control Plan
DWR	California Department of Water Resources
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
ESA	Environmental Site Assessment
°F	degrees Fahrenheit
FEMA	Federal Emergency Management Agency
FSA	Final Staff Assessment
ft	feet
ft^2	square feet
ft^2/d	square feet per day
gpd	gallon per day
gpm	gallons per minute
GPS	global positioning system
HDPE	high-density polyethylene
HTF	Heat Transfer Fluid
I-10	Interstate-10
IEPR	Integrated Energy Policy Report

in	inches
LDS	leachate detection system
LORS	Laws Ordinances, Regulations and Standards
LTU	Liquid Treatment Unit
MFTL	Mojave fringe-toed lizard
mg/L	milligrams per liter
MW	megawatt
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NRCS	National Resource Conservation Service
NWIS	National Water Information System
NWP	nationwide permit
PSA	Preliminary Staff Assessment
PSEGS	Palen Solar Electric Generating System
PSPP	Palen Solar Power Project
PVMGB	Palo Verde Mesa Groundwater Basin
REC	recognized environmental conditions
RO	reverse osmosis
ROW	right of way
ROWD	Report of Waste Discharge
RWQCB	Regional Water Quality Control Board
SIC	Standard Industrial Classification
SoCal Gas	Southern California Gas
SPCC	Spill Prevention, Control, and Countermeasure
SRSG	solar receiver steam generator
STATSGO	State Soil Geographic
SWPPP	Storm Water Pollution Prevention Plan
SWRCB	California State Water Resources Control Board
TDS	Total Dissolved Solids
USACE	United States Army Corp of Engineers
USBR	United States Bureau of Reclamation
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
WDR	waste discharge requirements
WRCC	Western Regional Climate Center
WSAC	wet surface air cooler

SOIL AND WATER RESOURCES – APPENDIX B

Staff has proposed modifications to the **Soil & Water Resources – Appendix B** as shown below. (**Note:** Deleted text is in ~~strikethrough~~, new text is **<u>bold and underlined</u>**)

FACTS FOR WASTE DISCHARGE — Palen Solar ~~I~~<u>Holdings</u>, LLC, Owner/Operator, Palen Solar ~~Power Project~~ <u>Electric Generating System</u>, Riverside County

1. ~~Solar Millennium~~**<u>Palen Solar Holdings</u>**, LLC, (the Discharger) is proposing to construct, own and operate a concentrated solar power **<u>tower</u>** (CSP) electric generating facility **<u>and</u>** evaporation ponds ~~and a land treatment unit (LTU)~~ on land owned by the Bureau of Land Management (BLM). The solar power **<u>tower</u>** project is proposed by Palen Solar ~~I~~**<u>Holdings</u>**, LLC (~~PSI~~**PSH**) a ~~wholly~~ **<u>company jointly</u>** owned ~~subsidiary of Solar Millennium, LLC~~ **<u>by BrightSource Energy and Abengoa Solar, LLC</u>**. The project is located in the Chuckwalla Valley along the Interstate 10 corridor (I- 10), east of Desert Center and west of the City of Blythe. The facility is referred to as the Palen Solar ~~Power Project (PSPP)~~ **<u>Electric Generating System (PSEGS or Project)</u>**. A site map (**Soil and Water Resources Appendix B Figure 1**), as incorporated herein and made a part of these requirements for waste discharge (Waste Discharge Requirements, or WDRs). The address for~~, Solar Millennium, LLC 1625 Shattuck Ave. Ste 270, Berkeley, Ca 94709-1161~~ **<u>PSH is 1999 Harrison Street, Suite 2150, Oakland, CA 94612.</u>**

2. These WDRs regulate the Facility's ~~four~~ **<u>two</u>** evaporation ponds~~ and two LTUs~~. The evaporation ponds are designated as Class II Surface Impoundments Waste Management Units (WMU) and must meet the requirements of the California Code of Regulations (CCRs), Title 27, CCR §20200 et seq. The boundaries of the ~~Palen Solar Project~~ **<u>PSEGS</u>** are shown on (**Soil and Water Resources Appendix B Figure 2**), as incorporated herein and made a part of these WDRs.

3. The Discharger submitted ~~two~~ **<u>one</u>** Report~~s~~ of Waste Discharge (ROWD), ~~January 6, 2010 for the LTU and~~ **<u>on</u>** May 25, 2010 for the evaporation ponds **<u>for the PSEGS</u>**. ~~for the Palen Solar Project.~~

4. Definition of terms used in these WDRs:

   a. **Facility** – The entire parcel of property where the proposed ~~Palen Solar Project~~**<u>PSEGS</u>** industrial operation or related solar industrial activities are conducted.

   b. **Waste Management Units (WMUs)** – The area of land, or the portions of the Facility where wastes are discharged. The ~~LTU and the~~ evaporation ponds are WMUs.

c. **Discharger** – The term Discharger means any person who discharges waste that could affect the quality of the waters of the State, and includes any person who owns the land, WMU or who is responsible for the operation of a WMU. Specifically, the terms “discharger” or “dischargers” in these WDRs means ~~Palen Solar I, LLC~~**PSH**.

Facility Location

5. The ~~Project~~ **Facility** site is located approximately 0.5 mile north of I-10 and approximately 10 miles east of Desert Center, in an unincorporated area of eastern Riverside County, California (**Soil and Water Resources Appendix B Figure 1**). Desert Center (population 125) is located along I-10 approximately halfway between the cities of Indio and Blythe, California, and is approximately three miles east of the southeast end of Joshua Tree National Park. The area inside the Project’s security fence, the footprint within which all Project facilities will be located, will occupy approximately 2,970 acres of Federal land managed by the BLM.

Surrounding Land Use

6. The Project site lies on 2,970 acres of vacant undeveloped desert located approximately 0.5 mile north of I-10 and 12 miles east of the small rural community of Desert Center. The Project site is not located in a designated wilderness area; however, it is located near lands that are designated as wilderness lands or Areas of Critical Environmental Concern (ACEC) (NECO Maps 2-38 and 2-4). The nearest Federal wilderness areas are located in mountainous land to the northeast and south of the Project site and referred to as the Palen/McCoy and Chuckwalla Mountains, respectively. The Chuckwalla Mountains are also designated by BLM as a Desert Wildlife Management Areas (DWMA); the Chuckwalla DWMA is located less than one mile south of the site and south of I-10. The Palen Dry Lake and dunes, located to the northeast of the Project site, are designated as ACEC. The edge of designated desert tortoise critical habitat extends into approximately 180 acres of the southwestern portion of the Facility.

7. South of I-10 is undeveloped public and private desert land. Undeveloped and irrigated desert is located west of the site where several large parcels are actively farmed. The nearest residence is located approximately 25 feet north of the Project’s ROW boundary and approximately 1,000 feet from Unit #2. One other residence is located approximately 3,500 feet north of the Project boundary. No other residences are known to exist within the one-mile radius of the Project site.

8. The Project site is vegetated with desert scrub throughout and includes some sand dunes in the northeast. Several dirt roads and transmission lines cross the Project site, as well as four desert northeast-southwest trending washes. Based on information in Northern and Eastern Colorado Desert (NECO) Plan, the Project site has not been leased for grazing by BLM. The nearest grazing lands are the Ford Dry Lake grazing allotment approximately 10 miles east of the site and north of I-10.

9. The site is currently undeveloped and few off-highway vehicle tracks were observed. The site does not appear to be frequented as a recreational area. No portion of the Facility is known to be an active recreational area.

10. The NECO Plan does not identify any scenic resources in the Project Study Area. The County of Riverside has identified the I-10 corridor as eligible for county designation as a scenic corridor. The I-10 corridor between Palm Springs and Blythe is not designated by the State of California as a scenic corridor.

Facility Description

11. The ~~PSPP~~ **PSEGS** is comprised of two, nominally rated 250 MW power blocks. The performance of each power block will vary with solar radiation and ambient temperature levels. At optimal solar radiation and low air cooled condenser back pressure (low ambient temperatures), the steam turbine-generator can produce 272 MW gross. As ambient temperature increases, the cooling effectiveness of the air cooled condenser decreases, causing the back pressure on the steam turbine to rise and, correspondingly, lowering steam turbine output. Parasitic loads also vary in relation to ambient temperature, due to the increasing power requirement for the large air cooled condenser and cooling plant auxiliary equipment. At an ambient temperature of 96°F, the steam turbine generator will produce 264 MW and plant parasitic load will be approximately 29 MW providing a net-to-grid power block rating of approximately 235 MW. Conversely, on a cool winter day with optimal solar radiation, the steam turbine generator will produce 272 MW, plant parasitic load will be approximately 28 MW and the net-to-grid power block rating will be approximately 244 MW.

12. The Project proposes to use dry cooling condenser for power plant cooling. Water for cooling tower makeup, process water makeup, and other industrial uses such as mirror washing will be supplied ~~U~~**u**p to ten onsite wells. This source will also be used to supply water for employee use (e.g., drinking, showers, sinks, and toilets). Water received from the on-site wells will be pumped directly to a reverse osmosis (RO) treatment unit to meet the requirements of the California Department of Health Services for potable water supplies. Power cycle makeup, mirror washing water, and cooling of ancillary equipment will require on-site treatment for reduction of dissolved solids, and this treatment varies according to the quality required for each of these uses.

13. The power generation cycle will not produce cooling tower blow down because the plant will be dry cooled. A small auxiliary cooling tower will generate a small amount of blow down, which will be reused on-site. No off-site backup cooling water supply is planned at this time.

14. The main waste stream at the site consists of industrial wastewater generated in the various processes associated with power generation. Industrial wastewater is treated via a high pH reverse osmosis at each of the two Power Units. At each Unit, the treated water is recycled to the ~~1,~~0**8**00,000-gallon Service/Fire Water tank for reuse in the process. The concentrate from the RO system is discharged to lined evaporation ponds (~~two~~ **one** per Unit). The ~~PSPP~~**PSEGS** Facility therefore includes ~~four~~ **two** proposed evaporation ponds for waste storage and disposal. Sanitary wastewater generated at each Unit is disposed of via septic systems.

15. The project will include evaporation ponds for the evaporation of brine waste from the RO plant and other industrial wastes. There will be ~~four~~ **two** ponds, ~~four~~ **two** acres in size and, ~~two within each power block~~ **both located next to the common area** (**Soil and Water Resources Appendix B Figure 2**). The evaporation ponds will be designed in accordance with Colorado River Basin Regional Water Quality Control Board (Regional Board) requirements.

~~16. The Project will include two LTUs to treat soil contaminated with HTF. Based on the release history from the NextEra LLC Kramer Junction Facility, which is a parabolic trough solar power plant that employs HTF in the same fashion as proposed for the PSPP and which also has LTUs, the PSPP LTUs have been designed in accordance with CCR Title 27 requirements and to receive about 1,666 cubic yards of impacted soil on an annual basis. There are two LTUs proposed for the Project. Each will cover an area of approximately 800 feet by 220 feet (4 acres) in the southern portion of the Project site (**Figure 2**). The LTUs will use indigenous bacteria and amendments to the soil to bioremediate HTFaffected soils to levels acceptable for reuse on-site. Characterization of the hazardous characteristics of HTF-affected soil will be established by the Department of Toxic Substances Control (DTSC) prior to operation and remediation. Soils in excess of the criterion established by the DTSC will be removed from the site and transported to an appropriate treatment storage and disposal facility. Soil with HTF at concentrations below this criterion will be managed in the LTUs and remediated to acceptable levels for reuse as fill on-site.~~

~~17~~**16**. The estimated project life for the Project is 30 years. Personnel will staff the Project 24 hours per day/seven days per week. Even when the solar power plant is not operating, personnel will be present as necessary for maintenance, to prepare the Project for startup, and/or for site security.

~~18~~**17**. A sanitary septic system and on-site leach field will be used to dispose of sanitary wastewater within each power block.

Climate

~~19~~**18**. The Project is located in an arid desert climate; therefore, there are extreme daily temperature changes, low annual precipitation, strong seasonal winds and mostly clear skies. Evaporation rates are higher than precipitation rates. Based on 60 years of data from Blythe Airport, the mean maximum temperatures in June to September exceed 100°F. Winter months are more moderate with mean maximum temperatures of high 60's to low 70's °F and minimum temperatures in the low to mid 40's °F. Although there are no average minimal temperatures below freezing point (32°F), the temperature has historically dropped below freezing point between November and March.

~~20~~**19**. Average annual evaporation in the Facility area, based on published data at the Indio Fire Station 70 miles west of the Project site, is 105 inches, of which 87 percent of that evaporation occurs between March and October. Average annual precipitation in the Project area, based on the gauging station at Blythe Airport, is 3.55 inches, with August recording the highest monthly average of 0.63 inches and June recording the lowest monthly average of 0.02 inches. Per the National Oceanic and Atmospheric Administration (NOAA) Atlas 14 for the Southern California area, 3.51 inches of rainfall shall fall in the 100 year, 24 hour storm event.

~~21~~**20**. Winds in the Project area are generally south to southwest with a less frequent component of northerly winds (north through northwest). Calm conditions occur approximately 16.43% of the time, with the annual average wind speed being approximately 7.62 miles per hour (mph) (3.41 m/s).

Regional Topography and Drainage

~~22~~**21**. The Project ~~S~~**s**ite is located on the alluvial sediments of the Chuckwalla Valley, and is 2 to 3 miles northeast of the Chuckwalla Mountains and approximately two miles southwest of the Palen Mountains. Surface water in the Chuckwalla Valley drains from the surrounding mountains toward Palen or Ford Dry Lakes (playas), the topographic low points within the valley.

~~23~~**22**. Site topography slopes gently to the northeast at grades of 1.4 percent or less. The general storm water flow pattern is from the higher elevations in the Chuckwalla Mountains, located approximately 6 miles southwest of the site, to the lower elevations in Chuckwalla Valley to the northeast. The site is mostly flat, with elevation ranging on United States Geological Survey (USGS) topographical maps from a high of about 625 feet above sea level at the southwestern limits of the site to a low of about 425 feet above sea level along the eastern site boundary. Storm water from the Project site flows to the northeast across the site and then southeast to a dry lake bed (Ford Dry Lake), which also receives overland flow from the Palen Mountains and the area toward I-10.

~~24~~**23**. The major watercourse in the Project area is Corn Springs Wash, which drains approximately 31 square miles of the Chuckwalla Mountains and flows northeast toward the Project site. Storm water flows and discharge from springs in the Chuckwalla Mountains travel through Corn Springs Wash and adjacent unnamed washes northeastward before being cut off by I-10. Storm water flows are intercepted by dikes located south of I-10 and conveyed to three box culverts that cut beneath the roadway of I-10, south (upgradient) of the Project site. These structures were constructed during construction of I-10 and are dikes and culverts that re-concentrate the flows back to three discrete discharge points on the north side of I-10. From these discharge points, storm water flows continue across the Project site flowing northeast towards Palen Mountains.

~~25~~**24**. Impacts to the ephemeral washes within the Project site will be mitigated by rerouting the washes in two new channels around the east and west sides of the facility and one through the center of the site (between Units #1 and #2). The new channels will be designed to be wildlife friendly, and drainage downstream of the site maintained as close as practicable to the pre-existing conditions. Storm Water Pollution Prevention Plans (SWPPP) and a CEC mandated Drainage, Erosion, and Sediment Control Plan (DESCP) were provided in the August 2009 PSPP Application for Certification and contain Best Management Practices (BMPs), which will be implemented to avoid significant drainage/stormwater runoff and water quality impacts.

Flood Hazard

~~26~~**25**. According to FEMA, no flood insurance rate maps have been created for the Project site and adjacent areas. Reviews of flood zone maps generated by the Riverside County Flood Control District also did not identify any flood zone maps for this area of Riverside County.

Regional Geology

~~27~~**26**. The Facility is located in the northwestern Colorado Desert, in the alluvial-filled basin of the Palo Verde Mesa, which is part of the greater Colorado Desert Geomorphic Province. The basin is bound by the McCoy Mountains to the west, the Little Maria Mountains to the northwest, and the Big Maria Mountains to the northeast. This area has a generally low relief until near the surrounding mountains. In the region, the Palo Verde Valley is roughly equivalent to the recent historic floodplain of the Colorado River. Surficial deposits of late Miocene to Holocene age form most of the land surface in the area. Most of these deposits are composed of Quaternary Alluvium, underlain by the Pliocene Bouse Formation, which is in turn unconformably underlain by the Miocene Fanglomerate. These deposits are all underlain by bedrock consisting of metamorphic and igneous intrusive rocks of pre-Tertiary age, including Proterozoic schist and gneiss, Paleozoic sedimentary rocks, and Mesozoic sedimentary and metavolcanic rock sequences.

Site Specific Geology

~~28~~**27**. The Project is located in the alluvial-filled basin of the Chuckwalla Valley. Regionally, this valley formed as a structural depression or a pull-apart basin and is composed of two broad geologic units: consolidated rocks and unconsolidated alluvium (DWR 1963, 1979). The consolidated rocks consist of pre-Tertiary age igneous and metamorphic rocks, which form the basement complex, and in some locations, Tertiary-age volcanic rocks that overlie the basement complex. The consolidated rocks are nearly impermeable except for areas where fracturing or weathering has occurred. It is uncertain the extent that these rocks yield water to the alluvium. Some literature indicates that the fractured bedrock is in communication with the alluvium and there are wells that are completed in the bedrock that yield sufficient quantities of water. The flux of groundwater into and out of the bedrock is unknown.

Seismicity

~~29~~**28**. The Project site is located in seismically active Southern California, a region that has experienced numerous earthquakes in the past. A review of the Alquist Priolo (AP) Earthquake Fault Maps and the Riverside County AP Earthquake Hazard Zone Map indicate that there are no AP fault zones present within the Project boundaries (California Division of Mines and Geology 2000, California Geological Survey 2003, 2007). In addition, no active fault zones are present within one mile of the Project site; however, the site is approximately 2.5 miles southwest of an unnamed fault located at the southern end of the Palen Mountains. This fault has not been mapped by the USGS as a Quaternary (sufficiently active) fault, and is not listed by the EQFAULT program as a fault potentially affecting the site (Blake 2000).

~~30~~**29**. Regardless of whether there are faults across the site, because the Project is located in a seismically active area, all Project structures must be designed to comply with the California Building Code (CBC) and Universal Building Code (UBC) Zone 4 requirements. The CBC and UBC are considered to be standard safeguards against major structural failures and loss of life. The goals of the codes are to provide structures that will:

a. Resist minor earthquakes without damage;

b. Resist moderate earthquakes without structural damage but with some nonstructural damage; and

c. Resist major earthquakes without collapse but with some structural and nonstructural damage.

~~31~~**30**. The CBC and UBC base seismic design on minimum lateral seismic forces ("ground shaking"). The CBC and UBC requirements operate on the principle that providing appropriate foundations, among other aspects, helps to protect buildings from failure during earthquakes.

~~32~~**31**. The Project site is located in seismically active Southern California, a region that has experienced numerous earthquakes in the past. A review of the Alquist Priolo (AP) Earthquake Fault Maps and the Riverside County AP Earthquake Hazard Zone Map indicate that there are no AP fault zones present within the Project boundaries (California Division of Mines and Geology 2000, California Geological Survey 2003, 2007).

Ground Rupture

~~33~~**32**. The Project site is not located within a State of California Earthquake Fault Zone designated by the Alquist-Priolo Special Studies Zone Act of 1972 (formerly known as a Special Studies Zone), an area where the potential for fault rupture is considered probable (Riverside County, 2008). In addition, no Quaternary, Sufficiently Active, or Well Defined Faults are located under or near the Site. Based on this information and engineering judgment, earthquake induced ground rupture is not considered to be a significant hazard at the Site.

Slope Stability

~~34~~**33**. The **Project** ~~S~~**s**ite is not considered to be an area with the potential for permanent ground displacement due to earthquake-induced landslides because surface topography at and near the site is relatively flat (Riverside County, 2008). A review of the Riverside County General Plan, Safety Element, did indicate areas considered susceptible to earthquake induced landslides and rock falls in the McCoy Mountains; however, these areas are several miles from the Site and are not expected to impact the Project. Based on this information and engineering judgment, slope instability is not considered to be a significant hazard at the Site.

Erosion

~~35~~**34**. Erosion is the displacement of solids (soil, mud, rock, and other particles) by wind, water, or ice and by downward or down-slope movement in response to gravity. Due to generally flat terrain, the Project site is not prone to significant mass wasting (gravity-driven erosion and non-fluvial sediment transport) at present. The Riverside County General Plan, Safety Element (Riverside County, 2008), indicates the Site is in an area with moderate potential for wind erosion, the off-site linears are in areas with moderate to high potential for wind erosion. Soil characteristics at the Project site allow for the potential for wind and water erosion, and significant sediment transport currently occurs across the valley axial drainage that crosses the majority of the proposed plant site. As indicated above, these valley axial deposits are characterized by subdued bar and swale topography and ongoing deposition from sheet floods. Limited sand and aeolian erosion also occurs between depositional episodes.

~~36~~**35**. To address the management of sediment transport, erosion and sedimentation during operation, the project design will incorporate diversion berms, channels, and dispersion structures. The final design for these features will be developed during detailed design, and will include industry-standard calculations and modeling to reduce the potential for erosion or sedimentation, and to reduce the need for ongoing maintenance. Dirt roads and exposed surfaces will be periodically treated with dust palliatives as needed to reduce wind erosion. Construction and maintenance of the proposed drainage and sediment management system at the Site is expected to reduce water and wind erosion at and downstream of the Site to less than significant levels.

Liquefaction

~~37~~**36**. Liquefaction is a soil condition in which seismically induced ground motion causes an increase in soil water pressure in saturated, loose, uniformly-graded sands, resulting in loss of soil shear strength. As a result, the effects of liquefaction can include loss of bearing strength, differential settlement, ground oscillations, lateral spreading, and flow failures or slumping. Liquefaction occurs primarily in areas where the groundwater table is within approximately 50 feet of the surface (Riverside County, 2008). The depth to water beneath the Site is estimated to be approximately 195 feet bgs. In addition, the sandy soils encountered in the upper 100 feet beneath the Project site during geotechnical drilling are generally dense and well graded. Dense, well-graded sands are not generally considered susceptible to liquefaction. Based on this information and engineering judgment, the potential for liquefaction hazard at the Project site is considered to be low. The potential for liquefaction will be further evaluated as part of the Final Geotechnical Investigation for the Project, and if necessary, design parameters to address identified conditions will be incorporated into the detailed project design.

Differential Settlement

~~38~~**37**. Seismically induced settlement can occur during moderate and large earthquakes in soft or loose, natural or fill soils that are located above the ground water table, resulting in differential settlement. The settlement can cause damage to surface and near-surface structures. The most susceptible soils are clean loose granular soils. Due to the expected dense to very dense nature of the near surface soils, the potential for damage due to seismically induced settlement is considered to be low at the Project site. The potential for seismically-induced settlement will be further evaluated as part of the Final Geotechnical Investigation for the Project, and if necessary, design parameters to address identified conditions will be incorporated into the detailed project design.

Collapsible Soil Conditions

~~39~~**38**. Alluvial soils in arid and semi-arid environments can have characteristics that make them prone to collapse with increase in moisture content and without increase in external loads. Soils that are especially susceptible to collapse or hydrocompaction in a desert environment are loose dry sands and silts, and soils that contain a significant fraction of water soluble salts. Overall soil gradation observed at the Facility site trended from coarser- to finer-grained alluvial deposits as distance from the McCoy Mountains increased. The ground surface in the western portion of the Project site is dominated by areas of desert pavement with layers of flat-lying gravel overlying finer-grained sandy materials. East toward Black Creek road, the surface becomes less dominated by desert pavement and becomes sandier. Soils observed at the Facility site have a low permeability and high runoff potential. Based on this data and engineering judgment, the site soils do not have a significant potential for hydrocompaction or collapse. The potential for hydrocompaction and soil collapse will be further evaluated as part of the Final Geotechnical Investigation for the Project, and if necessary, design parameters to address identified conditions will be incorporated into the detailed project design.

Expansive Soil

~~40~~**39**. Expansive soil is predominantly fine grained and contains clay minerals capable of absorbing water in their crystal structure. It is often found in areas that were historically a flood plain or lake area, but can also be associated with some types of shale, volcanic ash or other deposits, and can occur in hillside areas also. Expansive soil is subject to swelling and shrinkage, varying in proportion to the amount of moisture present in the soil. As water is initially introduced into the soil (by rainfall or watering) expansion takes place. If dried out, the soil will contract, often leaving small fissures or cracks. Excessive drying and wetting of the soil can progressively deteriorate structures that are not designed to resist this effect, and can lead to differential settlement under buildings and other improvements. The surficial soils at the site generally consist of predominantly granular soils that do not contain much clay and are not subject to significant expansion hazards. The potential for expansive soils will be further evaluated as part of the Final Geotechnical Investigation for the Project, and if necessary, design parameters to address identified conditions will be incorporated into the detailed project design.

~~41~~**40**. Based on the above information, the cut and fill slope dimensions and earthwork requirements will be adequate to address the stability of the evaporation ponds ~~and LTU~~ for the life of the ~~p~~**P**roject and no further analysis is warranted.

Regional Hydrogeology

~~42~~**41**. The Recent-age (~11,000 years) younger alluvium consists of poorly-sorted gravel, sand, silt, and clay. The younger alluvium overlies the older geologic units as a thin veneer and is believed to be mostly above the water table. The Recent-age playa deposits consist mainly of clay, silt, and sand and occur in Ford and Palen Lakes and Hayfield Reservoir. During recent history, groundwater levels were shallower and groundwater likely discharged to Palen Dry Lake. Regional water level data suggests that water is possibly shallower than 25 feet below Palen Dry Lake, a depth which would suggest water may be lost or discharged through evapotranspiration. Recent groundwater levels below Ford Dry Lake show the water to be about 50 feet below the surface of the lake. At this depth, it is unlikely that water is lost through evapotranspiration. The dune sand deposits occur on the lower elevations of the valley from the northwest end of Chuckwalla Valley to the eastern end of the valley, and just northeast of the Project site.

~~43~~**42**. The older alluvium generally consists of fine to coarse sand inter-bedded with gravel, silt, and clay. The color ranges from dark brown to red, with abundant small white caliche nodules. This unit is assumed to be extensive, readily yields water to wells, and is considered the most important aquifer in the Chuckwalla Valley Groundwater Basin. It is believed that saturated sediments below the side to a depth of about 500 feet are older alluvial deposits.

Hydrostratigraphy

~~44~~**43**. The Pinto Formation consists of coarse fanglomerate and lacustrine clay with interbedded basalt. The DWR suggests (2004) that this unit yields limited quantities of water. Below the Pinto Formation, the PlioPleistocene Bouse Formation is comprised predominantly of coarse-grained fanglomerate deposits.

~~45~~**44**. Well logs were located through reports published by the DWR and through information provided in various reports. There are two wells on the Project site and one has a boring log with lithologic information available in a reported prepared by the DWR. The log for well 5S/17E-33N001 indicated surficial sands were encountered from the ground surface to 102 feet bgs; 18 feet of clay, sand and gravel were encountered from 102 feet to 120 feet bgs; clay was encountered between 120 and 208 feet bgs, sand and gravel were encountered from 208 to 216 feet bgs; clay streaks and sand were encountered from 216 feet to 556 feet bgs; and sand streaks and “sandstone cappings” were encountered within predominantly fine-grained materials between 556 feet and 758 feet bgs. It is possible that sediments encountered to a depth of 556feet bgs area older alluvial deposits. The log of well 5S/17E-33N001 does not have sufficient detail to readily discern the contact between the units reported for the Chuckwalla Valley Groundwater Basin.

~~46~~**45**. Boring logs could be found for only approximately 10 percent of the wells that were identified from an online database and literature within the basin. Available information provided in these logs was used to provide an understanding of subsurface conditions and develop a generalized geologic cross section for the Chuckwalla Valley Groundwater Basin. The limited geologic data revealed general variations in the sediments from the west to the east. In general, very few wells were drilled to the top of the basement or base of the fresh water in the Chuckwalla Valley Groundwater Basin. One well located on the eastern edge of the basin, due west of the gap to the Palo Verde Groundwater Basin, was drilled to a depth of about 1,200 feet bgs, where it encountered bedrock.

~~47~~**46**. In general, sediments on the western and eastern portions of the valley, and along the fringes of the basin are comprised of a higher percentage of coarsegrained sediments. These deposits are the proximal facies of coalescing alluvial fans. In the central portion of the valley and below the Project, sediments are generally composed of a much higher percentage of clay with subordinate amount of sand that occurs as layered inter-beds. These deposits have been interpreted as lacustrine deposits in the central portion of the basin. The wells located along the central portion of the valley and shown on the axial cross section through the valley appear to be completed within an inter-bedded sequence of alluvial fan and lacustrine deposits. Shallow sediment encountered below the Project consisted of very fine-grained silty sand and sand, suggesting distal fan facies. Interbedded clay with these sediments is probably lacustrine deposits. While the data is not conclusive these deposits to a depth of 538 feet are probably in the older alluvium.

~~48~~**47**. The basal portion of may be upper portions of the Bouse Formation. The deeper Fanglomerate was not encountered and it is likely that the Pinto Formation was also not found below the Project site based on the absence of interbedded basalt deposits.

On-site Drainage

~~49~~**48**. On-site storm water management for the completed facility will be provided through the use of source control techniques, site design and treatment control. The storm flows from the solar collector arrays will be treated through the use of swales, and ditches.

~~50~~**49**. Locations within the power block for the potential of chemical or oil releases will be fully contained. Rainfall within the containment areas will be allowed to evaporate or will be drained through an oil water separator. Locations within the power block where “contact” storm water may occur will be contained within a system of curbs or trenches. Drains from these curbed areas or containment trenches will be directed to an oil water separator. The oil separated and captured within the oil water separator will be trucked off-site to a licensed disposal/recycling facility. Clean water discharged from the oil water separator will be used on Project site by discharging it to the cooling tower or to the raw water storage tank. The water discharge from the oil water separator will not be discharged to the storm water system.

Facility Operational Water

~~51~~**50**. The Project will be dry cooled. The Project's various water uses include water for solar collector mirror washing, makeup for the SSG feed water, dust control, water for cooling plant auxiliary equipment, potable water and fire protection. Water needs for the Project will be met by use of groundwater pumped from wells on the Project site. The estimated water supply need for the Project operation is approximately 300 acre-feet per year.

Evaporation Ponds (Design and Installation Sequence)

~~52~~**51**. The containment strategy for the evaporation ponds is summarized as follows:

a. Meet or exceed regulatory requirements for containment of waste fluids;

b. Select materials that are compatible with the physical, chemical and thermal characteristics of the water and contaminated soils being contained;

c. Protect against physical damage to the containment layers by including protective layers into the designs of each containment facility;

d. Allow for occasional removal of contained media without otherwise damaging the integrity of the containment systems; and

e. Include the ability to monitor the integrity of the containment system, to transfer fluids out of permeable layers on a continuous basis, and to transfer fluids from one evaporation pond to another.

~~53~~**52**. Each ~~4~~**2**.0 acre evaporation pond has a proposed design depth of seven feet which incorporates:

a. Drying each pond at alternating four year intervals;

b. 3 feet of operational depth;

c. 2 foot of sludge build up over 4 years; and

d. 2 feet of freeboard.

~~54~~**53**. The containment design for the evaporation ponds, from the surface of the evaporation ponds downwards, consists of the following:

a. A hard surface / protective layer;

b. A primary 60 mil high density polyethylene (HDPE) liner;

c. An interstitial leak detection system (LDS) comprising a drainage layer and piping;

d. A secondary 40 mil HDPE liner; ~~and~~

e. A 2 foot thick compacted silty-sand base**; and**

f. A moisture detection system.

~~55~~**54**. The hard surface / protective layer provides protection against accidental damage to the HDPE liners which could be caused by burrowing animals, falling objects, varying climatic conditions and worker activities. Second, the hard surface / protective layer will allow for occasional removal of the precipitated solids within the evaporation ponds. Various hard surface media such as reinforced concrete, roller compacted concrete, revetments, or combinations of these media will be assessed prior to the selection of the preferred option.

~~56~~**55**. High density polyethylene (HDPE) was selected as the preferred fabric for the primary and secondary liners for the following reasons:

a. It is chemically resistant to potentially high concentrations of dissolved salts;

b. It is very durable during installation;

c. It is strong and possesses desirable stress-strain characteristics; and

d. It is the most common synthetic liner material and as such there is a broad base of practical experience associated with the installation of HDPE amongst construction contractors.

~~57~~**56**. A 60 mil upper liner was selected to provide appropriate balance between strength and ductility characteristics, which is very important during liner installation. A non-woven geotextile will be installed on top of the 60 mil liner to act primarily as a protective layer. A 40 mil lower liner was selected for the lower and secondary liner to provide slightly better ductility and handling characteristics during installation, as strength is of lesser importance for the secondary liner. HDPE possesses large thermal expansion and contraction characteristics, and exhibits stress when liner temperature exceeds 122 ºF. The temperature of the blowdown water is not expected to exceed 122ºF.

~~58~~**57**. A 2 foot thick basal layer of compacted silty sand is included in the design profile to protect the underlying groundwater in the unlikely event that both synthetic liner materials are punctured during construction or operation of the evaporation ponds. This base layer also serves to provide a smooth, competent surface to support the overlying synthetic liners and leak detection system layers.

Leak Detection System

~~59~~**58**. A drainage layer is included in the design profile for the evaporation ponds which consists of a granular drainage layer with perforated piping to collect and convey fluids to an extraction riser in a leak detection sump (LDS). Geocomposite drainage materials, consisting of HDPE geonet and nonwoven geotextiles heat bonded to one or both sides, may be used in conjunction with or as a substitute for the granular drainage layer on slopes.

~~60~~**59**. The water collected in the LDS will drain by gravity to a unique monitoring well that is constructed for each of the leak collection layer. Automated pneumatic, solar-powered pumping systems are included in the design of each of these monitoring wells to automatically return water to that pond, which in turn minimizes the hydraulic pressures across the secondary liners and therefore the risk of impact to groundwater quality.

~~61~~**60**. The base of the evaporation pond leak detection and collection layer will slope at a minimum inclination of 1 percent to a leak collection trench. The trench will contain screened sand (with no fines) and a perforated pipe that will slope at a minimum inclination of 3/4 percent towards a leak detection and collection sump, located at the lowest point in the pond. The water in the collection sump will drain by gravity to a monitoring well that is constructed for each evaporation pond (one well per pond). Automated pneumatic pumping systems in the monitoring wells will automatically return water collected in the sump to that evaporation pond, which in turn minimizes the hydraulic pressures across the secondary liners and, therefore, minimizes the risk of leakage through the secondary liner. Leakage rates will be measured using a flow totalizer.

~~62~~**61**. The collection sump, pipe, and monitoring well, will include prefabricated and field-fabricated HDPE components with water tight, extrusion welded and wedge-welded seams and penetrations. The liner system will be installed in accordance with current practices. Destructive and non-destructive testing procedures will be used to verify sump and penetration tightness and continuity.

~~63~~**62**. This design is consistent with CCR Title 27, Section 20340, which requires an LDRS between the liners for the evaporation ponds.

~~64~~**63**. The side slopes around the evaporation ponds will contain the same liner system as the base of the ponds, except that leak collection pipes will not be located on the pond side slopes.

~~65~~**64**. The berms shall be covered with a minimum 6-inch thick road base or approved equivalent. The top of the berms will be a minimum of 2 feet above the surrounding grade to prevent potential inflow of stormwater.

~~66~~**65**. The wastewater will come into contact with the hard surface/protective layer. The media for this layer will either be roller-compacted concrete or an approved equivalent alternate. All final media selection will be compatible with the wastewater by using quality concrete with maximum chemical resistance (specifications will be provided to the concrete manufacturer to ensure proper mix selection).

~~67~~**66**. If there is leakage in the evaporation pond, the wastewater will come into contact with the primary/secondary liner. HDPE is chemically resistant to saline solutions and long-term contact between the wastewater in the evaporation ponds and the HDPE liner system will not compromise liner integrity.

~~68~~**67**. The hard surface/protective layers, liner system, and base layer will have the ability to withstand the dissolved solids content of the water without degradation. These systems will not fail due to pressure gradients from physical contact with the wastewater and residue or undergo chemical reactions or degradation.

~~69~~**68**. The containment construction process will follow these general steps:

a. Prior to construction, the topsoil and subsoil covering the area will be stripped and stockpiled.

b. Placement and compaction of the silty sand base material;

c. Installation of the carrier pipe for the moisture detection (neutron probe) system beneath the base of the ponds;

d. Construction of finish grading to sub grade, as needed, and excavation of the leak collection trench and detection/collection sumps.

e. Scarification, moisture conditioning, compaction, proof rolling and testing of subgrade materials;

f. Installation of secondary HDPE liner;

g. Installation of leak detection layer, sump, and leak extraction risers;

h. Installation of primary HDPE liner;

i. Installation of the non-woven geomembrane liner;

j. Installation of granular fill;

k. Installation of liner protection layers; and

l. Hard surface placement.

Waste Classification

~~70~~**69**. Wastewater from several processes within the Facility will be piped to ~~two~~ one ~~4~~**2**.0- acre evaporation ponds per Unit ~~(total combined area of 8 acres per Unit)~~ for disposal. The pond area provides sufficient evaporative capacity to dispose of the anticipated wastewater stream, and allows for one pond to be taken out of service for up to approximately eight months for cleaning, potential future maintenance, and repair without impacting the operation of the plant. Raw water for the Facility is supplied from groundwater wells. Discharge into the evaporation ponds is from ~~two~~ **one** sources~~s~~:

a. High pH RO (Reverse Osmosis Concentrate**)**~~; and~~**.**

Wastewater Discharge

~~71~~**<u>70</u>**. The estimated concentrations of chemical constituents in the wastewater discharge to the evaporation ponds are provided in the **Table 1**, Raw Water Quality and Estimated Chemistry of Wastewater Flows. The total concentrations of chemical constituents estimated in the evaporation pond residue that will accumulate in the ponds during operation are provided in **Table 2**.

~~72~~**<u>71</u>**. Classification of wastewater and evaporation pond residue is summarized in the Classification of Wastewater and Evaporation Pond Residue **Table 3** below.

~~73~~**<u>72</u>**. Testing of this material will be conducted as part of the facility monitoring program to verify this characterization. The evaporation pond residue accumulated in the ponds is non hazardous; however, it does contain pollutants which could exceed water quality objectives if released, or that could be expected to affect the beneficial uses of waters of the state. Therefore, the evaporation pond residue is classified as a "designated waste."

Evaporation Residue

~~74~~**<u>73</u>**. During the 30-year operating life of the Project, about 6,400 tons of evaporites will accumulate in the ponds. However, because it is anticipated that windblown silt will accumulate in the ponds at a rate of perhaps 6 inches per year, it will be necessary to clean out the ponds on approximately four-year intervals. Assuming 2 feet of silt accumulation, the sludge removed from the ponds will be approximately nine percent evaporate and 91 percent silt. The predicted chemical makeup of the evaporite, based on information about the raw water chemistry and knowledge of the water use and treatment processes at the Project, is summarized in **Soil and Water Resources Appendix B Table 3**.

~~**Land Treatment Unit**~~

~~75. In compliance with Table 2.1 in CCR Title 27, Chapter 3, Subchapter 2, Article 2, Section 20210, solid designated wastes will be managed in full containment in a Class II LTU with a single liner system. The LTUs will be constructed to be above the level of a 100-year storm event and designed to meet seismic hazard criteria. In addition, the base of the LTUs will have a greater than 5-foot separation to the underlying groundwater. The location of the east and west LTUs are shown on **Figure 2**.~~

~~76. The LTU will not incorporate a liner containment system or leak detection and removal system, but will be constructed with a prepared base consisting of 2 feet of compacted, low permeability, lime-treated material. This base will serve as a competent platform for land treatment activities, and will serve to slow the rate of surface water infiltration in the treatment area. The compacted lime-treated and native soil beneath the LTU is designated as a "treatment zone" to a depth of 5 feet. Although the LTU will be taking vehicle traffic, no hard surface will be required, as there is no liner system to protect. A staging area is allocated in the LTU for storage of HTF-impacted soils while they are being characterized. Soil characterized as hazardous will be removed from the site; therefore, no additional liner system is required in the LTU to cater for the hazardous waste.~~

77. ~~The LTU will be surrounded on all sides by a 2-foot high compacted earthen berm with side slopes of approximately 3:1 (horizontal: vertical). These berms will control and prevent potential inflow (run on) of surface storm water into the LTU or runoff of storm water from the unit.~~

78. ~~The LTUs are sized based on data from an existing solar farm that uses an LTU to bioremediate HTF-impacted soil and the following basis:~~

    a. ~~HTF-impacted soil is generated at a rate consistent with existing solar farm experience. Kramer Junction is a 150 MW facility that generates an average of 500 cubic yards (cyd) of HTF-impacted soil per year (DTSC correspondence, 1995). This rate is approximately 3.3 cyd/year/MW.~~

    b. ~~Applying the Kramer Junction experience to the 500 MW Palen facility, the Palen facility is estimated to generate ~1,666 cyd/year of HTFimpacted soil.~~

    c. ~~HTF-impacted soil is treated in 6-inches thicknesses, so, on average, 90,000 square feet or 2.1 acres is needed for HTF-impacted generated per year.~~

    d. ~~The LTU will be used for either placement of HTF-impacted soil or treatment of HTF-impacted soil. That is at any one time the LTU is used to place material to be treated as it is generated or being used for soil treatment. HTF-impacted soil treatment is estimate to take 1 to 4 months to complete bio remediation; however the design of the LTU will allow soil placed at the beginning of the year to have up to twelve months to complete bioremediation and removal.~~

    e. ~~To address above average spill events, Kramer Junction has additional capacity in the LTU or a factor of safety for HTF-impacted soil treatment. Kramer Junction has a capacity to treat 1,944 cyd/year and generates an average of 500 cyd/year of HTF-impacted soil, so the facility has ~ a 3.9 factor of safety. Applying this factor of safety to Palen, the total area estimated for LTU is approximately 350,000 square feet or 8 acres~~

79. ~~Treatment of HTF-impacted soil in the LTU will involve moisture conditioning and may involve addition of nitrogen and phosphorous nutrients (i.e., fertilizers) as needed to stimulate consumption of HTF by the indigenous bacteria. The HTF-impacted soil will be moisture conditioned and turned periodically as needed to enhance aeration, promote breakdown of HTF by the indigenous bacteria and/or to control dust emissions. Permanent or portable irrigation sprinklers will supply water to the area for dust control and to assist in treatment.~~

80. ~~Treatment piles may be covered by plastic sheeting as needed to enhance temperature and moisture retention characteristics, and as needed to control storm water contact, odors and dust emissions.~~

81. ~~The base layer construction process will follow these general steps:~~

a. ~~Prior to construction, the LTU will be stripped, grubbed and cleared of topsoil;~~

b. ~~General excavation and grading to sub grade will take place as needed;~~

c. ~~Scarification and moisture conditioning of sub grade materials will take place; and~~

d. ~~Placement, moisture conditioning, lime treatment, and compaction of native clayey silt material to form the base and perimeter berms will be completed before proof rolling after finish grading.~~

82. ~~The LTU pad and berm construction will use standard cut and fill techniques. Native clayey silt material will be used to construct the pad and berms. The clayey silt material will be moisture conditioned and treated with at least 2 percent quicklime to achieve an R-Value of at least 40 to 50. Treatment and compaction of the material will be conducted using standard commercial lime treatment methods and equipment and compacted in lifts using a sheeps foot roller. The lime treated layer will be compacted to a minimum of 95 percent of the maximum dry density as determined by American Standard for Testing and Materials (ASTM) D1557. Field testing of the density of the soil will be performed at regular intervals. Compaction results will be recorded. After finish grading, the surface of the LTU pad and berms will be proof rolled.~~

~~Waste Classification~~

83. ~~The HTF-affected soils will be characterized as hazardous or non hazardous waste prior to determination of whether the material can be treated at the LTU or must be removed for off-site disposal. Therefore, HTF affected soils will be relocated to a temporary staging area in the LTU and characterized consistent with U.S. Environmental Protection Agency (EPA) protocols. Soil sample of excavated HTF-affected soil will be collected in accordance with the EPA's current version of the manual "Test Methods for Evaluating Solid Waste" (SW- 846) and the waste material will be characterized in accordance with State and Federal requirements. Soil samples will be analyzed for HTF constituents (Biphenyl and Diphenyl Ether) using modified EPA Method Modified 8015.~~

84. ~~Prior to operation of the LTU and initiation of any on-site remediation of HTF, the waste stream will be characterized and a waste classification determination rendered by the DTSC. Initially, in addition to sampling for HTF, soil samples will also be analyzed for ignitability and toxicity using appropriate State and Federal methods to characterize the waste as hazardous or non-hazardous. Once a sufficient data set has been accumulated to allow characterization of the material as hazardous or non-hazardous waste based on HTF content and generator knowledge, the DTSC will be petitioned for a determination of waste classification for HTF-affected soils generated at the facility. Following this determination, subsequent samples will only be analyzed for HTF to determine disposition of the waste either for remediation or for transportation and disposal off-site. If the soil is characterized~~

~~as a hazardous waste, the impacted soils will be transported from the site by a licensed hazardous waste hauler for disposal at a licensed hazardous waste landfill or treatment storage and disposal facility (TSDF).~~

85. ~~Based on the classification practice and management of similar waste stream at the Kramer Junction Solar Electric Generating System (SEGS) facility in Kern County, it is anticipated that soil containing 10,000 mg/kg HTF or more will be managed as hazardous waste, and that soil containing less than 10,000 mg/kg HTF will be non-hazardous waste and can be managed at the site. At the Kramer Junction facility, the DTSC issued a letter dated April 4, 1995, stating that soil contaminated with HTF "poses an insignificant hazard" and classifies the waste as non-hazardous for soils with a concentration of less than 10,000 mg/kg HTF pursuant to CCR Title 22, Section 66260.200(f). Given that the formulation of HTF has not changed significantly since this determination, it is anticipated that future waste characterization at PSPP will yield a similar result although the DTSC has indicated that this decision will be made on a project specific basis and the Kramer Junction classification does not necessarily ensure the same classification for the PSPP.~~

86. ~~All HTF-affected soil classified as a hazardous waste will be removed for the site for proper off-site disposal; therefore the material in the LTU will be managed as a non-hazardous "designated waste" as defined in CCR Title 23, Chapter 15, Section 2522. Based on waste discharge requirements for similar sites, soil containing HTF in concentrations less than 100 mg/kg will not be regulated as a waste and could be reused as fill on-site.~~

~~Waste Management~~

87. ~~The LTU will be used to treat HTF-affected soil at various concentrations. Spills of HTF will be cleaned up within 48 hours and affected soil will be moved to a temporary staging area in the LTU where it will be placed on 60-mil plastic and covered with plastic sheeting pending receipt of analytical results and characterization of the waste material. As possible, free liquids will be removed using a vacuum truck. The liquids will be filtered and reused to the extent possible and reintroduced into the process. Filtrate that cannot be reused will be characterized, as appropriate though will likely be managed as hazardous waste, as the concentration in the filtrate will likely be more than 10,000 mg/kg HTF.~~

88. ~~No HTF-affected soils characterized as hazardous waste will be disposed or treated on-site. As stated previously, it is anticipated that soil containing 10,000 mg/kg HTF or more will be managed as hazardous waste, and that soil containing less than 10,000 mg/kg HTF will be managed at the site as nonhazardous waste. If the soil is characterized as a non-hazardous waste, it will be spread in the LTU for bioremediation treatment. In general, within the LTU, more highly contaminated soil will be covered with plastic sheeting to prevent contact with storm water and to control potential odors and emissions, as well as for moisture and temperature retention. Once the soil has been treated to a concentration of less than 100 mg/kg HTF, it will be moved from the LTU to another portion of the site until it is reused at the Project site as fill material.~~

~~89. Based on available operation data from other sites, it is anticipated that approximately 1,666 cubic yards (on average) of HTF-affected soil may be treated per year. Larger or smaller quantities could be generated during some years, depending on the frequency and size of leaks and spills.~~

~~90~~**74**. A Spill Prevention, Control, and Countermeasure (SPCC) Plan will be developed for the Project (refer to Section 13.4 for details). ~~Periodically, equipment failures in and around mirror fields are expected at the Project that may result in spills of HTF onto soil.~~

~~91. Excess wastewater or rain fall may occasionally accumulate in the LTU. The LTU has been constructed with 2-foot high berms such that storm water will not drain into or from the LTU. Based on the frequency of storms in the area, it is anticipated accumulation of rainwater within the containment would occur on a yearly basis. Water that accumulates within the LTU will be sampled for HTF and amendments. If HTF is not detected above the practical quantitation limit (PQL) and amendment concentrations (i.e., nitrate, phosphate, TDS) are at or near background groundwater concentrations and below State of California primary or secondary maximum contaminant levels the water may be reused in the plant process. If HTF is detected and amendment concentrations exceed background or drinking water standards the waste will be properly disposed of at a licensed TSDF.~~

Hazardous Waste

~~92~~**75**. There will be a variety of chemicals stored and used during construction and operation of the project. The storage, handling, and use of all chemicals will be conducted in accordance with applicable laws, ordinances, regulations, and standards.

~~93~~**76**. Hazardous materials will be stored in proper containers in material yards and designated construction areas. Cleanup materials (spill kits) will also be stored in these areas. Fuel, oil, and hydraulic fluids used in on-site vehicles will be transferred directly from a service truck to construction equipment and will not otherwise be stored on-site.

~~94~~**77**. Designated, trained service personnel will perform fueling either prior to the start of the workday or at completion of the workday. Service personnel and construction contractors will follow SOPs for filling and servicing construction equipment and vehicles.

~~95~~**78**. ~~Any HTF impacted soil classified as hazardous will be removed from the LTU staging area after the initial characterization~~. The evaporation ponds will not contain hazardous wastewater or sludge as it is illegal to discharge hazardous waste into surface impoundments under the Toxic Pits Cleanup Act of 1984.

Basin Plan

~~96~~**79**. The Water Quality Control Plan for the Colorado River Basin Region of California (Basin Plan) was adopted on November 17, 1993, and designates the beneficial uses of ground and surface water in this Region.

~~97~~**80**. The Basin Plan designates beneficial uses for surface waters in each watershed of the Colorado River Basin region. Beneficial uses of surface waters within the Facility area and vicinity that could be impacted by the Facility include:

a. Agricultural use

b. Municipal use

c. Industrial use

d. Recreational use

e. Groundwater recharge

f. Wildlife habitat

g. Preservation of Rare, Threatened, or Endangered Species

~~98~~**81**. The beneficial uses of ground water in the Imperial Hydrological Unit are:

a. Municipal Supply (MUN)

b. Industrial Supply (IND)

c. Agricultural supply

Monitoring Parameters

~~99~~**82**. Based on the chemical characteristics of the projected discharges to the evaporation ponds from wastewater, the following list of monitoring parameters are required. These specific parameters are selected because they provide the best distinction between the wastewater and the groundwater in the Project area that can be used to differentiate a potential release that could change the chemical composition of the groundwater.

a. Cations: Antimony, Arsenic, Barium, Cadmium, Calcium, Total Chromium, Cobalt, Copper, Lead, Mercury, Nickel, Selenium, Zinc;

b. Anions: Chloride and Sulfate; and

c. Other: ~~HTF~~, Total Dissolved Solids, Specific Conductivity, and pH.

California Environmental Quality Act (CEQA)

~~100~~**83** The California Energy Commission (CEC) is the lead agency under the California Environmental Quality Act (CEQA) (Public Resources Code Section 21000 et seq.) for all thermal power plants with power ratings of 50 MW or more. The CEC's power plant licensing process is a CEQA-equivalent process. The CEC will coordinate reviews and approvals with the regulatory agencies to ensure that the proposed project meets CEQA requirements. This includes obtaining these WDRs from the staff of the Regional Board. The CEC will certify this project and will include these WDRs as conditions of certification in accordance with the Warren-Alquist Act.[24]

Monitoring and Reporting Program

~~101~~**84** The monitoring and reporting requirements in the Monitoring and Reporting Program (Appendix D), and the requirement to install groundwater monitoring wells, are necessary to determine compliance with these WDRs, and to determine the Facility's impacts, if any, on receiving water. **All technical reports require the signature of a California Registered Professional Engineer or Professional Geologist.**

[24] The Warren-Alquist State Energy Resources Conservation and Development Act is the authorizing legislation for the California Energy Commission. The Act is codified at Public Resources Code (PRC) Section 25000 et seq.. PRC Section 25500 establishes the Commission's authority to certify all sites and related facilities for thermal power plants with power ratings of 50 megawatts or more. The section further declares that "the issuance of a certificate by the commission shall be in lieu of any permit, certificate, or similar document required by any state, local or regional agency, or federal agency to the extent permitted by federal law, for such use of the site and related facilities, and shall supersede any applicable statute, ordinance, or regulation of any state, local, or regional agency, or federal agency to the extent permitted by federal law."

Soil and Water Resources Appendix B Table 1 –
Raw Water Quality and Estimated Chemistry of Wastewater Streams

	Supply Water[1]	Wastewater to Evaporation Pond[2]	STCL[3]	TCLP[4]
24-Average Flow Rate (GPM)	63	4.23	--	--
Peak Operation Flow Rate (GPM)	97		--	--
Constituent	(mg/L)			
Cations				
Calcium	31	3,000	--	--
Magnesium	4.7	640	--	--
Sodium	352	20,500	--	--
Potassium	4	370	--	--
Ammonia	< 0.1			
Anions				
M-Alkinity			--	--
Sulfate	380	15,000	--	--
Chloride	200	25,000	--	--
Nitrate	0,7	0.15	--	--
Silicon Dioxide		1,200	--	--
General Water Quality				
Bicarbonate	149		--	--
Carbonate	ND		--	--
OH				--
P-Alkalinity				
pH		5 - 7		--
Spec Cond			--	--
TDS	1010	72,000	--	--
Total Hardness ($CaCO_3$)	830	4,200		
Turbidity				
Total Phosphate	< 0.31	2	--	--
Fluoride	6.1	140	180	--
Barium	31	3	--	--
Iron	< 100	11	--	--
Total Suspended Solids	1960		--	--
Biological Oxygen Demand	< 1		--	--

Soil and Water Resources Appendix B Table 1 (Cont.) – Raw Water Quality and Estimated Chemistry of Wastewater Streams

	Supply Water[1]	Wastewater to Evaporation Pond[2]	STCL[3]	TCLP[4]
Trace Metals				
Arsenic		0.43		
Boron	1.8		--	--
Chromium		0.2		
Copper	< 5	2	25	--
Manganese		0.7		
Molybdenum	73	2	350	--
Nickel		0.4		
Selenium		0.2		
Vanadium	< 5		24	--
Zinc	22	12	250	--

1. Water quality data from AFC Table Water 4, AECOM, 2009
2. Water Quality data from Palen Amendment Table 5.2-1, Palen 2012a
3. STLC = Soluble Threshold Limit Concentration, Regulated by CCR Title 22, Division 4.5, Article 3, Section 66261.24
4. TCLP = Toxicity Characteristics Leaching Procedure; Regulate under 40 CFR Section 261.24

Soil and Water Resources Appendix B Table 2 – Estimated Chemistry of Evaporation Pond Residue

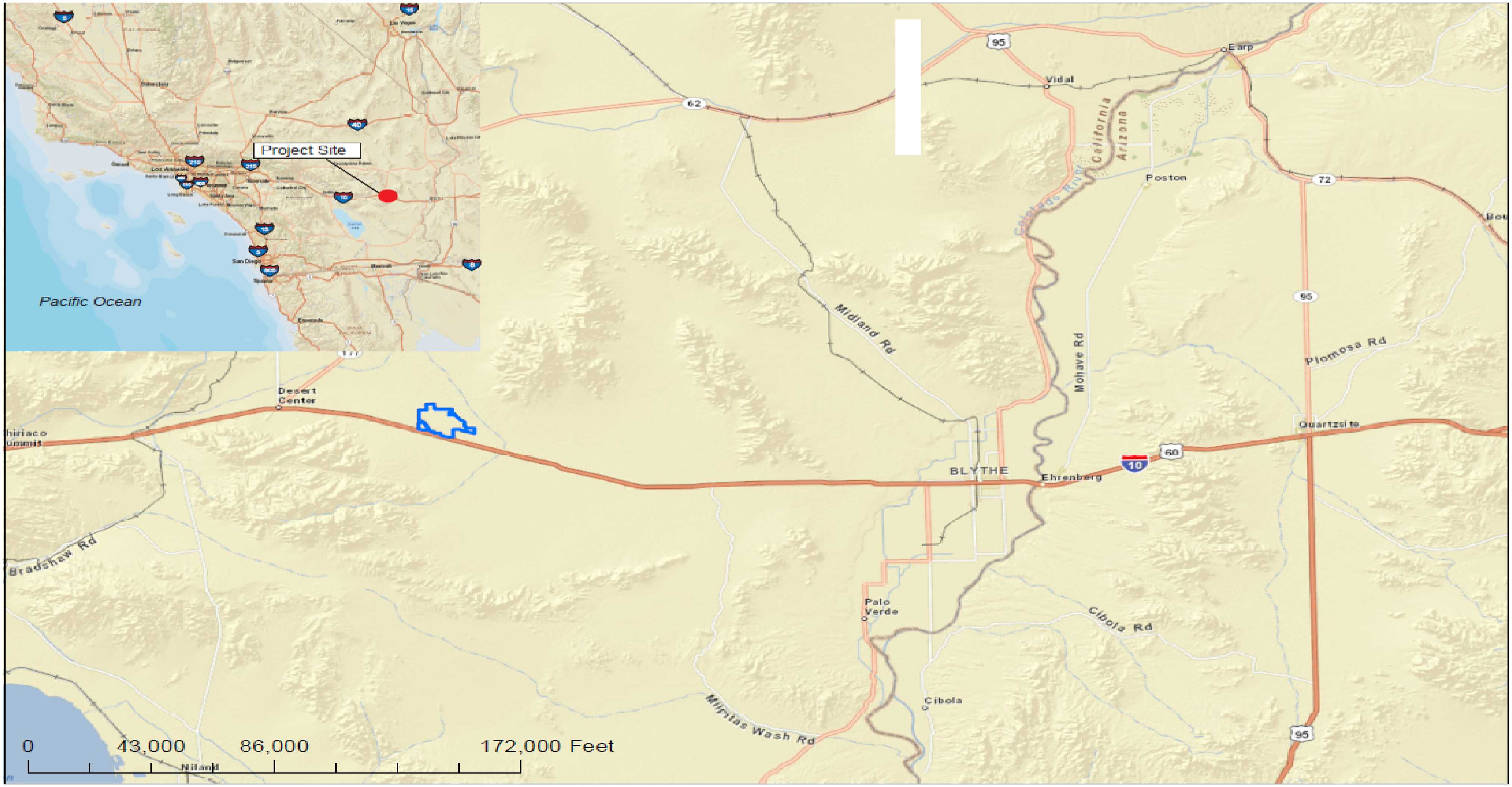
	Concentration in Evaporation Pond Discharge[1]	Total Residue Mass After 1 Year[2]	Concentration in 50% dry solids	Concentration with silt, 50% dry	STLC	TTLC	TCLP
	(mg/L)	(lbs)	(mg/kg)	(mg/kg)	(mg/L)	(mg/kg)	(mg/L)
Arsenic	0.43	0.0055	0.013	0.0012			
Barium	3	0.039	0.091	0.0082			
Chromium	0.2	0.0026	0.0061	0.00055			
Copper	2	0.026	0.061	0.0055			
Molybdenum	2	0.026	0.061	0.0055			
Nickel	0.4	0.0052	0.012	0.0011			
Selenium	0.2	0.0026	0.0061	0.00055			
Zinc	12	0.15	0.35	0.032			
Calcium	3000	39	91	8.2			
Magnesium	640	8.2	19	1.7			
Sodium	20500	260	610	55			
Potassium	370	4.8	11	0.99			
Iron	11	0.14	0.33	0.03			
Manganese	0.7	0.0090	0.021	0.0019			
Fluoride	140	1.8	4.2	0.38			
Chloride	25000	320	750	68			
Nitrate, as N	0	0	0	0			
Sulfate	0.15	0.0019	0.0044	0.00040			
Phosphate	2	0.026	0.061	0.0055			
Alkalinity, as CaCO3	4200	54	130	12			
Silica	1200	15	35	3.2			
pH	5-7	--	--	--			
TDS	7200.00	--	--	--			

Notes:
1. Concentration in Evaporation Pond Discharge based on Table 5.2-1 in the Petition for Amendment.
2. Based on daily flow of 4.23 g/d (16.01 l/d, 5,844.5 l/yr) from Project Water Balance.

Soil and Water Resources Appendix B Table 3 – Classification of Wastewater and Evaporation Pond Residue

Waste Stream	Waste Stream Compared To	Regulation	Waste Stream Characteristic	State & Federal Classification	CWC Section 13173 Classification
Wastewater	Soluble Threshold Limit Concentration (STLC)	CCR Title 22, Chapter 11, Division 4.5, Article 3, Section 66261.24 "Characteristics of Toxicity"	<STLC	Non-hazardous	Designated waste
	Toxicity Characteristic Leaching Procedure (TCLP)	Code of Federal Regulations (CFR) Part 261, Section 261.24	<TCLP	Non-hazardous	Designated waste
Evaporation Pond Residue	STLC	CCR, Title 22, Chapter 11, Division 4.5, Article 3, Section 66261.24 "Characteristics of Toxicity"	<STLC	Non-hazardous	Designated waste
	Total Threshold Limit Concentration (TTLC)	CCR, Title 22, Chapter 11, Division 4.5, Article 3, Section 66261.24 "Characteristics of Toxicity"	<TTLC	Non-hazardous	Designated waste
	TCLP	Code of Federal Regulations (CFR) Part 261, Section 261.24	<TCLP	Non-hazardous	Designated waste

Soil and Water Resource Appendix B Figure 1



Legend

Palen Solar Electric Generating System

N

FIGURE NO. 2.1-1

SITE VICINITY MAP

Soil and Water Resources Appendix B Figure 2

SOIL AND WATER RESOURCES – APPENDIX C

Staff has proposed modifications to the **Soil & Water Resources – Appendix C** as shown below. (**Note:** Deleted text is in ~~strikethrough~~, new text is **<u>bold and underlined</u>**)

REQUIREMENTS FOR WASTE DISCHARGE - Palen Solar ~~I~~<u>Holdings</u>, LLC, Owner/Operator, Palen Solar ~~Power Project~~ <u>Electric Generating System</u>, Riverside County

A. Discharge Specifications

1. The treatment or disposal of wastes at this Facility shall not cause pollution or nuisance as defined in Sections 13050 of Division 7 of the California Water Code (CWC).

2. The Discharger will maintain the monitoring wells in good working order at all times. Well maintenance may include periodic well re-development to remove sediments.

3. Thirty **<u>(30)</u>** days prior to introduction of a new waste stream into the evaporation ponds, the Discharger must receive approval from the Regional Board's Executive Officer.

4. Waste material shall be confined or discharged to the evaporation ~~ponds and LTU~~.

5. Prior to drilling a new well or abandoning a well at the Facility, the Discharger shall notify, in writing, the Regional Board's Executive Officer of the proposed change.

6. Containment of waste shall be limited to the areas designated for such activities. Any revision or modification of the designated waste containment area, or any proposed change in operation at the Facility that changes the nature and constituents of the waste produced must be submitted in writing to the Regional Board's Executive Officer for review and approval before the proposed change in operations or modification of the designated area is implemented.

7. Any substantial increase or change in the annual average volume of material to be discharged under this order at the Facility must be submitted in writing to the Regional Board's Executive Officer for review and approval.

8. If any portions of the evaporation ponds are to be closed, the Discharger shall notify the Regional Board's Executive Officer at least 180 days prior to beginning any partial or final closure activities.

9. Fluids and/or materials discharged to and/or contained in the evaporation ponds shall not overflow the ponds.

10. Prior to the use of new chemicals for the purposes of adjustment or control of microbes, pH, scale, and corrosion of the cooling tower water and wastewater, the Discharger shall notify the Regional Board's Executive Officer in writing.

11. For the liquids in the evaporation ponds, a minimum freeboard of two (2) feet shall be maintained at all times.

12. Final disposal of residual waste from cleanup of the evaporation ponds shall be accomplished to the satisfaction of the Regional Board's Executive Officer upon abandonment or closure of operations.

13. The evaporation ponds shall be designed, constructed, operated, and maintained to prevent inundation or washout due to floods having a predicted frequency of once in 100 years.

14. Prior to removal of solid material that has accumulated in the evaporation ponds, an analysis of the material must be conducted and the material must be disposed of in a manner consistent with that analysis and applicable laws and regulations.

15. Conveyance systems throughout the Facility area shall be cleaned out at least every 90 days to prevent the buildup of solids.

16. Pipe maintenance and de-scaling activities that include hydroblasting and/or sandblasting shall be performed within a designated area that minimizes the potential for release to the environment. Waste generated as a result of these activities shall be disposed of in accordance with applicable laws and regulations. Water from the hydroblasting process shall be conveyed to the evaporation ponds.

17. Public contact with wastewater shall be precluded through such means as fences, signs, or other acceptable alternatives.

18. The evaporations ponds shall be managed and maintained to ensure their effectiveness, in particular,

19. Implementation of erosion control measures shall assure that small coves and irregularities are not created.

20. The liner beneath the evaporation ponds shall be appropriately maintained to ensure its proper functioning.

21. Solid material shall be removed from the evaporation ponds in a manner that minimizes the likelihood of damage to the liner.

22. Ninety **<u>(90)</u>** days prior to the cessation of discharge operations at the Facility, the Discharger shall submit a workplan, subject to approval of the Regional Board's Executive Officer, for assessing the extent, if any, of contamination of natural geological materials and waters of the Chuckwalla Valley Groundwater Basin by the waste. One hundred twenty **<u>(120)</u>** days following workplan approval, the Discharger shall submit a technical report presenting results of the contamination assessment. A California Registered Civil Engineer or Certified Engineering Geologist must prepare the workplan, contamination assessment, and engineering report.

23. Upon ceasing operation at the Facility, all waste, all natural geologic material contaminated by waste, and all surplus or unprocessed material shall be removed from the site and disposed of in accordance with applicable laws and regulations.

24. The Discharger shall establish an irrevocable bond for closure in an amount acceptable to the Regional Board's Executive Officer or provide other means to ensure financial security for closure if closure is needed at the discharging site. The closure fund shall be established (or evidence of an existing closure fund shall be provided) within six (6) months of the adoption of this Order.

25. Surface drainage from tributary areas or subsurface sources, shall not contact or percolate through the waste discharged at this site.

26. The Discharger shall implement the attached Monitoring and Reporting Program, Appendix D, and revisions thereto, in order to detect, at the earliest opportunity, any unauthorized discharge of waste constituents from the Facility, or any impairment of beneficial uses associated with (caused by) discharges of waste to the brine pond.

27. The Discharger shall use the constituents listed in the attached Monitoring and Reporting Program, Appendix D, and revisions thereto, as "Monitoring Parameters".

28. The Discharger shall follow the Water Quality Protection Standard (WQPS) for detection monitoring established by the Regional Board. The following are parts of WQPS as established by the Regional Board's Executive Officer:

    a. The Discharger shall test for the monitoring parameters and the Constituents of Concern (COCs) listed in the Monitoring and Reporting R7-2010-0xxx and revisions thereto.

    b. Concentration Limits – The concentration limit for each monitoring parameter and constituents of concern for each monitoring point (as stated in the Detection Monitoring Program), shall be its statically determined background value or method detection limit, whichever is higher as obtained during that reporting period.

29. All current, revised, and/or proposed monitoring points must be approved by the Region Board's Executive Officer.

30. Water used for the process and site maintenance shall be limited to the amount necessary in the process, for dust control, and for Facility cleanup and maintenance.

31. The Discharger shall not cause or permit the release of pollutants, or waste constituents, in a manner which could cause or contribute to a condition of contamination, nuisance, or pollution to occur.

32. The Discharger must develop and implement a Hazardous Materials Business Plan (HMBP), which will include, at a minimum, procedures for:

    a. Hazardous materials handling, use, and storage;

    b. Emergency response;

    c. Spill control and prevention;

    d. Employee training; and

    e. Reporting and record keeping.

33. Hazardous materials expected to be used during construction include: unleaded gasoline, diesel fuel, oil, lubricants (i.e., motor oil, transmission fluid, and hydraulic fluid), solvents, adhesives, and paint materials. There are no feasible alternatives to these materials for construction or operation of construction vehicles and equipment, or for painting and caulking buildings and equipment.

34. The construction contractor will be responsible for assuring that the use, storage and handling of these materials will comply with applicable federal, state, and local laws, ordinances, regulations and standards (LORS), including licensing, personnel training, accumulation limits, reporting requirements, and recordkeeping.

35. During Facility operations, chemicals will be stored in chemical storage areas appropriately designed for their individual characteristics. Bulk chemicals will be stored outdoors on impervious surfaces in aboveground storage tanks with secondary containment. Secondary containment areas for bulk storage tanks will not have drains. Any chemical spills in these areas will be removed with portable equipment and reused or disposed of properly. Other chemicals will be stored and used in their delivery containers.

36. A portable storage trailer may be on-site for storage of maintenance lube oils, chemicals, paints, and other construction materials, as needed. All drains and vent piping for volatile chemicals will be trapped and isolated from other drains to eliminate noxious vapors. The storage, containment, handling, and use of these chemicals will be managed in accordance with applicable laws, ordinances, regulations, and standards.

37. Small quantities of hazardous wastes will be generated over the course of construction. These may include paint, spent solvents, and spent welding materials. Some hazardous wastes will be recycled, including used oils from equipment maintenance, and oil-contaminated materials such as spent oil filters, rags, or other cleanup materials. Used oil must be recycled, and oil or heavy metal contaminated materials (e.g., filters) requiring disposal must be disposed of in a Class I waste disposal facility. Scale from pipe and equipment cleaning operations, and solids from the evaporation pond, will be disposed of in a similar manner.

38. All hazardous wastes generated during facility construction and operation must be handled and disposed of in accordance with applicable laws, ordinances, regulations, and standards. Any hazardous wastes generated during construction must be collected in hazardous waste accumulation containers near the point of generation and moved daily to the contractor's 90-day hazardous waste storage area located on-site. The accumulated waste must subsequently be delivered to an authorized waste management facility. Hazardous wastes must be either recycled or managed and disposed of properly in a licensed Class I waste disposal facility authorized to accept the waste.

39. The Discharger shall monitor the evaporation ponds in conformance with applicable CCR Title 27 requirements for Class II surface impoundment waste management units.

40. The leachate collection and removal system must be used to provide preliminary detection monitoring of leaks through the top liner of the doublelined evaporation ponds. Physical evidence of leachate beneath the upper concrete liner shall be interpreted as a warning that containment of the evaporation pond contents may be compromised.

41. Groundwater monitoring wells must be constructed adjacent to and both up gradient and down gradient of the evaporation ponds to provide background and detection monitoring for any potential release from the evaporation ponds containment. The Point of Compliance to be used for the detection monitoring must be the uppermost groundwater beneath the evaporation pond. The groundwater monitoring wells must be constructed in conformance with Title 27 CCR Section 20415 requirements. The monitoring wells must be designed to meet the background and detection monitoring requirements in conformance with Title 27 CCR Section 20415(b)(1)(B) as applicable, including:

    a. Providing a sufficient number of monitoring points to yield ground water samples from the uppermost aquifer that represent the quality of ground water passing the Point of Compliance and to allow for the detection of a release from the evaporation ponds;

    b. Providing a sufficient number of monitoring points and background monitoring points installed at appropriate locations and depths to yield ground water samples from the uppermost aquifer to provide the best assurance of the earliest possible detection of a release from the evaporation ponds; and

    c. Selecting monitoring point locations and depths that include the zone(s) of highest hydraulic conductivity in the ground water body monitored.

42. The detection monitoring wells shall be constructed to meet the well performance standards set forth in Title 27 CCR Section 20415(b)(4), as applicable, including:

43. All monitoring wells shall be cased and constructed in a manner that maintains the integrity of the monitoring well bore hole and prevents the bore hole from acting as a conduit for contaminant transport.

44. The sampling interval of each monitoring well shall be appropriately screened and fitted with an appropriate filter pack to enable collection of representative ground water samples.

45. For each monitoring well, the annular space (i.e., the space between the bore hole and well casing) above and below the sampling interval shall be appropriately sealed to prevent entry of contaminants from the ground surface, entry of contaminants from the unsaturated zone, cross contamination between portions of the zone of saturation, and contamination of samples.

46. All monitoring wells shall be adequately developed to enable collection of representative ground water samples.

47. The monitoring program must also meet the general requirements set forth in Title 27 CCR Section 20415(e), which require that all monitoring systems be designed and certified by a registered geologist or a registered civil engineer. The applicable general requirements set forth for boring logs, quality assurance/quality control, sampling and analytical methods used, background sampling, data analysis, and other reporting as applicable will be implemented.

48. Baseline samples of the groundwater must be collected from each of the monitoring wells and analyzed prior to discharging wastewater to the evaporation ponds. The groundwater must be initially sampled for each of the proposed monitoring parameters listed in the attached Monitoring and Reporting Program, Appendix D, and any additional Constituents of Concern (COC) identified by the Regional Board.

B. Prohibitions

1. The discharge or deposit of solid waste to the evaporation ponds as a final form of disposal is prohibited, unless authorized by the Regional Board's Executive Officer.

2. The Discharger is prohibited from discharging, treating or composting at this site the following wastes:

    a. Municipal solid waste;

    b. Sludge (including sewage sludge, water treatment sludge, and industrial sludge);

    c. Septage;

    d. Liquid waste, unless specifically allowed by these WDRs or approved by the Regional Board's Executive Officer;

    e. Oily and greasy liquid waste; unless specifically allowed by these WDRs or approved by the Regional Board's Executive Officer;

    f. Hot, burning waste materials or ash.

3. The Discharger shall not cause degradation of any groundwater aquifer or water supply.

4. The discharge of waste to land not owned or controlled by the Discharger is prohibited.

5. Use of wastewater or cooling tower liquids on access roads, well pads, or other developed project locations for dust control is prohibited.

6. The discharge of hazardous or designated wastes to other than a waste management unit authorized to receive such waste is prohibited.

7. Any hazardous waste generated or stored at the facility will be contained and disposed in a manner that complies with federal and state regulations.

8. Wastewater or any fluids in the evaporation ponds shall not enter any canal, drainage, or drains (including subsurface drainage systems) which could provide flow to the Waters of the State.

9. The Discharger shall appropriately dispose of any materials, including fluids and sediments removed from the evaporation ponds.

10. The Discharger shall neither cause nor contribute to the contamination or pollution of ground water via the release of waste constituents in either liquid or gaseous phase.

11. Direct or indirect discharge of any waste to any surface water or surface drainage courses is prohibited.

12. The Discharger shall not cause the concentration of any Constituent of Concern or Monitoring Parameter to exceed its respective background value in any monitored medium at any Monitoring Point assigned for Detection Monitoring pursuant to the attached Monitoring and Reporting, Appendix D, and future revisions thereto.

C. Provisions

1. The Discharger shall comply with the attached Monitoring and Reporting Program, Appendix D, and future revisions thereto, as specified by the Regional Board's Executive Officer.

2. Unless otherwise approved by Regional Board's Executive Officer, all analyses shall be conducted at a laboratory certified for such analyses by the California Department of Public Health. All analyses shall be conducted in accordance with the latest edition of "Guideline Establishing Test Procedures for Analysis of Pollutants", promulgated by the United States Environmental Protection Agency.

3. The laboratory shall use detection limits less than or equal to Environmental Protection Agency (EPA) Action Level/Maximum Contaminate Levels (MCLs) or California Department of Public Health (CDPH) Notification Level/MCL for all samples analyzed. The lowest concentration, whether EPA or CDPH, of the two agencies must be used for the analysis.

4. Prior to any change in ownership of this operation, the Discharger shall transmit a copy of the Board Order to the succeeding owner/operator, and forward a copy of the transmittal letter to the Regional Board.

5. Prior to any modification in this facility that would result in material change in the quality or quantity of discharge, or any material change in the location of discharge, the Discharger shall report all pertinent information in writing to the Regional Board's Executive Officer and obtain revised waste discharge requirements before any modification is implemented.

6. All permanent containment structures and erosion and drainage control systems shall be certified by a California Registered Civil Engineer or Certified Engineering Geologist as meeting the prescriptive standards and performance goals.

7. The Discharger shall ensure that all site-operating personnel are familiar with the content of these WDRs, and shall maintain a copy of these WDRs at the site.

8. These WDRs do not authorize violation of any federal, state, or local laws or regulations.

9. The Discharger shall allow the Regional Board, or an authorized representative, upon presentation of credential and other documents as may be required by law, to:

   a. Enter upon the premises regulated by these WDRs, or the place where records must be kept under the conditions of these WDRs;

   b. Have access to and copy, at reasonable times, any records that shall be kept under the condition of these WDRs;

   c. Inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under these WDRs; and

   d. Sample or monitor at reasonable times, for the purpose of assuring compliance with these WDRs or as otherwise authorized by the CWC or California Code of Regulations, any substances or parameters at this location.

10. The Discharger shall comply with all of the conditions of these WDRs. Any noncompliance with these WDRs constitutes a violation of the Porter-Cologne Water Quality Act and may be grounds for enforcement action.

11. The Discharger shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) that are installed or used by the Discharger to achieve compliance with these WDRs. Proper operation and maintenance also includes adequate laboratory controls and appropriate quality assurance procedures.

12. These WDRs do not convey any property rights of any sort or any exclusive privileges, nor does it authorize any injury to private property or any invasion of personal rights, nor any infringement of federal, state, or local laws or regulations.

13. The Discharger shall comply with the following:

    a. Samples and measurements taken for the purpose of monitoring shall be representative of the monitored activity.

    b. The Discharger shall retain records of all monitoring information, copies of all reports required by these WDRs, and records of all data used to complete the application for these WDRs, for a period of at least five (5) years from the date of the sample, measurement, report or application. This period may be extended by request of the Regional Board's Executive Officer at any time.

    c. Records of monitoring information shall include:

        i. The date, exact places, and time of sampling or measurements.

        ii. The individual(s) who performed the sampling or measurements.

        iii. The date(s) analyses were performed.

        iv. The individual(s) responsible for reviewing the analyses.

        v. The results of such analyses.

    d. Monitoring must be conducted according to test procedures described in the attached Monitoring and Reporting Program, Appendix D, unless other test procedures have been specified in these WDRs or approved by the Regional Board's Executive Officer.

14. All monitoring systems shall be readily accessible for sampling and inspection.

15. The Discharger is the responsible party for the WDRs, and the monitoring and reporting program for the Facility. The Discharger shall comply with all conditions of these WDRs. Violations may result in enforcement actions, requiring corrective action or imposing civil monetary liability.

16. The Discharger shall furnish, under penalty of perjury, technical monitoring program reports, and such reports shall be submitted in accordance with the specifications prepared by the Regional Board's Executive Officer. Such specifications are subject to periodic revisions as may be warranted.

17. The Discharger may be required to submit technical reports as directed by the Regional Board's Executive Officer.

18. The procedure for preparing samples for the analyses shall be consistent with the attached Monitoring and Reporting Program, Appendix D, and any future revisions thereto. The Monitoring Reports shall be certified to be true and correct, and signed, under penalty of perjury, by an authorized official of the company. All technical reports require the signature of a California Registered Professional Engineer or Professional Geologist.

19. All monitoring shall be done as described in Title 27 of the CCRs.

SOIL AND WATER RESOURCES – APPENDIX D

MONITORING AND REPORTING PROGRAM FOR WASTEWATER DISCHARGE - Palen Solar Holdings, LLC, Owner/Operator, Palen Solar Electric Generating System, Riverside County

PART I – GENERAL REQUIREMENTS

A. GENERAL

A Discharger who owns or operates a Class II Surface Impoundment is required to comply with the provisions of Title 27, Division 2, Chapter 3, Subchapter 3, Article 1 of the California Code of Regulations for the purpose of detecting, characterizing, and responding to releases to the groundwater. Section 13267, California Water Code (CWC) gives the Colorado River Basin Regional Water Quality Control Board (Regional Board) authority to require monitoring program reports for discharges that could affect the quality of waters within its region.

1. This Monitoring and Reporting Program (MRP) is Appendix D of the WDRs set forth in Appendices B and C, and are incorporated herein by this reference. The principal purpose of this self-monitoring program is:
   a. To document compliance with Waste Discharge Requirements (WDRs), and prohibitions established by the Regional Board;
   b. To facilitate self-policing by the Discharger in the prevention and abatement of pollution arising from waste discharge;
   c. To conduct water quality analyses.
2. The Regional Board Executive Officer may alter the monitoring parameters, monitoring locations, and/or the monitoring frequency during the course of this monitoring program.

B. DEFINITION OF TERMS

1. Affected Persons – all persons who either own or occupy land outside the boundaries of the parcel upon which a waste management unit (surface impoundment or impoundment) is located that has been or may be affected by the release of waste constituents from the unit.
2. Background Monitoring Point – a device (e.g. well) or location (e.g. a specific point along a lakeshore) that is up gradient or side gradient from the impoundment assigned by this MRP, where water quality samples are taken that are not affected by a release from the impoundment and that are used as a basis of comparison against samples taken from down gradient Monitoring Points.
3. Constituents of Concern (COCs) – those constituents likely to be in the waste, or derived from waste constituents in the event of a release from the impoundment.
4. Matrix Effect – refers to any change in the Method Detection Limit (MDL) or Practical Quantitation Limit (PQL) for a given constituent as a result of the

presence of other constituents - either of natural origin or introduced through a spill or release - that are present in the sample being analyzed.

5. Method Detection Limit (MDL) – the lowest constituent concentration that can support a non-zero analytical result with 99 percent reliability. The MDL is laboratory specific and should reflect the detection capabilities of specific procedures and equipment used by the laboratory.

6. Monitored Media – water - bearing media monitored pursuant to this Monitoring and Reporting Program. The Monitored Media may include: (1) groundwater in the uppermost aquifer, in any other portion of the zone of saturation (as defined in Title 27, Section 20164) in which it would be reasonable to anticipate that waste constituents migrating from the surface impoundment could be detected, and in any perched zones underlying the impoundment, (2) any bodies of surface water that could be measurably affected by a release, (3) soil-pore liquid beneath and/or adjacent to the surface impoundment, and (4) soil-pore gas beneath and/or adjacent to the surface impoundment.

7. Monitoring Parameters – the list of constituents and parameters used for the majority of monitoring activity.

8. Monitoring Point – a device (e.g. well) or location (e.g. a specific point along a lakeshore) that is down gradient from the surface impoundment assigned by this MRP, at which samples are collected for the purpose of detecting a release by comparison with samples collected at Background Monitoring Points.

9. Practical Quantification Limit (PQL) – the lowest constituent concentration at which a numerical concentration can be assigned with a 99 percent certainty that its value is within 10 percent of the actual concentration in the sample. The PQL is laboratory specific and should reflect the detection capabilities of specific procedures and equipment used by the laboratory.

10. Reporting Period – the duration separating the submittal of a given type of monitoring report from the time the next iteration of that report is scheduled for submittal. Unless otherwise stated, the due date for any given report shall be 30 days after the end of its Reporting Period.

11. Sample Locations -

    a. For Monitoring Points – the number of data points obtained from a given Monitoring Point during a given Reporting Period – used for carrying out the statistical or non-statistical analysis of a given analyte during a given Reporting Period.

    b. For Background Monitoring Points – the number of new and existing data points from all applicable Background Monitoring Points in a given Monitored Medium – used to collectively represent the background concentration and variability of a given analyte in carrying out a statistical or non-statistical analysis of that analyte during a given Reporting Period.

12. Uppermost Aquifer – the geologic formation nearest the natural ground surface that is an aquifer, as well as, lower aquifers that are hydraulically interconnected with this aquifer within the facility's property boundary.

13. Volatile Organic Constituents (VOCs) – the suite of organic constituents having a high vapor pressure. The term includes at least the 47 organic constituents listed in Appendix I to 40 CFR Part 258.

14. VOC_{water} – the composite monitoring parameter that includes all VOCs that are detectable in less than 10 percent of the applicable background samples. This parameter is analyzed using the non-statistical method described in Part III.A.2 of this MRP, to identify releases of VOCs that are detected too infrequently in background water to allow for statistical analysis.

C. SAMPLING AND ANALYTICAL METHODS

Sample collection, storage, and analysis shall be performed according to the most recent version of Standard USEPA methods, and California ELAP rulings. Water and waste analysis shall be performed by a laboratory approved for these analyses by the California Department of Public Health. Specific methods of analysis must be identified. If methods other than USEPA-approved methods or Standard Methods are used, the exact methodology must be submitted for review and approval by the Regional Board Executive Officer prior to use. The director of the laboratory whose name appears on the certification shall supervise all analytical work in his/her laboratory and shall sign all reports of such work submitted to the Regional Board. All monitoring instruments and equipment shall be properly calibrated and maintained to ensure accuracy of measurement. In addition, the Discharger is responsible for verifying that laboratory analysis of all samples from Monitoring Points and Background Monitoring Points meet the following restrictions:

1. Methods, analysis, and detection limits used must be appropriate for expected concentrations. For detection monitoring of any constituent or parameter found in concentrations that produce more than 90% non-numerical determinations (i.e. "trace" or "ND") in data from Background Monitoring Points for that medium, the analytical methods having the lowest "facility-specific method detection limit (MDL)", defined in Part I.B.5., shall be selected from among those methods that provide valid results in light of any "Matrix Effects" (defined in Part I.B.4.) involved.

2. Analytical results falling between the MDL and the PQL shall be reported as "trace", and shall be accompanied both by the estimated MDL and PQL values for that analytical run, and by an estimate of the constituent's concentration.

3. MDLs and PQLs shall be derived by the laboratory for each analytical procedure, according to State of California laboratory accreditation procedures. These MDLs and PQLs shall reflect the detection and quantitation capabilities of the specific equipment used by the lab. If the lab suspects that, due to a change in matrix or other effects, the true detection limit or quantitation limit for a particular analytical run differs significantly from the laboratory-derived MDL/PQL values,

the results shall be flagged accordingly, along with an estimate of the detection limit and quantitation limit actually achieved.

4. All Quality Assurance/Quality Control (QA/QC) data shall be reported, along with the sample results to which it applies, including the method, equipment, and analytical detection limits, the recovery rates, an explanation of any recovery rate that is less than method recovery standards, the results of equipment and method blanks, the results of spiked and surrogate samples, the frequency of quality control analysis, and the name and qualifications of the person(s) performing the analyses. Sample results shall be reported unadjusted for blank results or spike recovery.

5. Upon receiving written approval from the Regional Board Executive Officer, an alternative statistical or non-statistical procedure can be used for determining the significance of analytical results for a constituent that is a common laboratory contaminant (i.e., methylene chloride, acetone, diethylhexyl phthalate, and di-n-octyl phthalate) during any given Reporting Period in which QA/QC samples show evidence of laboratory contamination for that constituent. Nevertheless, analytical results involving detection of these analytes in any background or down gradient sample shall be reported and flagged for easy reference by Regional Board staff.

6. In cases where contaminants are detected in QA/QC samples (i.e. field, trip, or lab blanks), the accompanying sample results shall be appropriately flagged.

7. The MDL shall always be calculated such that it represents a concentration associated with a 99% reliability of a non-zero result.

D. RECORDS TO BE MAINTAINED

Written reports shall be maintained by the Discharger or laboratory, and shall be retained for a minimum of five (5) years. This period of retention shall be extended during the course of any unresolved litigation regarding this discharge or when requested by the Regional Board. Such records shall show the following for each sample:

1. Identity of sample and of the Monitoring Point or Background Monitoring Point from which it was taken, along with the identity of the individual who obtained the sample;

2. Date and time of sampling;

3. Date and time that analyses were started and completed, and the initials of the personnel performing each analysis;

4. Complete procedure used, including method of preserving the sample, and the identity and volumes of reagents used;

5. Calculations of results; and

6. Results of analyses, and the MDL and PQL for each analysis.

E. REPORTS TO BE FILED WITH THE REGIONAL BOARD

1. Detection Monitoring Reports – For each Monitored Medium, all Monitoring Points and Background Monitoring Points assigned to detection monitoring under Part II.A.7 of this MRP shall be monitored **semiannually** for the Monitoring Parameters (Part II.A.4). A "Detection Monitoring Report" shall be submitted to the Regional Board in accordance with the schedule contained in the Summary of Self-Monitoring and Reporting Requirements, and shall include the following:

    a. A Letter of Transmittal that summarizes the essential points in each report shall accompany each report submittal. The letter of transmittal shall be signed by a principal executive officer at the level of vice-president or above, or by his/her duly authorized representative, if such representative is responsible for the overall operation of the facility from which the discharge originates. The letter of transmittal shall include:

        i. A discussion of any violations noted since the previous report submittal and a description of the actions taken or planned for correcting those violations. If no violations have occurred since the last submittal, that should be so stated;

        ii. If the Discharger has previously submitted a detailed time schedule or plan for correcting any violations, a progress report on the time schedule and status of the corrective actions being taken; and

        iii. A statement by the official, under penalty of perjury, that to the best of the signer's knowledge the report is true, complete, and correct.

    b. A Compliance Evaluation Summary shall be included in each Detection Monitoring Report. The compliance evaluation summary shall contain at least:

        i. Velocity and direction of groundwater flow for each monitored groundwater body under and around the surface impoundment based upon the water level elevations taken during the collection of water quality data. A description and graphical presentation (e.g., arrow on a map) shall be submitted;

        ii. Methods used for water level measurement and pre-sampling purging for each monitoring well addressed by the report including:

            1. Method, time, and equipment used for water level measurement;

            2. Type of pump used for purging, placement of the pump in the well, pumping rate, and well recovery rate;

            3. Methods and results of field testing for pH, temperature, electrical conductivity, and turbidity, including;

                a. Equipment calibration methods, and

                b. Method for disposing of purge water

iii. Methods used for sampling each Monitoring Point and Background Monitoring Point, including:

1. A description of the type of pump, or other device used, and its placement for sampling;

2. A detailed description of the sampling procedure: number and description of samples, field blanks, travel blanks, and duplicate samples; types of containers and preservatives used; date and time of sampling; name and qualifications of individual collecting samples, and other relevant observations;

c. A map or aerial photograph showing the locations of Monitoring Points, and Background Monitoring Points;

d. For each Detection Monitoring Report, provide all relevant laboratory information including results of all analyses, and other information needed to demonstrate compliance with Part I.C.;

e. An evaluation of the effectiveness of the run-off/run-on control facilities;

f. A summary of reportable spills/leaks occurring during the reporting period; include estimated volume of liquids/solids discharged outside designated containment area, a description of management practices to address spills/leaks, and actions taken to prevent reoccurrence.

2. Annual Summary Report – The Discharger shall submit to the Regional Board, an "Annual Summary Report" for the period extending from January 1 through December 31. The "Annual Summary Report" is due **March 15** of each year, and shall include the following:

a. A graphical presentation of analytical data for each Monitoring Point and Background Monitoring Point (Title 27, Section 20415(e)(14)). The Discharger shall submit, in graphical format, the laboratory analytical data for all samples taken within at least the previous five (5) calendar years. Each such graph shall plot the concentration of one (1) or more constituents over time for a given Monitoring Point and Background Monitoring Point, at a scale appropriate to show trends or variations in water quality. The graphs shall plot each datum, rather than plotting mean values. For any given constituent or parameter, the scale for background plots shall be the same as that used to plot down gradient data. On the basis of any aberrations noted in the plotted data, the Regional Board Executive Officer may direct the Discharger to carry out a preliminary investigation (Title 27, Section 20080(d)(2)), the results of which will determine whether or not a release is indicated;

b. A tabular presentation of all monitoring analytical data obtained during the previous two (2) Monitoring and Reporting Periods, submitted on hard copy within the annual report as well as digitally on electronic media in a file format acceptable to the Regional Board Executive Officer (Title 27, Section 20420(h)). The Regional Board regards the submittal of data in hard copy and on diskette CD-ROM as "...a form necessary for..." statistical analysis in that this facilitates periodic review by the Regional Board statistical consultant;

c. A comprehensive discussion of the compliance record and any corrective actions taken or planned, which may be needed to bring the Discharger into full compliance with WDRs;

d. A written summary of the groundwater analyses, indicating changes made since the previous annual report; and

e. An evaluation of the effectiveness of the run on/run-off control facilities, pursuant to Title 27, Section 20365.

3. <u>Contingency Reporting</u>

a. The Discharger shall report any spill of evaporation pond liquid by telephone within 48 hours of discovery. The reportable quantity for evaporation pond liquid is 150 gallons.

After reporting a spill, a written report shall be filed with the Regional Board Executive Officer within seven (7) days, containing at a minimum the following:

i. A map showing the location(s) of the discharge/spill;

ii. A description of the nature of the discharge (all pertinent observations and analyses including quantity, duration, etc.); and

iii. Corrective measures underway or proposed.

b. Should the initial statistical comparison (Part III.A.1.) or non-statistical comparison (Part III.A.2.) indicate, for any Constituent of Concern or Monitoring Parameter, that a release is tentatively identified, the Discharger shall immediately notify the Regional Board verbally as to the Monitoring Point(s) and constituent(s) or parameter(s) involved, shall provide written notification by certified mail within seven (7) days of such determination (Title 27, Section 20420(j)(1)), and shall conduct a discrete retest in accordance with Part III.A.3. If the retest confirms the existence of a release, the Discharger shall carry out the requirements of Part I.E.3.d. In any case, the Discharger shall inform the Regional Board of the outcome of the retest as soon as the results are available, following up with written results submitted by certified mail within seven (7) days of completing the retest.

c. If either the Discharger or the Regional Board determines that there is significant physical evidence of a release (Title 27, Section 20385(a)(3)), the Discharger shall immediately notify the Regional Board of this fact by certified mail (or acknowledge the Regional Board's determination) and shall carry out the requirements of Part I.E.3.d. for all potentially-affected monitored media.

d. If the Discharger concludes that a release has been discovered:

i. If this conclusion is <u>not</u> based upon “direct monitoring” of the Constituents of Concern, pursuant to Part II.A.5., then the Discharger shall, within thirty days, sample for all Constituents of Concern at all Monitoring Points and submit them for laboratory analysis. Within seven (7) days of receiving the laboratory analytical results, the Discharger shall notify the Regional Board, by certified mail, of the concentration of all Constituents of Concern at each Monitoring Point. Because this scan is not to be tested against background, only a single datum is required for each Constituent of Concern at each Monitoring Point [Title 27 Section 20420(k)(1)];

ii. The Discharger shall, within 90 days of discovering the release (Title 27, Section 20420(k)(5)), submit a Revised Report of Waste Discharge proposing an Evaluation Monitoring Program meeting the requirements of Title 27, Section 20425; and

iii. The Discharger shall, within 180 days of discovering the release (Title 27, Section 20420(k)(6), submit a preliminary engineering feasibility study meeting the requirements of Title 27, Section 20430.

e. Any time the Discharger concludes - or the Regional Board Executive Officer directs the Discharger to conclude - that a liquid phase release from the surface impoundment has proceeded beyond the facility boundary, the Discharger shall so notify all persons who either own or reside upon the land that directly overlies any part of the plume (Affected Persons).

i. Initial notification to Affected Persons shall be accomplished within 14 days of making this conclusion and shall include a description of the Discharger's current knowledge of the nature and extent of the release; and

ii. Subsequent to initial notification, the Discharger shall provide updates to all Affected Persons, including any persons newly affected by a change in the boundary of the release, within 14 days of concluding a material change in the nature or extent of the release has occurred.

4. <u>Surface Impoundment - Leakage Detection System (LDS), and Solids Monitoring</u>

a. Sampling and reporting shall be conducted semi-annually.

b. Provide volume of solids removed from the holding pond each month for that reporting period, and transported to a waste management facility for disposal. Include name and location of waste management facility.

c. Conduct quarterly inspections of Leakage Detection System (LDS), and holding pond.

PART II – MONITORING REQUIREMENTS FOR GROUNDWATER

A. GROUNDWATER SAMPLING AND ANALYSIS FOR DETECTION MONITORING

1. Groundwater Surface Elevation and Field Parameters – Groundwater sampling and analysis shall be conducted semiannually pursuant to California ELAP rulings, and include an accurate determination of the groundwater surface elevation and field parameters (temperature, electrical conductivity, turbidity) for each Monitoring Point and Background Monitoring Point (Title 27, Section 20415(e)(13)). Groundwater elevation obtained prior to purging the well and sample collection, shall be used to fulfill the semi-annual groundwater flow rate/direction analyses required under Part I.E.1.b.i. Groundwater wells shall be gauged using an electronic sounder capable of measuring depth to groundwater within 100th of an inch. Following gauging, wells shall be purged according to EPA groundwater sampling procedures until:

   a. pH, temperature, and conductivity are stabilized within 10 percent, and

   b. turbidity has been reduced to 10 NTUs or the lowest practical levels achievable.

   The above identified parameters shall be recorded in the field, and submitted in the monitoring report. Sampling equipment shall be decontaminated between wells. Purge water may be discharged to the brine pond; discharge to the ground surface is prohibited.

2. Groundwater Sample Collection - Groundwater samples shall be collected from all monitoring points and background monitoring points after wells recharge to within at least 80 percent of their original static water level. Groundwater samples shall be collected with a paristaltic pump that is decontaminated between sampling events. Samples shall be labeled, logged on chain-of-custody forms, and placed in cold storage pending delivery to a State certified analytical laboratory.

3. Five-Day Sample Procurement Limitation – To satisfy data analysis requirements for a given reporting period, samples collected from all Monitoring Points and Background Monitoring Points shall be taken within a span not exceeding five (5) days, and shall be taken in a manner that insures sample independence to the greatest extent feasible (Title 27, Section 20415(e)(12)(B)).

4. Groundwater Monitoring Parameters for Detection Monitoring – Groundwater samples collected from monitoring points and background monitoring points shall be analyzed for the following:

Parameter	Unit	Sample Type
Chloride	mg/L	Grab
Sulfate	mg/L	Grab
Total Dissolved Solids (TDS)	mg/L	Grab

pH	#	Grab
Specific Conductance	μohms/cm	Grab
Heavy Metals (Sb, As, Ba, Cd, Ca, Cr, Co, Cu,		
Pb, Hg, Ni, Se, Zn)	mg/L	Grab
Oil & Grease	mg/L	Grab

All Monitoring Points and Background Monitoring Points assigned to Detection Monitoring shall be sampled semi-annually in **June** and **December** of each year in accordance with Part I of this MRP. Monitoring results shall be reported in the semi-annual Detection Monitoring Report.

5. Data Analysis – Statistical or non-statistical analysis shall be carried out as soon as the data is available, in accordance with Part III of this monitoring program.

   Monitoring Points and Background Monitoring Points – At a minimum of 90 days prior to the operation of the facility, the Discharger shall submit a proposed groundwater monitoring program, including background and detection monitoring locations, to the Executive Officer for review and approval.

6. Initial Background Determination: For the purpose of establishing an initial pool of background data for each Constituent of Concern at each Background Monitoring Point [Title 27, Section 20415(e)(6)]:

   a. Whenever a new Constituent of Concern is added to the Water Quality Protection Standard, including any added by the adoption of this Board Order, the Discharger shall collect at least one (1) sample **quarterly** for at least one (1) year from each Background Monitoring Point in each monitored medium and analyze for the newly-added constituent(s); and

   b. Whenever a new Background Monitoring Point is added, including any added by this Board Order, the Discharger shall sample the new monitoring point at least **quarterly** for at least one (1) year, analyzing for all Constituents of Concern and Monitoring Parameters.

7. Semiannual Determination of Groundwater Flow Rate/Direction (Title 27, Section 20415(e)(15): The Discharger shall measure the water level in each well and determine groundwater flow rate and direction in each groundwater body described in Part II.A.1. at least semiannually. This information shall be included in the semi-annual Detection Monitoring Reports required under Part I.E.1.

PART III – STATISTICAL AND NON-STATISTICAL ANALYSES

A. STATISTICAL AND NON-STATISTICAL ANALYSIS

The Discharger shall use the most appropriate of the following methods to compare the down gradient concentration of each monitored constituent or parameter with its respective background concentration to determine if there has been a release from the surface impoundment. For any given data set, proceed sequentially down the list of statistical analysis methods listed in Part III.A.1., followed by the non-statistical method in Part III.A.2., using the first method for which the data qualifies. If that analysis tentatively indicates the detection of a release, implement the retest procedure under Part III.A.3.

1. Statistical Methods. The Discharger shall use one (1) of the following statistical methods to analyze Constituents of Concern or Monitoring Parameters that exhibit concentrations exceeding their respective MDL in at least ten percent of the background samples taken during that Reporting Period. Each of these statistical methods is more fully described in the Statistical Methods discussion below. Except for pH, which uses a two-tailed approach, the statistical analysis for all constituents and parameters shall be a one-tailed (testing only for statistically significant increase relative to background) approach:

   a. One-Way Parametric Analysis of Variance (ANOVA) followed by multiple comparisons (Title 27, Section 20415(e)(8)) – This method requires at least four (4) independent samples from each Monitoring Point and Background Monitoring Point during each sampling episode. It shall be used when the background data for the parameter or constituent obtained during a given sampling period, has not more than 15% of the data below PQL. Prior to analysis, replace all 'trace' determinations with a value halfway between the PQL and the MDL values reported for that sample run, and replace all "non-detect" determinations with a value equal to half the MDL value reported for that sample run. The ANOVA shall be carried out at the 95% confidence level. Following the ANOVA, the data from each down gradient Monitoring Point shall be tested at a 99% confidence level against the pooled background data. If these multiple comparisons cause the Null Hypothesis (i.e., that there is no release) to be rejected at any Monitoring Point, the Discharger shall conclude that a release is tentatively indicated from that parameter or constituent; or

   b. One-Way Non-Parametric ANOVA (Kruskal-Wallis Test), followed by multiple comparisons – This method requires at least nine (9) independent samples from each Monitoring Point and Background Monitoring Point; therefore, the Discharger shall anticipate the need for taking more than four (4) samples per Monitoring Point, based upon past monitoring results. This method shall be used when the pooled background data for the parameter or constituent, obtained within a given sampling period, has not more than 50% of the data below the PQL. The ANOVA shall be carried out at the 95% confidence level. Following the ANOVA, the data from each down gradient Monitoring Point shall be tested at a 99% confidence level against the pooled background data. If these multiple comparisons cause the Null Hypothesis (i.e., that there is no release) to be rejected at any Monitoring Point, the Discharger shall conclude that a release is tentatively indicated for that parameter or constituent; or

c. Method of Proportions – This method shall be used if the "combined data set" – the data from a given Monitoring Point in combination with the data from the Background Monitoring Points – has between 50% and 90% of the data below the MDL for the constituent or parameter in question. This method; (1) requires at least nine (9) down gradient data points per Monitoring Point per Reporting Period, (2) requires at least thirty data points in the combined data set, and (3) requires that n * P > 5 (where n is the number of data points in the combined data set and P is the proportion of the combined set that exceeds the MDL); therefore, the Discharger shall anticipate the number of samples required, based upon past monitoring results. The test shall be carried out at the 99% confidence level. If the analysis results in rejection of the Null Hypothesis (i.e., that there is no release), the Discharger shall conclude that a release is tentatively indicated for that constituent or parameter; or

d. Other Statistical Methods. – These include methods pursuant to Title 27, Section 20415(e)(8)(c-e).

2. Non-Statistical Method. The Discharger shall use the following non-statistical methods for all constituents that are not amenable to statistical analysis by virtue of having been detected in less than 10% of applicable background samples. A separate variant of this test is used for the VOC_{water} Composite Monitoring Parameters. Regardless of the test variant used, the method involves a two-step process: (1) from all constituents to which the test variant applies, compile a list of those constituents which equal or exceed their respective MDL in the down gradient sample from a given Monitoring Point, then (2) evaluate whether the listed constituents meet either of the test variant's two possible triggering conditions. For each Monitoring Point, the list described above shall be compiled based on either the data from a single sample taken during the Monitoring Period for that Monitoring Point, or (where several independent samples have been analyzed for that constituent at a given Monitoring Point) from the sample that contains the largest number of detected constituents. Background shall be represented by the data from all samples taken from the appropriate Background Monitoring Points during that Reporting Period (at least one (1) sample from each Background Monitoring Point). The method shall be implemented as follows:

a. VOC_{water} Composite Monitoring Parameter – For any given Monitoring Point, the VOC_{water} Monitoring Parameter is a composite parameter addressing all detectable VOCs including at least all 47 VOCs listed in Appendix I to 40 CFR 258 and all unidentified peaks. The Discharger shall compile a list of each VOC which (1) exceeds its MDL in the Monitoring Point sample (an unidentified peak is compared to its presumed (MDL), and also (2) exceeds its MDL in less than ten percent of the samples taken during that Reporting Period from that medium's Background Monitoring Points. The Discharger shall conclude that a release is tentatively indicated for the VOC_{water} composite Monitoring Parameter if the list either (1) contains two or more constituents, or (2) contains one constituent that exceeds its PQL;

b. Constituents of Concern: As part of the COC monitoring required under Part 2.A.5 of this MRP, for each Monitoring Point, the Discharger shall compile a list of COCs that exceed their respective MDL at the Monitoring Point, yet do so in less than ten percent of the background samples taken during that Reporting Period. The Discharger shall conclude that a release is tentatively indicated if the list either (1) contains two or more constituents, or (2) contains one constituent that exceeds its PQL.

3. Discrete Retest – In the event that the Discharger concludes that a release has been tentatively indicated (under Parts III.A.1. or III.A.2.), the Discharger shall, within 30 days of that conclusion, collect two (2) new suites of samples for the indicated Constituent(s) of Concern or Monitoring Parameter(s) at each indicated Monitoring Point, collecting at least as many samples per suite as were used for the initial test. Re-sampling of Background Monitoring Points is optional. As soon as the retest data is available, the Discharger shall use the same statistical method or non-statistical comparison separately on each suite of retest data. For any indicated Monitoring Parameter or Constituent of Concern at an affected Monitoring Point, if the test results of either (or both) of the retest data suites confirms the original indication, the Discharger shall conclude that a release has been discovered. All retests shall be carried out only for the Monitoring Point(s) for which a release is tentatively indicated, and only for the Constituent of Concern or Monitoring Parameter that triggered the indication there, as follows:

   a. If an ANOVA method was used in the initial test, the retest shall involve only a repeat of the multiple comparison procedure, carried out separately on each of the two (2) new suites of samples taken from the indicating Monitoring Point;

   b. If the Method of Proportions statistical test was used, the retest shall consist of a full repeat of the statistical test for the indicated constituent or parameter, carried out separately on each of the two (2) new sample suites from the indicating Monitoring Point;

   c. If the non-statistical comparison was used:

      i. Because the VOC Composite Monitoring parameters (VOC_{water}) each address, as a single parameter, an entire family of constituents which are likely to be present in any surface impoundment release, the scope of the laboratory analysis for each retest sample shall include all VOCs detectable in that retest sample. Therefore, a confirming retest for either parameter shall have validated the original indication even if the suite of constituents in the confirming retest sample(s) differs from that in the sample that initiated the retest;

      ii. Because all Constituents of Concern that are jointly addressed in the non-statistical testing under Part III.A.2. remain as individual Constituents of Concern, the scope of the laboratory analysis for the non-statistical retest samples shall be narrowed to involve only those constituents detected in the sample which initiated the retest.

SUMMARY OF SELF-MONITORING AND REPORTING REQUIREMENTS

A. GROUNDWATER MONITORING

1. Groundwater monitoring wells shall be sampled/analyzed semi-annually for the following parameters/constituents:

Parameters &	Type of	Reporting	
Constituent	**Unit**	**Sample**	**Frequency**
a. Chloride	mg/L	grab	semiannual
b. Sulfate	mg/L	grab	semiannual
Total Dissolved Solids (TDS)	mg/L	grab	semiannual
c. PH	#	field measurement	semiannual
d. Specific Conductance	μohms/cm	field measurement	semiannual
e. Heavy Metals (Sb,As, Ba, Cd, Ca, Cr, Co, Cu, Pb, Hg, Ni, Se, Zn)	mg/L	grab	semiannual
f. Oil & Grease	mg/L	grab	semiannual

2. The collection, preservation, and holding times of all samples shall be in accordance with the U.S. Environmental Protection Agency approved procedures. All analyses shall be conducted by a laboratory certified by the California Department of Public Health to perform the required analyses.

B. SURFACE IMPOUNDMENT: Leakage Detection System (LDS), and Solids Monitoring

	Unit	Observation or Sampling Frequency	Reporting Frequency
1. Estimated volume of solid/liquid in holding pond	ft^3	Monthly	semiannual
2. Measurement of freeboard	ft	Monthly	semiannual
3. Volume of solids removed and shipped to off-site waste management facility	tons	Monthly	semiannual

C. MONITORING REPORTS AND OBSERVATION SCHEDULE

"Reporting Period" means the duration separating the submittal of a given type of monitoring report from the time the next iteration of that report is scheduled for submittal. An annual report, which is a summary of all the monitoring during the previous year, shall also be submitted to the Regional Board. The submittal dates for Detection Monitoring Reports and the Annual Summary Report are as follows:

1. Detection Monitoring Reports
   a. 1st Semiannual Report (January 1 through June 30) – report due by **August 1**
   b. 2nd Semiannual Report (July 1 through December 31) – report due by **March 1**
2. Annual Summary Report

   January 1 through December 31 – report due **March 15** of the following year.
3. The Detection Monitoring Reports and the Annual Summary Report shall include the following:
   a. The Discharger shall arrange the data in tabular form so that the specified information is readily discernible. The data shall be summarized in such a manner as to clearly illustrate whether the facility is operating in compliance with WDRs.
   b. Records of monitoring information shall include:
      i. The date, exact place, and time of sampling or measurement;
      ii. The individual performing the sampling or measurement;
      iii. The date the analysis was performed;
      iv. The initials of the individual performing the analysis;
      v. The analytical technique or method used; and
      vi. The result of the analysis.
   c. Each report shall contain the following statement:

      "I declare under the penalty of law that I have personally examined and am familiar with the information submitted in this document, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of a fine and imprisonment for knowing violations."
   d. A duly authorized representative of the Discharger may sign the documents if:
      i. Authorization is made in writing by the person described in Part I.E.1.a;

ii. Authorization specifies an individual or person having responsibility for the overall operation of the regulated disposal system; and

iii. Written authorization is submitted to the Regional Board Executive Officer.

iv. Monitoring reports shall be certified under penalty of perjury to be true and correct, and shall contain the required information at the frequency designated in this monitoring report. All technical reports require the signature of a California Registered Professional Engineer or Professional Geologist.

TRAFFIC AND TRANSPORTATION

Testimony of Andrea Koch, Gregg Irvin, Ph.D., Alvin Greenberg, Ph.D., and David Flores

SUMMARY OF CONCLUSIONS

California Energy Commission (Energy Commission) staff has analyzed the information provided in the Petition for Amendment and acquired from other sources to determine the potential for the Palen Solar Electric Generating System (PSEGS) project to have significant traffic and transportation-related impacts. Staff has also assessed the potential for mitigation proposed by the project owner and conditions developed by staff to reduce any potential impacts to a less than significant level, as well as the feasibility and enforceability of those proposed mitigations and recommended conditions of certification.

Without mitigation, peak construction of the PSEGS would cause significant impacts to traffic level of service (LOS) on Corn Springs Road and, during the morning peak hour, at the Corn Springs Road and Interstate 10 (I-10) ramp intersections. Implementation of proposed Condition of Certification **TRANS-1**, which would require preparation and implementation of a traffic control plan, would mitigate these traffic impacts to less than significant. PSEGS operations traffic would cause less than significant impacts to traffic LOS that would require no mitigation.

There is no risk for either photothermal or photochemical retinal damage to motorists, pilots or the general civilian population outside of the PSEGS site from either the heliostats or solar power tower solar receiver steam generators (SRSGs). However, without mitigation, direct solar reflections from the heliostats (DSRH) would cause drivers on I-10 to experience discomfort glint and glare, and potentially disability glint and glare. Implementation of proposed Condition of Certification **TRANS-7** requires a Heliostat Positioning and Monitoring Plan that would minimize the frequency of DSRH events during the testing, calibration and operational phases of the PSEGS, resulting in less than significant impacts to motorists and pilots.

Sustained glare from the SRSGs during nominal operating conditions (where luminance would be less than $1x10^6$ candelas per meter squared [cd/m^2]) would not produce discomfort or disability glare that would interfere with motorists' or pilots' abilities to operate their vehicles and planes, respectively. However, at higher luminance levels, the SRSGs could produce discomfort or disability glare that would significantly impact drivers on I-10. To ensure that the SRSGs operate at acceptable luminance levels that would not impact the traveling public, staff has proposed Condition of Certification **TRANS-8** to require a solar power tower receiver luminance and monitoring plan. **TRANS-8** would provide procedures for identification and mitigation of visual distraction, discomfort glare, or disability glare effects with the potential of causing significant impacts to motorists.

INTRODUCTION

In the Traffic and Transportation analysis, Energy Commission staff focuses on (1) whether construction and operation of the Palen Solar Electric Generating System (PSEGS) would result in significant traffic and transportation impacts under the California Environmental Quality Act (CEQA); and (2) whether the project would comply with applicable laws, ordinances, regulations, and standards (LORS). The analysis includes discussion of potential impacts to surrounding transportation systems and roadways resulting from construction and operation of the PSEGS. Energy Commission staff proposes mitigation measures (conditions of certification) where necessary.

METHODOLOGY AND THRESHOLDS FOR DETERMINING ENVIRONMENTAL CONSEQUENCES

Significance criteria used in this document for evaluating environmental impacts are based on the CEQA Guidelines, the CEQA Environmental Checklist for Transportation/Traffic, performance standards or thresholds identified by Energy Commission staff, and applicable LORS used by other governmental agencies. Specifically, staff analyzed whether the proposed project would:

1. cause an increase in traffic that is substantial in relation to the existing traffic load and capacity of the street system (i.e., result in a substantial increase in either the number of vehicle trips, the volume-to-capacity ratio on roads, or congestion at intersections);

2. conflict with an applicable plan, ordinance or policy establishing measures of effectiveness for the performance of the circulation system, taking into account all modes of transportation including mass transit and non-motorized travel and relevant components of the circulation system, including but not limited to intersections, streets, highways and freeways, pedestrian and bicycle paths, and mass transit;

3. conflict with an applicable congestion management program, including, but not limited to, level of service (LOS) standards and travel demand measures, or other standards established by the county congestion management agency for designated roads or highways;

4. substantially increase hazards due to a design feature (e.g., sharp curves, dangerous intersections, or glint and glare) or incompatible uses (e.g., farm equipment);

5. result in inadequate emergency access;

6. conflict with adopted policies, plans, or programs regarding public transit, bicycle, or pedestrian facilities, or otherwise decrease the performance or safety of such facilities;

7. result in a change in air traffic patterns, including either an increase in traffic levels or a change in location that results in substantial safety risks;

8. produce a thermal plume in an area where flight paths are expected to occur below 1,000 feet from the ground[1]; or

9. have individual environmental effects that, when considered with other impacts from the same project or in conjunction with impacts from other closely related past, present, and reasonably foreseeable future projects, are considerable or compound or increase other environmental impacts.

LAWS, ORDINANCES, REGULATIONS, AND STANDARDS (LORS)

In addition to the LOS significance criteria discussed above in "Methodology and Thresholds for Determining Environmental Consequences", staff uses laws, ordinances, regulations, and standards (LORS) as significance criteria to determine if the proposed PSEGS would have a significant adverse impact on the environment. The federal, state, and local LORS that are applicable to the proposed PSEGS are listed below in **Traffic and Transportation – Table 1**:

Traffic and Transportation – Table 1
Laws, Ordinances, Regulations, and Standards (LORS)

Applicable LORS	Description
Federal	
Title 14, Code of Federal Regulations, Aeronautics and Space, part 77 - Objects Affecting Navigable Airspace (14 C.F.R. part 77)	These regulations establish standards for determining physical obstructions to navigable airspace; set noticing and hearing requirements; provide for aeronautical studies to determine the effect of physical obstructions on the safe and efficient use of airspace; and oversee the development of antenna farm areas.
Title 49, Code of Federal Regulations Subtitle B, parts 171-173, 177-178, 350-359, 397.9 and Appendices A-G	Addresses safety considerations for the transport of goods, materials, and substances. Governs the transportation of hazardous materials including types of materials and marking of the transportation vehicles.
State	
California Vehicle Code, sections 353; 2500-2505; 31303-31309; 32000-32053; 32100-32109; 31600-31620; California Health and Safety Code, sections 25160 et seq.	Regulates the highway transport of hazardous materials.
California Vehicle Code, sections 13369; 15275 and 15278	Addresses the licensing of drivers and the classification of licenses required for the operation of particular types of vehicles; also requires certificates permitting operation of vehicles transporting hazardous materials.
California Vehicle Code, sections 35100 et seq.; 35250 et seq.; 35400 et seq.	Specifies limits for vehicle width, height, and length.
California Vehicle Code, section 35780	Requires permits for any load exceeding Caltrans weight, length, or width standards on public roadways.
California Streets and Highways Code, sections 117, 660-672	Requires permits for any load exceeding Caltrans weight, length, or width standards on County roads.

[1] The FAA recommends that pilots avoid overflight of plume-generating industrial sites below 1,000 feet AGL (FAA 2006).

Applicable LORS	Description
California Streets and Highways Code, sections 117, 660-670, 1450, 1460 et seq., and 1480 et seq.	Regulates permits from Caltrans for any roadway encroachment from facilities that require construction, maintenance, or repairs on or across State highways and County roads.
Local	
Riverside County General Plan Circulation Element	Specifies long-term planning goals and procedures for transportation infrastructure system quality.
Riverside County General Plan Circulation Element	Specifies LOS standards used to assess the performance of a street or highway system and the capacity of a roadway.
Riverside County Municipal Code Title 10, Chapter 10.08, Sections 10.08.010-10.08.180	Specifies limits and permit requirements for oversize loads.
Riverside County Municipal Code Title 12, Chapter 12.08, Sections 12.08.010-12.08.100	Specifies requirements for encroachment permits.

PROPOSED MODIFIED PROJECT

The modified project would use BrightSource's solar power tower technology instead of the originally proposed parabolic trough solar collection system and associated heat transfer fluid. The modified project would consist of two solar fields, designated as Unit 1 and Unit 2, each comprised of 85,000 heliostats (elevated mirrors guided by a tracking system mounted on a pylon) and a 760-foot-high[2] tower. To produce electricity, the heliostats would focus the sun's rays on a solar receiver steam generator located atop each tower, creating steam to drive a turbine that would generate electricity. Each solar field would produce 250 MW of electricity for a combined nominal output of approximately 500 MW.

The two solar fields would share common facilities, including a common area containing an administration building, warehouse, evaporation ponds, maintenance complex, a meter/valve station for incoming natural gas service to the site, an on-site switchyard, and a 10-mile single-circuit 230-kV generation tie-line to deliver power to the newly constructed Red Bluff Substation immediately south of I-10. Other on-site facilities would include access and maintenance roads (either dirt, gravel, or paved), perimeter fencing, tortoise fencing, and other ancillary security facilities. During project construction, there would be an approximately 203-acre laydown area located in the southwestern portion of the site. This area would be used for laydown of materials, parking, staging of traffic to avoid congestion at the I-10/Corn Springs interchange, and possibly a temporary concrete batch plant.

As with the original project, site access would be from Corn Springs Road at the I-10 interchange. Corn Springs Road currently runs north-south across I-10 and terminates just north of the I-10 overpass. From this dead-end, a new 1,350 foot-long access road running east to the project site entrance would be constructed. The new access road would have a paved width of 24 feet and a 12-foot-wide gravel shoulder for truck staging.

[2] The actual tower height would be 750 feet. However, including the lighting appurtenance affixed to the top, the total height of the tower would be 760 feet.

If approved, the units would be constructed in phases, with the first phase of construction including the generation tie-line and Unit 1 and the second phase including Unit 2. The first phase of construction is scheduled to begin in the fourth quarter of 2013, according to the Petition to Amend. However, construction likely would not begin until spring 2014 to allow for desert tortoises to be cleared from the site. The second phase of construction would begin several months later. Commercial operation of both units would likely begin in late 2016, due to the delay for desert tortoise clearing.

SETTING AND EXISTING CONDITIONS

The proposed PSEGS site is located in eastern Riverside County about 10 miles east of the unincorporated community of Desert Center, 3 miles east of the southeastern end of Joshua Tree National Park, and about 0.5 mile north of U.S. Interstate 10. The site is located on approximately 3,794 acres of public land managed by the Bureau of Land Management (BLM) (Right-of-Way No. CACA-048810). See **Traffic and Transportation Figures 1 and 2** for views of the regional and local transportation network in the project vicinity.

LOCAL HIGHWAYS AND ROADS

The following describes the roadways in the vicinity of the PSEGS site:

U.S. Interstate 10

Interstate 10 is an east-west regional arterial that crosses much of the southern United States. It runs from the L.A. area east to Phoenix, Arizona, where it turns south and continues to Tucson, Arizona, ultimately continuing east to Jacksonville, Florida. In the project area, the speed limit is 70 miles per hour and the road is fully improved to freeway status with two lanes in each direction. There are no bicycle or pedestrian facilities located on I-10 near the project site; however, bicycles are allowed on I-10 from Dillon Road, Coachella (west of the PSEGS site) to Mesa Drive, Blythe (east of the PSEGS site). The California Department of Transportation (Caltrans) allows bicycle use on state highways where no alternative route is available.

Corn Springs Road

Corn Springs Road is an exit off of I-10 accessed by a diamond-configured interchange. The interchange includes single-lane ramps with ramp junctures, where stop signs control traffic from I-10 before it enters Corn Springs Road. Corn Springs Road is a relatively short road that runs north toward the project site, as well as south, where it intersects with Chuckwalla Valley Road. Corn Springs Road has a curb and gutter, but no bicycle or pedestrian facilities.

Chuckwalla Valley Road

Chuckwalla Valley Road is a minor local access road running in an east-west direction just south of I-10 in the vicinity of the project site. It is a two-lane frontage road extending from the southern part of the Corn Springs Road interchange to the Ford Dry Lake Road interchange approximately 10 miles to the east. Stop signs on the Chuckwalla Valley Road approaches control the Corn Springs Road/Chuckwalla Valley

Road intersection. Chuckwalla Valley Road has curb and gutter, but no bicycle or pedestrian facilities.

PUBLIC TRANSPORTATION

Public transportation in the project area consists of rail and bus service, bicycle and pedestrian facilities, and airports. Information about these forms of public transportation follows.

Rail and Bus Service

The nearest passenger rail service is an Amtrak station in Palm Springs to the west. With regard to freight rail, on January 13, 2010, the Surface Transportation Board ruled that the Arizona & California Railroad Company could abandon service in Riverside County. Therefore, no rail service exists in the area.

The nearest national bus service stations are the Indio and Blythe Greyhound stations. Local bus service near the project site is limited to the Red Route of the Desert Roadrunner bus service for Blythe, which provides service to the Ironwood/Chuckwalla Valley State Prison approximately 21 miles east of the project, and the Sunline Transit Agency, which provides bus service in the vicinity of Indio.

Bicycle and Pedestrian Facilities

Bicycle and pedestrian activity in the vicinity of the PSEGS site is minimal-to-none. Development is extremely low-density and spread over a large area, which is not conducive to biking or walking.

Aviation Activities

The nearest airport is the Desert Center Airport, located approximately 6 miles northwest of the PSEGS site. It is a private airport with a pattern altitude of 1,559 feet above mean sea level (AMSL). The airport has one basic runway, Runway 5/23. For the 12-month period ending in December 2006, the most recent year for which data is available, the airport hosted 150 annual aircraft operations, with all operating aircraft classified as transient general aviation (AIRNAV 2013).

The Chocolate Mountain Aerial Gunnery Range (CMAGR) is approximately 15 miles south of the site. The U.S. Navy and Marines use this approximately 459,000-acre area for military aircrew training in air combat maneuvering and tactics, airborne laser system operations, gunnery, live fire aerial gunnery practice, aerial bombing, rocketry, and strafing (attacking ground targets). The Department of the Navy (DoN) owns approximately half of the CMAGR, while the Bureau of Land Management (BLM) manages the other half. The military’s right to use the BLM-managed land expires in 2014, so the DoN is requesting that Congress renew its use of the land and continue the military reservation for another 25 years (DON 2012).

The project site also lies within the vicinity of Department of Defense military training routes VR-296, VR-1265, VR-1268, and IR-218.

ASSESSMENT OF IMPACTS AND DISCUSSION OF MITIGATION

The direct and indirect impacts of the proposed PSEGS on the traffic and transportation system are discussed in this section. The assessment of traffic- and transportation-related impacts is based on an analysis which compares the current traffic and transportation conditions to conditions that would exist during construction and operation of the PSEGS.

CONSTRUCTION PERIOD TRAFFIC IMPACTS AND MITIGATION

Level of Service (LOS) is a generally accepted measure used by traffic engineers and planners to describe and quantify the traffic congestion level on a particular roadway or intersection in terms of speed, travel time, and delay. The *Highway Capacity Manual 2010*[3], published by the Transportation Research Board Committee on Highway Capacity and Quality of Service, includes six levels of service for roadways and intersections. These levels of service range from LOS A, the best and smoothest operating conditions, to LOS F, the worst, most congested operating conditions. Staff used LOS to quantify the traffic congestion experienced on local roadways before and during project construction.

Workers for the project would commute from the surrounding areas. Workers from regional areas would find temporary housing in Blythe, Indio or Ehrenberg (CEC 2013w). Workers with permanent residences in Palm Springs, the Los Angeles basin, and the Indio area would travel east on I-10 to the project site, while workers from Blythe and the Arizona communities of Quartzsite, Ehrenberg, and Cibola would follow I-10 west to the project site. Workers residing permanently in San Bernardino County could follow either I-10 west or I-10 east to the project site.

Construction of the PSEGS would occur over 33 months, with peak construction expected to occur during Month 22 (in the year 2015). The average daily workforce would be approximately 998 workers, with a peak daily workforce of approximately 2,311 workers. The construction workforce would be higher than that proposed for the approved Palen Solar Power Project (PSPP), which had an average daily workforce of 566 workers and a peak daily workforce of 1,141 workers.

PSEGS construction workers would not all arrive at or depart from the project site at the same time, as the project owner has proposed that construction workers would be spread out over two or three work shifts. Also, some of the construction workers would be working offsite on the transmission and gas lines, further reducing the number of workers that would simultaneously arrive at and depart from the project site. The project owner estimates that the day shift, which would begin at 5 AM, would consist of 790 average daily workers and 1,700 peak daily workers. The project owner also assumes that carpooling would result in a 7.5 percent reduction[4] in construction vehicle trips.

[3] The *Highway Capacity Manual* (HCM) is the most widely used resource for traffic analysis. The Highway Capacity Manual is prepared by the Transportation Research Board Committee on Highway Capacity and Quality of Service. The current edition was published in 2010.

[4] This reduction is based on the assumption that 15% of workers would carpool. This carpooling estimate is based on the remote location of the project site, the high cost of gas, and the assumption that some

However, the traffic analysis for this project is conservative and evaluates the worst-case construction traffic scenario. The analysis evaluates trips made by all 2,311 construction workers, not just day shift workers, during the peak construction period during the peak hour of traffic in the project area. Also, the traffic analysis does not take into account the 7.5 percent reduction in construction vehicle trips and instead uses the assumption that no carpooling would occur. For a summary of peak construction traffic impacts to study roadways, see **Traffic and Transportation – Table 2** (below). This table compares peak hour traffic volume and level of service (LOS) on all study roadways during the year 2015 without the PSEGS and the year 2015 with the PSEGS (during peak construction). During peak construction and peak hour, I-10 west and east of the PSEGS would be expected to operate at LOS A, a free-flowing traffic condition. However, Corn Springs Road would be expected to operate at LOS F, an LOS classification indicating the most congested traffic conditions. This would be a significant traffic impact. Congested LOS F traffic conditions on Corn Springs Road could potentially cause a bottleneck at the I-10/Corn Springs Road interchange, causing project traffic to spill over onto I-10, resulting in traffic stacking on I-10 near the project site.

Traffic and Transportation – Table 2
Peak Hour Volumes and LOS on Study Roadways During Peak Construction

Roadway Segment	Existing (2013) Volume	LOS	Peak Construction Year (2015) Volume without PSEGS	LOS	**Peak Construction Year (2015) Volume with PSEGS**	**LOS**
I-10 West of the PSEGS	1,611	A	1,643	A	**2,799**	**A**
I-10 East of the PSEGS	1,600	A	1,632	A	**2,788**	**A**
Corn Springs Road	2	A	2	A	**2,311**	**F**

Notes:
- Volume is peak hour volume.
- Caltrans Year 2013 traffic volumes were expanded to Year 2015 using the rate of growth (1%/year) seen between 2012 and 2013 ((Palen 2013ee, Palen 2013uu, CEC 2013y).

Staff also evaluated peak construction peak hour traffic impacts at intersections near the project site. See **Traffic and Transportation – Table 3** (below), which compares peak hour delay and LOS on all study intersections during the Year 2015 without the PSEGS and the Year 2015 with the PSEGS (during peak construction). As shown in the table, the I-10 Westbound Ramps/Corn Springs Road and I-10 Eastbound Ramps/Corn Springs Road intersections would operate at acceptable levels of LOS C or better during the evening peak hour, but would operate at congested, unacceptable levels of LOS F during the morning peak hour[5]. The LOS F conditions that would be experienced

workers would stay nearby at the same hotels and would carpool to and from the site. With an average of two people per vehicle, there would be a 7.5% reduction in construction vehicle trips.

[5] The LOS is better during the evening peak hour because much of the traffic leaving the site would be able to enter I-10 as a free, uncontrolled movement (without a stop sign).

at these intersections during the morning peak hour would constitute a significant traffic impact.

Traffic and Transportation – Table 3
Peak Hour Delay and LOS on Study Intersections During Peak Construction

Intersection	Existing (2013) Delay and LOS		Peak Construction Year (2015) without PSEGS: Delay and LOS		**Peak Construction Year (2015) with PSEGS: Delay and LOS**	
	AM Peak	PM Peak	AM Peak	PM Peak	**AM Peak**	**PM Peak**
I-10 Westbound Ramps/Corn Springs Road	5.8 seconds LOS A	7.7 seconds LOS A	5.8 seconds LOS A	7.7 seconds LOS A	**>50 seconds** **LOS F**	**0.5 seconds** **LOS A**
I-10 Eastbound Ramps/Corn Springs Road	6.3 seconds LOS A	2.9 seconds LOS A	6.3 seconds LOS A	2.9 seconds LOS A	**>50 seconds** **LOS F**	**19.7 seconds** **LOS C**

Notes:
- Volume is peak hour volume.
- Caltrans Year 2013 traffic volumes were expanded to Year 2015 using the rate of growth (1%/year) seen between 2012 and 2013 (Palen 2013ee, Palen 2013uu, CEC 2013y).

To mitigate the PSEGS's significant peak construction traffic impacts to Corn Springs Road and to the I-10 Westbound Ramps/Corn Springs Road and I-10 Eastbound Ramps/Corn Springs Road intersections during the morning peak hour, staff has proposed Condition of Certification **TRANS-1**, which requires the project owner to prepare a traffic control plan to reduce traffic impacts through means such as staggered work shifts, off-peak work schedules, and/or restricting travel to and departures from the project site to 10 or fewer vehicles every three minutes. This condition is the same as that proposed for the original project, with some minor modifications specifically asking for a detailed plan for construction worker arrival and departure times, and methods to ensure worker compliance.

It should be noted that the traffic analysis above does not include truck trips, but that inclusion of truck trips would not significantly alter the outcome of the traffic LOS impacts analysis. During construction, the average number of daily truck trips would be 20 roundtrips (40 one-way trips). During peak construction, the number of daily truck trips would be higher at approximately 45 daily roundtrips (90 daily one-way trips) (CEC 2013t, Palen 2012a, Palen 2013g). Truck trips for the PSEGS would be higher than those for the PSPP. The PSPP as approved would have generated an average of approximately 10-15 daily truck roundtrips (20-30 one-way trips) during construction, with 20 daily roundtrips (40 one-way trips) during peak construction (Palen 2012a). To ensure that slow-moving truck delivery traffic would not cause back-ups and resulting impacts to traffic LOS, Condition of Certification TRANS-1 requires limitation of truck deliveries to off-peak construction commute hours and/or staggering of truck deliveries throughout the day.

Oversized or overweight trucks with unlicensed drivers could be hazardous to the general public and/or damage roadways. Condition of Certification TRANS-2 requires that the project owner comply with limits on vehicle sizes and weights and driver licensing regulations. Because construction traffic and trucks could also damage roadways, Condition of Certification TRANS-3 requires that prior to construction, the project owner repave and restore all roads to a condition that could accommodate construction traffic, and immediately restore all roads damaged by construction activities. Construction and/or construction repairs could require encroachment into public rights-of way. **TRANS-4** requires that the owner obtain necessary encroachment permits from Caltrans and any other relevant jurisdictions and comply with limitations for encroachment into public rights-of-way.

OPERATION TRAFFIC IMPACTS AND MITIGATION

Analysis of the originally proposed project indicated that with 134 daily operations workers and approximately 6 truck trips per day, there would be no significant impacts to LOS at the studied road segments or intersections during project operations. As part of the original project, staff found that LOS on all roadways and intersections would continue to operate at LOS A, the pre-project LOS, which is better than the minimum LOS of C.

The PSEGS proposes approximately 6 truck trips per day, the same as for the approved PSPP, but 100 daily operation workers (40 during the day and 60 during the evening), a smaller number than the 134 daily operation workers proposed as part of the PSPP (Palen 2012a). However, to be conservative, the operation traffic impact analysis assumes 134 operation workers, the number of daily operation workers from the approved PSPP (Palen 2013ee). See **Traffic and Transportation – Table 4**, Peak Hour Volumes and LOS on Study Roadways During Project Operation, and **Traffic and Transportation – Table 5**, Peak Hour Delay and LOS on Study Intersections During Project Operation. These tables show that during project operation, all roadways and intersections would operate at LOS A. Therefore, the PSEGS would result in less than significant operation impacts to LOS.

Traffic and Transportation – Table 4
Peak Hour Volumes and LOS on Study Roadways During Project Operation

Roadway Segment or Intersection	Year 2016 Volume without PSEGS	Year 2016 Volume with PSEGS	LOS
I-10: West of the project site	1,659	1,726	A
I-10: East of the project site	1,648	1,715	A
Corn Springs Road	2	136	A

Notes:
Caltrans Year 2013 traffic volumes were expanded to Year 2016 using the same rate of expansion (1%/year) seen between 2012 and 2013 (Palen 2013ee, Palen 2013uu, CEC 2013y).

Traffic and Transportation – Table 5
Peak Hour Delay and LOS on Study Intersections During Project Operation

	Year 2016 without PSEGS		**Year 2016 with PSEGS**	
Study Intersection	**AM Peak Delay/LOS**	**PM Peak Delay/LOS**	**AM Peak Delay/LOS**	**PM Peak Delay/LOS**
I-10 Westbound Ramps/Corn Springs Road	5.8 seconds LOS A	7.7 seconds LOS A	4.6 seconds[6] LOS A	1.2 seconds LOS A
I-10 Eastbound Ramps/Corn Springs Road	6.3 seconds LOS A	2.9 seconds LOS A	8.5 seconds LOS A	6.2 seconds LOS A

Notes:
Caltrans Year 2013 traffic volumes were expanded to Year 2016 using the same rate of expansion (1%/year) seen between 2012 and 2013 (Palen 2013ee, Palen 2013uu, CEC 2013y, Palen 2013ddd).

EMERGENCY SERVICES VEHICLE ACCESS

The project includes a proposed primary access from Corn Springs Road. The proposed primary access provides adequate site access for emergency vehicles traveling to the site from I-10 and exiting on Corn Springs Road.

Due to site constraints increasing the difficulty of providing a secondary access road, **Worker Safety and Fire Protection** staff is instead requiring at least two emergency access gates, one each on the north fence line and south fence line. These gates would not encroach on Caltrans' right-of-way. In the event of an emergency, if the main access road was blocked, all-terrain fire engines would be able to access the site through these gates. **Worker Safety and Fire Protection** staff is requiring that PSEGS "buy into" the Riverside County Fire Department's all-terrain fire engines purchased by the Genesis Solar Energy Project by paying the Genesis project owners the PSEGS's fair share of the cost of the purchase and maintenance of the fire engines. See the **WORKER SAFETY AND FIRE PROTECTION** section of this Final Staff Assessment (FSA) for more details. Traffic and Transportation staff finds these alternative emergency vehicle accesses adequate from a traffic and transportation perspective.

WATER, RAIL, BUS AND AIR TRAFFIC

The proposed PSEGS is not adjacent to a navigable body of water and therefore would not alter water-related transportation. The proposed modified project also would not alter rail or bus transportation. No rail tracks or bus services exist on or near the project site.

The project could potentially impact aviation activities. See the discussion below.

[6] AM peak delay is actually less during operation of the PSEGS because of the project's addition of vehicles making free movements through the intersection with no delay. These vehicles reduce the average vehicle delay for the intersection (Palen 2013ddd).

Aviation Activities

Height

The project site, with its proposed 760-foot-high solar towers, lies within the vicinity of Department of Defense military training routes VR-296, VR-1265, VR-1268, and IR-218. Michael A. Aimone, Executive Director of the Department of Defense (DoD) Siting Clearinghouse, submitted a letter to the Energy Commission stating that while DoD predicts that the project would impact these military training routes, DoD believes these impacts can be mitigated and is not opposed to construction of the project. If the PSEGS is constructed, military aircraft would fly around the PSEGS or at higher altitudes.

The PSEGS's 760-foot-high solar towers would exceed a height of 200 feet above ground level (AGL). Therefore, under Title 14, Part 77 of the Code of Federal Regulations, the towers would require review by the Federal Aviation Administration (FAA). In March 2013, the project owner submitted to the FAA for each solar tower a Form 7460-1 "Notice of Proposed Construction or Alteration" as required. The FAA responded to the submittal on July 18, 2013 with a "Determination of No Hazard to Air Navigation". The FAA stated that the Determination of No Hazard included any temporary construction equipment such as cranes or derricks with heights of up to 760 feet, but that any temporary construction equipment with heights of greater than 760 feet would require separate notice to the FAA (Palen 2013 ccc). To ensure compliance, staff is proposing Condition of Certification **TRANS-5** to require that the project owner notify the FAA of any construction equipment exceeding 760 feet in height.

In the FAA's Determination of No Hazard for the solar towers, the FAA required as a condition of the Determination that the towers be marked and lighted in accordance with FAA Advisory Circular 70/7460-1 K Change 2, Obstruction Marking and Lighting, a med-dual system - Chapters 4,8(M-Dual), &12 (Palen 2013 ccc). To ensure compliance, staff is proposing **TRANS-6,** which would require the project owner to install obstruction marking and lighting on the solar towers as specified above by the FAA. The form of lighting required by the FAA and by **TRANS-6** is in accordance with the recommendations of **Biological Resources** staff to use flashing lights at night. This would reduce the potential for wildlife (birds and bats in particular) to be attracted to the project site where they could be subject to collisions or other anthropogenic sources of injury or mortality.

With implementation of Conditions of Certification **TRANS-5 and TRANS-6**, the project would comply with FAA regulations, and the project structures would not create a significant impact to aviation.

Thermal Plumes

The PSEGS's wet surface air cooler, auxiliary boiler and nighttime boiler would produce thermal plumes, hot columns of gas discharged toward the sky. Thermal plume velocities would be greatest at the discharge points, with plume velocities decreasing with increasing altitude. Aircraft flying through parts of thermal plumes exceeding 4.3 meters/second (m/s) in vertical velocity could experience moderate to severe turbulence, which could compromise pilot control and aircraft stability.[7]

To determine whether the thermal plumes emitted from the PSEGS would exceed 4.3 m/s at altitudes where aircraft could fly, Energy Commission Air Quality staff (Jacquelyn Leyva Record) modeled plume velocities for the project's wet surface air cooler, auxiliary boiler, and nighttime boiler. Air Quality staff found that in each case, thermal plume vertical velocity exceeded 4.3 m/s at altitudes of approximately 200 feet above ground level (AGL) or below. At altitudes higher than approximately 200 feet AGL, thermal plume velocity was below the critical 4.3 m/s threshold for endangering aircraft. Aircraft would generally be flying at altitudes much higher than 200 feet AGL; therefore, the thermal plumes would have less than significant impacts to aviation.

GLINT AND GLARE IMPACTS ON MOTORISTS AND PILOTS

The proposed PSEGS's mirrored heliostats and solar receiver steam generator (SRSG) tower would generate glint and glare, which could cause impacts to both ground traffic and aviation if sufficient to compromise a driver's or pilot's ability to operate his/her vehicle or aircraft. PSEGS Unit 2 is especially close to I-10, at a distance of approximately 4,500 feet from the highway.

A thorough assessment of the PSEGS's potential glint and glare impacts is provided in **APPENDIX TT1 – VISUAL SAFETY IMPACT ASSESSMENT**. For details, please consult this appendix. The sections below summarize the conclusions discussed in the appendix.

Retinal Damage

Retinal damage is a permanent loss of visual function in the affected retinal region and can be caused by either photothermal or photochemical mechanisms. Photothermal damage is the physical damage to the retina that can occur from high levels of irradiance which thermally overload and burn the retina. Photochemical damage is associated with both long-duration exposure times and lower-wavelength (higher-energy) light exposure. For photothermal retinal damage, the highest level of exposure considered to be safe is called the Maximum Permissible Exposure (MPE) limit. The MPE is an international standard and is specified for both momentary and continuous exposures. Calculations of the retinal irradiance from both the PSEGS's heliostats and

[7] This is based on staff's review of a 2004 safety circular (AC 139-05(0)), prepared by the Australian Government Civil Aviation Safety Authority, that noted "aviation authorities have established that an exhaust plume with a vertical velocity in excess of 4.3 meters per second (m/s) may cause damage to an aircraft airframe or upset an aircraft when flying at low levels" (CASA 2004). In their safety study on thermal plumes the FAA noted that they "do not necessarily approve/disapprove or warrant the data contained in the CASA AC 139-05." The safety team accepted "the information and data contained in AC 139-05 as a valid representation of hazardous exhaust velocities" (FAA 2006).

SRSGs have demonstrated that exposures at or above the MPE limit are not possible outside the solar plant's boundaries. Therefore, there is no risk of photothermal retinal damage to motorists or pilots. However, on-site workers within plant boundaries could experience a level of exposure exceeding the MPE for a very limited and unique set of conditions and tower observation points. See the **WORKER SAFETY AND FIRE PROTECTION** section of this FSA for conditions of certification which would mitigate this impact by requiring site workers to wear the appropriate personal protection equipment (PPE) in the form of protective sunglasses.

Photochemical retinal damage is both dose-dependent and cumulative in nature. Motorists and pilots would not be exposed to light from the PSEGS for long enough periods of time to experience photochemical retinal damage. Only on-site workers would be at risk of photochemical retinal damage due to their extensive exposure to the ambient (background) light of the site (being outdoors essentially all day) and to the additional illumination from the heliostat field and SRSGs. See the **WORKER SAFETY AND FIRE PROTECTION** section of this FSA for conditions of certification which would mitigate this impact by requiring site workers to wear the appropriate PPE in the form of protective sunglasses.

Glint and Glare

Glint and glare may cause a viewer to experience difficulty seeing. While glint is a temporary flash of brilliant light, glare is a more sustained bright light. Additionally, glare is generally divided into two class types: discomfort glare and disability glare. Discomfort glare results in an instinctive desire to look away from a bright light source or difficulty in seeing a task. Disability glare renders the task impossible to view, such as when driving westward at sunset.

Heliostats are sources of both glint and glare: glint from direct solar reflections and sustained glare from reflections of either the sun or sky background. The SRSGs are sources of sustained glare. This glint and glare could potentially impact motorists on I-10 and pilots flying near the project site. Staff recognizes that definitive standards for the safety effects of glint and glare, from distraction to discomfort to disability, do not exist and there are no reliable metrics for determining the glint and glare thresholds for a significant impact to traffic and transportation.

Glint and Glare from the Heliostats

Motorists could potentially experience glint and glare impacts from the PSEGS's heliostats. The heliostats would commonly produce sky reflections. These would not be a significant source of glint and/or glare that would be experienced by motorists. However, during both project construction and operation, direct solar reflections from the heliostats (DSRH) would cause discomfort glare to motorists within 10 miles of the project site, and possibly at even further distances. This would be a significant impact. To mitigate this impact, staff proposes Condition of Certification **TRANS-7**, which would require the project owner to develop and implement a heliostat positioning and monitoring plan to minimize the frequency of DSRH events during the testing, calibration and operational phases of the PSEGS. With implementation of **TRANS-7**, glint and glare impacts to motorists would be less than significant.

Pilots could also experience glint and glare impacts from the PSEGS's heliostats. Sky reflections from the heliostats would be noticeable to pilots but not significant. DSRH events would be more visually prominent to pilots than indirect sky reflections. Because the heliostats point toward the sky when in standby position, airborne DSRH events are inevitable. Their frequency and severity would depend on the frequency, range and geometry of aircraft operations in the project vicinity. However, direct solar reflections are expected events for pilots, commonly occurring as reflections from lakes, streams, and man-made objects such as metal roofing. Pilots are generally very adept at dealing with such events, and such events are expected to cause only mild discomfort. Also, implementation of **TRANS-7** would require the project owner to maximally limit DSRH on all observers through effective heliostat positioning. This would ensure that the number of heliostats pointing skyward would be minimized to only those necessary. With implementation of **TRANS-7**, individual or sequential DSRH events may cause mild discomfort to pilots but are not expected to induce severe discomfort or disability glare that would compromise pilots' abilities to operate their aircraft. Heliostat glint and glare impacts to pilots are expected to be less than significant.

Glare from the SRSGs

The SRSGs would produce unavoidable glare. Staff concludes that sustained glare from the SRSGs during nominal operating conditions (where luminance would be less than $1x10^6$ cd/m^2) would not produce discomfort or disability glare that would interfere with motorists' or pilots' abilities to operate their vehicles and planes, respectively. However, at higher luminance levels, the SRSGs could produce discomfort or disability glare that would significantly impact drivers on I-10. To ensure that the SRSGs operate at acceptable luminance levels (less than $1x10^6$ cd/m^2) that would not impact drivers, staff has proposed Condition of Certification **TRANS-8** to require a solar power tower receiver luminance and monitoring plan. **TRANS-8** would provide procedures for identification and mitigation of visual distraction, discomfort glare, or disability glare effects with the potential of causing significant impacts to motorists.

MOTORIST ACCIDENTS

Staff analyzed the potential for project glint and glare to cause motor vehicle accidents on I-10. For this analysis, see **APPENDIX TT2 – RISK OF IMPACTS TO VEHICLE OPERATORS DRIVING ON INTERSTATE-10 DUE TO GLINT AND GLARE ASSOCIATED WITH THE PALEN SOLAR ELECTRIC GENERATING SYSTEM**. In summary, staff found that under normal operating conditions, the risk of glint or glare causing vehicular accidents would be less than significant. However, if a heliostat during construction, before implementation of heliostat control algorithms, or a malfunctioning heliostat during operations were to be oriented even for a few seconds facing I-10 such that drivers would experience a direct (or within 10 degrees) reflection from a heliostat, visual impairment (flash blindness or disability glare) could occur and result in a vehicular accident. See **APPENDIX TT2** for more information.

Proposed Condition of Certification **TRANS-7** would require implementation of a heliostat positioning and monitoring plan which would mitigate these potential impacts to less than significant. **TRANS-7** requires that the project owner cover the mirrored surfaces of the heliostats during construction until they are properly seated, oriented and under computer control. It also requires the project owner to implement early heliostat computer control algorithms during construction to ensure that heliostats would not reflect onto I-10 motorists or any other ground-based observers during construction or operation. With implementation of **TRANS-7**, the PSEGS's potential to cause motor vehicle accidents would be less than significant.

TRANSPORTATION OF HAZARDOUS MATERIALS

Both the construction and operation of the proposed PSEGS would involve the transportation of hazardous materials to the site. The transport vehicles would be required to follow federal and state regulations governing proper containment vessels and vehicles, including appropriate identification of the nature of the contents.

In addition to the governing federal and state regulations, Condition of Certification **TRANS-9** requires that the project owner secure permits and/or licenses from the California Highway Patrol and Caltrans for the transportation of hazardous materials. See the **HAZARDOUS MATERIALS MANAGEMENT** section of this FSA for more information. With implementation of Condition of Certification **TRANS-9**, the PSEGS would cause less than significant impacts to roadways and the traveling public from transportation of hazardous materials.

PARKING CAPACITY

Construction period parking demands would be accommodated by a construction laydown area of approximately 203 acres. This parking area would accommodate all construction workforce vehicles.

During project operation, employees would park on-site at the common facilities area and at each power block. The project would provide 38 spaces at the common facilities area, 19 spaces at the Unit 1 power block, and 19 spaces at the Unit 2 power block for a total of 76 parking spaces. These parking areas would provide sufficient parking for all operation employees on-site simultaneously (40 workers during the day and 60 workers during the evening).

Because the PSEGS supplies an adequate amount of on-site parking, the project would not result in any parking spill-over to sensitive areas and would not create any adverse impacts.

PROJECT-RELATED FUTURE ACTIONS – TRANSPORTATION AND TRAFFIC

The original Palen analysis included a discussion of the SCE Red Bluff Substation as an associated reasonably foreseeable project. It also included an analysis of traffic generated by construction of the substation. Because construction of the SCE Red Bluff Substation is currently underway and anticipated to be completed before start of construction of the PSEGS, there is no need to analyze substation traffic impacts at this point.

CUMULATIVE IMPACTS AND MITIGATION

A project may result in a significant adverse cumulative impact when its effects are cumulatively considerable. *Cumulatively considerable* means that the incremental effects of an individual project are significant when viewed in connection with the effects of (1) past projects; (2) other current projects; and (3) probable future projects (California Code Regulation, Title 14, section 15130).

The potential exists for substantial future development throughout the entire Southern California Desert Region as well as on the Interstate 10 (I-10) corridor in eastern Riverside County. In this document, Energy Commission staff has limited the traffic and transportation analysis to the I-10 corridor of eastern Riverside County within a range starting approximately 20 miles west of the project site and ending approximately 40 miles east of the project site near Blythe, CA. Staff selected this range because it encompasses many existing and proposed development projects, including many other energy projects, that could generate traffic traveling on I-10 near the PSEGS site. See **TRAFFIC AND TRANSPORTATION FIGURE 3 – TRAFFIC AND TRANSPORTATION CUMULATIVE PROJECTS** for a list of current, pending, and foreseeable development projects in this area.

Traffic LOS on I-10 could degrade with the volume of construction traffic generated by the PSEGS in combination with traffic generated by the identified additional projects shown in **TRAFFIC AND TRANSPORTATION FIGURE 3 – TRAFFIC AND TRANSPORTATION CUMULATIVE PROJECTS**. Proposed Condition of Certification **TRANS-1** would ensure that the PSEGS's contribution to cumulative impacts would be less than significant by requiring the PSEGS project owner to implement staggered work shifts and/or off-peak work schedules, and/or to restrict travel to and departures from the project site to 10 or fewer vehicles every three minutes. With implementation of **TRANS-1**, the project's impacts to Corn Springs Road and the I-10 ramp intersections during the morning peak hour would be minimized, thus averting bottlenecks that could cause traffic back-ups on I-10, which could potentially contribute to cumulative impacts. With implementation of **TRANS-1**, I-10 is expected to continue to operate at LOS A in the project area during peak construction. PSEGS operations traffic also would not contribute to cumulative traffic impacts, as operations traffic would be minimal.

The PSEGS project would not combine with other nearby existing or proposed solar projects to cause significant cumulative glint and glare impacts to motorists. There are a couple of other nearby large-scale solar projects involving mirrors, such as the Genesis Solar Energy Project (GSEP), which uses parabolic troughs and is under construction, and the Blythe Solar Power Project (BSPP), approved by the Energy Commission to use parabolic trough technology, although an amendment petition was filed in June 2012 to use solar photovoltaic (PV) technology instead. However, these projects are sufficiently far from the PSEGS so that motorists on I-10 would not experience glint and glare impacts from either of these projects simultaneously with the most severe glint and glare impacts from the PSEGS. The GSEP is approximately 15 miles east of the proposed PSEGS site and the BSPP is approximately 30 miles east of the proposed

PSEGS site. Furthermore, if the BSPP is converted to PV technology, it would emit very little glint and glare, as PV panels are designed to absorb rather than reflect sunlight.

The PSEGS project also would not combine with other nearby existing or proposed projects to cause significant cumulative glint and glare impacts to pilots. Many nearby energy projects use solar photovoltaic technology, which is designed to absorb solar energy rather than reflect it, and therefore does not generate glint or glare impacts to pilots. Viewed by a pilot from the air, a photovoltaic plant looks similar to a body of water, such as a lake. Two other nearby power plant projects, the BSPP (approved by the Energy Commission) and GSEP (approved by the Energy Commission and under construction), use mirror technology, specifically parabolic troughs. These projects could potentially produce glint and glare experienced by pilots. However, an amendment has been filed with the Energy Commission to convert the BSPP to photovoltaic technology, which would not generate significant glint or glare impacts to pilots, and the GSEP is approximately 15 miles east of the PSEGS site, making it unlikely that pilots would experience glint and glare from both projects at the same time.

In conclusion, the PSEGS's cumulative impacts to aviation would be less than significant.

COMPLIANCE WITH LORS

The PSEGS project as proposed and with conditions of certification as mitigation would comply with federal, state, and local LORS. See **Traffic and Transportation – Table 6**, below, for a summary of the PSEGS's conformance with all applicable LORS.

Traffic and Transportation – Table 6
PSEGS Compliance with Adopted Traffic and Transportation LORS

Applicable LORS	Description
Federal	
Title 14, Code of Federal Regulations, Aeronautics and Space, part 77 - Objects Affecting Navigable Airspace (14 C.F.R., part 77)	These regulations establish standards for determining physical obstructions to navigable airspace; set noticing and hearing requirements; provide for aeronautical studies to determine the effect of physical obstructions on the safe and efficient use of airspace; and oversee the development of antenna farm areas. <u>Consistent</u>: In March 2013, the project owner submitted to the FAA for each solar tower a Form 7460-1 "Notice of Proposed Construction or Alteration" as required by FAA regulations for structures exceeding 200 feet in height. The FAA responded to the submittal on July 18, 2013 with a "Determination of No Hazard to Air Navigation". As a condition of the determination, the FAA is requiring that the towers be marked and lighted in accordance with FAA Advisory Circular 70/7460-1 K Change 2, Obstruction Marking and Lighting, a med-dual system - Chapters 4,8(M-Dual), &12. For project compliance with FAA regulations, staff is proposing Condition of Certification **TRANS-5** to require that the project owner notify the FAA of any construction equipment exceeding 760 feet in height, as requested by the FAA in its Determination of No Hazard for the towers. Staff is also proposing **TRANS-6,** which would require the project owner to install obstruction marking and lighting on the solar

Applicable LORS	Description
	towers in accordance with FAA Advisory Circular 70/7460-1 K Change 2, Obstruction Marking and Lighting, a med-dual system - Chapters 4,8(M-Dual), &12, as required by the FAA. With implementation of Conditions of Certification **TRANS-5** and **TRANS-6**, the project would comply with FAA regulations.
Title 49, Code of Federal Regulations Subtitle B, parts 171-173, 177-178, 350-359, 397.9 and Appendices A-G	Addresses safety considerations for the transport of goods, materials, and substances. Governs the transportation of hazardous materials including types of materials and marking of the transportation vehicles. Consistent: PSEGS construction and operation would involve transport of hazardous materials. Enforcement would be provided by state and local law enforcement agencies and through state agency licensing and ministerial permitting (e.g., California Department of Motor Vehicles licensing, Caltrans permits), and/or local agency permitting (e.g., County of Riverside). The project owner would adhere to all required regulations. This adherence is made part of the licensing process as Condition of Certification **TRANS-9**.
State	
California Vehicle Code, sections 353; 2500-2505; 31303-31309; 32000-32053; 32100-32109; 31600-31620; California Health and Safety Code, sections 25160 et seq.	Regulates the highway transport of hazardous materials. Consistent: The PSEGS would comply with these regulations. Enforcement would be provided by state and local law enforcement agencies, and through ministerial state agency licensing and permitting and/or local agency permitting. Adherence is made part of the licensing process as Condition of Certification **TRANS-9**.
California Vehicle Code, sections 13369; 15275 and 15278	Addresses the licensing of drivers and the classification of licenses required for the operation of particular types of vehicles; also requires certificates permitting operation of vehicles transporting hazardous materials. Consistent: The PSEGS would comply with these regulations. Enforcement would be provided by state and local law enforcement agencies, and through ministerial state agency licensing and permitting and/or local agency permitting. Adherence is made part of the licensing process as Conditions of Certification **TRANS-2** and **TRANS-9**.
California Vehicle Code, sections 35100 et seq.; sections 35250 et seq.; and sections 35400 et seq.	Specifies limits for vehicle width, height, and length. Consistent: The PSEGS would comply with these regulations. Enforcement would be provided by state and local law enforcement agencies, and through ministerial state agency licensing and permitting and/or local agency permitting. Adherence is made part of the licensing process as Condition of Certification **TRANS-2**.
California Vehicle Code, section 35780	Requires permits for any load exceeding Caltrans weight, length, or width standards for public roadways. Consistent: The PSEGS would comply with these regulations. Enforcement would be provided by state and local law enforcement agencies, and through ministerial state agency licensing and permitting and/or local agency permitting. Adherence is made part of the licensing process as Condition of Certification **TRANS-2**.
California Streets and Highways Code, sections 117, 660-672	Requires permits for any load exceeding Caltrans weight, length, or width standards on County roads. Consistent: The PSEGS would comply with these regulations. Enforcement would be provided by state and local law enforcement agencies, and through ministerial state agency licensing and permitting

Applicable LORS	Description
	and/or local agency permitting. Adherence is made part of the licensing process as Condition of Certification **TRANS-2**.
California Streets and Highways Code, sections 117, 660-670, 1450, 1460 et seq., and 1480 et seq.	Regulates permits from Caltrans for any roadway encroachment for facilities that require construction, maintenance, or repairs on or across State highways and County roads. Consistent: The PSEGS would comply with these regulations. Enforcement would be provided by state and local law enforcement agencies, and through ministerial state agency licensing and permitting and/or local agency permitting. Adherence is made part of the licensing process as Condition of Certification **TRANS-3** and **TRANS-4**.
Local	
Riverside County General Plan Circulation Element	Specifies long-term planning goals and procedures for transportation infrastructure system quality. Consistent: With implementation of Condition of Certification **TRANS-1**, the PSEGS would not significantly impact traffic LOS. With implementation of all conditions of certification, the PSEGS would not significantly impact any part of the traffic and transportation system.
Riverside County General Plan Circulation Element	Specifies LOS standards to assess the performance of a street or highway system and the capacity of a roadway. Consistent: With implementation of Condition of Certification **TRANS-1**, road and intersection LOS would remain at or above Riverside County's threshold of LOS C.
Riverside County Municipal Code Title 10, Chapter 10.08, Sections 10.08.010-10.08.180	Specifies limits and permit requirements for oversize loads. Consistent: The PSEGS would comply with these regulations. Riverside County would provide enforcement and any necessary permitting. Adherence is made part of the licensing process as Condition of Certification **TRANS-2**.
Riverside County Municipal Code Title 12, Chapter 12.08, Sections 12.08.010-12.08.100	Specifies permit requirements for encroachment permits. Consistent: The PSEGS would comply with these regulations. Riverside County would provide enforcement and any necessary permitting. Adherence is made part of the licensing process as Condition of Certification **TRANS-4**.

NOTEWORTHY PUBLIC BENEFITS

While the development of the proposed modified project is intended to address the requirements of federal and state mandates to develop renewable energy, it would not yield any noteworthy public benefits related to traffic and transportation.

DEPARTMENT OF DEFENSE, OFFICE OF THE UNDER SECRETARY OF DEFENSE, MICHAEL A. AIMONE, PETITION TO AMEND APPENDIX 6-A, TN #68910, DECEMBER 17, 2012 (PALEN 2012A):

Comment: The U.S. Department of Defense (DoD) submitted a comment letter, included in the Petition to Amend, stating that while the project would likely impact military training routes in the area, they believe those impacts can be mitigated. Military aircraft would fly around the project or at higher altitudes to avoid the towers.

GALATI BLEK LLP, MARIE FLEMING/PALEN SOLAR HOLDINGS, LLC'S, INITIAL COMMENTS ON THE PRELIMINARY STAFF ASSESSMENT, TN # 71551, JULY 11, 2013 AND GALATI BLEK LLP, MARIE FLEMING/PALEN SOLAR HOLDINGS LLC'S, FINAL COMMENTS ON THE PRELIMINARY STAFF ASSESSMENT, TN # 200077, JULY 29, 2013 (PALEN 2013DD, PALEN 2013PP):

Comment: The project owner suggested after reviewing the PSA that the verification language for Condition of Certification **TRANS-6** be modified to ensure that Compliance Project Manager (CPM) inspection activities would not conflict with FAA jurisdictional requirements.

Response: Staff accepted this minor change and modified the language as part of this FSA.

Comment: The project owner also suggested that staff use for the heliostat positioning and monitoring plan condition the version proposed by the project owner as part of the May 2013 Response to Workshop Queries.

Response: Staff used this version of the condition as a starting point but added more detail to more fully mitigate the project. Also, staff did not use the project owner's proposed **TRANS-6** references to avoiding interference with operation of the Riverside County PSEC microwave tower because it is not a traffic and transportation issue. **Transmission Line Safety and Nuisance** staff does not anticipate that the heliostats would interfere with operation of the PSEC microwave tower. See the **TRANSMISSION LINE SAFETY AND NUISANCE** section of this FSA for more information.

SHAUN GONZALES, PUBLIC COMMENT, TN # 200041, JULY 25, 2013 (PC 2013A):

Comment: The PSEGS site is roughly located beneath aviation routes, including routes previously identified by the Department of Defense (DoD) as military training routes (MTR) where aircraft fly at least one segment at or below 1500 feet above ground level. CEC's PSA notes that the DoD's Siting Clearinghouse stated that the impacts of PSEGS can be mitigated, but it is not yet clear how DoD considered the use of power tower technology, or whether it conducted analysis on the potential impacts of glare and heat flux-induced turbulence on military aircraft using the routes above the proposed project site. The FAA has acknowledged the potential for heated air to cause severe turbulence over other types of power plants located under flight paths. The CEC should investigate, and explain in detail how the military plans to mitigate this impact.

Response:_ The DoD has submitted a comment letter indicating that they have no major concerns about the PSEGS project affecting their activities (Palen 2012a). Military aircraft would avoid the PSEGS power plant by flying higher above or around it. Thermal plumes would not be a concern for any aircraft flying more than 200 feet above the ground, and military aircraft would not normally fly below 200 feet, especially over the PSEGS site. Aircraft would also not fly sufficiently low to suffer from heat impacts.

See also the glint and glare analysis in this section of the FSA, which finds no significant impacts from the PSEGS to pilots as far as retinal damage and glint and glare.

COUNTY OF RIVERSIDE, JOHN J. BENOIT, COMMENTS ON THE PRELIMINARY STAFF ASSESSMENT, TN # 200094, JULY 30, 2013 (CR 2013A):

Comment: Riverside County staff stated that they wanted to review the project owner's traffic data, which was submitted on July 19, 2013 as a data response to Energy Commission staff's Data Request 14.

Response: Energy Commission Traffic and Transportation staff provided the data to Adam Rush of Riverside County on July 30, 2013.

Comment: County staff also requested that the project owner explain how it was determined that carpooling would result in a 7.5 percent reduction in carpooling vehicle trips.

Response: This reduction is based on the assumption that 15% of workers would carpool. This carpooling estimate is based on the remote location of the project site, the high cost of gas, and the assumption that some workers would stay nearby at the same hotels and would carpool to and from the site. With an average of two people per vehicle, there would be a 7.5% reduction in construction vehicle trips.

Comment: The County requested that the project owner be required to provide analyses of the pavement structure for all County roadways that could be utilized by PSEGS's construction traffic. If the analyses determine that the pavement would not provide sufficient load bearing capacity for the construction traffic, the County would require and requests that the Energy Commission require the project owner to provide road improvements specified by the County Director of Transportation.

Response: Condition of Certification **TRANS-3** now requires that the project owner provide a pavement analysis and restore all inadequate roads prior to construction.

Comment: The County requested that the project owner restore all County public roads, easements, and rights-of-way that may be damaged due to project-related construction activities to original or near original condition in a timely manner. To ensure County involvement, the County requested that Condition of Certification **TRANS-3** be revised to include reference to the County of Riverside as a participant in compliance. The County also requested that the Traffic and Transportation conditions of certification be amended to require that all monthly compliance reports (MCRs) be forwarded to the Riverside Department of Transportation for review and comment.

Response: **TRANS-3** now more explicitly specifies the County of Riverside’s role in **TRANS-3** implementation and requires that MCRs be forwarded to Riverside County. Also, **TRANS-3** would require the project owner to submit details of repairs to the County for review and comment.

Comment: The County requested that the project owner be required to provide financial security to the County, in a form acceptable to the County, to ensure the restoration or replacement of County public roads, easements, and rights-of-way.

Response: The Energy Commission would ensure that all necessary road restoration or replacement take place and would involve Riverside County. The County expressed its concerns that project glint and glare would attract the attention of motorists on I-10 and impact driver visibility, which could lead to an increased number of collisions near the project site and an increased demand for County emergency services.

Response: See **APPENDIX TT2 – RISK OF IMPACTS TO VEHICLE OPERATORS DRIVING ON INTERSTATE 10 DUE TO GLINT AND GLARE ASSOCIATED WITH THE PALEN SOLAR ELECTRIC GENERATING SYSTEM** (Glint and Glare Risk Assessment). The Glint and Glare Risk Assessment shows no significant risk of increased collisions near the project site as a result of glint and glare.

Staff has also proposed Conditions of Certification **TRANS-7** and **TRANS-8** to minimize glint and glare impacts by requiring implementation of a heliostat positioning and monitoring plan and a power tower luminance and monitoring plan.

Comment: The County also recommends that a 24-hour telephone line be established and published for complaints from the public, motorists, and pilots concerning the glint and glare coming from the project.

Response: Condition of Certification **TRANS-7** requires posting of a complaint line, and both **TRANS-7** and **TRANS-8** establish procedures for complaint investigation and resolution.

RIVERSIDE COUNTY, AIRPORT LAND USE COMMISSION, ED COOPER, COMMENTS REGARDING PRELIMINARY STAFF ASSESSMENT OF THE PALEN SOLAR ELECTRIC SYSTEM PETITION TO AMEND, TN # 200112, JULY 30, 2013 (CR 2013B):

Comment: Pursuant to Policy 1.5.3(c) of the Countywide Policies of the 2004 Riverside County Airport Land Use Compatibility Plan, proposals "for construction or alteration of a structure (including antennas) taller than 200 feet above the ground level at the site" constitute major land use actions subject to ALUC review "[r]egardless of location within Riverside County." Therefore, if this project were not on federal land, it would be subject to ALUC review, as well as County review, absent the Energy Commission's certification authority. ALUC requests the opportunity to consider the project locally at a public hearing in Riverside County and forward its conditions to the Energy Commission for its consideration.

Response: There is still opportunity for the ALUC to comment further on the project. Staff anticipates that Evidentiary Hearings for the PSEGS will be held in late October, and any written or oral comments the ALUC provides may be entered into the record at that time. Also, after the hearings, the Energy Commission will release a Presiding Members Proposed Decision (PMPD), which requires a 30-day public review period during which the ALUC may also submit comments.

The FAA has issued a “Determination of No Hazard” for the tower structures and included requirements for obstruction marking and lighting (Palen 2013 ccc). Staff has proposed conditions of certification **TRANS-5** and **TRANS-6** to require notification of the FAA for construction equipment exceeding 760 feet in height and marking and lighting of all tower structures in accordance with FAA requirements provided in the Determination of No Hazard.

Comment: The thermal plume could affect low-flying emergency medical evacuation helicopters. Provision should be made for the wet surface air cooler, auxiliary boiler, and nighttime boiler to be shut down in the event of an (on-site) emergency requiring an airborne evacuation.

Response: A revision to Conditions of Certification **WORKER SAFETY-1** and **WORKER SAFETY-2** is proposed by staff to include a requirement that the project owner submit an Emergency Medical Evacuation Plan as part of the Emergency Response Plan, one for the construction period and another for operations. Staff does not anticipate emergency medical helicopters landing within the heliostat fields due to space constraints; instead, emergency medical helicopters would likely land at the perimeter of the facility, or in the common area. There is also no reason for an emergency medical helicopter to fly within 200 feet above the wet surface air cooler, auxiliary boiler, and nighttime boiler while landing, or through any part of the plant facility. Thus, staff believes that no helicopters would be at risk from a thermal plume at the site. The requirement that an Emergency Medical Evacuation Plan be prepared and submitted to the Compliance Project Manager (CPM) for review and approval would ensure that the helicopters are not placed at risk. See the **WORKER SAFETY AND FIRE PROTECTION** section of this FSA for more information.

Comment: Solar flux could potentially burn the occupants of low-flying emergency medical evacuation helicopters. In the event that an emergency medical evacuation is needed from a location at or near the tower and/or the heliostats, it may be necessary to shut down the entire facility to reduce the temperatures sufficiently to allow a helicopter to safely exit the facility, or to transfer the patient(s) to a ground location that would allow the helicopter to safely land and take off without entering the superheated airspace.

Response: See above response.

Comment: This is one of many solar energy generation facilities (both thermal facilities subject to Energy Commission certification and photovoltaic facilities subject to county permitting) proposed along the Interstate 10 corridor between the privately operated Desert Center Airport and public use Blythe Airport. Airport Land Use Commissioners have expressed increasing concerns regarding the adverse cumulative impacts created by these facilities on an airport.

Response: Cumulative impacts to airports from the PSEGS in combination with other nearby solar facilities are less than significant. Please see the "Cumulative Impacts" portion of the Traffic and Transportation section of this FSA for more information.

STATE OF CALIFORNIA, DEPARTMENT OF TRANSPORTATION, DANIEL KOPULSKY, TN # 200198, AUGUST 12, 2013 (DOT 2013A):

Access Road

Comment: Right-of-way (ROW) for I-10 extends beyond the Corn Springs Road Interchange. Design and construction for the project access road connection to Corn Springs Road Interchange shall follow the guidelines in Caltrans Highway Design Manual Section 504.8 – Access Control:

> http://www.dot.ca.gov/hq/oppd/hdm/hdmtoc.htm.

Response: Staff added the following language to Condition of Certification **TRANS-4**, which requires the project owner to obtain the required encroachment permits:

> "Design and construction for the project access road connection to the Corn Springs Road Interchange shall follow the guidelines in Caltrans Highway Design Manual Section 504.8 – Access Control:
>
> > http://www.dot.ca.gov/hq/oppd/hdm/hdmtoc.htm.

Comment: The delivery of turbine equipment, construction materials, water trucks, tractor trailers, and other heavy equipment may have an impact on the State Highway System. It is recommended that the project owner restore all public roads, easements, and rights-of-way that have been damaged due to project-related construction activities to original or near-original condition in a timely manner. Repairs and restoration of access roads may be required at any time during the construction phase of the project to assure safe ingress and egress.

Response: Condition of Certification **TRANS-3** requires this.

Glint and Glare

Comment: Caltrans staff requests further consultation with Energy Commission staff before mitigation measures for glint and glare are proposed. Caltrans staff requests an extension for submitting any glint and glare comments.

Response: Glint and glare comments are welcome, but cannot be considered by staff in this FSA. When comments are received, they will be addressed during the next stage of our process. Staff anticipates that Evidentiary Hearings for the PSEGS will be held in late October, and any written or oral comments Caltrans provides may be entered into the record at that time. Also, after the hearings, the Energy Commission will release a Presiding Members Proposed Decision (PMPD), which requires a 30-day public review period during which Caltrans may also submit comments.

Please see the glint and glare discussion and glint and glare appendix in this section of the FSA. With implementation of Conditions of Certification **TRANS-7** and **TRANS-8**, glint and glare impacts would be less than significant. Condition of Certification **TRANS-7** and **TRANS-8** require coordination with Caltrans in preparation and implementation of a heliostat positioning and monitoring plan and a power tower luminance monitoring plan.

I-10 Tie Line Proposed Condition of Power Line Placement

Comment: When/if lane closures are required on the State Highway System during construction, it is recommended that Section 517 of the Encroachment Permits Manual be referenced for the proper procedures to manage traffic during construction. The manual can be accessed online at:

http://www.dot.ca.gov/hq/traffops/developserv/permits/

Response: Staff modified Condition of Certification **TRANS-1**, which requires a traffic control plan, including plans for lane closures, to include this information.

Comment: A Transportation Control Plan should be formulated to reduce traffic congestion in the event of overlapping construction schedules from the other projects in the area.

Response: See Condition of Certification **TRANS-1**, which requires preparation and implementation of a traffic control plan which would reduce traffic congestion.

Comment: It is suggested that there be appropriate signage notifications of construction traffic throughout the construction period.

Response: See Condition of Certification **TRANS-1**, which requires that signage be addressed as part of the traffic control plan.

Comment: Stagger worker times, limit truck deliveries to off-peak hours, and implement measures to ensure I-10 operates at LOS C or higher during peak travel time.

Response: See Condition of Certification **TRANS-1**, which requires these congestion reduction methods to be detailed in the traffic control plan.

Comment: Issuance of a Caltrans Encroachment Permit will be required prior to any construction within the State right-of-way and shall be in compliance with all current design standards, applicable policies, and construction practices.

Response: Condition of Certification **TRANS-4** requires the project owner to obtain all the necessary encroachment permits from Caltrans and the applicable local jurisdictions.

Transportation Permit

Comment: Caltrans has the discretionary authority to issue special permits for the movement of vehicles/loads exceeding statutory limitations on the size, weight, and loading of vehicles contained in Division 15 of the California Vehicle Code. Requests for such special permits require the completion of a Transportation Permit. For information regarding Transportation Permit application for travel within the State of California, contact:

Transportation Permits Office
1823 14th Street
Sacramento, CA 95811-7119
Main Number: (916) 322-1297

Response: Condition of Certification **TRANS-2** requires the project owner to comply with limitations imposed by Caltrans District 8 and other relevant jurisdictions on vehicle sizes and weights and driver licensing. It also requires the project owner to the obtain necessary transportation permits from Caltrans and all relevant jurisdictions for roadway use.

Project Development Procedures Manual Chapter 17 – Tranverse Utility Encroachment

Comment: New utility installations and adjustment or relocation of existing utilities may be permitted to cross a freeway or expressway. To the extent feasible and practicable, they should cross on a line generally normal to, but not less than 60 degrees, from the freeway longitudinal alignment, and preferably under the freeway. The utility should be located in such a manner that it can be serviced, maintained, and operated from outside the right-of-way, except for special cases covered under "New Utility Longitudinal Encroachments".

http://www.dot.ca.gov/hq/oppd/pdpm/pdpmn.htm#pdpm

Response: Condition of Certification **TRANS-4** requires the project owner to obtain all the necessary encroachment permits from Caltrans and the applicable local jurisdictions.

CONCLUSIONS

1. With implementation of Condition of Certification **TRANS-1**, which would require preparation and implementation of a traffic control plan, the PSEGS's construction traffic impacts would be less than significant.

2. The PSEGS's operational traffic impacts would be less than significant.

3. The PSEGS's primary emergency vehicle access is adequate. The PSEGS's alternative emergency access, which would be provided by all-terrain fire trucks and

two access gates, as required by **Worker Safety and Fire Protection** staff, is also adequate.

4. Because of the PSEGS's distance from the nearest rail and bus service, the project would have no impact on these forms of transportation.

5. With implementation of Conditions of Certification **TRANS-5** and **TRANS-6**, the PSEGS would not pose significant obstruction hazards to aircraft. **TRANS-5** would require that the project owner notify the FAA of any construction equipment exceeding 760 feet in height. **TRANS-6** would require the project owner to install obstruction marking and lighting on the solar towers.

6. The PSEGS would not produce a high-velocity thermal plume impacting aircraft.

7. The PSEGS would not cause photothermal or photochemical retinal damage to motorists or pilots outside of the PSEGS site. On-site workers within plant boundaries could potentially experience retinal damage for a very limited and unique set of conditions and tower observation points. See the **WORKER SAFETY AND FIRE PROTECTION** section of this FSA for conditions of certification which would mitigate this impact by requiring site workers to wear the appropriate personal protection equipment (PPE) in the form of protective sunglasses.

8. During project construction and operation, DSRH would significantly impact motorists by causing significant discomfort glare. With implementation of Condition of Certification **TRANS-7**, glint and glare impacts to motorists would be less than significant. **TRANS-7** would require the project owner to develop and implement a heliostat positioning and monitoring plan to minimize the frequency of DSRH events during the testing, calibration and operational phases of the PSEGS.

9. DSRH are not expected to significantly impact pilots' abilities to operate their aircraft. Pilots would experience only mild discomfort glare, not severe discomfort or disability glare. Implementation of **TRANS-7** would help ensure that impacts would remain less than significant. **TRANS-7** would require the project owner to maximally limit DSRH on all observers through effective heliostat positioning.

10. Sustained glare from the SRSGs during nominal operating conditions (where luminance would be less than $1x10^6$ cd/m^2) would not produce discomfort or disability glare that would interfere with motorists' or pilots' abilities to operate their vehicles and planes, respectively. However, at higher luminance levels, the SRSGs could produce discomfort or disability glare that would significantly impact drivers on I-10. To ensure that the SRSGs operate at acceptable luminance levels (less than $1x10^6$ cd/m^2) that would not impact drivers, staff has proposed Condition of Certification**TRANS-8** to require a solar power tower receiver luminance and monitoring plan. **TRANS-8** would provide procedures for identification and mitigation of visual distraction, discomfort glare, or disability glare effects with the potential of causing significant impacts to motorists. **TRANS-8** would help ensure that glare impacts to motorists and pilots would remain less than significant.

11. With implementation of Condition of Certification **TRANS-9**, the PSEGS would cause less than significant impacts to roadways and the traveling public from transportation of hazardous materials. **TRANS-9** requires that the project owner secure permits and/or licenses from the California Highway Patrol and Caltrans for the transportation of hazardous materials.

12. The PSEGS supplies an adequate amount of on-site parking during both construction and operation and would not create any significant parking impacts.

13. With implementation of Condition of Certification **TRANS-1**, which requires preparation and implementation of a traffic control plan, cumulative impacts from PSEGS construction traffic would be less than significant. PSEGS operations traffic would not contribute to cumulative impacts, as operations traffic would be minimal.

14. The PSEGS project would not combine with other nearby existing or proposed solar projects to cause cumulative glint and glare impacts to motorists.

15. The PSEGS project would not combine with other nearby existing or proposed solar projects to cause cumulative glint and glare impacts to pilots.

16. The PSEGS project as proposed and with conditions of certification would comply with applicable LORS related to traffic and transportation.

17. **TRANS-1** requires the owner to develop and implement a Traffic Control Plan (TCP). The TCP would include a plan for reducing peak construction traffic impacts

18. **TRANS-2** requires the owner to comply with limits on vehicle sizes and weights and driver licensing regulations.

19. **TRANS-3** requires the owner to restore all roads to a condition that can accommodate construction activities and to restore all damage caused by construction activities.

20. **TRANS-4** requires the owner to comply with limits on encroachment into public-rights-of-way and to obtain all of the necessary project permits.

21. As part of the amendment, staff is proposing a new condition of certification, **TRANS-5**, to require that the project owner notify the FAA of any construction equipment exceeding 760 feet in height.

22. As part of the amendment, staff is proposing a new condition of certification, **TRANS-6,** to require the project owner to install obstruction marking and lighting on the solar towers in accordance with FAA Advisory Circular 70/7460-1 K Change 2, Obstruction Marking and Lighting, a med-dual system - Chapters 4,8(M-Dual), &12.

23. As part of the amendment, staff is replacing the original project's Condition of Certification **TRANS-6**, which required certain mirror movements to mitigate glint and glare impacts, with proposed Condition of Certification **TRANS-7**, which would require a detailed heliostat positioning and monitoring plan.

24. As part of the amendment, staff is proposing a new condition of certification, **TRANS-8**, to require a power tower receiver luminance and monitoring plan.

25. **TRANS-9** requires the owner to secure permits and licenses for the transport of hazardous materials.

Staff has reviewed **Socioeconomics Figure 1**, which shows that there is no minority population within a six-mile buffer of the proposed PSEGS. Therefore, construction and operation of the proposed project would not cause disproportionate direct or cumulative traffic and transportation impacts to an environmental justice population.

PROPOSED CONDITIONS OF CERTIFICATION

Staff has proposed modifications to the Traffic and Transportation Conditions of Certification as shown below. (**Note:** Deleted text is in ~~strikethrough~~, new text is **<u>bold and underlined.</u>**)

In summary, staff has added new conditions for the amendment (**TRANS-5**, **TRANS-6, TRANS-7, and TRANS-8**) which made it necessary to renumber the existing conditions for the original project.

<u>TRANS-1</u>~~**TRANS-1**~~ Prior to the start of construction of the PSEGS, the project owner shall prepare and implement a Traffic Control Plan (TCP) for the PSEGS's construction and operations traffic. The TCP shall address the movement of workers, vehicles, and materials, including arrival and departure schedules and designated workforce and delivery routes.

The project owner shall consult with the County of Riverside and the California Department of Transportation (Caltrans) District 8 office in the preparation and implementation of the Traffic Control Plan (TCP). The project owner shall submit the proposed TCP to the County of Riverside and the Caltrans District 8 office in sufficient time for review and comment, and to the Energy Commission Compliance Project Manager (CPM) for review and approval prior to the proposed start of construction and implementation of the plan. ~~The CPM shall review and approve the TCP or identify any material deficiencies within thirty (30) days of receipt.~~ The project owner shall provide a copy of any written comments from the County of Riverside and the Caltrans District 8 office and any changes to the TCP to the CPM prior to the proposed start of construction.

The Traffic Control Plan (TCP) shall include:

- A work schedule ~~and end-of-shift departure plan~~ designed to ensure that stacking does not occur at intersections necessary to enter and exit the project site~~s~~, **and that LOS at these intersections and on I-10 remains at LOS C or better.** The project owner shall consider using one or more of the following measures designed to prevent stacking: staggered work shifts, off-peak work schedules, and/or restricting travel to and departures from each project site to 10 or fewer vehicles every three minutes ~~during peak travel hours on I-10~~. **The submitted work schedule shall include a detailed plan for worker arrival and departure, including number of workers that are planned to arrive and depart at each time, and methods for ensuring worker compliance.**
- **A plan for monthly monitoring of traffic volume and/or delay and LOS at study roadways and intersections during periods of higher construction employment (Months 19 through 25, including Month 22, the peak construction month).**
- Provisions for an incentive program, such as employer-sponsored commuter checks, to encourage construction workers to carpool and/or use van or bus service.
- Limitation of truck deliveries at the project site to only off-peak **construction commute** hours **and/or staggering of truck deliveries throughout the day**.
- A heavy-haul plan addressing the transport and delivery of heavy and oversized loads requiring permits from the California Department of Transportation (Caltrans) or other state or federal agencies.
- Timing of heavy equipment and building material delivery to the sites
- Parking for workforce and construction vehicles.
- Emergency vehicle access to the project site.
- Provisions for redirection of construction traffic with a flag person as necessary to ensure traffic safety and minimize interruptions to non-construction related traffic flow.
- Placement of signage, lighting, and traffic control devices at the project construction site and laydown areas.
- Placement of signage along northbound Corn Springs Road and at the entrance of each of the I-10 westbound and eastbound off-ramps at Corn Springs Road notifying drivers of construction traffic throughout the duration of the construction period.
- Placement of signage to redirect traffic from Corn Springs Road during construction activities related to roadway realignments and pipeline installation in and across the Corn Springs Road right-of-way.

- Temporary closing of travel lanes, if necessary. **When/if lane closures are required on the State Highway System during construction, refer to Section 517 of Caltrans' Encroachment Permits Manual for the proper procedures to manage traffic during construction. The manual can be accessed online at:**

  http://www.dot.ca.gov/hq/traffops/developserv/permits/

- Access to adjacent residential and commercial property during the construction of all linears.

Verification: At least 60 calendar days prior to the start of construction, including any grading or site remediation on the power plant site or its associated easements, the project owner shall submit the proposed TCP to the County of Riverside and the Caltrans District 8 office for review and comment and to the CPM for review and approval. The project owner shall also provide the CPM with a copy of the transmittal letter to the County of Riverside and the Caltrans District 8 office requesting review and comment.

At least 30 calendar days prior to the start of construction, the project owner shall provide copies of any comment letters received from either the County of Riverside and the Caltrans District 8 office, along with any changes to the proposed Traffic Control Plan, to the CPM for review and approval.

In the MCRs during Months 19 through 25, submit the monitoring results for the study intersections.

TRANS-2~~TRANS-1~~ The project owner shall comply with limitations imposed by Caltrans District 8 and other relevant jurisdictions, including the County of Riverside, on vehicle sizes and weights and driver licensing. In addition, the project owner or its contractor shall obtain necessary transportation permits from Caltrans and all relevant jurisdictions for roadway use.

Verification: In the Monthly Compliance Reports (MCRs), the project owner shall report permits received during that reporting period. In addition, the project owner shall retain copies of permits and supporting documentation on-site for Compliance Project Manager (CPM) inspection if requested.

TRANS-3 The project owner shall **coordinate with Riverside County to conduct pavement testing for all County roadways that could be utilized by PSEGS construction and operation activities. Based on results of the pavement testing and prior to the first heavy haul delivery, the project owner shall make any necessary improvements to ensure the roads provide sufficient load-bearing capacity for construction and operation traffic. Improvements must meet the minimum Riverside County or Caltrans standard (whichever is applicable) for a roadway that accommodates heavy trucks.** ~~restore all public roads, easements, and rights-of-way that have been~~

<u>**Following construction, the project owner shall ensure that any roads**</u> damaged due to project-related construction activities <u>**are restored**</u> to original or near-original condition~~in a timely manner~~, as directed by the CPM <u>**and in coordination with Caltrans and/or Riverside County**</u>. Repair and restoration of access roads may be required at any time during the construction phase of the project to assure <u>**public**</u> safe<u>**ty.**</u> ~~ingress and egress.~~ <u>**Repairs required during construction shall be made as soon as possible.**</u>

<u>**Verification: Prior to site mobilization, the project owner shall provide a copy of the pavement test to the CPM and Riverside County for review. Sixty (60) days prior to start of construction, the project owner shall establish a schedule for approval and completion of any roadway improvements.**</u>

~~At least 30 days prior to the start of mobilization, the project owner shall photograph or videotape all affected public roads, easements, right-of-way segments and/or intersections and shall provide the CPM, the affected local jurisdictions and Caltrans (if applicable) with a copy of these images. The project owner shall rebuild, repair and maintain all public roads, easements, and rights-of-way in a usable condition throughout the construction phase of the project.~~

At least 30 days prior to the start of site mobilization, the project owner shall consult with the County of Riverside and Caltrans District 8 and notify them of the proposed schedule for project construction. The purpose of this notification is to request that the County of Riverside and Caltrans consider postponement of public right-of-way repair or improvement activities in areas affected by project construction until construction is completed, and to coordinate with the project owner regarding any concurrent construction-related activities that are planned or in progress and cannot be postponed.

<u>**During construction, the project owner shall report in the MCRs any project-related damage requiring restoration and the status of that restoration. The MCRs shall be forwarded to Riverside County for review and comment on these activities.**</u>

Within 60 calendar days after completion of construction, the project owner shall meet with the CPM, the County of Riverside, and Caltrans District 8 to identify sections of public right-of-way to be repaired. At that time, the project owner shall establish a schedule to complete the repairs and to receive approval for the action(s). Following completion of any public right-of-way repairs, the project owner shall provide to the CPM letters signed by the County of Riverside and Caltrans District 8 stating their satisfaction with the repairs.

TRANS-4~~**TRANS-5**~~ The project owner or contractor shall comply with Caltrans' and other relevant jurisdictions' limitations for encroachment into public rights-of-way and shall obtain necessary encroachment permits from Caltrans and any other relevant jurisdictions. **Design and construction for the project access road connection to the Corn Springs Road Interchange shall follow the guidelines in Caltrans Highway Design Manual Section 504.8 – Access Control:**

http://www.dot.ca.gov/hq/oppd/hdm/hdmtoc.htm.

Verification: In the MCRs, the project owner shall report permits received during that reporting period. In addition, for at least six months after the start of commercial operation, the project owner shall retain copies of permits and supporting documentation on-site for CPM inspection if requested.

TRANS-5 Federal Aviation Administration Notification of Construction Equipment

The project owner shall file a Form 7460-1 with the Federal Aviation Administration (FAA) regarding the use of any construction equipment exceeding 760 feet in height.

Verification: At least 90 days prior to ground disturbance, the project owner shall submit a copy of the FAA Determination of No Hazard to Navigable Airspace regarding the construction equipment to the CPM.

TRANS-6 Obstruction Marking and Lighting

The project owner shall install obstruction marking and lighting on the two solar power towers. Marking and lighting for the towers shall be consistent with requirements provided in the FAA's "Determination of No Hazard" for the towers, and as expressed in the following documents:

- **FAA Advisory Circular 70/7460-1K, Change 2, Obstruction Marking and Lighting, a med-dual system - Chapters 4,8(M-Dual), &12**
- **FAA Safety Alert for Operators (SAFO) 09007.**

Evening lighting shall use the longest permissible interval between flashes and the shortest flash duration permissible. (See the Biological Resources section for more information.)

Temporary lighting must be installed once a tower reaches 200 feet in height during construction. Permanent lighting consistent with all requirements shall be installed and activated within 5 days of completion of construction and prior to the start of plant operation. Within 5 days after the towers reach their greatest height, an FAA Form 7460-2 "Notice of Actual Construction or Alteration" shall be submitted to the FAA.

Lighting shall be operational 24 hours a day, 7 days a week for the life of project operation. Upgrades to the required lighting configurations, types, location, or duration shall be implemented consistent with any changes to FAA obstruction marking and lighting requirements.

The FAA has proposed publishing guidance on the use of Audio Visual Warning Systems (AVWS) for obstruction lighting. The project owner has the future option to change the tower obstruction lighting system to an Audio Visual Warning System. An AVWS was recommended by the National Park Service in a comment on the FAA Notice of Construction or Alteration for the PSEGS to preserve the natural darkness in this portion of the Mojave Desert. If it is feasible and the project owner wishes to implement an AVWS in the future, the project owner shall consult with the FAA and the CPM as necessary.

Verification: At least 60 days prior to the start of construction, the project owner shall submit to the CPM for approval final design plans for the two solar power towers that depict the required air traffic obstruction marking and lighting, including the temporary lighting.

Within 1 day of the tower heights reaching 200 feet in height, the project owner shall install temporary lighting consistent with FAA requirements and shall inform the CPM in writing (including a photo of the lighting) within 10 days of installation.

Within 5 days of completion of solar power tower construction and prior to the start of plant operation, the project owner shall install and activate permanent obstruction marking and lighting consistent with FAA requirements and shall inform the CPM in writing within 10 days of installation and activation. The project owner shall also provide to the CPM a copy of Form 7460-2 provided to the FAA. The CPM (or designated inspector) shall conduct an inspection after activation to ensure the lighting is operable and has been installed with federal installation and manufacturing standards as established by the FAA under FAA Advisory Circulars.

TRANS-7 Heliostat Positioning and Monitoring Plan

To reduce glint and glare from the project, the project owner shall prepare a Heliostat Positioning and Monitoring Plan (HPMP) which includes the following information. The HPMP shall be implemented during installation of the heliostats and during project operation.

1. Identify the heliostat movements and positions (including during normal operations, daytime mirror-washing, removal of solar flux due to high winds, and all non-normal known operational scenarios and possible malfunctions) that could result in potential exposure of observers at various locations, including pilots, motorists, pedestrians and hikers in nearby wilderness areas, to direct solar reflections from the heliostats (DSRH).

2. Describe within the HPMP how programmed heliostat operation would address potential DSRH events at locations of observers, and how it would maximally limit or avoid potential exposures. This shall include heliostat positioning and transition algorithm exclusion zones that maximally avoid ground-based DSRH events.

3. Describe how the mirrored surfaces of the heliostats would be covered during construction until the heliostats are properly seated, oriented, and under computer control to avoid exclusion zones.

4. Implement a set of baseline heliostat positioning and control algorithms to minimize DSRH events as soon as realistically possible after heliostat installation. The baseline control algorithms shall initially minimize ground-based DSRH events during site set-up, testing and calibration prior to power generation operations. If this does not work to minimize ground-based DSRH events, the project owner shall modify the perimeter fencing along I-10 to prevent motorists from experiencing DSRH events.

5. Prepare a monitoring plan to quantify the frequency and locations of DSRH events and validate that the DSRH events are minimized by HPMP implementation. This may be implemented with a staring camera system along a known line of sight to ground-based observation points (e.g., I-10).

   The monitoring plan shall be made available to interested parties, including the Department of Defense (DoD), California Department of Transportation (Caltrans), California Highway Patrol (CHP), Federal Aviation Administration (FAA), Riverside County Economic Development Agency Department of Aviation, the Riverside County ALUC, and the Riverside County Transportation and Land Management Agency . The monitoring plan shall be updated on an annual basis for the first 5 years and at 2-year intervals thereafter for the life of the project.

6. Obtain field measurements in candela per meters squared and watts per meter squared to validate that the HPMP avoids the potential for human health and safety hazards consistent with the methodologies detailed in the 2010 Sandia Lab document presented by Clifford Ho, et al., including those studies and materials related to ocular damage referenced within.

7. Provide requirements and procedures to document, investigate and resolve legitimate complaints regarding glint and glare events. This includes establishing a toll-free number for the public to report complaints related to glint and glare and posting this number in the same location as that required in Condition of Certification COMPLIANCE-9.

The project owner shall notify the CPM within 3 days of receiving a glint or glare complaint. As soon as the complaint has been resolved or within 10 days of the complaint, the project owner shall submit to the CPM a report in which the complaint(s) as well as the actions taken to resolve the complaint are documented. The report shall include (a) a complaint summary, including the name and address of the complainant; (b) a discussion of the steps taken to investigate the complaint; (c) the reasons supporting a determination of whether or not the complaint is legitimate; and (d) the steps taken to address the complaint and the final results of these efforts. This information shall be included in the Monthly Compliance Reports.

Verification: 60 days prior to the start of construction, the project owner shall prepare and submit to the CPM for review and approval a plan for baseline heliostat positioning and control algorithms to minimize DSRH events after heliostat installation and during site set-up, testing, and calibration. 90 days prior to the start of operation of any unit, the project owner shall submit the remainder of the HPMP describing how the above measures will be implemented to reduce glint and glare during project operation, and how monitoring will occur.

If the project owner receives a complaint regarding glint or glare, the owner shall conduct an investigation to determine whether the complaint is legitimate and if the project is the source of such glint or glare. If it is determined that the project is the source of such glint or glare, the project owner shall take all feasible measures to eliminate or reduce the glint or glare. Such measures may include localized screening.

The project owner shall notify the CPM within 3 days of receiving a glint or glare complaint. As soon as the complaint has been resolved or within 10 days of the complaint, the project owner shall submit to the CPM a report in which the complaint(s) as well as the actions taken to resolve the complaint are documented. The report shall include (a) a complaint summary, including the name and address of the complainant; (b) a discussion of the steps taken to investigate the complaint; (c) the reasons supporting a determination of whether or not the complaint is legitimate; and (d) the steps taken to address the complaint and the final results of these efforts. This information shall be included in the Monthly Compliance Reports.

If no legitimate complaints are received and/or if a legitimate complaint is received and the project owner has resolved the source of the complaint(s) within the first 12 months of project operation, project owner can request that the CPM release the project owner from the obligations under Section 4 of this condition after the 12th month of project operations.

~~**TRANS-6** To reduce glint and glare from the Project, the Project Owner shall implement the following measures during operation of any unit:~~

~~1. Ensure the mirrors are brought out of stowage before sunrise and are aligned to catch the first rays of the morning sun;~~

2. ~~Ensure the mirrors are returned to stow position after sunset;~~

3. ~~As soon as is feasible, redirect malfunctioning mirrors to the east in a manner so that there is no reflection from the sun as the sun continues west; and~~

4. ~~Establish a toll-free number for the public to report complaints related to glint and glare and post such number in the same location as that required in Compliance-9. If the project owner receives a complaint regarding glint or glare it shall investigate to determine whether the complaint is legitimate and if the project is the source of such glint or glare. If it is determined that the project is the source of such glint or glare and the glint or glare is causing human health or safety hazards, the project owner shall take all feasible measures to reduce the glint or glare. Such measures may include localized screening. The project owner shall notify the CPM within 3 days of receiving a glint or glare complaint. As soon as the complaint has been resolved the project owner shall submit to the CPM a report in which the complaint(s) as well as the actions taken to resolve the complaint are documented. The report shall include (a) a complaint summary, including the name and address of the complainant; and (b) a discussion of the steps taken to investigate the complaint, the reasons supporting a determination of whether or not the complaint is legitimate, and the steps taken to address the complaint and the final results of these efforts. In the monthly compliance report, the project owner shall describe any complaints it received that month that it determined not to be legitimate and shall explain the basis of its determination.~~

~~**Verification:**~~ ~~90 days prior to the start of operation of any unit, the project owner shall prepare and submit to the CPM for review and approval a plan describing how the above measures will be implemented to reduce glint and glare. If a legitimate complaint is received concerning potential human health and safety hazards relating to glint or glare, the project owner shall notify the CPM within 3 days of receipt of the complaint and shall provide to the CPM within 10 days of the complaint the report detailing how the complaint has been addressed. . In the monthly compliance report, the project owner shall describe any complaints received that month that were determined not to be legitimate and shall explain the basis of that determination. If no legitimate complaints are received and/or if a legitimate complaint is received and the project owner has resolved the source of the complaint(s) within the first 12 months of project operation, project owner can request that the CPM release the project owner from the obligations under Section 4 of this condition after the 12th month of project operations.~~

TRANS-8 Power Tower Luminance Monitoring Plan

The project owner shall prepare a Power Tower Luminance Monitoring Plan for: providing procedures for conducting periodic monitoring of power tower luminance; and for documenting, investigating, and resolving complaints regarding visual distraction or discomfort glare effects from the power towers experienced by pilots, motorists, and pedestrians.

The Power Tower Luminance Monitoring Plan shall include provisions for the following:

1. Measurement of luminance using an appropriate photometer or similar device and reporting of data in photometric units. The measurements are intended to:

   a) develop a baseline of tower luminance measurements to verify that the luminance values are not in excess of 10^6 cd/m^2 and to support anticipation and investigation of any future visual distraction or discomfort glare events, and to

   b) provide quantitative measures of luminance that can be associated with any observed and reported visual distraction or discomfort glare events/ effects from the power tower receivers;

2. Coordination of luminance evaluations with the FAA, Department of Defense (DoD), Caltrans, California Highway Patrol, Riverside County Economic Development Agency Department of Aviation, Riverside County Transportation and Land Management Agency, and the Riverside County Airport Land Use Commission (ALUC) in relation to the Desert Center and Blythe Airports and I-10. Within 30 days after completing luminance measurements required under this plan, the project owner shall submit a summary report to these agencies for review and comment, and to the CPM for review and approval.

3. Measurement of luminance at locations where any visual distraction or discomfort glare effects have been reported or at a representative site location where accurate measurements of luminance can be made that would be representative of conditions prompting the complaint;

4. Identification and implementation of appropriate mitigation measures if reported visual distraction or discomfort glare events are determined to be legitimate and/ or if power tower luminance is determined to be causing a safety concern. The project owner shall consider and propose any reasonable mitigation measures that are technically and financially feasible. The mitigation measures may include: surface treatment; material or structural changes to increase absorption and reduce reflectivity of the power tower receivers; reduction of the number of heliostats incident on the towers; road signage; screening; or other reasonable measures to either reduce luminance or mitigate the safety concern.

5. Post-mitigation verification. Within 30 days following the implementation of mitigation measures designed to reduce reflectivity of the power towers or mitigate the safety concern, the project owner shall repeat the luminance measurements to demonstrate the effectiveness of mitigation measures and prepare a

supplemental survey report for review and comment by the FAA, Caltrans, California Highway Patrol, Riverside County Economic Development Agency Department of Aviation, and the Riverside County ALUC for review and comment, and to the CPM for review and approval.

Verification: At least 90 days prior to commercial operation of the first PSEGS power plant, the project owner shall provide a Power Tower Luminance Monitoring Plan as described above for review and approval by the CPM. The plan shall require the project owner to report any complaint to the CPM within 10 days of receiving the complaint.

Under the following circumstances, the project owner shall submit to the CPM an evaluation of the effects of the intensity of the luminance of light reflected from the power tower receivers:

A. Within 30 days following commercial operation of each unit;

B. Within 90 days following commercial operation of each unit;

C. After the first 5 years of operation;

D. If a major design change is implemented that results in an increase in the reflective luminance of either power tower; or

E. After receiving a legitimate complaint regarding visual distraction or discomfort glare associated with the power towers.

TRANS-9~~TRANS-2~~ The project owner shall ensure that permits and/or licenses are secured from the California Highway Patrol and Caltrans for the transport of hazardous materials.

Verification: In the MCRs, the project owner shall report permits and/or licenses for hazardous substance transportation received during that reporting period. In addition, the project owner shall retain copies of permits, licenses, and supporting documentation on-site for CPM inspection if requested.

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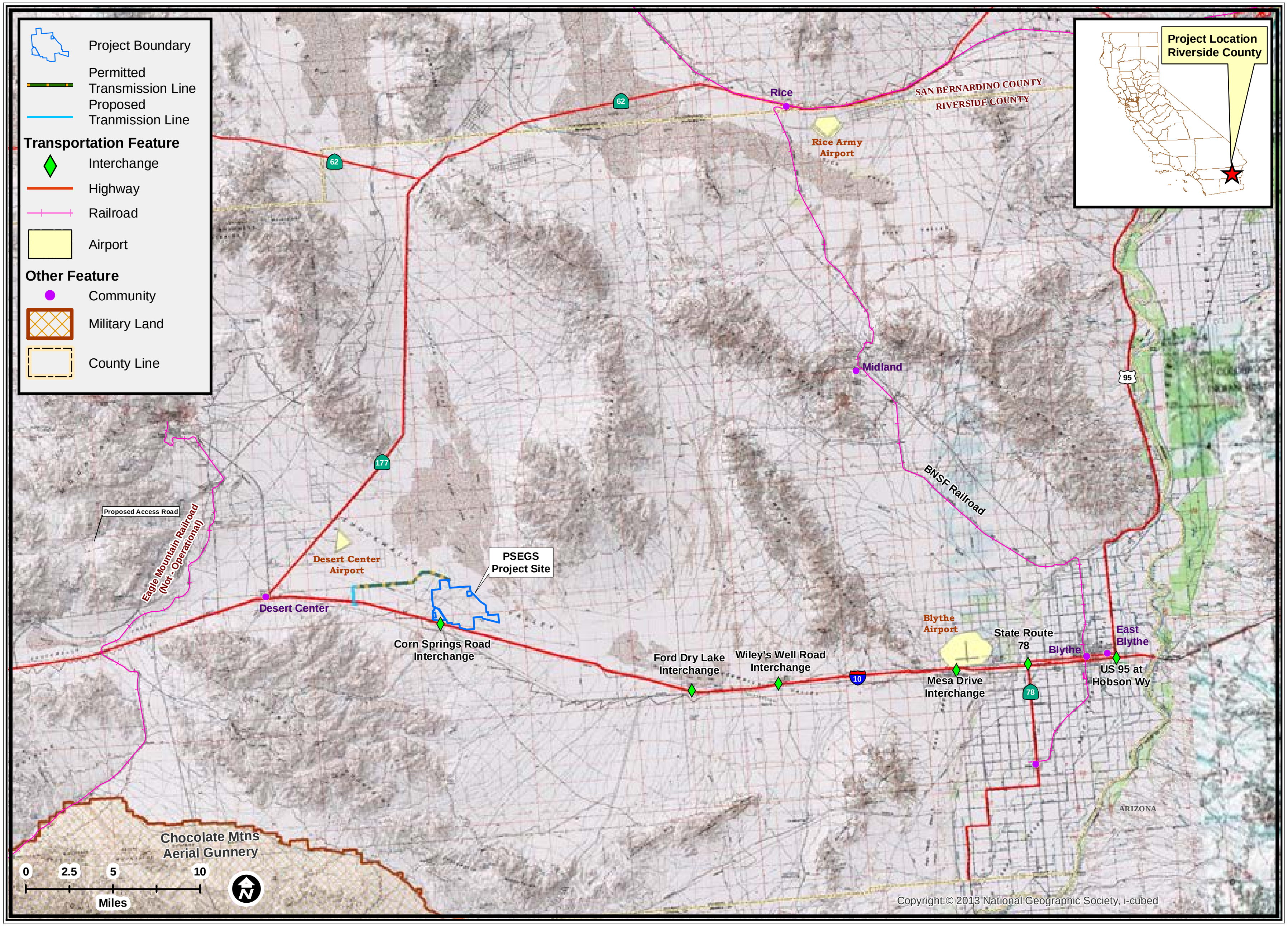
TRAFFIC AND TRANSPORTATION - FIGURE 1

Palen Solar Electric Generating System - Regional Transportation Network



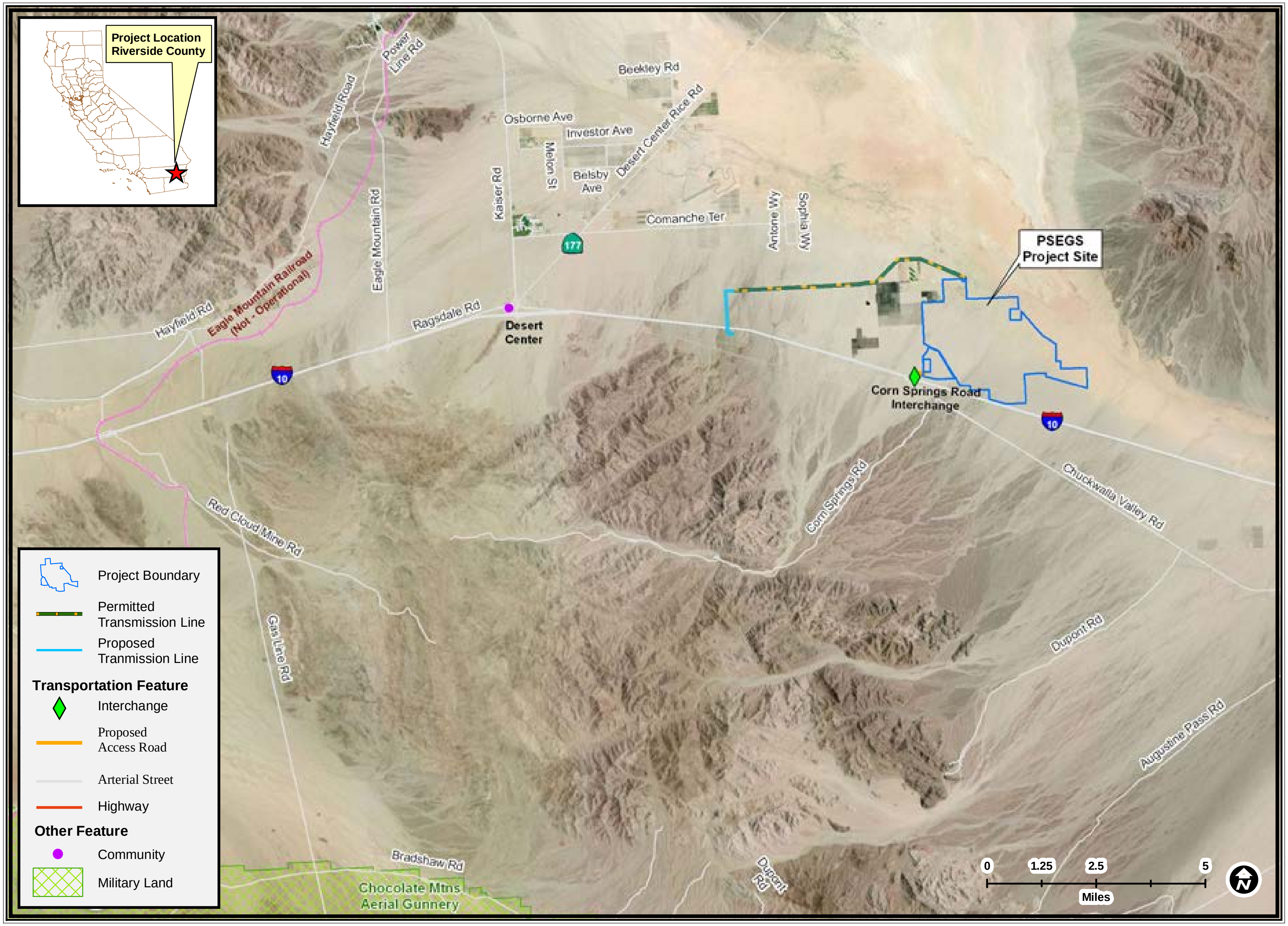
TRAFFIC & TRANSPORTATION

CALIFORNIA ENERGY COMMISSION - SITING,TRANSMISSION AND ENVIRONMENTAL PROTECTION DIVISION

SOURCE: California Energy Commission Statewide Power Plant Maps 2010 - Tele Atlas

TRAFFIC AND TRANSPORTATION - FIGURE 2

Palen Solar Electric Generating System - Local Transportation Network



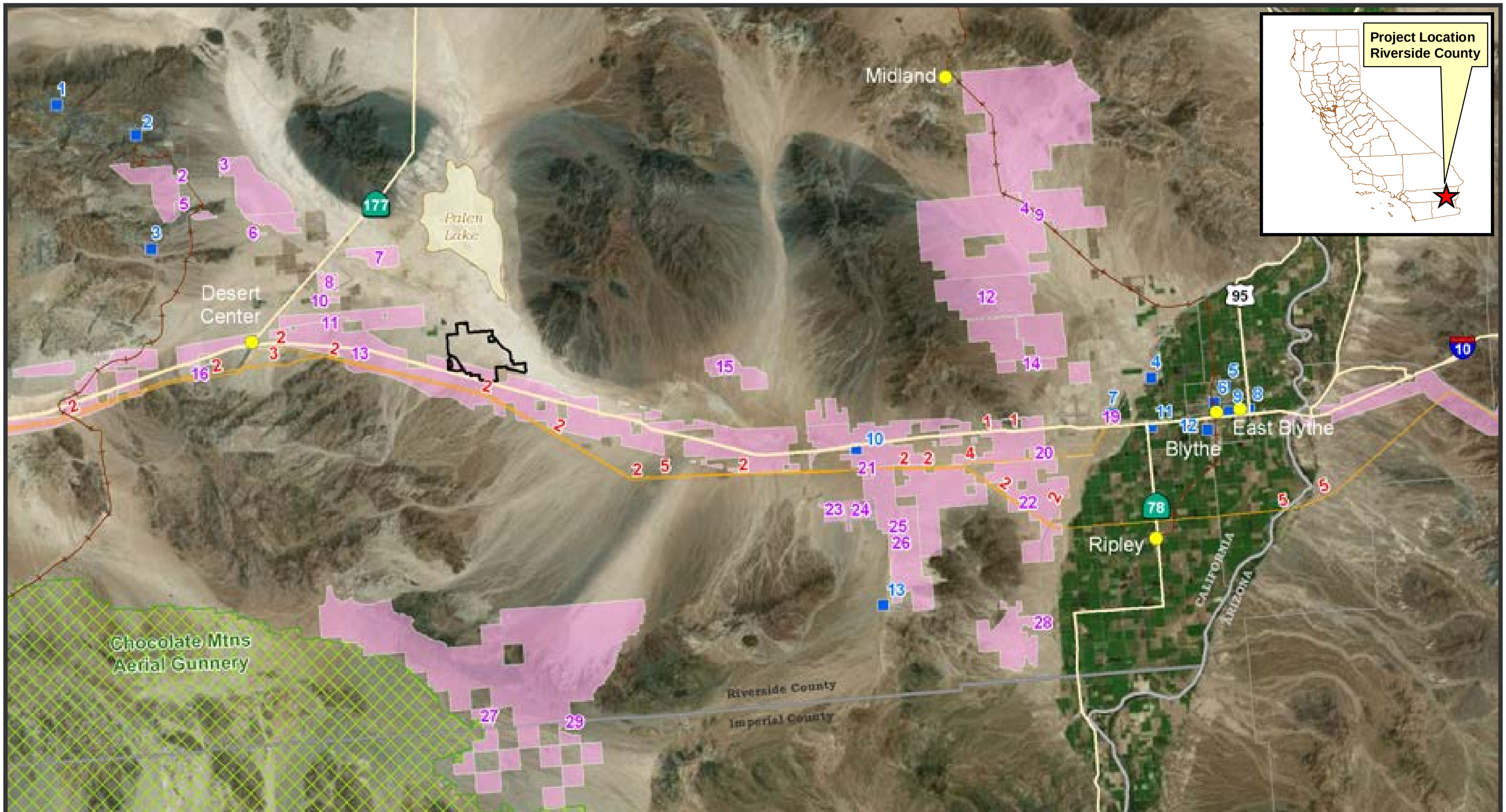
TRAFFIC & TRANSPORTATION

CALIFORNIA ENERGY COMMISSION - SITING,TRANSMISSION AND ENVIRONMENTAL PROTECTION DIVISION

SOURCE: California Energy Commission Statewide Power Plant Maps 2010 - Tele Atlas

TRAFFIC & TRANSPORTATION - FIGURE 3

Palen Solar Electric Generating System - Traffic and Transportation Cumulative Projects

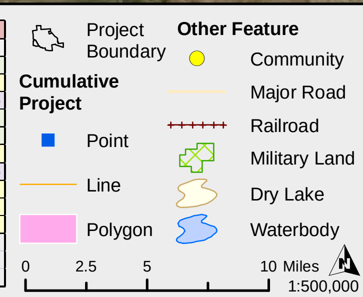


POINT		
LABEL	PROJECT	STATUS
1	Kaiser Mine	Existing
2	Eagle Mountain Pumping	Foreseeable
3	Eagle Mountain Landfill	Foreseeable
4	Blythe Solar Power Generation Station 1	Foreseeable
5	Twelve Residential Developments	Foreseeable
6	Colorado River Substation Expansion	Foreseeable
7	Blythe Energy Project	Existing
8	Intake Shell	Foreseeable
9	Four Commercial Projects	Foreseeable
10	Wileys Well Communication Tower	Foreseeable
11	Blythe Mesa Solar I	Foreseeable
12	Three Residential	Foreseeable
13	Recreational Opportunities	Existing

LINE		
LABEL	PROJECT	STATUS
1	Interstate 10	Existing
2	Blythe Energy Project Transmission Line	Foreseeable
3	Green Energy Express Transmission Line Project	Foreseeable
4	Desert Southwest Tranmission Line Project	Foreseeable
5	Devers-Palo Verde No. 2 Transmission Line Project	Foreseeable

POLYGON		
LABEL	PROJECT	STATUS
1	L.H. Renewables Riverside County Type II	Pending
2	Eagle Mountain Wind Project	Foreseeable
3	Desert Sunlight Project	Foreseeable
4	Big Maria Vista Solar	Foreseeable
5	Eagle Mountain Pumping Plant	Existing
6	Desert Harvest	Foreseeable

POLYGON					
LABEL	PROJECT	STATUS	LABEL	PROJECT	STATUS
7	Desert Lily Soleil Project	Foreseeable	20	Blythe PV Project	Existing
8	Chuckwalla Valley Raceway	Existing	21	Sonoran West	Pending
9	McCoy Soleil Project	Foreseeable	22	Desert Quartzite	Foreseeable
10	Desert Center 50	Foreseeable	23	Ironwood State Prison	Existing
11	Power Partners SW - Chuckwalla Solar I	Foreseeable	24	Chuckwalla State Prison	Existing
12	NextEra (FPL) McCoy	Foreseeable	25	Mule Mountain III	Pending
13	SCE Red Bluff Substation	Foreseeable	26	Mule Mountain Solar Project	Foreseeable
14	Blythe Solar Power Project	Foreseeable	27	Graham Pass Wind Project	Pending
15	Genesis Solar Energy Project	Foreseeable	28	Palo Verde Mesa Solar Project	Pending
16	West-wide Section 368 Energy Corridors	Existing	29	Milpitas Wash	Pending
17	Blythe Airport Solar I Project	Foreseeable			
18	EnXco	Foreseeable			
19	Blythe Energy Project II	Foreseeable			



CALIFORNIA ENERGY COMMISSION - SITING, TRANSMISSION AND ENVIRONMENTAL PROTECTION DIVISION

SOURCE: Microsoft Bing Aerial, BrightSource, OpenStreetMap - May 2013, Bureau of Land Management - May 2013

APPENDIX TT1 –
VISUAL SAFETY IMPACT ASSESSMENT

Testimony of Gregg Irvin, Ph.D.

This appendix provides an assessment of potential retinal damage and glint and glare impacts from the proposed Palen Solar Electric Generating System (PSEGS). Specifically, staff assessed the project's potential to cause retinal damage and temporary visual discomfort and disability to nearby viewers.

RETINAL DAMAGE

The ability of light to cause injury to the retina has been shown both clinically and experimentally. Light can result in retinal damage through photothermal, photomechanical, and photochemical mechanisms.

Photothermal damage is the physical damage to the retina that can occur from high levels of irradiance. Irradiance is the density of radiation on a given surface. Well-established standards are provided by the American National Standards Institute (ANSI, Z136.1-2000) for protection of the human eye from photic exposure.

Photomechanical damage is mediated by an acoustic process and is associated with high energy pulses of extremely short duration, such as a pulsed laser exposure. Photomechanical damage mechanisms are not relevant to the Palen Solar Electric Generating System (PSEGS).

Photochemical damage is associated with both long-duration exposure times as well as lower-wavelength (higher-energy) light exposure. While retina pigment epithelium (RPE) and the neurosensory retina are protected from light-induced exposure by the absorption profile of the surrounding ocular structures (e.g., cornea, crystalline lens, macular pigments) as well as through retinal photoreceptor outer segment regeneration, photic injury is still quite possible due to photochemical retinal light toxicity mechanisms. Photochemical injury is both dose dependent and cumulative in nature. This has significant implications for observers (such as workers on site) that spend a significant amount of time in proximity to the high luminance solar field in the additional presence of high ambient (existing) luminance characteristic of a desert environment. As retinal injury can be caused by exposure to otherwise innocuous visible light, there appears to be some critical dose or threshold at which exposure becomes injurious. The safe exposure times for common ophthalmic instruments (e.g., fundal photography) has been reported in the literature and supports the concept of a critical threshold dose necessary for injury.

For the current project, both photothermal and photochemical mechanisms are relevant.

PHOTOTHERMAL RETINAL DAMAGE

Photothermal retinal damage occurs when the eye is exposed to sufficient light energy to heat the retina to a point where damage occurs, resulting in a permanent blind spot. Because the eye is an optical focusing system, the energy at the retinal surface is concentrated by as much as a factor of 100,000. The ocular impact on an observer from either the heliostats or the solar receiver steam generators (SRSGs) is calculated as the retinal irradiance (Er). The calculation of Er takes into consideration the size of the light emitting object (SRSG or heliostat), the intensity in W/m^2 (irradiance) at the observer location, and the vulnerability of the human eye.

The level of exposure which is considered as the limit between safe and harmful is called Maximum Permissible Exposure (MPE) limit. The MPE that can be tolerated by the human eye is an industry standard and is defined by Sliney and Freasier & el. The MPE is defined for two exposure condition types: momentary exposure, correlated with the human blinking instinct, and continuous exposure.

- MPE for a momentary exposure (0.15 s) is 1 W/cm^2 = 10,000 W/m^2.
- MPE for continuous exposure is 0.1 W/cm^2 = 1,000 W/m^2.

Motorists

During normal operation, only the focal area of the SRSG, which is approximately 20 by 20 meters, will receive concentrations of solar radiation. Locations on the ground and areas surrounding the footprint of the plant will not receive solar radiation concentrations above that of direct sunlight. Therefore, in normal plant operation, there is no potential for any plant-sourced solar radiation exposure hazard to motorists outside the boundary of the project.

The intensity of light emitted from the SRSG is 70 W/m^2. Using a conservative approach, the intensity at the observer's location can be assumed to equal the intensity at the source. For comparison, the intensity of visible light from the sun is 80,000 W/m^2 at the retina and the Maximum Permitted Exposure at the retina is 1,000 W/m^2, assuming continuous exposure.

The shortest distance between a PSEGS SRSG and a passing I-10 motorist is 4,265 feet, or 1,300 meters. The SRSG diameter is approximately 100 feet. Therefore, the subtended angle is 23 mrad (milliradians) or 1.33 degrees.

When an illuminated object subtends an angle of 23 mrad to the viewer's eye, the retinal irradiance threshold for damage is greater than 40,000 W/m^2. Thus, since the light intensity from the SRSG is no greater than 70 W/m2 at any point of observation along I-10, there is no potential for photothermal damage from the SRSG to I-10 motorists.

The same calculation for retinal irradiance from the SRSG can be used for heliostats. Using a ray tracing method, the amount of light concentration at given distances from a given heliostat was calculated. The light concentration at a given distance is dependent upon the heliostat focal length, and three different heliostat focal lengths at PSEGS were used to calculate the safe retinal irradiance for increasing distances. The results demonstrated that there is no possibility for photothermal retinal damage to I-10 motorists from the solar field. Further, the only possible risk is when standing on the tower and having a direct solar reflection from a heliostat within 200 meters. This operational hazard will be mitigated with appropriate safety procedures and guidelines for on-site personnel.

Motorists outside the plant boundaries will not be exposed to retinal irradiance (Er) levels beyond the maximum permissible exposure (MPE) and will not experience photothermal retinal damage. Staff concludes that there is no risk for photothermal retinal damage to motorists or ground-based observers.

Pilots

The heliostats are designed to reflect sunlight toward the SRSG at the top of the tower. For normal operation, the heliostats will orient themselves according to their position in the field, day of the year, and time of day in order to reflect the sun's rays either onto the SRSG ("tracking" orientation) or onto an area nearby (standby orientation, when the heliostats are focused far enough from the tower and SRSG to free them from radiation but close enough to allow the heliostats to quickly enter tracking mode). In the standby position, the heliostats reflect sunlight back into the sky where the potential exists for the heliostat 'beam' to intercept aircraft.

The size of the PSEGS site as defined by Federal Aviation Administration (FAA) regulations is the volume that encompasses the perimeter of the site up to a height of 500 feet above the tower. This imaginary volumetric body is the control volume that the heliostat tracking system takes under consideration. Within this volume, the heliostats are programmed to concentrate flux in certain positions that will cause the flux leaving the imaginary control volume to scatter to a level that will cause no retinal damage to pilots. The control system is designed so that solar flux will not exceed the momentary MPE (10 kW/m^2) outside and above this control volume.

Staff concludes that there is no risk for photothermal retinal damage to pilots.

PSEGS Site Workers

Sandia researchers found that retinal irradiance from single heliostat beams exceeded the safe limits only within a short range (up to 40 meters [131 feet]) within the focal distance of the heliostat. This is true for both the Solar One facility and the Ivanpah Solar Electric Generating System (ISEGS). For heliostats with focal distances greater than 270 meters (886 feet), safe retinal limits were never exceeded (Ho, 2011). The levels of irradiance that exceed the safe limit are only associated with heliostats that have a focal distance of 270 meters (886 feet) or less, and the limits are only exceeded within ±20 meters (66 feet) of that focal length. In other words, the maximum distance where the limits may be exceeded from the PSEGS is 290 meters, or 951 feet, even when assuming worst case conditions for all parameters. Thus, levels of irradiance may only be exceeded within 951 feet of the facility's heliostats that have focal lengths of less than 270 meters (886 feet). These heliostats are in the solar field near the tower. This area where levels of irradiance may exceed the safe limits would not include any ground-based observer outside the project perimeter fence or any airspace that any pilot would be legally allowed to fly in near the power tower. The project owner's risk mitigation plans include a prevention program with safety precautions and guidelines for maintenance, monitoring, and employee training measures to insure eye protection under these rare conditions of exposure. The workers would be trained to take appropriate safety precautions when working onsite during power operations, including use of appropriate eye protection. See the **WORKER SAFETY AND FIRE PROTECTION** section's conditions of certification, which require workers to wear protective eyewear.

PHOTOCHEMICAL RETINAL DAMAGE

Photochemical damage is associated with long-duration exposure times as well as lower-wavelength (higher-energy) light exposure. While retina pigment epithelium (RPE) and the neurosensory retina are protected from light-induced exposure by the absorption profile of the surrounding ocular structures (e.g., cornea, crystalline lens, macular pigments) and through retinal photoreceptor outer segment regeneration, photic injury is still possible due to photochemical retinal light toxicity mechanisms.

Photochemical injury is both dose-dependent and cumulative in nature (Irvin and Ramer, 1988). The cumulative time-dependent nature is that daily exposures can build up and can last many weeks. For example, it has been estimated that the half-life (1/e, when an exposure effect has decayed to approximately 37%) of the cumulative dose exposure effect is on the order of 30 days. This has significant implications for observers that spend a significant amount of time in proximity to the high luminance environment of a solar field in the presence of the additional high terrestrial ambient of the desert environment.

As retinal injury can be caused by exposure to otherwise innocuous visible light, there appears to be some critical dose or threshold at which exposure becomes injurious. The safe exposure times for common ophthalmic instruments (e.g., fundal photography) has been reported in the literature and supports the concept of a critical threshold dose necessary for injury.

Staff agrees with the project owner that the potential for photochemical retinal damage to motorists and pilots given the cumulative exposure effects of the combined terrestrial ambient and solar field/ tower exposure levels is not significant. At these distances and because these individuals will not experience long duration exposure, there is no risk for photochemical damage.

When evaluating the implications of photochemical effects for on-site workers in proximity to the towers or the heliostats, it must be noted that the effect is directly related to the ambient (background) light conditions. The PSEGS is located in a bright desert environment thereby increasing the potential chance for photochemical retinal damage. The cumulative daily exposure to workers to the ambient environment combined with the additional potential cumulative effects of heliostat and SRSG exposure puts project workers at risk for photochemical retinal damage. This is due to the cumulative nature of photochemical effects. Thus, to ensure the safety of the workers and others within the project boundaries, personal protection equipment (PPE) in the form of protective glasses will be provided as required in the **Worker Safety and Fire Protection** conditions of certification. Protective glasses have been developed for workers engaged in intense solar field work, tower work, and intense close viewing of the SRSG.

There is precedence for the issuance of special safety glasses. For example, they have been issued to the operators at Solar Energy Development Center (SEDC) and at the Coalinga and ISEGS solar thermal plants. The potential photochemical retinal hazards are calculated according to IEC 62471 standard (same as CIE S 009: 2002), titled: "*Photobiological Safety of Lamps and Lamp Systems*", where the spectral values were taken from "ASTM G173-03 Reference Spectra Derived from SMARTS v. 2.9.2 (AM1.5)" and are the same as the "ISO 9845-1-1992." Based on these standards, the project owner has identified appropriate PPE in the form of specialty safety glasses (sunglasses) for workers engaged in intense solar field work, tower work, and intense close viewing of the SRSG. **Worker Safety and Fire Protection** staff has included conditions of certification requiring that workers wear the appropriate specialty safety glasses. (See Condition of Certification **WORKER SAFETY-1** (Project Construction Safety and Health Program) and **WORKER SAFETY-2** (Project Operations and Maintenance Safety and Health Program).

GLINT AND GLARE

Glare is considered as difficulty seeing in the presence of bright light, including direct or reflected sunlight or artificial light such as car headlamps at night. Glare is generally defined as a continuous/ sustained source of excessive brightness relative to the ambient lighting. In contrast, glint is considered as difficulty seeing in the presence of a transient bright light source and is generally considered to be intermittent. A glint effect would be, for example, brief reflections of sky or sunlight from one of the heliostats while driving by. A glare effect is more sustained, such as might be present from the sustained reflections from the tower SRSGs. The heliostats can be a source of glint (e.g., from direct solar reflections from the heliostats (DSRH) and a source of sustained glare (e.g., from reflections of the sky background). The tower SRSGs can be a sustained source of glare.

Glint and glare are measured both in terms of the potential for physiological effects and for psychological effects. Physiological effects involve the potential for light to adversely affect the retina of viewers and other parts of the eye through photothermal and photochemical damage. This potential is evaluated in units of watts or kilowatts per square meter (W/m^2 or kW/m^2) and is generally referred to as irradiance. (See the earlier discussion of photothermal and photochemical damage.) Psychological effects, referred to as glint, glare and perceived brightness, are considered in terms of luminance, evaluated in units of candelas per square meter (cd/m^2).

Perceived brightness, as well as glint and glare effects, depends on a variety of factors, including the global ambient luminance, target size, retinal location, and the relationship between the luminance of the target and background. The global ambient luminance, or background luminance, sets the state of visual adaptation and hence the spatial and temporal processing characteristics of the human visual system. Within this context, perceived brightness depends critically on the luminance relationship and sizes of the target (SRSGs receivers and/or heliostats) and background (sky or terrain, mainly terrain at the Palen site).

Glare is caused by a significant ratio of luminance between the task (that which is being looked at) and the glare source. Factors such as the angle between the task and the glare source and eye adaptation significantly influence the experience of glare. In the 1920's, researchers (Luckiesh and Holladay 1925, Stiles, 1929) independently proposed that illumination conditions can produce two different types of glare effects: discomfort glare and disability glare. Today, glare is still generally divided into these two class types.

Discomfort glare results in an instinctive desire to look away from a bright light source, or difficulty in seeing a task. Discomfort glare is a negative subjective reaction to the presence of a glare condition. Whether or not discomfort glare affects visual performance and/ or task performance depends critically on the nature and difficulty of the task to be performed. Discomfort glare, as any visual stimulus of significant luminance, transiently desensitizes the retina locally and can produce afterimages. Discomfort glare generally occurs when luminance contrast values become large enough to elicit a psychological response, a sensation of annoyance. Although studied fairly extensively, discomfort glare has not been sufficiently quantified to provide an accurate predictive capability. It is relatively easy to elicit a discomfort glare response. However, establishing a reliable objective correlate and predictive capability remains elusive.

Disability glare renders the task impossible to view, such as when driving westward at sunset. Disability glare is generally caused by the intraocular reflection of light within the eye, a scattering effect which can mask parts of the visual field and reduces the local contrast between task (that which is being observed, the target fixated) and glare source to the point where the task cannot be resolved or distinguished. Detailed quantitative studies have investigated disability glare (Vos, 1984) and the phenomena appears to be reasonably well understood. While the cause of disability glare is fairly well known, discomfort glare is less well understood. Further, there are no standards or agreed upon methodologies for assessing disability glare, especially in daylight conditions (Berman, 1993).

Staff recognizes that definitive standards for the safety effects of glint and glare, from distraction to discomfort to disability, do not exist. Although a variety of organizations, including the vision research community, academia, the National Highway Traffic Safety Administration (NHTSA) and the US Air Force have conducted research on various aspects of deleterious effects of glint and glare, there is currently no accepted standard for assessing, measuring, or limiting the distraction, discomfort, or disability effects of glint and glare. Essentially, there is no consensus in the research regarding thresholds for onset of glint and glare effects and there are no reliable metrics for determining the glint and glare thresholds for a significant impact to traffic and transportation.

GLINT AND GLARE FROM THE HELIOSTATS

The project owner has demonstrated through current and prior modeling for the Hidden Hills and Rio Mesa projects that heliostat retinal irradiance and beam intensity (under worst-case conditions) is eye safe and would not cause retinal damage. The heliostats are designed to reflect sunlight toward the SRSG at the top of the tower and are programmed such that reflectivity would rarely be directed toward ground-level viewers located outside of the project site during power generation operations. Staff is not concerned that exposures in excess of MPE would occur. This issue has been dealt with comprehensively and thoroughly by the project owner and by the **Worker Safety and Fire Protection** conditions of certification, and permanent retinal damage effects are not a concern. The concern is for visual effects below the MPE where it is uncertain what the impacts of glint and glare would be to both ground-based and airborne observers.

When observed from a distance during operations, the heliostat fields would generally reflect a portion of the sky to the viewer. In the distal field regions (to the far right and left of the towers) the appearance would be somewhat like a body of blue water. In the region closer to the tower, the heliostats would often reflect a portion of the sky in greater proximity to the sun, and these regions would appear brighter and whiter, producing a low to moderate level of sustained glare depending on viewing geometry and range. Staff considers these signatures, although salient, as not significant. The visual signatures from indirect reflections from the heliostats, even in great numbers, are considered as rather benign.

However, this is not the case for DSRH. DSRH occur when the sun's image is reflected directly into the observers view.

DIRECT SOLAR REFLECTIONS FROM THE HELIOSTATS (DSRH)

The project owner provided luminance data for DSRH as a function of range and heliostat focal length. At Palen, three populations of heliostats are used, with focal lengths of 250, 450 and 1,000 meters. The heliostats with focal lengths of 450 and 1,000 meters have luminance values greater than 75 percent of the sun (1,250,000,000 cd/m^2) for all viewing distances greater than 400 meters and out to a distance well in excess of 2,000 meters. The glint (from a transient exposure) or glare (from a more sustained exposure) from a single heliostat at this luminance level causes fairly extensive intra-ocular scattering. The minimum luminance across all distances and heliostat focal distances for direct solar reflection is 400,000,000 cd/m^2. (Note: For comparison, the luminance of the clear sky at noon is about 5,000 to 10,000 cd/m^2). DSRH events observed at ISEGS produced total visual occlusions on the order of 3 degrees of the central visual field and extensive visual interference on the order of 10 degrees. At a minimum, DSRH are considered as being at a discomfort level and all reasonable actions should be taken to mitigate these events during site construction, testing and operations. DSRH could also potentially be disabling for motorists.

DSRH are judged to be in excess of the threshold for discomfort glare for viewing distances up to at least 10 miles (based on empirical observations at ISEGS SEGS, 07/08/2013). DSRH can occur at ground level for motorists on I-10 and State Route 177, at Joshua Tree National Park, at the Palen McCoy and Chuckwalla Mountains Wilderness areas, and at a variety of locations where human observers and operators will be present.

Given the visual impact of DSRH events, staff believes they must be reasonably mitigated to a minimum during the construction phase, during initial start-up, which includes heliostat calibrations and operational testing, and during standard power generation operations. Relying exclusively on trained employee observers and citizen self-report mechanisms to access the frequency and severity of DSRH for ground-based receptors is considered as insufficient for providing robust monitoring and subsequent mitigation procedures.

Condition of Certification **TRANS-7** Heliostat Positioning and Monitoring Plan is proposed, which includes procedures and methodologies for the quantification and minimization of DSRH events during construction, testing and operations. **TRANS-7** would provide empirical feedback as to the frequency of events, the efficacy of the heliostat control algorithms, and data for the improvement of the heliostat control algorithms. Staff concludes that with appropriate modeling of ground-based receptor locations and heliostat control, steering and monitoring algorithms, the frequency of ground-based DSRH events can be mitigated to a realistic minimum.

An additional glint and glare concern from the heliostats is for aircraft. As for ground-based observers, staff considers the indirect sky reflections from the heliostats to be salient but not significant for pilots. The most significant airborne events from the heliostats would be DSRH events. Impacts to airborne receptors cannot be mitigated to the same extent as impacts to ground-based receptors. Airborne DSRH events are considered inevitable and their frequency and severity would depend on the frequency, range and geometry of airborne events in the area. The ability to obtain and account for the presence, range, location and time of aircraft transits in the area is not realistically achievable. Furthermore, direct solar reflections are common and expected events for pilots. They commonly occur from reflections over lakes and streams as well from reflections from man-made objects such as metal roofing. Pilots are generally very adept at dealing with such events, and individual or sequential DSRH events are not considered as inducing severe discomfort or compromising pilot visual or control performance.

Locations on the ground, areas surrounding the footprint of the plant, and the surrounding airspace would not receive solar radiation concentrations above that of direct sunlight. Significant precautionary measures are planned for incorporation into the anticipated heliostat control algorithms. The guidelines for these measures are detailed in **TRANS-7**.

With currently available information, staff estimates that glint and glare effects from the heliostats may cause some mild discomfort to pilots but should not be considered as significant discomfort or disability glare.

GLARE FROM THE SRSGS

During operation, the tower SRSGs would produce a sustained bright source of reflected light from the heliostats. Because the SRSGs are ‘circular’ (wrapping around the tower 360 degrees) and near the peaks of the solar towers, they would be highly visible from most vantage points and for many miles. There is no doubt that the tower SRSGs would result in a prominent and sustained visual effect. The issue from a Traffic and Transportation perspective is: Will the SRSGs produce sufficient glare and/or excessive perceived brightness to result in discomfort glare, disability glare and/or compromised operator performance for motorists or pilots? As discussed previously, glint and glare effects and the associated perceived brightness depend on a variety of factors, including the state of visual adaptation, source size, and target to background contrast. Within this context, perceived brightness depends critically on the luminance relationship and sizes of the target (SRSG) and background (sky or terrain). Also, it is very difficult to predict perceived brightness from luminance alone, especially at the substantially high levels under consideration.

The irradiance of the sun is enormous, on the order of 80,000 W/m^2. As such, the luminance of the sun is also enormous and on the order of $1.6x10^9$ cd/m^2 (clear sky at noon). The luminance of the tower SRSGs is anticipated to be much lower, on the order of $1x10^6$ cd/m^2, and the worst case maximum irradiance is estimated to be 70 W/m^2. Furthermore, since luminance does not decrease much with distance, the conservative assumption has been made that luminance stays constant. Although the SRSGs would be lower in luminance (1,000,000 cd/m^2) than the sun, this is still a very high luminance level in comparison with the brightest sky, which would be approximately 8,000 cd/m^2. Also, at PSEGS, the towers would generally be viewed with the mountains in the background, rather than the sky, further elevating the target/ background contrast level. Thus, the contrast ratio for the towers could range from 125:1 (sky background) to roughly 1,000:1 (mountain background at 1,000 cd/m^2). At these contrast ratios, the SRSGs would appear very bright, salient, and visually distracting (commanding visual attention and eliciting fixation) but the visual effect is anticipated to be less than that which would produce discomfort glare.

Perceived brightness, like visual spatial integration, is dependent on system spatial resolution. For target sizes in excess of the spatial integration limit (i.e., daytime acuity levels) brightness remains relatively constant as a function of viewing distance. As the limits of acuity are approached (in our case due to increasing viewing distance), brightness falls off and transitions to a relationship in which brightness is proportional to distance. Thus, at large viewing distances, the perceived brightness of the SRSGs would decrease substantially despite a relatively small change in luminance (due to atmospheric attenuation). It is estimated that by 10 miles, when the SRSG visual subtense is 0.1 degrees, this transition would be well in process and the tower brightness would be falling off substantially.

Staff concludes that at a maximum luminance of $1x10^6$ cd/m^2 and in the visual context of the PSEGS site, the tower SRSGs would not be a source of discomfort or disability glare from a practical and operational perspective. Arguably and clearly, the sun is a source of disability glare. If a person stares directly at the sun, visual function is severely degraded and visually-based performance is severely limited. However, one rarely hears complaints about the sun in this regard. The simple reason for this is that normally people do not fixate on or look at the sun directly for any length of time. In general, a single 100-150 msec fixation is sufficient for an aversion reaction to look elsewhere (and sufficient for a fairly prominent after-image). The limited times in which the sun can be a source of disability glare are under conditions when visual performance requires a gaze in close proximity to the sun’s location. This would occur, for example, when driving west into the sunset when visual monitoring of the road requires viewing gazes near the sun’s visual location.

Staff thinks that a similar situation exists for the tower SRSGs, albeit to a lesser extent given the significantly lower tower luminance. Due to their anticipated perceived brightness based on the luminance of the towers during nominal operations, it is anticipated that observers would not look directly at the tower SRSGs for more than a single fixation (or several separate fixations due to tower novelty) before averting their gaze to an alternate location. Additionally, because the forward line of site for motorists on I-10 in proximity to the PSEGS field is looking forward either eastward or westward and the two SRSGs are to the north, it would not be necessary to gaze in close proximity to the towers. As such, observers would tend to preserve their visual function (much as they do with the sun) and the tower SRSGs would not functionally be a source of discomfort or disability glare.

It should be noted that glare is generally considered as a scattering effect in the eye, although any optical interface can also add to perceived glare, such as glasses, automotive windshields and aircraft canopies. Scattering in the human eye increases as a function of age (Sliney and Freasier, 1972). Glare-related scatter effects remain nearly constant as a function of age until 40-45 years, when scatter rises exponentially and triples by the age of 60. As such, any glare effects produced by the SRSGs may be more pronounced in the aging population.

Staff considers the glare effects from the tower SRSG receivers as significant from a visual perspective (salience, distraction, prominence) and unmitigable while maintaining effective plant operations. The brightness of the SRSGs would be clearly visible and prominent. The extent to which the visual signature (either from a brightness or glare perspective) would be distracting remains unclear. However, staff concludes that the sustained glare from the SRSGs during nominal operating conditions would not be significant and not produce discomfort or disability glare to the extent of producing a safety hazard from an operator control perspective (e.g., driving a vehicle, flying a plane).

This conclusion is based on the project owner's calculations that the SRSGs would not exceed a luminance of 1×10^6 cd/m^2 under any operating or viewing conditions. Given the uncertainty of the particular viewing conditions and methodologies for establishing the conditions under which discomfort and/or disability glare would occur, a Condition of Certification is proposed to monitor the tower SRSGs's luminance over time. The intent of **TRANS-8** is to periodically monitor the luminance of tower SRSGs to ensure that they are within the stated maximum luminance values and therefore would not create a safety hazard for pilots, motorists, and recreation users. This includes enacting appropriate monitoring procedures to verify performance over time, establishing procedures for addressing any complaints regarding visual distraction or discomfort glare effects from the power towers, and training project operating and maintenance personnel to quickly identify and address potential glare-related safety issues.

CONCLUSIONS

1. Staff concludes that there is no risk for photothermal retinal damage to motorists, pilots or the general civilian population outside of the PSEGS site from either the heliostats or tower SRSGs. Workers within the site boundaries could rarely experience exposures (from the subset of heliostats with 270 meter focal lengths and over a very narrow range of distances) at or slightly above MPE. Staff concludes that planned safety precautions, worker training and use of protective eyewear as required in the **Worker Safety and Fire Protection** conditions mitigates this risk to less than significant.

2. Staff concludes that there is no risk for photochemical retinal damage to motorists, pilots or the general civilian population outside of the PSEGS site from either the heliostats or tower SRSGs. However, workers on site (engaged in intense solar field work, tower work, and intense close viewing of the SRSG) are at risk of photochemical retinal damage. The provision of personal protection equipment (PPE) in the form of protective glasses (sunglasses) is adequate to provide an additional margin of safety regarding any potential effects of photochemical retinal damage. (See Conditions of Certification **WORKER SAFETY-1** Project Construction Safety and Health Program and **WORKER SAFETY-2** Project Operations and Maintenance Safety and Health Program.)

3. Staff concludes that sky reflections from the heliostat fields, although inevitable and salient, are not a source of significant visual discomfort glare. However, DSRH (even single heliostat events) are significant and a source of discomfort glint and glare, and potentially of visual disability glint and glare. Staff concludes that if appropriately implemented, Condition of Certification **TRANS-7** Heliostat Positioning and Monitoring Plan will minimize the frequency of DSRH events during the testing, calibration and operational phases of the PSEGS to a non-significant level.

4. Staff concludes that the sustained glare from the SRSGs during nominal operating conditions (at a maximum of $1x10^6$ cd/m^2) would not produce discomfort or disability glare that would interfere with motorists' or pilots' operation of their vehicles, and would therefore not result in significant traffic and transportation impacts. This glare would be significant from a visual resources perspective, however. Higher luminance levels could cause significant traffic and transportation impacts as well. Proposed Condition of Certification **TRANS-8** Power Tower Receiver Luminance and Monitoring Plan provides procedures and methodologies for the identification and mitigation of visual distraction effects and discomfort glare or disability glare effects with the potential of causing a safety concern. This condition would ensure that luminance would remain at $1x10^6$ cd/m^2 or less.

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APPENDIX TT2 –
Risk of Impacts to Vehicle Operators Driving on Interstate-10 Due to Glint and Glare Associated with the Palen Solar Electric Generating System

Testimony of Alvin Greenberg, Ph.D., QEP, Geoff Lesh, PE, CSP, Gregg Irvin, Ph.D.

SUMMARY OF CONCLUSIONS

Staff has conducted an assessment of the chances that glint and glare coming from the proposed Palen Solar Electrical Generating Station (PSEGS) could disrupt a person's vision enough so as to interfere with driving a vehicle on nearby Interstate-10 (I-10), thus causing accidents on the highway. Staff analyzed two scenarios: diffuse glint and glare coming from the proper operating of the system and direct light coming from a malfunctioning or misoriented heliostat (mirror) pointing directly at the highway. Staff found that based upon a qualitative analysis, it is implausible that glint and glare under normal operating conditions could cause vehicular accidents on I-10. Therefore, staff concludes that the risk of glint or glare causing impairment of vehicle operators on I-10 is less than significant.

However, if a heliostat during construction or operations were to be oriented even for a few seconds facing the interstate such that drivers would experience a direct reflection from the heliostat within their field of vision, staff found based upon a quantitative risk assessment that significant visual impairment (flash blindness or impairing glare) could occur and result in a vehicular accident. Therefore, staff concludes that, in this specific scenario, the risk of direct glare from an improperly-oriented heliostat causing impairment of vehicle operators on I-10 is significant and requires mitigation.

Since the likelihood of heliostat orientation failure would be remote during operations but highly probable during construction, staff recommends that the project owner be required to implement appropriate mitigation procedures. These could include covering the mirrored surfaces of the heliostats during construction until they are properly seated, oriented, and under computer control and/or implementing early heliostat computer control algorithms to establish exclusion zones which could result in direct reflections to ground based observers.

BACKGROUND

Palen Solar Holdings, LLC (PSH) has filed a petition with the Energy Commission requesting to modify the Palen Solar Power Project (PSPP), now called PSEGS (Palen 2012a). The major modification involves replacing the parabolic trough solar collection system with Bright Source's solar tower technology. Two adjacent solar fields producing 250 MW each are proposed for a combined nominal output of approximately 500 MW. Heliostats - elevated mirrors mounted on a pylon guided by a tracking system - focus the sun's rays on a solar receiver steam generator (SRSG) located atop a 750-foot tower near the center of each of the two solar fields to create steam to drive a turbine generator that provides electricity.

Because the PSEGS project involves the use of mirrors (heliostats) to direct reflected sunlight at power tower receivers, the potential exists for glare or glint to be observed by nearby viewers, including motorists on the adjacent interstate. The heliostats can be a source of glint for direct solar reflections and a source of sustained glare for reflections of the sun and sky background.

The location of the power plant very near Interstate-10 (an east-west regional arterial with fully approved freeway status and a speed limit of 70 mph) has raised concerns over the impact light reflected from the heliostats (referred to as glint and glare) might have on driver's ability to see the road clearly when in the vicinity of the PSEGS. The distance between this heavily-traveled Interstate Highway and large numbers of heliostats will be as little as a few hundred feet for a considerable distance along the highway. It is well known that glare from a rising or setting sun directly in-line with traffic flows can visually impair drivers to the point of causing temporary inability to see the road in front, thus resulting in vehicular accidents. The National Highway Traffic Safety Administration estimated that glare accounted for about 16 percent of the environment-related crashes in the U.S. between 2005 and 2007 (NHTSA 2008) and the State of Nebraska estimated that during 2002–2009, there was an average of one sun glare-related motor vehicle crash per day (Nebraska Crash Outcome Data Evaluation System 2011).

During normal operation, only the focal area near the top of each 750-ft. solar tower will receive high concentrations of solar radiation from thousands of heliostats. Locations on the ground and areas surrounding the footprint of the plant will not receive reflected solar radiation concentrations above that of direct sunlight. Therefore, in normal plant operation, there is little potential for any direct-focused solar radiation exposure hazard to motorists outside the boundary of the project. PSEGS's Unit 2 is closest to Interstate I-10 and the Unit 2 tower is approximately 1,368 meters (4,488 feet) from the highway. At this distance, there is no potential for retinal damage due to gazing at the SRSG (CEC 2013r).

Because the PSEGS project involves the use of mirrors (heliostats) to direct reflected sunlight at power tower SRSG, the potential exists for glare or glint to be observed by nearby viewers, including motorists on the adjacent roadway. The heliostats can be a source of glint for direct solar reflections and a source of sustained glare for reflections of the sun and sky background. The geometric arrangement of the solar array orients the mirrored face of each heliostat towards the central receiving tower. Each heliostat has a motorized computer controlled positioning system that positions each mirror to focus its reflected energy on the receiver at the top of the central receiving tower.

After a thorough review of the scientific literature – including the review of over 24 scientific studies and reports and over a dozen other studies found only on internet sites -- staff learned that definitive safety standards that would protect people from the effects of glint and glare (ranging from distraction to discomfort to disability) do not exist. Although a variety of organizations including the vision research community, academia, the National Highway Traffic Safety Administration (NHTSA) and the U.S. Air Force have conducted research on various aspects of deleterious effects of glint and glare, there is currently no accepted quantitative standard for assessing, measuring, or limiting the distraction, discomfort, or disability effects of glint and glare. There is essentially no scientific or regulatory consensus regarding thresholds for onset of glint and glare effects that fall short of permanent eye damage and there are no reliable metrics for determining the glint and glare thresholds for a significant impact to traffic and transportation. Therefore, absent a no-effects threshold standard or even a lowest observable effects level, staff was unable to conduct a quantitative risk assessment and instead performed a qualitative study based upon safety metrics established for prevention of permanent eye damage relative to exposure angles and distances of the proposed solar facility. In this manner, staff used a risk assessment metric of simply "Yes" or "No" chances for impacts.

Appendix TT2 Figure 1 (Source: Palen 2012a, Fig. 2.1-5) depicts the proposed solar power plant layout and its proximity to I-10. **Appendix TT2 Figure 2** (Adapted from Palen 2012a) is an enlargement of the field closest to Interstate 10. **Appendix TT2 Figure 3** (Source: Palen 2012a) shows the alignment of Interstate 10 at greater distance from the solar field.

Purpose and Methodology

The purpose of this risk assessment is to evaluate the risk associated with vehicular operator impairment due to glint or glare resulting from the proposed Palen Solar Electric Generating Facility (PSEGS) and to evaluate the potential risk of vehicular accidents that such impairment could cause. According to Clifford Ho, a leading researcher and spokesman on this subject, "solar glare caused by reflections from solar energy installations can occur at varying times in unexpected locations….. [Both glint and glare] can result from reflections of light on solar energy components such as PV modules, concentrating solar collectors/mirrors and receivers" (Ho 2013, Page 1).

A second purpose is to evaluate the potential for disability glare due to a malfunction of a heliostat producing direct reflection of light onto traffic on I-10. This effect can be quantitatively assessed by use of a Daylight Glare Index (DGI).

Staff analyzed two scenarios: diffuse glare coming from the proper operating of the system and direct disability glare (sometimes referred to as veiling glare) coming from a malfunctioning or misoriented heliostat pointing directly at the highway.

Strong specular reflection of sunlight (defined as the mirror-like reflection from a surface in which light from a single incoming direction is reflected into a single outgoing direction as opposed to diffuse reflection where incoming light is reflected in all directions) from a smooth surface is often referred to as glint. Glint causes difficulty seeing in the presence of a transient bright light source and is generally considered to be intermittent. A glint effect would be, for example, brief reflections of sky or sunlight from one of the heliostats while driving by. Glare has been defined as the reflection of a bright light source such as the sky around the sun. A glare effect is more sustained, such as might be present from the sustained reflections from the Solar Recovery Steam Generators (SRSGs) located at the top of each tower. However, definitions of glint and glare are not consistent in the literature, and either can be characterized as transitory or continuous. Whatever term is used, the effect of glint or glare in the context of assessing risk to drivers occurs in the presence of an offending light source that disrupts the field of vision thereby compromising the driving task. This is typically referred to as disability glare.

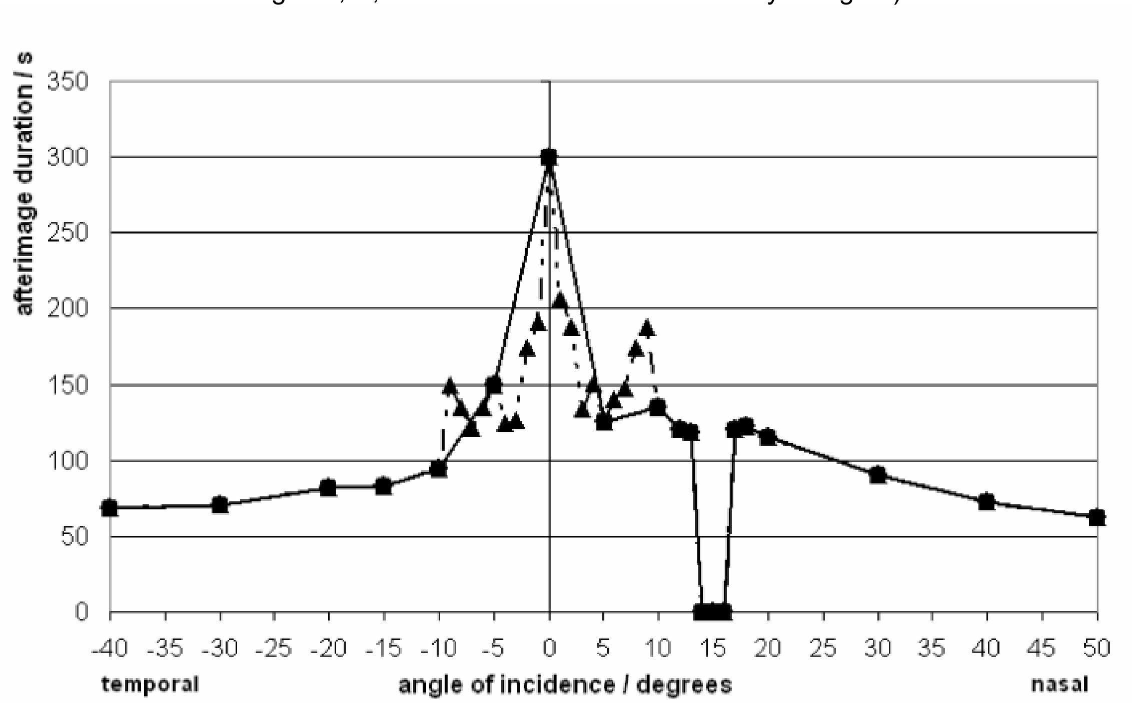
Glare is a disturbance of visual acuity or complete disruption of vision resulting from the inability of the eye to adapt to changes in levels of light relative to the ambient background light that otherwise exists in the desired field of vision. Disability glare is in essence a “signal-to-noise” problem (where the “signal” is the light coming from the object to be viewed such as the car in front while driving and “noise” is light coming from all other objects in the background and periphery such as light reflected off of other cars, buildings, or coming directly from the sun during sunrise or sunset). It is similar to discerning speech in a location with loud background noise such as a crowded noisy restaurant or bar. The degree of disruption depends on many factors including intensity and size of the offending light source, the background luminance of the field of vision, the angular displacement of the offending light source relative to the axis of the line of sight, and continuous duration and/or the pulsed duration period of exposure. Glare exists when there is a significant difference between the light in the field of vision necessary to perform a task such as driving and the intensity of an offending light source in the same field of vision (Wördenweber, et al. 2007, Page 273).

Reflection of sunlight from a heliostat could be either specular or diffuse. However, about 95 percent of the light reflected from a mirrored heliostat is specular. The remaining incident light is either absorbed or diffusely reflected. The intensity of the diffusely reflected light will decrease as the inverse square of the distance from the heliostat. During normal operation the specular portion of the reflected light from the solar field will be directed at the central receiver Based on these factors staff believes that risk of significant visual impairment from glare would only be associated with strong specular reflection from the mirrored faces of heliostats in the solar field array.

There are three mechanisms of visual disruption caused by glint and glare that are typically associated with the task of driving. The first occurs when a large part of the visual field is at a very high luminance caused by a large offending light source, e.g., driving west into a sunset. This is referred to as saturation, veiling, or disability glare. The second mechanism causing visual disruption occurs when the desired field of vision on the road is disrupted by a sudden large increase in the luminance of the whole visual field e.g. such as when exiting a tunnel. This is referred to as adaption glare. The third mechanism is a very sudden extremely intense short duration flash of light causing complete bleaching of retinal photo pigments, e.g., the light flash from a camera flash. This type of light exposure is often referred to as flash blindness and is also associated with after images (Wördenweber, et al. 2007, Pages 273-4). All of these types of glare can persist for a significant period of time required for the eye to adjust to the post glare equilibrium condition.

When incident light is reflected from an optically flat smooth surface, the angle of incidence is equal to the angle of reflection. Under such conditions, the ultimate path of the reflected rays of light is determined by the geometry of the flat surface relative to the light source. The propensity for glint or glare to cause visual disability of a vehicle operator is strongly dependent on the angular deviation of the light source from the observer’s line of sight with small deviation from the line of sight significantly decreasing the sensitivity to visual impairment from offending light sources (See **Appendix TT2 – Tables 1** and **2**).

Appendix TT2 – Table 1
Afterimage duration as a function of the angle of incidence (glare angle)
Exposure parameter: He:Ne-laser at 632.8 nm, P = 30 μW, t = 10 s (●, solid line: measurements every 5 degrees, ▲, dashed line measurements every 1 degree)



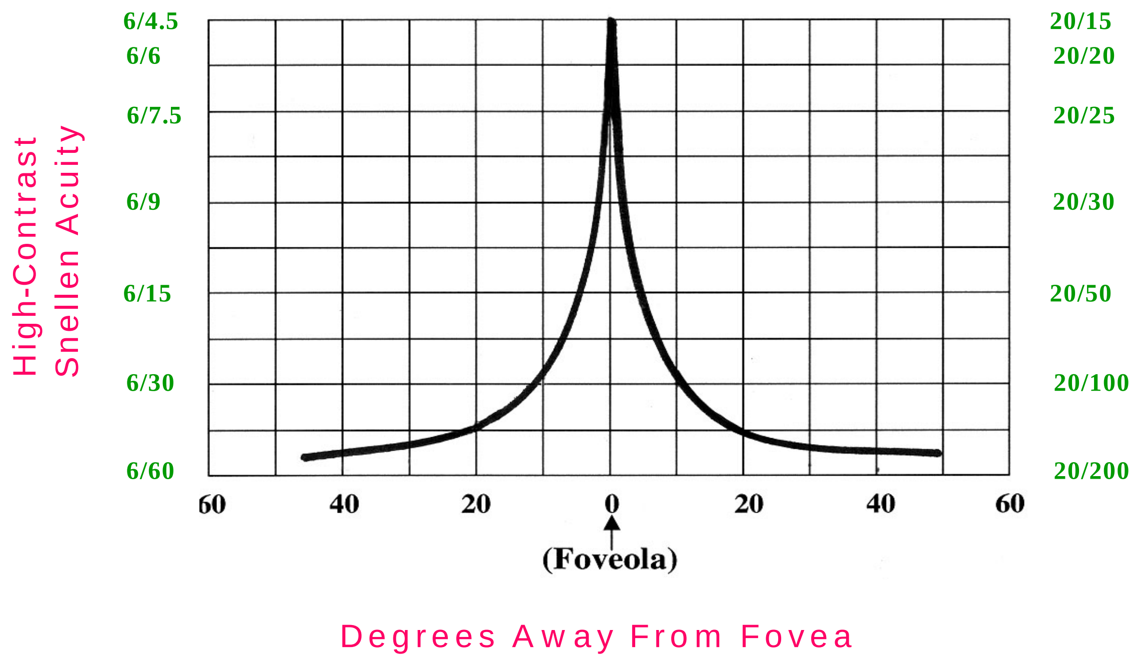
Source: Hans-Dieter Reidenbach

In fact, a light source that is displaced to the side of the field of vision can require 5 to 10 times the luminance of a light source directly in the line-of-sight to cause the same level of adaptive response (Bedell 1978, Page 5). This effect parallels retinal cone density, visual spatial resolution (acuity) and brightness perception as a function of displacement from the line-of-sight.

Thus, light sources that are directly in the line-of-sight are much more effective in creating disability glare. For example, the adverse effects of bright headlights are much greater on narrow two lane undivided roads than on wider multi-lane divided roads. Thus, the risk of creating disability glare is strongly dependent on the light source being located along the line of sight or at a small angle to it.

This effect of lower light sensitivity on the periphery of the visual field is also consistent with the physiology of the human eye. The cone photoreceptors in the retina are responsible for all visual function during daytime illumination conditions. The cones of the retina located at its center are responsible for fine visual acuity and are concentrated in the fovea region (the part of the eye located in the center of the macula region of the retina that is responsible for sharp central vision necessary for reading, driving, etc.). The density of cones drops very rapidly as a function of distance from the fovea, especially outside a ten degree visual radius. This structure accounts for the rapid decline in visual acuity and contrast that occurs as objects in the visual field deviate from the line of sight. Table 2 demonstrates this loss of acuity and light contrast as image moves from the center of the line of sight to the periphery of vision (FAA, undated).

Appendix TT2 – Table 2
Visual Acuity as a Function of Cone Distribution



Source: FAA – Laser Exposure

The hazard associated with driving in the presence of impairing glare is well documented and has resulted in a significant number of vehicular injuries and fatalities. The National Highway Traffic Safety Administration data estimate solar glare causes nearly 200 fatalities and thousands of motor vehicle accidents each year (NHTSA 2008). The phenomenon of visual impairment is the result of bright light in the field of vision that is more intense than the light reflected from objects illuminated by lower intensity ambient light, thus overwhelming the eyes' ability to compensate for the large contrast in light intensity. When such conditions occur they can impair a driver's visual acuity and ability to identify collision hazards. Common examples of such visual impairment is driving on a road traveling in a westerly direction at sunset when the direct light from the sun is shining in a driver's eyes or driving into bright headlights at night. In fact most accidents attributed to glare occur much more often at times close to sunrise and sunset.

Notwithstanding the eye's reduced sensitivity to glare sources which are displaced from its line of sight, any glint and glare sources of sufficient brightness and duration, are still capable of producing flash blindness if they occur within a driver's field of vision, even if substantially offset from his direct line of sight. The reflection from a mirrored surface such as a heliostat is a direct image of the sun and can thus produce light intensities similar to those associated with looking directly into the sun. If the reflected energy from a heliostat were to shine directly at oncoming traffic along the line of sight it could produce impairment similar to that caused by driving directly into the sun at sunset.

The proposed PSEGS project is located in very close proximity to I-10. The maximum speed limit on I-10 is 70 miles per hour. Thus, the available reaction time is very limited when a collision hazard is present. Therefore, any significant visual impairment associated with glint or glare from the proposed PSEGS project on I-10 would pose a serious risk to public safety.

Dose Response Assessment

Most assessments of risk associated with human exposure have focused on light intensity associated with permanent physical ocular damage. However, visual impairment can occur at exposures that are 2 to 4 orders of magnitude lower than those causing permanent injury to the eye (Ho, et. al, undated). As demonstrated in **Appendix TT2 – Table 3**, the threshold for ocular damage is several magnitudes greater than the threshold for flash blindness, a condition potentially hazardous to drivers. Based on studies by Saur and Dobrash, the lower limit of light intensity causing flash blindness lasting for less than a second is about 1 watt per square meter (W/m^2) at the eye (Ho, Ghanbari, and Diver (undated). In this assessment, staff could not quantitatively evaluate potential impacts and thus, did not rely on this metric for a risk determination. Staff's evaluation was instead based on the risk and plausibility of potential exposure that if it occurred could compromise the ability of a vehicle operator to avoid collision at high vehicle speeds.

Impairment of the driving task will occur only when offending glare is in the visual field of the driver. When the driver is looking forward, as is normal during the driving task, a direct heliostat exposure within, say, 10 degrees is highly improbable. To create a reflected beam from the closest heliostat that is offset perpendicular to I-10 by a distance of 220 feet from the west bound lane of the road, it would require a beam to travel a distance of more than 1,250 feet to align within 10 degrees) of a vehicle operator's line of sight. To align within 5 degrees of a driver's line of sight would require the reflected beam to cross the interstate at 2,500 feet. This is assuming that a heliostat is directed to precisely the optimum direction along the horizon. Such an alignment is would be very highly unlikely, even during a process control upset, once the heliostats are placed in operation and under automated control. If the alignment is even slightly above or below the horizon it would not be in the driver's field of vision at all at these distances.

However, if direct heliostat exposures should occur on I-10, line-of-sight exposures would be quite probable due to reflexive head and eye movements to regard (fixate) the glare source. There is a strong reflexive response to fixate a bright source suddenly introduced into the visual field. Most direct heliostat exposures, if in the drivers peripheral visual field and if sustained for more than 250-500 milliseconds, will be fixated and become optimally aligned with a driver's line of sight. At 70 miles per hour, a driver crossing through a five-meter wide heliostat beam, intercepting the interstate at 10 degrees would be exposed for 850 milliseconds and at 5 degrees for 1,700 milliseconds so that there could be sufficient exposure time for fixation to occur. Further, although the visual subtense (angular size of the object as viewed from some distance) of a heliostat is physically very small (much less than 1 degree), due to the potential maximum luminance (50-75 percent of one Sun's maximum luminance) there is very significant ocular (inside the eye) scatter and the resulting retinal stimulus (glare field) is much larger (Stine 2001). Observations at the ISEGS have resulted in 3-7 degree total visual field occlusions due to heliostat glare at viewing ranges of up to 5 miles. After such exposures and resuming the driving task, the central visual field of the driver will be transiently compromised for both visual acuity and contrast sensitivity.

Appendix TT2 – Table 3
Comparison of exposure levels causing permanent eye injury with those causing flash blindness

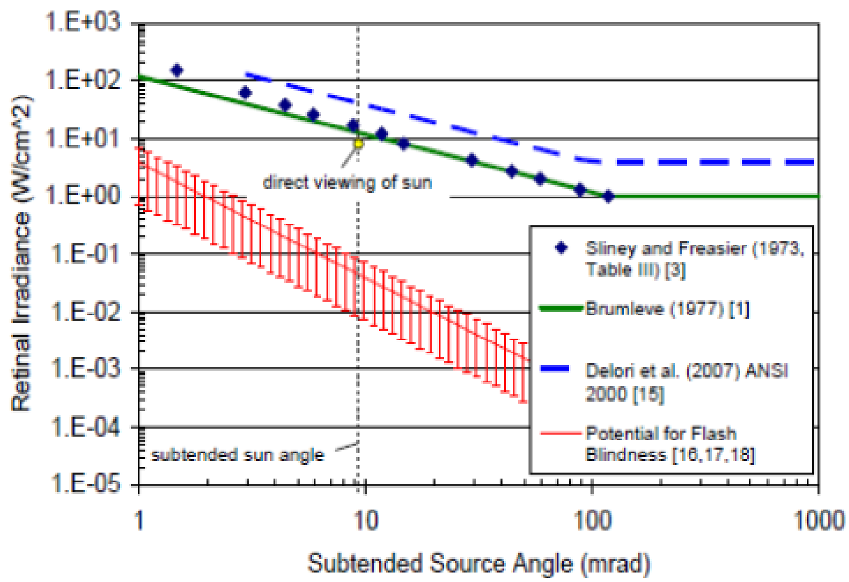
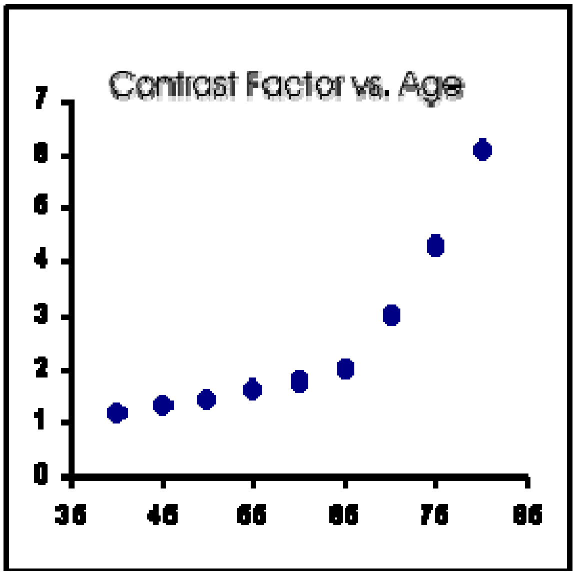


Figure 5. Retinal irradiance metrics as a function of subtended source angle for 0.15 s exposure (typical blink response time). Sliney and Freasier [3], Brumleve [1], and Delori et al. [15] provide safe retinal irradiance values to prevent irreversible eye damage. The range of retinal irradiances that can induce flash blindness is from several data sources [16], [17], [18].

Source: Ho, et al., undated.

It should also be noted that there is considerable variability in the effectiveness of light adaptive response within the population of vehicle operators, including the factor of age (Green, 2009). As **Appendix TT2 – Table 4** below demonstrates, the adaptive capability decreases dramatically with age by about a factor of 10. Additionally, light eye color and use of corrective lenses can also in increase the potential disruptive effects on vision associated with glare. To establish a safe exposure criterion for flash blindness it would be necessary to use the 1.0 W/m^2 described above as a Lowest Observed Adverse Effect Level (LOAEL), applying a safety factor of 10, and resulting in a safe exposure criteria of 0.1 W/m^2.

Appendix TT2 – Table 4
Reduction of adaptive response to light contrast with age



Source: Marc Green, Ph.D. : Visual Forensics of Older Drivers

To establish exposure criteria from this data, it is necessary to divide the 1.0 W/m^2 threshold of adverse effect for flash blindness by a factor of at least 10 to account for response variability within the population of vehicle operators. This leads to a safe exposure criterion for irradiance from a heliostat on vehicle operators of $0.1 W/m^2$ to prevent potential for flash blindness in sensitive sub groups. However, staff questions the use of flash blindness as the most sensitive type of potential impairment. It is not clear that saturation glare such as occurs when driving into the sunset could not occur at lower intensities of light exposure than those associated with flash blindness.

To evaluate potential for saturation or veiling glare due to a malfunction or misorientation of a heliostat producing direct reflection of light onto traffic on I-10, staff utilized the Daylight Glare Index (DGI; Fan 2009, Suk 2012, Bembook 2013). Staff believes this scenario would represent a worst case exposure and that the DGI is the most appropriate glare index for evaluation of glare potential during bright daytime conditions. To conduct this analysis, staff evaluated a scenario where one of the heliostats closest to I-10 is assumed to be directed so that the reflected beam crosses the interstate and it is also assumed that the resultant reflection from the heliostat is along the horizon, such that the beam is at a driver's eyelevel when it crosses the road. This scenario also assumes that the sun is in a precise location where it could produce a reflected beam along the horizon and at an angle that crosses the interstate. It should be noted that this scenario is extremely unlikely or even implausible during normal operation of the facility and very unlikely otherwise (i.e. during construction or mal-operation). Therefore, this analysis represents an abnormal condition for illustrative purposes only. The DGI can be calculated using the following equations:

eq. 1

In this case, it is assumed that only one glare source exists and thus in the summation above n=1. Therefore the equation reduces to the following:

$$DGI = 10\ log_{10}\left(\frac{0.478\ L_S^{1.6}\ \Omega_S^{0.8}}{L_b + 0.07\omega_S^{0.5} L_S}\right) \qquad \text{eq. 2}$$

$$\Omega = \frac{\omega_S}{P_S^2} \qquad \text{eq. 3}$$

$$\ln(\mathrm{P}) = \left(35.2 - 0.3189\tau - 1.22e^{-\frac{2\tau}{9}}\right) \times 10^{-3}\sigma + (21 + 0.2667\tau - 0.002963\tau^2) \times 10^{-5}\sigma^2 \qquad \text{eq.4}$$

where τ and σ are incidence angles,

$$\omega_S = \frac{A_{heliostat}}{R^2} \qquad \text{eq.5}$$

where L_s = the luminance of the glare source (the luminance from the heliostat),

L_b = the luminance of the background (on a bright sunny day with high solar insolation),

ω_S = the subtended area of the glare source, and

P = the position index of the glare source with σ equal to 10 degrees and τ equal to 90 degrees.

Staff used a value of 0.8 x 10^9 candela per m^2 (cd/m^2) for L_s, a value of 10,000 cd/m^2 for L_b, a value of 1.09 for P calculated from equation 4 above, and a value of 21 x 10^{-6} for ω from equation 5. With these values the resultant DGI is 50. A value of 50 for the DGI would be well above an acceptable level and could even be termed “intolerable” (i.e.: DGI > 28) (Suk 2012) and therefore indicates a level of glare that would cause temporary flash blindness or other impairing glare in an exposed driver. Within a broad range of relevant angles and distances the DGI remains above 40, still in the “intolerable” range. Thus, if a heliostat or mirror were to malfunction and end up facing the interstate and all other conditions postulated above were to occur, the reflection from the heliostat would cause sufficient glare to impair the visual driving task on I-10. Practically, any heliostat in the solar field capable of directing an unobstructed reflection of the sun towards I-10, such that it falls within a driver’s field of vision, regardless of its distance and angular orientation with respect to I-10, has the potential to cause an impairment of the visual driving task.

Exposure Assessment

As mentioned above, the specular reflection of light (also called glint) is produced as a direct reflection of the sun onto a surface that is smooth at the microscopic level such as the mirrored surface of a heliostat. Visual impairment on I-10 is contingent on glint intercepting the path of oncoming traffic at the driver’s eye height. This could occur if the reflecting surface of a heliostat were to become oriented toward I-10 with the reflected beam nearly parallel to the horizon, for example with the sun being low on the horizon such that it would be reflected toward oncoming traffic. Even without safety measures incorporated into the automated heliostat controls to avoid unintended reflection (discussed below), virtually all operational conditions would dictate that the reflected light be directed upward toward the sky and toward the center of the solar field, or down toward the ground.

The normal operation of the proposed facility would result in reflected sunlight from the heliostats being directed toward the solar receiver on the top of the 750 foot high central tower in each solar field i.e. directed in a significantly upward direction well above the horizon (BrightSource, 2011). Each heliostat is under automatic computer control that optimizes this effect. Heliostats that are not directed at the tower are either automatically directed to the standby position just off the central receiver or to a default position with the reflecting surface facing directly up (BrightSource, 2011). If the automatic controls were to fail and the default positioning did not occur, the reflective surface would remain in the failed position as the harmonic drive gear and the linear drive gear chosen by the project owner to position heliostats' azimuth and elevation (respectively) would be required to lock in position when the gears stop rotation. This position would always be at an angle significantly above the horizon. Additionally, if the sun were on either horizon, its rays would be directed onto the back sides of the heliostat mirrors at the nearest edge of the solar field, and would be blocked from reaching the heliostats oriented with their reflective surfaces facing its rays, located on the opposite side of the solar field, even if local landscape topography did not already prevent it.

Therefore, the geometry of the heliostat field makes it implausible that the reflective surface of many of the heliostats would reflect along the horizon once the heliostats are properly installed. Only the heliostats on the very edge of the solar fields closest to the Interstate would be capable of reflecting any significant light onto I-10 without being blocked by other heliostats and then only if the heliostat were rotated by some unknown force such as the wind after failure of the supporting structures or harmonic or linear actuator drives of the control motors. Even if such a catastrophic failure were to occur, it is implausible that the failed heliostat would remain intact without being shattered or that it would come to rest in the very specific alignment along the line of sight required to potentially affect drivers.

However, the conditions described above are for operations and would not necessarily be present during construction. Thus, individual mirrors could reflect along the horizon and at a small angle nearly parallel to I-10 during and immediately after placement on the support structure. Additionally, individual mirrors could reflect onto I-10 during the construction, testing and calibration phases prior to power generation operations. This period can last many months and occurs prior to the rigorous implementation of the heliostat control algorithms (computer programs that control the movement of the heliostats) to avoid ground based direct exposures.

However, this risk can be easily mitigated by requiring the covering of the mirrored face of the individual heliostats until they are properly installed and oriented to the default position facing directly up or within the range of normal positioning, and subject to a method that implements directional exclusion zones (either through mechanical motion limiters or computer algorithms), to insure no direct exposure events at ground level occur on I-10 prior to operations.

Uncertainty Analysis

While staff was able to identify a safe exposure criterion for glare strong enough to potentially cause flash blindness, staff was unable to find a safe exposure level for more diffuse glare causing visual saturation. Yet, although staff is convinced that the potential for impairment from diffuse glare causing visual saturation would occur at lower exposure intensities than for flash blindness, the lack of a Lowest Observable Adverse Effect level (LOAEL) for visual saturation presents a significant uncertainly in any calculation of risk. However, staff believes that this uncertainty is inconsequential when compared to the numerous other uncertainties involved in an attempt to quantify the multiplicity of events that would have to occur to result in impairment of a driver on I-10. In other words, even if a safe exposure level were to exist for visual saturation glare, the other many uncertainties and remote possibilities would render any quantitative risk assessment unreliable and of little utility. Based on professional opinion and experience, staff finds that the probability of a heliostat becoming disoriented and then causing offending glare resulting in impairment of drivers' vision on I-10 is extremely low, making it a less-than-significant potential event.

Risk Characterization

Based on this analysis, staff concludes that the risk of glint or glare causing impairment of vehicle operators on I-10 is less than significant. Risk is the product of both the probability of occurrence and consequence of the undesirable effect. The consequences of visual impairment of a vehicle operator on I-10 would be high and potentially result in serious injuries and or fatalities. However, the probability of this event is so low as to be termed unlikely. The potential adverse outcome evaluated would require the concurrent occurrence of several independent events each having a very low probability.

Conclusions and Recommendations

Based on staff's qualitative analysis, it is implausible that glint and glare under normal operating conditions could cause vehicular accidents on I-10 in the vicinity of the proposed PSEGS facility. However, if a heliostat were to malfunction and end up facing the interstate such that drivers would experience a direct reflection within their field of vision, a significant visual impairment (flash blindness or impairing glare) could occur and result in a vehicular accident.

Under normal operating conditions, a numerical estimation of risk due to glint and glare would be extremely difficult to prepare – if not impossible due to the lack of certain objective criteria – and would not provide any further useful information about the risk or change staff's finding or recommendations.

Staff therefore recommends that the project owner be required to cover the mirrored surfaces of the heliostats during construction until they are properly seated, oriented, and under computer control and/or placed under the control of a directional exclusion zone program.

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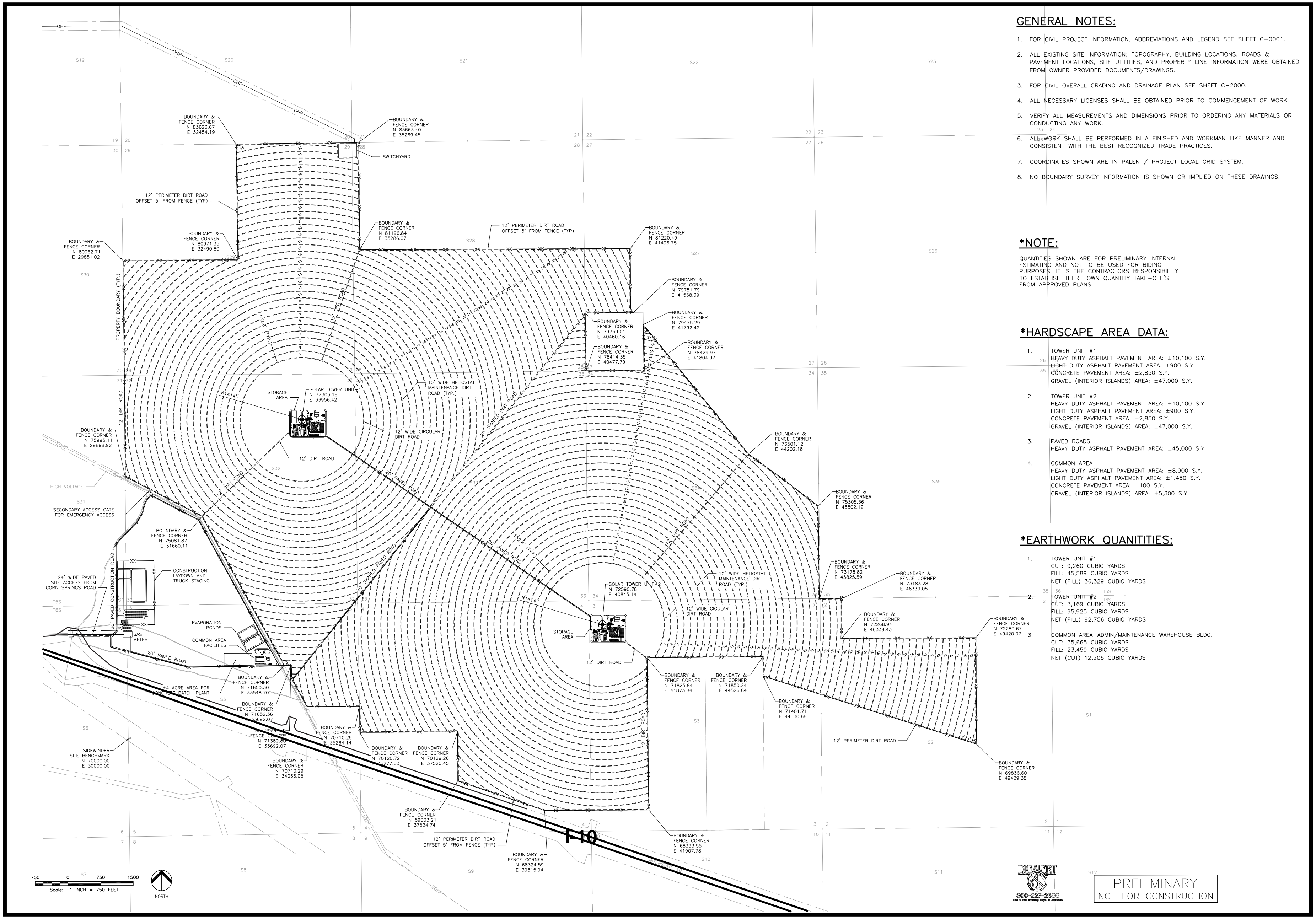
APPENDIX TT2 - FIGURE 1

Palen Solar Electric Generating System - Solar Electric Generation Station

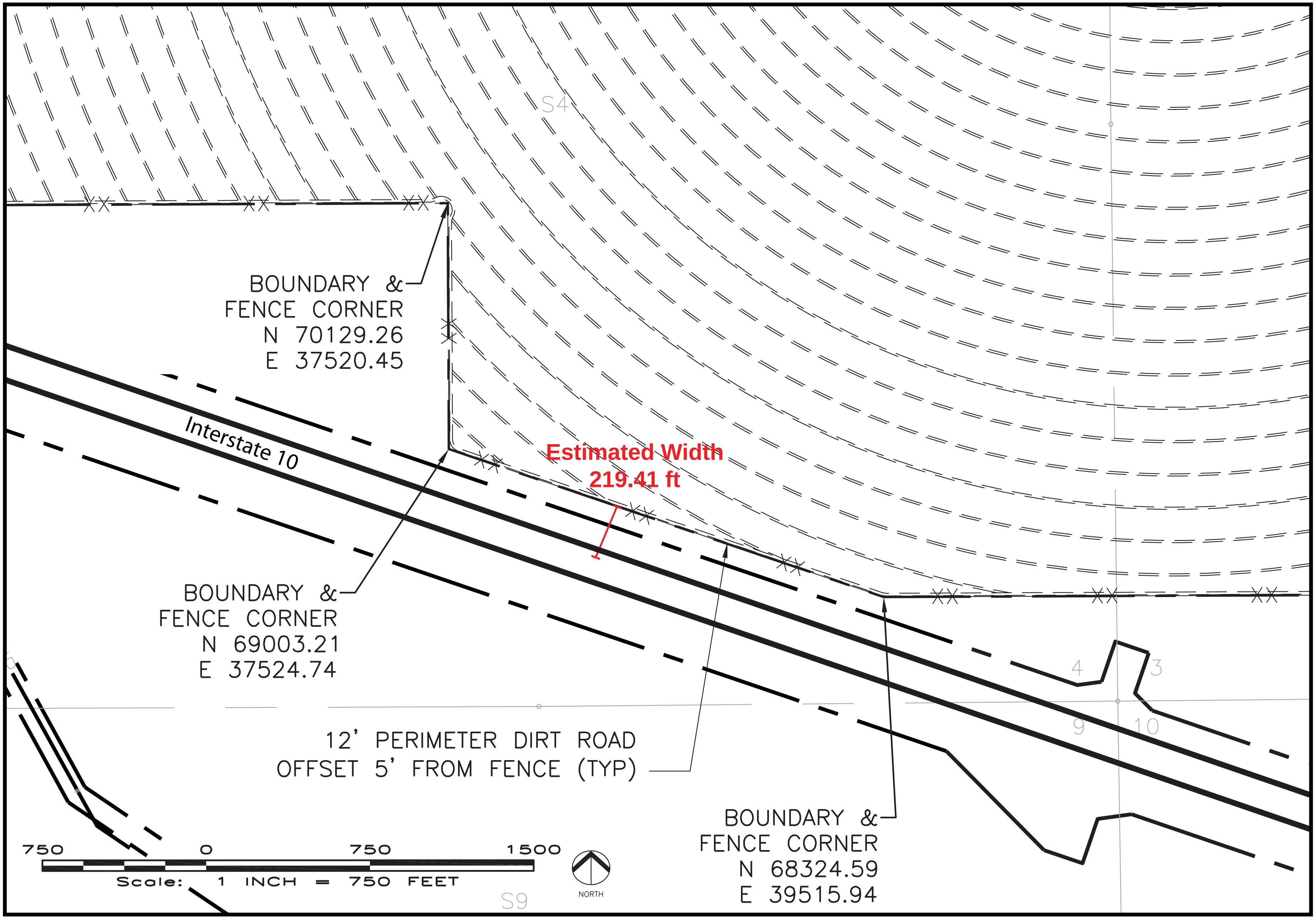


CALIFORNIA ENERGY COMMISSION - SITING, TRANSMISSION AND ENVIRONMENTAL PROTECTION DIVISION

SOURCE: 09 - AFC - 07, Civil Overall Site Plan - Figure 2.1-5

APPENDIX TT2 - FIGURE 2

Palen Solar Electric Generating System - Solar Electric Generation Station

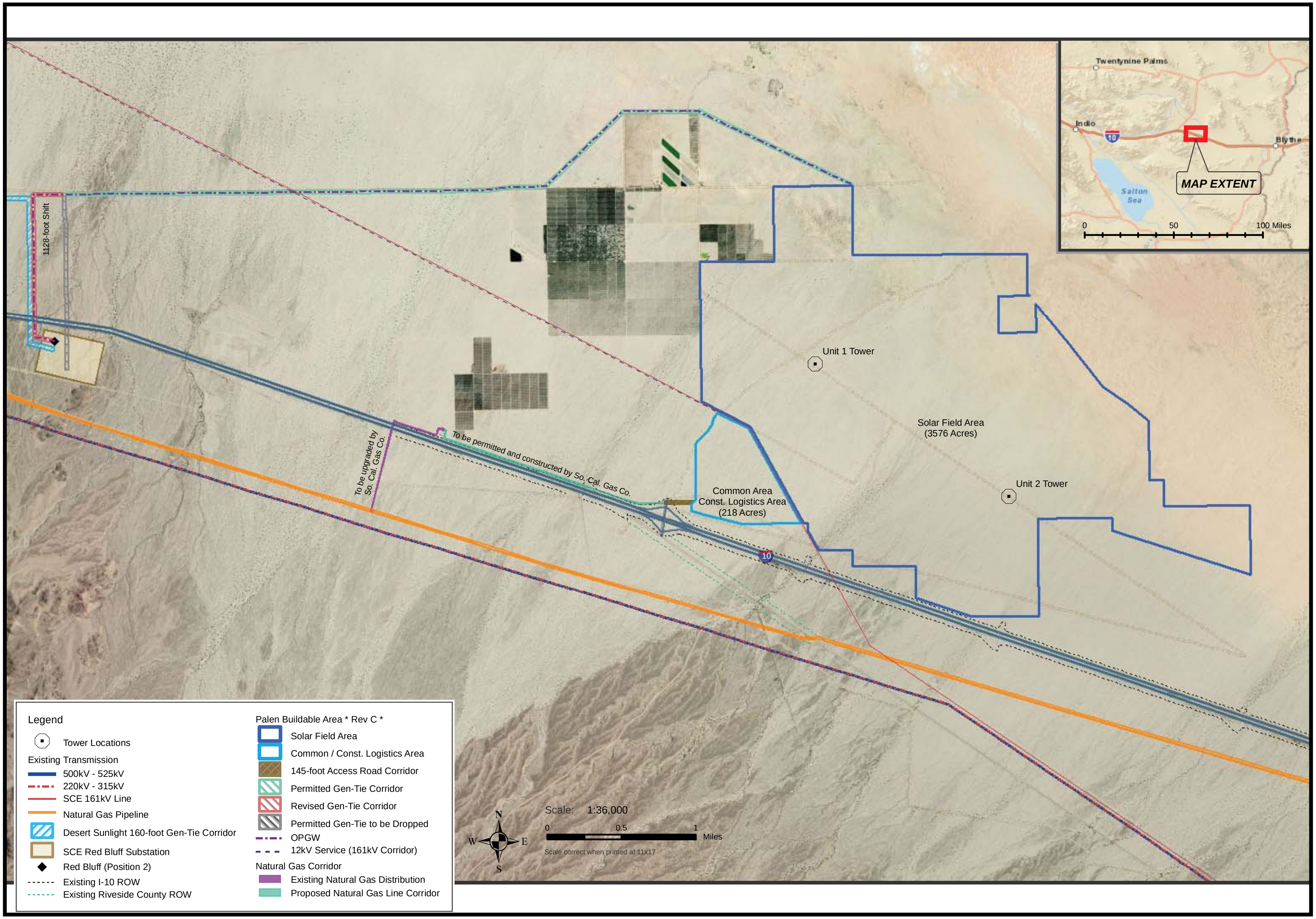


CALIFORNIA ENERGY COMMISSION - SITING, TRANSMISSION AND ENVIRONMENTAL PROTECTION DIVISION

SOURCE: 09 - AFC - 07, Civil Overall Site Plan - Figure 2.1-5

APPENDIX TT2 - FIGURE 3

Palen Solar Electric Generating System - Site alignment in relation to Interstate 10



APPENDIX TT2

CALIFORNIA ENERGY COMMISSION - SITING, TRANSMISSION AND ENVIRONMENTAL PROTECTION DIVISION

SOURCE: 09 - AFC - 07, Facility Boundary Map - Figure 2.1-3

TRANSMISSION LINE SAFETY AND NUISANCE

Testimony of Obed Odoemelam, Ph.D.

SUMMARY OF CONCLUSIONS

The project owner, Palen Solar Holdings, LLC (PSH) proposes to transmit the power from the proposed Palen Solar Electric Generating System (PSEGS) to the Southern California Edison (SCE) transmission grid through SCE's Red Bluff Substation currently under construction near the community of Desert Center. The project's tie-in line would be a single-circuit 230-kV overhead transmission line connecting the project's on-site 230-kV switchyard to the SCE 220-kV Red Bluff Substation. When completed, this substation would be under the jurisdiction of the California Public Utilities Commission (PUC) and the Bureau of Land Management (BLM). Therefore, this staff analysis is for the tie-in project line as it stretches from the proposed on-site switchyard to the SCE substation. Since the proposed tie-in line would be located in the SCE service area, it would be constructed, operated, and maintained according to SCE's guidelines for line safety and field management which conform to applicable laws, ordinances, regulations and standards (LORS). The route for the proposed project line is undisturbed desert land with no nearby residents, eliminating the potential for residential electric and magnetic field exposures when the line is operating.

With the four proposed Conditions of Certification, any safety and nuisance impacts from routing the proposed tie-in line from the project site to the area around the community of Desert Center would be less than significant. These Conditions of Certification are unchanged from those required for the approved project, Palen Solar Power Project (PSPP).

INTRODUCTION

The purpose of this staff assessment is to assess the proposed PSEGS's transmission line's design and operational plan to determine whether its related field and nonfield impacts would constitute a significant environmental hazard in the areas around the proposed route as it runs between the proposed site and the community of Desert Center approximately 10 miles to the west. PSEGS would consist of two generating units whose generated power would be transmitted to SCE's Red Bluff Substation using an overhead single-circuit 230-kilovolt (kV) line. The substation is currently being built by SCE near the community of Desert Center. Since it is being built on federal land and within SCE's service area, the substation would be under the jurisdiction of the California Public Utilities Commission (PUC) and the Bureau of Land Management (BLM). This staff analysis is for the proposed PSEGS tie-in line and related on-site switchyard to be built and operated by the project owner. The potential impacts of concern are those to be encountered along the proposed corridor running between the project site and the SCE substation. All related health and safety laws, ordinances, regulations, and standards (LORS) are currently aimed at minimizing such impacts. Staff's analysis focuses on the following issues taking into account both the physical presence of the line and the physical interactions of its electric and magnetic fields:

- aviation safety;
- interference with radio-frequency communication;
- audible noise;
- fire hazards;
- hazardous shocks;
- nuisance shocks; and,
- electric and magnetic field (EMF) exposure.

Transmission Line Safety and Nuisance Table 1 below shows the federal, state, and local laws and policies that apply to the control of the field and nonfield impacts of electric power lines. Staff's analysis examines the project's compliance with these requirements.

METHODOLOGY AND THRESHOLDS FOR DETERMINING ENVIRONMENTAL CONSEQUENCES

The LORS and practices listed in TLSN Table 1 have been established to maintain impacts below levels of potential significance. Thus, if staff determines that the project would comply with applicable LORS, we would conclude that any transmission line-related safety and nuisance impacts would be less than significant. The nature of these individual impacts is discussed below together with the potential for compliance with the LORS that apply.

LAWS, ORDINANCES, REGULATIONS, AND STANDARDS (LORS)

Transmission Line Safety and Nuisance (TLSN) Table 1
Laws, Ordinances, Regulations, and Standards (LORS)

Applicable LORS	Description
Aviation Safety	
Federal	
Title 14, Part 77 of the Code of Federal Regulations (CFR),"Objects Affecting the Navigable Air Space"	Describes the criteria used to determine the need for a Federal Aviation Administration (FAA) "Notice of Proposed Construction or Alteration" in cases of potential obstruction hazards.
FAA Advisory Circular No. 70/7460-1G, "Proposed Construction and/or Alteration of Objects that May Affect the Navigation Space"	Addresses the need to file the "Notice of Proposed Construction or Alteration" form (Form 7640) with the FAA in cases of potential for an obstruction hazard.
FAA Advisory Circular 70/460-1G, "Obstruction Marking and Lighting"	Describes the FAA standards for marking and lighting objects that may pose a navigation hazard as established using the criteria in Title 14, Part 77 of the CFR.

Applicable LORS	Description
Interference with Radio Frequency Communication	
Federal	
Title 47, CFR, section 15.2524, Federal Communications Commission (FCC)	Prohibits operation of devices that can interfere with radio-frequency communication.
State	
California Public Utilities Commission (CPUC) General Order 52 (GO-52)	Governs the construction and operation of power and communications lines to prevent or mitigate interference.
Audible Noise	
Local	
Riverside County General Plan, Noise Element	Establishes policies and programs to ensure that noise levels are appropriate to land uses.
Riverside County Noise Ordinance	Establishes performance standards for planned residential or other noise-sensitive land uses.
Hazardous and Nuisance Shocks	
State	
CPUC GO-95, "Rules for Overhead Electric Line Construction." CPUC GO-128. Rules for Construction of Underground Electric Supply and Communication Systems.	Governs clearance requirements to prevent hazardous shocks, grounding techniques to minimize nuisance shocks, and maintenance and inspection requirements. Establishes requirements and minimum standards for installing underground lines and communication circuits.
Title 8, California Code of Regulations (CCR) section 2700 et seq. "High Voltage Safety Orders"	Specifies requirements and minimum standards for safely installing, operating, working around, and maintaining electrical installations and equipment.
National Electrical Safety Code	Specifies grounding procedures to limit nuisance shocks. Also specifies minimum conductor ground clearances.
Industry Standards	
Institute of Electrical and Electronics Engineers (IEEE) 1119, "IEEE Guide for Fence Safety Clearances in Electric-Supply Stations"	Specifies the guidelines for grounding-related practices within the right-of-way and substations.
Electric and Magnetic Fields	
State	
GO-131-D, CPUC "Rules for Planning and Construction of Electric Generation Line and Substation Facilities in California"	Specifies application and noticing requirements for new line construction including EMF reduction.
CPUC Decision 93-11-013	Specifies CPUC requirements for reducing power frequency electric and magnetic fields.
Industry Standards	
American National Standards Institute (ANSI/IEEE) 644-1944 Standard Procedures for Measurement of Power Frequency Electric and Magnetic Fields from AC Power Lines	Specifies standard procedures for measuring electric and magnetic fields from an operating electric line.

Applicable LORS	Description
Fire Hazards	
State	
14 CCR sections 1250-1258, “Fire Prevention Standards for Electric Utilities”	Provides specific exemptions from electric pole and tower firebreak and conductor clearance standards and specifies when and where standards apply.

PROPOSED MODIFIED PROJECT

The proposed PSEGS 230-kV tie-in line would consist of the following individual segments:

- A new, single-circuit 230-kV overhead transmission line extending the 10 miles from the on-site project switchyard to the SCE Red Bluff Substation under construction; and
- The project’s on-site 230-kV switchyard from which the conductors would extend to the Red Bluff Substation.

The overhead conductors would be aluminum steel-reinforced cables supported on steel pole structures placed approximately 1,100 feet apart and with a maximum height of 120 feet as typical of similar SCE lines. The width of the right-of-way would be approximately 120 feet (Solar Millennium 2009a, p. 2-27). The PSPP project applicant (Solar Millennium 2009a, p. 5.14-11) provided the details of the proposed support structures as related to line safety, maintainability, and field reduction efficiency. About 38 of these poles would be required in addition to poles for supporting turning points (PSH, 2013)

Building the PSEGS would involve a slight re-routing of the generation tie-line near the western end of the route around the new Red Bluff Substation (PSH, 2013). Such realignment would not significantly affect the levels of the field and nonfield impacts from the proposed modified project as compared to the previously approved project. Another modification-related change would be the elimination of the proposal to relocate the 161-kV SCE line in the immediate project area. This would not significantly affect the levels of the assessed line impacts.

SETTING AND EXISTING CONDITIONS

The two units of the proposed PSEGS (Unit 1 and Unit 2) would occupy a total of 3,794 acres of federal land currently managed by the BLM. The site is presently vacant, undeveloped desert approximately 0.5 miles north of Interstate 10 and 10 miles east of the rural community of Desert Center in eastern Riverside County. The power generated by each of the proposed units would flow from the high-voltage side of each unit’s transformer to a common switchyard located on the northern side of the site via underground copper cables. From there, the generated power would be transmitted to the SCE power grid using a single-circuit overhead, 230-kV line.

As previously noted, the point of connection with the SCE grid would be SCE's Red Bluff Substation approximately 10 miles to the west and currently under construction with completion expected by the end of 2013. Since this SCE substation would be under the jurisdiction of the PUC, it would be designed, built, and operated according to SCE guidelines in keeping with existing LORS.

The proposed project site is uninhabited, open desert land with no existing structures other than SCE's 161-kV Eagle Mountain-Blythe transmission that traverses the southwestern portion. There are only two residences within 2 miles of the project site and the transmission line. The closest is approximately 1,000 feet from the site boundary (Solar Millennium 2009, pp. 5.7-12 and 5.8-7). Since both buildings are unoccupied, there would not be the type of residential field exposures that have been of health concern in recent years over power line operation.

ASSESSMENT OF IMPACTS AND DISCUSSION OF MITIGATION

DIRECT IMPACTS AND MITIGATION METHODS

Aviation Safety

For the PSEGS, any potential hazard to area aircraft would relate to the potential for collision in the navigable airspace. The requirements listed on **TLSN Table 1** establish the standards for assessing the potential for obstruction hazards within the navigable space and establish the criteria for determining when to notify the Federal Aviation Administration (FAA) about such hazards. These regulations require FAA notification in cases of structures over 200 feet from the ground. Notification is also required if the structure is to be below 200 feet in height but would be located within the restricted airspace in the approaches to public or military airports. For airports with runways longer than 3,200 feet, the restricted space is defined by the FAA as an area extending 20,000 feet from the runway. For airports with runways of 3,200 feet or less, the restricted airspace would be an area that extends 10,000 feet from this runway. For heliports, the restricted space is an area that extends 5,000 feet.

The closest operational airport of concern for the modified project is Blythe Airport, approximately 30 miles east of the project site and therefore too far away for the proposed line to pose an aviation hazard to utilizing aircraft. Also, the maximum height of 120 feet for the proposed line support structures (Solar Millennium 2009a, p. 2-27, and Figure 5.14-1) would be much less than the 200 feet that triggers the concern over aviation hazards according to FAA requirements.

Since (a) the physical dimensions of the proposed modified project's line structures are less than normally associated with collision hazards and (b) the distances from area aviation centers would be less that related to same collision hazard, staff does not find it necessary to recommend any aviation-related Conditions of Certification.

Interference with Radio-Frequency Communication

Transmission line-related radio-frequency interference is one of the indirect effects of line operation and is produced by the physical interactions of line electric fields. Such interference is due to the radio noise produced by the action of the electric fields on the surface of the energized conductor. The process involved is known as *corona discharge*, but is referred to as *spark gap electric discharge* when it occurs within gaps between the conductor and insulators or metal fittings. When generated, such noise manifests itself as perceivable interference with radio or television signal reception or interference with other forms of radio communication. Since the level of interference depends on factors such as line voltage, distance from the line to the receiving device, orientation of the antenna, signal level, line configuration and weather conditions, maximum interference levels are not specified as design criteria for modern transmission lines. The level of any such interference usually depends on the magnitude of the electric fields involved and the distance from the line. The potential for such impacts is therefore minimized by reducing the line electric fields and locating the line away from inhabited areas.

The PSEGS's transmission line would be built and maintained in keeping with standard SCE practices that minimize surface irregularities and discontinuities. Moreover, the potential for such corona-related interference is usually of concern for lines of 345 kV and above, and not for 230-kV lines such as the proposed line. The line's proposed low-corona designs are used for all SCE lines of a similar voltage rating to reduce surface-field strengths and the related potential for corona effects. Since the proposed line would traverse an uninhabited open space, staff does not expect any corona-related radio-frequency interference or related complaints and does not recommend any related Condition of Certification.

Audible Noise

The noise-reducing designs related to electric field intensity are not specifically mandated by federal or state regulations in terms of specific noise limits. As with radio noise, such noise is limited instead through design, construction, or maintenance practices established from industry research and experience as effective without significant impacts on line safety, efficiency, maintainability, and reliability. Audible noise usually results from the action of the electric field at the surface of the line conductor and could be perceived as a characteristic crackling, frying, or hissing sound or hum, especially in wet weather. Since the noise level depends on the strength of the line electric field, the potential for perception can be assessed from estimates of the field strengths expected during operation. Such noise is usually generated during rainfall, but mainly from overhead lines of 345 kV or higher. It is, therefore, not generally expected at significant levels from lines of less than 345 kV as proposed for PSEGS. Research by the Electric Power Research Institute (EPRI 1982) has validated this by showing the fair-weather audible noise from modern transmission lines to be generally indistinguishable from background noise at the edge of a right-of-way of 100 feet or more. Since the low-corona designs for the proposed modified project are also aimed at minimizing field strengths, staff does not expect the proposed line operation to add significantly to current background noise levels in the project area. For an assessment of the noise from the proposed line and related facilities, please refer to staff's analysis in the **NOISE AND VIBRATION** section.

Fire Hazards

The fire hazards addressed through the related LORS in **TLSN Table 1** are those that could be caused by sparks from conductors of overhead lines, or that could result from direct contact between the line and nearby trees and other combustible objects.

Standard fire prevention and suppression measures for similar SCE lines would be implemented by the project owner for the proposed modified project line (Solar Millennium 2009a, p. 5.14-10). Such measures are required under section 4292 of the Public Resources Code and section 1250 of Title 14 of the California Code of Regulations. The project owner's intention to comply with the clearance-related aspects of GO-95 would be an important part of this mitigation approach. Existing Condition of Certification **TLSN-3** is recommended to ensure compliance with all aspects of their intended fire prevention program.

Hazardous Shocks

Hazardous shocks are those that could result from direct or indirect contact between an individual and the energized line, whether overhead or underground. Such shocks are capable of serious physiological harm or death and remain a driving force in the design and operation of transmission and other high-voltage lines.

No design-specific federal regulations have been established to prevent hazardous shocks from overhead power lines. Safety is assured within the industry from compliance with the requirements specifying the minimum national safe operating clearances applicable in areas where the line might be accessible to the public.

Implementation of the GO-95- and GO-128-related measures against direct contact with the energized line would serve to minimize the risk of hazardous shocks for the proposed modified project. Existing Condition of Certification **TLSN-1** would be adequate to ensure implementation of the necessary mitigation measures.

Nuisance Shocks

Nuisance shocks are caused by current flow at levels generally incapable of causing significant physiological harm. They result mostly from direct contact with metal objects electrically charged by fields from the energized line. Such electric charges are induced in different ways by the line's electric and magnetic fields.

There are no design-specific federal or state regulations to limit nuisance shocks in the transmission line environment. For modern overhead high-voltage lines, such shocks are effectively minimized through grounding procedures specified in the National Electrical Safety Code (NESC) and the joint guidelines of the American National Standards Institute (ANSI) and the Institute of Electrical and Electronics Engineers (IEEE). For the proposed modified project line, the project owner will be responsible in all cases for ensuring compliance with these grounding-related practices within the right-of-way.

The potential for nuisance shocks around the proposed line would be minimized through standard industry grounding practices. Existing Condition of Certification **TLSN-4** will ensure compliance with standard industry grounding practices.

Electric and Magnetic Field Exposure

The possibility of deleterious health effects from EMF exposure has increased public concern in recent years about living near high-voltage lines. Both electric and magnetic fields occur together whenever electricity flows, and exposure to them together is generally referred to as EMF exposure. The available evidence as evaluated by the CPUC, other regulatory agencies, and staff has not established that such fields pose a significant health hazard to exposed humans. There are no health-based federal regulations or industry codes specifying environmental limits on the strengths of fields from power lines. Most regulatory agencies believe, as staff does, that health-based limits are inappropriate at this time. They also believe that the present knowledge of the issue does not justify any retrofit of existing lines.

Staff considers it important, as does the CPUC, to note that while such a hazard has not been established from the available evidence, the same evidence does not serve as proof of a definite lack of a hazard. Staff therefore considers it appropriate, in light of present uncertainty, to recommend feasible reduction of such fields without affecting safety, efficiency, reliability, and maintainability.

While there is considerable uncertainty about EMF health effects, the following facts have been established from the available information and have been used to establish existing policies:

- Any exposure-related health risk to the exposed individual will likely be small.
- The most biologically significant types of exposures have not been established.
- Most health concerns are about the magnetic field.
- There are measures that can be employed for field reduction, but they can affect line safety, reliability, efficiency, and maintainability, depending on the type and extent of such measures.

State's Approach to Regulating Field Exposures

In California, the CPUC (which regulates the installation and operation of many high-voltage lines owned and operated by investor-owned utilities) has determined that only no-cost or low-cost measures are presently justified in any effort to reduce power line fields beyond levels existing before the present health concern arose. The CPUC has further determined that such reduction should be made only in connection with new or modified lines. It requires each utility within its jurisdiction to establish EMF-reducing measures and incorporate such measures into the designs for all new or upgraded power lines and related facilities within their respective service areas. The CPUC further established specific limits on the resources to be used in each case for field reduction. Such limitations were intended by the CPUC to apply to the cost of any redesign to reduce field strength or relocation to reduce exposure. Publicly owned utilities, which are not within the jurisdiction of the CPUC, voluntarily comply with these CPUC requirements. This CPUC policy resulted from assessments made to implement CPUC Decision 93-11-013.

In keeping with this CPUC policy, staff requires a showing that each proposed overhead line would be designed according to the EMF-reducing design guidelines applicable to the utility service area involved. These field-reducing measures can impact line operation if applied without appropriate regard for environmental and other local factors bearing on safety, reliability, efficiency, and maintainability. Therefore, it is up to each project owner to ensure that such measures are applied in ways that prevent significant impacts on line operation and safety. The extent of such applications would be reflected by ground-level field strengths as measured during operation. When estimated or measured for lines of similar voltage and current-carrying capacity, such field strength values can be used by staff and other regulatory agencies to assess the effectiveness of the applied reduction measures. These field strengths can be estimated for any given design using established procedures. Estimates are specified for a height of 1 meter above the ground, in units of kilovolts per meter (kV/m), for the electric field, and milligauss (mG) for the companion magnetic field. Their magnitude depends on line voltage (in the case of electric fields), the geometry of the support structures, degree of cancellation from nearby conductors, distance between conductors, and, in the case of magnetic fields, amount of current in the line.

Since the CPUC currently requires that most new lines in California be designed according to the EMF-reducing guidelines of the electric utility in the service area involved, their fields are required under this CPUC policy to be similar to fields from similar lines in that service area. Designing the proposed modified project line according to existing SCE field strength-reducing guidelines would constitute compliance with the CPUC requirements for line field management.

The CPUC has revisited the EMF management issue to assess the need for policy changes to reflect the available information on possible health impacts. The findings specified in Decision D.06-1-42 of January 2006, did not point to a need for significant changes to existing field management policies. Since there are no residences in the immediate vicinity of the proposed modified project’s realigned transmission line, there would, as previously noted, not be the long-term residential EMF exposures mostly responsible for the health concern of recent years. The only project-related EMF exposures of potential significance would be the short-term exposures of plant workers, regulatory inspectors, maintenance personnel, visitors, or other individuals in the vicinity of the line. These types of exposures are short term and well understood as not significantly related to the health concern.

Industry’s and Project Owner’s Approach to Reducing Field Exposures

The present focus is on the magnetic field because unlike electric fields, magnetic fields can penetrate the soil, buildings, and other materials to produce the types of human exposures at the root of the health concern of recent years. The industry seeks to reduce exposure, not by setting specific exposure limits, but through design guidelines that minimize exposure in each given case. As one focuses on the strong magnetic fields from the more visible high-voltage power lines, staff considers it important, for perspective, to note that an individual in a home could be exposed to much stronger fields while using some common household appliances than from high-voltage lines (National Institute of Environmental Health Services and the U.S. Department of

Energy, 1998). The difference between these types of field exposures is that the higher-level, appliance-related exposures are short term, while the exposures from power lines are lower level, but long term. Scientists have not established which of these types of exposures would be more biologically meaningful in the individual. Staff notes such exposure differences only to show that high-level magnetic field exposures regularly occur in areas other than around high-voltage power lines.

As with similar SCE lines, specific field strength-reducing measures would be incorporated into the proposed line's design to ensure the field strength minimization currently required by the CPUC in light of the concern over EMF exposure and health.

The field reduction measures to be applied include the following:

1. increasing the distance between the conductors and the ground to an optimal level;
2. reducing the spacing between the conductors to an optimal level;
3. minimizing the current in the line; and
4. arranging current flow to maximize the cancellation effects from interacting of conductor fields.

Since the intended route of the proposed modified project line would have no residences in the immediate vicinity of the right-of-way, the long-term residential field exposures at the root of the health concern of recent years would not be a significant concern. The field strengths of most significance in this regard would be as encountered at the edge of the line's right-of-way. These field intensities would depend on the effectiveness of the applied field-reducing measures. The PSPP project owner (Solar Millennium 2009a, p. 5.14-8 and Figures 5.14-2 and 5.14-3) calculated the maximum electric and magnetic field intensities expected along the proposed route of the project line. Staff has verified the accuracy of the modeling approach used in the project owner's calculations with regard to parameters bearing on field strength dissipation and exposure assessment. The maximum electric field strength was calculated as 0.053 kV/m at the edge of the 150-foot right-of-way and is thus similar to those of SCE lines of the same voltage rating. The maximum magnetic field intensity of approximately 32.5 milligauss (mG) at the edge of this right-of-way is similar to that of SCE lines of the same current-carrying capacity (as required under current CPUC regulations) but is much less than the 200 mG currently specified by the few states with regulatory limits. The requirements in existing Condition of Certification **TLSN-2** for field strength measurements are intended to validate the project owner's assumed reduction efficiency.

NON-OPERATION AND FACILITY CLOSURE IMPACTS AND MITIGATION

If the proposed PSEGS were to be closed and all related structures are removed as described in the **PROJECT DESCRIPTION** section, the minimal area aviation risk electric shocks potential and fire hazards from the physical presence of this tie-in line would be eliminated. Closure and removal would also eliminate the transmission line's field impacts assessed in this analysis in terms of nuisance shocks, radio-frequency impacts, audible noise, and electric and magnetic field exposure. Since the line would be designed and operated according to existing SCE guidelines, these impacts would be as expected for SCE lines of the same voltage and current-carrying capacity and therefore, at levels reflecting compliance with existing health and safety LORS.

PROJECT-RELATED FUTURE ACTIONS

As previously noted, SCE is presently building the Red Bluff Substation, a new 220/500-kV substation southeast of Desert Center, in eastern Riverside County. The location is immediately north of and adjacent to the DPV1 transmission line where it will occupy approximately 90 acres when completed (First Solar, 2009). The construction of this substation is expected to be completed by the end of 2013.

The substation components will include a number of 220 kV and 500 kV transmission lines, 220/ 500 kV transformer banks, associated switch racks and a microwave tower (First Solar 2009). Other typical substation components include dead-end structures to allow the transmission line to enter the substation, and outdoor night lighting to illuminate the switch rack. Large substations like Red Bluff also require a mechanical-electrical equipment room that would house all the controls, protective equipment, and a telecommunications room. The tallest component of a 220/500 kV substation would likely be the terminating transmission tower or turning pole, which would range between 150 and 180 feet tall. The tallest component in the switch rack would likely be the dead-end pole, which would be approximately 130 feet tall. Other equipment would include disconnect switches, protective relays, metering and Supervisory Control and Data Acquisition (SCADA) system equipment. There would also likely be an emergency power generator, a fire prevention system (including hydrants, water tank, and walls between transformer phases), two single-story relay/control shelters, a single-story storage building, an oil containment system and a radio antenna tower to enhance communications. A permanent access road will provide vehicular access to the substation (First Solar 2009).

CUMULATIVE IMPACTS

The impacts from a specific project may, even at insignificant levels, combine with similarly low-level impacts from other nearby projects to produce the total effects that could be characterized as cumulatively considerable. For the proposed and similar projects, being, "cumulatively considerable" means that the incremental effects of an individual project would be significant when viewed in connection with the effects from past, existing or future projects (California Code Regulation, Title 14, Section 15130). NEPA, for example thus states that cumulative effects can result from individually minor, but collectively significant actions taking place over a period of time” (40 CFR §1508.7).

When field intensities are measured or calculated for a specific location, they reflect the interactive, and therefore, cumulative effects of fields from all contributing conductors. Such interactions could be additive or subtractive depending on prevailing conditions.

The staff of the Energy Commission has identified the existing or future area sources of the field and nonfield impacts of concern in this analysis. The sources were identified in terms of source and distance from the proposed project line. Their respective intensities and contributions to cumulative impacts would diminish with distance from each source. These individual impacts would be reflected in the levels estimated for the proposed line at the points of maximum interest. Since the proposed project line would be designed, built, and operated according to applicable field-reducing SCE guidelines (as currently required by the CPUC for effective field management), any contribution to cumulative area fields should be at levels expected for SCE lines of similar voltage and current-carrying capacity. It is this similarity in intensity that constitutes compliance with current CPUC requirements for EMF management. The actual field strengths and contribution levels for the proposed line design would be assessed from the results of the field strength measurements specified in existing Condition of Certification **TLSN-2**.

COMPLIANCE WITH LORS

As previously noted, current CPUC policy on safe EMF management requires that any high-voltage line within a given area be designed to incorporate the field strength-reducing guidelines of the main area utility lines to be interconnected. The utility in this case is SCE. Since the proposed project 230-kV line and related switchyard would be designed according to the respective requirements of the LORS listed in **TLSN Table 1**, and operated and maintained according to current SCE guidelines on line safety and field strength management, staff considers the proposed design and operational plan to be in compliance with the health and safety requirements of concern in this analysis. The actual contribution to the area's field exposure levels would be assessed from results of the field strength measurements required in existing Condition of Certification **TLSN-2**.

NOTEWORTHY PUBLIC BENEFITS

Since the proposed PSEGS tie-in line would pose specific, although insignificant risks of the field and nonfield effects of concern in this analysis, its building and operation would not yield any public benefits regarding the effort to minimize any human risks from these impacts.

RESPONSE TO COMMENTS

Staff received no comments relating to **Transmission Line Safety and Nuisance**.

CONCLUSIONS

Since staff does not expect the proposed 230-kV project transmission line to pose an aviation hazard according to current FAA criteria. We therefore do not consider it necessary to recommend specific location changes on the basis of a potential hazard to area aviation.

The potential for nuisance shocks would be minimized through grounding and other field-reducing measures that would be implemented in keeping with current SCE guidelines (reflecting standard industry practices). These field-reducing measures would maintain the generated fields within levels not associated with radio-frequency interference or audible noise.

The potential for hazardous shocks would be minimized through compliance with the height and clearance requirements of CPUC's General Order 95 and the placement requirements of GO-128 for the on-site underground segment. Compliance with Title 14, California Code of Regulations, section 1250, would minimize fire hazards while the use of low-corona line design, together with appropriate corona-minimizing construction practices, would minimize the potential for overhead corona noise and its related interference with radio-frequency communication.

Since electric or magnetic field health effects have neither been established nor ruled out for the proposed PSEGS and similar transmission lines, the public health significance of any related field exposures cannot be characterized with certainty. The only conclusion to be reached with certainty is that the proposed line's design and operational plan would be adequate to ensure that the generated electric and magnetic fields are managed to an extent the CPUC considers appropriate in light of the available health effects and safety information. The long-term, mostly residential magnetic exposure of health concern in recent years would be insignificant for the proposed line given the general absence of residences in the immediate vicinity of the intended route. On-site worker or public exposure would be short term and at levels expected for SCE lines of similar design and current-carrying capacity. Such exposure is well understood and has not been established as posing a significant human health hazard.

Since the proposed modified project line would be operated to minimize the health, safety, and nuisance impacts of concern to staff and would be routed through an area with no residences in its immediate vicinity, staff considers the proposed design, maintenance, and construction plan as complying with the applicable LORS. With implementation of the four existing Conditions of Certification, any such impacts would be less than significant.

PROPOSED CONDITIONS OF CERTIFICATION

Staff does not propose any changes to the existing Conditions of Certification for the proposed PSEGS project. The existing conditions are presented below.

TLSN-1 The project owner shall construct the proposed project transmission line according to the requirements of: (a) California Public Utility Commission's GO-95, GO-52, GO-131-D, GO-128, Title 8, and Group 2; (b) the High Voltage Electrical Safety Orders, sections 2700 through 2974 of the California Code of Regulations; and (3) Southern California Edison's EMF reduction guidelines.

Verification: At least 30 days prior to start of construction of the transmission line or related structures and facilities, the project owner shall submit to the Compliance Project Manager (CPM) a letter signed by a California-registered electrical engineer affirming that the lines will be constructed according to the requirements stated in the condition.

TLSN-2 The project owner shall use a qualified individual to measure the strengths of the electric and magnetic fields from the line at the points of maximum intensity along the route for which the project owner provided specific estimates. The measurements shall be made before and after energization according to the American National Standard Institute/Institute of Electrical and Electronic Engineers (ANSI/IEEE) standard procedures. These measurements shall be completed no later than six months after the start of operations.

Verification: The project owner shall file copies of the pre-and post-energization measurements with the CPM within 60 days after completion of the measurements.

TLSN-3 The project owner shall as part of its intended fire prevention program ensure that the right-of-way of the transmission line is kept free of combustible material, as required under the provisions of section 4292 of the Public Resources Code and section 1250 of Title 14 of the California Code of Regulations.

Verification: During the first five years of plant operation, the project owner shall provide a summary of inspection results and any fire prevention activities carried out along the right-of-way and provide such summaries in the Annual Compliance Report on transmission line safety and nuisance-related requirements.

TLSN-4 The project owner shall ensure that all permanent metallic objects within the right-of-way of the project-related line are grounded according to industry standards regardless of ownership.

Verification: At least 30 days before the line is energized, the project owner shall transmit to the CPM a letter confirming compliance with this condition.

REFERENCES

EPRI (Electric Power Research Institute) 1982 – Transmission Line Reference Book: 345 kV and Above.

National Institute of Environmental Health Services 1998 – An Assessment of the Health Effects from Exposure to Power-Line Frequency Electric and Magnetic Fields. A Working Group Report, August 1998

Palen Solar Holdings 2013. Response to CEC Staff Data Requests, Sets 1 and 2. March 2013.

Solar Millennium 2009a (TN 52939) – Application for Certification for the Palen Solar Electric Generating System, Volumes I and II. Submitted to the California Energy Commission on September 24, 2009.

VISUAL RESOURCES

Testimony of William Kanemoto and Gregg Irvin Ph.D.

SUMMARY OF CONCLUSIONS

California Energy Commission staff (hereafter referred to as staff) has analyzed visual resource-related information pertaining to the proposed Palen Solar Electric Generating System (PSEGS) and concludes that the proposed amended project would result in a substantial adverse impact to existing scenic resource values as seen from several viewing areas and Key Observation Points in the project vicinity and Chuckwalla Valley area, including:

- Eastbound and westbound Interstate 10 (I-10), which is located immediately south of the project site and transmission line;
- State Route 177, to the west and northwest of the project site;
- Joshua Tree National Park to the west and northwest of the project site;
- Palen McCoy Wilderness to the northeast of the project site;
- Chuckwalla Mountains Wilderness to the south of the project site; and
- Corn Springs Road in the immediate vicinity of the project site.

Staff concludes that these visual impacts would be significant in terms of three of the four criteria of California Environmental Quality Act (CEQA) Appendix G, could not be mitigated to less than significant levels, and would thus result in significant and unavoidable impacts under CEQA. Staff also concludes that the project's contribution to significant cumulative visual effects would be cumulatively considerable when combined with the effects of other renewable and development projects along the I-10 corridor, within the Chuckwalla Valley, and within the California Desert Conservation Area as a whole.

In addition, staff concludes that the project would be inconsistent with several goals and policies of the Riverside County Integrated Plan.

If the Energy Commission approves the amended project, staff recommends that the conditions of certification from the Commission Decision for the originally certified Palen Solar Power Project (PSPP), as modified herein by staff, be adopted in order to minimize impacts to the greatest feasible extent.

INTRODUCTION

Visual resources are the natural and cultural features of the environment that can be viewed. This analysis focuses on whether the Palen Solar Electric Generating System (PSEGS) would cause significant adverse visual consequences and whether the project would be in compliance with applicable laws, ordinances, regulations, and standards (LORS). The California Environmental Quality Act (CEQA) requires the California Energy Commission to determine the potential for significant impacts to visual resources resulting from the proposed project. **VISUAL RESOURCES APPENDIX VR-1** describes the visual resources methodology employed for the CEQA analysis (Energy

Commission staff's methodology), and the "Method and Threshold for Determining Significance," subsection below, describes the thresholds for determining environmental consequences (as discussed above in the "Summary of Conclusions" subsection). In accordance with staff's procedure, conditions of certification are proposed as needed to reduce potentially significant impacts (under CEQA) to less than significant levels or to the extent possible, and to ensure LORS conformance, if feasible.

EXISTING PROJECT VISUAL SETTING

REGIONAL SETTING

The proposed project landscape is part of the Great Basin section of Fenneman's Basin and Range physiographic province, a vast desert area of the western U.S. extending from eastern Oregon to western Texas, characterized by periodic north-south trending, highly eroded mountain ranges that rise sharply from and are separated by broad, flat desert valleys (Fenneman, 1931). The project region marks the transition zone between the high elevation Mojave Desert to the north and the arid, lower elevation Sonoran Desert to the south and east. The project site is located adjacent and to the north of I-10 in Chuckwalla Valley, approximately 9 miles east of Desert Center in eastern Riverside County. The Chuckwalla Valley is a broad, flat desert plain that includes scattered dry lakes and rolling sand dunes and is bordered by a number of rugged mountain ranges including the Eagle Mountains to the west and north, the Coxcomb and Granite Mountains to the north, the Palen Mountains to the northeast and the Chuckwalla Mountains to the south.

There are a number of sensitive land uses and protected areas within the expansive viewshed of the site including: to the north – Palen Dry Lake and Sand Dunes Area, and Desert Lily Sanctuary Area of Critical Environmental Concern (ACEC); to the northwest, Joshua Tree National Park; to the northeast – Palen McCoy Wilderness; to the east – Palen Dry Lake ACEC and Ford Dry Lake OHV Area; to the south – Chuckwalla Mountains Wilderness; and to the west – Alligator Rock ACEC and Desert Center. This portion of Chuckwalla Valley offers panoramic views of a desert plain landscape that appears relatively visually intact except for the presence of I-10 to the immediate south and two transmission lines. I-10 is the main travel corridor between Southern California and Phoenix, Arizona.

Project Site and Vicinity

The project site is presently undeveloped and consists mainly of desert scrub (largely scattered Creosote Bush), lakebed, and dune landscapes and is predominantly intact on the broad, Chuckwalla Valley floor (elevation 150 feet). There are three desert washes, indicated primarily by associated vegetation (desert dry wash woodlands), traversing the site (AFC, Page 5.15-7). A wood-pole, H-frame 161 kV transmission line passes through the southwestern corner of the project site. Several BLM 4WD roads that provide recreational access to Palen Dry Lake, the Palen Sand Dunes Area, Palen Dry Lake ACEC, and the perimeter of the Palen McCoy Wilderness also cross the site. **Visual Resources Figure 1**, *Characteristic Landscape of the Project Site*, presents a view of the project site from the BLM recreational access road just off the Corn Springs Road/I-10 off-ramp. The view presented in Figure 1 reveals a primarily natural setting comprised of a mosaic of sparse, shrubby vegetation of darker greens and tans, low-growing grasses and light-colored soils, rocks and desert pavement openings. Views from the site are panoramic, encompassing the open Chuckwalla Valley and the various mountain ranges that define the valley. The rugged ridges, angular forms and bluish hue of the Palen Mountains to the immediate east of the project site provide a contrast of visual interest to the flat, light-colored horizontal landform of the Chuckwalla Valley floor and project site. The area surrounding the project site is very lightly populated. There are two residences within 3,500 feet of the PSEGS northern boundary, one of which reportedly is occupied only seasonally (AFC, Page 5.15-9).

Project Viewshed

The *viewshed* or area of potential visual effect (the area within which the project could potentially be seen) is extensive and encompasses much of Chuckwalla Valley and the site-facing slopes and ridgelines of the surrounding mountains as indicated by the yellow colored area in **Visual Resources Figure 2,** *Project Viewshed*. The computer-generated viewshed mapping is based on the height of the proposed towers. The mapping is accurate within the limits of error of the 10-meter resolution (horizontal) USGS digital elevation model (DEM). In this landscape, because of the general absence of tall land-cover that could alter the actual viewshed, the topographically generated viewshed mapping is considered generally accurate. A feature of this desert landscape is the potential for large projects to be seen over great distances where elevated viewpoints exist, due to the large open areas of level topography and absence of intervening landscape features.

ORIGINAL APPLICATION PROJECT DESCRIPTION

The original approved 2010 Palen Solar Power Project (PSPP) was proposed to occupy roughly the same site as the current PSEGS project, but on a somewhat different footprint. The PSPP proposed a 4.5 square-mile solar thermal generating facility utilizing solar trough technology, consisting of fields of long, linear rows of parabolic mirrors, as well as associated generation facilities. The maximum height of the mirror structures is approximately 25 feet. In addition, various structures such as steam generators, air-cooled condenser, and water-storage tanks would comprise the power generation block. The air-cooled condenser would be 150 feet tall. Other structures in the power block would vary in height but would be considerably shorter. The predominant visual profile of the solar trough power plant would thus be of a vast, level mirror field, relatively low in height (25 feet), with two taller; approximately 26-acre power blocks in the center of two mirror fields. Occasional bright ’glint ‘ reflections of the sun off the mirrors, perceptible to viewers on the ground under certain conditions and times of day, were noted as a potential concern in the review of the PSPP and other solar trough projects. These events are assumed occasional and transitory.

Overall, the visual analysis of the Revised Staff Assessment concluded that the PSPP would cause moderate-to-high levels of visual change for viewers in the Chuckwalla Valley at foreground and middle-ground distances, particularly from Highway I-10; and moderate-to-high levels of visual change for higher elevation viewers in the mountains of the Palen-McCoy and Chuckwalla Mountains wilderness areas, to background distances (over 5 miles distance).

Based on these findings the Energy Commission concluded that proposed conditions of certification would not reduce the project's visual impacts to a less-than-significant level. The Commission also concluded that the PSPP would contribute to significant cumulative visual impacts in the I-10 corridor. The Commission approved the PSPP with a Statement of Overriding Considerations.

AMENDED PROJECT VISUAL DESCRIPTION

As the prior approved project, the proposed amended project would convert a vast area of naturally appearing desert plain to an industrial facility characterized by complex, geometric forms and lines and industrial surfaces that are dissimilar to the surrounding natural landscape character. The overall area of the amended project would be 572 acres smaller than the approved PSPP. Much of the developed area would be covered with the arrays of heliostats (elevated mirrors) that would be used to collect heat energy from the sun. Like the PSPP, these mirror-fields would be relatively low in height (assumed to be under 20 feet maximum height). The amended project would however include two 750-foot-tall solar towers topped by 130-foot-tall solar receivers (SRSGs) that would concentrate the sunlight reflected by the field of heliostats to create steam, as well as reflect sunlight outward. For context, the towers would be the fifth tallest structures in California. The super-heated SRSGs would act as extremely bright sources of light. Similar to the PSPP, the amended project would also include various power-generation structures and a power transmission line from the project site extending westward to the Red Bluff substation, under construction south of I-10 between the project site and Desert Center. The greatest potential for public views of the transmission line would be from I-10 immediately to the south and State Highway 177 roughly 9 miles to the west. The project's transmission line route traverses Colorado Desert Creosote Bush Scrub community shrubs and grasses. **Attachments 1A through 1D** in the **VISUAL RESOURCES APPENDIX VR-1** present typical heliostat (1A), solar tower/power block elevation (1B), project layout (1C), and transmission line route (1D). **Visual Resources Table 1** provides a list of the major project features that would contribute to the apparent visual change of the landscape. A more detailed discussion of the proposed project is presented in the **PROJECT DESCRIPTION** section of this document. In addition to the features listed in Table 1 below, the proposed project would also include the installation of chain link fencing and desert tortoise fencing around the perimeter of the site for security and protection of sensitive biological resources.

Visual Resources Table 1
Key Project Components

Component	Dimensions (LxWxH) (Feet) / Capacity	Footprint (square feet)
Common Area		
Administration Building	180 x 80 x 34	14,400
Maintenance and Electrical Shops and Warehouse	90 x 120 x 48	10,800
Fire Water Storage Tank	25 (diameter) 15 (height)	NA
Fire Water Pump House	12 x 36 x 10	432
Emergency Diesel Generator Enclosure	12 x 18 x 10	216
Power Block #1		
Solar Tower including Solar Receiver Steam Generators	75 (diameter) 750 (height)	NA
Steam Turbine Generator Enclosure	34 x 46 x 52	1,564
Air Cooled Condenser	220 x 300 x 120	NA
Steam Turbine Enclosure	40 x 56 x 52	2,240
Steam Turbine Generator Lube Oil Enclosure	22 x 38 x 18	836
Deaerator/Feedwater Heater Structure	56 x 66 x 80	NA
Emergency Diesel Generator Enclosure	12 x 32 x 12	384
Plant Service Building	56 x 100 x 16	5,600
ACC Power Distribution Center – North	14 x 50 x 16	700
ACC Power Distribution Center – South	14 x 50 x 16	700
Fire Water Pump House	36 x 12 x 12	432
Demineralized Water Storage Tank	26 (diameter) 26 (height)	NA
Service/ Firewater Storage Tank	40 (diameter) 30 (height)	NA
Mirror Wash Water Storage Tank	25 (diameter) 21 (height)	NA
Boiler Pump Power Distribution Center	50 x 14 x 16	700
Waste Water Storage Tank	25 (diameter) 23 (height)	NA
Water Treatment Power Distribution Center	30 x 14 x 16	420
Night Preservation Auxiliary Boiler	10 x 12 x 12	NA
Start-up Auxiliary Boiler	14 x 56 x 16	NA
Mirror Wash Vehicle Refueling and Storage Area Canopy	74 x 116 x 24	NA
Mirror Wash Vehicle Storage Area Canopy	40 x 184 x 20	NA
Wet Surface Air Cooler (WSAC)	48 x 36 x 26	NA
Thermal Evaporation Unit	34 x 18 x 64	NA
Residue Tank	12 (diameter) 13 (height)	NA
Water Treatment Building	66 x 90 x 26	5,940
Generator Step-up Transformer	12 x 26 x 22	NA
Drains Tank	12 (diameter) 13 (height)	NA
Power Block #2		
Solar Tower including Solar Receiver Steam Generators	75 (diameter) 750 (height)	NA
Steam Turbine Generator Enclosure	34 x 46 x 52	1,564
Air Cooled Condenser	220 x 300 x 120	NA
Steam Turbine Enclosure	40 x 56 x 52	2,240
Steam Turbine Generator Lube Oil Enclosure	22 x 38 x 18	836
Deaerator/Feedwater Heater Structure	56 x 66 x 80	NA
Emergency Diesel Generator Enclosure	12 x 32 x 12	384
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Mirror Wash Water Storage Tank	25 (diameter) 21 (height)	NA
Boiler Pump Power Distribution Center	50 x 14 x 16	700
Waste Water Storage Tank	25 (diameter) 23 (height)	NA
Water Treatment Power Distribution Center	30 x 14 x 16	420
Night Preservation Auxiliary Boiler	10 x 12 x 12	NA
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Mirror Wash Vehicle Refueling and Storage Area Canopy	74 x 116 x 24	NA
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Thermal Evaporation Unit	34 x 18 x 64	NA
Residue Tank	12 (diameter) 13 (height)	NA
Water Treatment Building	66 x 90 x 26	5,940
Generator Step-up Transformer	12 x 26 x 22	NA
Drains Tank	12 (diameter) 13 (height)	NA

Source: Palen 2012a, Appendix 2-A.

LAWS, ORDINANCES, REGULATIONS, AND STANDARDS

Staff also evaluates the project to determine compliance with federal, state and local laws, ordinances, regulations and standards (LORS). **Visual Resources Table 3** lists relevant LORS pertaining to aesthetics or the preservation and protection of sensitive visual resources, and presents a discussion of project conformance with them. **Visual Resources Table 3** may be found at the end of the section, following the discussion of project impacts and mitigation under CEQA, under “Compliance with Applicable LORS.”

ASSESSMENT OF IMPACTS AND DISCUSSION OF MITIGATION

This section includes information about the following:

1. Method and threshold for determining significance

2. Direct/indirect/induced impacts and mitigation

3. Cumulative impacts and mitigation

METHOD AND THRESHOLD FOR DETERMINING SIGNIFICANCE

CEQA Criteria of Significance

The following regulatory criteria were considered in determining whether a visual impact would be significant under CEQA.

The CEQA *Guidelines* define a “significant effect” on the environment to mean a “substantial, or potentially substantial, adverse change in any of the physical conditions within the area affected by the project including...objects of historic or aesthetic significance.” (Cal. Code Regs., tit.14, §15382.) Appendix G of the *Guidelines*, under

Aesthetics, lists the following four questions to be addressed regarding whether the potential impacts of a project are significant:

1. Would the project have a substantial adverse effect on a scenic vista?

2. Would the project substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway?

3. Would the project substantially degrade the existing visual character or quality of the site and its surroundings?

4. Would the project create a new source of substantial light or glare which would adversely affect day or nighttime views in the area?

Key Observation Points (KOPs)

The visual resources approach is based on detailed analysis from representative Key Observation Points (KOPs). KOPs are generally selected to be representative of the most critical locations from which the project would be seen. KOPs are selected based on their usefulness in evaluating existing landscapes and potential impacts on visual resources with various levels of sensitivity, in different landscape types and terrain, and from various vantage points. Typical KOP locations for the proposed project and alternatives include (1) along major or significant travel corridors (I-10); (2) along recreational access 4WD roads and trails; (3) at key vista points; (4) from publicly accessible vantage points within designated Wilderness or other protected areas; and (5) at locations that provide good examples of the existing landscape context and viewing conditions.

At each KOP, the existing landscape was characterized by photographs that were obtained to indicate existing conditions without the project and then were modified to include a simulation of the project. Consequently, staff has a visual representation of the viewshed before and after a project is introduced to assist in the analysis.

Energy Commission staff evaluated the visual setting and proposed project in detail from several viewing areas represented by existing and simulated views of the following six key observation points, provided by the project owner and shown in **Visual Resources Figure 3,** *Key Observation Points (KOPs).* The project owner's simulations were taken from two submittals with different KOP numbering systems (Solar Millennium 2009a; Palen 2013w). To minimize confusion, a new KOP numbering system is adopted for this report, as described below and depicted in Figure 3. For each KOP, the equivalent KOP number from the relevant document is also provided in parentheses. 'VRA' refers to KOP numbers assigned in the project owner's *PSEGS Visual Resource Analysis Report, May 2013* (Palen 2013w).

- **KOP 1** (VRA 3) – State Route 177, approximately 7 miles northwest of the project site, and approximately 8 miles northwest of the nearest solar tower, looking to the southeast. This KOP is representative of views from the SR 177 corridor. It also represents the nearest viewpoint within Joshua Tree National Park (JTNP, background distance).

- **KOP 2** (VRA 7) – Northwest of Desert Center, approximately 13 miles northwest of the project site, and approximately 14 miles northwest of the nearest solar tower, looking southeast. This viewpoint is the second nearest viewpoint to the project within JTNP (background distance).
- **KOP 3** (AFC 8B) – Eastbound Interstate 10 (I-10), approximately 0.5 mile west of the western boundary of the project site, and approximately 1.5 miles southwest of the nearest solar tower, looking to the east. This KOP represents the view of motorists traveling along I-10 (eastbound, middleground distance).
- **KOP 4** (VRA 13) – Westbound Interstate 10 (I-10), approximately 6.4 miles southeast of the southeast corner of the project site, and approximately 5.7 miles southeast of the nearest solar tower, looking to the northwest. This KOP represents the view of motorists traveling along I-10 (westbound, background distance).
- **KOP 5** (VRA 12) – Chuckwalla Mountains Wilderness, approximately 5 miles southwest of the project site, and approximately 6 miles southwest of the nearest solar tower, looking to the northeast. This KOP represents elevated views within the Chuckwalla Mountains Wilderness at background distance.
- **KOP 6** (VRA 15) – Palen McCoy Wilderness, approximately 3.5 miles northeast of the project site, and approximately 4.5 miles northeast of the nearest solar tower, looking to the southwest. This KOP represents elevated views within the Palen McCoy Wilderness at middle-ground-distance.

Each of these six key observation points is shown on **Visual Resources Figure 3**. At each KOP, a visual analysis was conducted and a discussion of the visual setting for each KOP is presented in the subsection entitled “C. Visual Character or Quality” below, and summarized in tabular form in **Visual Resources Table 2**. Existing conditions photographs and visual simulations of the project are presented in **VISUAL RESOURCES APPENDIX VR-2**.

DIRECT/INDIRECT IMPACTS AND MITIGATION

This analysis considered the potential impacts of the proposed project in relation to the four significance criteria for visual resource impacts listed in Appendix G of the CEQA Guidelines, under Aesthetics, specified above.

A. <u>Scenic Vistas</u>

”Would the project have a substantial adverse effect on a scenic vista?”

For the purposes of this analysis, a *scenic vista* is defined as a designated scenic vista (identified in public planning documents); a view of high scenic quality perceived through and along a corridor or opening; or a view from a designated scenic area. While not the sole criterion for designation of wilderness areas, preservation of scenic values is a key concern underlying the Wilderness Act (P.L. 88-577 (16 U.S. C. 1131-1136)). The highly scenic, currently unspoiled views from elevated viewpoints within the Palen McCoy and Chuckwalla Mountains Wilderness areas are thus considered here to represent scenic vistas.

Yes. Although no designated scenic vistas were identified in the study area, panoramic and highly scenic vistas are available to backcountry recreationists that access the southern ridges of the Palen McCoy Wilderness and the northeastern ridges of the Chuckwalla Mountains Wilderness. Both areas overlook the expansive Chuckwalla Valley ringed by distinguishable mountain ranges. The brightness of glare from the project's two solar receivers would be seen from the two wilderness areas (WAs) at distances of as little as 4.5 miles. At this distance, based on information provided by the project owner, staff has determined that the solar receiver steam generators (SRSGs) would appear to viewers as very bright and prominent. While not physically damaging to the eyes, this level of brightness could impair the recreational use of the WAs within the viewshed of the SRSGs, introducing a prominent, distracting, very bright industrial feature into the wilderness experience within an estimated range of up to 10 miles from the solar towers. Refer to **APPENDIX TT1 - VISUAL SAFETY IMPACT ASSESSMENT** in the **TRAFFIC AND TRANSPORTATION** section of the Final Staff Assessment (FSA) for a more detailed discussion. Thus, within some substantial portion of the exposed wilderness areas, the solar towers and SRSGs would exhibit a high level of contrast with the existing natural background landscape. They would exhibit strong visual dominance, demanding attention. Because wilderness viewers are assumed to have a high level of viewer concern and moderately high overall visual sensitivity, this strong contrast would represent a substantial adverse visual and glare effect.

As shown in **Visual Resources Figures 8B and 9B**, the project would be prominently visible from both wilderness areas and the introduction of glare; industrial character and structural visual contrast would result in substantial adverse effects on these vistas. These effects are discussed under KOPs 5 and 6, below. In addition, based on information provided by the project owner, the SRSGs could potentially have substantial adverse glare effects on certain viewpoints in the easternmost portions of the JTNP as depicted in **Visual Resources Figures 4B and 5B**. These effects are discussed under KOPs 1 and 2, below.

B. Scenic Resources

"Would the project substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway?"

For the purpose of this analysis, *scenic resources* include a unique water feature (waterfall, transitional water, part of a stream or river, estuary); a unique physical geological terrain feature (rock masses, outcroppings, layers or spires); a tree having a unique/historical importance to a community (a tree linked to a famous event or person, an ancient, old growth tree); historic building; or other scenically important physical features, particularly if located within a designated federal scenic byway or state scenic corridor.

No. The Chuckwalla Valley floor consists primarily of desert scrub vegetation. The project site is located adjacent and to the north of I-10, which is not listed as an eligible State Scenic Highway, and there are no notable scenic features or historic structures located within the site. Therefore, the project would not substantially damage scenic resources such as trees, rock outcroppings, or historic buildings within a state scenic highway.

C. Visual Character or Quality

"Would the project substantially degrade the existing visual character or quality of the site and its surroundings?"

CEQA Criterion C is typically determined by staff's visual sensitivity/visual change assessment methodology, applied through analysis of representative KOPs throughout the project viewshed. However, due to the unusual character of the proposed project, visual impact conclusions under Criterion C revolve primarily around predicted effects of glare from the SRSGs, whose effects would be much stronger and extend much farther than those from visual change and contrast from the project structures themselves. The reader should thus also refer to the discussion of Criterion D, Light and Glare, and to the discussion in **APPENDIX TT1 – VISUAL SAFETY IMPACT ASSESSMENT** in the **TRAFFIC AND TRANSPORTATION** section of this FSA.

Yes. The proposed project would introduce prominent structures with industrial character into the foreground to background views from SR 177 and the Desert Center area (see KOPs 1 and 2), I-10, Corn Springs Road (see KOPs 3, 4 and 5), nearby wilderness areas (see KOPs 6 and 7), Joshua Tree National Park (see KOPs 1 and 2), and a few nearby residences. The resulting visual change would range from moderate to high among these KOPs and, overall, result in a substantial degradation of the existing visual character or quality of the site and its surroundings.

The visual aspects evaluated according to Criterion C are organized into two categories: 1) construction impacts and 2) operational impacts.

Construction Impacts and Mitigation

Construction of the proposed project would cause temporary visual impacts due to the presence of equipment, materials, and workforce. These impacts would occur at the proposed solar power plant site and along the transmission line route. Construction would involve the use of cranes, heavy construction equipment, temporary storage and office facilities, and temporary laydown/staging areas. Construction would include site clearing and grading, construction of the actual facilities, and site cleanup and restoration. Visible traffic would also increase along I-10 and the BLM recreational access road during construction and grading activities would generate large dust clouds, which can be visually distracting if not controlled properly. Construction activities would be visible from I-10 (the primary travel corridor in the region), nearby BLM recreational access roads, the few residences in the area, SR 177, Palen McCoy Wilderness, and Chuckwalla Mountains Wilderness. Throughout the extensive construction period of approximately 33 months, the industrial character of the activities would constitute adverse and significant visual impacts. However, the vast majority of the area disturbed by construction would eventually be occupied by project facilities (see the “Operational Impacts and Mitigation” subsection below) though some areas of disturbed soil surfaces (characterized by high color, line and texture contrasts) would remain and would be visible from the various viewing vantage points. These areas of residual disturbance would require successful restoration. Proper implementation of Condition of Certification **VIS-2** would ensure that the visual impacts of residual disturbed areas associated with project construction remain less than significant. It is also anticipated that construction activity will take place at night. Implementation of Condition of Certification **VIS-3**, presented later in this analysis, would ensure that significant construction lighting impacts do not occur.

Operational Impacts and Mitigation

An analysis of operation impacts was conducted for the view areas represented by the key viewpoints selected for in-depth visual analysis. The results of the operation impact analysis are discussed below by KOP and presented in **Visual Resources Table 2**. The visual impacts of night lighting are discussed in a separate section of this analysis. For each KOP, an evaluation of visual contrast, project dominance, and view blockage is presented with a concluding assessment of the overall degree of visual change caused by the proposed project. Visual change is then considered within the context of viewers’ overall visual sensitivity to arrive at a determination of visual impact significance.

The analysis that follows is based in part on visual simulations provided by the project owner and reproduced at the end of this section. It should be noted that judgments of visual contrast and dominance should be based on reproductions of the simulations at ‘life-sized’ scale (i.e., at a scale that reproduces the viewing conditions as seen by the naked eye at the site of the KOP). Based on camera lens information provided to staff, this implies figure reproduction at approximately ledger-size, viewed at normal reading distance. It is also noted that brightness of glare sources such as the SRSGs cannot be reproduced in a printed (or projected) image.

KOP 1 – State Route 177 Corridor/Coxcomb Mountain (JTNP)

KOP 1 was selected to characterize the visual impact to residents, park visitors, and motorists on and around State Route (SR) 177, in the area northwest of the proposed project. KOP 1 is located near southbound SR 177, approximately 7 miles northwest of the project site and 8.7 miles to the nearest solar tower (background distance). The view is to the southeast and is depicted in **Visual Resources Figure 4A**. The existing landscape within the SR 177 corridor varies in character, quality, and sensitivity. Much of the corridor between Desert Center and the KOP is typified by disturbance from human activity in the foreground. From the vicinity of the KOP northward, views are intact and natural in appearance. In addition, a range of high-sensitivity viewers is present in this portion of the viewshed, including national park visitors and residents.

Visual Quality: Moderately low. The foreground to middleground views from SR 177 encompass a broad, open and predominantly undeveloped landscape, punctuated however by various signs of human habitation in the highway foreground, including rural residences, jojoba and palm farming, and an auto wrecking yard. From the vicinity of the KOP northward, views are intact and undisturbed by human uses. The KOP is also within the easternmost portion of the JTNP, where the park boundary adjoins SR 177. The landscape in this portion of the viewshed consists of a relatively non-descript, flat, grass- and shrub-covered plain, back-dropped by the angular forms of the Palen and Chuckwalla Mountains to the east and southeast, and the Granite and Coxcomb Mountains to the north. The mountain ranges add visual interest and contribute to the low-to-moderate rating for visual quality.

Viewer Concern: High. Viewer concern is considered particularly high at this KOP due to its location within the JTNP. Similarly, the Desert Lily ACEC is located a short distance from the KOP. In addition, residential viewers in the general SR 177 corridor, including homes along SR 177 and the Lake Tamarisk neighborhood to its west, would have high viewer concern. Viewers at commercial operations, such as farms, an auto-wrecking yard and the Chuckwalla Valley Raceway would have moderately low or low viewer concern. Viewer concern of motorists in this segment of SR 177 is considered moderate. Motorists' expectations would be moderated by the existing intrusion of visual disturbances, although some proportion of motorists would be en route to or from JTNP. Overall, however, due to the high sensitivity of national park, ACEC, and residential viewers, viewer concern in the SR 177 corridor is considered high.

Viewer Exposure: Moderately high. Site visibility is high in that the view of the site from KOP 1 is largely unobstructed. Although the site is at background distance from the KOP, the very tall and extremely bright towers would exert strong visual influence over an unusually large range, extending well into background distances. Based on available information, the SRSGs would be highly prominent from the SR 177 corridor, due particularly to glare. The number of viewers within the SR 177 corridor is moderate. The view duration for residents is high. For motorists view duration would be extended, with uninterrupted sightlines to the site for many miles of travel distance. The high visibility, moderate number of viewers, and extended duration of view would result in moderately high viewer exposure.

Overall Visual Sensitivity: Moderately high. For viewers at KOP 1 and along SR 177, the low-to-moderate visual quality combined with high viewer concern and moderately high viewer exposure result in an overall moderate-to-high visual sensitivity of the visual setting and viewing characteristics.

Visual Resources Figure 4B presents a visual simulation of the proposed project and illustrates the visibility of the project area as viewed from KOP 1.

Visual Contrast: High. As indicated in the simulation, the solar towers and taller features of the power block would remain visible even at this distance, presenting moderate form contrast even at background distances due to their vertical form against the horizontal ground plain. Form and texture contrast would be moderate. One of the two towers would penetrate the ridgeline of the mountains in the background. As depicted in the simulations, the heliostat fields would also be partly visible, and exhibit diffuse reflection of the sky that could be very bright under some conditions, presenting color and texture contrast somewhat similar to a lake surface reflecting the sun. However, as discussed in detail farther below, form and color contrast would tend to be rendered irrelevant in comparison to the brightness of the glare of the solar receivers. Based on available information, staff concluded that at the range of distances characteristic of the SR 177 corridor (very roughly 8 - 10 miles to the nearest solar receiver), viewers would be within the range of strong, significant glare impacts from the SRSGs. The illumination from the SRSGs at the tops of the two solar towers would be clearly visible from KOP 1 and throughout the SR 177 corridor, causing visual distraction and exacerbating the contrast associated with the project facilities. The resulting visual contrast of this combination of strong glare and form contrast would be high (see the **Visual Resources Table 2**).

In addition to glare impacts of the SRSGs, staff is concerned with potential impacts of very bright, inadvertent direct solar reflections from the heliostats (DSRH) caused by stray mirrors, particularly during pre-operation mirror calibration and testing. During full operation, it is assumed that such stray reflections will not occur. However, the intensity of even very transitory ground-based DSRH events are such that they would cause discomfort glare and constitute a significant visual and glare impact. This impact is discussed further under CEQA Criterion D, Light and Glare, below; and is fully addressed in Condition of Certification **TRANS-7**, Heliostat Positioning and Monitoring Plan.

Project Dominance*:* Dominant. As described previously, staff concluded that viewers at KOP 1 and the SR 177 corridor would be within the range of significant glare impacts.

The brightness of the receivers would dominate attention, could not be ignored by the viewer, and could cause discomfort in views toward the project. The proposed project also would appear prominent given the location of the two solar towers within (a) the center of Chuckwalla Valley (north to south) and (b) the center of a primary field of view toward the Palen and Chuckwalla Mountains across the valley. Overall, project dominance would be high.

View Blockage: Moderate. Glare from the solar receivers would make views toward those portions of the Palen and Chuckwalla Mountains near the solar receivers uncomfortable. The receivers would thus effectively block views of the Chuckwalla and Palen Mountains in those portions of the view in which the receivers are seen. The resulting view blockage would be moderate.

Overall Visual Change: Moderately high. Based on available information, from KOP 1, the values for visual contrast, project dominance, and view blockage, when taken together, constitutes a high level of overall visual change.

Visual Impact Significance: Adverse and significant. When considered within the context of the overall moderately high visual sensitivity of viewers in this portion of the viewshed, the moderately high visual change that would be perceived from KOP 1 would cause an adverse and significant visual impact.

Mitigation: Given the large scale of the impact area and the height and glare of the solar towers, no available mitigation measures were identified that would be adequate to mitigate the significant visual impacts to less than significant levels. However, if the amended project is approved, Energy Commission staff recommends the following conditions of certification to minimize structure contrast and lighting and glare impacts to the extent possible: **VIS-1**, Surface Color Treatment of Structures; **VIS-2**, Revegetation of Disturbed Soil Areas; **VIS-3**, Temporary and Permanent Exterior Lighting. Conditions of Certification **VIS-1**, **VIS-2**, and **VIS-3** are from the Commission Decision. Staff also recommends Condition of Certification **TRANS-7** to address inadvertent DSRH glint impacts, both during and prior to project operation.

Residual Impact Significance After Mitigation. No mitigation measures were identified by Energy Commission staff to fully address impacts. Impacts would remain significant and unavoidable.

KOP 2 – Northwest of Desert Center/Big Wash (JTNP)

KOP 2 was selected to characterize the visual impact to recreationists accessing the Joshua Tree National Park, and is the second nearest location to the project within the JTNP after KOP 1. KOP 2 is located at the eastern edge of the hills west of Desert Center and SR 177, approximately 13 miles northeast of the project site and approximately 15 miles from the nearest SRSG. The view is across the Chuckwalla Valley to the southeast and is depicted in **Visual Resources Figure 5A**. This location provides an open and unobstructed view of the site that would be experienced by recreationists seeking an off-road and backcountry recreational experience. The foreground to middleground terrain is flat and supports sparse desert scrub vegetation. The existing landscape appears predominantly natural in appearance and is absent any built features. Visible in the background are the angular forms of the Palen and Chuckwalla Mountains.

Visual Quality: Moderate. The foreground to middleground views encompass a broad, open and undeveloped landscape consisting of a relatively non-descript, flat, grass- and shrub-covered plain, back-dropped by the angular forms of the Palen Mountains (adjacent and to the east of the site). As depicted in the KOP, visual disturbance from human activity is relatively minimal in views toward the site from this portion of the viewshed (JTNP), which is visually isolated by terrain from the Eagle Mine and Hayfield pumping station to the north. The mountain range adds visual interest and contributes to the moderate rating for visual quality.

Viewer Concern: High. Viewers within the JTNP are considered by definition to have high viewer concern, and undisturbed scenery is a primary expectation of such viewers. In general, as the landscapes along the I-10 corridor and within the Chuckwalla Valley become more and more industrialized with the addition of built features with industrial character, opportunities for recreational experiences that offer expansive views of intact and natural-appearing desert landscapes are rapidly diminishing. Thus, the off-road, backcountry recreationists seeking unspoiled landscapes and a respite from the highly urbanized areas of Southern California to the west would be highly sensitive to the introduction of industrial character to this naturally appearing landscape, and would perceive such as an adverse visual change. Therefore, overall viewer concern is rated high.

Viewer Exposure: Moderately high. Site visibility is high in that the view of the site from KOP 2 is unobstructed. As described under KOP 1, although the site is quite distant from KOP 2, the brightness of glare from the SRSGs is expected to greatly accentuate the prominence, dominance and contrast of the project, even at such background distances. Although the precise level of brightness at this distance is not known, based on the information currently available, the SRSGs are anticipated to remain prominent at this viewing distance (15 miles). While the number of viewers would be low, the view duration would be extended, with uninterrupted views to the site from KOP 2 and its vicinity occurring for substantial distances at low travel speeds. The high visibility, low numbers of viewers and extended duration of view would result in moderately high viewer exposure.

Overall Visual Sensitivity: Moderately high. For viewers at KOP 2 and along nearby access roads, the moderately low visual quality combined with high viewer concern and moderately high viewer exposure result in an overall moderate-to-high visual sensitivity of the visual setting and viewing characteristics.

Visual Resources Figure 5B presents a visual simulation of the proposed project site and illustrates the visibility of the project area.

Visual Contrast: Moderate. From this KOP, form contrast of the towers would be low. Their vertical form would contrast with the predominantly horizontal lines of the setting and would penetrate the ridgeline of background mountains, drawing the eye, but their magnitude in the overall field of view would be subordinate to other features in the view. Taller power block features, including the air-cooling condensers, would also be visible but would present a subordinate level of form contrast. If the concern were the project structures alone, project contrast at this distance would be moderately low or low. However, as described previously in KOP 1, the brightness of the solar receivers would be sufficiently intense as to render other aspects of visual contrast secondary. Based on currently available information, this KOP, at a distance of approximately 14 miles from the nearest solar tower, is expected to lie outside the range of significant glare impact identified by staff. However, contrast from glare at this KOP is anticipated to remain moderate.

Project Dominance: Co-dominant. Based on available information, KOP 2 is believed by staff to be outside of the range of significant glare impacts from the SRSGs. However, they would remain evident as very bright, although small, points of light, which would contrast with the visual background and attract attention. The mirror fields would appear relatively inconspicuous at this distance, unless bright glint reflections occurred off mirrors under certain conditions. These conditions would be transitory however. With recommended Condition of Certification **TRANS-7**, glint effects would remain considerably less bright than the SRSGs. Overall project dominance would be co-dominant. Staff considers that SRSG brightness could remain at least moderate and co-dominant from KOP 2. (The reader is referred to **APPENDIX TT1 VISUAL SAFETY IMPACT ASSESSMENT** in the **TRAFFIC AND TRANSPORTATION** section of this document.)

View Blockage: Moderately low. At these distances, glare from the solar receivers would remain prominent in views looking toward the Palen and Chuckwalla Mountains. However, at this distance the proportion of the field of view affected by the project in its entirety remains quite small, as depicted in the simulation. From the vicinity of KOP 2, the solar towers would not block large portions of the Chuckwalla Valley floor, the background Palen and Chuckwalla Mountains, or the sky from view, but the towers would be higher and more prominent than the mountains in the nearby background, and their reflected sunlight would be apparent in views in the direction of the towers. Overall, the resulting view blockage from the effect of glare would be considered moderately low.

Overall Visual Change: Moderate. Based on available information, the values for visual contrast, project dominance, and view blockage, when taken together, constitute a moderate level of overall visual change.

Visual Impact Significance: Adverse and significant. Due to the location within JTNP, based on available information, when considered within the context of viewers' overall moderately high visual sensitivity, the moderate visual change that would be perceived from KOP 2 would represent an adverse and significant visual impact.

Mitigation: Given the large scale of the impact area, no available mitigation measures were identified that would be adequate to mitigate the potentially significant visual impacts to a less than significant level. However, if the amended project is approved, Energy Commission staff recommends the following conditions of certification to minimize structure contrast and lighting and glare impacts to the extent possible: **VIS-1**, Surface Color Treatment of Structures; **VIS-2**, Revegetation of Disturbed Soil Areas; **VIS-3**, Temporary and Permanent Exterior Lighting.

Residual Impact Significance After Mitigation: No measures were identified by Energy Commission staff to fully address impacts. Impacts would remain potentially significant and unavoidable.

KOP 3 – Eastbound Interstate 10

KOP 3 was selected to characterize the visual impact to motorists on I-10 in the immediate vicinity of the proposed project. KOP 3 is located on eastbound I-10, just east of the Corn Springs Road/I-10 eastbound on-ramp, approximately 0.5 mile west of the project site. The view is to the east as depicted in **Visual Resources Figure 6A.** Views from I-10 near the project provide an open and unobstructed view of the site. The foreground to middleground terrain is flat and supports sparse desert scrub vegetation. The existing landscape appears absent any built features and is natural in appearance. The project would be visible in the foreground. To the north and east of the site (background mountains in the image) are the Palen Mountains and Palen McCoy Wilderness. To the north and north-northwest of the site (beyond the frame of the image) are the Granite and southern end of the Coxcomb Mountains, and Joshua Tree National Park.

Visual Quality: Moderate. The foreground to middleground views from I-10 encompass a broad, open and predominantly undeveloped landscape consisting of a relatively non-descript, flat, grass- and shrub-covered plain, backdropped by the striking angular forms of the Palen Mountains and the more distant Granite and Coxcomb Mountains to the north. The mountain ranges add visual interest and contribute to the moderate rating for visual quality. Existing visual disturbances in the highway corridor include existing transmission lines, commercial uses of Desert Center, and the Red Bluff substation, under construction roughly 3.9 miles west of the project site.

Viewer Concern: Moderately high. Typically, viewer concern of highway motorists is considered moderate. However, as the landscapes along the I-10 corridor become more and more industrialized with the addition of built features with industrial character, opportunities for expansive views of natural appearing desert landscapes are rapidly diminishing. Combined with the high volume of travelers on I-10 (the primary travel corridor between Southern California and Phoenix) and viewer expectations of observing higher quality landscape features while traveling through a designated conservation area (CDCA), travelers would be highly sensitive to the introduction of industrial character to this naturally appearing landscape, which would be perceived as an adverse visual change. Therefore, overall viewer concern is rated moderately high.

Viewer Exposure: High. Site visibility is high in that the view of the site from KOP 3 is unobstructed at foreground viewing distances. The number of viewers is high and the view duration for motorists on I-10 would be extended, with uninterrupted sightlines to the site from I-10 extending out many miles of travel. The high visibility and number of viewers and extended duration of view would result in high viewer exposure.

Overall Visual Sensitivity: Moderately high. For viewers at KOP 3 and along I-10, the moderate visual quality combined with moderately high viewer concern and high viewer exposure result in an overall moderately high visual sensitivity of the visual setting and viewing characteristics.

Visual Resources Figure KOP 6B presents a visual simulation of the proposed project as viewed from KOP 3.

Visual Contrast: High. The proposed project would add prominent industrial features to the foreground landscape, including the prominent vertical forms of the solar towers, air-cooled condensers, heliostat fields, and nearby segment of the transmission line to the Red Bluff substation.

As depicted in the simulation of KOP 3 (**Visual Resources Figures 6B)**, form contrast of the towers alone would be very strong at this distance, their vertical form contrasting strongly with the predominantly horizontal lines of the existing valley floor landscape, and breaking the ridgeline of the Palen Mountains in the background. The 750-foot-tall towers would appear massive at this distance (approximately 1.5 mile to the nearest tower). For purposes of comparison, the solar towers would be the third-tallest structures in San Francisco, with a luminous receiver area of approximately 12 stories in height. From the vicinity of I-10, lower project features such as the air-cooling unit, transmission towers, and the heliostat fields would also be prominent, adding a further highly industrial character to views.

However, as described previously, form and color contrast of the towers would be rendered less relevant due to the extreme brightness of the solar receivers, which at this distance would be so bright that viewers would avoid looking directly at the towers. As discussed below under the “Criterion D, Light and Glare” subsection, at this distance (approximately 1.5 mile from the nearest tower) the receivers would appear roughly as large in magnitude within the viewer’s field of vision (subtended visual angle) as the sun, and would be sufficiently bright as to constitute a highly dominant and distracting visual feature. At this distance, the visual effect could thus be subjectively similar to two additional suns in the sky. Although the level of brightness would not cause physical harm to viewers’ vision, it would make the towers visually highly dominant, and would strongly disrupt the experience of the natural landscape. The resulting level of visual contrast due to glare would be high. In addition, high levels of diffuse sky reflection off the heliostats are anticipated during certain hours of the day, extending the area of high project contrast over large portions of the visual field.

Project Dominance: Dominant. At this distance, the solar receiver towers would exert strong scale dominance, as the only comparable vertical element within the immediate field of view in a setting characterized by flat, horizontal topography. The brightness of the solar receivers, however, would be the dominating visual element of the landscape, strongly demanding viewers’ attention. Overall project dominance would be high.

View Blockage: High. From the vicinity of KOP 4, glare from the solar receivers would intrude strongly into views in the direction of the Palen Mountains. In effect, the receivers would thus effectively block views of the Palen Mountains from this general area by distracting viewers, or causing them to avert their gaze. View blockage is thus considered high.

Overall Visual Change: High. From KOP 4, the values for visual contrast, project dominance, and view blockage, when taken together, constitutes a high level of overall visual change.

Visual Impact Significance: Adverse and significant. When considered within the context of the overall moderately high visual sensitivity of the existing landscape and viewing characteristics, the high visual change that would be perceived from KOP 4 would cause an adverse and significant visual impact.

Mitigation: Given the large scale of the impact area, no available mitigation measures were identified that would be adequate to mitigate the significant visual impacts to levels that would be less than significant. However, if the amended project is approved, Energy Commission staff recommends the following conditions of certification to minimize structure contrast and lighting and glare impacts to the extent possible: **VIS-1**, Surface Color Treatment of Structures; **VIS-2**, Off-Site Landscape Screening; **VIS-3**, Revegetation of Disturbed Soil Areas; **VIS-4**, Temporary and Permanent Exterior Lighting. Staff also recommends Condition of Certification **TRANS-7** to address inadvertent DSRH glint impacts.

Residual Impact Significance After Mitigation: No measures were identified by Energy Commission staff to fully address impacts. Impacts would remain significant and unavoidable.

KOP 4 – Westbound Interstate 10

Like KOP 3, KOP 4 represents the experience of motorists on I-10 in the immediate vicinity of the proposed project. For purposes of comparison to KOP 3, which is at middleground distance, KOP 4 is located on westbound I-10, approximately 6.4 miles southeast of the project site, at background distance. The view is to the northwest as depicted in **Visual Resources Figure 7A**. Viewing conditions are as described previously under KOP 3.

Visual Quality, Viewer Concern, and Viewer Exposure: Visual quality, viewer concern, and viewer concern from I-10 near the project site were described above under KOP 3.

Overall Visual Sensitivity: Moderately high. As under KOP 3, for viewers at KOP 4 and along I-10, the moderate visual quality combined with moderately high viewer concern and high viewer exposure result in an overall moderate-to-high visual sensitivity of the visual setting and viewing characteristics.

Visual Resources Figure 7B presents a visual simulation of the proposed project as viewed from KOP 4.

Visual Contrast: High. As described under KOP 3, the proposed project would add prominent industrial features to the landscape of I-10, including the prominent vertical forms of the solar towers, air-cooled condensers, heliostat fields, and nearby segment of the transmission line to the Red Bluff substation. From background distances such as KOP 4, the form contrast of the project features would be moderate. However, based on available information, even at this distance (6.4 miles from project), SRSG glare is anticipated to be strong, demanding viewers' attention, eliciting visual fixation and afterimages, and representing a high degree of contrast. In addition, high levels of bright, diffuse glare off portions of the heliostat fields are anticipated during certain hours of the day, extending high project contrast over a large portion of the field of view.

Project Dominance: Dominant. Dominance of project features alone would be moderate. However, even at this background distance the level of glare from the SRSGs would strongly demand viewers' attention and could not be ignored.

View Blockage: High. From the vicinity of KOP 4, glare from the solar receivers would intrude into views in the direction of the Eagle and Coxcomb Mountains, strongly altering the perception of the natural landscape. In effect, the receivers would thus tend to block views of the Eagle and Coxcomb Mountains from this general area by distracting viewers or causing them to avert their gaze. View blockage is thus considered high.

Overall Visual Change: High. From KOP 4, the values for visual contrast, project dominance, and view blockage, when taken together, constitute a high level of overall visual change.

Visual Impact Significance: Adverse and significant. When considered within the context of the overall moderately high visual sensitivity of the existing landscape and viewing characteristics, the high visual change perceived from KOP 4 would cause an adverse and significant visual impact.

KOP 5 – Corn Springs Road/Chuckwalla Mountains Wilderness

KOP 5, **Visual Resources Figure 8A,** depicts the view from Corn Springs Road, within the Chuckwalla Mountains Wilderness. Corn Springs Road provides access to the wilderness area, and to the BLM Corn Springs Campground, a popular recreational destination located, atypically, within the wilderness area. The campground, noted for a palm oasis and exceptional archaeological features, lies outside of the viewshed of the PSEGS, visually isolated by intervening mountains. KOP 5 is located in the northeast portion of the wilderness area, approximately 3.5 miles southwest of the project site, and roughly 4.7 miles from the nearest solar tower (middleground distance). Open and unobstructed views of the site would be experienced both by recreationists seeking the backcountry recreational wilderness experience and by visitors enroute to and from the Corn Springs Campground. Views in the WA are characterized by panoramic vistas of the project site, Chuckwalla Valley and beyond, seen from an elevated position. The middleground to background view encompasses the flat valley floor, backdropped by the rugged and vivid forms of the Palen, Granite and Coxcomb Mountains. From this vantage point, the existing landscape appears predominantly natural in appearance and is absent any noticeable built features except for the thin linear form of I-10 that passes through the valley.

Visual Quality: Moderately high. As depicted in **Visual Resources Figure 8A**, the middleground to background panoramic vistas from even the lower north-facing foothills of the Chuckwalla Mountains Wilderness encompass broad expanses of the low-lying Chuckwalla Valley, dry lake bed, and bajadas ringed by rugged, angular mountain ranges that appear to rise abruptly from the flat valley floor. Visual integrity of the dramatic desert landscape is relatively high. The Sunrise Powerlink transmission lines, development of Desert Center and the thin line of I-10 are visible in the distance but remain subordinate within the view. The elevated perspective from KOP 5 thus provides a panoramic overview of the relatively intact valley landscape over vast distances. Overall visual quality is moderately high.

Viewer Concern: High. Backcountry recreationists seeking the desert wilderness experience would expect to find viewing opportunities that offer expansive views of intact and natural appearing desert landscapes with minimal if any industrial character. These backcountry and wilderness visitors would be highly sensitive to the introduction of industrial character to this naturally appearing landscape, and would perceive such additions as an adverse visual change. Therefore, overall viewer concern is rated high.

Viewer Exposure: Moderately high. Viewer exposure is high in that the view toward the project site from KOP 5 is both unobstructed and elevated. From this elevated position, expansive, panoramic views of the surface of the valley floor and project site are visible in the distance below. The large scale of the project would render the project highly prominent in the field of view to the north, even at a 5-mile viewing distance. While the number of viewers would be low, the view duration would be extended from throughout the northeastern portion of the Chuckwalla Mountains Wilderness. Viewer numbers would be somewhat higher than typical in wilderness areas due to use of the campground and accessibility provided by Corn Springs Road. The high visibility, low numbers of viewers and extended duration of view would result in moderately high viewer exposure.

Overall Visual Sensitivity: Moderately high. For viewers at KOP 5 and other nearby viewing areas within the Chuckwalla Mountains Wilderness, the moderately high visual quality combined with high viewer concern and moderately high viewer exposure result in overall moderately high visual sensitivity.

Visual Resources Figure 8B presents a visual simulation of the proposed project form KOP 5.

Visual Contrast: High. The proposed project would convert a substantial portion of the existing, natural-appearing desert valley landscape to an industrial facility that would be characterized (at a five-mile viewing distance) by geometric forms and prominent horizontal and vertical lines and industrial colors and surface textures. The project, occupying 5.9 square miles of the valley floor, would dominate a large portion of the northward field of view. Because of the elevated perspective, a majority of the facility would be visible including both towers, the power blocks, heliostat field, and transmission line, though at this viewing distance (approximately five miles) many structural details would not be discernible. As suggested in the simulation, the heliostat fields, viewed from an elevated position, would display large areas of diffuse reflection somewhat like a lake surface, which would vary in brightness with hour and season. Overall the introduced industrial characteristics are highly contrastive with the existing landscape.

However as discussed previously, the brightness of the solar receivers would be sufficiently intense as to render other aspects of visual contrast less relevant. The receivers, visible in this KOP at middleground to background distance, would be perceived as extremely bright light sources demanding attention and causing visual distraction when in the field of view. As such, visual contrast of the project from KOP 5 is considered high.

Project Dominance: Dominant. The proposed project would appear prominent given the spatial prominence of the proposed facility within (a) the center of Chuckwalla Valley (north to south) and (b) the center of a primary field of view toward the Coxcomb, Granite, and Palen Mountains across the valley. The proposed project would dominate views of the broad valley floor surface and strongly intrude into views of the background mountains. Overall, the solar receivers would dominate the visual environment, could not be ignored, and would cause discomfort in views in the direction of the towers over a broad area. Overall project dominance would be high.

View Blockage: Moderately high. Glare from the solar receivers would intrude strongly into views northward from within a broad area of the northeastern Chuckwalla Mountains Wilderness, prominently altering their character from a natural desert landscape to a predominantly industrial one. A From the vicinity of KOP 5, the heliostat fields would also block from view a noticeable and central portion of the Chuckwalla Valley floor. The resulting view blockage would be moderately high.

Overall Visual Change: High. The project would demand attention, could not be overlooked, and would be dominant in the landscape. From KOP 5, the values for visual contrast, project dominance, and view blockage, when taken together, would constitute a high level of overall visual change.

Visual Impact Significance: Adverse and significant. When considered within the context of the overall moderately high visual sensitivity of the existing landscape and viewing characteristics, the high visual change that would be perceived from KOP 5 would cause a significant and unavoidable visual impact.

Mitigation: Given the large scale of the impact area, no available mitigation measures were identified that would be adequate to mitigate the significant visual impacts to levels that would be less than significant. However, if the amended project is approved, Energy Commission staff recommends the following conditions of certification to minimize structure contrast and lighting and glare impacts to the extent possible: **VIS-1**, Surface Color Treatment of Structures; **VIS-2**, Revegetation of Disturbed Soil Areas; **VIS-3**, Temporary and Permanent Exterior Lighting.

Residual Impact Significance After Mitigation: No measures were identified by Energy Commission staff to fully address impacts. Impacts would remain significant and unavoidable.

KOP 6 – Palen McCoy Wilderness

KOP 6 represents the visual impact to recreationists in the Palen McCoy Wilderness. KOP 6 is located on a ridge in the southwestern portion of the wilderness area. The elevated view to the southwest is depicted in **Visual Resources Figure 9A**. This location provides an open and unobstructed elevated view of the site that would be experienced by recreationists seeking the backcountry wilderness experience, with panoramic vista views of the Chuckwalla Valley and beyond. The middleground to background view encompasses the flat valley floor, backdropped by the rugged, angular forms of the Chuckwalla Mountains. From this elevated vantage point, the existing landscape appears predominantly natural in appearance and is absent any noticeable built features except for the thin linear form of I-10 that passes through the valley and some rectilinear fields of irrigated agriculture whose green color contrasts with the surrounding area.

Visual Quality: Moderately high. The middleground to background panoramic views from the ridges along the southern flanks of the Palen McCoy Wilderness encompass broad expanses of the Chuckwalla Valley, ringed by rugged, angular mountain ranges that rise abruptly from the flat valley floor, contributing a vivid, dramatic element. Visual integrity of the desert landscape is high, with minimal intrusions of visually discordant built features to interrupt the distinctive basin-range physiography. The elevated perspective of KOP 6 enables views of considerable visual interest, and overall visual quality is rated moderately high.

Viewer Concern: High. Backcountry recreationists seeking the desert wilderness experience would expect to find viewing opportunities that offer expansive views of intact and natural appearing desert landscapes with minimal if any industrial character, particularly within the California Desert Conservation Area. These backcountry and wilderness visitors would be highly sensitive to the introduction of industrial character to this naturally appearing landscape, and would perceive such additions as an adverse visual change. Therefore, overall viewer concern is rated high.

Viewer Exposure: Moderate. Site visibility is high in that the view of the site from KOP 6 is unobstructed at a middleground viewing distance and the site is central to the field of view. While the number of viewers would be very low, the view duration would be extended from the vista viewpoints along the southern ridges of the Palen McCoy Wilderness. The high visibility, very low numbers of viewers and extended duration of view would result in moderately high viewer exposure.

Overall Visual Sensitivity: Moderately high. For viewers at KOP 6 and other nearby viewing areas within the Palen McCoy Wilderness, the moderately high visual quality combined with high viewer concern and moderate viewer exposure result in an overall moderately high visual sensitivity.

Visual Resources Figure 9B presents a visual simulation of the proposed project from KOP 6.

Visual Contrast: High. The proposed project would convert a substantial portion of the existing, natural-appearing landscape to an industrial facility that would be characterized by rectilinear and geometric forms with strong horizontal and vertical lines and industrial and reflective surfaces. Because of the elevated perspective, the entire facility would be visible, including both towers, the power blocks, heliostat field, and transmission line. These introduced industrial characteristics would contrast strongly in form, line, color and texture with the existing landscape.

As described previously, the brightness of the solar receivers would be sufficiently intense as to render other aspects of visual contrast less relevant. From this typical KOP, the solar receivers would be visible at a distance of between 5 and 6 miles and would be perceived as extremely bright light sources demanding attention and contrasting strongly with the natural background landscape when in the field of view. As such, visual contrast of the project from KOP 6 is considered high.

Project Dominance: Dominant. The proposed project would appear highly prominent given the great spatial extent of the proposed facility within (a) the center of Chuckwalla Valley (north to south) and (b) the center of a primary field of view toward the southwest and the Chuckwalla Mountains across the valley. The proposed project would occupy a large proportion of the valley floor as seen from south- and west-facing slopes in the southernmost area of the Palen McCoy Wilderness. Most significantly, the glare of the solar receivers would dominate the visual environment over a substantial portion of both lowlands and highlands in the south- and west-facing areas of the wilderness. The glare of the SRSGs could not be ignored, and would dominate views in the direction of the towers. Overall project dominance would be high.

View Blockage: Moderately high. Glare from the solar receivers would intrude strongly into views in the direction of the project from within a large area of the wilderness. In addition, from elevated viewpoints such as KOP 6, the project facilities would block from view a substantial and central portion of the Chuckwalla Valley floor. The resulting view blockage would be moderately high.

Overall Visual Change: High. The project would demand attention, could not be overlooked, and would be dominant in the landscape. From KOP 6, the values for visual contrast, project dominance, and view blockage, when taken together, would constitute a high level of overall visual change.

Visual Impact Significance: Adverse and significant. When considered within the context of the overall moderately high visual sensitivity of the existing landscape and viewing characteristics, the high visual change that would be perceived from KOP 6 would cause an adverse and significant visual impact.

Mitigation: Given the large scale of the impact area, no available mitigation measures were identified that would be adequate to mitigate the significant visual impacts to levels that would be less than significant. However, if the amended project is approved, Energy Commission staff recommends the following conditions of certification to minimize structure contrast and lighting and glare impacts to the extent possible: **VIS-1**, Surface Color Treatment of Structures; **VIS-2**, Revegetation of Disturbed Soil Areas; **VIS-3**, Temporary and Permanent Exterior Lighting.

Residual Impact Significance After Mitigation: No measures were identified by Energy Commission staff to fully address impacts. Impacts would remain significant and unavoidable.

Visual Resources Table 2
KOP Ratings: Visual Sensitivity/Visual Change and Impact Significance under CEQA Criterion C

KOP No.	VISUAL SENSITIVITY (Existing Condition)						
			Viewer Exposure				
	Visual Quality	Viewer Concern	Visibility	No. of Viewers	Duration of View	Overall Viewer Exposure	Overall Visual Sensitivity
1 SR 177 Corridor/ Coxcomb Mt. (JTNP)	Moderately low	High	High	Moderat e	High	Moderately high	Moderately high
2 Northwest of Desert Center/ Big Wash (JTNP)	Moderate	High	High	Low	High	Moderate to High	Moderately high
3 Eastbound I-10	Moderate	Moderately high	High	High	High	High	Moderately high
4 Westbound I-10	Moderate	Moderately high	High	High	High	High	Moderately high
5 Corn Springs Road/ Chuckwalla Mountains Wilderness	Moderately high	High	High	Low	High	Moderately high	Moderately high
6 Palen McCoy Wilderness	Moderate high	High	High	Very Low	High	Moderate	Moderately high

KOP No.	VISUAL CHANGE (Project Effect)			
	Contrast	Dominance	View Blockage	Overall Visual Change
1 SR 177 Corridor/ Coxcomb Mt. (JTNP)	High	Dominant	Moderate	Moderately high
2 Northwest of Desert Center/ Big Wash (JTNP)	Moderate	Co-Dominant	Moderately low	Moderate
3 Eastbound I-10	High	Dominant	High	High
4 Westbound I-10	High	Dominant	High	High

5 Corn Springs Road/ Chuckwalla Mountains Wilderness	High	Dominant	Moderately high	High
6 Palen McCoy Wilderness	High	Dominant	Moderately high	High

KOP No.	**KOP VISUAL IMPACT SIGNIFICANCE DETERMINATION – (CEQA Criterion C)**			
	Overall Visual Sensitivity	**Overall Visual Change**	**Visual Impact Significance**	**Mitigation (See Staff Proposed KOP Visual Mitigation Measures)**
1 SR 177 Corridor/ Coxcomb Mt. (JTNP)	Moderately high	High	Significant	VIS-1, -2, -3, -4 Significant and unavoidable
2 Northwest of Desert Center/ Big Wash (JTNP)	Moderately high	Moderate	Significant	VIS-1, -2, -3, -4 Significant and unavoidable
3 Eastbound I-10	Moderately high	High	Significant	VIS-1, -2, -3, -4 Significant and unavoidable
4 Westbound I-10	Moderately high	High	Significant	VIS-1, -2, -3, -4 Significant and unavoidable
5 Corn Springs Road/ Chuckwalla Mountains Wilderness	Moderately high	High	Significant	VIS-1, -2, -3, -4 Significant and unavoidable
6 Palen McCoy Wilderness	Moderately high	High	Significant	VIS-1, -2, -3, -4 Significant and unavoidable

Non-operation and Facility Closure

After the end of the project’s useful life, owner would be required to close the facility. The complete removal of the facility would leave a very prominent visual impact over the entire site due to the strong color contrast created between graded, disturbed soil areas and undisturbed soil areas near the project site. In addition, revegetation of areas in this desert region are difficult and generally of limited success. Thus, visual recovery from land disturbance of the facility closure would likely occur only over a very long period of time.

D. Light And Glare

"Would the project create a new source of substantial light or glare that would adversely affect daytime or nighttime views in the area?"

Glare is defined as a difficulty in seeing in the presence of bright light, and is caused by a significant ratio of luminance between the task (that which is being looked at) and the glare source. Glare can be generally divided into two types, **discomfort** glare and **disability** glare. Discomfort glare results in an instinctive desire to look away from a bright light source or difficulty in seeing a task. Disability glare renders the task impossible to view, such as when driving westward at sunset.

To analyze the potential for significant glare impacts, staff relied on SRSG luminance data provided by the project owner, as well as past technical studies of the anticipated luminance properties of solar receivers, conducted by staff for other projects. According to data provided by the project owner in response to Data Request Set 3, the SRSGs would have a maximum luminance of $1X10^6$ cd/ m^2. On that basis, staff concluded that the SRSGs would appear very bright and distracting, demanding visual attention and eliciting visual fixation to distances of 10 miles or greater, but would not be a source of either discomfort or disability glare. However, based on the luminance level cited and an analysis of the project site and viewing conditions, staff concluded that SRSG brightness would be very high, dominating the landscape when in the field of view, demanding viewers' attention, and exhibiting high levels of visual contrast to distances of 10 miles or greater. Under conditions of moderate or high overall visual sensitivity of viewers, this level of contrast was considered a significant adverse visual impact.

(Please refer to the detailed discussion of glare effects found in the **TRAFFIC AND TRANSPORTATION** section, **APPENDIX TT1 – VISUAL SAFETY IMPACT ASSESSMENT)**.

Non-Mirror Facility Surfaces:

No. Surfaces of the facilities of the PSEGS project (excluding the solar receivers and the mirrored surfaces of the heliostats, which are discussed below) have the potential to introduce reflected glare into the visual environment. With the effective implementation of Condition of Certification **VIS-1** from the PSPP Commission Decision, the project would use colors and finishes on surfaces that do not cause excessive glare and would be in harmony with the project's desert environment (with the exception of the heliostat mirrors and SRGSs, discussed below).

Heliostats:

Yes. Staff is concerned with the potential for inadvertent direct solar reflections from the heliostats (DSRH), both during and prior to project operation, particularly during the project's mirror-calibration phase. DSRH are judged to be in excess of the threshold for discomfort glare for minimum viewing distances of 10 miles. As such staff recommends that all reasonable actions be taken to mitigate these events during site construction, testing and operations. Recommended measures to address DSRH can be found in Condition of Certification **TRANS-7**, Heliostat

Positioning and Monitoring Plan. This condition is anticipated to reduce DSRH impacts to less-than-significant levels.

When observed from a distance during operations the heliostat fields generally reflect a portion of the sky to the viewer. In the region closer to the tower the heliostats often reflect a portion of the sky in greater proximity to the sun and these regions appear brighter and whiter producing a low to moderate level of sustained glare depending on viewing geometry and range. Elsewhere in the mirror field, reflections of the sky are visible ('lake effect'). These heliostat reflections from the mirror fields as a whole would be prominent and would contribute to the overall visual contrast of the project as seen from various KOPs, as discussed under Criterion C, above. However, this type of heliostat glare would not cause either disability or discomfort glare and is not considered a significant glare impact here under Criterion D.

Solar Power Towers/SRSGs:

Yes. Energy Commission staff has determined that the visual impact of glare from the SRSGs will have a significant and unavoidable visual impact.

The principal anticipated project visual impact would result from glare of the SRSGs. For purposes of this analysis, the potential for significant glare impacts have relied on SRSG luminance data provided by the project owner, as well as past technical studies of the anticipated luminance properties of solar receivers, conducted by staff for other projects. According to data provided by the project owner in response to Data Request Set 3, the SRSGs would have a maximum luminance of $1X10^6$ cd/m^2. On that basis, staff concluded that the SRSGs would appear very bright and distracting, demanding visual attention and eliciting visual fixation to distances of 10 miles or greater, but would <u>not</u> be a source of either discomfort or disability glare. However, based on the anticipated luminance level cited and an analysis of the project site and viewing conditions, staff concluded that SRSG brightness would appear very high, dominating the landscape when in the field of view, demanding viewers' attention, and exhibiting high levels of visual contrast to distances of 10 miles or greater. Under conditions of moderate or high overall visual sensitivity of viewers, this level of contrast was considered a significant adverse visual impact.

Staff is also concerned with potential glare from shield structures located directly above and below the SRSGs. These reflective structures shield the tower support structure from heat of stray heliostat reflections. If inadvertently lit by stray mirror reflections, these surfaces have the potential to act as large glare sources and, because they are reflective, have the potential to be brighter glare sources than the SRSGs themselves. If inadvertently lit in this way, the shields would contribute to a larger and brighter combined glare source than the SRSGs alone. However, with recommended Condition of Certification **TRANS-7**, this impact could be avoided.

Night Lighting and FAA Safety Lighting:

No, with recommended conditions. Nighttime light pollution could result from project operational lighting, and from FAA warning lighting required on the solar towers. With effective implementation of light trespass mitigation measures as described in Condition of Certification **VIS-4** (VIS-3 from the Commission Decision), the project's off-site operation-related lighting impacts, excluding FAA safety lighting, would be less than significant. Condition of Certification **VIS-4** requires a comprehensive lighting plan be submitted to Riverside County for review and comment and to the Energy Commission compliance project manager (CPM) for review and approval. Staff recommends Condition of Certification **VIS-4** to ensure full compliance and verification of night lighting measures.

The addition of the aviation safety lighting would alter the nighttime appearance of the project area and would be visible in the night sky due to the height of the towers and the number of lights required by the towers' size. The brightest FAA-required lighting, of medium- or high-intensity white flashing lights, would apply during the day and twilight. At night, these would be replaced by less bright, flashing red safety lighting. Due to the height of the towers, FAA could require either high-intensity flashing white lights or non-luminous marking in addition to medium-intensity flashing white lights for daytime and twilight use. Staff observes that during daytime operation, both high-intensity FAA lighting *and* non-luminous marking would tend to be visually obscured by the much greater brightness of SRSG glare. Since views in the direction of the solar towers during daytime would tend to cause viewers to avert their gaze, both the safety lighting and tower marking would be of less importance than the brighter SRSG glare.

Nighttime light pollution impacts would be of particular concern to visitors to the Palen/McCoy WA, the Chuckwalla Mountains WA, and the JTNP. The pristine, completely unlit night sky is part of the attraction of virtually all WAs within the California desert, and is often cited as a valued attraction of the desert for campers (IDSA, 2010). However, staff concluded that night light pollution effects of the project, including night-time FAA lighting, with appropriate mitigation measures as described in Condition of Certification **VIS-4**, would not be substantial beyond background distances of very roughly 4 or 5 miles. The project would be visible from the portions of Palen/McCoy and Chuckwalla Mountains WAs that lie within this estimated radius of substantial night lighting effect. Camping is permitted throughout the WAs and it is assumed that camping may occur at undesignated sites within 4 miles of the project site. The Corn Springs Campground is located on Corn Springs Road approximately five miles southwest of the project site, in an east-west canyon that screens views of the project site from the campground. Therefore, campers at the Corn Springs Campground would not be affected by project night lighting. Project lighting effects would potentially be more pronounced to WA visitors within 4 miles of the project. With Condition of Certification **VIS-4**, off-site effects of bright operational lighting of the power block would be mitigated to a less-than-significant level. Therefore, the primary nighttime lighting effect to such WA visitors would result from required red FAA nighttime safety lighting. This would be visible in campers' night sky views, which would no longer have a pristine, unlit character and become more urban. The safety lighting would not, however, represent a very bright or highly distracting light source. It was assumed that campers with concern for pristine, completely unlit night skies could seek that experience in more remote locations of the WAs. This, together with the fact that the number of visitors to the WAs is believed to be low, leads staff to the conclusion that night lighting impacts to visitors in the WAs would be less-than-significant.

Two nighttime simulations of the PSEGS, prepared by the project owner, are reproduced at the end of this section as **Visual Resources Figures 10A and 10B, and 11A and 11B.** Staff comments on these simulations may be found under staff responses to intervenor comments, below. These and other night simulations may be found in the project owner's *Joshua Tree National Park Visual Resources Analysis Report,* dated May 31, 2013 (Palen 2013v).

CUMULATIVE IMPACTS AND MITIGATION

A project may result in a significant adverse cumulative impact where its effects are cumulatively considerable. "Cumulatively considerable" means that the incremental effects of an individual project are significant when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects (Cal. Code Regs., tit. 14, § 15130).

Cumulative impacts to visual resources would occur where project facilities occupy the same field of view as other built facilities or impacted landscapes, and an adverse change in the visible landscape character is perceived. In some cases, a cumulative impact could also occur if a viewer perceives that the general visual quality or landscape character of a localized area (Chuckwalla Valley or I-10 corridor) or larger region (California Desert District) is diminished by the proliferation of visible structures or construction effects, even if the changes are not within the same field of view as existing (or future) structures or facilities. The result is a perceived "industrialization" of the existing landscape character.

There is the potential for substantial future development in the Chuckwalla Valley area, along the I-10 corridor and throughout the California Desert District. As stated in the Application for Certification for the previously approved Solar Millennium Palen Solar Power Project at the project site (AFC, Page 5.15-20): *"If all the [cumulative projects] were to be implemented, the projects would convert many thousands of acres along the I-10 corridor between roughly Desert Center and Blythe from undeveloped desert viewshed to a more industrialized appearance."* Analysis of cumulative impacts is based on data provided in the Cumulative Scenario section and includes:

- Cumulative Impacts Figure **1,** I-10 Corridor Existing and Future/Foreseeable Projects along the I-10 Corridor (Eastern Riverside County) **Executive Summary Attachment A – Tables 1, 2, and 3**
- **Executive Summary Attachment A – Table 1**, Existing Projects along the I-10 Corridor (Eastern Riverside County)

The analysis in this section first defines the geographic area over which cumulative impacts to visual resources could occur. The cumulative impact analysis then describes the potential for cumulative impacts to occur as a result of implementation of the proposed project along with the listed local and regional projects.

Cumulative impacts could occur if implementation of the PSEGS would combine with those of other local or regional projects. PSEGS is potentially associated with two types of cumulative impact:

1. Cumulative impacts within the project viewshed (local projects within the viewshed of PSEGS as defined by staff), essentially comprising existing and foreseeable future projects in the Chuckwalla Valley and the nearby stretches of I-10 and SR 177; and

2. Cumulative impacts of foreseeable future solar, renewable and other energy and development projects within the I-10 Corridor (beyond the local viewshed), and other broad basin of the project's affected landscape type, or the California Desert District as a whole (regional projects).

CUMULATIVE VISUAL IMPACTS WITHIN THE PROJECT VIEWSHED

The following discussion of cumulative impacts will address PSEGS's contribution to cumulative impacts within the context of the existing cumulative conditions and within the context of future foreseeable projects.

There has been minimal development and/or industrialization of the project landscape within PSEGS's viewshed. Four existing projects fall within the viewshed of PSEGS including Interstate 10, the West-wide Section 368 Energy Corridor, the Eagle Mountain/Hayfield Pumping Plant, and the Kaiser (Eagle) Mine (see **Executive Summary Attachment A – Table 1** and **Executive Summary Attachment A – Figure 1** in the Cumulative Scenario section). Interstate 10 is visible as a linear, horizontal feature in the landscape but does not possess industrial character (complex forms or lines) on the scale of an energy facility such as PSEGS. The West-wide Section 368 Energy Corridor is a designation that implies the possibility of future linear projects within the corridor. However, the actual corridor designation does not impart any visual impact that could be considered in a cumulative context. The Eagle Mountain/Hayfield Pumping Plant, while potentially visible within the field of view of PSEGS (at a distance of slightly over 14 miles), is minimally noticeable at the distant margin of the viewshed limit. Views of much of the inactive open-pit Kaiser/Eagle Mine are screened from the project site by intervening hills. The remainder of the Kaiser Mine, located approximately 15 miles east of the project site, is minimally noticeable at the distant margin of the viewshed limit. Therefore, given the relative lack of perceptible industrial development (or development with characteristics similar to that of the proposed project) that has occurred within the PSEGS viewshed, PSEGS would not cause a cumulatively significant effect within the context of existing cumulative conditions.

The cumulative contribution of PSEGS must also be considered within the context of future foreseeable projects, including future projects within the project area and future projects within the larger contexts of the I-10 corridor and the California desert as a whole.

Executive Summary Attachment A – Table 2 and **Executive Summary Attachment A – Figure 1** in the Cumulative Scenario section list 37 future foreseeable projects that would be located with PSEGS's viewshed including:

- Devers-Palo Verde 2 Transmission Line Project
- Desert Southwest Transmission Line
- Green Energy Express Transmission Line Project
- Blythe Energy Project Transmission Line
- Eagle Mountain Pumped Storage Project
- Eagle Mountain Landfill
- Eagle Mountain Wind Project
- Graham Pass Wind Project
- Genesis Solar Energy Project
- Chuckwalla Solar I
- Desert Sunlight
- Desert Lily Soleil
- Desert Center 50
- Sol Orchard
- Silverado Power I, II, III
- Desert Harvest
- LH Renewables Riverside County Type II
- EnXco
- Blythe Energy Project II
- Blythe Solar Power Generation Station 1
- Blythe Mesa Solar I
- Milpitas Wash
- Sonoran West
- Mule Mountain Solar
- Mule Mountain III
- Desert Quartzite
- Nextlight Quartzite
- Palo Verde Mesa Solar Project
- La Posa Solar Thermal
- Three Residential (Blythe)

- 12 Residential Developments (Blythe)
- Four Commercial Projects (Blythe)
- Intake Shell
- Chuckwalla Valley Raceway
- Red Bluff Substation
- Colorado River Substation Expansion
- Wileys Well Communication Tower

While most of these projects are energy projects that would share similar industrial visual characteristics with PSEGS, all 37 projects would contribute to the conversion of natural desert landscapes to landscapes with prominent industrial character (complex industrial forms and lines and surface textures and colors not found in natural desert landscapes). Therefore, there would be a significant cumulative impact to visual resources from the combination of PSEGS and the 37 foreseeable projects listed above, both individually (each project plus PSEGS) and collectively (all 37 projects plus PSEGS).

REGIONAL CUMULATIVE VISUAL IMPACTS

Table 3 and Figure 2 in the Cumulative Scenario section also identify an additional nine future foreseeable energy projects along the I-10 corridor that would also contribute to the sense of industrialization of the desert landscape as one drives between Blythe and Desert Center or Los Angeles and Phoenix in a broader context. In a regional context, Table 1A and Figure 1 in the Cumulative Scenario section of the PSPP RSA (CEC 2010b) identified 125 renewable energy projects scattered throughout the California Desert Conservation Area. The number of projects shown in RSA Figure 1 is so great that there would not be a single major travel corridor through the Southern California desert that will not experience at least some visible “industrialization” due to the presence of nearby energy projects. As a result, travelers will encounter numerous industrial landscapes en-route to regionally and nationally significant desert destinations such as Anza-Borrego Desert State Park, the Salton Sea, Joshua Tree National Park, Mojave National Preserve, Death Valley National Park, and the Colorado River. Therefore, as a result of this collective industrialization of the conservation area landscapes, PSEGS would contribute a significant cumulative visual impact to visual resources in combination with foreseeable renewable projects in the California desert.

OVERALL CUMULATIVE IMPACT CONCLUSION

PSEGS would not result in a cumulative visual impact in the context of existing cumulative conditions. However, PSEGS’s contribution to the visible industrialization of the desert landscape would be cumulatively considerable and constitute a significant visual impact when considered with future foreseeable projects, both within the project viewshed and in a broader context that encompasses the whole of the California Desert Conservation Area.

COMPLIANCE WITH APPLICABLE LORS

The proposed project would be subject to the laws, ordinances, regulations, and standards (LORS) of the U.S. Government (Bureau of Land Management – BLM) and environmental laws of the State of California. Because the PSEGS would be located entirely on land managed by the BLM, the project would not be subject to the County of Riverside's LORS. However, staff has included a discussion of the project's consistency with the visual resources goals and objectives of Riverside County since these LORS informed staff's CEQA analysis of the project and indicate the importance of open space and scenic resources to the county. Consistency with these LORS is summarized in the following paragraphs and presented in more detail in **Visual Resources Table 3**.

COMPLIANCE WITH FEDERAL LORS

The project was found to be in compliance with the impact disclosure requirements of the California Desert Conservation Area (CDCA) Plan through the visual impact analysis presented here and in the BLM DEIS for this project.

COMPLIANCE WITH STATE LORS

The proposed project was found to be in compliance with the State Scenic Highway Program as pertains to compliance with scenic highway management objectives. The adjacent Interstate 10 is neither an eligible or a designated scenic highway under the state program.

CONSISTENCY WITH LOCAL LORS

Staff concludes that the project would be inconsistent with several County of Riverside requirements pertaining to protection/preservation of natural features, the visual character of the existing landscape, and scenic corridors. These requirements are found in LU 13.1 (preservation of scenic vistas), LU 13.3 (compatible appearance with surrounding environment), LU 20.1 (environmental character), LU 20.2 (avoid unnatural appearance) and LU 20.4 (open space and rural character). Staff also concludes that the project would be inconsistent with several landscaping requirements and pedestrian access requirements because landscaping is not proposed and pedestrians would not be allowed within the facility. However, given the arid conditions and remote location, this is understandable. These requirements are found in LU 4.1(c), LU 4.1(d), LU 4.1(m), LU 4.1(n), and LU 4.1(p).

Visual Resources Table 3
Laws, Ordinances, Regulations and Standards (LORs)

Applicable LORS	Description	Compliance/Consistency (assumes implementation of staff-recommended conditions of certification)
Federal		
California Desert Conservation Area (CDCA) Plan	PSEGS is located within the California Desert Conservation Area Plan, which is the BLM Resource Management Plan applicable to the project site (USDOI, 1980, as amended). The CDCA Plan did not include Visual Resource Management (VRM) inventory or management classes. However, a BLM-approved Visual Resource Inventory (VRI) was conducted in 2005 for the Devers-Palo Verde 2 Transmission Line Project EIS/EIR, which covers the project site. The PSEGS site is classified in the CDCA Plan as Multiple-Use Class (MUC) M (Moderate Use). Management of MUC M lands is based upon a controlled balance between higher intensity use and protection of public lands. This class provides for a wide variety of present and future uses such as mining, live- stock grazing, recreation, energy, and utility development. Class M management is also designed to conserve desert resources and to mitigate damage to those resources, which permitted uses may cause. The CDCA Plan includes a table (Table 1), which illustrates the types of allowable land uses by MUC Class. The table specifically includes Electrical Power Generation Facilities including Wind/Solar facilities. Guidance provided under this section allows for the authorization of such facilities within MUC M lands in compliance with National Environmental Policy Act (NEPA) requirements. New major electric transmission facilities may be allowed only within designated utility corridors. Existing facilities within designated utility corridors may be maintained and upgraded or improved in accordance with existing rights-of-way or amendments to right-of- way grants.	**Complies**. Solar electrical generation plants are specifically allowed for under the Multiple Use Class (MUC) Class M Guidelines if NEPA requirements are met.

Applicable LORS	Description	Compliance/Consistency (assumes implementation of staff-recommended conditions of certification)
State		
State Scenic Highway Program	The California State Department of Transportation (Caltrans) identifies a state system of eligible and designated scenic highways, which, if designated, are subject to various controls intended to preserve their scenic quality (California Streets and Highways Code, sections 260 through 263).	**Complies**. Highway I-10 within the project viewshed is not an eligible or designated State scenic highway.
Local		
Riverside County Integrated Plan LU-4 Relating to Project Design	LU 4.1 Requires that new developments be located and designed to visually enhance, not degrade the character of the surrounding area through consideration of the following concepts: c. Require that an appropriate landscape plan be submitted and implemented for development projects subject to discretionary review.	**Consistent.** The project owner does not propose to landscape the project site, and therefore would not submit a landscape plan for the project area. However, given the location of the project and the potential impacts to water and biological resources resulting from landscaping this location, staff concludes that this approach is appropriate.
	d. Require that new development utilize drought- tolerant landscaping and incorporate adequate drought-conscious irrigation systems.	**Consistent.** The project owner does not propose any landscaping, and therefore will not require irrigation or unnecessarily use water in the desert.
	l. Mitigate noise, odor, lighting, and other impacts on surrounding properties.	**Consistent.** All outdoor lighting at the project site will be the minimum required to meet safety and security standards and all light fixtures will be hooded to eliminate any potential for glare effects and to prevent light from spilling off the site or up into the sky. In addition, the light fixtures will have sensors and switches to permit the lighting to be turned off at times when it is not required. Condition of Certification **VIS-4** ensures compliance.
	m. Provide and maintain landscaping in open spaces and parking lots.	**Consistent.** The project footprint, as proposed, includes no open space, and parking facilities would be minimal. Planting and maintaining landscaping in the parking area of PSEGS, which would be inaccessible to the public, would require that water be used unnecessarily.
	n. Include extensive landscaping.	**Consistent.** Including extensive landscaping would not serve the project or surrounding viewers, and would require that water be used unnecessarily.

Applicable LORS	Description	Compliance/Consistency (assumes implementation of staff-recommended conditions of certification)
	o. Preserve natural features, such as unique natural terrain, drainage ways, and native vegetation, wherever possible, particularly where they provide continuity with more extensive regional systems.	**Consistent.** Required grading for the amended project would be substantially reduced compared to the PSPP.
	p. Require that new development be designed to provide adequate space for pedestrian connectivity and access, recreational trails, vehicular access and parking, supporting functions, open space, and other pertinent elements.	**Not Consistent.** The project would not be accessible by pedestrians, recreationists, or general vehicular travel.
	LU 4.2 Require property owners to maintain structures and landscaping to a high standard of design, health, and safety through the following: c. Promote and support community and neighborhood based efforts for the maintenance, upkeep, and renovation of structures and sites.	**Consistent**. The project owner would maintain the appearance of the project and ensure proper maintenance practices.
County Scenic Corridors	LU 13.1 Preserve and protect outstanding scenic vistas and visual features for the enjoyment of the traveling public.	**Not Consistent.** The project would not preserve or protect scenic vistas of the southern ridges of the Joshua Tree National Park and Palen McCoy Wilderness and the northeastern ridges of the Chuckwalla Mountains Wilderness, but would significantly impact them.
	LU 13.3 Ensure that the design and appearance of new landscaping, structures, equipment, signs, or grading within Designated and Eligible State and County scenic highway corridors are compatible with the surrounding scenic setting or environment.	**Not Consistent.** The project is not compatible in design and appearance with scenic highway corridors. Riverside County has requested that Interstate 10 (I-10) be designated a State Scenic Highway, but Caltrans has not designated I-10 as either an Eligible or Officially Designated Scenic Highway. Therefore, Riverside County has designated I-10 to be a County Scenic Highway from SR-62 near Palm Springs to the California-Arizona border.
	LU 13.7 Require that the size, height, and type of on-premise signs visible from Designated and Eligible State and County Scenic Highways be the minimum necessary for identification. The design, materials, color, and location of the signs shall blend with the environment, utilizing natural materials where possible.	**Consistent.** The project would include simple identification signage at the facility gate. Such signage would be visible from I-10, a Designated County Scenic Highway.

Applicable LORS	Description	Compliance/Consistency (assumes implementation of staff-recommended conditions of certification)
	LU 13.8 Avoid the blocking of public views by solid walls.	**Consistent.** No solid walls are proposed. However, the high density of project structures would essentially form the appearance of a solid wall of steel and glass that would block views of the surrounding landscape from I-10 and nearby BLM recreational access roads.
The following policies apply to properties designated as Open Space-Rural on the area plan land use maps.	LU 20.1 Require that structures be designed to maintain the environmental character in which they are located. LU 20.2 Require that development be designed to blend with undeveloped natural contours of the site and avoid an unvaried, unnatural, or manufactured appearance. LU 20.4 Ensure that development does not adversely impact the open space and rural character of the surrounding area.	**Not Consistent.** The industrial design and character of the project facilities would not maintain the existing landscape character of a desert valley floor, presently absent such industrial features. **Not Consistent.** The industrial appearance of the project structures and vertical components would not blend with the existing natural-appearing desert valley landscape. **Not Consistent.** Although the project has been intentionally located away from populated areas and sensitive viewers, the project would significantly impact the natural desert landscape and rural character of the site and surroundings.

NOTEWORTHY PUBLIC BENEFITS

While the development of the amended project is intended to address the requirements of federal and state mandates to develop renewable energy, it would not yield any noteworthy public benefits related to visual resources.

RESPONSE TO COMMENTS

STATE OF CALIFORNIA, ENERGY RESOURCES CONSERVATION AND DEVELOPMENT COMMISSION/BASIN AND RANGE WATCH, KEVIN EMMERICH AND LAURA CUNNINGHAM, COMMENTS ON PSA, TN #: 200078, JULY 28, 2013:

Comment: *We would like to see a dark skies KOP simulation of the project. Because the towers would have 16 flashing lights each, this will be a noticeable impact to the night sky.*

Response: The project owner prepared and docketed with the Energy Commission, a study titled *Joshua Tree National Park Visual Resources Analysis Report,* dated May 31, 2013 (Palen 2013v). That study includes three nighttime simulations representing the appearance of the PSEGS at night from three viewpoints within JTNP. Staff did not attempt to validate the accuracy of those simulations, but makes the following observations:

- as indicated in the simulations, at the distances simulated (up to 15 miles), the project would be clearly visible at night.
- in each simulated nighttime view, substantial light from the power block areas is observable, and appears brighter than the solar tower FAA warning lighting. However, Condition of Certification **VIS-3**, which requires shielding of lighting and other mitigation measures, is intended to reduce off-site visibility of power block lighting to a minimum. Lighting conditions similar to those simulated would thus suggest non-compliance with **VIS-3**.
- as illustrated in KOP 3 (South of Eagle Mountain), the broad project setting is not a pristine night sky environment. KOP 3 depicts existing night lighting, apparently of Chuckwalla State Prison, that is a relatively larger and brighter night light source than the proposed project.
- the report also includes analogous night photography of the (under construction) Ivanpah project. However, those photographs include construction lighting and thus appear very bright, compared to what would be expected under PSEGS operation conditions with **VIS-3**. The applicability of those photographs to operational conditions is thus questionable, but they are useful for indicating the considerable brightness of construction activities, even at distances of 15 miles.

Two of the night simulations, KOP 1 and KOP 3, are reproduced at the end of this section as **Visual Resources Figures 10A and 10B, and 11A and 11B.**

Comment: *The impacts that the Palen Project would have on Joshua Tree National Park and wilderness areas surrounding the project can now be compared with the Ivanpah Solar Electric Generating System. The project has now been tested at 10 to 20 percent of full capacity and the glare can be described as intense. It should be blinding at 100 percent. When possible, a full visual analysis of the Ivanpah Project at 100 percent capacity would help us understand the full scope of the visual impacts the Palen towers would have.*

Response: Following publication of the PSEGS PSA, staff conducted field observations of the Ivanpah project during mirror calibration. According to the project owner at that time, one tower (Tower 3) was observed operating at 20 percent capacity, similar to conditions reported by Intervenor Basin and Range Watch. Staff agrees with the commenter that observations of Ivanpah Solar Electric Generating System (ISEGS) at full 100 percent operation would be extremely valuable in evaluating anticipated brightness of PSEGS. As discussed in detail in **APPENDIX TT-1**, clear quantitative criteria for predicting, for example, discomfort levels of glare, are not known. Because no man-made light source of a comparable magnitude of brightness to either the PSEGS or ISEGS solar receivers has ever existed, empirical observations of ISEGS under full operation would provide perhaps the best indication of levels of SRSG brightness impacts, which are in part perceptual and thus partly subjective, experiential effects. Staff understands from the ISEGS project owner, however, that 100 percent operation of ISEGS is unlikely to take place during the time frame of these PSEGS proceedings.

Comment: *Impacts to visual resources could be mitigated with alternate solar technology and preferably, an off –site alternative.*

Response: Staff agrees that visual impacts of PSEGS would be reduced with alternative solar technologies because the most pronounced impact of PSEGS, solar receiver (SRSG) glare, is unique to solar tower technology. This is discussed in the **ALTERNATIVES** section of this FSA.

COUNTY OF RIVERSIDE, JOHN J. BENOIT, COMMENTS ON THE PSA, TN # 200094, JULY 30, 2013:

Comment: The County generally agrees with staff conclusions in the PSA, and notes LORS inconsistencies discussed in the PSA. In addition, the County notes that:

'*Further, the Project is inconsistent with the development standards for any zone in the County's zoning Ordinance No. 348. The two 70-foot tall concrete towers of the Project do not comply with the height limits in any zone in the County. While the Project is not subject to the County's land use ordinance because it is located on BLM land, this inconsistency . . . further demonstrates the visual impact of the project. . . .*

. . . the County does not believe the proposed mitigation is sufficient to off-set the vast changes being imposed on motorists traveling Interstate 10, local residents, and recreational visitors within the vicinity of the Project. Since these impacts cannot be fully mitigated, the residents living in the vicinity should reap some benefit from the Project that they will see and live with daily. . . . The County ask for stronger efforts to minimize and fully mitigate the visual impacts of the Project.'

Response: County's comments are noted. Staff welcomes further discussion of potential visual mitigation that the County proposes.

COLORADO RIVER INDIAN TRIBES, WAYNE PATCH SR., COMMENTS ON THE PSA, TN # 200075, JULY 29, 2013:

Comment: *'CRIT Objects to the Selection of the Key Observation Points in the Visual Resources Section.'*

'The Visual Resources section of the PSA does not address the potential cultural implications of the Project's disruption of the visual landscape on Tribal members.' The CRIT goes on to comment on cultural and spiritual significance of Coxcomb, Chuckwall and McCoy Mountains.

‘CRIT Objects to the PSA’s Absence of Analysis of the Visual Impacts to Traditional Trails.’

‘The analysis of the Project’s impacts to the ‘Prehistoric Trails Network Cultural Landscape’ (PTNCL) does not address the cultural implications of the Project’s disruption of the visual landscape.

Response: Staff acknowledges the absence of discussion on visual effects to the cultural landscape within the Visual Resources analysis. This omission is typically the case in CEQA analyses of visual impacts because, according to staff’s understanding, the applicable criteria for determining significant visual effects on cultural resources, e.g. under Section 106 and corresponding state law, differ from the methodology being used for the visual analysis. Because the expertise needed to evaluate the applicable cultural criteria is outside of the visual resource area, this analysis is typically deferred to cultural resource experts. However, staff is cognizant of the potential for such issues and has strived to provide visual analysis relevant to the purpose of cultural review. Thus, for example, the analysis of KOPs in the Coxcomb, Chuckwalla, and McCoy Mountains should provide an understanding of the extent and intensity of possible *visual* effects in those areas. The selection of KOPs in the visual analysis provides a representative sample of *all* sections of the project viewshed, and thus an understanding of specifically visual effects throughout the viewshed. The evaluation of these visual effects on *cultural* resources and values, including effects on traditional trails is, however, outside of visual staff’s expertise. The reader is thus referred to the **CULTURAL RESOURCES** section of this FSA for these analyses.

SHAUN GONZALEZ, PUBLIC COMMENT, TN # 200041, JULY 15, 2013

Comment: *The CEC should reject BrightSource’s application for a power tower design at the site, and review other alternatives that are significantly less disruptive, such as photovoltaic solar or solar trough with storage.*

Response: For staff’s comparison of potential visual impacts of various alternative technologies, please refer to the **ALTERNATIVES** section of this FSA.

CONCLUSIONS

Energy Commission staff concludes that the Palen Solar Electric Generating System project would result in a substantial adverse impact to existing scenic resource values as seen from several Key Observation Points in the Chuckwalla Valley and Coxcomb, Granite, Palen and Chuckwalla Mountains, including:

- Both westbound and eastbound Interstate 10;
- State Route 177, to the west and northwest of the project site;
- Joshua Tree National Park to the west and northwest of the project site;
- Palen McCoy Wilderness to the northeast of the project site;
- Chuckwalla Mountains Wilderness to the south of the project site.

Staff concludes that these visual impacts would be significant in terms of three of the four criteria of CEQA Appendix G, (the project would have a substantial adverse effect on scenic vistas, the project would substantially degrade the existing visual character or quality of the site and its surroundings, and the project would create a new source of substantial light or glare that would adversely affect daytime or nighttime views in the area). Also, staff concludes that these visual impacts would be significant in terms of the context and intensity of the effects in general. Specifically, the context of the project is one of a broad open desert valley with panoramic vista views of the surrounding rugged mountain ranges and designated wilderness areas including Palen McCoy (to the northeast) and Chuckwalla (to the south), and Joshua Tree National Park (to the north-northwest). Also to the northwest is the Desert Lily Sanctuary Area of Critical Environmental Concern (ACEC). The Palen Dry Lake and Sand Dunes area immediately north of the project site is a popular desert recreation destination area. To the west of the project site is Desert Center and Alligator Rock ACEC.

The landscape of the project vicinity is generally undeveloped and appears mostly natural in character. The panoramic vista views are largely unobstructed and encompass wide-open desert spaces. The proposed project would introduce a densely developed and geographically extensive industrial feature into a landscape presently absent similar features. Most importantly, the project would introduce prominent glare from the solar receiver steam generators (SRSGs) over a large area. Energy Commission staff also concludes that the project's contribution to significant cumulative visual effects would be cumulatively considerable when combined with the effects of other renewable and development projects along the I-10 corridor, within the Chuckwalla Valley, and within the California Desert Conservation Area as a whole.

Energy Commission staff has concluded that the potentially significant visual impacts cited above could not be mitigated to less than significant levels and would thus result in significant and unavoidable impacts under CEQA.

Also, Energy Commission staff concludes that the project would be inconsistent with several goals and policies of the Riverside County Integrated Plan as follows:

- LU 13.1, requiring preservation and protection of outstanding scenic vistas and visual features for the enjoyment of the traveling public. The project would be a highly visible industrial feature in the panoramic, vista views from the southern ridges of Palen McCoy Wilderness, the northeastern ridges of Chuckwalla Mountains Wilderness, and Joshua Tree National Park (though at slightly greater distance).
- LU 13.3, requiring the design and appearance of new structures within Designated County scenic highway corridors (I-10) to be compatible with the surrounding scenic setting. The project would have an industrial appearance that would not be consistent with the surrounding, natural, undeveloped desert landscape.
- LU 20.1, requiring that structures be designed to maintain the environmental character in which they are located. The project's industrial character would not be consistent with the surrounding, natural, undeveloped desert landscape character.

- LU 20.2, requiring that development be designed to blend with undeveloped natural contours of the site and avoid a manufactured appearance. The project would have an industrial, manufactured appearance.
- LU 20.4, requiring that development does not adversely impact the open space and rural character of the surrounding area. The project would convert an open, undeveloped desert landscape to an intensive industrial use.

As stated, staff concludes that the project would have significant unavoidable adverse impacts in both a direct and cumulative context, impacts that could not be fully mitigated. However, if the Energy Commission approves the amended project, staff recommends that the conditions of certification from the Commission Decision for the originally certified Palen Solar Power Project, as modified herein by staff, be adopted in order to minimize impacts to the greatest feasible extent.

CONDITIONS OF CERTIFICATION

The Energy Commission should adopt the following conditions of certification if it approves the amended project. Staff has proposed modifications to the conditions of certification as shown below. (Note: Deleted text is in ~~strikethrough~~, new text is **<u>bold and underlined</u>**).

Condition of Certification **VIS-4** of the PPSP RSA was included in the RSA in response to BLM requirements for what was originally envisioned as a joint state/federal action. However, measures in that condition that are applicable to the current project have been incorporated in the other measures. Condition VIS-4 was thus deleted as redundant to these other conditions.

SURFACE TREATMENT OF PROJECT STRUCTURES AND BUILDINGS

VIS-1 The project owner shall treat the surfaces of all project structures and buildings visible to the public such that a) their colors minimize visual intrusion and contrast by blending with (matching) the existing characteristic landscape colors; b) their colors and finishes do not create excessive glare; and c) their colors and finishes are consistent with local policies and ordinances. The transmission line conductors shall be non-specular and non-reflective, and the insulators shall be non-reflective and non-refractive.

Following in-field consultation with the Energy Commission/BLM Visual Resources specialist and other representatives as deemed necessary, the project owner shall submit for **<u>Energy Commission</u>** Compliance Project Manager (CPM) review and approval, a specific Surface Treatment Plan that will satisfy these requirements. The treatment plan shall include:

A. A description of the overall rationale for the proposed surface treatment, including the selection of the proposed color(s) and finishes based on the characteristic landscape. Colors will be fielded tested using the actual distances from the KOPs to the proposed structures, using the proposed colors painted on representative surfaces;

B. A list of each major project structure, building, tank, pipe, and wall; the transmission line towers and/or poles; and fencing, specifying the color(s) and finish proposed for each. Colors must be identified by vendor, name, and pantone number; or according to a universal designation system;

C. One set of color brochures or color chips showing each proposed color and finish;

D. A specific schedule for completion of the treatment; and

E. A procedure to ensure proper treatment maintenance for the life of the project.

The project owner shall not specify to the vendors the treatment of any buildings or structures treated during manufacture, or perform the final treatment on any buildings or structures treated in the field, until the project owner receives notification of approval of the treatment plan by the CPM. Subsequent modifications to the treatment plan are prohibited without CPM approval.

Verification: At least 90 days prior to specifying to the vendor the colors and finishes of the first structures or buildings that are surface treated during manufacture, the project owner shall submit the proposed treatment plan to the CPM for review and approval and simultaneously to **the BLM and** Riverside County for review and comment. If the CPM determines that the plan requires revision, the project owner shall provide to the CPM a plan with the specified revision(s) for review and approval by the CPM before any treatment is applied. Any modifications to the treatment plan must be submitted to the CPM for review and approval.

Prior to the start of commercial operation, the project owner shall notify the CPM that surface treatment of all listed structures and buildings has been completed and they are ready for inspection and shall submit to each one set of electronic color photographs from the same key observation points identified in (d) above. The project owner shall provide a status report regarding surface treatment maintenance in the Annual Compliance Report. The report shall specify a): the condition of the surfaces of all structures and buildings at the end of the reporting year; b) maintenance activities that occurred during the reporting year; and c) the schedule of maintenance activities for the next year.

REVEGETATION OF DISTURBED SOIL AREAS

VIS-2 The project owner shall minimize visual disturbances due to construction and revegetate disturbed soil areas to the greatest practical extent, as described in Condition of Certification **BIO-8,** measures 1, 2, 5, and 21. In order to address specifically visual concerns, the required spreading of preserved topsoil shall include reclamation of the area of disturbed soils used for laydown, project construction, and siting of the other ancillary operation and support structures that appear in the visual foreground of I-10.

Verification: Refer to Condition of Certification **BIO-8**.

TEMPORARY AND PERMANENT EXTERIOR LIGHTING

VIS-3 To the extent feasible, consistent with safety and security considerations, the project owner shall design and install all permanent exterior lighting and all temporary construction lighting such that a) lamps and reflectors are not visible from beyond the project site, including any off-site security buffer areas; b) lighting does not cause excessive reflected glare; c) direct lighting does not illuminate the nighttime sky, except for required FAA aircraft safety lighting (which should be an on-demand, audio-visual warning system that is triggered by radar technology); d) illumination of the project and its immediate vicinity is minimized, and e) the plan complies with local policies and ordinances. The project owner shall submit to the CPM for review and approval and simultaneously to the **BLM and** County of Riverside for review and comment a lighting mitigation plan that includes the following:

A. Location and direction of light fixtures shall take the lighting mitigation requirements into account;

B. Lighting design shall consider setbacks of project features from the site boundary to aid in satisfying the lighting mitigation requirements;

C. Lighting shall incorporate fixture hoods/shielding, with light directed downward or toward the area to be illuminated;

D. Light fixtures that are visible from beyond the project boundary shall have cutoff angles that are sufficient to prevent lamps and reflectors from being visible beyond the project boundary, except where necessary for security;

E. All lighting shall be of minimum necessary brightness consistent with operational safety and security; and

F. Lights in high illumination areas not occupied on a continuous basis (such as maintenance platforms) shall have (in addition to hoods) switches, timer switches, or motion detectors so that the lights operate only when the area is occupied.

G. Lighting plan shall demonstrate that plant operational lighting will not be reflected upward or off-site by heliostats in nighttime stow position. Control measures for eliminating such reflections shall be incorporated in the HMPP specified in Condition of Certification TRANS-7.

At least 90 days prior to ordering any permanent exterior lighting or temporary construction lighting, the project owner shall contact the CPM to discuss the documentation required in the lighting mitigation plan. At least 60 days prior to ordering any permanent exterior lighting, the project owner shall submit to the CPM for review and approval and simultaneously to the **BLM and** County of Riverside for review and comment a lighting mitigation plan. If the CPM determines that the plan requires revision, the project owner shall provide to the CPM a revised plan for review and approval by the CPM.

The project owner shall not order any exterior lighting until receiving CPM approval of the lighting mitigation plan.

Prior to commercial operation, the project owner shall notify the CPM that the lighting has been completed and is ready for inspection. If after inspection, the CPM notifies the project owner that modifications to the lighting are needed, within 30 days of receiving that notification the project owner shall implement the modifications and notify the CPM that the modifications have been completed and are ready for inspection.

Within 48 hours of receiving a lighting complaint, the project owner shall provide the CPM with a complaint resolution form report as specified in the Compliance General Conditions including a proposal to resolve the complaint, and a schedule for implementation. The project owner shall notify the CPM within 48 hours after completing implementation of the proposal. A copy of the complaint resolution form report shall be submitted to the CPM within 30 days.

PROJECT DESIGN

~~**VIS-4**~~ ~~To the extent possible, the project owner shall use proper design fundamentals to reduce the visual contrast to the characteristic landscape. These include proper siting and location; reduction of visibility; repetition of form, line, color (see VIS-1) and texture of the landscape; and reduction of unnecessary disturbance. Design strategies to address these fundamentals shall be based on the following factors:~~

~~**Earthwork:** Select locations and alignments that fit into the landforms to minimize the size of cuts and fills. Avoid hauling in or hauling out of excess earth cut or fill. Avoid rounding and/or warping slopes. Retain existing rock formations, vegetation, and drainage. Tone down freshly broken rock faces with emulsions or stains. Use retaining walls to reduce the amount and extent of earthwork. Retain existing vegetation by using retaining walls or fill slopes, reducing surface disturbance, and protecting roots from damage during excavations. Avoid soil types that generate strong color contrasts. Reduce dumping or sloughing of excess earth and rock on downhill slopes.~~

~~**Vegetation Manipulation:** Retain as much of the existing vegetation as possible. Use existing vegetation to screen the development from public viewing. Use scalloped, irregular cleared edges to reduce line contrast. Use irregular clearing shapes to reduce form contrast. Feather and thin the edges of cleared areas and retain a representative mix of plant species and sizes.~~

~~**Structures:** Minimize the number of structures and combine different activities in one structure. Use natural, self-weathering materials and chemical treatments on surfaces to reduce color contrast. Bury all or part of the structure. Use natural appearing forms to complement the characteristic landscape. Screen the structure from view by using natural land forms and vegetation. Reduce the line contrast created by straight edges.~~

~~**Linear Alignments:** Use existing topography to hide induced changes associated with roads, lines, and other linear features. Select alignments that follow landscape contours. Avoid fall-line cuts and bisecting ridge tops. Hug vegetation lines and avoid open areas such as valley bottoms. Cross highway corridors and less sharp angles.~~

~~**Reclamation and Restoration:** Reduce the amount of disturbed area and blend the disturbed areas into the characteristic landscape. Replace soil, brush, rocks, and natural debris over disturbed area. Newly introduce plant species should be of a form, color, and texture that blends with the landscape.~~

~~As early as possible in the site and facility design, the project owner shall meet with the CPM to discuss incorporation of these above factors into the design plans. At least 90 days prior to final site and facility design, the project owner shall contact the CPM to review the incorporation of the above factors into the final facility and site design plans. If the CPM determine that the site and facility plans require revision, the project owner shall provide to the CPM a revised plan for review and approval by the CPM.~~

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Palen 2013w. PSEGS Visual Resources Analysis Report, dated May 31, 2013. Submitted to CEC/Docket Unit submitted on May 31, 2013

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_______. 1980 as amended. California Desert Conservation Area Plan. USDI, BLM.

VISUAL RESOURCES APPENDIX VR-1

ENERGY COMMISSION VISUAL RESOURCE ANALYSIS EVALUATION CRITERIA

Energy Commission staff conducts a visual resource analysis according to Appendix G, "Environmental Checklist Form—Aesthetics," California Environmental Quality Act (CEQA). The CEQA analysis requires that commission staff make a determination of impact ranging from "Adverse and Significant" to "Not Significant."

Staff's analysis is based on Key Observation Points or KOPs. KOPs are photographs of locations within the project area that are highly visible to the public—for example, travel routes; recreational and residential areas; and bodies of water as well as other scenic and historic resources.

Those photographs are taken to indicate existing conditions without the project and then modified to include a simulation of the project. Consequently, staff has a visual representation of the viewshed before and after a project is introduced and makes its analysis accordingly. Information about that analytical process follows.

VISUAL RESOURCE ANALYSIS WITHOUT PROJECT

When analyzing KOPs of existing conditions without the project, staff considers the following conditions: visual quality, viewer concern, visibility, number of viewers, duration of view. Those conditions are then factored into an overall rating of viewer exposure and viewer sensitivity. Information about each condition and rating follows.

Visual Quality

An expression of the visual impression or appeal of a given landscape and the associated public value attributed to the resource. Visual quality is rated from *high* to *low*. A high rating is generally reserved for landscapes viewers might describe as picture-perfect.

Landscapes rated high generally are memorable because of the way the components combine in a visual pattern. In addition, those landscapes are free from encroaching elements, thus retaining their visual integrity. Finally, landscapes with high visual quality are visually coherent and harmonious when each element is considered as part of the whole. On the contrary, landscapes rated *low* are often dominated by visually discordant human alterations.

Viewer Concern

Viewer concern represents the reaction of a viewer to visible changes in the viewshed an area of land visible from a fixed vantage point. For example, viewers have a high expectation for views formally designated as a scenic area or travel corridor as well as for recreational and residential areas. Viewers generally expect that those views would be preserved. Travelers on highways and roads, including those in agricultural areas, are generally considered to have moderate viewer concerns and expectations.

However, viewers tend to have low-to-moderate viewer concern when viewing commercial buildings. And industrial uses typically have the lowest viewer concern. Regardless, the level of concern could be lower if the existing landscape contains discordant elements. In addition, some areas of lower visual quality and degraded visual character may contain particular views of substantially higher visual quality or interest to the public.

Visibility

Visibility is a measure of how well an object can be seen. Visibility depends on the angle or direction of views; extent of visual screening; and topographical relationships between the object and existing homes, streets, or parks. In that sense, visibility is determined by considering any and all obstructions that may be in the sightline—trees and other vegetation; buildings; transmission poles or towers; general air quality conditions such as haze; and general weather conditions such as fog.

Number of Viewers

Number of viewers is a measure of the number of viewers per day who would have a view of the proposed project. *Number of viewers* is organized into the following categories: residential according to the number of residences; motorist according to the number of vehicles; and recreationists.

Duration of View

Duration of view is the amount of time to view the site. For example, a high or extended view of a project site is one reached across a distance in two minutes or longer. In contrast, a low or brief duration of view is reached in a short amount of time—generally less than ten seconds.

Viewer Exposure

Viewer exposure is a function of three elements previously listed, *visibility*, *number of viewers*, and *duration of view*. Viewer exposure can range from a *low* to *high*. A partially obscured and brief background view for a few motorists represents a low value; and unobstructed foreground view from a large number of residences represents a high value.

Visual Sensitivity

Visual sensitivity is comprised of three elements previous listed, *visual quality*, *viewer concern*, and *viewer exposure*. Viewer sensitivity tends to be higher for homeowners or people driving for pleasure or engaged in recreational activities and lower for people driving to and from work or as part of their work.

Visual Resource Analysis with Project

Visual resource analyses with photographic simulations of the project involve the elements of contrast, dominance, view disruption, and visual change. Information about each element follows.

Contrast

Contrast concerns the degree to which a project's visual characteristics or elements — form, line, color, and texture — differ from the same visual elements in the existing landscape. The degree of contrast can range from *low* to *high*. A landscape with forms, lines, colors, and textures similar to those of a proposed energy facility is more visually absorbent; that is, more capable of accepting those characteristics than a landscape in which those elements are absent. Generally, visual absorption is inversely proportional to visual contrast.

Dominance

Dominance is a measure of (a) the proportion of the total field of view occupied by the field; (b) a feature's apparent size relative to other visible landscape features; and (c) the conspicuousness of the feature due to its location in the view.

A feature's level of dominance is lower in a panoramic setting than in an enclosed setting with a focus on the feature itself. A feature's level of dominance is higher if it is (1) near the center of the view; (2) elevated relative to the viewer; or (3) has the sky as a backdrop. As the distance between a viewer and a feature increases, its apparent size decreases; and consequently, its dominance decreases. The level of dominance ranges from *low* to *high*.

View Disruption

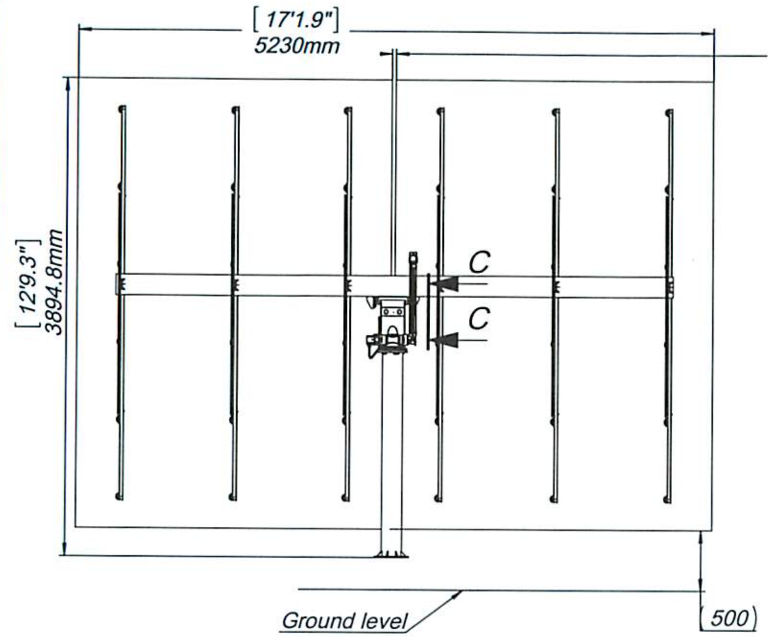
The extent to which any previously visible landscape features are blocked from view constitutes view disruption. The view is also disrupted when the continuity of the view is interrupted. When considering a project's features, higher quality landscape features can be disrupted by lower quality project features, thus resulting in adverse visual impacts. The degree of view disruption can range from *none* too *high*.

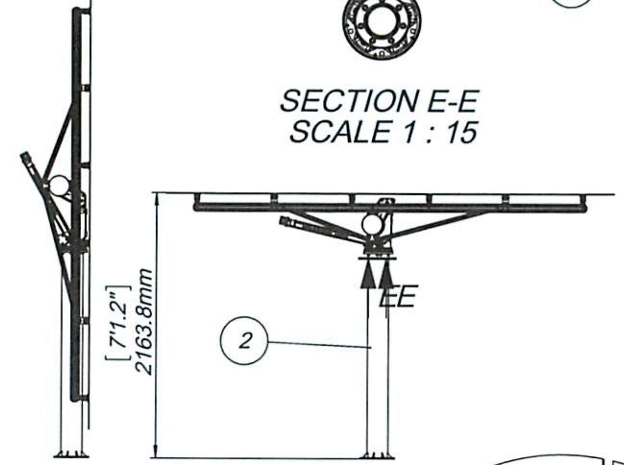
Visual Change

Visual change is a function of *contrast*, *dominance*, and *view disruption*. Generally, *contrast* and *dominance* contribute more to the degree of visual change than does *view disruption*.

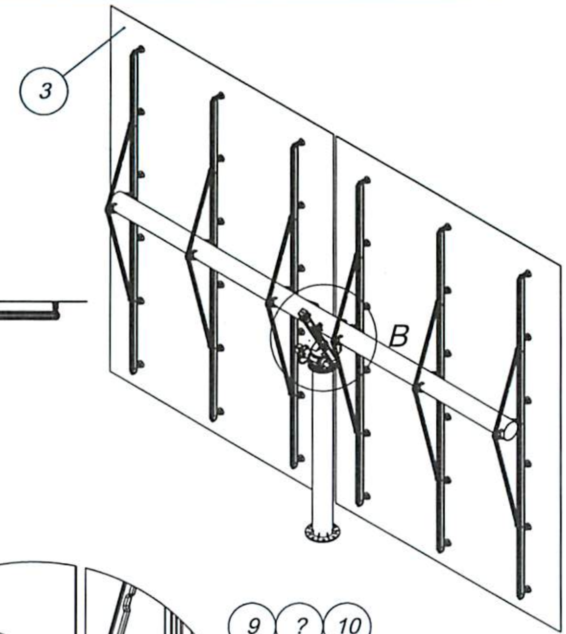
VISUAL RESOURCES ATTACHMENT 1A –

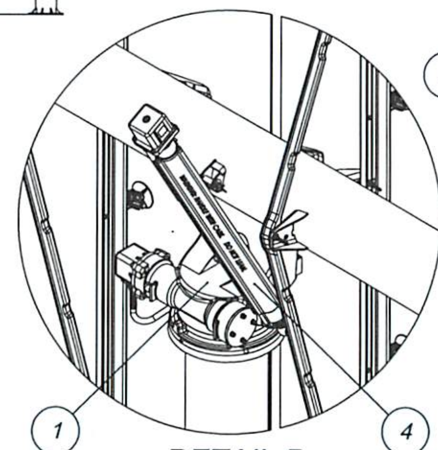
HELIOSTAT



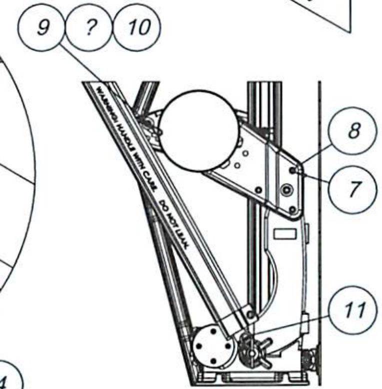


SECTION E-E
SCALE 1 : 15





DETAIL B



SECTION C-C

NO.	Part Number	Description	Vertical Heliostat/QTY.	Notes
12	09-00070S09	FLAT WASHER M12; DIN 125A; BN 715	1	
11	09-02560S02	R-Pin - Spring Cotter 4mm wire diameter DIN 11024; FABORY No. 030.001	1	
10	09-02560S01	R-Pin - Spring Cotter 2mm wire diameter DIN 11024; FABORY No. 030.001	1	
9	08-23587A01	Clevis-pin-M12x45 - F9	1	
8	09-02230S02	1/4" [6.4mm] AVDELOK FASTENER - Pin	6	
7	09-02240S02	1/4" [6.4mm] AVDELOK FASTENER - Collar	6	
6	09-00310S02	Hex cap bolt M8x25 ISO4017/DIN933/BN56	5	
5	09-00900S02	NORD LOCK washer metric NL8	5	
4	01-23101A01	ELEVATION DRIVE	1	
3	01-23129A01	Heliostat Reflector Assy	1	
2	05-23417A01	Test site Pylon	1	
1	01-23260A01	AD Main assembly	1	

TOLERANCES
0..120 = ±0.1
Angles = ±0.5°
Between Holes = ±0.1
Holes <Φ8 = +0.2 -0.05
Drawing REV 00C

NAME
CHECK-IN: SElany
CHECK-IN Date: 8/21/2011
DESIGN: SElany
APPROVED: S.Huss
QA: A.Keiser
Reviewer:

DESIGN STATUS: In Design
MATERIAL: See BOM
TREATMENT
FINISH
WEIGHT 339.48
DIMENSIONS ARE INmm

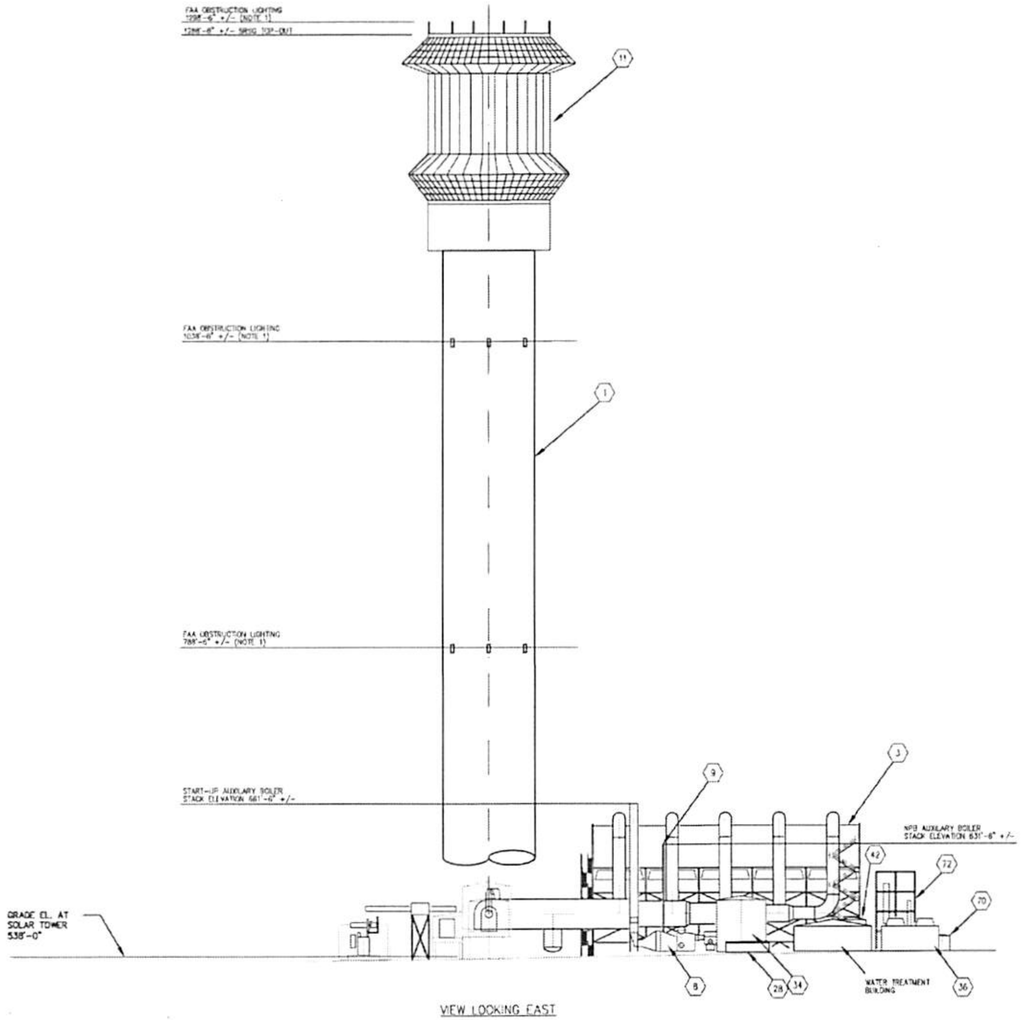
BrightSource
Har Hotzvim, Kiryat Mada # 11
Amot Bldg # 6
Jerusalem 91450, ISRAEL
Tel: 972-(0)77-202-5000
Fax: 972-(0) 2-571-1059

TITLE: FIGURE NO. 2.2-4
LH2.3 Mock-up Top Assy

SIZE: A3
DOCUMENT NO. 01-22951A01
REV 00Q
SCALE: 1:10
SHEET: 1 of 1

VISUAL RESOURCES ATTACHMENT 1B –

SOLAR TOWER/POWER BLOCK ELEVATION



EQUIPMENT LEGEND

1 SOLAR POWER TOWER
3 AIR COOLED CONDENSER (ACC)
8 START-UP AUXILARY BOILER
9 NIGHT PRESERVATION AUXILARY BOILER (NPAB)
11 SOLAR RECEIVER STEAM GENERATOR (SRSG)
28 FIRE WATER PUMP HOUSE W/1 DIESEL, 1 ELEC. & 1 JOCKEY PUMP
34 SERVICE / FIRE WATER STORAGE TANK
36 CCW WET SURFACE AIR COOLER (WSAC)
42 WASTE WATER TANK
70 RESIDUE TANK
72 THERMAL EVAPORATION UNIT

NOTES:
1. FAA OBSTRUCTION LIGHTING:
MEDIUM INTENSITY FLASHING WHITE OBSTRUCTION LIGHT SYSTEM (MIWOL), SIX LIGHT UNITS PER LEVEL (0° NORTH 60°, 120°, 180° SOUTH, 240°, 300°)

50 0 50 100
Scale: 1 INCH = 50 FEET

NO	DATE	REVISION	BY	CHK

REVISION APPROVAL — REV / DATE
DISCIPLINE / REVIEWED: CIVIL, STRUCTURAL, MECHANICAL, PROCESS, PIPING, ELECTRICAL, INST & CNTRL, ARCHITECTURAL, PLANT LAYOUTS

STATUS — ISSUED / REV / DATE / DM / SDE / PEM: PRELIMINARY; FOR REVIEW AND APPROVAL; APPROVED FOR CONSTRUCTION; REVISED & APPROVED FOR CONSTRUCTION

RESPONSIBLE ENGINEER

PE #

SCALE 1" = 50'-0"

BrightSource

PROJECT NO. 459892

CH2MHILL

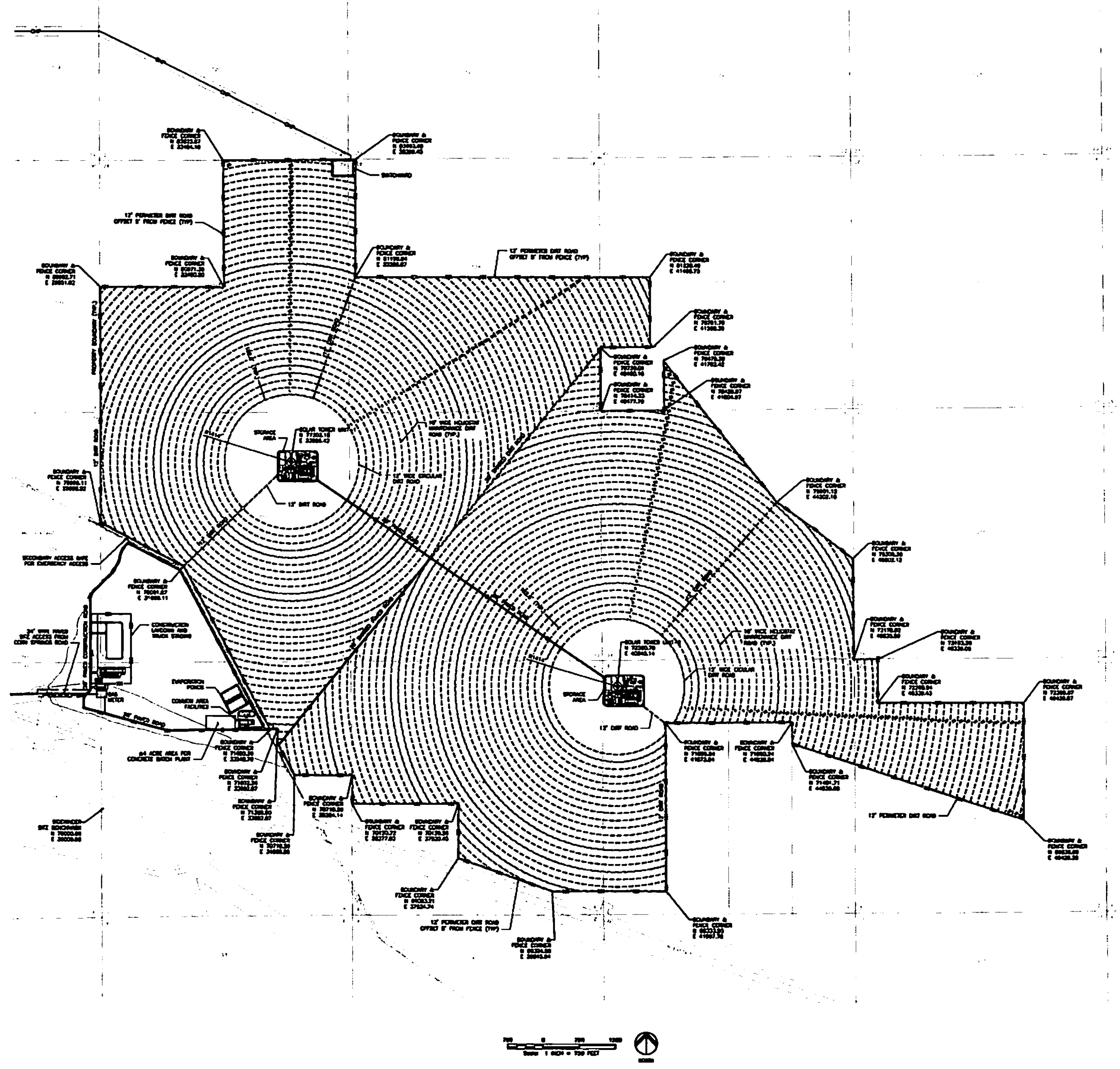
EQUIPMENT ARRANGEMENT ELEVATION
POWER BLOCK #2
FIGURE NO. 2.2-2B

DWG. NO. P-1002A REV. 1

BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"

VISUAL RESOURCES ATTACHMENT 1C –

PROJECT LAYOUT



GENERAL NOTES:

*NOTE:

*HARDSCAPE AREA DATA:

*EARTHWORK QUANTITIES:

PRELIMINARY
NOT FOR CONSTRUCTION

BrightSource

CH2MHILL

CIVIL
OVERALL SITE PLAN
FIGURE NO. 2.1-5

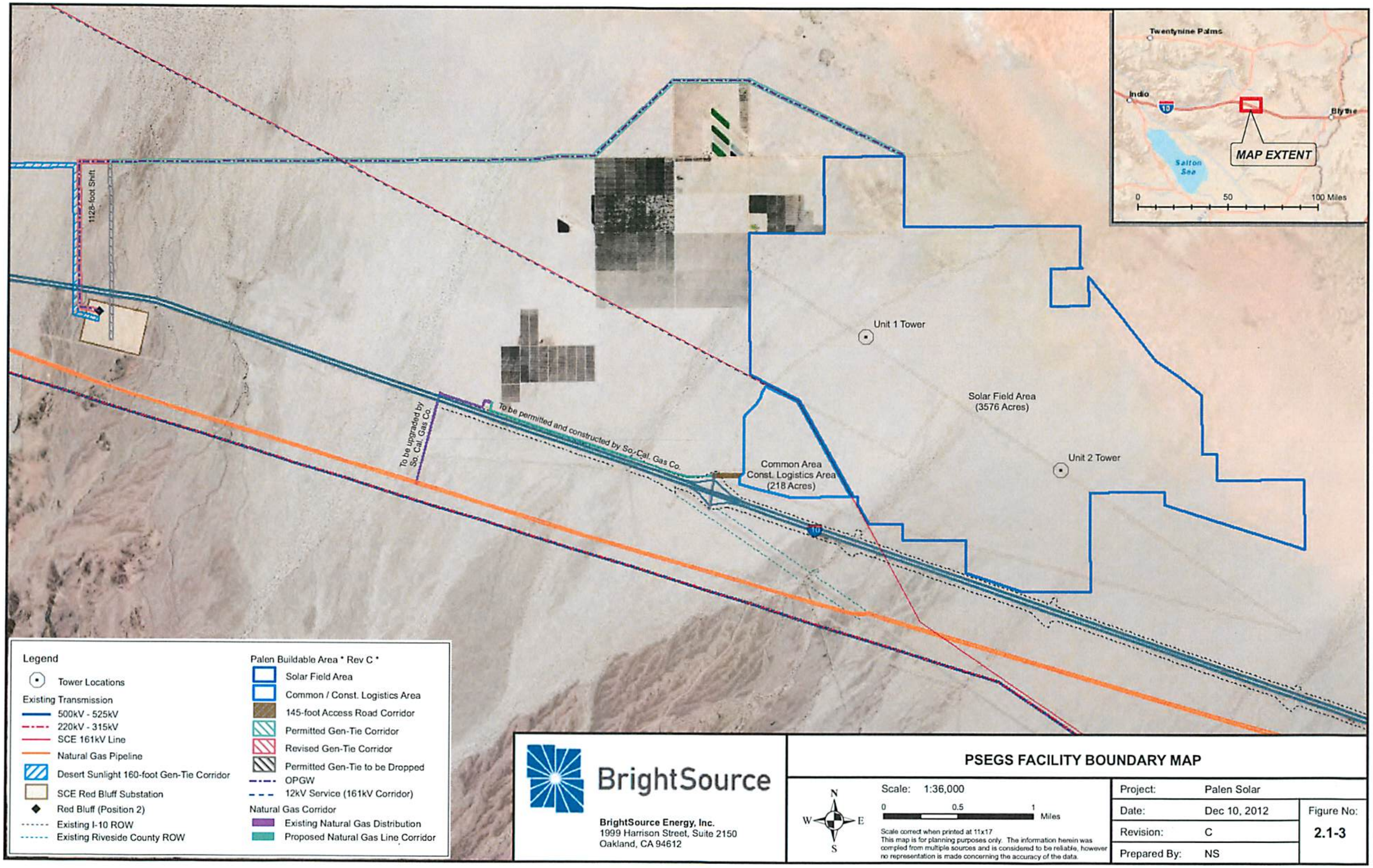
PALEN
SOLAR ELECTRIC GENERATION
STATION

D

C-1000

VISUAL RESOURCES ATTACHMENT 1D –

TRANSMISSION LINE ROUTE


Twentynine Palms
Indio
10
Blythe
Salton Sea
MAP EXTENT
0
50
100 Miles
1128-foot Shift
Unit 1 Tower
Solar Field Area
(3576 Acres)
Unit 2 Tower
Common Area
Const. Logistics Area
(218 Acres)
To be upgraded by So. Cal. Gas Co.
To be permitted and constructed by So. Cal. Gas Co.
10
Legend
Tower Locations
Existing Transmission
500kV - 525kV
220kV - 315kV
SCE 161kV Line
Natural Gas Pipeline
Desert Sunlight 160-foot Gen-Tie Corridor
SCE Red Bluff Substation
Red Bluff (Position 2)
Existing I-10 ROW
Existing Riveside County ROW
Palen Buildable Area * Rev C *
Solar Field Area
Common / Const. Logistics Area
145-foot Access Road Corridor
Permitted Gen-Tie Corridor
Revised Gen-Tie Corridor
Permitted Gen-Tie to be Dropped
OPGW
12kV Service (161kV Corridor)
Natural Gas Corridor
Existing Natural Gas Distribution
Proposed Natural Gas Line Corridor
BrightSource
BrightSource Energy, Inc.
1999 Harrison Street, Suite 2150
Oakland, CA 94612
PSEGS FACILITY BOUNDARY MAP
N
W
E
S
Scale: 1:36,000
0
0.5
1
Miles
Scale correct when printed at 11x17
This map is for planning purposes only. The information herein was compled from multiple sources and is considered to be reliable, however no representation is made concerning the accuracy of the data.
Project: Palen Solar
Date: Dec 10, 2012
Revision: C
Prepared By: NS
Figure No:
2.1-3

VISUAL RESOURCES APPENDIX VR-2

FIGURES

Figure 1 – Characteristic Landscape of the Project Site

Figure 2 – Project Viewshed

Figure 3 – Location of Key Observation Points (KOPs)

Figure 4a – Existing View from KOP 1, State Route 177/Coxcomb Mountain (JTNP)

Figure 4b – Visual Simulation of Proposed Project from KOP 1, State Route 177/Coxcomb Mountain (JTNP)

Figure 5a – Existing View from KOP 2 Northwest of Desert Center/Big Wash (JTNP)

Figure 5b – Visual Simulation of Proposed Project from KOP 2 Northwest of Desert Center/Big Wash (JTNP)

Figure 6a – Existing view from KOP 3, Eastbound I-10

Figure 6b – Visual Simulation of Proposed Project from KOP 3 Eastbound I-10

Figure 7a – Existing view from KOP 4, Westbound I-10

Figure 7b – Visual Simulation of Proposed Project from KOP 4, Westbound I-10

Figure 8a – Existing view from KOP 5, Corn Springs Road/Chuckwalla Mountains Wilderness

Figure 8b – Visual Simulation of Proposed Project from KOP 5, Corn Springs Road/Chuckwalla Mountains Wilderness

Figure 9a – Existing view from KOP 6 in the Palen McCoy Wilderness

Figure 9b – Visual Simulation of Proposed Project from KOP 6 in the Palen McCoy Wilderness

Figure 10a – KOP 1-Near Desert Center Looking Southeast-Existing View Taken at 10:00pm

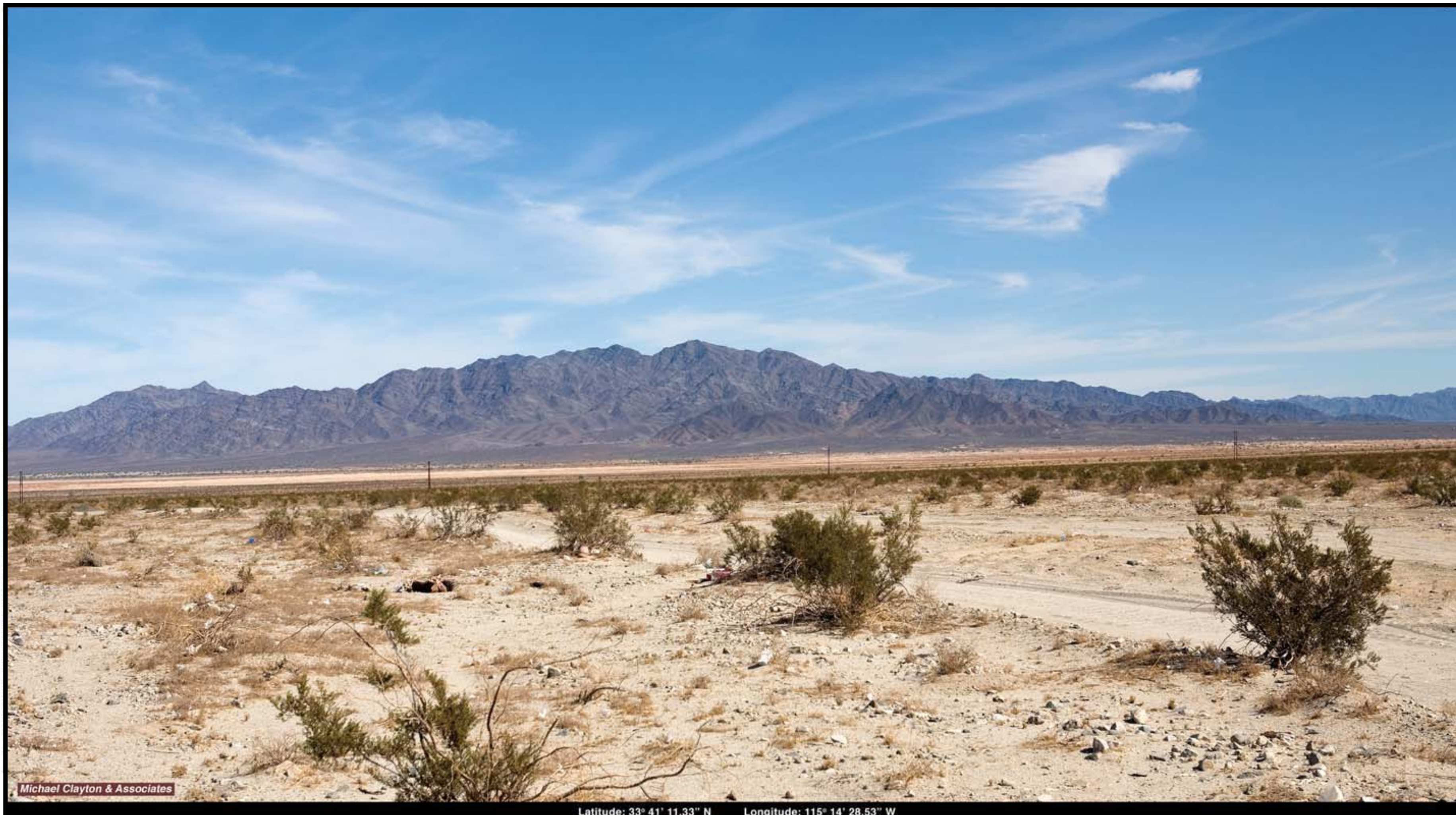
Figure 10b – KOP 1-Near Desert Center Looking Southeast-Proposed View Taken at 10:00pm

Figure 11a – KOP 3-South of Eagle Mountain Looking Southeast-Existing View Taken at 10:00pm

Figure 11b – KOP 3-South of Eagle Mountain Looking Southeast-Proposed View Taken at 10:00pm

VISUAL RESOURCES - FIGURE 1

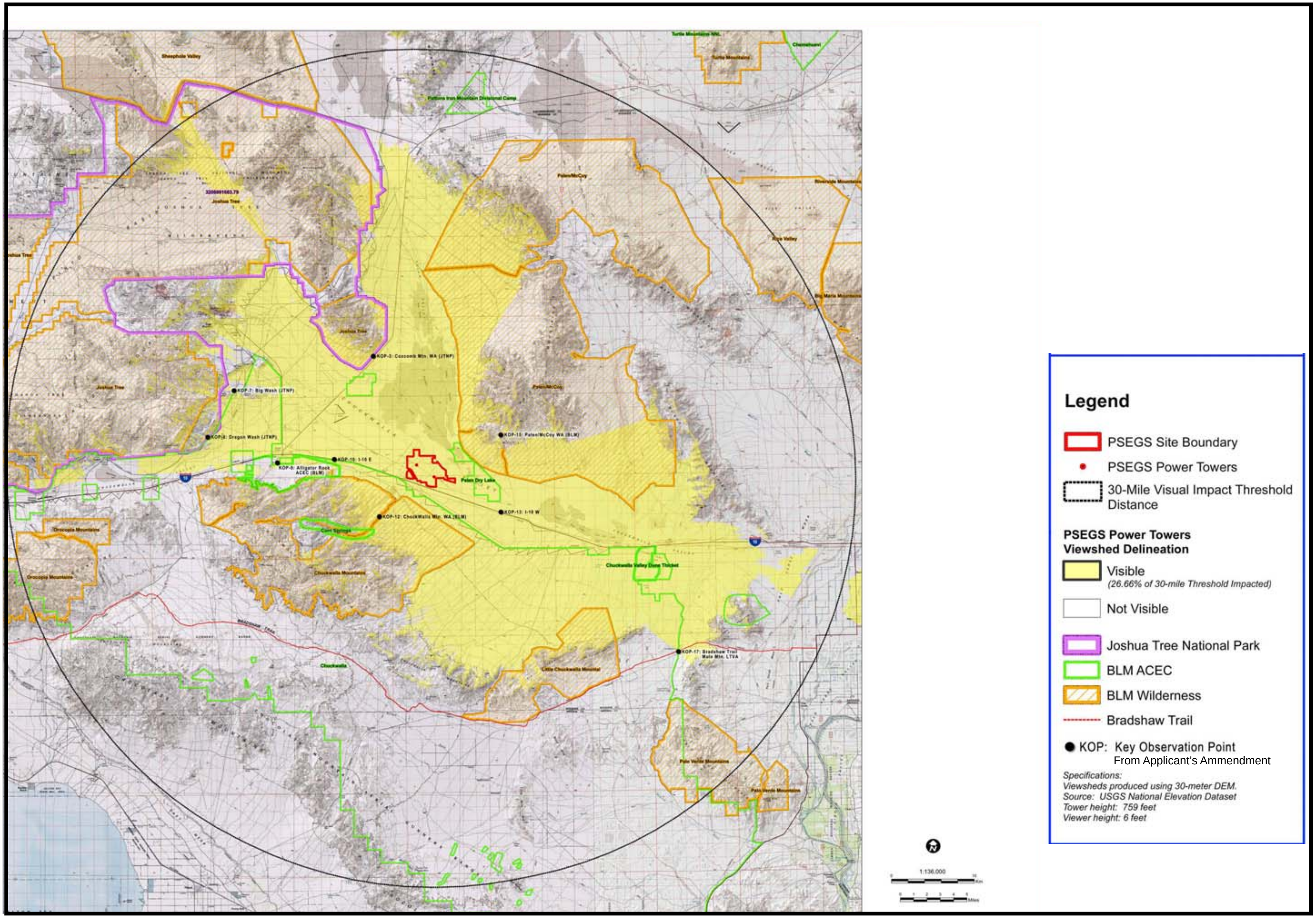
Palen Solar Electric Generating System - Characteristic Landscape of the Project Site



SOURCE: Michael Clayton and Associates

VISUAL RESOURCES - FIGURE 2

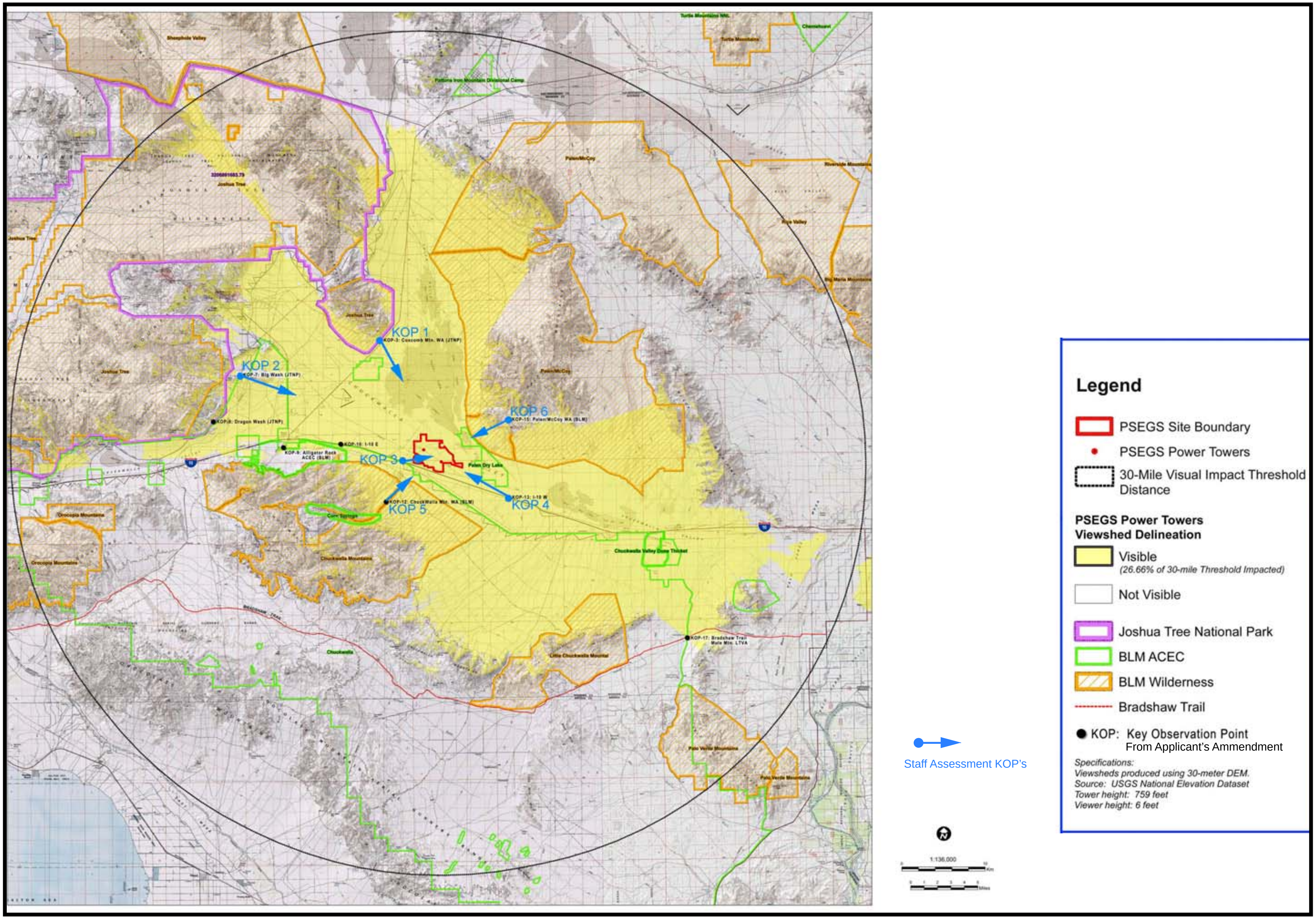
Palen Solar Electric Generating System - Viewshed Delineation



SOURCE: 3DScape

VISUAL RESOURCES - FIGURE 3

Palen Solar Electric Generating System - Key Observation Points (KOPs)



CALIFORNIA ENERGY COMMISSION - SITING, TRANSMISSION AND ENVIRONMENTAL PROTECTION DIVISION

SOURCE: 3DScape

VISUAL RESOURCES - FIGURE 4a

Palen Solar Electric Generating System - KOP 1 - State Route 177/Coxcomb Mountain (JTNP) - Existing Condition

CALIFORNIA ENERGY COMMISSION - SITING, TRANSMISSION AND ENVIRONMENTAL PROTECTION DIVISION

SOURCE: 3DScape

VISUAL RESOURCES - FIGURE 4b

Palen Solar Electric Generating System - KOP 1 - State Route 177/Coxcomb Mountain (JTNP) - Proposed Condition

CALIFORNIA ENERGY COMMISSION - SITING, TRANSMISSION AND ENVIRONMENTAL PROTECTION DIVISION

SOURCE: 3DScape

VISUAL RESOURCES - FIGURE 5a

Palen Solar Electric Generating System - KOP 2 - Northwest of Desert Center/Big Wash (JTNP) - Existing Condition

SOURCE: 3DScape

VISUAL RESOURCES - FIGURE 5b

Palen Solar Electric Generating System - KOP 2 - Northwest of Desert Center/Big Wash (JTNP) - Proposed Condition

SOURCE: 3DScape

VISUAL RESOURCES - FIGURE 6a

Palen Solar Electric Generating System - KOP 3 - Eastbound I-10 (Middleground Distance) - Existing Condition

SOURCE: 3DScape

VISUAL RESOURCES - FIGURE 6b

Palen Solar Electric Generating System - KOP 3 - Eastbound I-10 (Middleground Distance) - Proposed Condition

CALIFORNIA ENERGY COMMISSION - SITING, TRANSMISSION AND ENVIRONMENTAL PROTECTION DIVISION

SOURCE: 3DScape

VISUAL RESOURCES - FIGURE 7a

Palen Solar Electric Generating System - KOP 4 - Westbound I-10 (Background Distance) - Existing Condition

CALIFORNIA ENERGY COMMISSION - SITING, TRANSMISSION AND ENVIRONMENTAL PROTECTION DIVISION

SOURCE: 3DScape

VISUAL RESOURCES - FIGURE 7b

Palen Solar Electric Generating System - KOP 4 - Westbound I-10 (Background Distance) - Proposed Condition

VISUAL RESOURCES - FIGURE 8a

Palen Solar Electric Generating System - KOP 5 - Corn Springs Road/Chuckwalla Mountains Wilderness - Existing Condition

CALIFORNIA ENERGY COMMISSION - SITING, TRANSMISSION AND ENVIRONMENTAL PROTECTION DIVISION

SOURCE: 3DScape

VISUAL RESOURCES - FIGURE 8b

Palen Solar Electric Generating System - KOP 5 - Corn Springs Road/Chuckwalla Mountains Wilderness - Proposed Condition

CALIFORNIA ENERGY COMMISSION - SITING, TRANSMISSION AND ENVIRONMENTAL PROTECTION DIVISION

SOURCE: 3DScape

VISUAL RESOURCES - FIGURE 9a

Palen Solar Electric Generating System - KOP 6 - Palen McCoy Wilderness - Existing Condition

SOURCE: 3DScape

VISUAL RESOURCES - FIGURE 9b

Palen Solar Electric Generating System - KOP 6 - Palen McCoy Wilderness - Proposed Condition

CALIFORNIA ENERGY COMMISSION - SITING, TRANSMISSION AND ENVIRONMENTAL PROTECTION DIVISION

SOURCE: 3DScape

VISUAL RESOURCES - FIGURE 10a

Palen Solar Electric Generating System - KOP 1 - Near Desert Center Looking Southeast - Existing View Taken at 10:00 pm

Latitude:	33.848735
Longitude:	-115.341666
Elevation of Viewpoint Position (ft):	721.20
Height of Camera Above Ground (ft):	5.4
Date of Photography:	May 17, 2013 at 10:00 pm
Orientation of View:	SE
Lens type:	28mm
Horizontal Field of View:	65°
Vertical Field of View:	46°
Distance to nearest tower (mi):	12.38

Camera location has been captured using a handheld GPS device.

This image was captured with a full frame 28mm lens and should be viewed at a distance of 10.9 inches when printed at 11x17.

Key Observation Point

Proposed Facility

VISUAL RESOURCES

CALIFORNIA ENERGY COMMISSION - SITING, TRANSMISSION AND ENVIRONMENTAL PROTECTION DIVISION

SOURCE: Truescape

VISUAL RESOURCES - FIGURE 10b

Palen Solar Electric Generating System - KOP 1 - Near Desert Center Looking Southeast - Proposed View Taken at 10:00 pm

Latitude:	33.848735
Longitude:	-115.341666
Elevation of Viewpoint Position (ft):	721.20
Height of Camera Above Ground (ft):	5.4
Date of Photography:	May 17, 2013 at 10:00 pm
Orientation of View:	SE
Lens type:	50mm Equivalent
Horizontal Field of View:	40°
Vertical Field of View:	27°
Distance to nearest tower (mi):	12.38

Camera location has been captured using a handheld GPS device.

This image was captured with a full frame 28mm lens and should be viewed at a distance of 10.9 inches when printed at 11x17.

Key Observation Point

Proposed Facility

CALIFORNIA ENERGY COMMISSION - SITING, TRANSMISSION AND ENVIRONMENTAL PROTECTION DIVISION

SOURCE: Truescape

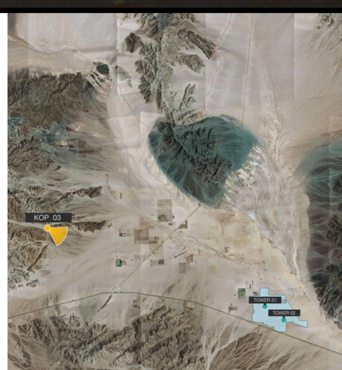
VISUAL RESOURCES - FIGURE 11a

Palen Solar Electric Generating System - KOP 3 - South of Eagle Mountain Looking Southeast - Existing View Taken at 10:00 pm

Latitude:	33.771322
Longitude:	-115.481469
Elevation of Viewpoint Position (ft):	524.03
Height of Camera Above Ground (ft):	5.4
Date of Photography:	May 16, 2013 at 10:00 pm
Orientation of View:	SE
Lens type:	28mm
Horizontal Field of View:	65°
Vertical Field of View:	46°
Distance to nearest tower (mi):	15.56

Camera location has been captured using a handheld GPS device.

This image was captured with a full frame 28mm lens and should be viewed at a distance of 10.9 inches when printed at 11x17.



Key Observation Point
Proposed Facility

CALIFORNIA ENERGY COMMISSION - SITING, TRANSMISSION AND ENVIRONMENTAL PROTECTION DIVISION

SOURCE: Truescape

VISUAL RESOURCES - FIGURE 11b

Palen Solar Electric Generating System - KOP 3 - South of Eagle Mountain Looking Southeast - Proposed View Taken at 10:00 pm

Latitude:	33.771322
Longitude:	-115.481469
Elevation of Viewpoint Position (ft):	524.03
Height of Camera Above Ground (ft):	5.4
Date of Photography:	May 16, 2013 at 10:00 pm
Orientation of View:	SE
Lens type:	50mm Equivalent
Horizontal Field of View:	40°
Vertical Field of View:	27°
Distance to nearest tower (mi):	15.56

Camera location has been captured using a handheld GPS device.

This image was captured with a full frame 28mm lens and should be viewed at a distance of 10.9 inches when printed at 11x17.

Key Observation Point

Proposed Facility

CALIFORNIA ENERGY COMMISSION - SITING, TRANSMISSION AND ENVIRONMENTAL PROTECTION DIVISION

SOURCE: Truescape

WASTE MANAGEMENT

Testimony of Christopher Dennis, PG

SUMMARY OF CONCLUSIONS

The proposed amended project would employ the BrightSource power tower technology, which would eliminate parabolic trough technology and the need for heat transfer fluid (HTF). With the elimination of HTF and the waste management requirements related to this fluid, Condition of Certification **WASTE-8** is no longer required.

Management of the nonhazardous and hazardous waste generated during construction, operation, and closure of the Palen Solar Electric Generating Station (PSEGS) would not result in significant adverse impacts under the California Environmental Quality Act (CEQA) guidelines (Appendix G: Environmental Checklist Section XVI - Utilities and Service Systems). The PSEGS would be consistent with the applicable waste management laws, ordinances, regulations, and standards (LORS), provided that the measures proposed by the applicant and mitigation proposed by Energy Commission staff (staff) are implemented.

INTRODUCTION

This section presents an analysis of the potential adverse environmental impacts and LORS compliance related to the wastes that would be generated by PSEGS during construction, operation, and eventual closure. Management and discharge of wastewater is addressed in the **SOIL AND WATER RESOURCES** section of this document. Additional information related to waste management may also be covered in the **WORKER SAFETY** and **HAZARDOUS MATERIALS MANAGEMENT** sections of this document.

The objectives of this analysis are to evaluate whether:

1. PSEGS generated wastes would be managed in compliance with all applicable LORS;

2. To ensure that wastes generated during PSEGS construction, operation, and closure would be managed and disposed of in an environmentally safe manner and would not significantly and adversely impact existing waste disposal facilities; and

3. To ensure that PSEGS generated wastes and waste constituents would not pose a significant risk to humans or the environment.

METHODOLOGY AND THRESHOLDS FOR DETERMINING ENVIRONMENTAL CONSEQUENCES

Staff analyzed the expected direct, indirect, and cumulative impacts that would be caused by management of waste generated during construction, operation, and closure of PSEGS. This analysis includes evaluation of the potential impact of existing contamination associated with on site activities on or near the PSEGS site and impacts from the generation and management of wastes during demolition of existing structures and during project construction and operation. If potential impacts related to the proposed project would be negative and significant, staff has recommended mitigation to avoid or reduce the effect of those impacts to a level of less than significant.

Staff's analysis includes review of a Phase I Environmental Site Assessment (ESA) submitted as part of the project application for certification. This ESA was updated as part of this proposed project amendment. A Phase I evaluates existing and potential site contamination. The evaluation is performed by a qualified environmental professional who inquires into past uses and ownership of the property, researches hazardous substance releases and hazardous waste disposal at the site and within a certain distance of the site, and visually inspects the property to observe potential contamination and possible areas of concern. After conducting all necessary file reviews, interviews, and site observations, the environmental professional then provides a report of findings about the environmental conditions at the site.

Because the Phase I ESA does not include sampling or testing, the environmental professional may give an opinion about the potential need for any additional investigation. Additional investigation may be needed, for example, if there were significant gaps in the information available about the site, if an ongoing release is suspected, or to confirm an existing environmental condition. If additional investigation is needed to identify the extent of possible contamination, a Phase II ESA may be required. The Phase II ESA usually includes sampling and testing of potentially contaminated media to verify the extent and concentration of contamination. Based on this information, remediation plans, if necessary, can be developed.

If potential or existing releases or contamination is identified, the CEQA significance of the release or contamination is to be determined by site-specific factors, which include:

- The amount and concentration of contaminants or contamination;
- The proposed use of the area where the contaminants/contamination is found; and
- Any potential contaminant exposure pathways to workers, the public or sensitive species or environmental areas.

Unmitigated contamination or releases of hazardous substances that pose a risk to human health or environmental receptors are considered a significant adverse impact.

Staff also analyzed project compliance with the local, state, and federal LORS. LORS compliance is a major component of the determination regarding the significance and acceptability of the proposed project with respect to management of waste.

LAWS, ORDINANCES, REGULATIONS, AND STANDARDS

The following federal, state, and local LORS have been established to ensure the safe and proper management of both non-hazardous and hazardous wastes. These LORS are designed to protect human health and the environment.

Waste Management Table 1
Laws, Ordinances, Regulations, and Standards (LORS)

Applicable LORs	Description
Federal	
Title 42, United States Code (U.S.C.), §6901, et seq. Solid Waste Disposal Act of 1965 (as amended and revised by the Resource Conservation and Recovery Act of 1976, et al.)	The Solid Waste Disposal Act, as amended and revised by the Resource Conservation and Recovery Act (RCRA) et al., establishes requirements for the management of solid wastes (including hazardous wastes), landfills, underground storage tanks, and certain medical wastes. The statute also addresses program administration, implementation and delegation to states, enforcement provisions, and responsibilities, as well as research, training, and grant funding provisions. RCRA Subtitle C establishes provisions for the generation, storage, treatment, and disposal of hazardous waste, including requirements addressing: • Generator record keeping practices that identify quantities of hazardous wastes generated and their disposition; • Waste labeling practices and use of appropriate containers; • Use of a manifest when transporting wastes; • Submission of periodic reports to the United States Environmental Protection Agency (U.S. EPA) or other authorized agency; and • Corrective action to remediate releases of hazardous waste and contamination associated with RCRA-regulated facilities. RCRA Subtitle D establishes provisions for the design and operation of solid waste landfills. RCRA is administered at the federal level by U.S. EPA and its 10 regional offices. The Pacific Southwest regional office (Region 9) implements U.S. EPA programs in California, Nevada, Arizona, and Hawaii.
Title 42, U.S.C., §9601, et seq. Comprehensive Environmental Response, Compensation and Liability Act	The Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), also known as *Superfund*, establishes authority and funding mechanisms for cleanup of uncontrolled or abandoned hazardous waste sites, as well as cleanup of accidents, spills, or emergency releases of pollutants and contaminants into the environment. Among other things, the statute addresses: • Reporting requirements for releases of hazardous substances; • Requirements for remedial action at closed or abandoned hazardous waste sites, and brownfields; • Liability of persons responsible for releases of hazardous substances or waste; and • Requirements for property owners/potential buyers to conduct “all appropriate inquiries” into previous ownership and uses of the property to 1) determine if hazardous substances have been or may have been released at the site, and 2) establish that the owner/buyer did not cause or contribute to the release. A Phase I Environmental Site Assessment is commonly used to satisfy CERCLA “all appropriate inquiries” requirements.
Title 40, Code of	These regulations were established by U.S. EPA to implement the provisions of

Applicable LORs	Description
Federal Regulations (C.F.R.), Subchapter I – Solid Wastes	the Solid Waste Disposal Act and RCRA (described above). Among other things, the regulations establish the criteria for classification of solid waste disposal facilities (landfills), hazardous waste characteristic criteria and regulatory thresholds, hazardous waste generator requirements, and requirements for management of used oil and universal wastes. • Part 257 addresses the criteria for classification of solid waste disposal facilities and practices. • Part 258 addresses the criteria for municipal solid waste landfills. • Parts 260 through 279 address management of hazardous wastes, used oil, and universal wastes (i.e., batteries, mercury-containing equipment, and lamps). U.S. EPA implements the regulations at the federal level. However, California is a RCRA-authorized state, so most of the solid and hazardous waste regulations are implemented by state agencies and authorized local agencies in lieu of U.S. EPA.
Title 49, C.F.R., Parts 172 and 173. Hazardous Materials Regulations	These regulations address the United States Department of Transportation (DOT) established standards for transport of hazardous materials and hazardous wastes. The standards include requirements for labeling, packaging, and shipping of hazardous materials and hazardous wastes, as well as training requirements for personnel completing shipping papers and manifests. Section 172.205 specifically addresses use and preparation of hazardous waste manifests in accordance with Title 40, CFR, section 262.20.
Federal Clean Water Act, 33 U.S.C. §1251 et seq.	The Clean Water Act controls discharge of wastewater to the surface waters of the U.S.
State	
California Health and Safety Code (Health and Safety Code), Chapter 6.5, §25100, et seq. Hazardous Waste Control Act of 1972, as amended	This California law creates the framework under which hazardous wastes must be managed in California. The law provides for the development of a state hazardous waste program that administers and implements the provisions of the federal RCRA program. It also provides for the designation of California-only hazardous wastes and development of standards (regulations) that are equal to or, in some cases, more stringent than federal requirements. The California Environmental Protection Agency (Cal/EPA), Department of Toxic Substances Control (DTSC) administers and implements the provisions of the law at the state level. Certified Unified Program Agencies (CUPAs) implement some elements of the law at the local level.
Title 22, California Code of Regulations (Cal. Code Regs.), Division 4.5. Environmental Health Standards for the Management of Hazardous Waste	These regulations establish requirements for the management and disposal of hazardous waste in accordance with the provisions of the California Hazardous Waste Control Act and federal RCRA. As with the federal requirements, waste generators must determine if their wastes are hazardous according to specified characteristics or lists of wastes. Hazardous waste generators must obtain identification numbers; prepare manifests before transporting the waste off site; and use only permitted treatment, storage, and disposal facilities. Generator standards also include requirements for record keeping, reporting, packaging, and labeling. Additionally, while not a federal requirement, California requires that hazardous waste be transported by registered hazardous waste transporters. The standards addressed by Title 22, CAL. CODE REGS. include: • Identification and Listing of Hazardous Waste (Chapter 11, §66261.1, et seq.). • Standards Applicable to Generator of Hazardous Waste (Chapter 12, §66262.10, et seq.).

Applicable LORs	Description
	• Standards Applicable to Transporters of Hazardous Waste (Chapter 13, §66263.10, et seq.). • Standards for Universal Waste Management (Chapter 23, §66273.1, et seq.). • Standards for the Management of Used Oil (Chapter 29, §66279.1, et seq.). • Requirements for Units and Facilities Deemed to Have a Permit by Rule (Chapter 45, §67450.1, et seq.). The Title 22 regulations are established and enforced at the state level by DTSC. Some generator and waste treatment standards are also enforced at the local level by CUPAs.
Health and Safety Code, Chapter 6.11 §§25404 – 25404.9 Unified Hazardous Waste and Hazardous Materials Management Regulatory Program (Unified Program)	The Unified Program consolidates, coordinates, and makes consistent the administrative requirements, permits, inspections, and enforcement activities of the six environmental and emergency response programs listed below. • Aboveground Petroleum Storage Act requirements for Spill Prevention, Control, and Countermeasure (SPCC) Plans. • Hazardous Materials Release and Response Plans and Inventories (Business Plans). • California Accidental Release Prevention (CalARP) Program. • Hazardous Materials Management Plan / Hazardous Materials Inventory Statements. • Hazardous Waste Generator / Tiered Permitting Program. • Underground Storage Tank Program. The state agencies responsible for these programs set the standards for their programs while local governments implement the standards. The local agencies implementing the Unified Program are known as CUPAs. The DTSC's Calexico Field Office is the CUPA for the SES Solar Two project. Note: The Waste Management analysis only considers application of the Hazardous Waste Generator/Tiered Permitting element of the Unified Program.
Title 27, Cal. Code Regs., Division 1, Subdivision 4, Chapter 1, §15100, et seq. Unified Hazardous Waste and Hazardous Materials Management Regulatory Program	While these regulations primarily address certification and implementation of the program by the local CUPAs, the regulations do contain specific reporting requirements for businesses. • Article 9 – Unified Program Standardized Forms and Formats (§§ 15400–15410). • Article 10 – Business Reporting to CUPAs (§§15600–15620).

Applicable LORs	Description
Public Resources Code, Division 30, §40000, et seq. California Integrated Waste Management Act of 1989 (AB 939)	The California Integrated Waste Management Act (CIWMA) (AB 939) sets mandates and standards for management of solid waste in California for local jurisdictions (cities and counties) and the state. AB 939 sets landfill diversion requirements; a preferred waste management hierarchy (source reduction first, then recycling and reuse, and treatment and disposal last); standards for design and construction of municipal landfills; and programs for county waste management plans and local implementation of solid waste requirements. AB 939 is designed to reduce the volume and toxicity of solid waste landfilled and incinerated by requiring local governments to prepare and implement plans to improve the management of waste resources. AB 939 set out the requirement to reduce the amount of solid waste disposed in landfills and transformed by 50 percent by the year 2000 and every year thereafter, through source reduction, recycling, and composting.
Title 14, Cal. Code Regs., Division 7, §17200, et seq. California Integrated Waste Management Board	These regulations implement the provisions of the California Integrated Waste Management Act and set forth minimum standards for solid waste handling and disposal. The regulations include standards for solid waste management, as well as enforcement and program administration provisions. • Chapter 3 – Minimum Standards for Solid Waste Handling and Disposal. • Chapter 3.5 – Standards for Handling and Disposal of Asbestos Containing Waste. • Chapter 7 – Special Waste Standards. • Chapter 8 – Used Oil Recycling Program. • Chapter 8.2 – Electronic Waste Recovery and Recycling.
Health and Safety Code, Division 20, Chapter 6.5, Article 11.9, §25244.12, et seq. Hazardous Waste Source Reduction and Management Review Act of 1989	This law was enacted to expand the state's hazardous waste source reduction activities. Among other things, it establishes hazardous waste source reduction review, planning, and reporting requirements for businesses that routinely generate more than 12,000 kilograms (approximately 26,400 pounds) of hazardous waste in a designated reporting year. The review and planning elements are required to be done on a four-year cycle, with a summary progress report due to DTSC every fourth year.
Title 22, Cal. Code Regs., §67100.1 et seq. Hazardous Waste Source Reduction and Management Review	These regulations further clarify and implement the provisions of the Hazardous Waste Source Reduction and Management Review Act of 1989 (noted above). The regulations establish the specific review elements and reporting requirements to be completed by generators subject to the act.
Title 23, Cal. Code Regs., Division 3, Chapters 16 and 18	These regulations relate to hazardous material storage and petroleum UST cleanup, as well as hazardous waste generator permitting, handling, and storage. The DTSC Imperial County CUPA is responsible for local enforcement.
Local	
County of Riverside General Plan, Safety Element: Policy S 6.1	Describes the County's policies and siting criteria identified in the County of Riverside Hazardous Waste Management Plan including coordination of hazardous waste facility responsibilities on a regional basis through the Southern California Hazardous Waste Management Authority

Applicable LORs	Description
Riverside County Integrated Waste Management Program	The Countywide Integrated Waste Management Plan (CIWMP) was prepared in accordance with the California Integrated Waste Management Act of 1989, Chapter 1095 (AB 939) to ensure the County's compliance with the requirements of AB 939.
Riverside County Code Title 8 Chapters 8.60, 8.84, and 8.132, Health and Safety	Establishes requirements for the use, generation, storage, and disposal of hazardous and non-hazardous materials and wastes within the County.

PROPOSED MODIFIED PROJECT

The PSEGS site encompasses 3,794 acres, located approximately 0.5 miles north of U.S. Interstate Highway 10 (I-10) and approximately 10 miles east of the community of Desert Center in Riverside County, California. The site is located on vacant, undeveloped public land administered by the Bureau of Land Management (BLM). The only existing structure on the PSEGS site is the Southern California Edison's Eagle Mountain-Blythe 161 kV transmission line. This transmission line would be slightly re-routed near the western end of the PSEGS, around the newly constructed Red Bluff Substation. The modified PSEGS project would consist of:

- Two 250 MW units, each with a 750 feet solar power tower and receiver, power block, and dedicated heliostat field;
- A 15-acre common facilities area with an administration/warehouse building and two, two-acre evaporation ponds;
- A 203-acre temporary construction laydown area;
- A re-routed generation transmission line;
- A re-routed redundant telecommunication line along the generation transmission line; and
- A natural gas delivery connection from a new extension of the existing Southern California Gas distribution system to the PSEGS boundary.

The proposed amended project would employ the BrightSource power tower technology and thereby eliminating the need for parabolic trough technology and HTF.

ASSESSMENT OF IMPACTS AND DISCUSSION OF MITIGATION

This waste management analysis addresses the existing project site conditions and the potential for contamination associated with prior activities on or near the project site, and the potential impacts from the generation and management of wastes during project construction, operation, and closure.

EXISTING PROJECT SITE CONDITIONS AND POTENTIAL FOR CONTAMINATION

Historical use of the PSEGS site included General George Patton's Desert Training Camps during World War II. The site is located near Palen Pass, which was the site of some of the largest mock battles in the California-Arizona Maneuver Area. Live-fire training occurred in camps and facilities in the area and conventional, unconventional, and improvised land mines have been detected in addition to unexploded ordinance (UXO). Due to the proximity of the PSEGS site to Palen Pass and the camps, the project owner plans to conduct pre-construction UXO surveys with qualified technicians that meet Department of Defense requirements and/or employ UXO experts during ground disturbances in areas that may contain UXO (AECOM 2010a, DR-WM-279). The project owner also provided an outline for the Munitions and Explosions of Concern/UXO Recognition Training Program (AECOM 2010a). Existing Condition of Certification **WASTE-1** requires UXO training, investigation, removal, and disposal.

A Phase I ESA, dated May 2009, was prepared by AECOM in accordance with the American Society for Testing and Materials (ASTM) Standard Practice E 1527-05 for ESAs (Solar Millennium, 2009a). The 2009 ESA did not identify any Recognized Environmental Conditions (REC) in connection with historical or current site operations. An REC is the presence or likely presence of any hazardous substances or petroleum products on a property under the conditions that indicate an existing release, past release, or a material threat of a release of any hazardous substance or petroleum products into structures on the property, the ground, groundwater, or surface water.

The environmental records review portion of the 2009 ESA was updated on June 10, 2013. No changes in historical or current records were identified in this update (Palen, 2013cc). The ESA update was done in compliance with ASTM E 1527-05, which contains provisions for updating an existing ESA.[1]

In the event that contamination is identified during any phase of construction, existing Condition of Certification **WASTE-2** requires the availability of an experienced and qualified Professional Engineer or Professional Geologist for consultation. If contaminated soil is identified, existing Condition of Certification **WASTE-3** requires that the Professional Engineer or Professional Geologist inspect the site, determine what is required to characterize the nature and extent of contamination, and provide a report to the Energy Commission compliance project manager (CPM) and DTSC with findings and recommended actions. Condition of Certification **WASTE-3** also requires the Phase I to be updated with a current onsite inspection for RECs.

In the unlikely event that contaminated soil is encountered during excavation activities, the soil would be segregated, sampled, and tested to determine appropriate disposal and treatment options. If the soil is classified as hazardous, the Riverside County Department of Environmental Health would be notified and the soil hauled to a Class I landfill or other appropriate soil treatment and recycling facility, as required. The Riverside County Department of Environmental Health would also be notified if previously unknown

[1] These provisions require an ESA to be updated within a year if a new project is proposed for the property on which the initial ESA was prepared.

wells, tanks, or other underground storage facilities are discovered during construction. Subsequent removal of such equipment, including potential remediation activities, would be conducted in accordance with applicable LORS (Solar Millennium, 2009a). Staff believes that existing Conditions of Certification **WASTE-2** and **WASTE-3** would be adequate to address any soil contamination contingency that may be encountered during construction of the project and would further support compliance with LORS.

IMPACTS FROM GENERATION AND MANAGEMENT OF WASTES DURING PROJECT CONSTRUCTION, OPERATION, AND CLOSURE

Handling and management of waste generated by PSEGS would follow the hierarchical approach of source reduction, recycling, treatment, and disposal as specified in California Public Resources Code Sections 40051 and 40196. The first priority of the project owner is to use materials that reduce the waste that is generated. The next level of waste management involves reusing or recycling wastes. For wastes that cannot be recycled, treatment is to be used, if possible, to make the waste nonhazardous. Finally, waste that cannot be reused, recycled, or treated is to be transported off site to a permitted treatment, storage, or disposal facility.

Direct/Indirect Impacts and Mitigation

The Integrated Waste Management Act of 1989 [Assembly Bill (AB) 939, Sher, Chapter 1095, Statutes of 1989] set landfill waste diversion goals for local jurisdictions of 50 percent by the year 2000. To meet this goal, many jurisdictions require applicants for construction and demolition projects to submit a reuse/recycling plan for at least 50 percent of construction and demolition materials prior to the issuance of a building or demolition permit. While Riverside County does not have such a requirement, staff encourages the project owner to meet the 50 percent waste diversion rate.

Construction

Site preparation and construction of PSEGS would last approximately 34 months and generate non-hazardous, universal, and hazardous wastes in solid and liquid forms. Based on estimates by the project owner, these waste streams and volumes generated by the modified project would be roughly the same as those of the original project. Non-hazardous solid wastes generated during PSEGS construction would consist of scrap wood, rock, sand, concrete, metals, glass, plastic, paper, insulating materials, oil filters, sanitary, and food waste. The composition and volume of PSEGS non-hazardous construction waste would not differ significantly from that of the original project. For all construction waste, recyclable materials would be separated and removed to recycling facilities. Non-recyclable materials would be disposed of at a Class III landfill.

Wastewater would be generated during construction, and would include sanitary waste, hydrostatic test water, and equipment wash water. Sanitary waste would be contained in portable facilities and routinely disposed of at an offsite treatment/disposal facility by a sanitary service. Hydrostatic test water would be disposed of in accordance with in State Water Resources Control Board (SWRCB) *Order No. 2003-003-DWQ Statewide General Waste Discharge Requirements (WDRs) for Discharges to Land with a Low Threat to Water Quality (General WDRs)*. Potentially contaminated equipment wash water would be contained at designated wash areas and transported to a wastewater treatment facility via a licensed hauler. Please see the **SOIL AND WATER RESOURCES** section of this document for more information about the management of project wastewater.

Universal waste generated during construction would include spent alkaline batteries and fluorescent and mercury vapor lamps. The spent batteries and lamps would be recycled or disposed of by licensed universal waste handlers. Universal waste would be accumulated for less than one year and recycled off site. Before construction begins, the project owner would be required to develop and implement a Construction Waste Management Plan to ensure that waste is recycled when possible and properly landfilled as necessary. Existing Condition of Certification **WASTE-4** requires the project owner to submit a Construction Waste Management Plan to the CPM at least 30 days prior to the start of construction activities.

Hazardous waste generated during construction would include empty hazardous material containers, solvents, used oil and lube, paint, adhesives, oily rags, oil sorbent, spent welding materials, spent lead-acid batteries, corrosive cleaning materials, and flushing and cleaning wash water. This hazardous construction waste does not differ significantly from that of the original project. Empty hazardous material containers would be returned to the vendor or disposed of at a hazardous waste facility. Spent lead-acid batteries, solvents, used oils and lube, paint, adhesives, oil sorbent, and oily rags would be disposed of at a hazardous waste facility, recycled, or used for energy recovery. Corrosive cleaning materials would be disposed of at a permitted hazardous waste disposal facility. Flushing and cleaning wash water would be recycled, used for energy recovery, or disposed of based on its specific waste stream characteristics.

The generation of hazardous waste requires a unique hazardous waste generator identification number. The hazardous waste generator number is determined based on site location and, therefore, both the construction contractor and the PSEGS project owner/operator could be considered the generator of hazardous wastes at the site. The PSEGS project owner would be required to obtain a unique hazardous waste generator identification number for the site prior to starting construction in compliance with California Code of Regulation Title 22, Division 4.5. Existing Condition of Certification **WASTE-5** would require the PSEGS project owner to submit the notification and issued identification number documentation to the CPM prior to construction activity.

Hazardous wastes would be collected in hazardous waste accumulation containers and stored in a laydown area, warehouse area, or storage tank on equipment skids for less than 90 days (or less than 180 days in the case of lead acid batteries). The accumulated wastes would then be properly manifested, transported, and disposed of at a permitted hazardous waste disposal facility by a licensed hazardous waste collection and disposal firm. Staff reviewed the disposal methods and concluded that all wastes would be disposed of in accordance with all applicable LORS. Should any construction waste management-related enforcement action be taken or initiated by a regulatory agency, the project owner would be required by existing Condition of Certification **WASTE-6** to notify the CPM whenever the owner becomes aware of such action.

Operation

The proposed modified project would generate non-hazardous, universal, and hazardous wastes in solid and liquid forms under normal operating conditions. Based on estimates by the project owner, these waste streams and volumes generated by the modified project would be roughly the same as those of the original project.

PSEGS would generate non-hazardous waste, such as routine maintenance wastes (used air filters, spent deionization resins, sand and filter media) and domestic and office wastes (office paper, newsprint, aluminum cans, plastic, and glass). All non-hazardous solid wastes would be recycled to the maximum extent possible and non-recyclable wastes would be regularly transported off-site to a solid waste disposal facility.

Non-hazardous liquid wastes would be generated during facility operation and would include reverse osmosis (RO) membrane cleaning waste, RO system concentrate, and sanitary wastewater. RO membrane cleaning waste would be adjusted to neutralize its pH and used as a dust suppressant on-site or disposed of at a permitted waste management facility. Sanitary wastewater would be piped to an on-site septic system and leach field. RO system concentrate would be used for dust control if determined to be inert or disposed of at a permitted waste management facility if determined to be designated waste.

Project operations would also generate universal waste, including spent batteries (e.g., alkaline dry cell, nickel-cadmium, or lithium ion) and spent fluorescent bulbs or high-intensity discharge lamps. Universal waste would be accumulated for less than one year and recycled off-site. In accordance with existing Condition of Certification **WASTE-7**, the project owner would be required to develop and implement an Operations Waste Management Plan which would require documentation of the actual operational waste streams and waste volumes. The measures in the Operations Waste Management Plan would ensure that operational wastes are treated in compliance with all LORS and that an accurate record of PSEGS waste generation, storage, and disposal practices is maintained.

Hazardous wastes generated during project operations would include used lubricating oil and oil filters, solvents, paint, adhesives, oily rags, and oil sorbents. Used oils and grease would be recycled. Effluent from the oil-water separation system would be recycled. Oil adsorbent and oil filters would be sent off-site for recovery or disposal at a Class I landfill. No HTF-related wastes would be generated. Therefore, Condition of Certification **WASTE-8** is no longer required.

The PSEGS project owner would be considered the generator of hazardous wastes during facility operations. The hazardous waste generated identification number that would be required before the start of construction would be the same identification number used during project operations as required by existing Condition of Certification **WASTE-5**.

Proper hazardous material handling, good housekeeping practices, and personnel training would help keep spill wastes to a minimum. To ensure proper cleanup and management of any contaminated soils or waste materials generated from hazardous materials spills, existing Condition of Certification **WASTE-9** requires the project operator to document, clean up, and properly manage and dispose of wastes from any hazardous materials spills or releases in accordance with all applicable federal, state, and local requirements. More information related to hazardous materials management is provided in the **HAZARDOUS MATERIALS MANAGEMENT** section of this document.

The hazardous wastes generated during proposed modified project operations would be temporarily stored on-site, transported off-site by licensed hazardous waste haulers, and recycled or disposed of at authorized disposal facilities in accordance with established standards applicable to generators of hazardous waste (Title 22, Cal. Code Regs., §66262.10 et seq.). Should any operations waste management-related enforcement action be taken or initiated by a regulatory agency, the project owner would be required by existing Condition of Certification **WASTE-6** to notify the CPM when advised of any such action.

Closure

The closure of the proposed modified project would produce both hazardous and non-hazardous solid and liquid waste. The project owner did not identify waste streams or quantities of materials requiring disposal from closure. Required elements of a facility's non-operation and closure are outlined in a repair/restoration plan and facility closure plan as specified in proposed Conditions of Certification **COMPLIANCE-14** and **-15**. To ensure adequate review of a planned project closure, the PSEGS project owner would be required to submit a proposed facility closure plan to the CPM for review and approval at least 36 months (or other period of time agreed to by the CPM) prior to commencement of closure activities. The facility closure plan would document non-hazardous and hazardous waste management practices, including the inventory, management, and disposal of hazardous materials and wastes and permanent disposal of permitted hazardous materials and waste storage units. In addition, the plan would identify landfills with adequate capacity to receive closure-generated wastes. Conditions of Certification **WASTE-1** through **WASTE-10,** excluding **WASTE-8**, would apply to the proposed modified project during closure of PSEGS.

IMPACT ON EXISTING WASTE DISPOSAL FACILITIES

The Rio Mesa SEGF project, which proposed to use the same technology with the same capacity and would occupy virtually the same acreage, provided the following construction and operation non-hazardous waste and hazardous waste volume estimates (CEC, 2012):

- Construction non-hazardous waste (2,135 cubic yards) and hazardous waste (153 cubic yards).
- Operation for 30-years non-hazardous waste (2,070 cubic yards) and hazardous waste (2,160 cubic yards).

The PSEGS project owner estimated the operational non-hazardous waste volume would be 335 tons per year (approximately 1,500 cubic yards over 30 years) (Palen, 2013cc). This volume is similar to the estimate of 2,070 cubic yards provided for Rio Mesa SEGF. These volumes of non-hazardous and hazardous waste do not differ significantly from that of the PSEGS original project, except, however, no HTF would be used and no HTF related wastes would be generated.

Non-hazardous waste would be stored on site in appropriate containers and recycled or disposed of in a Class III landfill on a regular basis. As shown in **Waste Management Table 2**, there are six Class III waste disposal facilities in Riverside County that could potentially accommodate the PSEGS non-hazardous construction and operation wastes project: Badlands, Blythe, Desert Center, Lamb Canyon, Mecca II, and Oasis (CalRecycle, 2013).

Waste Management Table 2
Riverside County Landfill Capacity

Landfill	Permitted Days of Operation	Remaining Capacity (cubic yards)
Badlands	Mon - Sat, closed holidays	14,730,025
Blythe	Mon - Fri and first Sat of the month, closed holidays	4,159,388
Desert Center	2 days per year, closed holidays	23,246
Lamb Canyon	Mon - Sat, closed holidays	18,955,000
Mecca II	2 days per year, closed holidays	34,786
Oasis	Every Weds and Sat, closed holidays	149,597
	Total	**38,052,042**

Sources: CalRecycle, 2013; RCoWMD, 2013.

The combined remaining capacity of these six landfills is approximately 38 million cubic yards (CalRecycle, 2013). The non-recyclable, non-reusable component of the PSEGS waste stream would contribute to filling the available capacity of these landfills and would contribute a substantial portion of the remaining capacity at the Desert Center and Mecca II landfills. The remaining capacity of Desert Center and Mecca II landfills is limited to 34,786 cubic yards and 23,246 cubic yards, respectively (CalRecycle, 2013). In addition, the days of operation of these two landfills is very limited (RCoWMD, 2013). Therefore, existing Condition of Certification **WASTE-10** would require that all project-related non-hazardous, non-recyclable, and non-reusable construction and operation waste be diverted to Riverside County landfills other than Desert Center and Mecca II. Disposal of the non-hazardous solid wastes generated by the proposed modified project could occur without impacting the capacity or remaining life of the other Class III facilities.

There are two Class I waste disposal facilities in California that are currently accepting hazardous waste: Clean Harbors Buttonwillow Landfill in Kern County and the Chemical Waste Management Kettleman Hills Landfill in Kings County (Solar Millennium, 2009a). In total, there is a combined excess of 10 million cubic yards of remaining hazardous waste disposal capacity at these landfills with at least 30 remaining operating years (Solar Millennium, 2009a). In addition, the Kettleman Hills facility is in the process of permitting an additional 4.6 to 4.9 million cubic yards of disposal capacity (Waste Management, 2009). Hazardous wastes generated during construction, operation, and closure would be recycled to the extent possible and practical. Those wastes that cannot be recycled would be transported off site to a permitted treatment, storage, or disposal facility.

As noted above, type and quantity of waste for non-operation and closure have not been identified. The repair/restoration plan and facility closure plan prepared pursuant to Conditions of Certification **COMPLIANCE-14** and **-15** would provide this information as well as disposal facilities with adequate capacity to receive the wastes.

Cumulative Impacts

A project may result in a significant adverse cumulative impact where its effects are cumulatively considerable. "Cumulatively considerable" means that the incremental effects of an individual project are significant when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects (California Code of Regulations, Title 14, section 15130). NEPA states that cumulative effects can result from individually minor but collectively significant actions taking place over a period of time" (40 CFR §1508.7).

As proposed, the amount of non-hazardous and hazardous wastes generated during construction and operation of PSEGS would add to the total quantity of waste generated in Riverside County. Project non-hazardous wastes would be generated in modest quantities, approximately 2,135 cubic yards of solid waste during construction and 69 cubic yards per year during operation. These wastes would be recycled wherever practical and sufficient capacity is available at several treatment and disposal facilities to handle the volumes of wastes that would be generated by the project. The four available Class III landfills listed in **Waste Management Table 2** have a remaining capacity of approximately 38 million cubic yards.

Approximately 153 cubic yards of construction hazardous waste and 72 cubic yards per year of operation hazardous waste would be generated by PSEGS. California Class I landfills have over 15 million cubic yards of remaining capacity for hazardous waste. There is sufficient landfill capacity for hazardous waste in Riverside County.

The amount of non-hazardous and hazardous wastes generated during construction, operation, and closure of PSEGS would add to the total quantity of hazardous and non-hazardous waste generated in Riverside County. Projects in Riverside County would recycle waste wherever practical and sufficient landfill capacity is available throughout the area, especially with the addition of the Mesquite Regional Landfill with a capacity of 600 million tons when it is fully constructed (Fisher, 2013). As part of the County of Riverside AB 939 planning and reporting requirements, the county estimates that the existing county waste disposal system provides approximately 59.3 million tons of permitted disposal capacity (as of 12/31/2006), which would provide more than 15 years of the county's disposal capacity (RCoWMD, 2009). Therefore, impacts of PSEGS, when combined with impacts of other development projects currently proposed within Riverside County, would not result in significant adverse cumulative impacts under CEQA. Staff concludes that the waste generated by PSEGS would not cumulatively result in local or regional significant adverse waste management impacts under CEQA, provided that applicant complies with Condition of Certification **WASTE-10** and diverts project wastes to Riverside County landfills with adequate capacity.

LORS COMPLIANCE

Energy Commission staff concludes that the proposed modified project would comply with all applicable LORS regulating the management of non-hazardous and hazardous wastes during facility construction and operation. The project owner would be required to recycle and/or dispose of non-hazardous and hazardous wastes at facilities licensed or otherwise approved to accept the wastes. Because hazardous wastes would be produced during project construction and operation, PSEGS would be required to obtain a hazardous waste generator identification number from U.S. EPA. PSEGS would also be required to:

- Properly store, package, and label all hazardous waste;
- Use only approved transporters;
- Prepare hazardous waste manifests;
- Keep detailed records; and
- Appropriately train employees in accordance with state and federal hazardous waste management requirements.

NOTEWORTHY PUBLIC BENEFITS

PSEGS would not require use of HTF. The elimination of the use of HTF eliminates the possibility of HTF soil contamination and the need for removal of HTF-impacted soil to a Class I hazardous waste landfill or onsite bioremediation to non-hazardous concentrations.

RESPONSE TO COMMENTS

COUNTY OF RIVERSIDE/JOHN J. BENOIT, COMMENTS ON THE PRELIMINARY STAFF ASSESSMENT FOR THE PROPOSED PSEGS, TN # 200094, JULY 30, 2013:

In a comment letter dated July 30, 2013, the County of Riverside had reserved the right to comment on the waste management section of the Preliminary Staff Assessment pending submittal of additional data staff had requested. Staff has subsequently received the information requested. This information included:

- An updated Phase I ESA;
- Estimates of the type and volume of hazardous and non-hazardous waste expected to be generated by construction and operation of the proposed project; and
- An updated summary of the anticipated operation waste streams, estimated waste volumes, and generation frequency and proposed management methods.

During a telephone conversation on August 15, 2013, staff discussed the project owner's submittal of this information with the county (RCoWMD, 2013b). Based on this discussion, the county believes there would be no significant waste management impacts provided the proposed project complies with all LORS, as proposed by staff.

CONCLUSIONS

After review of the project owner’s proposed waste management procedures, staff concludes that:

- In areas that may contain UXO, pre-construction UXO surveys with qualified technicians that meet Department of Defense requirements and/or employ UXO experts during ground disturbances are required;
- In the unlikely event that contaminated soil is encountered during excavation activities, the soil would be segregated, sampled, and tested to determine appropriate disposal and treatment options;
- PSEGS wastes would be managed in compliance with all applicable waste management LORS;
- Construction, operation, and closure wastes would be characterized and managed as either hazardous or non-hazardous waste;
- All non-hazardous wastes would be recycled or reused to the extent feasible, and non-recyclable wastes would be collected by a licensed hauler and disposed of at a permitted solid waste disposal facility; and
- Hazardous wastes would be accumulated on site in accordance with maximum allowable accumulation times, and then properly manifested, transported to, and disposed of at a permitted hazardous waste management facility by licensed hazardous waste collection and disposal companies.

Based on estimates provided by the project owner, disposal of non-hazardous PSEGS wastes would be approximately the same as the original project, and would not adversely impact Class III landfill capacity and disposal of project-related hazardous wastes would not adversely impact Class I landfill capacity.

Existing Conditions of Certification **WASTE-1** through **-7**, **-9** and **-10** would ensure that PSEGS would remain in compliance and no new conditions of certification are proposed. These conditions would require the project owner to:

- Ensure the project site is investigated and remediated for any UXO that may pose a risk to construction personnel or the environment (**WASTE-1**);
- Ensure the project site is investigated and any contamination identified is remediated as necessary, with appropriate professional and regulatory agency oversight (**WASTE-2** and **-3**);
- Obtain approval for the Construction Waste Management and Operation Waste Management Plans detailing the types and volumes of wastes to be generated and how wastes will be managed, recycled, and/or disposed of after generation (**WASTE-4** and **-7**);
- Obtain a hazardous waste generator identification number from the United States Environmental Protection Agency (**WASTE-5**);
- Report any waste management-related LORS enforcement actions and how violations will be corrected (**WASTE-6**);

- Ensure that all spills or releases of hazardous substances are reported and cleaned-up in accordance with all applicable federal, state, and local requirements; (**WASTE-9**); and
- Ensure that non-recyclable solid waste is diverted to landfills with sufficient remaining capacity (**WASTE-10**).

Because the proposed amended project would employ the BrightSource power tower technology, which would eliminate parabolic trough technology and the need for HTF, staff is recommending the deletion of Waste Discharge Requirement stipulations for treatment of HTF-contaminated soils (**WASTE-8**).

PROPOSED CONDITIONS OF CERTIFICATION

Staff has proposed modifications to the **Waste Management** conditions of certification as shown below. (**Note:** Deleted text is in ~~strikethrough~~; new text is **<u>bold and underlined</u>**)

WASTE-1 The project owner shall prepare a UXO Identification, Training and Reporting Plan to properly train all site workers in the recognition, avoidance and reporting of military waste debris and ordnance. The project owner shall submit the plan to the ~~Compliance Project Manager (~~CPM~~)~~ for review and approval prior to the start of construction. The project owner shall provide documentation of the plan and provide survey results to the CPM. The plan shall contain, at a minimum, the following:

- A description of the training program outline and materials, and the qualifications of the trainers;
- Identification of available trained experts who will oversee earth-moving activities where ordnance could be uncovered and respond to notification of discovery of any ordnance (unexploded or not); and
- Work plan to identify, recover, and remove discovered ordnance, and to complete additional field screening, including geophysical surveys to investigate adjacent areas for surface, near surface or buried ordnance in all proposed land disturbance areas.

<u>Verification:</u> The project owner shall submit the UXO Identification, Training and Reporting Plan to the CPM for approval no later than 30 days prior to the start of site mobilization. The results of geophysical surveys shall be submitted to the CPM within 30 days of completion of the surveys.

WASTE-2 The project owner shall provide the résumé of an experienced and qualified Professional Engineer or Professional Geologist to the ~~Compliance Project Manager (~~CPM~~)~~ for review and approval. The résumé shall show experience in remedial investigation and feasibility studies. This Professional Engineer or Professional Geologist shall be available during site characterization (if needed), excavation, grading, and demolition activities. The Professional Engineer or Professional Geologist shall be given authority by the project owner to oversee any earth-moving activities that have the potential to disturb contaminated soil and impact public health, safety, and the environment.

Verification: No later than 30 days prior to the start of site mobilization the project owner shall submit the resume to the CPM for review and approval.

WASTE-3 If potentially contaminated soil is identified during site characterization, excavation, grading, or demolition at either the proposed site or linear facilities—as evidenced by discoloration, odor, detection by handheld instruments, or other signs—the Professional Engineer or Professional Geologist shall inspect the site; determine the need for sampling to confirm the nature and extent of contamination; and provide a written report to the project owner, representatives of Department of Toxic Substances Control (DTSC) or Regional Water Quality Control Board (RWQCB) and the ~~Compliance Project Manager (~~CPM~~)~~ stating the recommended course of action.

Depending on the nature and extent of contamination, the Professional Engineer or Professional Geologist shall have the authority to temporarily suspend construction activity at that location for the protection of workers or the public. If in the opinion of the Professional Engineer or Professional Geologist significant remediation may be required, the project owner shall contact the CPM and representatives of the DTSC or RWQCB for guidance and possible oversight.

Verification: The project owner shall submit any reports filed by the Professional Engineer or Professional Geologist to the CPM within 5 days of their receipt. The project owner shall notify the CPM within 24 hours of any orders issued to halt construction.

WASTE-4 The project owner shall submit a Construction Waste Management Plan to the ~~Compliance Project Manager (~~CPM~~)~~ for review and approval prior to the start of construction. The plan shall contain, at a minimum, the following:

- a description of all construction waste streams, including projections of frequency, amounts generated and hazard classifications;
- a survey of structures to be demolished that identifies the types of waste to be managed;
- a reuse/recycling plan for construction and demolition materials that meets or exceeds the 50 percent waste diversion goal established by the Integrated Waste Management Compliance Act; and,
- management methods to be used for each waste stream, including temporary on-site storage, housekeeping and best management practices to be employed, treatment methods, and companies providing treatment services, waste testing methods to assure correct classification, methods of transportation, disposal requirements and sites, and recycling and waste minimization/reduction plans.

Verification: The project owner shall submit the Construction Waste Management Plan to the CPM for approval no later than 30 days prior to the initiation of construction activities at the site.

WASTE-5 The project owner shall obtain a hazardous waste generator identification number from the United States Environmental Protection Agency (USEPA) prior to generating any hazardous waste during project construction and operations.

Verification: The project owner shall keep a copy of the identification number on file at the project site and provide documentation of the hazardous waste generation and notification and receipt of the number to the CPM in the next scheduled monthly compliance report after receipt of the number. Submittal of the notification and issued number documentation to the CPM is only needed once unless there is a change in ownership, operation, waste generation, or waste characteristics that requires a new notification to USEPA. Documentation of any new or revised hazardous waste generation notifications or changes in identification number shall be provided to the CPM in the next scheduled compliance report.

WASTE-6 Upon notification of any impending waste management-related enforcement action related to project site activities by any local, state, or federal authority, the project owner shall notify the CPM of any such action taken or proposed against the project itself, or against any waste hauler or disposal facility or treatment operator with which the owner contracts for the project, and describe the owner's response to the impending action or if a violation has been found, how the violation will be corrected.

Verification: The project owner shall notify the CPM in writing within 10 days of receiving written notice from authorities of an impending enforcement action. The CPM shall notify the project owner of any changes that will be required in the way project-related wastes are managed as a result of a finalized action against the project.

WASTE-7 The project owner shall submit the Operation Waste Management Plan to the CPM for review and approval. The plan shall contain, at a minimum, the following:

- a detailed description of all operation and maintenance waste streams, including projections of amounts to be generated, frequency of generation, and waste hazard classifications;
- management methods to be used for each waste stream, including temporary on-site storage, housekeeping and best management practices to be employed, treatment methods and companies providing treatment services, waste testing methods to ensure correct classification, methods of transportation, disposal requirements and sites, and recycling and waste minimization/source reduction plans;
- information and summary records of contacts with the local Certified Unified Program Agency and the ~~Department of Toxic Substances Control~~ **DTSC** regarding any waste management requirements necessary for project activities. Copies of all required waste management permits, notices, and/or authorizations shall be included in the plan and updated as necessary;

- a detailed description of how facility wastes will be managed and any contingency plans to be employed, in the event of an unplanned closure or planned temporary facility closure; and
- a detailed description of how facility wastes will be managed and disposed upon closure of the facility.

Verification: The project owner shall submit the Operation Waste Management Plan to the CPM for approval no later than 30 days prior to the start of project operation. The project owner shall submit any required revisions to the CPM within 20 days of notification from the CPM that revisions are necessary.

The project owner shall also document in each annual compliance report the actual volume of wastes generated and the waste management methods used during the year, provide a comparison of the actual waste generation and management methods used to those proposed in the original Operation Waste Management Plan, and update the Operation Waste Management Plan as necessary to address current waste generation and management practices.

~~**WASTE-8** The project owner shall document all releases and spills of Heat Transfer Fluid (HTF) as described in Condition **WASTE-9** and report only those that are 42 gallons or more, the CERCLA reportable quantity, as required in the **SOIL AND WATER RESOURCES** section of this Decision. Cleanup and temporary staging of HTF-contaminated soils shall be conducted in accordance with the approved Operation Waste Management Plan required in Condition **WASTE-7**. The project owner shall sample HTF-contaminated soil from CERCLA reportable incidents involving 42 gallons or more in accordance with the United States Environmental Protection Agency's (USEPA) current version of "Test Methods for Evaluating Solid Waste" (SW-846). Samples shall be analyzed in accordance with USEPA Method 8015 or other method to be reviewed and approved by DTSC and the CPM.~~

~~Within 28 days of an HTF spill, the project owner shall provide the results of the analyses and their assessment of whether the HTF-contaminated soil is considered hazardous or non-hazardous to the Department of Toxic Substances Control (DTSC) and the CPM for review and approval.~~

~~If DTSC, and the CPM determine the HTF-contaminated soil is considered hazardous, it shall be disposed of in accordance with California Health and Safety Code Section 25203 and procedures outlined in the approved Operation Waste Management Plan required in Condition **WASTE-7** and reported to the CPM in accordance with Condition **WASTE-9**.~~

~~If DTSC and the CPM determine the HTF-contaminated soil is considered non-hazardous it shall be retained in the land treatment unit (LTU) and treated on-site in accordance with the Waste Discharge Requirements contained in the **SOIL AND WATER RESOURCES** section of this Decision.~~

~~**Verification:** The project owner shall submit to the CPM and the DTSC for approval the project owner's assessment of whether the HTF contaminated soil is considered hazardous or non-hazardous under state regulations. HTF-contaminated soil that exceeds the regulatory hazardous waste levels must be disposed of in accordance with California Health and Safety Code Section 25203. HTF-contaminated soil that does not exceed the hazardous waste levels may be discharged to the on-site LTU. For discharges into the LTU, the project owner shall comply with the Waste Discharge Requirements contained in the **SOIL AND WATER RESOURCES** section of this Decision.~~

WASTE-9 The project owner shall ensure that all accidental spills or unauthorized releases of hazardous substances, hazardous materials, and hazardous waste are documented and remediated, and that wastes generated from accidental spills and unauthorized releases are properly managed and disposed of in accordance with all applicable federal, state, and local LORS and requirements. For the purpose of this condition of certification, "release" shall have the definition in Title 40 of the Code of Federal Regulations, Part 302.3.

Verification: No later than 30 days of the date that a project-related hazardous substance release was discovered, the project manager shall provide a copy of the accidental spill or unauthorized release documentation to the CPM.

The project owner shall document management of all accidental spills and unauthorized releases of hazardous substances, hazardous materials, and hazardous wastes that occur on the project property or related linear facilities. The documentation shall include, at a minimum, the following information: location of release; date and time of release; reason for release; volume released; how release was managed and material cleaned up; amount of contaminated soil and/or cleanup wastes generated; if the release was reported; to whom the release was reported; release corrective action and cleanup requirements placed by regulating agencies; level of cleanup achieved and actions taken to prevent a similar release or spill; and disposition of any hazardous wastes and/or contaminated soils and materials that may have been generated by the release.

WASTE-10 The project owner shall ensure that none of the project's non-hazardous, non-recyclable, and non-reusable construction and operation wastes shall be diverted to or deposited at either the Desert Center Landfill or the Oasis Sanitary Landfill.

Verification: The project owner shall provide documentation of all project-related solid waste disposal activities and identify the landfills receiving project-related wastes in the annual compliance report submitted to the CPM.

REFERENCES

CalRecycle, 2013. California's Department of Resources Recycling and Recovery, Solid Waste Information System. Website accessed on July 22, 2013: http://www.calrecycle.ca.gov/SWFacilities/Directory/Search/

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RCoWMD, 2013. Riverside County, Waste Management Department, Website accessed on July 23, 2013: http://www.rivcowm.org/opencms/

RCoWMD, 2013b. Report of Conversation with Ryan Ross, Senior Planner, Riverside County, Waste Management Department, August 15, 2013.

Solar Millennium 2009a – Solar Millennium (TN 52939). Application for Certification Vol. 1 & 2, Dated 8/24/2009.

WORKER SAFETY AND FIRE PROTECTION

Testimony of Alvin Greenberg, Ph.D.

SUMMARY OF CONCLUSIONS

California Energy Commission (Energy Commission) staff (staff) concludes that if the project owner for the proposed modified Palen Solar Electric Generating System (PSEGS) provides a Project Construction Safety and Health Program and a Project Operations and Maintenance Safety and Health Program, as required by revised Conditions of Certification **WORKER SAFETY-1**and **-2** and fulfills the requirements of Conditions of Certification **WORKER SAFETY-3** through **-12**, the project would incorporate sufficient measures to ensure adequate levels of industrial safety and comply with applicable laws, ordinances, regulations, and standards. The conditions of certification in this section of the Final Staff Assessment (FSA), including existing, modified, and new conditions, provide assurance that the Construction Safety and Health Program and the Operations and Maintenance Safety and Health Program proposed by the project owner would be reviewed by the appropriate agencies before implementation. The conditions also require verification that the proposed plans adequately assure worker safety and fire protection and comply with applicable laws, ordinances, regulations, and standards.

Staff has considered the positions of Palen Solar Holdings LLC and the Riverside County Fire Department (RCFD) and has considered all relevant information, including past and current experience at other solar power plants in California. Staff has determined that the modified project would cause a significant direct impact on local fire protection services but would not cause a significant cumulative impact. A direct impact is caused by the need to equip and train the fire department to respond to the specific unique hazards posed by solar tower technology which would be new to the county. No significant cumulative impact would occur because 1) the construction and operation of this solar power plant is not likely to change the overall hazard profile of facilities requiring emergency response in the county, 2) emergency events at this solar power plant are not likely to escalate (i.e., spread to other structures or locations) within or beyond the power plant site, and 3) emergencies are not likely to occur simultaneously with other facilities.

Therefore, staff is proposing mitigation to reduce the direct impact to less than significant by requiring payment to the RCFD for capital improvements and annual support (see proposed revised Condition of Certification **WORKER SAFETY-7**). Staff is also proposing a new Condition of Certification (**WORKER SAFETY-10**) that would clarify the requirement for the project owner to submit plans for all fire detection and suppression systems to the RCFD and to pay the fire department's usual and customary fee for those reviews and subsequent inspections.

In order to protect workers from potential exposure to Valley Fever (VF), staff proposes a revision to existing Condition of Certification, now numbered **WORKER SAFETY-8**, which would require enhanced dust control measures. Additionally, staff proposes Condition of Certification **WORKER SAFETY-12**, which would require reporting of confirmed VF cases (along with heat stress incidences) to the Energy Commission staff.

Staff proposes a new Condition of Certification (**WORKER SAFETY-11**) that would require two Tower Access and Safety Plans, one for construction and one for commissioning and operations, be prepared and implemented to control access to the towers, address fire detection and suppression systems, and ensure that the emergency hoist systems and backup power supply for the elevators and hoists are in place

Lastly, staff deleted and revised various conditions that pertained to design features of the previously approved Palen project.

INTRODUCTION

Worker safety and fire protection is regulated through laws, ordinances, regulations, and standards (LORS), at the federal, state, and local levels. Industrial workers at the facility operate equipment and handle hazardous materials daily and may face hazards that can result in accidents and serious injury. Protection measures are employed to eliminate or reduce these hazards or to minimize the risk through special training, protective equipment, and procedural controls.

The purpose of this Final Staff Assessment (FSA) is to assess the worker safety and fire protection measures proposed by the PSEGS and to determine whether the project owner has proposed adequate measures to:

- comply with applicable safety LORS;
- protect the workers during construction and operation of the facility;
- protect against fire; and
- Provide adequate emergency response procedures.

METHODOLOGY AND THRESHOLDS FOR DETERMINING ENVIRONMENTAL CONSEQUENCES

Two issues are assessed in **Worker Safety and Fire Protection**:

- the potential for impacts on the safety of workers during demolition, construction, and operations activities, and
- Fire prevention/protection, emergency medical response, and hazardous materials spill response during construction and operations.

Worker safety issues are thoroughly addressed by the California Department of Occupational Safety and Health (Cal/OSHA) regulations. If all LORS are followed, workers will be adequately protected. Thus, the standard for staff's review and determination of significant impacts on workers is whether or not the project owner has demonstrated adequate knowledge about and dedication to implementing all pertinent and relevant Cal/OSHA standards.

Regarding fire prevention matters, staff reviews and evaluates the on-site fire-fighting systems proposed by the project owner and the time needed for off-site local fire departments to respond to a fire, medical, or hazardous material emergency at the proposed power plant site. If on-site systems do not follow established codes and industry standards, staff recommends additional measures. Staff reviews and evaluates the local fire department capabilities and response time in each area and interviews the local fire officials to determine if they feel adequately trained, manned, and equipped to respond to the needs of a power plant. Staff then determines if the presence of the power plant would cause a significant impact on a local fire department. If it does, staff will recommend that the project owner mitigate this impact by providing increased resources to the fire department.

Staff has also established a procedure when a local fire department has identified either a significant incremental project impact to the local agency or a significant incremental cumulative impact to a local agency. Staff first conducts an initial review of the position and either agrees or disagrees with the fire department's determination that a significant impact would exist if the proposed power plant is built and operated. A process then starts whereby the project owner can either accept the determination made by staff or refute the determination by providing a Fire Needs Assessment and a Risk Assessment. The Fire Needs Assessment would address fire response and equipment/staffing/location needs while the Risk Assessment would be used to establish that while an impact to the fire department may indeed exist, the risk (chances) of that impact occurring and causing injury or death is less than significant.

LAWS, ORDINANCES, REGULATIONS, AND STANDARDS

Worker Safety and Fire Protection Table 1
Laws, Ordinances, Regulations, and Standards (LORS)

Applicable LORS	Description
Federal	
Title 29 U.S. Code (USC) section 651 et seq (Occupational Safety and Health Act of 1970)	This act mandates safety requirements in the workplace with the purpose of “[assuring] so far as possible every working man and woman in the nation safe and healthful working conditions and to preserve our human resources” (29 USC §651).
Title 29 Code of Federal Regulation (CFR) sections 1910.1 to 1910.1500 (Occupational Safety and Health Administration Safety and Health Regulations)	These sections define the procedures for promulgating regulations and conducting inspections to implement and enforce safety and health procedures to protect workers, particularly in the industrial sector.
29 CFR sections 1952.170 to 1952.175	These sections provide federal approval of California’s plan for enforcement of its own Safety and Health requirements, in lieu of most of the federal requirements found in 29 CFR sections 1910.1 to 1910.1500.
State	
Title 8 California Code of Regulations (Cal Code Regs.) all applicable sections (Cal/OSHA regulations)	These sections require that all employers follow these regulations as they pertain to the work involved. This includes regulations pertaining to safety matters during construction, commissioning, and operations of power plants, as well as safety around electrical components, fire safety, and hazardous materials use, storage, and handling.
24 Cal Code Regs. section 3, et seq.	This section incorporates the current addition of the Uniform Building Code.
Health and Safety Code section 25500, et seq.	This section presents Risk Management Plan requirements for threshold quantity of listed acutely hazardous materials at a facility.
Health and Safety Code sections 25500 to 25541	These sections require a Hazardous Material Business Plan detailing emergency response plans for hazardous materials emergency at a facility.
Local (or locally enforced)	
Riverside County Ordinance 457	Adopts specific building, mechanical, plumbing, and electrical codes from sources such as the California Building Standards Commission with county-specific modifications.
Riverside County Ordinance 787.6	Adopts the 2010 edition of the California Fire Code and portions of the 2010 edition of the California Building Code with county-specific modifications.
Riverside County Ordinance 615	Establishes requirements for the use, generation, storage and disposal of hazardous materials within the County.
Riverside County Department of Environmental Health, Hazardous Materials Releases	Adopts State requirements and guidelines to govern hazardous materials release response plans and inventories.
NFPA 850	This industry standard of the National Fire Protection Association (NFPA) address fire protection at electrical generating stations.
Chapter 22 of the 2010 California Fire Code	This section of the CFC addresses requirement for Motor Fuel-Dispensing Facilities and Repair Garages. It has been adopted by Riverside County and will apply to the fuel depot at the site.
NFPA 30a	This is the NFPA code for Motor Fuel Dispensing Facilities and Repair Garages (2008Edition) and is the industry standard for fuel depots.

PROPOSED MODIFIED PROJECT

On December 17, 2012, Palen Solar Holdings, LLC (PSH) filed a petition with the Energy Commission requesting to modify the Palen Solar Power Project (PSPP) now called PSEGS. The major modification is replacing the parabolic trough solar collection system using heat transfer fluid with Bright Source's solar tower technology. Heliostats—elevated mirrors guided by a tracking system mounted on a pylon—focus the sun's rays on a solar receiver steam generator located atop a 750-foot tower near the center of each solar field to create steam to drive a turbine that generates electricity.

Two adjacent solar fields producing 250 MW each are proposed for a combined nominal output of approximately 500 MW. Each of the 250 MW solar fields would have a dedicated tower, solar field/heliostat array of approximately 85,000 heliostats, and a dedicated steam turbine generator/power block. Both solar fields would share common facilities, including a common area containing an administration building, warehouse, evaporation ponds, maintenance complex, a meter/valve station for incoming natural gas service to the site, an onsite switchyard, and a 10-mile single-circuit 230-kV generation tie-line. Other onsite facilities would include access and maintenance roads (either dirt, gravel, or paved), perimeter fencing, tortoise fencing, and other ancillary security facilities.

SETTING AND EXISTING CONDITIONS

The proposed facility would be located in Riverside County off Interstate 10 approximately 10 miles east of Desert Center, and would consist of two units producing a total output of 500 MW. Fire support services to the site would be under the jurisdiction of the Riverside County Fire Department (RCFD). The closest RCFD fire station to the project site is the Lake Tamarisk Station #49 located at 43880 Lake Tamarisk in Desert Center, about 13 miles from the project. The estimated response time is 14 minutes once dispatched. The next nearest station would be the Blythe Air Base Station #45 located about 40 miles east, with a response time of about 30 minutes once dispatched. The fire station in Indio (Terra Lago Station #87 located at 42900 Golf Center Parkway, about 59 miles west of the PSEGS) would also respond if necessary, with a response time of 45 minutes once dispatched. All RCFD fire stations are staffed full-time with a minimum of three personnel per shift which include paramedics (Solar Millennium 2009a, Section 5.11.2.6 and RCFD 2010a).

The project owner has stated that designated plant personnel would be trained as a hazardous materials response team and that one or more spill response kits would be available on-site (Solar Millennium 2009a, Section 5.6.4.2). In the event of a large incident involving hazardous materials, backup support would be provided by the RCFD, which has a hazmat response unit that is capable of responding to any incident at the proposed PSEGS. The RCFD hazmat unit is located in Palm Desert (about 70 miles away) and would respond within 1.5 to 2 hours (RCFD 2010a).

Worker Safety and Fire Protection Table 2
Fire and Emergency Response for the PSEGS

RCFD Station	Response Time[1]	Distance to PSEGS	EMS/HazMat Capability[2]
Lake Tamarisk Station #49	14 minutes	~13 miles	Y/Y
Blythe Air Base Station #45	30 minutes	~40 miles	Y/Y
Terra Lago Station #87	45 minutes	~59 miles	Y/Y

Notes:
1 - Response times are estimated from the moment of dispatch.
2 - All personnel are trained to EMT-1 level and first responder for hazardous materials incidents.
Source: E-mail communications with the RCFD (RCFD 2010a)

In addition to construction and operations worker safety issues, the potential exists for exposure to contaminated soil during site preparation. The Phase I Environmental Site Assessment conducted for this site in 2009 found no “Recognized Environmental Conditions” per the American Society for Testing and Materials Standards (ASTM) definition. That is, there was no evidence or record of any use, spillage, or disposal of hazardous substances on the site, nor was there any other environmental concern that would require remedial action (Solar Millennium 2009a, Section 5.16.2.3). To address the unlikely possibility that soil contamination would be encountered during construction of the PSEGS, proposed Conditions of Certification **WASTE-2** and **WASTE-3** require a registered professional engineer or geologist to be available during soil excavation and grading to ensure proper handling and disposal of contaminated soil. See the staff assessment section on **WASTE MANAGEMENT** for a more detailed analysis of this topic.

Another potential hazard present at this site is the likelihood of encountering unexploded ordinance (UXOs) left over from large scale military training exercises conducted along what is now the route of Interstate 10 between 1942 and 1945 and in 1964. During WW-II, the area served as part of General George S. Patton’s Desert Training Center (DTC), the largest military facility in the world. As a result of these historic military maneuvers, there is a potential for unexploded ordnance (UXO) to occur at this site. Please see **WASTE MANAGEMENT** for further discussion of this issue. With implementation of Condition of Certification **WASTE-1**, staff concludes that any potential impact to workers from UXO would be reduced to less than significant.

ASSESSMENT OF IMPACTS AND DISCUSSION OF MITIGATION

WORKER SAFETY

Industrial environments are potentially dangerous during construction and operation of facilities. Workers at the proposed PSEGS would be exposed to loud noises, glint and glare, moving equipment, trenches, and confined space entry and egress problems. The workers may experience falls, trips, burns, lacerations, and numerous other injuries. They have the potential to be exposed to falling equipment or structures, chemical spills, hazardous waste, fires, explosions, and electrical sparks and electrocution. It is important for the PSEGS to have well-defined policies and procedures, training, and hazard recognition and control at its facility to minimize such hazards and protect workers. If the facility complies with all LORS and conditions of certification, workers will be adequately protected from health and safety hazards.

A Safety and Health Program would be prepared by the project owner to minimize worker hazards during construction and operation. Staff uses the phrase “Safety and Health Program” to refer to the measures that would be taken to ensure compliance with the applicable LORS during the construction and operational phases of the project.

Construction Safety and Health Program

Workers at the PSEGS would be exposed to hazards typical of construction and operation of a solar thermal electric power generating facility.

Construction Safety Orders are published at Title 8 California Code of Regulations sections 1502, et seq. These requirements are promulgated by Cal/OSHA and would be applicable to the construction phase of the project. The Construction Safety and Health Program would include the following:

- Construction Injury and Illness Prevention Program (8 Cal Code Regs. §1509)
- Construction Fire Prevention Plan (8 Cal Code Regs. §1920)
- Personal Protective Equipment Program (8 Cal Code Regs. §§1514-1522)
- Emergency Action Program and Plan

Additional programs under General Industry Safety Orders (8 Cal Code Regs. §§3200 to 6184), Electrical Safety Orders (8 Cal Code Regs. §§2299 to 2974) and Unfired Pressure Vessel Safety Orders (8 Cal Code Regs. §§450 to 544) would include:

- Electrical Safety Program
- Motor Vehicle and Heavy Equipment Safety Program
- Forklift Operation Program
- Excavation/Trenching Program
- Fall Protection Program
- Scaffolding/Ladder Safety Program
- Articulating Boom Platforms Program
- Crane and Material Handling Program
- Housekeeping and Material Handling and Storage Program
- Respiratory Protection Program
- Employee Exposure Monitoring Program
- Hand and Portable Power Tool Safety Program
- Hearing Conservation Program
- Back Injury Prevention Program
- Ergonomics Program
- Heat and Cold Stress Monitoring and Control Program
- Hazard Communication Program

- Lock Out/Tag Out Safety Program
- Pressure Vessel and Pipeline Safety Program
- Solar Components Safe Handling Program

The Application for Certification (AFC) includes adequate outlines of each of the above programs (Solar Millennium 2009a, Section 5.18.3.1). Prior to the start of construction of PSEGS, detailed programs and plans would be provided to the Energy Commission Compliance Project Manager (CPM) and to the RCFD pursuant to the Condition of Certification **WORKER SAFETY-1**.

Operations and Maintenance Safety and Health Program

Prior to the start of operations at PSEGS, the Operations and Maintenance Safety and Health Program would be prepared. This operational safety program would include the following programs and plans:

- Injury and Illness Prevention Program (8 Cal Code Regs. §3203)
- Fire Protection and Prevention Program (8 Cal Code Regs. §3221)
- Personal Protective Equipment Program (8 Cal Code Regs. §§3401 to 3411)
- Emergency Action Plan (8 Cal Code Regs. §3220)

In addition, the requirements under General Industry Safety Orders (8 Cal Code Regs. §§3200 to 6184), Electrical Safety Orders (8 Cal Code Regs. §§2299 to 2974) and Unfired Pressure Vessel Safety Orders (8 Cal Code Regs. §§450 to 544) would be applicable to the project. Written safety programs for PSEGS, which the project owner would develop, would ensure compliance with the above-mentioned requirements.

The AFC includes adequate outlines of the Injury and Illness Prevention Program, Emergency Action Plan, Fire Prevention Program, and Personal Protective Equipment Program (Solar Millennium 2009a, Section 5.18.3). These outlines are still applicable to PSEGS Prior to operation of PSEGS, all detailed programs and plans would be provided to the CPM and RCFD pursuant to Condition of Certification **WORKER SAFETY-2**.

Safety and Health Program Elements

As mentioned above, the project owner provided the proposed outlines for both a Construction Safety and Health Program and an Operations Safety and Health Program. The measures in these plans are derived from applicable sections of state and federal law. Both safety and health programs would be comprised of six more specific programs and would require major items detailed in the following paragraphs.

Injury and Illness Prevention Program

The IIPP would include the following components as presented in the AFC and are still applicable to PSEGS (Solar Millennium 2009a, Section 5.18.3.1):

- identity of person(s) with authority and responsibility for implementing the program;
- safety and health policy of the plan;

- definition of work rules and safe work practices for construction activities;
- system for ensuring that employees comply with safe and healthy work practices;
- system for facilitating employer-employee communications;
- procedures for identifying and evaluating workplace hazards and developing necessary program(s);
- methods for correcting unhealthy/unsafe conditions in a timely manner;
- safety procedures; and
- Training and instruction.

Fire Prevention Plan

California Code of Regulations requires an Operations Fire Prevention Plan (8 Cal Code Regs. §3221). The AFC outlines a proposed Fire Prevention Plan which is acceptable to staff for the PSEGS project (Solar Millennium 2009a, Section 5.18.3.2). The plan would accomplish the following:

- determine general program requirements (scope, purpose, and applicability);
- determine potential fire hazards;
- develop good housekeeping practices and proper handling and materials storage;
- determine potential ignition sources and control measures for these sources;
- determine persons responsible for equipment and system maintenance;
- locate portable and fixed fire-fighting equipment in suitable areas;
- establish and determine training and instruction requirements; and
- define recordkeeping requirements.

Under the existing license for the project, the project owner is required to submit a final Fire Prevention Plan to the CPM for review and approval and to the RCFD for review and comment to satisfy Conditions of Certification **WORKER SAFETY-1** and **WORKER SAFETY-2**. Staff is recommending that the Best Management Practices for the storage and application of herbicides be removed from Condition of Certification **WORKER SAFETY-2** because herbicides are not proposed to be used to control vegetation in the heliostat field. No other changes are being made to these two conditions.

Personal Protective Equipment Program

California regulations require Personal Protective Equipment (PPE) and first aid supplies whenever hazards are present that, due to process, environment, chemicals or mechanical irritants, can cause injury or impair bodily function as a result of absorption, inhalation, or physical contact (8 Cal Code Regs. §§ 3380 to 3400). The PSEGS operational environment would require PPE.

All safety equipment must meet National Institute of Safety and Health (NIOSH) or American National Standards Institute (ANSI) standards and would carry markings, numbers, or certificates of approval. Respirators must meet NIOSH and Cal/OSHA standards. Each employee must be provided with the following information pertaining to the protective clothing and equipment:

- proper use, maintenance, and storage;
- when to use the protective clothing and equipment;
- benefits and limitations; and
- when and how to replace the protective clothing and equipment.

The PPE Program ensures that employers comply with the applicable requirements for PPE and provides employees with the information and training necessary to protect them from potential workplace hazards.

Emergency Action Plan

California regulations require an Emergency Action Plan (8 Cal Code Regs. §3220). The AFC contains a satisfactory outline for an emergency action plan (Solar Millennium 2009a, Section 5.18.3.2).

The outline lists plans to accomplish the following:

- establish scope, purpose, and applicability;
- identify roles and responsibilities;
- determine emergency incident response training;
- develop emergency response protocols;
- specify evacuation protocols;
- define post emergency response protocols; and
- determine notification and incident reporting.

Written Safety Program

In addition to the specific plans listed above, additional LORS called *safe work practices* apply to the project. Both the Construction and the Operations Safety Programs would address safe work practices under a variety of programs. The components of these programs include, but are not limited to, the programs found under the heading "Construction Safety and Health Program" in this Worker Safety and Fire Protection section.

Safety Training Programs

Employees would be trained in the safe work practices described in the above-referenced safety programs.

Additional Safety Issues

This solar power plant would present several unique work environments, the first of which involves a solar field located in the high desert. The solar field features thousands of heliostats (mirrors) that would focus intense solar flux on the top of a 750-foot tower. Workers would inspect the solar array for broken mirrors at least once each day by driving up and down dirt paths between the rows of mirrors and even under the mirrors thus generating dust. Cleaning the mirrors will also be conducted on a routine schedule. All these activities would take place year-round and especially during the summer months of peak solar power generation, when outside ambient temperatures routinely reach 115°F and above.

The project owner had indicated that workers would be adequately trained and protected, but did not included precautions against heat stress. However, the existing Conditions of Certification **WORKER SAFETY-1** and **-2** include a worker heat stress protection plan that implements and expands on existing Cal OSHA regulations (8 CCR 3395). Staff believes that effective implementation of a Heat Stress Protection Plan would mitigate the potential for significant risks to workers from heat during both construction and operations. And because heat illness incidences (including but not limited to heat stress, heat exhaustion, heat stroke, or heat prostration) are not only highly probable in desert environments but have now occurred at desert solar power plants under construction, staff believes it is imperative to keep track of these incidences to ensure that all worker protections are indeed being implemented and are adequate. Therefore, staff proposes new Condition of Certification **WORKER SAFETY-12** which would require the project owner to immediately report all heat-related incidences (regardless of whether they are reportable under OSHA regulations) to the CPM within 24 hours of occurrence. In this manner, staff can have a current data base of occurrences at all desert power plants to assist in determining the adequacy of worker protection.

The second unique work environment involves the need to protect workers from the adverse effects of glint and glare coming from the tower and the heliostats. Staff evaluated effects on-site workers in proximity to the towers or the heliostats in Appendix tt1 – Visual Safety Impact Assessment of the **TRAFFIC AND TRANSPORTATION** section of this FSA. As described in that section, the PSEGS is located in a bright desert environment thereby increasing the potential chance for photochemical eye damage, specifically to the retina. The cumulative daily exposure to workers to the ambient environment combined with the additional potential cumulative effects of heliostat and SRSG exposure puts project workers at risk for retinal damage. To ensure the safety of the workers and others within the project boundaries, staff recommends that personnel protection equipment (PPE) in the form of protective glasses be provided.

Protective glasses have been developed for workers engaged in intense solar field work, tower work, and intense close viewing of the SRSG. There is precedence for the issuance of special safety glasses, for example they have been issued to the operators at Solar Energy Development Center (SEDC), and the Coalinga and Ivanpah solar thermal plants. Staff therefore proposes a modification to both existing Conditions **WORKER SAFETY-1** (Project Construction Safety and Health Program) and **WORKER**

SAFETY-2 (Project Operations and Maintenance Safety and Health Program) to include this requirement.

And the third unique work environment involves working at an elevated enclosed location, the inside and atop the two 750 ft. solar towers. Experience and site visits to the existing nearly 500 ft. towers at the Ivanpah facility demonstrate the need for the project owner to address this unique work environment. Worker access to the towers must be controlled and monitored so that it is known at all times and with great precision the number of workers inside the towers. Wood near-fire - smoldering - events have occurred in the more open steel-structure towers at Ivanpah and the ability to detect and suppress such a fire in the more closed concrete towers proposed for the PSGES will require more scrutiny and safety procedures. And since the only method of rescue from inside or from the top of these towers would be via the internal elevator (fire department ladder trucks can reach only to ~100 ft.), the need for a safe and effective elevator system and emergency hoist system becomes paramount.

Staff requested additional information about the towers' safety controls from the owner and the reply (Palen 2013ss) indicated that neither detailed nor schematic drawings of the structures have been developed at this time, but the final layout and design would meet all applicable LORS and be subject to review by the CBO. The response indicated that the following safety measures would be implemented:

1. Tower Access would be provided by a rack-and-pinion industrial-type elevator and a staircase.

2. The elevators would be connected to both grid power, and to the plant essential services bus bar powered by an emergency backup diesel generator. The elevators would also have centrifugal braking in the drive unit upon power failure.

3. A fire detection system would be designed and erected per code in the Electrical Equipment Module (electrical room), which would also be equipped with a dry powder extinguisher. Detection system alarms would be generated to plant operation systems and personnel, and addressees as agreed with the Fire Marshal. A water-based fire suppression system would not be needed as there are no especially flammable materials or unusual potential ignition sources in the tower and SRSG.

4. No workers would be stationed at the top of the tower during routine operation. However, the area may be accessed on occasion for maintenance (typically electrical or instrumentation work or checks, and occasionally circulation pump maintenance).

5. A detailed emergency response plan would be created after detailed design of the tower and its internal systems are further developed.

Staff agrees mostly with the petitioner's safety procedures and therefore proposes new Condition of Certification **WORKER SAFETY-11** to require that these safety measures be incorporated into two Tower Access and Safety Plans, one for construction and one for commissioning/operations, that would address controlled access to the towers, fire detection and suppression systems, elevator operations, the planned emergency hoist systems, and backup power supply for the elevators and hoists.

In summary, staff recommends adoption of revised Condition of Certification **WORKER SAFETY- 1** (Project Construction Safety and Health Program), revised Condition of Certification **WORKER SAFETY-2** (Project Operations and Maintenance Safety and Health Program), and new Condition of Certification **WORKER SAFETY-11** (Tower Access and Safety Plan) which are designed to insure that workers in the solar field and towers have a safe work environment and receive and wear the appropriate personal protective equipment including protective sunglasses.

Another worker safety issue has surfaced based upon experience at the Ivanpah solar power plant. During the summer months in what is referred to as the "monsoon season", sub-tropical weather fronts enter the desert southwest from the south and bring intense storms with extremely heavy rainfall over very brief periods of time. These storms are mostly unpredictable and flash floods can result from the dropping of high amounts of water (inches of rain) in a very short time onto the desert floor resulting in high levels of run-off in otherwise dry washes. The force of moving water in a flash flood is often underestimated and workers at a desert solar power plant site may attempt to drive or walk through the swift flows to cross it. However, as little as two feet of water is enough to carry away most passenger vehicles and swiftly moving water six inches deep can cause a person to lose balance (NOAA 2005). A review of Figure 15 from the Soil and Water section of this FSA shows that although the administration building and both power blocks are outside of the large desert washes, the paved main access road connecting the power blocks and several other internal unpaved roads are located within washes and thus would be expected to flood during heavy precipitation events.

To avoid injury or death during a flood event, staff proposes to modify Conditions of Certification **WORKER SAFETY-1** and **WORKER SAFETY-2** to include a Construction Flood Safety Plan and an Operations Flood Safety Plan. These Plans would provide requirements and guidance to on-site workers with respect to avoiding injury or death during a very large flood event (100-year flooding or larger). The Plans would be submitted to the Energy Commission for review and approval and include the following:

- Specific actions to be completed during a very large flood event in order to protect workers.
- Identified flood refuge areas that would not be susceptible to 100-year flooding.
- Requirements that all on-site workers implement the Plan and that the Plan be updated, as needed, during the life of the project.

Additional Mitigation Measures

Protecting construction workers from injury and disease is among the greatest challenges in occupational safety and health. The following facts are reported by the National Institute for Occupational Safety and Health (NIOSH):

- More than 7 million persons work in the construction industry, representing 6 percent of the labor force. Approximately 1.5 million of these workers are self-employed.
- Of approximately 600,000 construction companies, 90 percent employ fewer than 20 workers. Few have formal safety and health programs.
- From 1980 to 1993, an average of 1,079 construction workers were killed on the job each year—more fatal injuries than in any other industry.
- Falls caused 3,859 construction worker fatalities (25.6 percent) between 1980 and 1993.
- Construction injuries account for 15 percent of workers' compensation costs.
- Assuring safety and health in construction is complex, involving short-term work sites, changing hazards, and multiple operations and crews working in close proximity.
- In 1990, Congress directed NIOSH to undertake research and training to reduce diseases and injuries among construction workers in the United States. Under this mandate, NIOSH funds both intramural and extramural research projects.

The hazards associated with the construction industry are thus well documented. These hazards increase in complexity in the multi-employer worksites typical of large, complex, industrial-type projects such as the construction of solar power plants. In order to reduce and/or eliminate these hazards, it has become standard industry practice to hire a Construction Safety Supervisor to ensure a safe and healthful environment for all personnel. That this standard practice has reduced and/or eliminated hazards has been evident in the audits staff recently conducted of power plants under construction. The federal Occupational Safety and Health Administration (OSHA) has also entered into strategic alliances with several professional and trade organizations to promote and recognize safety professionals trained as Construction Safety Supervisors, Construction Health and Safety Officers, and other professional designations. The goal of these partnerships is to encourage construction subcontractors in four areas:

- to improve their safety and health performance;
- to assist them in striving for the elimination of the four hazards (falls, electrical, caught in/between and struck-by hazards), which account for the majority of fatalities and injuries in this industry and have been the focus of targeted OSHA inspections;
- to prevent serious accidents in the construction industry through implementation of enhanced safety and health programs and increased employee training; and
- to recognize those subcontractors with exemplary safety and health programs.

To date, there are no OSHA or Cal/OSHA requirements that an employer hire or provide for a Construction Safety Officer. OSHA and Cal/OSHA regulations do, however, require that safety be provided by an employer and the term *Competent Person* is used in many OSHA and Cal/OSHA standards, documents, and directives. A Competent Person is usually defined by OSHA as an individual who, by way of training and/or experience, is knowledgeable of standards, is capable of identifying workplace hazards relating to the specific operations, is designated by the employer, and has authority to take appropriate action. Condition of Certification **WORKER SAFETY-3** requires that the project owner to designate and provide for a power plant site Construction Safety Supervisor which serves as the Competent Person as required by OSHA and Cal/OSHA. Staff does not propose any changes to this condition.

As discussed above, the hazards associated with the construction industry are well documented. These hazards increase in complexity in the multi-employer worksites typical of large, complex, industrial-type projects such as the construction of solar power plants.

Accidents, fires, and a worker death have occurred at Energy Commission-certified power plants in the past due to the failure to recognize and control safety hazards and the inability to adequately supervise compliance with occupational safety and health regulations. Safety problems have been documented by Energy Commission staff in safety audits conducted in 2005 at several power plants under construction. The findings of the audit staff include, but are not limited to, such safety oversights as:

- lack of posted confined space warning placards/signs;
- confusing and/or inadequate electrical and machinery lockout/tagout permitting and procedures;
- confusing and/or inappropriate procedures for handing over lockout/tagout and confined space permits from the construction team to commissioning team and then to operations;
- dangerous placement of hydraulic elevated platforms under each other;
- inappropriate placement of fire extinguishers near hotwork;
- dangerous placement of numerous power cords in standing water on the site, thus increasing the risk of electrocution;
- construction of an unsafe aqueous ammonia unloading pad;
- inappropriate and unsecure placement of above-ground natural gas pipelines inside the facility but too close to the perimeter fence; and
- lack of adequate employee- or contractor-written training programs addressing proper procedures to follow in the event of finding suspicious packages or objects either on or off-site.

In order to reduce and/or eliminate these hazards, it is necessary for the Energy Commission to have a professional Safety Monitor on-site to track compliance with Cal/OSHA regulations and periodically audit safety compliance during construction, commissioning, and the hand-over to operational status. These requirements are outlined in existing Condition of Certification **WORKER SAFETY-4**. A Safety Monitor, hired by the project owner, yet reporting to the Chief Building Official (CBO) and CPM, will serve as an “extra set of eyes” to ensure that safety procedures and practices are fully implemented at all power plants certified by the Energy Commission. During the audits conducted by staff, most site safety professionals welcomed the audit team and actively engaged it in questions about the team’s findings and recommendations. These safety professionals recognized that safety requires continuous vigilance and that the presence of an independent audit team provided a fresh perspective of the site. Staff does not propose any changes to **WORKER SAFETY-4**.

Valley Fever (Coccidioidomycosis)

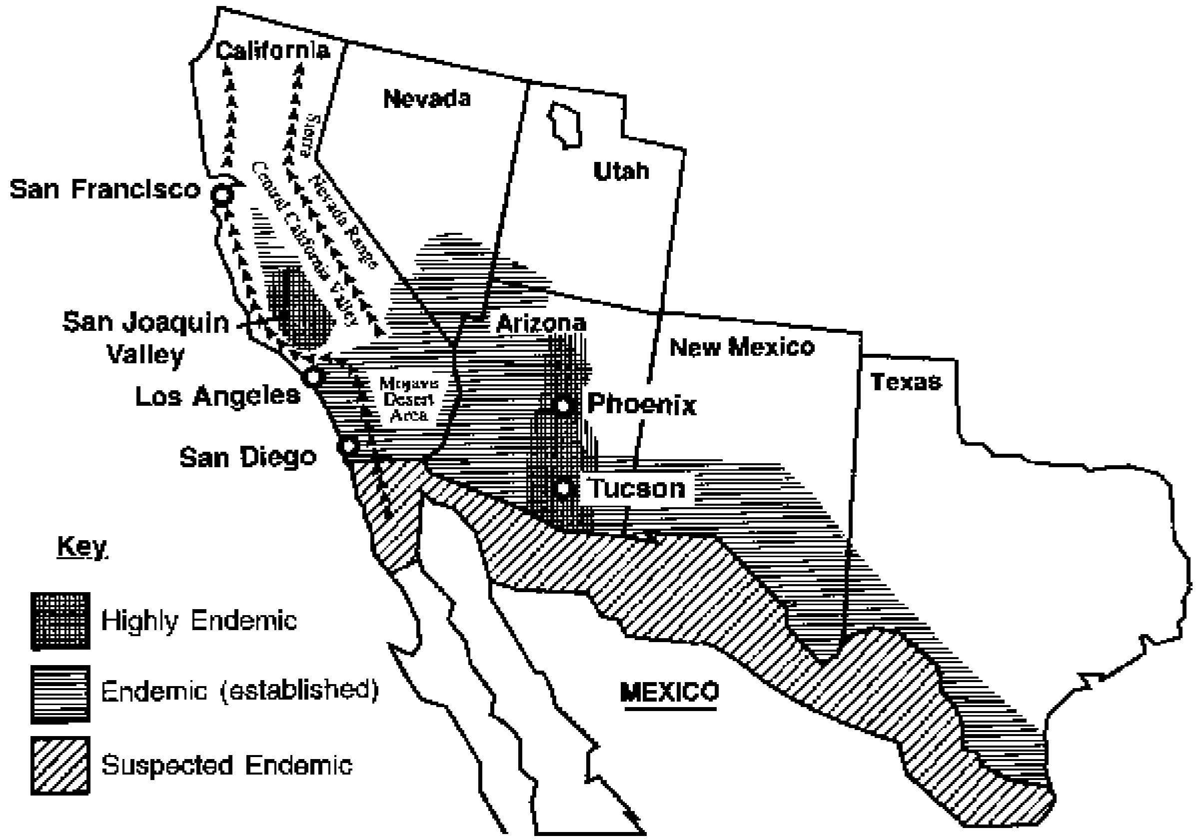
Coccidioidomycosis or "Valley Fever" (VF) is primarily encountered in southwestern states, particularly in Arizona and California (see **Worker Safety and Fire Protection Figures 1** and **2**). It is caused by inhaling the spores of the fungus Coccidioides immitis, which are released from the soil during soil disturbance (e.g., during construction activities) or wind erosion. The disease usually affects the lungs and can have potentially severe consequences, especially in at-risk individuals such as the elderly, pregnant women, and people with compromised immune systems. Trenching, excavation, and construction workers are often the most exposed population. Treatment usually includes rest and antifungal medications. No effective vaccine currently exists for VF. VF is endemic to the San Joaquin Valley in California, which presumably gave this disease its common name. In California, the highest VF rates are recorded in Kern, Kings, and Tulare Counties, followed by Fresno and San Luis Obispo Counties. LA County, San Diego County, San Bernardino County, and Riverside County also have reported VF cases although much fewer.

In October 2007, a construction crew excavated a trench for a new water pipe in California. Within three weeks, 10 of 12 crew members developed Valley Fever) with 7 of the 10 displaying abnormal chest x-rays, four had rashes, and one had an infection that had spread beyond his lungs and affected his skin (Das, Rupali et al. 2012). Over the next few months, the ten ill crew members missed at least 1660 hours of work and two workers were on disability for at least five months. A February 2013 outbreak of VF affecting at least 28 workers at a photovoltaic solar plant in eastern San Luis Obispo County, along with an increase in inmates at two San Joaquin Valley prisons coming down with the disease, has sparked renewed interest and concern. (The California Department of Public Health, Cal-OSHA, and San Luis Obispo County are investigating that outbreak.) The interest is high enough for the California State Senate to declaring the month of August 2013 as Valley Fever Awareness Month. This designation appears justified in that although California does not yet have an official statewide method of tracking the rate of Valley Fever infections, infection rates in California and Arizona have risen 400 percent in the last 10-year reporting period, from an estimated 31 cases for every 100,000 people in 1999 to 157 cases for every 100,000 people in 2011 and the number of cases in Kern County alone has more than tripled from 2009 to a total of 2,051 cases in 2010 and 2,734 cases in 2011 (MMWR 2013).

The Centers for Disease Control and Prevention also reports that the total number of VF cases nationwide rose by nearly 900 percent from 1998 to 2011 (MMWR 2013). Researchers don't have a good explanation for the dramatic increase even when accounting for growing populations throughout the Southwest, although when soil is dry and it is windy, more spores are likely to become airborne in endemic areas, according to Dr. Gil Chavez, Deputy Director of the Center for Infectious Diseases at the California Department of Public Health.

A recent report from the U.S. Centers for Disease Control (CDC 2012, MMWR 2013) showed that the rise in VF incidence has resulted in it being a major cause of community-acquired pneumonia in California and the southwestern U.S. The CDC found that in 2011, more than 20,000 cases were reported in the U.S., twice as many cases as tuberculosis. Nearly 75 percent of people who get VF miss work or school due to their illness, and more than 40 percent of people who get VF need to be hospitalized. In Ventura County after the Northridge earthquake of 1994, 203 cases including 3 deaths occurred with most of the cases occurring in the town of Simi Valley. In 2001, at least 7 people attending the World Championship of Model Airplane Flying in Lost Hills in Kern County developed VF after attending this event for only a few days. And at the Taft Correctional Facility in Kern County, 88 cases were identified from 2003-04. In 2011 (last full year of data), 5697 cases in California were reported to public health officials.

Worker Safety and Fire Protection Figure 1
Geographic Distribution of Coccidioidomycosis*



*Source: CDC 2006, Figure 2

Worker Safety and Fire Protection Figure 2
Geographic Distribution of Coccidioidomycosis in California

Source: Valley Fever Fact Sheet, California Dept. of Public Health. June 2013

A 2004 CDC report attributed increases in California and Arizona prior to 2004 to changes in land use, demographics, and climate in endemic areas, although certain cases might be attributable to increased physician awareness and testing (CDC 2006). According to the CDC Morbidity and Mortality Weekly Report of February 2009, Kern County experienced the highest incidence rates (150 cases per 100,000 population), and non-Hispanic blacks having the highest hospitalization rates (7.5 per 100,000 population).

Public health officials have tried to explain the sudden increase in Coccidioidomycosis cases that began in the early 1990's. They found that the San Joaquin Valley in California has the largest population of C. immitis, which is found to be distributed unevenly in the soil and seems to be concentrated around animal burrows and ancient Indian burial sites. It is usually found 4 to 12 inches below the surface of the soil. The paper also reported that incidences of coccidioidomycosis vary with the seasons; with highest rates in late summer and early fall when the soil is dry and the crops are harvested. Dust storms are frequently followed by outbreaks of coccidioidomycosis (Kirkland 1996). A modeling attempt to establish the relationship between fluctuations in VF incident rates and weather conditions in Kern County found that there is only a weak connection between weather and VF cases (weather patterns correlate with up to 4 percent of outbreaks). One study concluded that the factors that cause fluctuations in VF cases are not weather-related but rather biological and anthropogenic (i.e. human activities, primarily construction on previously undisturbed soil) (Talamantes 2007).

In correspondence with Dr. Michael MacLean of the Kings County Health Department, he noted that according to his experience and of those who study VF, it is very hard to find the fungus in soil that was previously farmed and irrigated, which greatly reduces the risk of infection resulting from disturbance of farmed lands. This does not apply to previously undisturbed lands where excavation, grading, and construction may correlate with increases in VF cases. Dr. MacLean feels that with the current state of knowledge, we can only speculate on the causes and trends influencing VF cases and he does not feel that construction activities are necessarily the cause of VF outbreaks (KCEHS 2009).

VF is spread through the air. If soil containing the fungus is disturbed by construction, natural disasters, or wind, the fungal spores get into the air where people can breathe in the spores. The disease is not spread from person to person. Occupational or recreational exposure to dust is an important consideration. Agricultural workers, construction workers, or others (such as archeologists) who dig in the soil in the disease-endemic area of the Central Valley are at the highest risk for the disease (CDC 2006; CDHS 2010). The risk for disseminated coccidioidomycosis is much higher among some ethnic groups, particularly African-Americans and Filipinos. In these ethnic groups, the risk for disseminated coccidioidomycosis is tenfold that of the general population (CDC 2006) (see **Worker Safety and Fire Protection Table 3,** Disease Forms of Valley Fever).

Worker Safety and Fire Protection Table 3
Disease Forms of Valley Fever

Categories	Notes
Asymptomatic	• Occurs in about 50 percent of patients
Acute Symptomatic	• Pulmonary syndrome that combines cough, chest pain, shortness of breath, fever, and fatigue. • Diffuse pneumonia affects immunosuppressed individuals • Skin manifestations include fine papular rash, erythema nodosum, and erythema multiforme • Occasional migratory arthralgias and fever
Chronic Pulmonary	• Affects between 5 to 10% of infected individuals • Usually presents as pulmonary nodules or peripheral thin-walled cavities
Extrapulmonary/Disseminated Varieties	
Chronic skin disease	• Keratotic and verrucose ulcers or subcutaneous fluctuant abscesses
Joints / Bones	• Severe synovitis and effusion that may affect knees, wrists, feet, ankles, and/or pelvis • Lytic lesions commonly affecting the axial skeleton
Meningeal Disease	• The most feared complication • Presenting with classic meningeal symptoms and signs • Hydrocephalus is a frequent complication
Others	• May affect virtually any organ, including thyroid, GI tract, adrenal glands, genitourinary tract, pericardium, peritoneum

Given the available scientific and medical literature on VF and the recent outbreaks in California, it is clear that the potential for VF to impact workers during construction and operation of the proposed PSEGS is very high. To minimize this potential exposure of workers and also the public to coccidioidomycosis during soil excavation and grading, extensive wetting of the soil prior to and during construction activities should be employed and dust masks should be worn at certain times during these activities. The dust (PM10) control measures found in the Air Quality section of the SA/RSA should be strictly adhered to in order to adequately reduce the risk of contracting VF to less than significant. Towards that, staff proposes revised Condition of Certification **WORKER SAFETY-8** which would require that the dust control measures found in proposed Conditions **AQ-SC3** and **AQ-SC4** be supplemented with additional requirements including implementing additional monitoring methods.

And because VF incidences are not only probable in desert environments but have now occurred at a solar PV power plant under construction in another very arid part of the state (and not under the licensing authority of the Energy Commission), staff believes it is imperative to keep track of these incidences to ensure that all worker protections are indeed being implemented and are adequate. Therefore, staff proposes new Condition of Certification **WORKER SAFETY-12** which would require the project owner to report all verified incidences of VF in all workers at the site to the CPM within 24 hours of receiving notification from a medical professional that the worker does indeed have VF. In this manner, staff can have an up-to-date data base of occurrences at all desert power plants to assist in determining the adequacy of worker protection.

FIRE HAZARDS

During construction and operation of the proposed PSEGS project, there is the potential for both small fires and major structural fires. Electrical sparks, combustion of fuel oil, hydraulic fluid, mineral oil, insulating fluid at the power plant switchyard or flammable liquids, explosions, and over-heated equipment, may cause small fires. Major structural fires in areas with automatic fire detection and suppression systems are unlikely to develop at power plants. Compliance with all LORS and providing mitigation to the RCFD would be adequate to assure protection from all fire hazards.

Staff reviewed the information provided in the AFC and the Fire and Emergency Services Risk Assessment, and spoke to representatives of the RCFD to determine if available fire protection services and equipment would adequately protect workers and to determine the project's impact on fire protection services in the area. The PSEGS will rely on both on-site fire protection systems and local fire protection services. The on-site fire protection system provides the first line of defense for small fires. The on-site system for the power blocks and common area are the same regardless of the type of solar generating system used (parabolic trough or tower). In the event of a major fire, fire support services, including trained firefighters and equipment for a sustained response, would be provided by the RCFD (RCFD 2010a).

Construction

During construction, the permanent fire protection systems proposed for the PSEGS would be installed as soon as practical; until then portable fire extinguishers would be placed throughout the site at appropriate intervals and periodically maintained. Safety procedures and training would be implemented according to the guidelines of the Construction Fire Protection and Prevention Plan (Solar Millennium 2009a, Section 5.18.3.1).

The project owner has also indicated that it intends to construct and operate a concrete batch plant and an above-ground fuel depot on the site during construction. The fuel depot (which may remain in service during operations) will contain a maximum of 20,000 gallons of diesel fuel and 500 gallons of gasoline (Galati & Blek2010i, Revised Project Description).The concrete batch plant will be required to have additional fire detection and suppression systems that will be reviewed and evaluated by the Riverside County Fire Marshall and the Energy Commission CPM.

The fire protection measures that are required by code for the fuel depot and dispensing facility include:

- Chapter 22 of the 2007 California Fire Code: Motor Fuel-Dispensing Facilities and Repair Garages (formally adopted by Riverside County)
- NFPA 30a: Code for Motor Fuel Dispensing Facilities and Repair Garages (2008Edition)

Applicable sections of the 2007 Ca Fire Code and NFPA 30a are very similar; however NFPA 30a contains more details for fuel tank design specifications and other requirements. The requirements listed in these codes include the materials to be used to construct fuel tanks, location of dispensing devices, spacing from other structures, fencing, physical protective barriers, shut-off valves, emergency relief venting, secondary containment, vapor and liquid detection systems with alarms, and other general design requirements.

NFPA 30a requires the following:

- 7.3.5 Fixed Fire Protection.
- 7.3.5.1 For an unattended, self-serve, motor fuel dispensing facility, additional fire protection shall be provided where required by the *authority having jurisdiction.(italics added)*
- 7.3.5.2 Where required, an automatic fire suppression system shall be installed in accordance with the appropriate NFPA standard, manufacturers' instructions, and the listing requirements of the systems.
- 9.2.5 Basic Fire Control.
- 9.2.5.1 Sources of Ignition. Smoking materials, including matches and lighters, shall not be used within 6m (20 ft) of areas used for fueling, servicing fuel systems…
- 9.2.5.2 Fire Extinguishers. Each motor fuel dispensing facility or repair garage shall be provided with fire extinguishers installed, inspected, and maintained as required by NFPA 10, *Standard for Portable Fire Extinguishers.* Extinguishers for outside motor fuel dispending areas shall be provided according to the extra (high) hazard requirements for Class B hazards, except that the maximum travel distance to an 80 B:C extinguisher shall be permitted to be 30.48m (100 feet).
- 9.2.5.3 Fire Suppression Systems. Where required, automatic fire suppression systems shall be installed in accordance with appropriate NFPA standard, manufacturer's instructions, and the listing requirements of the systems.

The authority having jurisdiction is the Energy Commission and the RCFD which will review and comment on the fire detection and suppression plans for the fuel depot before it is built and operated.

The only fire protection measure explicitly listed in the CA Fire Code is a requirement for fire extinguishers to be located within 75 feet of the fuel dispensing equipment. Neither the CFC nor the Riverside County codes require sprinkler systems for fuel dispensing facilities. Section 2203.2 of the CFC requires an approved, clearly identified and readily accessible emergency disconnect switch at an approved location to stop the transfer of fuel to the fuel dispensers in the event of a fuel spill or other emergency. Section 2205.3 requires spill control to prevent liquids spilled during dispensing operations from flowing into buildings and section 2206.5 requires that above-ground tanks be provided with secondary containment in the form of drainage control or placement of berms or dikes in accordance with Chapter 34. The project owner has proposed to install secondary containment.

Staff has assessed the proposed concrete batch plant and fuel depot and has determined that the project owner intends to meet all codes and standards in their operations of the batch plant and fuel depot. Existing Condition of Certification **WORKER SAFETY-1** would require the RCFD to review and the CPM to review and approve the fire protection systems for the fuel depot.

Operation

The information in the AFC indicates that the project intends to meet the fire protection and suppression requirements of the 2007 California Fire Code, all applicable recommended NFPA standards (including Standard 850 addressing fire protection at electric generating plants), and all Cal/OSHA requirements, with the exception of providing a secondary access road and gate for emergency response vehicles. The proposed PSEGS has only one access point, that being through the main gate (via a new paved access road from an I-10 interchange), and the AFC and the Petition to Amend make no mention of needing a secondary access road to the site or another access gate through the perimeter fence (Solar Millennium 2009a, Section 2.5.6.5, Palen 2012a). Indeed, the Petition requests that the requirement for a second access road found in existing Condition of Certification **WORKER SAFETY-6** be removed. Both the California Fire Code (24 CCR Part 9, chapter 5, section 503.1.2) and the Uniform Fire Code (sections 901 and 902) require that access to the site be reviewed and approved by the fire department, and the RCFD stated that a second road and gate for fire and emergency responders is required for this site (RCFD 2010b).

Staff originally recommended that a second access road and access gate was necessary to ensure fire department and other emergency response access should the main road or main gate be blocked. Additionally, the fire department may wish to suppress a fire from multiple sides and access to another part of the site would be needed. A second access road and gate is a standard requirement of the California Fire Code and NFPA codes and existing Condition of Certification **WORKER SAFETY-6** requires such a road.

However, there are several site-specific reasons why staff is not now recommending a second emergency access road but is instead recommending at least two emergency access gates (one each on the north fence line and the south fence line).

First, the removal of heat transfer fluid (HTF) and propane from the proposed modified project lowers the fire risk significantly. And although the need for rescue and high-structure fire fighting has been significantly elevated with the proposed towers in the modified project, the need to obtain access from different sides is greatly reduced. But just as important, various site-specific issues render the placement of a secondary access road problematical.

From a biological perspective, there are several constraints to be considered when siting the secondary access road. Desert tortoise critical habitat occurs north of the I-10 freeway, along the southwestern perimeter of the project site. Development within critical habitat is not desired, and can be costly given the 5:1 mitigation ratio. Additionally, large vegetated ephemeral washes flow across the area likely to be impacted by a secondary access road. Development within washes disrupts natural processes, adversely impacting wildlife and the greater ecosystem by increasing sedimentation, increasing the number of nonnative plants, and destruction of rare microphyll vegetation within and along the washes, which recuperate very slowly under desert conditions. Impacts to desert dry wash woodland are typically mitigated at a 3:1 ratio. For any alignment chosen, thorough and time-consuming surveys of existing would need to be performed as per the following partial list:

- Jurisdictional Delineation (CDFG Code 1600)
- Protocol desert tortoise surveys
- General wildlife surveys
- General botanical surveys
- Rare plant surveys
- Burrowing owl surveys

In order to comply with the requirements of LORS, staff proposes modifications to Condition of Certification **WORKER SAFETY-6** that would require the project owner to provide at least two secondary access gates for emergency vehicles to enter the site from around the perimeter in the event the main access road is blocked, and to ensure that all roads are capable of supporting a 60,000 pound fire engine. There must be at least two access gates equipped with either a keypad or key for fire department and other emergency response personnel to open the gate. The RCFD, the California Highway Patrol, and the Riverside County Sheriff's Department shall be given access to these gates. In the event of an emergency that requires the RCFD to enter the site through these gates, the RCFD will be able to access the gate by using their two all-terrain fire engines that were purchased for them by the Genesis Solar Energy Project. PSEGS will be required by **WORKER SAFETY-6** to "buy-into" these specialized fire engines by paying one-half the costs (payable to Genesis) and one-half the annual operating/maintenance costs (payable to Genesis).

Fire suppression elements in the proposed plant would include both fixed and portable fire extinguishing systems. The fire water would be supplied from up to ten on-site wells and stored in two 800,000-gallon water storage tanks (one at each power block) with a dedicated fire protection supply of 600,000 gallons in each power block and 480,000 gallons in a storage tank in the common area (Palen 2012a). One primary electric and one diesel-fueled backup firewater pump would ensure water supply to each fire protection loop at a maximum flow of 5000 gpm (Palen 2012a).

Fire hydrants would be installed throughout the site per NFPA requirements and a sprinkler deluge system would be installed in areas of risk including each unit's transformer. A sprinkler system would be installed at the steam turbine generators (STGs), in the towers, and in administrative buildings (Palen 2012a). In addition to the fixed fire protection system, appropriate class of service portable extinguishers and fire hydrants/hose stations would be located throughout the facility at code-approved intervals.

According to NFPA standards and Uniform Fire Code (UFC) requirements, the fire protection system must have fire detection sensors and monitoring equipment that would trigger alarms and automatically actuate the suppression systems. Staff has determined that these systems will ensure adequate fire protection.

The project owner would be required by Conditions of Certification **WORKER SAFETY-1** and **-2** to provide the final Fire Protection and Prevention Program to staff and to the RCFD prior to construction and operation of the project to confirm the adequacy of the proposed fire protection measures.

The major issue in contention regarding fire protection at this proposed solar power plant is the level of mitigation required to reduce the direct impacts to the RCFD to a level of insignificance. The petitioner, RCFD, and staff have all spent a considerable amount of time and effort reviewing this issue and explaining their respective positions. Despite these efforts and agreement that direct impacts would occur, no agreement among the parties has been achieved regarding the level of mitigation required and thus staff has undertaken a comprehensive review and evaluation of the impacts to the RCFD and arrived at a recommended level of mitigation.

Staff has considered the position of the RCFD and all relevant information as well as past experience at existing solar power plants that are similar to the proposed modified project. The proposed facility would be located in an area that is currently served by the RCFD. The fire, HazMat, rescue, inspection, and EMS needs at the proposed plant are real and would pose significant added demands on local fire protection services. In addition, staff concludes that the RCFD's Hazmat Response Team is not adequately equipped and staffed to respond to hazardous materials incidents at the proposed facility with an adequate response time. Staff concurs with the past and current assessment of the RCFD regarding direct impacts and has determined that the PSEGS would cause a significant direct impact on the local fire department but not cause a significant cumulative impact. A direct impact is caused by the need to equip and train the fire department to respond to the specific unique hazards posed by solar tower technology which would be new to the county. No significant cumulative impact would occur because the construction and operation of this solar power plant is not likely to change the overall hazard profile of facilities requiring emergency response in the county, emergency events at this solar power plant are not likely to escalate within or beyond the power plant site, and emergencies are not likely to occur simultaneously with other facilities.

Staff concludes that the RCFD will have to provide some level of services and encumber significant time and funds in six areas:

1. Becoming familiar with and planning for emergency responses to a facility using a solar energy technology new to Riverside County.

2. Plan reviews and inspections..

3. Fire response.

4. Hazmat spill response.

5. Rescue.

6. Emergency Medical Services (EMS).

Because there are no thermal solar power plants currently operating within the jurisdiction of the RCFD (one parabolic trough solar project, the Genesis Solar Energy Project, is expected to begin commercial operations in the Fall 2013), staff reviewed incidents involving solar power plants in San Bernardino County, including the newly built segments of the Ivanpah Solar Electric Generating System that uses solar tower technology. In summary, staff found that including emergency response for fire, rescue, medical and hazardous materials incidents, approximately 30 incidents occurred since 1998 that required the San Bernardino County Fire Department (and other fire stations through mutual aid agreements) to respond to four solar power plant sites currently operating within San Bernardino County. These included fires, fire alarm activations, injuries, medical emergencies, hazardous materials spills, complaints/calls from the public, and false alarms. However, the available records did not include documentation of a major fire at the SEGS 8 facility (80 MW) in January of 1990 that required a large part of the regional resources from four different fire districts including the San Bernardino County, Edwards Air Force Base, California Department of Forestry (now Cal Fire), and the Kern County fire departments. This fire is the largest incident that has occurred at a solar thermal plant in California and demonstrates the magnitude of fire department resources that can be required to respond to a fire at a large thermal solar facility. The inability to quickly control this event had ramifications for the project's finances and reliability - it took almost two years to bring the SEGS 8 heaters back on-line and supplement the solar field generation – and resulted in a "draw-down" of emergency response resources in the northern part of San Bernardino County. A "draw-down" is when emergency response teams vacate an area to respond to an emergency, thus leaving that area without adequate fire and other emergency response services. This represents a very serious situation where the population and infrastructure is left vulnerable.

The proposed PSEGS is very different from the industrial, commercial, and residential development currently found in the Riverside County desert region. It is also different from the existing solar plants located at Harper Lake and Kramer Junction in San Bernardino County. The PSEGS would consist of two towers, 750-feet high that would be similar to the solar towers being built and presently under commissioning at the Ivanpah project. The towers would present a much greater challenge for rescue than the original, mostly ground-level, PSPP project and present a greater challenge to fight a fire at the high elevations of the tower.

Presently, staff believes that the RCFD would able to respond to fire, hazmat, and EMS emergencies in a timely manner at the PSEGS, but not to high angle technical rescue emergencies. The standard fire department response for a fire or for a hazmat spill includes response of six engines and at least three fire fighters on each engine. To fight a fire inside a structure, the RCFD must adhere to standard operating procedures and Cal-OSHA regulations that require “two in, two out”. Thus, a response of three fire fighters from one station would not allow fire fighters to attack a fire from within a structure or conduct a rescue. Confined space and collapsed trench rescues would also be problematic with only three fire fighters. Therefore, no matter what size the fire or how many workers are initially in need of rescue, the RCFD would dispatch engines from at least three fire stations so that at a minimum, nine firefighters are sent to the scene but the RCFD could eventually dispatch a total of 9 engines. Even if mutual aid was available and an “automatic aid” pact was in effect (which as of the date of the FSA there are none in effect), the RCFD would still have to respond to an emergency at the PSEGS site because it is the Authority Having Jurisdiction. Additionally, it is very important to note that the PSEGS will be located in an extremely harsh desert environment. The ability of a fire fighter to perform duties while wearing a turn-out coat, heavy boots, and a respirator (self contained breathing apparatus) is limited under the best of circumstances. If conducting a rescue or fighting a fire that necessitates use of a respirator, the high-temperatures of the desert, often exceed 115°F, severely limits a fire fighter’s ability to perform the duties to 15 minutes at a time. This severe time restriction necessitates the mobilization of more fire fighters to respond to the emergency. Therefore, there exists ample evidence of a significant direct impact on the RCFD.

In order to assist in determining proper mitigation for significant impacts, staff has developed an Emergency Response Matrix that staff, the fire departments, and project owners may use to assess the level of emergency response need (CEC 201o). This analytical tool has a weighting scheme for the various categories of fire department response and utilizes professional judgment in the assignment of the “score” to the categories. Staff has tested this methodology on existing and planned solar power plants and concludes it to be useful but cautions against using it as the <u>sole</u> basis for determining need or for allocating financial responsibility for direct individual or cumulative impacts. Otherwise, staff recommends that the project owner prepare an independent fire needs assessment and a fire risk assessment for the Palen project to better assess impacts on emergency response services in the jurisdictions.

Staff's analysis and determination of mitigation is based upon the following:

1. A revised Staff Emergency Response Matrix(CEC 2013k; see **Worker Safety/Fire Protection Appendix A**);
2. The recent events at the Ivanpah Solar Energy Project which utilizes solar tower technology;
3. The increased need for and difficulty of rescue in a tower;
4. The need for the RCFD to expend resources to become familiar with new technology within its jurisdiction;
5. The decreased fire risk due to the removal of HTF and propane from the project;
6. The decreased risk of explosion due to the removal of propane; and
7. Staff's expertise and judgment.

Although the modified project will undoubtedly lower the risks of certain impacts, other risks would be raised. The original PSPP project is required by the Decision to pay to the RCFD as mitigation of both direct and cumulative impacts a total of $12,100,000 over a 30-year project lifespan ($850,000 initially for capital improvements and $375,000 annually for operations and maintenance). This amount was determined by staff when considering the impacts of the three solar projects proposed for the I-10 corridor within Riverside County that included the Genesis project and when considering that the PSPP was going to use HTF in a parabolic trough solar power plant.

The petitioner has provided a Fire and Emergency Services Risk Assessment (FESRA; Palen 2013ll) that staff has reviewed. The stated scope of this FESRA was to "review the potential for hazards to occur" during construction and operation of the PSEGS and "define the risks that would require fire protection and emergency medical services". An implied but not stated part of the scope was to recommend mitigation in the form of payments to the RCFD.

Staff had requested that a "Fire Needs Assessment" and a "Risk Assessment" both be prepared if the petitioner wished to make a case for a reduction in the amount of funds required for mitigation in the Decision. As discussed in the section entitled "Methodology and Thresholds for Determining Environmental Consequences" above, staff had previously established a procedure where a project owner can either accept the determination made by staff or refute the determination by providing a Fire Needs Assessment and a Risk Assessment. The Fire Needs Assessment would address fire response and equipment, staffing, and location needs while the Risk Assessment would be used to establish that while an impact to the fire department may indeed exist, the risk (chances) of that impact occurring and causing injury or death is less than significant.

In this case, the Energy Commission in its Decision has determined the amount of payments necessary and proper to fund fire and emergency services as mitigation for both direct and cumulative impacts. That amount, which is required by current Condition of Certification **WORKER SAFETY-7,** would amount to $12,100,000 dollars over a 30-year facility life-time. When the current petitioner (Palen Solar Holdings LLC) purchased the approved Palen project, they also purchased all encumbrances and responsibilities including the requirement to pay all amounts required by the Conditions of Certification.

However, staff is very much aware that things do change and has made an effort to provide some relief to the petitioner based upon what staff believes is a fair and objective metric and in consideration that a significant cumulative impact no longer exists because of the change in technology from parabolic tough utilizing HTF to a solar tower with heliostats. Staff recommended in the PSA that, in considering all the information available and taking the ratio of the new scores obtained for the modified PSEGS (2.4) vs. the present Genesis project (2.8) obtained by utilizing the revised Emergency Response Matrix and applying that ratio (0.86) to the $12,100,000 required by the Commission Decision, the result is a small reduction to ~$10,400,000 over thirty years and that would be the proper revised amount as mitigation to be paid by PSEGS.

In reviewing the new information contained in the FESRA provided by the petitioner, staff found that the report provided some useful information and perspective, despite containing a number of flaws. Staff notes that the report contains some assertions of probabilities unsupported by data or references, has no analysis of recent incidences at a similar solar tower in California (Ivanpah), and fails to provide a more robust economic analysis found in most fire service needs assessments, including the one prepared for the Abengoa Mojave Solar Project in 2012 (BAE 2012) that addressed the issue of facility exemption from property taxes, and the one in 2011 addressing U.S. fire service needs (NFPA 2011).

Specifically, staff found the following sections of the report to be either useful, lacking in substantive explanatory discussion, stating a position with which staff disagrees, or stating a position with which staff agrees.

- Section 2.2.11 Fire Protection System: This section contains a comprehensive description of fire systems at the PSEGS.
- Section 3.0 Applicable Standards contains a comprehensive discussion of LORS.
- Section 4.0 Fire Protection System: There is no discussion of any fire detection or suppression systems for the towers or lack thereof until a brief few words in Appendix A which did not include any discussion, elaboration, or detail.
- Section 6.0 Hazards of the Project contains a useful discussion of all hazards during construction and operations except those sections noted below.

- Section 6.4, Table 6-5 (Risk Probability at PSEGS): Although briefly discussed in the narrative on page 6-9 and purportedly based upon Cal-OSHA, National Fire Incident Reporting System (NFIRS), and California State Fire Marshall (CSFM) data (references not provided in the report), this table lacks any detailed explanation for the assigned risk probabilities of “Remote” and “Improbable” for many worker safety hazards. The probabilities appear to be based more on professional opinion rather than an analytical quantitative approach. Staff has considerable experience in occupational safety and health and in power plant OSHA matters and strongly disagrees with the assigned probabilities. Staff believes that the probabilities of hazards resulting in worker injuries at solar power plants under construction is actually very likely (almost a certainty) and not remote or improbable. Staff believes that the argument made in the report – that there is little, if any, chance that an event would occur at the proposed PSEGS, and that fire and emergency services would rarely, if ever, be needed – even if accurate is not an acceptable approach to fire protection and emergency response. Fire departments must plan for the possible, not the probable, and staff believes that unless the chances of an event are so remote as to be beyond the scope of reality, the fire department must plan for those events. Determining mitigation payments based upon an estimated future use is not appropriate fire protection. Even if the need for high angle rescue occurred only once in 30 years, staff is confident that the life of that one worker is worth the investment in rescue ability. Most homeowners and business owners never have the need for fire or emergency services in their lifetime and yet all pay for those services regardless of use. The fact that a solar tower environment is inherently risky and that smoke events have already occurred in the towers at Ivanpah convinces staff that the probabilities listed in Table 6-5 are inaccurate.
- Section 7.0 Existing Resources provided useful information about the RCFD and service call history.
- Section 8.1.1 Fire Protection: There appears to be no basis for stating risks requiring fire protection and EMS during construction and operation would be “extremely low”. No attempt was made to examine the fire, rescue, and EMS needs at existing solar power plants in the world or in California. For example, staff has reviewed the need for fire response at the Ivanpah solar power plant under construction and notes that the San Bernardino County Fire Department has responded to 3 incidences of fire or smoke events during the past 2 and ½ years of construction.
- Section 8.1.2 Technical Rescue: The report categorizes the demand for technical rescue (defined by the NFPA as including rope rescue, swiftwater rescue, confined space rescue, ski rescue, cave rescue, trench/excavation rescue, building collapse rescue, and high angle rescue) as being “extremely low”. The report appears to provide no basis for this assertion and provided little or no empirical evidence or data. Staff disagrees that the probability is “extremely low” and believes that rescue from a tower is not improbable. Besides, a fundamental duty of any fire department is to prepare for any reasonably foreseeable event and the need for rescue or evacuation from an enclosed 750-ft. tower which will contain high pressure and temperature steam piping systems that require ongoing maintenance both inside and outside the tower near the 750-ft. level is most definitely foreseeable and, quite frankly, likely to be needed.

- Section 8.1.2 Technical Rescue: The statement in the last sentence at the bottom of page 8-2 is incorrect. Currently there is no mutual aid contract with the Blythe Fire Department.
- Section 9.0 Recommendations: The report claims that workers at the towers will be trained based on “federal and state standards and equipment manufacturers’ requirements”. Other than generic federal and state OSHA standards, no citation has been provide for any safety standard specific to solar tower workers or to manufacturer’s requirements.
- Section 9.0 Recommendations: This section also contains recommendations for mitigation with which staff disagrees. The analysis appeared to minimize the need for fire and emergency services thus resulting in a level of mitigation inconsistent with staff’s analysis and findings.
- Appendix A: PSEGS Fire Protection Design Basis provided some information about the towers not before presented by the petitioner and therefore was both informative and useful.

The County of Riverside (CR) and the RCFD (CR 2013c**)** provided its assessment of the FESRA and staff has reviewed their comments. In summary, the CR/RCFD takes issue with some of the content and conclusions of the FESRA, what it feels to be a downplaying and minimization of the possible severity and frequency of occurrence of any potential impacts to the RCFD, the amount of mitigation to be provided, and the attempt to demonstrate that, based on call volume, no additional RCFD staff would be needed as a result of this Project (Paragraph 2, Page 7-5).

Specifically, staff found the following sections of CR/RCFD’s review of the FESRA to be on some points useful, lacking in substantive explanatory discussion, stating a position with which staff disagrees, or stating a position with which staff agrees.

- P. 1, 2: CR takes issue with some of the content and conclusions of the FESRA, the attempt to downplay and minimize the possible severity and frequency of occurrence of any potential impacts to the RCFD. – Staff agrees with this position.
- P. 1, 2, and 3: CR takes issue with Table 6-4 of the FESRA, the use of subjective adjectives in the “Description” column to quantify the frequency of occurrence for possible incidents, and the appearance that descriptions were chosen to create an image of little to no possibility that such an incident will occur. – Staff agrees with the CR position and has explained its criticism of Table 6-4 in comments above.
- P. 3, 1: CR takes issue with the FESRA attempt to use call volume, to support its contention that no additional RCFD staff would be needed as a result of this Project. RCFD has not claimed a significant call demand would occur; it is the various hazards created by this Project and the types of inherent risks associated with potential emergencies which will impact the County. RCFD categorizes these as low *frequency/high risk/little discretionary time* emergencies. The most significant impact to RCFD is the need to be prepared to provide immediate Technical Rescue services, which has normally been necessary only in built up commercial/industrial areas of the County. This is a significant increase in the service level from the basic service level historically provided to this otherwise rural desert area. – Staff agrees with this position and has articulated it above on page 4.14-28.

- P. 3, 2: CR believes that industrial accidents still occur in spite of all the LORS and that even basic medical emergencies can create access and rescue challenges when such emergencies occur high on catwalks or inside piping, tanks, vaults, or within a tower. – Staff agrees and while not wanting to downplay these risks, does not want to exaggerate them either. As staff has stated above (p. 4.14-6) and in the analysis of all power plants, industrial environments are potentially dangerous during construction and operation of facilities.
- P. 3, 3: CR states that it hopes that the RCFD would never need to respond to this facility but it is not realistic to base emergency preparedness on such hopes. The RCFD will need to be prepared to provide Technical Rescue services in addition to fire response as a result of the development of power plant. – Staff agrees and once again reiterates that it believes that fire departments must plan for and be cable of responding to all reasonably anticipated emergency scenarios.
- P. 3, 4: CR feels that the FESRA minimally addresses technical rescue in Section 8.1.2 and strongly disagrees with the conclusion. - Staff shares this view and has articulated in concerns above on page 4.14-29.
- P. 3, 6: CR explains that RCFD is the official "Authority Having Jurisdiction" for emergency responses to the project and disagrees with the suggestion that mutual aid might be used to help mitigate primary fire services for this project. CR goes on to explain that providing mutual aid is voluntary, not required, and is dependent on the availability of the provider's fire resources during any particular emergency. Mutual aid, therefore, is generally not depended on for primary service delivery. – Staff agrees with this position and has stated similar views on pages 4.14-4 and 4.14-29 above.
- P. 3, 7: CR states that The California Mutual Aid Plan clearly articulates that a jurisdiction is not required to respond outside their jurisdiction based on its own activities and needs, and further provides "… that no party shall be required to unreasonably deplete its own resources in furnishing mutual aid." While the County fully believes the Blythe City Fire Department would make every effort to assist RCFD at the project, it is not appropriate to assume Blythe City Fire Department would always be available, based on their own responsibility to respond first to incidents within their own jurisdiction. – Staff concurs with this interpretation of mutual aid in California.
- P. 4, 2: CR states that each jurisdiction relies first upon its own resources and thus has a responsibility to plan for these emergencies through proper training, equipping and staffing. It is inappropriate to burden, and potentially overextend, the Blythe City Fire Department in a first response capacity within the County's jurisdiction in lieu of appropriately staffing, training and outfitting RCFD resources. – Staff concurs and finds that this approach is consistent with its understanding of basic emergency planning.

- P. 4, 5: Section 2.2.3 access roads: The County wants all fire access road to meet RCFD Standards. – Staff agrees and towards that proposes three requirements in Conditions of Certification: 1), all roads must be capable of supporting fire engines that weight up to 60,000 pounds; 2) the Construction Fire Prevention Plan required by proposed Condition **WORKER SAFETY-1** must be submitted to the RCFD for review and comment, and 3),) the Operations Fire Prevention Plan required by proposed Condition **WORKER SAFETY-2** must also be submitted to the RCFD for review and comment.
- P. 4, 6: Section 2.2.11: CR notes that the reference to the Indio Office of the Riverside County Fire Department is incorrect. – Staff notes this.
- P. 4, 7: Section 2.2.11: CR notes that the references to Riverside County Ordinance No. 787.1 are outdated and that the correct reference is Ordinance No. 787.6. – Staff notes this.
- P. 4, 8: Section 3.2: CR notes that while the Uniform Fire Code, Article 80, is listed as a National Consensus Standard, the applicable code for this project will be the 2010 California Fire Code Chapter 27. – Staff agrees and had already noted this in **Worker Safety and Fire Protection Table 1** Laws, Ordinances, Regulations, and Standards (LORS) found on page 4.14-3&4 of this section.
- P. 4, 9: Section 3.3: Riverside County Fire Protection and Medical Master Plan - 1987. CR notes that this document is referenced in the FESRA several times yet was not discussed with RCFD during the development of the FESRA. The 1987 Master Plan is in the process of being replaced. A draft companion “Strategic Master Plan” has been completed and is in final editing, and will finalize the replacement of the 1987 Master Plan document. This is anticipated to be finalized prior to the Project’s approval. – Staff thanks the CR for this update.
- P. 4, 10: Section 8.1.3: CR disagrees with the statement in the FESRA that “addition of the PSEGS to the RCFD service area would not require additional emergency medical responses from the RCFD.” Any private duty industrial health care provider would not supersede the authority of, and has less capability than, RCFD paramedics operating within EMS control. Although an onsite nurse would be practical in an occupational health and safety situation, an onsite nurse is not recognized as a pre-hospital provider within the Riverside County EMS system. – Staff concurs and believes that any on-site provision of emergency response would be in addition to, not instead of, EMS response from the RCFD.

- P. 5, 2: Section 8.2: CR disagrees with the contention that the project can eliminate the need for emergency medical services and takes exception to paragraph 5 of this section wherein the applicant attempts to further deflect mitigation by introducing the argument that added resources would “primarily be used for incidents involving the general population…” and “…provide a net benefit to Riverside County.” It must be remembered that impacts on the County and requested mitigations are a direct and proximate result of the construction of major solar thermal power plants, including this project. Absent the construction of these significant industrial projects, impacts on the County and consequent need for mitigation would be substantially reduced. Riverside County is not seeking a net benefit from these facilities, but must respectfully demand that RCFD’s necessary capital and operational costs of emergency preparedness resulting from this Project be mitigated. – Staff agrees with this criticism of the FESRA and believes that ample evidence exists, as discussed above, that a direct significant impact on the RCFD is posed by the project that must be mitigated. This includes all types of services as listed above on page 4.14-24.
- Staff also wishes to point out that CR has not commented on the change in technology from parabolic trough using HTF to solar tower described in the FESRA in Sections 2.1 and 6.1. This change will result in a greatly reduced hazard posed by HTF and propane and was not been adequately discussed in the assessment by the County. This greatly diminished risk should not go overlooked and staff has noted this factor several times in the PSA and in this FSA. It is on this point, and the contribution this lowered risk makes to the impacts on the RCFD, that most likely serves as the basis for the difference in mitigation requested by staff and the County.

Riverside County also presented information and opinion on fire needs and mitigation from the RCFD in a comment letter on the PSA (CR 2013a). Several points made by CR under **Worker Safety & Fire Protection**, beginning on page 10 of that letter include:

> P. 10, 2: The County acknowledges that the change in technology reduces the presence of flammable products on-site but there still remain significant potential site hazards, worker safety risks, numerous sources of potential fire and explosions, medical emergencies, and technical rescues. -- Staff agrees that potential significant fire and safety risks would exist with the modified project but not that they would be numerous.
>
> P. 10, 3: In many respects, a number of these significant risks and hazards and any response to them are actually greater under the proposed tower technology than under the previously approved trough technology, and these greater risks and hazards off-set the reduction in risk attributable to the removal of flammable products. -- Staff disagrees with CR on this point and believes that in total, the risks and hazards are less with the modified project.

P. 10, 4: The RCFD must prepare for more complex emergencies requiring technical expertise and specialized equipment including, but not limited to, confined space, trench, hi-angle rope rescues, entrapments, etc. -- Staff agrees only with the need to prepare for high angle technical rescue. Staff believes that the need for confined space rescue would be less with the modified project and trench, entrapment, and medical emergencies would also be less or about the same. RC has not presented any data or professional experience to support its claim.

P. 11, 1: This also may include medical emergencies which occur in restricted access locations in and around the power block or within the towers.-- Staff believes that the need for response to medical emergencies would not be increased for the power block but would be increased for emergencies within the tower.

P. 11, 3: The RCFD will have an immediate and urgent need to rapidly ramp up a significantly greater level of planning, staffing, equipping, training, housing, and overall preparedness for responding to these potential and likely emergencies before major construction activity begins on the project. -- Staff agrees in part that there will be an immediate need to plan, staff, and train for the specific unique fire and safety risks posed by the construction and operations of the towers but not for the power blocks or heliostat arrays.

P. 11, 3: It will be necessary to configure and prepare RCFD Battalion 8 to respond to the PSEGS and Genesis projects and therefore there will be a significant impact on the County's emergency services which must be mitigated. -- Staff agrees and Genesis is already mitigating its direct and cumulative impact and staff proposes that PSEGS mitigate its direct impact.

P. 11, 4: In 2010, it was determined by the CEC that the impacts to RCFD must be fully mitigated and mitigations were crafted to be spread out over four solar thermal projects. In reality, there is now one project underway that is contributing (Genesis), and this project (Palen) in which there is a request to reduce their participation in our mitigation. As of the date of this letter, the other two solar thermal projects, Blythe and Rice, have not moved forward. The County does not have the ability to go back and re-condition Genesis for a larger participation level. -- Staff understands this issue and is sympathetic to the complexities and difficulties of planning for fire and emergency response in a constantly changing environment. But CEQA dictates that staff proposes mitigation for direct impacts from only those projects that are actually built and proposes additional mitigation for cumulative impacts when such impacts exist. In this case, staff must address the impacts of the project as it is currently modified and while staff has found that direct impacts would exist, it has determined that no cumulative impact would exist. As a factual matter, Rice is scheduled to break ground in March 2014 and Blythe has a modification before the Commission which if granted would result in some level of mitigation, albeit a reduced level.

P. 11, 5: This leaves Riverside County with still having a need to increase our fire and emergency service level in order to serve PSEGS and Genesis, and a significant lack of mitigating funds in order to cover our costs to do so. – Staff differs with this contention and believes that the mitigation already required and paid by the Genesis project and that proposed by staff would be adequate to mitigate the direct impacts of both projects and the cumulative impacts of the Genesis project.

P. 11, 5: It is therefore crucial that fire mitigation not be decreased as proposed by PSH, but instead at minimum, the previous level of mitigation conditioned for the project is maintained – commensurate with the mitigation currently paid by the Genesis project. – Staff understands the rationale for this request but differs on the amount of mitigation. However, staff notes that with the staff recommended annual escalator (requested by the RCFD), the total received by the RCFD for mitigation from PSEGS would be greater over the life of the project than the amount now required by the decision.

The County also provided additional comments specifically on the PSA which are discussed and responded to in the section **RESPONSE TO COMMENTS** below.

Staff finds that both the RCFD and the petitioner have raised some valid issues and important points in their comments and both also neglected to discuss certain variables that staff believes should be a factor in determining impacts and hence mitigation.

Although staff has differences of opinion with both the petitioner’s Fire and Emergency Services Risk Assessment and the position of the RCFD as outlined above, staff finds that the arguments made by the County of Riverside to be more compelling and better documented. Differences of professional opinion also exist between the petitioner and the RCFD and thus staff must make a recommendation without the benefit of a consensus among the parties. Staff finds that the Fire and Emergency Services Risk Assessment did not provide compelling evidence or arguments to serve as a basis for staff to modify its recommendation for funds to mitigate direct impacts to the RCFD.

Staff therefore continues to propose a one-time payment of $1.0 M for capital improvements and an annual payment of $313,000 for O&M for the remaining lifetime of the power plant as mitigation for direct impacts. Staff also believes that the RCFD raised an important point when it requested that the annual payments for mitigation include a cost-of-living escalator. Staff agrees and has added this to proposed revised Condition of Certification **WORKER SAFETY-7.** Staff proposes that the Consumer Price Index (CPI-U, US City Average, All Items Less Food and Energy) for the previous calendar year as published by the U.S Bureau of Labor Statistics be used as the annual escalator to account of inflation. The following table shows the different amounts proposed for mitigation:

Worker Safety and Fire Protection Table 6
Proposed Mitigation

	Decision	Staff proposed in PSA	Staff proposed in FSA	Petitioner	RCFD
one-time payment for capital improvements	$850,000	$1,000,000	$1,000,000	$1,200,000 (for a medium rescue vehicle)	$850,000
annual first 3 yrs	$375,000	$313,333	$313,000	$684,000	$375,000
annual yrs 4 - 30	$375,000	$313,333	$313,000	$114,000	$375,000
annual escalator	None	none	CPI-U	none	requested
Total over 30 yrs	$12,100,000	$10,400,000	$13,700,000*	$6,330,000**	$16,000,000

* at an average of 2% increase/yr, total over 30 yrs = $13.7 M (the average yearly increase in the CPI-U excluding food and energy in the past 10 years is ~2.1%)
** with 2% annual increase, total over 30 years would be ~$7.32M
*** with 2% escalator

Staff is recommending that both the initial one-time payment and the first annual payment be made no later than 30 days prior to the start of site mobilization because the fire department needs as much lead time as possible to procure equipment, adjust staffing needs, become familiar with the exact layout of the project, and conduct training.

Also, because of a few problems at other solar and gas-fired power plants where questions about fire department plan review and inspections have been raised, staff believes that it is necessary to clearly define the duty of the project owner to work with the local fire department in the review of fire detection and suppression systems. Staff therefore recommends adoption of new condition of Certification **WORKER SAFETY-10** which would require the project owner to submit to the RCFD all plans and schematic diagrams that show the details of all fire detection and suppression systems and pay the RCFD its usual and customary fee for the review of those plans and for inspections to ensure compliance with those plans. The project owner would then be required to provide proof to the CPM that the plans have been submitted to the RCFD on a timely basis, a copy of the comments received from the RCFD, and proof that the usual and customary payments for plan review have been made to the fire department.

EMERGENCY MEDICAL SERVICES RESPONSE

Staff conducted a statewide survey to determine the frequency of Emergency Medical Services (EMS) response for natural gas-fired power plants in California. The purpose of the analysis was to determine what impact, if any, power plants may have on local emergency services. Staff concluded that incidents at gas-fired power plants that require EMS response are infrequent and represent an insignificant impact on the local fire departments, except for instances where response times are high or a rural fire department has mostly volunteer fire-fighting staff. However, staff has determined that the potential for both work-related and non-work-related heart attacks exists at power plants. In fact, staff's research on the frequency of EMS response to gas-fired power plants shows that many of the responses for cardiac emergencies involved non-work-related incidences, including those involving visitors. The need for prompt response within a few minutes is well documented in the medical literature. Staff believes that the quickest medical intervention can only be achieved with the use of an on-site automatic external defibrillator (AED); the response from an off-site provider would take longer regardless of the provider location. This fact is also well documented and serves as the basis for many private and public locations (e.g., airports, factories, government buildings) maintaining on-site cardiac defibrillation devices. Therefore, staff concludes that, with the advent of modern cost-effective cardiac defibrillation devices, it is proper in a power plant environment to maintain such a device and the trained staff on-site in order to treat cardiac arrhythmias resulting from industrial accidents or other non-work related causes.

Existing Condition of Certification **WORKER SAFETY-5,** requires that a portable AED be located on-site, that all power plant employees on-site during operations be trained in its use, and that a representative number of workers on-site during construction and commissioning also be trained in its use. Comments from the RCFD include the suggestion that condition **WORKER SAFETY-5** also include a requirement that workers on-site be trained in basic first aid and that basic first aid kits be available on-site. Staff agrees with these suggestions and thereof proposes changes to this condition to include these requirements.

Also, at the request of the Riverside County Airport Land Use Commission, who raised a concern about the safety of medevac helicopters flying into or landing in an area where a thermal plume would exist (CR 2013b), a revision to Conditions of Certification **WORKER SAFETY-1** and **WORKER SAFETY-2** is proposed by staff to include a requirement that the project owner submit an Emergency Medical Evacuation Plan as part of the Emergency Response Plan, one for the construction period and another for operations. Staff does not anticipate emergency medical helicopters landing within the heliostat fields due to space constraints; instead, emergency medical helicopters would likely land at the perimeter of the facility, or in the common area. Thus, staff believes that no helicopters would be at risk from a thermal plume at the site. The requirement that an Emergency Medical Evacuation be prepared and submitted to the Compliance Project Manager (CPM) for review and approval would ensure that the helicopters are not placed at risk.

NON-OPERATION AND FACILITY CLOSURE IMPACTS AND MITIGATION

Closure of the proposed PSEGS (temporary or permanent) would follow a facility closure plan prepared by the project owner and designed to minimize public health and environmental impacts. Non-operation and facility closure procedures would be consistent with all applicable LORS (Solar Millennium 2009a, Section 5.6.3.4). Staff expects that impacts from non-operation and facility closure process would represent a fraction of the impacts associated with the construction or operation of the proposed PSEGS. Therefore based on staff's analysis for the construction and operation phases of this project, staff concludes that worker safety and fire protection-related impacts from non-operation and closure of the PSEGS would be insignificant.

Red Bluff Substation

The SCE Red Bluff Substation is expected to be operational in December, 2013. Therefore, staff concludes that there won't be any overlap of construction phase of SCE Red Bluff Substation and the PSEGS. Therefore, there is no need to discuss the potential impacts of the construction of the SCE Red Bluff Substation.

Conclusion

Incorporation of the measures discussed above and the Conditions of Certification recommended for the PSEGS would ensure adequate levels of industrial safety and fire protection and would comply with applicable LORS.

CUMULATIVE IMPACTS

The **Executive Summary** provides detailed information on the potential cumulative solar and other development projects in the project area. Together, these projects comprise the cumulative scenario which forms the basis of the cumulative impact analysis for the proposed modified project. In summary, these projects are placed into three categories:

- Existing energy projects on BLM, State, and private lands: Four projects are listed in **Executive Summary Attachment A – Table 1**.
- Foreseeable future energy projects in the immediate area and in the desert region: Thirty-eight foreseeable projects are listed in **Executive Summary Attachment A – Table 2**.
- Existing and foreseeable non-energy projects on BLM, State, and private lands: One hundred and nine projects are listed identified in **Executive Summary Attachment A – Tables 1** and **2**.

All of the above projects are defined within a geographic area that has been identified by the Energy Commission as covering an area large enough to provide a reasonable basis for evaluating cumulative impacts for all resource elements or environmental parameters. Most of these projects have, are, or will be required to undergo their own independent environmental review under the California Environmental Quality Act (CEQA). Even if the cumulative projects listed in the **Executive Summary Attachment A** tables have not yet completed the required environmental processes, they were considered in the cumulative impacts analyses in this section.

EFFECTS OF PAST AND PRESENT PROJECTS

For this analysis, staff notes that all of these projects or developments in the area or region have or will need the plan review and emergency response services of the RCFD. And, staff has found that when combined with the proposed PSEGS, all would not have a cumulative impact on the region. The need for rescue, fire, hazardous materials, and EMS response is frequent, yet not concentrated in this county because the distances between the projects are very great. Area power plants that are operating, under construction, or proposed p have had any direct fire protection impacts mitigated to a level of less than significance.

Staff has analyzed the potential for fire protection cumulative impacts at many other power plant projects located in California and in the region of the proposed PSEGS. A significant cumulative fire protection impact is defined as the simultaneous emergency at multiple locations that would require the concurrent response for rescue, fire fighting, hazardous materials spill control, and/or EMS response. Existing locations that would likely need emergency response, or locations where such facilities might likely be built, were both considered.

Staff believes that while cumulative impacts are theoretically possible, they are not probable because of the many safeguards implemented to both prevent and control the work environment, spills, and fires. The chances of one event requiring a concerted response from the RCFD is high because accidents do happen at industrial environments. However, the chance of two or more occurring simultaneously, with resulting draw-down of fire department resources to the point of endangering other communities with lack of fire department coverage are real but not as great. Staff believes the risk of draw-down due to an event at the proposed PSEGS is less than significant and thus the mitigation proposed in revised Condition of Certification **WORKER SAFETY-7** would address a direct individual impact and reduce it to a less than significant impact.

The project owner will develop and implement a fire protection program for the PSEGS independent of any other projects considered for potential cumulative impacts. Staff believes that the facility, as proposed by the project owner and with the additional mitigation measures proposed by staff, poses a less than significant risk.

Contribution of the Palen Solar Electric Generating System to Cumulative Impacts

Construction. The construction of PSEGS is not expected to result in short term adverse impacts related to fire protection during construction activities. It is expected that some of the cumulative projects described above which are not yet built may be under construction the same time as the PSEGS, however, short term impacts related to fire protection during construction of those cumulative projects are not expected to occur.

Operation. The operation of the PSEGS is expected to result in long term adverse impacts during operation of the project related to fire protection and staff has recommended mitigation in the form of Condition of Certification **WORKER SAFETY-7** to reduce that impact to a less than significant level.

Non-operation and Facility Closure. The non-operation and facility closure of the PSEGS is not expected to result in adverse impacts related to fire protection similar to construction impacts. It is unlikely that the construction or facility closure of any of the cumulative projects would occur concurrently with the facility closure of this project, because the facility closure is not expected to occur for approximately 30 years. As a result, it is not expected that significant impacts related to fire protection during facility closure of the PSEGS generated by the cumulative projects will occur.

COMPLIANCE WITH LORS

Staff concludes that construction and operation of the PSEGS project with staff's proposed mitigation would be in compliance with all applicable laws, ordinances, regulations, and standards (LORS) regarding long-term and short-term project impacts in the area of worker safety and fire protection.

NOTEWORTHY PUBLIC BENEFITS

Staff is unable to describe any noteworthy pubic benefit in the area of Worker Safety and Fire Protection.

RESPONSE TO COMMENTS

Staff has received numerous comments on fire protection issues consisting of opinions, suggestions, technical information, and factual rebuttal of other parties' comments as well as general comments on the contents of the PSA. Technical information and those comments staff considers to be more of a factual rebuttal of other technical information are described and responded to within the section on Fire Protection beginning above on page 4.14-24.

PSA WORKSHOP ON JULY 17, 2013:

The RCFD made the following verbal comments and suggestions:

Comment: The RCFD had no issues with existing Conditions of Certification **WORKER SAFETY-1** through **4.**

Response: *Thank you*.

Comment: Regarding existing Condition of Certification **WORKER SAFETY-5**, the RCFD suggested that the workers be trained in the operations of an AED and that they also be trained in basic first aid and have basic first aid kits available on-site.

Response: *Training on AEDs is already required in this condition and staff agrees that training in first aid should be required and has been proposed that it be added to this Condition.*

Comment: Regarding revised Condition of Certification **WORKER SAFETY-6**, the RCFD agreed with the wording but voiced a concern that any desert dirt access road be capable of supporting a 60,000 pound fire truck.

Response: *Comment noted and the Petitioner has noted it as well and assured the fire department that the access road and all roads within the facility would be capable of supporting any fire truck. Towards that, staff has proposed a requirement in Condition of Certification **WORKER SAFETY-6.***

Comment: Regarding revised Condition of Certification **WORKER SAFETY-7**, the RCFD disagreed with staff's recommended mitigation, stated that the impacts to the fire department did not decrease with a change in technology, and suggested that staff consider a cost-of-living or other inflation adjustment for the annual payments as the amount proposed would be greatly diminished by inflation over a thirty-year lifespan of the project.

Response: *Staff agrees that a cost-of-living or other escalator metric be used to increase the annual payment over the life of the project and has added that to Condition of Certification* ***WORKER SAFETY-7.*** *In regards to the mitigation payments, in the absence of adequate and appropriate documentation to the contrary, staff stands by its assessment of the mitigation needs.*

Comment: The RCFD stated support for existing Condition of Certification **WORKER SAFETY-8** and for revised proposed Condition of Certification **WORKER SAFETY-9**.

Response: *Thank you.*

Comment: The RCFD stated support for new Condition of Certification **WORKER SAFETY-10** and suggested that a requirement to pay fees for inspections be added.

Response: *Staff agrees with this suggestion and the proposed Condition of Certification* ***WORKER SAFETY-10*** *has been revised accordingly.*

GALATI BLEK LLP, MARIE FLEMING,PALEN SOLAR HOLDINGS LLC'S FINAL COMMENTS ON THE PSA, TN # 200077, JULY 29, 2013:

In a letter dated July 29, 2013, the Petitioner (Palen Solar Holdings, LLC), made the following written comments (Palen 2013dd):

Comment: WS/FP p.20, 1: agrees with staff's proposed WS-6.

Response: *Thank you.*

Comment: p. 20, 2, WS-7: believes that staff's matrix does not include all projects that may impact RCFD and thus the matrix does not allocate the correct percentages of the needs to the PSEGS

Response: *Staff indicated on page 25 of the PSA (page 26 of this FSA) that the matrix was but one tool staff used to allocate mitigation costs to the PSEGS. Staff believes the matrix to be complete in that it was meant to address only CEC-licensed solar power plants. In the FSA, staff explained that it also relied upon six other criteria including professional opinion, the petitioner's Fire and Emergency Services Risk Assessment, and the comments from the RCFD to determine an appropriate level of mitigation.*

Comment: p. 20, 3, WS-7: urges staff to consider the information contained in the Fire [Needs] Assessment.

Response: *Staff has indeed considered the Fire and Emergency Services Risk Assessment in this FSA.*

Comment: p. 20, 3, WS-7: would like the Commission to note that at no time has Riverside County provided any analysis justifying or providing evidence that it needs the financial support it has requested.

Response: *Staff notes that at the time this submittal was written, this statement was true. It is not now true and staff has considered the two filings by the County of Riverside on this matter.*

Comment: p. 20, 4, WS-7: offers to fund the cost of a medium rescue vehicle and equipment estimated cost $1.2 M.

Response: *Staff agrees with the need for this vehicle, equipment, and training and proposes funding of $1.0 M prior to site mobilization and funds for O&M beginning on the day of site mobilization and annually thereafter after. The net effect of staff's proposal would be an initial total funding of $1.313 M by the start of site preparation.*

Comment: p. 21, 1, WS-7: during construction, fund one Fire Captain and half the cost of a firefighter to staff the rescue unit.

Response: *Staff does not support a bifurcated level of annual mitigation for periods of construction and operations. No case has been made that the need for services (familiarization, plan review, inspections, fire response, hazmat spill response, rescue, EMS) is so substantially different during the periods suggested so as to warrant a greater or lesser payment. While different responses might be needed during different times, the overall net impact remains about the same.*

Comment: p. 21, 1, WS-7: during operation, fund one sixth of the on-going operations cost for one firefighter.

Response: *Staff finds no justification in these comments or in the Fire Risk Assessment for the provision of one-sixth the annual cost of full-time staffing of one firefighter as adequate mitigation during operations.*

Comment: p. 21, 2 & 3, WS-7: want to modify WS-7 as follows: initial payment of $1.2 M, annual payments of $684K for three years, and $144K each year after that.

Response: *Staff has given a great deal of consideration to this proposal and for the reasons stated above on pages 4.14-27 through 4.14-33 of this FSA, believes this proposal provides inadequate mitigation.*

COUNTY OF RIVERSIDE, JOHN J. BENOIT, COMMENTS ON PSA, TN # 200094, JULY 30, 2013:

The County of Riverside (CR 2013a) provided 31 separate and distinct substantive comments and technical arguments that staff has reviewed. Some were comments specifically on the PSA and are listed here while others were more technical in nature and pertained to the issue of impacts and mitigation. Those comments and staff's responses can be found beginning on page 4.14-29 above.

Comment: P. 11, **Worker Safety-1** through **Worker Safety -4**: The County continues to support.

Response: *Staff thanks the County for its support.*

Comment: P. 12, **Worker Safety-5**: The County supports the presence of an on-site Automatic External Defibrillator (AED) program and the concurrent training of sufficient staff. The County also recommends the CEC require that delegated staff be trained in First Aid and CPR.

Response: *Staff agrees and has proposed a revision to Condition **Worker Safety-5**.*

Comment: P. 12, Worker Saftey-5: In addition, the County recommends requiring Trauma/First-Aid kits sufficient to handle anticipated industrial accidents and requests that **Worker Safety-5** be amended to reflect this change.

Response: *Staff agrees and has proposed a revision to Condition **Worker Safety-5**.*

Comment: P. 12, **Worker Safety-6**: Regarding the road access, the County reminds CEC Staff and the applicant that any roads conditioned for fire access must meet Riverside County Fire Standards.

Response: *Staff agrees and it is clear that all LORS must be followed. Also, the specific requirement of the roads being able to handle the weight of a fire engine has been added to **Worker Safety-6.***

Comment: P. 12, 3, **Worker Safety-6:** The accepted life span of a fire apparatus is 20 years – with 15 years generally seen serving in a front-line capacity, and 5 years in reserve. This means these two all-wheel drive fire engines, expected to go into service in 2013, will be scheduled for 15-year replacement in approximately 2028. However, this is only halfway through the anticipated PSEGS life-span of 30 years. The County proposes the project owner be required to pay to Riverside County Fire in engine year 15 the then-current cost difference between two two-wheel drive fire engines and two all-wheel drive fire engines to mitigate the added cost of upgrading these engines.

Response: *Staff understands this matter but does not agree that the PSEGS should be responsible for the costs of mitigation for two 4WD fire engines. Staff also feels that the proposed annual mitigation fee for O&M (Operations and Maintenance) with an annual escalator to account for inflation would be adequate to cover the difference between the cost of a new 2WD fire engine and a new 4WD fire engine.*

Comment: P. 12, ¶4, **Worker Safety-7**: The County disagrees with CEC Staff's conclusions and recommendation on this point. As discussed at length above, RCFD has determined, consistent with the findings of the CEC's own Emergency Response Matrix, that the relative potential risks and hazards posed by this Project, and the corresponding level of emergency response preparedness necessary as a result, remain significant under the proposed change in technology. Furthermore, we have concluded that the change in technology does not afford us any reduction in needed mitigation. This will include the need for increased staffing and equipment, which in turn will entail expanded facilities, as well as ongoing training and planning.

Response: *This issue is discussed in great detail starting on page 14.4-24 above. Staff disagrees that the change in technology does not result in lower impacts and thus warrant a reduction in mitigation, however small that reduction may be. Staff continues to believe that its recommended level of mitigation found in the PSA, with a newly recommended escalator, is the appropriate level.*

Comment: P. 12, ¶5, **Worker Safety-7:** As outlined in more detail in Attachment A to this letter, at this time RCFD has identified the ongoing need for the addition of two additional firefighters per shift at the Blythe Airport Station (#45) an added annual cost in present dollars of $831,000 in addition to the position already added to the Lake Tamarisk Station (#49) at an annual cost of $334,000, and 24/7 coverage by a battalion chief at an annual added cost of $230,000. RCFD has also identified one-time needs for equipment upgrades estimated at $158,000 and technical rescue training totaling $120,000, with ongoing annual training for recertification and skills refreshers totaling $40,000 per year. In addition, to adequately house the additional personnel, trucks and equipment, RCFD will need to expand and/or replace facilities at both the Lake Tamarisk (#49) and Blythe Airport (#45) Fire Stations, at a currently estimated total cost of approximately $5,000,000.

Response: *Staff thanks the RCFD for the detailed cost estimates. This issue is discussed in great detail starting on page 14.4-24 above. Staff believes that the PSEGS should not be responsible for all the above-mentioned upgrades, personnel additions, and training. Staff continues to believe that its recommended level of mitigation found in the PSA, with a newly recommended escalator, will contribute to the funding of the these enhancement at the appropriate level.*

Comment: P. 12, 6: The annual mitigation payment of $375,000 received from the Genesis project is currently being used to support the additional position at the Lake Tamarisk Station, and the anticipated one-time payment of $850,000 from that project will be applied to offset a portion of the anticipated capital costs.

Response: *Thank you for this information.*

Comment: P. 13, 1: Since one of the projects (Blythe) on which these mitigation thresholds were calculated is changing to lower impact photovoltaic technology, and one (Rice) currently appears dormant, it is crucial to the County that at minimum the CEC condition the fire mitigation for PSEGS at the same level previously approved for PSPP. Given that the County is agreeing to accept secondary access gates, rather than insisting on a secondary access road, which will generate significantly greater project savings, the County does not see this request to maintain the previously approved mitigation level to support essential emergency response services as unreasonable.

Response: *This issue is discussed in great detail starting on page 14.4-24 above. Staff notes that mitigation funds will most likely be forthcoming in the future from Rice as it is scheduled to begin construction in March 2014. Staff has no information yet about the modified Blythe project as the decision on the petition is pending. Staff continues, however, to believe that its recommended level of mitigation found in the PSA, with a newly recommended escalator, is the appropriate level and will result in a greater amount of mitigation funds coming to the RCFD than with the current Decision.*

Comment: P. 13, **Worker Safety-8**: The County supports.

Comment: P. 13, **Worker Safety-9**: The County supports.

Comment: P. 13, **Worker Safety-10:** This addresses the need for RCFD to conduct plan checks and provide comments and requires the project owner to pay RCFD its usual and customary fee for the review of those plans. The County requests that RCFD's usual and customary fees for inspections also be paid by the project owner.

Response: *Staff agrees and has revised proposed Condition **Worker Safety-10** to reflect this requirement.*

Comment: P. 13, 3: In addition, the County requests that the following Worker Safety Condition of Certification be added:

Worker Safety – 11: The project owner shall comply with NFPA 56(PS) and not allow any fuel gas pipe cleaning activities on-site, either before placing the pipe into service or at any time during the lifetime of PSEGS, that involve "flammable gas blows" where natural (or flammable) gas is used to blow out debris from piping and then vented to atmosphere. Instead, an inherently safer method involving a non-flammable gas (e.g. air, nitrogen, or steam) or mechanical pigging shall be used. Pursuant to NFPA 56(PS), exceptions to this provision may be allowed only if no other satisfactory method is available, and then only with the approval of the CPM.

Response: *Staff agrees with the County and has placed a new more restrictive condition in the section on **HAZARDOUS MATERIALS MANAGEMENT** as proposed Condition **HAZ-4**.*

Attachment A: The RCFD provided an update on Battalion 8, the RCFD's fire and emergency response unit that covers the desert regions of eastern Riverside County. This Appendix discusses the present state of staffing and infrastructure and recommended staff, equipment, facility, and training enhancement planned or desired for this unit. Staff treated this Appendix as technical information and it thus considered in the discussion of impact mitigation beginning on page 4.14-24 above.

AIRPORT LAND USE COMMISSION, RIVERSIDE COUNTY, ED COOPER, COMMENTS ON THE PSA, TN # 200112, JULY 30, 2013:

In a letter dated July 30, the Riverside County Airport Land Use Commission (CR 2013b) made the following comment and request:

Comment: The thermal plume could affect low-flying emergency medical evacuation helicopters. Provision should be made for the wet surface air cooler, auxiliary boiler, and nighttime boiler to be shut down in the event of an (on-site) emergency requiring an airborne evacuation.

Response: *Staff has reviewed this issue and does not anticipate emergency medical helicopters landing within the heliostat fields due to space constraints or flying into the space between the heliostats and the towers; instead, emergency medical helicopters would likely land at the perimeter of the facility, or in the common area and would not fly through the space between the heliostats and the towers. Staff therefore believes that no helicopters would be at risk from a thermal plume at the site. However, to ensure the safety of medevac helicopters, a revision to Conditions of Certification* ***WORKER SAFETY-1*** *and* ***WORKER SAFETY-2*** *is proposed by staff to include a requirement that the project owner submit an Emergency Medical Evacuation Plan as part of the Emergency Response Plan, one for the construction period and another for operations. The requirement that an Emergency Medical Evacuation be prepared and submitted to the Compliance Project Manager (CPM) for review and approval would ensure that the helicopters are not placed at risk.*

OFFICE OF COUNTY COUNSEL, COUNTY OF RIVERSIDE, TIFFANY NORTH, COMMENTS ON PALEN SOLAR HOLDINGS LLC'S FIRE AND EMERGENCY SERVICES RISK ASSESSMENT FOR PROPOSED PSEGS AMENDMENT, TN # 200211, AUGUST 16, 2013

In a letter dated August 16, 2013, the County of Riverside provided written comments on the petitioner's Fire and Emergency Services Risk Assessment (CR 2013c). Staff has provided detailed responses to 16 separate and distinct substantive comments on pages 4.14-29 through 4.14-33 above.

CONCLUSIONS

Staff concludes that if the project owner for the proposed PSEGS project provides a Project Construction Safety and Health Program and a Project Operations and Maintenance Safety and Health Program as required by Conditions of Certification **WORKER SAFETY-1**, and **-2** and fulfils the requirements of Conditions of Certification **WORKER SAFETY-3** through **-12**, the project would incorporate sufficient measures to ensure adequate levels of industrial safety and comply with applicable LORS. With the implementation of staff's proposed Condition of Certification **WORKER SAFETY-8** (enhanced dust control measures), the potential impacts of Valley Fever would be minimized. Staff also concludes that the operation of this power plant, with mitigation, would not significantly impact the provision of emergency services.

PROPOSED CONDITIONS OF CERTIFICATION

Staff has proposed modifications to the conditions of certification as shown below. (**Note:** Deleted text is in ~~strikethrough~~, new text is **<u>bold and underlined</u>**)

WORKER SAFETY-1 The project owner shall submit to the Compliance Project Manager (CPM) a copy of the Project Construction Safety and Health Program that complies with all applicable federal and state LORS for Worker Safety and Health and includes the following:

- a Construction Personal Protective Equipment Program **<u>(including compliance with ANSI Standard Z87.1-2010 for protective eye wear)</u>;**
- a Construction Exposure Monitoring Program;
- a Construction Injury and Illness Prevention Program, including measures to prevent exposure to Valley Fever;
- a Construction heat stress protection plan that implements and expands on existing Cal-OSHA regulations as found in 8 CCR 3395;
- a Construction Emergency Action Plan **<u>(including an Emergency Medical Evacuation Plan for the period of construction)</u>**;
- **<u>a Construction Flood Safety Plan;</u> and**
- a Construction Fire Prevention Plan that includes the concrete batch plant and the above-ground fuel depot.

The Personal Protective Equipment Program, the Exposure Monitoring Program, the Heat Stress Protection Plan, and the Injury and Illness Prevention Program shall be submitted to the CPM for review and approval concerning compliance of the program with all applicable safety orders. The Construction Emergency Action Plan and the Fire Prevention Plan shall be submitted to the Riverside County Fire Department (RCFD) for review and comment prior to submittal to the CPM for approval.

<u>Verification:</u> At least 30 days prior to the start of construction, the project owner shall submit to the CPM for review and approval a copy of the Project Construction Safety and Health Program. The project owner shall provide a copy of a letter to the CPM from the Riverside County Fire Department stating the fire department's comments on the Construction Fire Prevention Plan and Emergency Action Plan.

WORKER SAFETY-2 The project owner shall submit to the CPM a copy of the Project Operations and Maintenance Safety and Health Program that complies with all applicable federal and state LORS related to Worker Safety and Health and include the following:

- an Operation Injury and Illness Prevention Plan, including measures to prevent exposure to Valley Fever;
- an Operation heat stress protection plan that implements and expands on existing Cal OSHA regulations (8 CCR 3395);
- ~~a Best Management Practices (BMP) for the storage and application of herbicides;~~
- an Emergency Action Plan **<u>(including an Emergency Medical Evacuation Plan for operations)</u>**;
- Hazardous Materials Management Program;
- Fire Prevention Plan that includes the fuel depot should the project owner elect to maintain and operate the fuel depot during operations (8 Cal Code Regs. § 3221) as well as the fire protection measures described in this Decision and any necessary upgrades required by current applicable LORS;
- **<u>An Operations Flood Safety Plan</u>**; **and**
- Personal Protective Equipment Program (8 Cal Code Regs, §§ 3401-3411) **<u>that also includes compliance with ANSI Standard Z87.1-2010 for protective eye wear</u>.**

The Operation Injury and Illness Prevention Plan, Emergency Action Plan, Heat Stress Protection Plan, ~~BMP for Herbicides,~~ and Personal Protective Equipment Program shall be submitted to the CPM for review and comment concerning compliance of the programs with all applicable safety orders. The Fire Prevention Plan and the Emergency Action Plan shall also be submitted to the Riverside County Fire Department for review and comment.

<u>Verification:</u> At least 30 days prior to the start of first-fire or commissioning, the project owner shall submit to the CPM for approval a copy of the Project Operations and Maintenance Safety and Health Program. The project owner shall provide a copy of a letter to the CPM from the Riverside County Fire Department stating the fire department's comments on the Operations Fire Prevention Plan and Emergency Action Plan.

WORKER SAFETY-3 The project owner shall provide a site Construction Safety Supervisor (CSS) who, by way of training and/or experience, is knowledgeable of power plant construction activities and relevant laws, ordinances, regulations, and standards; is capable of identifying workplace hazards relating to the construction activities; and has authority to take appropriate action to assure compliance and mitigate hazards. The CSS shall:

- have overall authority for coordination and implementation of all occupational safety and health practices, policies, and programs;
- assure that the safety program for the project complies with Cal/OSHA and federal regulations related to power plant projects;
- assure that all construction and commissioning workers and supervisors receive adequate safety training;
- complete accident and safety-related incident investigations and emergency response reports for injuries and inform the CPM of safety-related incidents; and
- assure that all the plans identified in Conditions of Certification **WORKER SAFETY-1** and **-2** are implemented.

Verification: At least 30 days prior to the start of site mobilization, the project owner shall submit to the CPM the name and contact information for the Construction Safety Supervisor (CSS). The contact information of any replacement CSS shall be submitted to the CPM within one business day.

The CSS shall submit in the Monthly Compliance Report a monthly safety inspection report to include:

A. A record of all employees trained for that month (all records shall be kept on-site for the duration of the project);

B. A summary report of safety management actions and safety-related incidents that occurred during the month;

C. A report of any continuing or unresolved situations and incidents that may pose danger to life or health; and

D. A report of accidents and injuries that occurred during the month.

WORKER SAFETY-4 The project owner shall make payments to the Chief Building Official (CBO) for the services of a Safety Monitor based upon a reasonable fee schedule to be negotiated between the project owner and the CBO. Those services shall be in addition to other work performed by the CBO. The Safety Monitor shall be selected by and report directly to the CBO and will be responsible for verifying that the Construction Safety Supervisor, as required in Condition of Certification **WORKER SAFETY-3**, implements all appropriate Cal/OSHA and Energy Commission safety requirements. The Safety Monitor shall conduct on-site (including linear facilities) safety inspections at intervals necessary to fulfill those responsibilities.

Verification: At least 30 days prior to the start of construction, the project owner shall provide proof of its agreement to fund the Safety Monitor services to the CPM for review and approval.

WORKER SAFETY-5 The project owner shall ensure that a portable automatic external defibrillator (AED) **and Trauma/First-Aid kits sufficient to handle anticipated industrial accidents are** ~~is~~ located on-site during construction and operations and shall implement a program to ensure that workers are properly trained in ~~its~~ **AED use and basic first aid (which includes CPR)** and that the equipment is properly maintained and functioning at all times. During construction and commissioning, the following persons shall be trained in ~~its~~ **AED use and basic first aid (which includes CPR)** and shall be on-site whenever the workers that they supervise are on-site: the Construction Project Manager or delegate, the Construction Safety Supervisor or delegate, and all shift foremen. During operations, all power place employees shall be trained in ~~its~~ **AED** use **and basic first aid (which includes CPR)**. The training program shall be submitted to the CPM for review and approval.

Verification: At least 60 days prior to the start of site mobilization, the project owner shall submit to the CPM proof that a portable automatic external defibrillator (AED) **and trauma/first aid kits** exist~~s~~ on-site and a copy of the training and maintenance program for review and approval.

WORKER SAFETY-6 The project owner shall:

A. Provide ~~a~~ **not less than two (2)** secondary site access gates for emergency personnel to enter the site**, one on the north site of the site and the other on the south side of the site**. ~~This~~ **These** secondary site access gate**s** shall be **located** at least one-~~quarter~~half mile from the main gate **and shall be equipped with locks that can be opened by emergency response personnel including the Riverside County Fire Department, the Riverside County Sheriff's Department, and the California Highway Patrol**.

~~B.~~ **In lieu of providing** ~~Provide~~ a second access road which provides entry to the site**, the project owner shall share the financial responsibility for the costs of obtaining and maintaining two all-terrain fire engines for the Riverside County Fire Department and shall initially pay to the Genesis Solar Energy Project owner an amount equally to 50 percent of the costs of the engines plus annually 50 percent of the annual maintenance**. ~~This road shall be at a minimum an all-weather gravel road, at least 20 feet wide, and shall come from the Interstate-10 right-of-way to the project site at the location of where the fence line of the eastern solar field comes the nearest to the I-10 right-of-way, if approved by Caltrans, a locked gate shall be placed in the I-10 right-of-way fence. The RCFD, the California Highway Patrol, and the Riverside County Sheriff's Department shall be given access to the gate.~~

C. Maintain the main access road ~~and the second access road~~ and provide a plan for construction and implementation, **<u>and ensure that the main access road and all internal site roads (paved or dirt) are capable of supporting fire engine with a weight of 60,000 pounds.</u>**

Plans for the secondary access gates, the method of gate operation, ~~secondary gravel road,~~ and maintenance of the roads shall be submitted to the Riverside County Fire Department for review and comment and to the CPM for review and approval.

<u>Verification:</u> At least 60 days prior to the start of site mobilization, the project owner shall submit to the RCFD and the CPM preliminary plans showing the **<u>locations of at least two (2)</u>** secondary site access gate<u>s</u> to the site, a description of how the secondary site access gate**<u>s</u>** will be opened by the fire department and other emergency services, and a description and map showing the location, dimensions, and composition of the main road~~, and the gravel road to the secondary site access gate~~.

At least 30 days prior to the start of site mobilization, the project owner shall submit the secondary site access gate<u>s</u> final plans plus the road maintenance plan to the CPM for review and approval. The final plan submittal shall also include a letter containing comments from the Riverside County Fire Department or a statement that no comments were received.

<u>At least 30 days prior to the start of site mobilization, the project owner shall submit to the CPM proof of payment for one-half of the cost of the two all-terrain fire trucks to the Genesis Solar Energy Project owner. In the Project Owners Annual Report, the project owner shall provide proof that it has paid to the Genesis Solar Energy Project owner its share of the annual maintenance costs of the two all-terrain fire trucks.</u>

~~At least 30 days after approval by Caltrans, the project owner shall submit final plans for the gate in the I-10 right-of-way to the Riverside County Fire Department for review and comment and to the CPM for review and approval.~~

WORKER SAFETY-7 The project owner shall ~~either:~~

~~A. Reach an agreement with the Riverside County Fire Department regarding funding of its project-related share of capital costs to build fire protection/response infrastructure and provide appropriate equipment as mitigation of project-related impacts on fire protection services, or, if no agreement can be reached shall~~ fund ~~its share of the~~ capital costs in the amount of ~~$850,000~~ **<u>$1,000,000</u>** and shall provide an annual payment of ~~$375,000~~ **<u>$313,000</u>** to the RCFD ~~for the support of three fire department staff~~ commencing with ~~the date of~~ site mobilization and continuing annually thereafter. **<u>All annual payments after the initial payment shall be subject to an annual escalator equal to the Consumer Price Index (CPI-U, US City Average, All Items Less Food and Energy) for the previous calendar year as published by the U.S Bureau of Labor Statistics to account of inflation</u>** on the anniversary until the final date of power plant **<u>closure</u>**~~decommissioning~~.

Verification: At least 30 days prior to the start of site mobilization, the project owner shall provide **proof** to the CPM ~~for review and approval~~ ~~either:A copy of the agreement with the RCFD or D~~ d~~ocumentation~~ ~~that a letter of credit in the amount of $850,000~~ that **$1,000,000** has been ~~provided~~ paid to the RCFD **for capital costs.**

Documentation that the annual payment of ~~a letter of credit in the amount of $375,000 will be provided~~ **$313,000 has been paid to the RCFD on the first day of site mobilization and each year after that** ~~each year at the start of commercial operations~~. ~~Proof of the annual~~ ~~$375,000 letter of credit~~ ~~payment of $313,333~~ **plus escalator** ~~has been made commencing with site mobilization~~ shall be included each year in the Project Owner's Annual Report to the CPM.

~~**WORKER SAFETY-8** The project owner shall place a water spray system on the two LPG storage tanks. The engineering design plans shall comply with NFPA 15, *Standard for Water Spray Fixed Systems for Fire Protection* and be provided to the CPM for review and approval prior to commencing construction of the water spray system.~~

~~**Verification**:~~ ~~At least 30 days prior to site mobilization, the project owner shall provide the engineering design plans to the CPM for review and approval. At least 30 days prior to the delivery of any LPG to the facility, the project owner shall provide a written statement to the CPM that the LPG tank water spray system has been built and successfully tested.~~

WORKER SAFETY-~~9~~8 The project owner shall develop and implement an enhanced Dust Control Plan that includes the requirements described in Conditions **AQ-SC3** and **AQ-SC4**, and additionally requires:

A. Site worker use of dust masks (NIOSH N-95 or better) whenever visible dust is present;

B. ~~Implementation of Rule 402 of the Kern County Air Pollution Control District (as amended Nov. 3, 2004); and~~ **No downwind PM10 ambient concentrations to increase more than 50 micrograms per cubic meter above upwind concentrations as determined by simultaneous upwind and downwind sampling. High-volume particulate matter samplers or other EPA-approved equivalent method(s) for PM10 monitoring shall be used. Samplers shall be:**

a. Operated, maintained, and calibrated in accordance with 40 Code of Federal Regulations (CFR), Part 50, Appendix J, or appropriate EPA-published documents for EPA-approved equivalent methods(s) for PM10 sampling;

b. Reasonably placed upwind and downwind of the large operation based on prevailing wind direction and as close to the property line as feasible, such that other sources of fugitive dust between the sampler and the property line are minimized; and

c. Operated during active operations.

C. Implementation of enhanced dust control methods (increased frequency of watering, use of dust suppression chemicals, etc. consistent with **AQ-SC4**) immediately whenever visible dust persists in the breathing zone of the workers, or when PM10 measurements obtained when implementing B (above) indicate an increase in PM10 concentrations due to project activities of 50 µg/m^3 or more.

Verification: At least 30 days prior to the commencement of site mobilization, the enhanced Dust Control Plan shall be provided to the CPM for review and approval.

WORKER SAFETY-~~10~~9 The project owner shall participate in annual joint training exercises with the Riverside County Fire Department (RCFD). The project owner shall coordinate this training with other Energy Commission-licensed solar power plants within Riverside County such that this project shall host the annual training on a rotating yearly basis with the other solar power plants.

Verification: At least 10 days prior to the start of commissioning, the project owner shall submit to the CPM proof that a joint training program with the RCFD is established. In each January Monthly Compliance Report during construction and the Annual Compliance Report during operation, the project owner shall include the date, list of participants, training protocol, and location of the annual joint training.

WORKER SAFETY-10 The project owner shall submit to the Riverside County Fire Department (RCFD) all plans and schematic diagrams that show the details of all fire detection and suppression systems and shall pay the RCFD its usual and customary fee for the review of those plans and for site inspections after construction but before operations begin. The project owner shall provide proof to the CPM that the plans have been submitted to the RCFD on a timely basis and a copy of the comments received from the RCFD after plan review and after site inspections.

Verification: In each Monthly Compliance Report during construction, the project owner shall include any and all comments received from the RCFD on fire detection and suppression systems and proof that the required plan review and inspection fees have been paid to the fire department.

During operation, the project owner shall provide proof in the Annual Compliance Report that the required inspection fees have been paid to the fire department.

WORKER SAFETY-11 The project owner shall prepare and implement a Tower Access and Safety Plan for the construction phase and one for operations (which includes commissioning). These plans shall include descriptions of the following:

1. **The type of elevators (cage, enclosed, man-lift, etc.) and emergency hoist systems, their capacity in number of people and pounds, the dimensions of the elevator cage or enclosed structure, and a diagram of the emergency hoist systems.**

2. **The primary and secondary (emergency) power supply to the elevators hoist systems and how emergency backup power will be triggered.**

3. <u>The emergency elevator recall system (manual on-site activation, remote from the control room, wired or wireless).</u>

4. <u>The fire detection and suppression systems (fixed and portable) within the towers and in the room at the top of tower behind the boiler.</u>

5. <u>Any planned ventilation systems for inside the towers.</u>

6. <u>The maximum number of workers allowed in each tower at any one time, allowed in the room at the top of each of the towers during periods when the tower will be exposed to solar flux, temperature sensors within the towers and the room at the top, and the expected durations and frequency of this need to have workers at the top of a tower.</u>

7. <u>The manner in which access to the towers and the tower elevators will be controlled, including how a Lockout/Tagout system will be implemented.</u>

8. <u>An Emergency Response Plan that includes a fire suppression plan to respond to emergencies in the tower, the type of PPE that would be available and required for workers both in a tower and those responding to an emergency in a tower to use in the event of a fire or smoke incidence, evacuation of workers, how the emergency hoist systems will be used, and evacuation or rescue of an injured worker from any level of the tower.</u>

9. <u>The project owner shall provide these plans to the CPM for review and approval.</u>

<u>Verification:</u> <u>At least 30 days prior to the start of construction, the project owner shall submit to the CPM for review and approval a copy of the construction Tower Access and Safety Plan. The project owner shall also provide a copy of a letter to the CPM from the RCFD stating the RCFD's comments on the Construction Tower Access and Safety Plan or a letter stating that no comments were received from the RCFD within thirty (30) days of sending the plan to the RCFD.</u>

<u>At least 30 days prior to the start of commissioning (as defined by the CPM), the project owner shall submit to the CPM for review and approval a copy of the Operations Tower Access and Safety Plan. The project owner shall also provide a copy of a letter to the CPM from the RCFD stating the RCFD's comments on the Operations Tower Access and Safety Plan or a letter stating that no comments were received from the RCFD within thirty (30) days of sending the plan to the RCFD.</u>

<u>WORKER SAFETY-12 The project owner shall report to the CPM within 24 hours of any incidence of heat illness (heat stress, exhaustion, stroke, or prostration) occurring in any worker on-site and shall report to the CPM the incidence of any confirmed case of Valley Fever in any worker on the site within 24 hours of receipt of medical diagnosis.</u>

<u>Verification:</u> **<u>The project owner shall provide reports of heat-related and Valley Fever incidences in any worker on the site via telephone call or e-mail to the CPM within 24 hours of a heat-related occurrence or confirmed diagnosis of a case of Valley Fever, and shall include such reports in the Monthly Compliance Report.</u>**

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WORKER SAFETY/FIRE PROTECTION APPENDIX A

Staff's Emergency Response Matrix

6/6/2013	**Estimated Values for Riverside County**						
Needs Criteria		**points**	**weight factor**	**Genesis**	**Palen**	**Blythe**	**Rice**
1. Learning, understanding, and training			0.15				
a.	minimal need	1				1	
b.	average need	3		3	3		3
c.	significant need	5					
2. Inspections			0.10				
a.	minimal need	1				1	
b.	average need	3		3	3		3
c.	significant need	5					
			Net -->	*0.3*	*0.3*	*0.1*	*0.3*
3. Fire			0.30				
A. Quantity liquid fuel or hydrogen gas stored on-site			0.10				
a.	<1,000 gal or <1000 lbs hydrogen gas	1			1	1	1
b.	>1000 and <100,000 gal or <10,000 lbs hydrogen gas	2					
c.	>100,000 gal or >10,000 lbs hydrogen gas	6		6			
			Net -->	*0.60*	*0.10*	*0.10*	*0.10*
B. Fire/Explosion off-site consequences			0.20				
a.	Limited to site	1		1	1	1	1
b.	Potential for smoke and/or fire and/or minor blast effects off-site	2					
c.	Potential for major fire/blast structure damage and/or injuries/fatalities off-site and/or major hwy disruption/closure	5					
d.	Potential for fire at elevated platforms (score 0, 1, 2, or 3)			1	3	0	3
			Net -->	*0.40*	*0.80*	*0.20*	*0.80*
4. HazMat			0.10				
A. Proximity to sensitive receptors			0.075				
a.	no sig quant of hazmats or no potential for off-site impacts within 1/2 mile	1		1	1	1	1
b.	<5 receptors within 1/2 mile	2					
c.	5-10 receptors within 1/2 mile	3					
d.	>10 within 1/2 mile	4					
			Net -->	*0.08*	*0.08*	*0.08*	*0.08*
B. Hazmat response time			0.025				
a.	<30 minutes	1				1	
b.	30 - 60 minutes	3		3	3		
c.	>60 minutes	4					4
			Net -->	*0.08*	*0.08*	*0.03*	*0.10*
5. Rescue			0.20				
a.	low need and difficulty or on-site capability	1				1	1
b.	medium need and difficulty	3		3	3		
c.	high need and difficulty	5					
			Net -->	*0.60*	*0.60*	*0.20*	*0.20*

6/6/2013	**Estimated Values for Riverside County**						
Needs Criteria		**points**	**weight factor**	**Genesis**	**Palen**	**Blythe**	**Rice**
6. EMS							
EMS response time			0.15				
a.	in-house EMT	1					1
b.	<30 minute response time	3			3	3	
c.	>30 minute response time	5		5			
			Net -->	*0.75*	*0.45*	*0.45*	*0.15*
	Sum weighting factors		**1.00**				
TOTAL SCORE			**======>**	2.80	2.40	1.15	1.73
LOW Priority: additional resources and mitigation may be needed.		0.1 - 1.5					
MEDIUM Priority: additional resources and mitigation needed.		>1.5 - 2.5					
HIGH Priority: very significant need for additional resources and mitigation.		>2.5 - 3.5					
VERY HIGH Priority: urgent need for additional resources and mitigation.		>3.5					

Engineering Assessment

FACILITY DESIGN

Testimony of Shahab Khoshmashrab

SUMMARY OF CONCLUSIONS

The California Energy Commission (Energy Commission) staff (staff) concludes that the design, construction, and eventual closure of the Palen Solar Electric Generating System (PSEGS) and its linear facilities would likely comply with applicable engineering laws, ordinances, regulations and standards. The proposed modifications as described in the Petition to Amend would not change staff's analysis or the conditions of certification as approved in the December 2010 Energy Commission Decision for the approved Palen Solar Power Project (PSPP). The existing conditions of certification below would ensure compliance with these laws, ordinances, regulations and standards.

INTRODUCTION

Facility design encompasses the civil, structural, mechanical, and electrical engineering design of the PSEGS. The purpose of this analysis is to:

- Verify that the laws, ordinances, regulations and standards (LORS) that apply to the engineering design and construction of the project have been identified;
- Verify that both the project and its ancillary facilities are sufficiently described, including proposed design criteria and analysis methods, in order to provide reasonable assurance that the project would be designed and constructed in accordance with all applicable engineering LORS, which would ensure the public health and safety;
- Determine whether special design features should be considered during final design to address conditions unique to the site which could influence public health and safety; and,
- Describe the design review and construction inspection process and establish the conditions of certification used to monitor and ensure compliance with the engineering LORS, in addition to any special design requirements.

Subjects discussed in this analysis include:

- Identification of the engineering LORS that apply to facility design;
- Evaluation of the project owner's proposed design criteria, including identification of criteria essential to public health and safety;
- Proposed modifications and additions provided in the Petition to Amend necessary for compliance with applicable engineering LORS; and
- Conditions of certification proposed by staff to ensure that the project would be designed and constructed to comply with all applicable engineering LORS, which would ensure public health and safety.

LAWS, ORDINANCES, REGULATIONS AND STANDARDS

Lists of LORS applicable to each engineering discipline (civil, structural, mechanical, and electrical) are described in the PSEGS Petition to Amend (Palen 2012a, §§ 2.15.1, 3.1.4, Appendices 2E through 2J). Key LORS are listed in **Facility Design Table 1,** below:

Facility Design Table 1
Key Engineering Laws, Ordinances, Regulations and Standards (LORS)

Applicable LORS	Description
Federal	Title 29 Code of Federal Regulations (CFR), Part 1910, Occupational Safety and Health standards
State	2010 (or latest edition) California Building Standards Code (CBSC) (also known as Title 24, California Code of Regulations)
Local	Riverside County regulations and ordinances
General	American National Standards Institute (ANSI) American Society of Mechanical Engineers (ASME) American Welding Society (AWS) American Society for Testing and Materials (ASTM)

PROPOSED MODIFIED PROJECT

The modifications proposed in the petition include replacing the parabolic trough solar collection system, steam turbine generator, and associated heat transfer fluid with BrightSource's solar tower technology. Heliostats—elevated mirrors guided by a tracking system mounted on a pylon—focus the sun's rays on a solar receiver steam generator (SRSG) located atop a 750-foot-tall tower near the center of each solar field to create steam to drive a turbine that generates electricity. These modifications do not change staff's analysis or conclusions as related to **Facility Design**.

SETTING AND EXISTING CONDITIONS

PSEGS would be built on a site located in Riverside County, California. For more information on the site and its related project description, please see the **PROJECT DESCRIPTION** section of this document. Additional engineering design details are contained in the Petition to Amend, § 3.1.3, Appendices 2E through 2J.

ASSESSMENT OF IMPACTS AND DISCUSSION OF MITIGATION

The purpose of this analysis is to ensure that the project would be built to applicable engineering codes, which would ensure public health and life safety. This analysis further verifies that applicable engineering LORS have been identified and that the project and its ancillary facilities have been described in adequate detail. It also evaluates the project owner's proposed design criteria, describes the design review and construction inspection process, and establishes conditions of certification that would monitor and ensure compliance with engineering LORS and any other special design requirements. These conditions allow both the California Energy Commission (Energy

Commission) compliance project manager (CPM) and the project owner to adopt a compliance monitoring scheme that would verify compliance with these LORS.

SITE PREPARATION AND DEVELOPMENT

Staff has evaluated the proposed design criteria for grading, flood protection, erosion control, site drainage, and site access, in addition to the criteria for designing and constructing linear support facilities such as natural gas and electric transmission interconnections. The project owner proposes the use of accepted industry standards (see Palen 2012a, § 3.1.4, Appendces 2E through 2J for a representative list of applicable industry standards), design practices, and construction methods in preparing and developing the site. Staff concludes that this project, including its linear facilities, would most likely comply with all applicable site preparation LORS, and proposes conditions of certification (see below and the **GEOLOGY AND PALEONTOLOGY** section of this document) to ensure that compliance is met.

MAJOR STRUCTURES, SYSTEMS, AND EQUIPMENT

Major structures, systems, and equipment are structures and their associated components or equipment that are**:** necessary for power production, costly or time consuming to repair or replace**;** are used for the storage, containment, or handling of hazardous or toxic materials**;** or**,** could become potential health and safety hazards if not constructed according to applicable engineering LORS.

PSEGS shall be designed and constructed to the 2010 California Building Standards Code (CBSC), also known as Title 24, California Code of Regulations, which encompasses the California Building Code (CBC), California Building Standards Administrative Code, California Electrical Code, California Mechanical Code, California Plumbing Code, California Energy Code, California Fire Code, California Code for Building Conservation, California Reference Standards Code, and other applicable codes and standards in effect when the design and construction of the project actually begin. If the initial designs are submitted to the chief building official (CBO) for review and approval after the update to the 2010 CBSC takes effect, the 2010 CBSC provisions shall be replaced with the updated provisions.

Certain structures in a power plant may be required, under the CBC, to undergo dynamic lateral force (structural) analysis; others may be designed using the simpler static analysis procedure. In order to ensure that structures are analyzed according to their appropriate lateral force procedure, staff has included Condition of Certification **STRUC-1**, below, which, in part, requires the project CBO's review and approval of the owner's proposed lateral force procedures before construction begins.

PROJECT QUALITY PROCEDURES

The project's Petition to Amend (Palen 2012a, § 3.1.3, Appendices 2E through 2J) describes a quality program intended to inspire confidence that its systems and components will be designed, fabricated, stored, transported, installed, and tested in accordance with all appropriate power plant technical codes and standards. Compliance with design requirements will be verified through specific inspections and audits. Implementation of this quality assurance/quality control (QA/QC) program will ensure that PSEGS is actually designed, procured, fabricated, and installed as described in this analysis.

COMPLIANCE MONITORING

Under California Code of Regulations Title 24, Part 2, Section 104.2 of the CBC, the CBO is authorized and directed to enforce all provisions of the CBC. The Energy Commission itself serves as the building official, and has the responsibility to enforce the code for all of the energy facilities it certifies. In addition, the Energy Commission has the power to interpret the CBC and adopt and enforce both rules and supplemental regulations that clarify application of the CBC's provisions.

The Energy Commission's design review and construction inspection process conforms to CBC requirements and ensures that all facility design conditions of certification are met. As provided by Section 104.2.2 of the CBC, the Energy Commission appoints experts to perform design review and construction inspections and act as delegate CBOs on behalf of the Energy Commission. These delegates typically include the local building official and/or independent consultants hired to provide technical expertise that is not provided by the local official alone. The project owner, through permit fees provided by the CBC, pays the cost of these reviews and inspections. While building permits in addition to Energy Commission certification are not required for this project, the project owner pays in lieu of CBC permit fees to cover the costs of these reviews and inspections.

Staff has developed proposed conditions of certification to ensure public health and safety and compliance with engineering design LORS. Some of these conditions address the roles, responsibilities, and qualifications of the engineers who will design and build the proposed modified project (conditions of certification **GEN-1** through **GEN-8**). These engineers must be registered in California and sign and stamp every submittal of design plans, calculations, and specifications submitted to the CBO. These conditions require that every element of the project's construction (subject to CBO review and approval) be approved by the CBO before it is performed. They also require that qualified special inspectors perform or oversee special inspections required by all applicable LORS.

While the Energy Commission and delegate CBO have the authority to allow some flexibility in scheduling construction activities, these conditions are written so that no element of construction (of permanent facilities subject to CBO review and approval) which could be difficult to reverse or correct can proceed without prior CBO approval. Elements of construction that are not difficult to reverse may proceed without approval of the plans. The project owner bears the responsibility to fully modify construction elements in order to comply with all design changes resulting from the CBO's subsequent plan review and approval process.

FACILITY CLOSURE

The removal of a facility from service, or closure, as a result of the project reaching the end of its useful life, may range from “mothballing” to removal of all equipment and appurtenant facilities and restoration of the site. Future conditions that may affect the closure decision are largely unknown at this time.

In order to assure that closure of the facility will be completed in a manner that is environmentally sound, safe and will protect public health and safety, the project owner shall submit a closure plan to the Energy Commission for review and approval prior to the commencement of closing the facility as required in **COM-15; FACILITY CLOSURE PLANS** in the **GENERAL CONDITIONS** section of this Final Staff Assessment.

The requirements in the **GENERAL CONDITIONS** are adequate protection, even in the unlikely event of project abandonment.

CUMULATIVE IMPACT ANALYSIS

Not applicable.

NOTEWORTHY PUBLIC BENEFITS

Staff has not identified any noteworthy public benefits associated with this **FACILITY DESIGN** section.

RESPONSE TO COMMENTS

Staff received no comments relating to Facility Design.

CONCLUSIONS

The laws, ordinances, regulations and standards (LORS) identified in the Petition to Amend and supporting documents directly apply to the project. Staff has evaluated the proposed engineering LORS, design criteria, and design methods in the record, and concludes that the design, construction, and eventual closure of the project will likely comply with applicable engineering LORS.

The proposed conditions of certification will ensure that PSEGS is designed and constructed in accordance with applicable engineering LORS. This will be accomplished through design review, plan checking, and field inspections that will be performed by the CBO or other Energy Commission delegate. Staff will audit the CBO to ensure satisfactory performance.

Though future conditions that could affect non-operation and facility closure are largely unknown at this time, it can reasonably be concluded that if, the project owner submits a facility closure plan as required in the **GENERAL CONDITIONS** portion of this document prior to facility closure, facility closure procedures will comply with all applicable engineering LORS.

Energy Commission staff recommends that:

1. The proposed conditions of certification be adopted to ensure that the project is designed and constructed in a manner that protects the public health and safety and complies with all applicable engineering LORS;

2. The project be designed and built to the 2010 CBSC (or successor standards, if in effect when initial project engineering designs are submitted for review); and

3. The CBO reviews the final designs, checks plans, and performs field inspections during construction. Energy Commission staff shall audit and monitor the CBO to ensure satisfactory performance.

PROPOSED CONDITIONS OF CERTIFICATION

All the **Facility Design** Conditions of Certification remain unchanged except for a minor edit to update the edition of the CBSC (see below). (**Note:** Deleted text is in ~~strikethrough~~, new text is **bold and underlined.**)

GEN-1 The project owner shall design, construct, and inspect the project in accordance with the ~~2007~~**2010** California Building Standards Code (CBSC), also known as Title 24, California Code of Regulations, which encompasses the California Building Code (CBC), California Building Standards Administrative Code, California Electrical Code, California Mechanical Code, California Plumbing Code, California Energy Code, California Fire Code, California Code for Building Conservation, California Reference Standards Code, and all other applicable engineering LORS in effect at the time initial design plans are submitted to the CBO for review and approval (the CBSC in effect is the edition that has been adopted by the California Building Standards Commission and published at least 180 days previously). The project owner shall ensure that all the provisions of the above applicable codes are enforced during the construction, addition, alteration, moving, demolition, repair, maintenance, or closure of the completed facility. All transmission facilities (lines, switchyards, switching stations and substations) are covered in the conditions of certification in the **TRANSMISSION SYSTEM ENGINEERING** section of this document.

In the event that the initial engineering designs are submitted to the CBO when the successor to the ~~2007~~**2010** CBSC is in effect, the ~~2007~~**2010** CBSC provisions shall be replaced with the applicable successor provisions. Where, in any specific case, different sections of the code specify different materials, methods of construction or other requirements, the most restrictive shall govern. Where there is a conflict between a general requirement and a specific requirement, the specific requirement shall govern.

The project owner shall ensure that all contracts with contractors, subcontractors, and suppliers clearly specify that all work performed and materials supplied comply with the codes listed above.

<u>Verification:</u> Within 30 days following receipt of the certificate of occupancy, the project owner shall submit to the CPM a statement of verification, signed by the responsible design engineer, attesting that all designs, construction, installation, and inspection requirements of the applicable LORS and the Energy Commission's decision have been met in the area of facility design. The project owner shall provide the CPM a copy of the certificate of occupancy within 30 days of receipt from the CBO.

Once the certificate of occupancy has been issued, the project owner shall inform the CPM at least 30 days prior to any construction, addition, alteration, moving, demolition, repair, or maintenance to be performed on any portion(s) of the completed facility that requires CBO approval for compliance with the above codes. The CPM will then determine if the CBO needs to approve the work.

GEN-2 Before submitting the initial engineering designs for CBO review, the project owner shall furnish the CPM and the CBO with a schedule of facility design submittals, and master drawings and master specifications list. The master drawings and master specifications list shall contain a list of proposed submittal packages of designs, calculations, and specifications for major structures, systems, and equipment. Major structures, systems, and equipment are structures and their associated components or equipment that are necessary for power production, costly or time consuming to repair or replace, are used for the storage, containment, or handling of hazardous or toxic materials, or could become potential health and safety hazards if not constructed according to applicable engineering LORS. The schedule shall contain the date of each submittal to the CBO. To facilitate audits by Energy Commission staff, the project owner shall provide specific packages to the CPM upon request.

<u>Verification:</u> At least 60 days (or a project owner- and CBO-approved alternative time frame) prior to the start of rough grading, the project owner shall submit to the CBO and to the CPM the schedule, and the master drawings and master specifications list of documents to be submitted to the CBO for review and approval. These documents shall be the pertinent design documents for the major structures, systems, and equipment defined above in Condition of Certification **GEN-2**. Major structures and equipment shall be added to or deleted from the list only with CPM approval. The project owner shall provide schedule updates in the monthly compliance report.

GEN-3 The project owner shall make payments to the CBO for design review, plan checks, and construction inspections, based upon a reasonable fee schedule to be negotiated between the project owner and the CBO, in accordance with the ~~2007~~**<u>2010</u>** CBC. These fees may be based on the value of the facilities reviewed; may be based on hourly rates; or may be otherwise agreed upon by the project owner and the CBO.

<u>Verification:</u> The project owner shall make the required payments to the CBO in accordance with the agreement between the project owner and the CBO. The project owner shall send a copy of the CBO's receipt of payment to the CPM in the next monthly compliance report indicating that applicable fees have been paid.

GEN-4 Prior to the start of rough grading, the project owner shall assign a California-registered architect, or a structural or civil engineer, as the resident engineer (RE) in charge of the project. All transmission facilities (lines, switchyards, switching stations, and substations) are addressed in the conditions of certification in the **TRANSMISSION SYSTEM ENGINEERING** section of this document.

The RE may delegate responsibility for portions of the project to other registered engineers. Registered mechanical and electrical engineers may be delegated responsibility for mechanical and electrical portions of the project, respectively. A project may be divided into parts, provided that each part is clearly defined as a distinct unit. Separate assignments of general responsibility may be made for each designated part.

The RE shall:

1. Monitor progress of construction work requiring CBO design review and inspection to ensure compliance with LORS;

2. Ensure that construction of all facilities subject to CBO design review and inspection conforms in every material respect to applicable LORS, these conditions of certification, approved plans, and specifications;

3. Prepare documents to initiate changes in approved drawings and specifications when either directed by the project owner or as required by the conditions of the project;

4. Be responsible for providing project inspectors and testing agencies with complete and up-to-date sets of stamped drawings, plans, specifications, and any other required documents;

5. Be responsible for the timely submittal of construction progress reports to the CBO from the project inspectors, the contractor, and other engineers who have been delegated responsibility for portions of the project; and

6. Be responsible for notifying the CBO of corrective action or the disposition of items noted on laboratory reports or other tests when they do not conform to approved plans and specifications.

The resident engineer (or his delegate) must be located at the project site, or be available at the project site within a reasonable period of time, during any hours in which construction takes place.

The RE shall have the authority to halt construction and to require changes or remedial work if the work does not meet requirements.

If the RE or the delegated engineers are reassigned or replaced, the project owner shall submit the name, qualifications and registration number of the newly assigned engineer to the CBO for review and approval. The project owner shall notify the CPM of the CBO's approval of the new engineer.

Verification: At least 30 days (or project owner- and CBO-approved alternative time frame) prior to the start of rough grading, the project owner shall submit to the CBO for review and approval, the resume and registration number of the RE and any other delegated engineers assigned to the project. The project owner shall notify the CPM of the CBO's approvals of the RE and other delegated engineer(s) within five days of the approval.

If the RE or the delegated engineer(s) is subsequently reassigned or replaced, the project owner has five days to submit the resume and registration number of the newly assigned engineer to the CBO for review and approval. The project owner shall notify the CPM of the CBO's approval of the new engineer within five days of the approval.

GEN-5 Prior to the start of rough grading, the project owner shall assign at least one of each of the following California registered engineers to the project: a civil engineer; a soils, geotechnical, or civil engineer experienced and knowledgeable in the practice of soils engineering; and an engineering geologist. Prior to the start of construction, the project owner shall assign at least one of each of the following California registered engineers to the project: a design engineer who is either a structural engineer or a civil engineer fully competent and proficient in the design of power plant structures and equipment supports; a mechanical engineer; and an electrical engineer. (California Business and Professions Code section 6704 et seq., and sections 6730, 6731 and 6736 require state registration to practice as a civil engineer or structural engineer in California). All transmission facilities (lines, switchyards, switching stations, and substations) are handled in the conditions of certification in the **TRANSMISSION SYSTEM ENGINEERING** section of this document.

The tasks performed by the civil, mechanical, electrical, or design engineers may be divided between two or more engineers, as long as each engineer is responsible for a particular segment of the project (for example, proposed earthwork, civil structures, power plant structures, equipment support). No segment of the project shall have more than one responsible engineer. The transmission line may be the responsibility of a separate California registered electrical engineer.

The project owner shall submit, to the CBO for review and approval, the names, qualifications, and registration numbers of all responsible engineers assigned to the project.

If any one of the designated responsible engineers is subsequently reassigned or replaced, the project owner shall submit the name, qualifications and registration number of the newly assigned responsible engineer to the CBO for review and approval. The project owner shall notify the CPM of the CBO's approval of the new engineer.

A. The civil engineer shall:

   1. Review the foundation investigations, geotechnical, or soils reports prepared by the soils engineer, the geotechnical engineer, or by a civil engineer experienced and knowledgeable in the practice of soils engineering;

   2. Design (or be responsible for the design of), stamp, and sign all plans, calculations, and specifications for proposed site work, civil works, and related facilities requiring design review and inspection by the CBO. At a minimum, these include: grading, site preparation, excavation, compaction, construction of secondary containment, foundations, erosion and sedimentation control structures, drainage facilities, underground utilities, culverts, site access roads and sanitary sewer systems; and

   3. Provide consultation to the RE during the construction phase of the project and recommend changes in the design of the civil works facilities and changes to the construction procedures.

B. The soils engineer, geotechnical engineer, or civil engineer experienced and knowledgeable in the practice of soils engineering, shall:

   1. Review all the engineering geology reports;

   2. Prepare the foundation investigations, geotechnical, or soils reports containing field exploration reports, laboratory tests, and engineering analysis detailing the nature and extent of the soils that could be susceptible to liquefaction, rapid settlement or collapse when saturated under load;

   3. Be present, as required, during site grading and earthwork to provide consultation and monitor compliance with requirements set forth in the ~~2007~~**2010** CBC (depending on the site conditions, this may be the responsibility of either the soils engineer, the engineering geologist, or both); and

   4. Recommend field changes to the civil engineer and RE.

   This engineer shall be authorized to halt earthwork and to require changes if site conditions are unsafe or do not conform to the predicted conditions used as the basis for design of earthwork or foundations.

C. The engineering geologist shall:

   1. Review all the engineering geology reports and prepare a final soils grading report; and

2. Be present, as required, during site grading and earthwork to provide consultation and monitor compliance with the requirements set forth in the ~~2007~~**2010** CBC (depending on the site conditions, this may be the responsibility of either the soils engineer, the engineering geologist, or both).

D. The design engineer shall:

1. be directly responsible for the design of the proposed structures and equipment supports;

2. Provide consultation to the RE during design and construction of the project;

3. Monitor construction progress to ensure compliance with engineering LORS;

4. Evaluate and recommend necessary changes in design; and

5. Prepare and sign all major building plans, specifications, and calculations.

E. The mechanical engineer shall be responsible for, and sign and stamp a statement with, each mechanical submittal to the CBO, stating that the proposed final design plans, specifications, and calculations conform to all of the mechanical engineering design requirements set forth in the Energy Commission's decision.

F. The electrical engineer shall:

1. be responsible for the electrical design of the project; and

2. Sign and stamp electrical design drawings, plans, specifications, and calculations.

Verification: At least 30 days (or project owner- and CBO-approved alternative time frame) prior to the start of rough grading, the project owner shall submit to the CBO for review and approval, resumes and registration numbers of the responsible civil engineer, soils (geotechnical) engineer and engineering geologist assigned to the project.

At least 30 days (or project owner- and CBO-approved alternative time frame) prior to the start of construction, the project owner shall submit to the CBO for review and approval, resumes and registration numbers of the responsible design engineer, mechanical engineer, and electrical engineer assigned to the project.

The project owner shall notify the CPM of the CBO's approvals of the responsible engineers within five days of the approval.

If the designated responsible engineer is subsequently reassigned or replaced, the project owner has five days in which to submit the resume and registration number of the newly assigned engineer to the CBO for review and approval. The project owner shall notify the CPM of the CBO's approval of the new engineer within five days of the approval.

GEN-6 Prior to the start of an activity requiring special inspection, including prefabricated assemblies, the project owner shall assign to the project, qualified and certified special inspector(s) who shall be responsible for the special inspections required by the ~~2007~~**2010** CBC. All transmission facilities (lines, switchyards, switching stations, and substations) are handled in conditions of certification in the **TRANSMISSION SYSTEM ENGINEERING** section of this document.

A certified weld inspector, certified by the American Welding Society (AWS), and/or American Society of Mechanical Engineers (ASME) as applicable, shall inspect welding performed on-site requiring special inspection (including structural, piping, tanks and pressure vessels).

The special inspector shall:

1. Be a qualified person who shall demonstrate competence, to the satisfaction of the CBO, for inspection of the particular type of construction requiring special or continuous inspection;

2. Inspect the work assigned for conformance with the approved design drawings and specifications;

3. Furnish inspection reports to the CBO and RE. All discrepancies shall be brought to the immediate attention of the RE for correction, then, if uncorrected, to the CBO and the CPM for corrective action; and

4. Submit a final signed report to the RE, CBO, and CPM, stating whether the work requiring special inspection was, to the best of the inspector's knowledge, in conformance with the approved plans, specifications, and other provisions of the applicable edition of the CBC.

Verification: At least 15 days (or project owner- and CBO-approved alternative time frame) prior to the start of an activity requiring special inspection, the project owner shall submit to the CBO for review and approval, with a copy to the CPM, the name(s) and qualifications of the certified weld inspector(s), or other certified special inspector(s) assigned to the project to perform one or more of the duties set forth above. The project owner shall also submit to the CPM a copy of the CBO's approval of the qualifications of all special inspectors in the next monthly compliance report.

If the special inspector is subsequently reassigned or replaced, the project owner has five days in which to submit the name and qualifications of the newly assigned special inspector to the CBO for approval. The project owner shall notify the CPM of the CBO's approval of the newly assigned inspector within five days of the approval.

GEN-7 If any discrepancy in design and/or construction is discovered in any engineering work that has undergone CBO design review and approval, the project owner shall document the discrepancy and recommend required corrective actions. The discrepancy documentation shall be submitted to the CBO for review and approval. The discrepancy documentation shall reference this condition of certification and, if appropriate, applicable sections of the CBC and/or other LORS.

Verification: The project owner shall transmit a copy of the CBO's approval of any corrective action taken to resolve a discrepancy to the CPM in the next monthly compliance report. If any corrective action is disapproved, the project owner shall advise the CPM, within five days, of the reason for disapproval and the revised corrective action to obtain CBO's approval.

GEN-8 The project owner shall obtain the CBO's final approval of all completed work that has undergone CBO design review and approval. The project owner shall request the CBO to inspect the completed structure and review the submitted documents. The project owner shall notify the CPM after obtaining the CBO's final approval. The project owner shall retain one set of approved engineering plans, specifications, and calculations (including all approved changes) at the project site or at another accessible location during the operating life of the project. Electronic copies of the approved plans, specifications, calculations, and marked-up as-builts shall be provided to the CBO for retention by the CPM.

Verification: Within 15 days of the completion of any work, the project owner shall submit to the CBO, with a copy to the CPM, in the next monthly compliance report, (a) a written notice that the completed work is ready for final inspection, and (b) a signed statement that the work conforms to the final approved plans. After storing the final approved engineering plans, specifications, and calculations described above, the project owner shall submit to the CPM a letter stating both that the above documents have been stored and the storage location of those documents.

Within 90 days of the completion of construction, the project owner shall provide to the CBO three sets of electronic copies of the above documents at the project owner's expense. These are to be provided in the form of "read only" (Adobe .pdf 6.0) files, with restricted (password-protected) printing privileges, on archive quality compact discs.

CIVIL-1 The project owner shall submit to the CBO for review and approval the following:

1. Design of the proposed drainage structures and the grading plan;
2. An erosion and sedimentation control plan;
3. Related calculations and specifications, signed and stamped by the responsible civil engineer; and
4. Soils, geotechnical, or foundation investigations reports required by the ~~2007~~**2010** CBC.

Verification: At least 15 days (or project owner- and CBO-approved alternative time frame) prior to the start of site grading the project owner shall submit the documents described above to the CBO for design review and approval. In the next monthly compliance report following the CBO's approval, the project owner shall submit a written statement certifying that the documents have been approved by the CBO.

CIVIL-2 The resident engineer shall, if appropriate, stop all earthwork and construction in the affected areas when the responsible soils engineer, geotechnical engineer, or the civil engineer experienced and knowledgeable in the practice of soils engineering identifies unforeseen adverse soil or geologic conditions. The project owner shall submit modified plans, specifications, and calculations to the CBO based on these new conditions. The project owner shall obtain approval from the CBO before resuming earthwork and construction in the affected area.

Verification: The project owner shall notify the CPM within 24 hours, when earthwork and construction is stopped as a result of unforeseen adverse geologic/soil conditions. Within 24 hours of the CBO's approval to resume earthwork and construction in the affected areas, the project owner shall provide to the CPM a copy of the CBO's approval.

CIVIL-3 The project owner shall perform inspections in accordance with the ~~2007~~ **2010** CBC. All plant site-grading operations, for which a grading permit is required, shall be subject to inspection by the CBO.

If, in the course of inspection, it is discovered that the work is not being performed in accordance with the approved plans, the discrepancies shall be reported immediately to the resident engineer, the CBO, and the CPM. The project owner shall prepare a written report, with copies to the CBO and the CPM, detailing all discrepancies, non-compliance items, and the proposed corrective action.

Verification: Within five days of the discovery of any discrepancies, the resident engineer shall transmit to the CBO and the CPM a non-conformance report (NCR), and the proposed corrective action for review and approval. Within five days of resolution of the NCR, the project owner shall submit the details of the corrective action to the CBO and the CPM. A list of NCRs, for the reporting month, shall also be included in the following monthly compliance report.

CIVIL-4 After completion of finished grading and erosion and sedimentation control and drainage work, the project owner shall obtain the CBO's approval of the final grading plans (including final changes) for the erosion and sedimentation control work. The civil engineer shall state that the work within his/her area of responsibility was done in accordance with the final approved plans.

Verification: Within 30 days (or project owner- and CBO-approved alternative time frame) of the completion of the erosion and sediment control mitigation and drainage work, the project owner shall submit to the CBO, for review and approval, the final grading plans (including final changes) and the responsible civil engineer's signed statement that the installation of the facilities and all erosion control measures were completed in accordance with the final approved combined grading plans, and that the facilities are adequate for their intended purposes, along with a copy of the transmittal letter to the CPM. The project owner shall submit a copy of the CBO's approval to the CPM in the next monthly compliance report.

STRUC-1 Prior to the start of any increment of construction, the project owner shall submit plans, calculations and other supporting documentation to the CBO for design review and acceptance for all project structures and equipment identified in the CBO-approved master drawing and master specifications lists. The design plans and calculations shall include the lateral force procedures and details as well as vertical calculations.

Construction of any structure or component shall not begin until the CBO has approved the lateral force procedures to be employed in designing that structure or component.

The project owner shall:

1. Obtain approval from the CBO of lateral force procedures proposed for project structures;

2. Obtain approval from the CBO for the final design plans, specifications, calculations, soils reports, and applicable quality control procedures. If there are conflicting requirements, the more stringent shall govern (for example, highest loads, or lowest allowable stresses shall govern). All plans, calculations, and specifications for foundations that support structures shall be filed concurrently with the structure plans, calculations, and specifications;

3. Submit to the CBO the required number of copies of the structural plans, specifications, calculations, and other required documents of the designated major structures prior to the start of on-site fabrication and installation of each structure, equipment support, or foundation;

4. Ensure that the final plans, calculations, and specifications clearly reflect the inclusion of approved criteria, assumptions, and methods used to develop the design. The final designs, plans, calculations, and specifications shall be signed and stamped by the responsible design engineer; and

5. Submit to the CBO the responsible design engineer's signed statement that the final design plans conform to applicable LORS.

Verification: At least 60 days (or project owner- and CBO-approved alternative time frame) prior to the start of any increment of construction of any structure or component listed in the CBO-approved master drawing and master specifications list, the project owner shall submit to the CBO the above final design plans, specifications and calculations, with a copy of the transmittal letter to the CPM.

The project owner shall submit to the CPM, in the next monthly compliance report, a copy of a statement from the CBO that the proposed structural plans, specifications, and calculations have been approved and comply with the requirements set forth in applicable engineering LORS.

STRUC-2 The project owner shall submit to the CBO the required number of sets of the following documents related to work that has undergone CBO design review and approval:

1. Concrete cylinder strength test reports (including date of testing, date sample taken, design concrete strength, tested cylinder strength, age of test, type and size of sample, location and quantity of concrete placement from which sample was taken, and mix design designation and parameters);

2. Concrete pour sign-off sheets;

3. Bolt torque inspection reports (including location of test, date, bolt size, and recorded torques);

4. Field weld inspection reports (including type of weld, location of weld, inspection of non-destructive testing (NDT) procedure and results, welder qualifications, certifications, qualified procedure description or number (ref: AWS); and

5. Reports covering other structural activities requiring special inspections shall be in accordance with the ~~2007~~**2010** CBC.

Verification: If a discrepancy is discovered in any of the above data, the project owner shall, within five days, prepare and submit an NCR describing the nature of the discrepancies and the proposed corrective action to the CBO, with a copy of the transmittal letter to the CPM. The NCR shall reference the condition(s) of certification and the applicable CBC chapter and section. Within five days of resolution of the NCR, the project owner shall submit a copy of the corrective action to the CBO and the CPM.

The project owner shall transmit a copy of the CBO's approval or disapproval of the corrective action to the CPM within 15 days. If disapproved, the project owner shall advise the CPM, within five days, the reason for disapproval, and the revised corrective action to obtain CBO's approval.

STRUC-3 The project owner shall submit to the CBO design changes to the final plans required by the U.S Energy Information Administration, "Natural Gas Pipelines in the Western Region, ~~2007~~**2010** CBC, including the revised drawings, specifications, calculations, and a complete description of, and supporting rationale for, the proposed changes, and shall give to the CBO prior notice of the intended filing.

Verification: On a schedule suitable to the CBO, the project owner shall notify the CBO of the intended filing of design changes, and shall submit the required number of sets of revised drawings and the required number of copies of the other above-mentioned documents to the CBO, with a copy of the transmittal letter to the CPM. The project owner shall notify the CPM, via the monthly compliance report, when the CBO has approved the revised plans.

STRUC-4 Tanks and vessels containing quantities of toxic or hazardous materials exceeding amounts specified in the ~~2007~~**2010** CBC shall, at a minimum, be designed to comply with the requirements of that chapter.

Verification: At least 30 days (or project owner- and CBO-approved alternate time frame) prior to the start of installation of the tanks or vessels containing the above specified quantities of toxic or hazardous materials, the project owner shall submit to the CBO for design review and approval final design plans, specifications, and calculations, including a copy of the signed and stamped engineer's certification.

The project owner shall send copies of the CBO approvals of plan checks to the CPM in the following monthly compliance report. The project owner shall also transmit a copy of the CBO's inspection approvals to the CPM in the monthly compliance report following completion of any inspection.

MECH-1 The project owner shall submit, for CBO design review and approval, the proposed final design, specifications and calculations for each plant major piping and plumbing system listed in the CBO-approved master drawing and master specifications list. The submittal shall also include the applicable QA/QC procedures. Upon completion of construction of any such major piping or plumbing system, the project owner shall request the CBO's inspection approval of that construction.

The responsible mechanical engineer shall stamp and sign all plans, drawings, and calculations for the major piping and plumbing systems, subject to CBO design review and approval, and submit a signed statement to the CBO when the proposed piping and plumbing systems have been designed, fabricated, and installed in accordance with all of the applicable laws, ordinances, regulations and industry standards, which may include, but are not limited to:

- American National Standards Institute (ANSI) B31.1 (Power Piping Code);
- ANSI B31.2 (Fuel Gas Piping Code);
- ANSI B31.3 (Chemical Plant and Petroleum Refinery Piping Code);
- ANSI B31.8 (Gas Transmission and Distribution Piping Code);
- NACE R.P. 0169-83;
- NACE R.P. 0187-87;
- NFPA 56;
- Title 24, California Code of Regulations, Part 5 (California Plumbing Code);

- Title 24, California Code of Regulations, Part 6 (California Energy Code, for building energy conservation systems and temperature control and ventilation systems);
- Title 24, California Code of Regulations, Part 2 (California Building Code); and
- San Diego County codes.

The CBO may deputize inspectors to carry out the functions of the code enforcement agency.

Verification: At least 30 days (or project owner- and CBO-approved alternative time frame) prior to the start of any increment of major piping or plumbing construction listed in the CBO-approved master drawing and master specifications list, the project owner shall submit to the CBO for design review and approval the final plans, specifications, and calculations, including a copy of the signed and stamped statement from the responsible mechanical engineer certifying compliance with applicable LORS, and shall send the CPM a copy of the transmittal letter in the next monthly compliance report.

The project owner shall transmit to the CPM, in the monthly compliance report following completion of any inspection, a copy of the transmittal letter conveying the CBO's inspection approvals.

MECH-2 For all pressure vessels installed in the plant, the project owner shall submit to the CBO and California Occupational Safety and Health Administration (Cal-OSHA), prior to operation, the code certification papers and other documents required by applicable LORS. Upon completion of the installation of any pressure vessel, the project owner shall request the appropriate CBO and/or Cal-OSHA inspection of that installation.

The project owner shall:

1. Ensure that all boilers and fired and unfired pressure vessels are designed, fabricated, and installed in accordance with the appropriate section of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, or other applicable code. Vendor certification, with identification of applicable code, shall be submitted for prefabricated vessels and tanks; and

2. Have the responsible design engineer submit a statement to the CBO that the proposed final design plans, specifications, and calculations conform to all of the requirements set forth in the appropriate ASME Boiler and Pressure Vessel Code or other applicable codes.

Verification: At least 30 days (or project owner- and CBO-approved alternative time frame) prior to the start of on-site fabrication or installation of any pressure vessel, the project owner shall submit to the CBO for design review and approval, the above listed documents, including a copy of the signed and stamped engineer's certification, with a copy of the transmittal letter to the CPM.

The project owner shall transmit to the CPM, in the monthly compliance report following completion of any inspection, a copy of the transmittal letter conveying the CBO's and/or Cal-OSHA inspection approvals.

MECH-3 The project owner shall submit to the CBO for design review and approval the design plans, specifications, calculations, and quality control procedures for any heating, ventilating, air conditioning (HVAC) or refrigeration system. Packaged HVAC systems, where used, shall be identified with the appropriate manufacturer's data sheets.

The project owner shall design and install all HVAC and refrigeration systems within buildings and related structures in accordance with the CBC and other applicable codes. Upon completion of any increment of construction, the project owner shall request the CBO's inspection and approval of that construction. The final plans, specifications and calculations shall include approved criteria, assumptions, and methods used to develop the design. In addition, the responsible mechanical engineer shall sign and stamp all plans, drawings and calculations and submit a signed statement to the CBO that the proposed final design plans, specifications and calculations conform with the applicable LORS.

Verification: At least 30 days (or project owner- and CBO-approved alternative time frame) prior to the start of construction of any HVAC or refrigeration system, the project owner shall submit to the CBO the required HVAC and refrigeration calculations, plans, and specifications, including a copy of the signed and stamped statement from the responsible mechanical engineer certifying compliance with the CBC and other applicable codes, with a copy of the transmittal letter to the CPM.

ELEC-1 Prior to the start of any increment of electrical construction for all electrical equipment and systems 480 Volts or higher (see a representative list, below), with the exception of underground duct work and any physical layout drawings and drawings not related to code compliance and life safety, the project owner shall submit, for CBO design review and approval, the proposed final design, specifications, and calculations. Upon approval, the above listed plans, together with design changes and design change notices, shall remain on the site or at another accessible location for the operating life of the project. The project owner shall request that the CBO inspect the installation to ensure compliance with the requirements of applicable LORS. All transmission facilities (lines, switchyards, switching stations, and substations) are handled in conditions of certification in the **TRANSMISSION SYSTEM ENGINEERING** section of this document.

A. Final plant design plans shall include:

1. one-line diagrams for the 13.8 kV, 4.16 kV and 480 V systems; and

2. System grounding drawings.

B. Final plant calculations must establish:

   1. Short-circuit ratings of plant equipment;

   2. Ampacity of feeder cables;

   3. Voltage drop in feeder cables;

   4. System grounding requirements;

   5. Coordination study calculations for fuses, circuit breakers and protective relay settings for the 13.8 kV, 4.16 kV and 480 V systems;

   6. System grounding requirements; and

   7. Lighting energy calculations.

C. The following activities shall be reported to the CPM in the monthly compliance report:

   1. Receipt or delay of major electrical equipment;

   2. Testing or energization of major electrical equipment; and

   3. A signed statement by the registered electrical engineer certifying that the proposed final design plans and specifications conform to requirements set forth in the Energy Commission decision.

<u>Verification:</u> At least 30 days (or project owner- and CBO-approved alternative time frame) prior to the start of each increment of electrical construction, the project owner shall submit to the CBO for design review and approval the above listed documents. The project owner shall include in this submittal a copy of the signed and stamped statement from the responsible electrical engineer attesting compliance with the applicable LORS, and shall send the CPM a copy of the transmittal letter in the next monthly compliance report.

REFERENCES

Solar Millennium 2009a – Solar Millennium (TN 52939). Application for Certification Vol. 1 & 2, dated 8/24/2009

Palen 2012a – Palen Solar Holdings, LLC/Galati Blek, Scott Galati (TN 68910). Palen Solar Holdings LLC's Petition for Amendment, dated December 17, 2012. Submitted to CEC/C. Stora on December 18, 2012.

GEOLOGY AND PALEONTOLOGY

Testimony of Casey Weaver, CEG

SUMMARY OF CONCLUSIONS

The proposed Palen Solar Electric Generating System (PSEGS) is located in a moderately active geologic area of the eastern Mojave Desert geomorphic province in eastern Riverside County in southeastern California. The main geologic hazards at this site include strong ground shaking, hydrocompaction, dynamic compaction, expansive soils, and corrosive soils. These potential hazards can be effectively mitigated through facility design by incorporating recommendations contained in a design-level geotechnical report as required by the California Building Code (CBC 2010) and Condition of Certification GEO-1. Conditions of Certification **GEN-1, GEN-5,** and **CIVIL-1** in the **FACILITY DESIGN** section, should also mitigate these impacts to a less than significant level.

The proposed project area is currently not used for mineral production, nor is it under claim, lease, or permit for the production of locatable, leasable, or salable minerals. Sand and gravel resources are present at the site and could potentially be a source of salable resources; however, such materials are present throughout the regional area such that the PSEGS should not have a significant impact on the availability of such resources. There are no other known viable geologic or mineralogic resources at the PSEGS site.

Based on its independent research and review, Energy Commission staff believes that the potential is low for significant adverse impacts to the proposed project from geologic hazards during its design life and to potential geologic and mineralogic, resources from the construction, operation, and closure of the proposed project.

Locally, paleontological resources have been documented within lacustrine sediments in nearby Ford Dry Lake, and regionally in older Quaternary alluvium. Older alluvium and lacustrine deposits may underlie younger Quaternary alluvium at an undetermined, but potentially shallow, depth beneath the site surface. Potential impacts to paleontologic resources would be mitigated through worker training and monitoring by qualified paleontologists, as required by Conditions of Certification, **PAL-1** through **PAL-8** in areas where soils are exposed by conventional excavation operations. In areas where heliostats are to be supported by pylons that are vibro-inserted into the ground, there may be impacts to paleontological resources – any resource present would be crushed without being identified. Existing studies indicate the soils beneath the solar field are likely to contain Pleistocene age vertebrate fossils. Staff has determined that based on existing information, the use of this technology would result in a significant impact.

In order to adequately mitigate for the potential impacts to paleontological resources in the subsurface soils where heliostat pylons are proposed, a subsurface paleontological characterization must be performed in accordance with Condition of Certification **PAL-9**. The characterization will allow for the refinement of various mitigation options including fossil recovery and data collection, avoidance, and modifications of pylon insertion to be implemented as appropriate to ensure significant impacts are mitigated.

INTRODUCTION

In this section, staff discusses the potential impacts of geologic hazards on the proposed PSEGS site as well as the project's potential impacts to geologic, mineralogic, and paleontologic resources. Staff's objective is to ensure that there will be no consequential adverse impacts to significant geologic and paleontologic resources during the project construction, operation, and closure and that operation of the plant will not expose occupants to high-probability geologic hazards. A brief geologic and paleontologic overview is provided. The section concludes with staff's proposed monitoring and mitigation measures for geologic hazards and geologic, mineralogic, and paleontologic resources, with proposed Conditions of Certification.

METHODOLOGY AND THRESHOLDS FOR DETERMINING ENVIRONMENTAL CONSEQUENCES

The CEQA Guidelines, Appendix G, provide a checklist of questions that lead agencies typically address.

- Section (V) (c) includes guidelines that determine if a project will either directly or indirectly destroy a unique paleontologic resource or site or a unique geologic feature.
- Sections (VI) (a), (b), (c), (d), and (e) focus on whether or not the project would expose persons or structures to geologic hazards.
- Sections (X) (a) and (b) concern the project's effects on mineral resources.

The California Building Standards Code (CBSC) and CBC (2010) provide geotechnical and geologic investigation and design guidelines, which engineers must follow when designing a facility. As a result, the criteria used to assess the significance of a geologic hazard include evaluating each hazard's potential impact on the design and construction of the proposed facility. Geologic hazards include faulting and seismicity, liquefaction, dynamic compaction, hydrocompaction, subsidence, expansive soils, corrosive soils, landslides, tsunamis, and seiches. Of these, dynamic compaction, hydrocompaction, subsidence, corrosive soils, and expansive soils are geotechnical engineering issues, but are not normally associated with concerns for public safety.

Staff has reviewed geologic and mineral resource maps for the surrounding area, as well as site-specific information provided by the applicant of the previously-approved PSPP project ("the PSPP applicant"), to determine if geologic and mineralogic resources exist in the area and to determine if operations could adversely affect geologic and mineralogic resources.

To evaluate whether the proposed project and alternatives would generate a potentially significant impact as defined by CEQA on mineral resources, staff evaluated them against checklist questions posed in the 2006 CEQA Guidelines, Appendix G, *Environmental Checklist established for Mineral Resources*. These questions are:

A. Would the project result in the loss of availability of a known mineral resource that would be of value to the region and residents of the state?

B. Would the project result in the loss of availability of a locally-important mineral resource recovery site delineated on a local general plan, specific plan, or other land use plan?

Staff reviewed existing paleontologic information and requested records searches from the Natural History Museum of Los Angeles County (NHMLA) and the University of California Museum of Paleontology (UCMP) online database for the site area. Site-specific information generated by the PSPP applicant for the previously-approved PSPP project was also reviewed. All research was conducted in accordance with accepted assessment protocol (SVP 1995) to determine whether any known paleontologic resources exist in the general area. If present or likely to be present, conditions of certification which outline required procedures to mitigate impacts to potential resources are proposed as part of the project's approval.

The Antiquities Act of 1906 (16 United States Code [§§431-433]) requires that objects of antiquity be taken into consideration for federal projects and the CEQA, Appendix G, also requires the consideration of paleontologic resources. The Paleontological Resources Preservation Act of 2009 requires the Secretaries of the United States Department of the Interior and Agriculture to manage and protect paleontologic resources on Federal land using scientific principles and expertise. The potential for discovery of significant paleontologic resources or the impact of surface disturbing activities to such resources is assessed using the Potential Fossil Yield Classification (PFYC) system. This system includes three conditions (Condition 1 [areas known to contain vertebrate fossils]; Condition 2 [areas with exposures of geological units or settings that have high potential to contain vertebrate fossils]; and Condition 3 [areas that are very unlikely to produce vertebrate fossils]). The PFYC class ranges from Class 5 (very high) for Condition 1 to Class 1 (very low) for Condition 3 (USDI 2007).

The existing Conditions of Certification allow the Energy Commission's compliance project manager (CPM) and the project owner to adopt a compliance monitoring scheme ensuring compliance with laws, ordinances, regulations, and standards (LORS) applicable to geologic hazards and the protection of geologic, mineralogic, and paleontologic resources.

Based on the information below, it is staff's opinion that where there is the potential for significant adverse impacts to the project from geologic hazards, and to potential geologic, mineralogic, and paleontologic resources from the proposed project will be mitigated to less than significant with the implementation of staff's recommended conditions of certification.

LAWS, ORDINANCES, REGULATIONS, AND STANDARDS (LORS)

Applicable LORS are listed in the application for certification (AFC) (Solar Millennium 2009a). The following briefly describes the current LORS for both geologic hazards and resources and mineralogic and paleontologic resources.

Geology and Paleontology Table 1
Laws, Ordinances, Regulations, and Standards (LORS)

Applicable LORS	Description
Federal	
Antiquities Act of 1906 (16 United States Code [USC], 431-433)	The proposed PSEGS facility site is located entirely on land currently administered by the Bureau of Land Management (BLM). Although there is no specific mention of natural or paleontologic resources in the Act itself, or in the Act's uniform rules and regulations (Title 43 Part 3, Code of Federal Regulations [43 CFR Part 3], 'objects of antiquity' has been interpreted to include fossils by the Federal Highways Act of 1956, the National Park Service (NPS), the BLM, the Forest Service (USFS), and other Federal agencies.
Federal Land Policy and Management Act (FLPMA) of 1976 (43 USC 1701-1784)	Mandates that the BLM manage public lands under the principles of multiple use and sustained yield unless otherwise specified by law, and to protect the quality scientific, scenic, historical, archeological, and other values, and to develop 'regulations and plans for the protection of public land areas of critical environmental concern', which include 'important historic, cultural or scenic values'. Also charged with the protection of 'life and safety from natural hazards'.
Paleontologic Resources Preservation Act (PRPA) of 2009 (Public Law [PL] 111-011)	Authorizes Departments of Interior and Agriculture Secretaries to manage the protection of paleontologic resources on Federal lands.
National Historic Preservation Act of 1966 (NHPA) (16 USC 470)	Establishes policies for the 'preservation of the prehistoric and historic resources of the United States', under the direction of the Secretary of the Interior and the BLM.
State	
California Building Code (CBC), 2007	The CBC (2007) includes a series of standards that are used in project investigation, design, and construction (including grading and erosion control).
Alquist-Priolo Earthquake Fault Zoning Act, Public Resources Code (PRC), section 2621–2630	Mitigates against surface fault rupture of known active faults beneath occupied structures. Requires disclosure to potential buyers of existing real estate and a 50-foot setback for new occupied buildings. Portions of the site and proposed ancillary facilities are located within designated Alquist-Priolo Fault Zones. The proposed site layout places occupied structures outside of the 50-foot setback zone.
The Seismic Hazards Mapping Act, PRC Section 2690–2699	Areas are identified that are subject to the effects of strong ground shaking, such as liquefaction, landslides, tsunamis, and seiches.
PRC, Chapter 1.7, sections 5097.5 and 30244	Regulates removal of paleontologic resources from state lands, defines unauthorized removal of fossil resources as a misdemeanor, and requires mitigation of disturbed sites.
Local	
Riverside County General Plan 2000, Safety Element	Adopts the Uniform Building Code (UBC) (1997), which provides design criteria for buildings and excavations. The UBC is superseded by the CBC (2007). Requires mitigation measures for geologic hazards, including seismic shaking, surface rupture (adopts APEFZ Act), liquefaction, unstable soils and slopes, and flooding.

Applicable LORS	Description
Local	
Riverside County General Plan 2000, Multipurpose Open Space Element	Provides for 'preservation of cultural, historical, archaeological, paleontologic, geologic and educational resources'. Also provides a map showing paleontologic sensitivity in the county.
Standards	
Society for Vertebrate Paleontology (SVP), 2010	The "Measures for Assessment and Mitigation of Adverse Impacts to Non-Renewable Paleontological Resources: Standard Procedures" is a set of procedures and standards for assessing and mitigating impacts to vertebrate paleontological resources. The measures were adopted in October 1995 and revised in 2010 by the SVP, a national organization of professional scientists.
Bureau of Land Management (BLM) Instructional Memorandum 2008-009	Provides up-to-date methodologies for assessing paleontological sensitivity and management guidelines for paleontological resources on lands managed by the Bureau of Land Management.

PROPOSED PROJECT

Each solar plant will be constructed using the following specifications:

Spread Footings

For most of the PSEGS project power block and common areas, shallow footings would be on the order of 1'-6" to 4'-0" thick with approximate top of footing set 2 ft +/- below grade requiring between 3'-6" to 6'-0" of excavation.

Slabs and Mat Foundations – Buildings and small equipment

Slabs and mat foundations placed near grade elevation can range from 0'-6" to 4'-0" thick and may be placed at grade level. Over-excavation of poor surface soils to 2'-0" depth that extends up to 5'-0" beyond the slab or mat may be required in accordance with the preliminary geotechnical report.

Large Foundations

Deeper mat foundations for the solar tower and STG are sized based on the preliminary geotechnical report that was prepared and submitted as part of the PSPP. Foundation design site parameters need to be verified with a specific soils investigation that addresses the power block foundation requirements. Note that an increase in the depth of these foundations requires an increase in the footing width to maintain the same contact pressure. The suggested foundation sizes can also be used as a pile supported mat, should further geotechnical investigation indicate the soil supported settlements are greater than currently anticipated.

Solar Tower

At the Solar Tower, the footing size would be 195 ft octagonal diameter (across flats) with a depth of 6'-0" below finish grade and soil disturbance to 8'-6" below grade.

Steam Turbine Generator (STG)

At the STG foundation, the mat will range from 3'-0" thick at the Lube Oil and Excitation Container area to between 6'-6" to 8'-0" thick under the STG and may extend beyond the edges of the STG unit to pick up the adjacent equipment skids.

Heliostats

Each solar plant will use approximately 85,000 heliostats—elevated mirrors guided by a tracking system mounted on a pylon—to focus the sun's rays on a SRSG atop a tower near the center of each solar field. The support pylons for the heliostats will be installed using vibratory technology to insert the pylons into the ground (pre-augering prior to the installation of the pylon may be required). Depths are not expected to be greater than 12 feet. The heliostat assembly (mirrors, support structure and aiming system) will be mounted on the pylon. The majority of the project site will maintain the original grades and natural drainage features and, therefore, construction will require machines that are maneuverable and can negotiate the terrain.

Onsite Electric Transmission System

The onsite electric transmission system would consist of underground cables to convey power from the power blocks to the switchyard. The cables would be routed under the paved access roads. A cable serving Solar Plant #2 will be routed to Solar Plant #1 and the cables will be routed in parallel to the common switchyard before transitioning to overhead structures and exiting the site. The installation of the transmission system would involve trenching to accommodate the underground electric transmission lines. The trench depth is expected to be up to 10 feet. Manholes located at intervals of approximately 1,000 to 2,000 feet may require excavation up to depths of 12 feet.

Generation Tie-line

A slight re-routing of the generation tie-line near the western end of the route and around the newly constructed Red Bluff Substation is proposed. The purpose of this re-routing is to align the PSEGS generation tie-line route immediately adjacent to the NextEra Desert Sunlight generation tie-line to minimize crossings over Interstate-10 and to ensure easy entry into the Red Bluff Substation nearest the PSEGS breaker position.

SETTING AND EXISTING CONDITIONS

Depending on the published reference, the project site is located in either the southeastern portion of the Mojave Desert geomorphic province (CGS 2002a), or the northeastern quarter of the Colorado Desert geomorphic province (Norris and Webb 1990), in the Mojave Desert of southern California near the Arizona border. Geologically and geographically the area is more characteristic of the Mojave Desert geomorphic province. The Mojave Desert is a broad interior region of isolated mountain ranges which separate vast expanses of desert plains and interior drainage basins. The physiographic province is wedge-shaped and separated from the Sierra Nevada and Basin and Range geomorphic provinces by the northeast-striking Garlock Fault on the northwest side. The northwest-striking San Andreas Fault defines the southwestern boundary, beyond which lie the Transverse Ranges. The Colorado Desert geomorphic province lies to the south and east of the project area. The topography and structural fabric in the Mojave Desert is predominately southeast to northwest, and is associated with mid-Miocene to recent faulting oriented similar to the San Andreas Fault. A secondary east to west orientation correlates with structural trends in the Transverse Ranges geomorphic province.

The site is situated on a broad alluvial plain within the northwest-trending Chuckwalla Valley between the Chuckwalla Mountains to the southwest, and the Palen Mountains to the northeast. Overall the proposed site slopes at very shallow grades north and northeast toward the local topographic low at Palen Dry Lake.

Quaternary age alluvial, lacustrine and eolian sedimentary deposits are mapped in the vicinity of the proposed PSEGS site (CDMG 1967; USGS 1989; USGS 1990). The local stratigraphy as interpreted by different authors is presented in **Geology and Paleontology Table 2**.

Geology and Paleontology Table 2
Correlation and Ages of Stratigraphic Units

Age	Unit/Description	Jennings (CDMG 1967)	Stone & Pelka (USGS 1989)	Stone (USGS 1990)
Holocene	Eolian sands	Qs	Qs	Qs
	Younger alluvium	Qal	Qya	Qta
	Playa lake deposits	Ql	Qp	Qp
Pleistocene	Older alluvium	Qc	Qia	Qta
			Qoa	

Holocene units, which include eolian sands, younger alluvium, and playa lake deposits, are mapped over nearly the entire site surface. Eolian sands consist of unconsolidated deposits of well sorted, windblown sand in dunes and sheets. Younger alluvium is composed of sand, pebbly sand and sandy pebble-gravel, and is generally coarser grained closer to mountain ranges. Desert varnish is not well developed in the mostly unconsolidated and undissected sediments. Playa lake deposits are also unconsolidated, and are comprised of clay, silt and sand. Older alluvium is present at the surface along the southwestern edge of the site. The exposures of older alluvium occur as northeast-oriented ridges of material protruding into the site from the southwest, with the intervening areas occupied by drainages filled with younger alluvium. Older alluvium is composed of consolidated gravel and sand that is moderately dissected with moderately developed desert pavement and varnish.

Exploration drilling conducted in 1978 by the U.S. Geological Survey (USGS) resulted in two boreholes in the Palen Dry Lake area, one of which lies within the boundaries of the site. U.S. Geological Survey Borehole PDL#1 was advanced to a depth of 505 feet below ground surface (bgs) near the north-central boundary of Section 27 near the northeast corner of the proposed project. The lithologic log of PDL#1 indicates the subsurface near the northern site boundary is composed of moderately to thickly bedded sands, gravels, and clays to a depth of approximately 55 feet where a transition to overall clay dominated formation takes place and continues to the total depth of the borehole. The interbedded clays, sands, and gravels probably represent periods of primarily lakebed deposition interspersed with episodes of coarse sediment transport from the nearby Chuckwalla and Palen Mountains. A gravel dominated bed present from approximately 90 to 110 feet also attests to a period of clastic deposition during a period of primarily lakebed sedimentation (Simoni Jr. 1981). Water wells 05S17E33N001S and 06S/17E-03M01S, which were drilled in 1958 in what is now the southeast portion of the proposed PSEGS site reportedly had a similar stratigraphic column with coarse alluvium from the surface to between 48 and 102 feet overlying strata which are clay dominated to the bottom of the well borings at depths between 758 feet and 818 feet bgs (PSEGS 2009).

A preliminary geotechnical investigation including 13 exploratory borings and eight test pits has been completed for the general area of the PSEGS site (Kleinfelder 2009). The preliminary geotechnical investigation reveals that the PSEGS site is underlain by alluvial and eolian deposits of Pleistocene through Holocene age, which consist of dune sands, alluvium and lake deposits to the depths explored (approximately 76.5 feet below the existing ground surface). The PSEGS site is generally surfaced with unconsolidated soils due to desiccation and/or wind deposition to a maximum depth of 2 feet below the existing grade. The soils below the surficial materials are generally medium dense to very dense poorly graded sand with varying amounts of silt, silty sand and clayey sand. Firm to very hard sandy clays are locally present as interbedded layers 5 to 10 feet thick at depths generally greater than 25 feet below existing grade. The near surface site soils are primarily granular with no to low swell potential; however, potentially expansive soils were observed at the ground surface in the northeastern portion of the site (Kleinfelder 2009). Loose dune sand was also observed at the ground surface and at depth in the southwestern portion of the site (Kleinfelder 2009). Collapse potential tests indicate the site soils exhibit a collapse potential in the range of 0 to 3.0 percent when inundated with water.

The site is not crossed by any known active faults or designated Alquist-Priolo Earthquake Fault Zone (EFZ, formerly called Special Studies Zones) (CGS 2002b). A number of major, active faults lie within 62 miles of the site. These faults are discussed in detail under the **GEOLOGIC HAZARDS** section later in this section. Several northwest-striking, south-dipping basement thrust faults are mapped at the extreme southern end of the Palen Mountains, and are inferred beneath Quaternary and Tertiary sediments in Chuckwalla Valley (Harding and Coney 1985; CDMG 1967; USGS 1990; USGS 2006). These faults are part of a major Mesozoic terrain-bounding structural zone that was active during late Jurassic time, and are associated with folding and metamorphism in the Palen and McCoy Mountains. The basement faults are no longer active, and are not exposed anywhere on the surface of the proposed site.

Little is known regarding the depth to bedrock beneath the proposed PSEGS site. Gravity investigations indicate the Chuckwalla Valley overlies three alluvium filled sub-basins separated by east to northeast-trending subsurface basement ridges. Gravity data indicate basin fill in Chuckwalla Valley ranges from approximately 650 feet deep across faulted subsurface basement ridges to greater than 6,000 feet deep near the sub-basin centers. Analysis of gravity anomalies indicates the crystalline basement beneath the sediment filled basins is highly faulted and structurally complex (Rotstein et al. 1976). Review of gravity anomaly data suggests the proposed PSEGS site is underlain at an undetermined depth by faulted tertiary non-marine and marine sedimentary, pyroclastic, and volcanic rocks.

The ground water level beneath the site was measured as part of the PSPP applicant's water resources investigation. Depth to water beneath the site in well 06S/17E-03M01S was reportedly 180 feet bgs on May 22, 2009 (PSEGS 2009). Subsurface exploration performed at the site (Kleinfelder 2009) encountered ground water at depths of 68 and 73 feet below existing grade; however, this occurrence of ground water is believed to be associated with perched conditions and not indicative of the true water table.

ASSESSMENT OF IMPACTS AND DISCUSSION OF MITIGATION

This section considers two types of impacts. The first is geologic hazards, which could impact the proper functioning of the proposed facility and create life/safety concerns. The second is the potential impacts the proposed facility could have on existing geologic, mineralogic, and paleontologic resources in the area.

DIRECT/INDIRECT IMPACTS AND MITIGATION

Ground shaking, hydrocompaction, dynamic compaction, expansive soils, and corrosive soils represent the main geologic hazards at the proposed site. These potential hazards could be effectively mitigated through facility design by incorporating recommendations contained in the project geotechnical evaluation as required by **GEO-1**. Conditions of Certification **GEN-1, GEN-5,** and **CIVIL-1** in the **FACILITY DESIGN** section should also mitigate these impacts to a less than significant level.

The site is currently not used for mineral production, nor is it under claim, lease, or permit for the production of locatable, leasable, or salable minerals. Sand and gravel resources are present at the site; however, such materials are present throughout the regional area such that the PSEGS should not have a significant impact on the availability of such resources. In addition, the potential resource would become available again following facility closure. Only limited exploration for oil and gas resources has been performed in the area, and no active oil or gas operations are located in the immediate vicinity of the project. As a result, the PSEGS would not impact any current or reasonably foreseeable development of geologic or mineral resources.

Staff has reviewed the paleontologic resources assessment in Section 5.9 and Appendix H of the AFC (Solar Millennium 2009a; SWCA 2009). Staff has also reviewed correspondence from NHMLA (McLeod 2009); UCMP; and the Riverside County Land Information System (RCLIA 2009) for information regarding known fossil localities and stratigraphic unit sensitivity within the proposed project area. All research was conducted in accordance with accepted assessment protocol (SVP 1995) to determine whether any known paleontologic resources exist in the general area. If present or likely to be present, Conditions of Certification which outline required procedures to mitigate impacts to potential resources are included as part of the projects approval.

Based on the above research, SVP criteria, the paleontologic report appended to the AFC (Solar Millennium 2009a) and the confidential paleontologic information filing (Solar Millennium 2009b), staff considers that there is a high probability that paleontologic resources will be encountered during grading and excavation in the older Quaternary age alluvial and lacustrine sediments. Further, deeper excavations in the younger alluvium that will encounter the underlying older Quaternary age alluvial soils will also have a high probability to encounter paleontologic resources. Conditions of Certification **PAL-1** to **PAL-8** are designed to mitigate potential impacts to paleontologic resources to less than significant levels in areas where conventional excavation operations occur. These Conditions of Certification essentially require a worker education program in conjunction with the monitoring of earthwork activities by a qualified professional paleontologist (paleontologic resource specialist [PRS]).

As stated above, existing information indicates that site soils have a high probability of containing fossils. The approved project proposed substantial site grading and excavation. Using conventional excavation methods, fossils encountered during construction would have been uncovered, discovered, collected and recorded, thereby contributing to the scientific understanding of the paleoclimate and paleobiology of the area. The proposed project would use a different construction methodology. Rather than parallel rows of mirrors suspended on level linear lattice structures, the proposed project would install 170,000 individual pole structures (pylons) to support heliostat mirrors (85,000 heliostats per solar unit). The pylons would be installed by vibro-insertion methods. Each pylon would be attached to a specialized piece of equipment that would drive each pylon through the soil column to a final depth of approximately 12 feet below ground surface. This method of construction does not utilize excavation and there is no retrieval of subsurface soils or any fossils contained within those soils. In effect, any fossils that are in the path of pylon insertion would be permanently destroyed with no recovery, discovery or scientific benefit realized.

Staff has determined that based on existing information, the use of this technology would result in a significant impact.

In order to adequately mitigate for the potential impacts to paleontological resources in the subsurface soils where heliostat pylons are proposed, a subsurface paleontological characterization must be performed in accordance with Condition of Certification **PAL-9**. The characterization will allow for the refinement of various mitigation options including fossil recovery and data collection, avoidance, and modifications of post insertion to be implemented as appropriate to ensure significant impacts are mitigated.

The existing Conditions of Certification allow the Energy Commission's CPM and the project owner to adopt a compliance monitoring scheme ensuring compliance with LORS applicable to geologic hazards and the protection of geologic and mineralogic resources.

Geologic Hazards

Review of the AFC (Solar Millennium 2009a) and the site-specific subsurface information (Kleinfelder 2009), coupled with staff's independent research, indicate that the possibility of geologic hazards significantly affecting the operation of the plant site during its practical design life is low. However, geologic hazards must be addressed in a design-level project geotechnical report per CBC (2010) requirements and Condition of Certification GEO-1.

Staff's independent research included the review of available geologic maps, reports, and related data of the site. Geologic information was available from the California Geological Survey (CGS), California Division of Mines and Geology (CDMG, now known as CGS), the USGS, the American Geophysical Union, the Geologic Society of America, the Southern California Earthquake Data Center (SCEDC), and other organizations.

Faulting and Seismicity

Energy Commission staff reviewed numerous CGS, CDMG and USGS publications as well as informational websites in order to gather data on the location, timing and type of faulting in the proposed project area. Type A and B faults within 63 miles (100 kilometers) of the site are listed in **Geology and Paleontology Table 3**. Type A faults have slip-rates of $\geq$5 mm per year and are capable of producing an earthquake of magnitude 7.0 or greater. Type B faults have slip-rates of 2 to 5 mm per year and are capable of producing an earthquake of magnitude 6.5 to 7.0. The fault type, potential magnitude, and distance from the site are summarized in **Geology and Paleontology Table 3**. Because of the large size of the proposed site, the distances to faults are measured from a point between the two proposed power blocks within the site.

Geology and Paleontology Table 3
Active Faults Relative to the Proposed Palen Solar Electric Generating System Site

Fault Name	Distance from Site (miles)	Maximum Earthquake Magnitude (Mw)	Fault Type and Strike	Fault Class
Brawley Seismic Zone	37.0	6.4	Right-Lateral Strike Slip (Northwest)	A
San Andreas: Coachella M-1c-5	37.0	7.2	Right-Lateral Strike Slip (Northwest)	A
San Andreas SB-Coachella M-1b-2	37.0	7.7	Right-Lateral Strike Slip (Northwest)	A
San Andreas: Whole	37.0	8.0	Right-Lateral Strike Slip (Northwest)	A
Elmore Ranch	40.6	6.6	Left-Lateral Strike Slip (Northeast)	B
Pinto Mountain	50.8	7.2	Left-Lateral Strike Slip (East-West)	B
Pisgah-Bullion Mountain–Mesquite Lake	54.9	7.3	Right-Lateral Strike Slip (Northwest)	B
Imperial	57.4	7.0	Right-Lateral Strike Slip (Northwest)	A
Superstition Hills	59.0	6.6	Right-Lateral Strike Slip (Northwest)	A
San Jacinto–Anza	60.0	7.2	Right-Lateral Strike Slip (Northwest)	A
Superstition Mtn.	62.1	6.6	Right-Lateral Strike Slip (Northwest)	A

Type C and otherwise undifferentiated faults which are more than 20 miles from the site are not discussed here because they are unlikely to undergo movement or generate seismicity which could affect the project.

Eleven Type A and B faults and fault segments were identified within 63 miles of the site (**Geology and Paleontology Table 3).** Of these, none are within 35 miles of the site. Eight of the faults are Type A right-lateral, northwest-trending strike-slip fault systems that are part of or subparallel to the San Andreas Fault System. Two of the remaining three faults are Type B, are east-west to northeast-striking, and are left-lateral strike-slip faults with characteristics similar to the Garlock Fault, which bounds the northwestern side of the Mojave Desert geomorphic province (CGS 2002a). All fault zones in

Geology and Paleontology Table 3 are subject to the Alquist-Priolo Earthquake Fault Zoning Act of 1972 (CDMG 2003).

The site is located just southwest of the Mojave-Sonoran Belt, a roughly 60-mile-wide structural belt that has been correlated with the southern extension of the Walker Lane Fault Zone (USGS 1991). The western boundary for the structural zone, located 5 to10 miles northeast of the proposed site, is marked by an abrupt termination of north- and northeast-trending mountain ranges and basins to the east that are characteristic of the San Andreas Fault Zone, and northwest-trending strike-slip faulting to the west. The Mojave-Sonoran Belt is notable for its relative lack of seismicity and recent faulting (USGS 1991). The region has experienced a low frequency of Pliocene faulting, and Pleistocene faults are nearly absent. These characteristics are unusual given its proximity to areas of intense faulting and frequent seismicity, such as the Eastern California Shear Zone (Dokka and Travis 1990) to the northwest and the Salton Trough to the southwest.

The close proximity of the site to the Mojave-Sonoran belt and relatively great distance from more seismically active areas to the west and northwest would suggest a relatively low to moderate probability of intense ground shaking in the project area. However, events such as the Landers earthquake (M7.6), which occurred on June 28, 1992 approximately 78 miles from the site (Blake 2000b), demonstrate that the site could be subject to moderate levels of earthquake-related ground shaking in the future.

Preliminary estimates of ground motion based on probabilistic seismic hazard analyses have also been calculated for the project site using the USGS Earthquake Hazards application called the U.S. Seismic "DesignMaps" Web Application (Geology and Paleontology Table 4). This application produces seismic hazard curves, uniform hazard response spectra, and seismic design values. The values provided by this application are based upon data from the 2008 USGS National Seismic Hazard Mapping Project. These design parameters are for use with the 2012 International Building Code, the 2010 ASCE-7 Standard, the 2009 NEHRP Provisions, and their respective predecessors.

These parameters are project-specific and, based on PSEG's location, were calculated using latitude and longitude inputs of 33.691degrees north and 115.198 degrees west, respectively. Other inputs for this application are the site "type" which is based on the underlying geologic materials and the "Structure Risk Category". The assumed site class for PSEG is "D", which is applicable to stiff soil. These parameters can be updated as appropriate following the results presented in a project-specific geotechnical investigation report performed for the site. The assumed "Structure Risk Category" is "III", which is based on its inherent risk to people and the need for the structure to function following a damaging event. Risk categories range from I (non essential) to IV (critical). Examples of risk category I include agriculture facilities, minor storage facilities, etc., while examples of category IV include fire stations, hospitals, nuclear power facilities, etc.

Geology and Paleontology Table 4
Planning Level 2010 CBC Seismic Design Parameters Maximum Considered Earthquake, ASCE 7 Standard

Parameter	Value
Assumed Site Class	D
Structure Risk Category	III - Substantial
SS – Mapped Spectral Acceleration, Short (0.2 Second) Period	0.657 g
S1 – Mapped Spectral Acceleration, Long (1.0 Second) Period	0.289 g
Fa – Site Coefficient, Short (0.2 Second) Period	1.275
Fv – Site Coefficient, Long (1.0 Second) Period	1.823
SDS – Design Spectral Response Acceleration, Short (0.2 Second) Period	0.558 g
SD1 – Design Spectral Response Acceleration, Long (1.0 Second) Period	0.351 g
SMS – Spectral Response Acceleration, Short (0.2 Second) Period	0.837 g
SM1 – Spectral Response Acceleration, Long (1.0 Second) Period	0.526 g

ASCE = American Society of Civil Engineers
Values from USGS 2010b

The ground acceleration values presented are typical for the area. Other developments in the adjacent area will also be designed to accommodate strong seismic shaking. The potential for and mitigation of the effects of strong seismic shaking during an earthquake should be addressed in a project-specific geotechnical report, per CBC 2010 requirements, and Condition of Certification **GEO-1** and Facility Design Conditions of Certification **GEN-1**, **GEN-5** and **CIVIL-1**. Compliance with these conditions of certification would ensure the project is built to current seismic standards and potential impacts would be mitigated to insignificant levels in accordance with current standards of engineering practice.

Liquefaction

Liquefaction is a condition in which a saturated cohesionless soil may lose shear strength because of sudden increase in pore water pressure caused by an earthquake. However, the potential for liquefaction of strata deeper than approximately 40 feet below surface is considered negligible due to the increased confining pressure and because geologic strata at this depth are generally too compact to liquefy.

The site is located within an area with low to moderate level of liquefaction potential as delineated by RCLIA (2009). However, the estimated depth to ground water based on measured values in boreholes and wells near the proposed site is greater than 60 feet below existing grade (Kleinfelder 2009; Solar Millennium 2009a). In addition, the typical medium dense to very dense nature of the coarse grain soils encountered in the PSEGS borings (Kleinfelder 2009) indicates that there is no liquefaction potential at the site (Kleinfelder 2009).

Lateral Spreading

Lateral spreading of the ground surface can occur within liquefiable beds during seismic events. Lateral spreading generally requires an abrupt change in slope; that is, a nearby steep hillside or deeply eroded stream bank. Other factors such as distance from the epicenter, magnitude of the seismic event, and thickness and depth of liquefiable layers also affect the amount of lateral spreading. Because the site is not subject to catastrophic liquefaction-induced settlement, the potential for lateral spreading during seismic events would be negligible due to the low relief and very shallow slopes at the site surface.

Dynamic Compaction

Dynamic compaction of soils results when relatively unconsolidated granular materials experience vibration associated with seismic events. The vibration causes a decrease in soil volume, as the soil grains tend to rearrange into a more dense state (an increase in soil density). The decrease in volume can result in settlement of overlying structural improvements. The site is generally underlain by medium-dense to very-dense granular soils. However, loose sand layers are occasionally present at the surface and as buried layers at the site (Kleinfelder 2009). The potential for and mitigation of the effects of dynamic compaction of site soils during an earthquake should be addressed in a project-specific geotechnical report as required by the CBC (2010) and Condition of Certification **GEO-1**. Common mitigation methods include deep foundations (driven piles; drilled shafts) for severe conditions, geogrid-reinforced fill pads for moderate severity and over-excavation and replacement for areas of minimal hazard.

Hydrocompaction

Hydrocompaction (also known as hydro-collapse) is generally limited to young soils that were deposited rapidly in a saturated state, most commonly by a flash flood. The soils dry quickly, leaving an unconsolidated, low density deposit with a high percentage of voids. Foundations built on these types of compressible materials can settle excessively, particularly when landscaping irrigation dissolves the weak cementation that is preventing the immediate collapse of the soil structure. The depositional environment of the Chuck-walla Valley suggests that the soils may be subjected to hydrocompaction. The project geotechnical report indicates that there is a low to moderate hydrocompaction potential based on the geotechnical data and the observation of soil profile in the test pits (Kleinfelder 2009). The potential for and mitigation of the effects of hydrocompaction of site soils should be addressed in a project-specific geotechnical report as required by the CBC (2007) and Condition of Certification **GEO-1**. Typical mitigation measures would include over-excavation/replacement, mat foundations or deep foundations depending on severity and foundation loads.

Subsidence

The Riverside County General Plan indicates the basin fill sediments in Chuckwalla Valley are susceptible to subsidence (RCLIA 2008). Regional ground subsidence is typically caused by petroleum or ground water withdrawal that increases the effective unit weight of the soil profile, which in turn increases the effective stress on the deeper soils. This results in consolidation or settlement of the underlying soils. However, even during the 1980’s and 1990’s when regional ground water extraction was at its historic maximum of approximately 48,000 acre-feet per year (ac-ft/yr) no localized or regional subsidence was recorded. Current ground water withdrawals are approximately 2,000 ac-ft/yr and even the proposed project demand of an additional 201 ac-ft/yr will not approach historic pumping demands. Additional information with respect to historical and anticipated ground water pumping is contained in the **SOIL AND WATER RESOURCES** section. In addition, no petroleum or natural gas withdrawals are taking place in the proposed site vicinity. Therefore, the potential for local or regional ground subsidence resulting from petroleum, natural gas, or ground water extraction is considered to be very low.

Local subsidence or settlement may also occur when areas containing compressible soils are subjected to foundation or fill loads. The typical medium dense to very dense granular site soils are indicative of low to negligible local subsidence. Clay layers present at depth are typically deeper than the anticipated zone of influence of shallow foundations and would therefore not be subjected to consolidation settlement from surcharge loading from conventional shallow foundations.

Expansive Soils

Soil expansion occurs when clay-rich soils with an affinity for water exist in place at a moisture content below their plastic limit. The addition of moisture from irrigation, precipitation, capillary tension, water line breaks, etc. causes the clay soils to absorb water molecules into their structure, which in turn causes an increase in the overall volume of the soil. This increase in volume can correspond to excessive movement (heave) of overlying structural improvements. The preliminary geotechnical report for the project did encounter potentially expansive clay soils at the ground surface in the northeastern portion of the site (Kleinfelder 2009). However, interbedded layers of clay soils are present in the subsurface soil profile in this area. As a result, there is the potential for expansive soils to be present at the locations of proposed structural improvements. The potential for and mitigation of the effects of expansive site soils should be addressed in a project-specific geotechnical report as required by the CBC (2010) and Condition of Certification **GEO-1**. Typical mitigation measures would include over-excavation/replacement or deep foundations depending on severity and foundation loads.

Corrosive Soils

Fine grain soils with high in-situ moisture contents that contain sulfides can be corrosive to buried metal pipe, which can lead to premature pipe failure and leaking. Such soils are present at this site, and the preliminary geotechnical investigation (Kleinfelder 2009) indicates that site soils could be potentially corrosive to metal pipe. The effects of corrosive soils can be effectively mitigated through final design by incorporating the recommendations of the site-specific project geotechnical report required by the CBC and Condition of Certification **GEO-1**. Mitigation of corrosive soils with respect to metal pipe typically involves cathodic protection or polyethylene encasement of the pipe.

Landslides

Due to the low site gradient and the absence of topographically high ground in the immediate site vicinity, the potential for landslide impacts to the site is considered to be negligible.

Flooding

The PSEGS area has not been mapped by the Federal Emergency Management Agency (FEMA) for flood potential (FEMA 2009). Because the site is topographically higher than Palen Dry Lake to the north, it is staff's opinion that the potential for flooding at the site is limited to infrequent high volume (flash flood) events which may occur due to heavy rainfall in the Chuckwalla Mountains southwest of the site. Storm waters would be carried across the proposed site from roughly southwest to northeast via existing drainages. Site drainage would be modified during project construction and other engineering improvements will also be made to mitigate potential impacts due to catastrophic flooding (Solar Millennium 2009). Additional information is contained in the **SOIL AND WATER RESOURCES** section.

Tsunamis and Seiches

The proposed PSEGS site is not located near any significant surface water bodies, and therefore the potential for impacts due to tsunamis and seiches is considered to be negligible.

Volcanic Hazards

The site is located approximately 40 miles west of the Lavic Lake volcanic hazard area (VHA), an approximately 14-square-mile area within the Mojave Desert comprised of Miocene to Holocene age dacitic to basaltic flows, pyroclastic rocks, and volcaniclastic sediments (Glazner 2000). The Lavic Lake VHA has been designated by the USGS as an area subject to lava flows and tephra deposits associated with basalt or basaltic andesite vents (Miller 1989). The Amboy Crater – Lavic Lake VHS is also considered to be subject to future formation of cinder cones, volcanic ash falls, and phreatic explosions. The recurrence interval for eruptions has not been determined, but is likely to be in the range of one thousand years or more. Because the site is not located within a designated volcanic hazard area, staff considers the likelihood of significant impacts to the project resulting from volcanic activity would be low.

Geologic, Mineralogic, and Paleontologic Resources

Geologic and Mineralogic Resources

Staff has reviewed applicable geologic maps and reports for this area (Blake 2000a and b; CDMG 1990; CDMG 1994a and b; CDMG 1998; CDMG 1999; CDMG 2003; CGS 2002a, b and c; CGS 2007; Jennings and Saucedo 2002; Kleinfelder 2009; SCEDC 2008; USGS 2003; USGS 2008a and b). The site is currently not used for mineral production, nor is it under claim, lease, or permit for the production of locatable, leasable, or salable minerals. Sand and gravel resources are present at the site and could potentially be a source of salable resources; however, such materials are present throughout the regional area such that the PSEGS should not have a significant impact on the availability of such resources.

The proposed PSEGS site is mapped as Mineral Resource Zone (MRZ)-4 (CDMG 1994a). Mineral Resource Zone-4 refers to "areas of no known mineral occurrences where geologic information does not rule out either the presence or absence of industrial mineral resources".

No economically viable mineral deposits are known to be present at the site (CDMG 1994a; Kohler 2006), and no mines are known to have existed within the proposed project boundaries (USGS 2008b). Many inactive mines and mineral prospects are hosted by metamorphic and intrusive basement rocks within 10 miles of the proposed project boundary, primarily in the Palen and Chuckwalla Mountains. These have produced a number of precious and base metals, including iron (magnetite) and pyrophyllite (CDMG 1994a). Minor gold, silver, copper and uranium prospects are located in the Palen Mountains northeast of the site. The Black Jack Mine in the northern McCoy Mountains about 16 miles northeast of the site is known for the most productive and most extensively worked manganese mine in the southern California. This manganese mine was active during war times and in the 1950s to produce several thousand tons of manganese. This area is within the approximately 1.4-square-mile surface area Ironwood Manganese District. Other mining areas, including the Blue Bird Mine area, St. John Mine area, and George Mine area are also located in the northern McCoy Mountains and have produced manganese, copper, and a small amount of silver and gold in the past (CDMG 1994a). Uranium has been claimed in the southern McCoy Mountains about 22 miles east of the site with reported past production by Caproci-Woock Groups (CDMG 1968). There are several other prospective or claim areas for minerals in the McCoy Mountains including manganese, copper, silver, gold, and uranium (USGS 2009). The Roosevelt and Rainbow group of mines in the Mule Mountain district, also known as the Hodges Mountain district that is located about 26 miles southeast of the site, have produced some gold and copper from the quartz veins in granitic rocks (CDMG 1998).

The nearest oil and gas fields are located more than 150 miles west of site in the Los Angeles Sedimentary basin (CDC 2001). The nearest geothermal field is located at Brawley just south of the Salton Sea in the Imperial Valley basin about 40 miles southwest of site (CDC 2000; CDC 2001).

Several gravel borrow pits are present along Interstate 10 (I-10) south of the site, and the presence of alluvial fan materials at the proposed project location means that the property could potentially be accessed and developed as a source of salable sand and gravel resources. During construction, the project owner may need or desire to move sand and gravel either off-site, or between the different units of the facility. Should this occur, the project owner would be required to comply with BLM regulations in 43 CFR Part 3600, which regulates the production and use of sand and gravel from public lands. Use of sand and gravel or other mineral materials within the boundaries of an authorized ROW is permitted; however, removal of these materials from an authorized ROW would require payment to the United States of the fair market value of those materials.

Paleontologic Resources

Staff has reviewed the paleontologic resources assessment in Section 5.9 of the AFC (Solar Millennium 2009a). Staff has also reviewed the paleontologic literature and records search conducted by NHMLA (McCleod, 2009); UCMP; and RCLIA (2009) for information regarding known fossil localities and stratigraphic unit sensitivity within the proposed project area. Site-specific information generated by the applicant for the PSPP was also reviewed (SWCA 2009).

Review of previous paleontological research conducted in the PSPP vicinity showed that the region is poorly understood. Very few comprehensive studies have taken place, and few finds have been reported to local museums. The information reviewed indicates there are no recorded fossil collection sites within the proposed project boundaries or within a one-mile radius. Three vertebrate fossil collection areas have been documented in the proposed project area within the same or similar sedimentary units which underlie the site. One location east-southeast of the site between I-10 and Ford Dry Lake contained fossil remains of a pocket mouse. Another site northwest of the proposed project site in the northern Chuckwalla Valley yielded fossil remains of tortoise, horse, camel, and llama.

More recently, there has been an influx of paleontological information associated with the large energy projects proposed and under construction in the Chuckwalla Valley and the Palo Verde Mesa. Originally, the low number of finds in the project vicinity was interpreted as an indication of low sensitivity. However, paleontological field survey and construction monitoring associated with these large projects in the last decade have consistently identified significant paleontological resources in both surface and buried contexts. For example, during construction of the Genesis Solar Energy Project, paleontological monitors have found multiple vertebrate fossils, primarily tortoise carapace and bones (BLM 2012).

Initial studies conducted for the nearby Desert Sunlight Project originally deemed the site to be of low probability for encountering vertebrate fossils (low sensitivity). However since the recent breaking of ground, several specimens (identifiable fragments or individual bones) and numerous unidentifiable fragments have been found. The identifiable species include Smilodon (carpels, metacarpels, and distal end of ulna), a phalange of an undetermined cervidae sp., a camilid, tortoise, and several partials of small mammals and rodentia. The results of these recent studies suggest that the Chuckwalla Valley is more paleontologically sensitive than originally believed (BLM 2012).

Multiple studies have identified paleosols (old soil horizons) within the Quaternary alluvium of the region. These horizons formed slowly through mechanical and chemical erosion during wetter periods in the Late Pleistocene of the Colorado Desert. These conditions are very favorable for the preservation of fossils, especially short-lived species such as rodents. These paleosols have been identified below desert pavement in the southern Chuckwalla Valley, south of Interstate 10 near State Route 177 (BLM 2012), and at the Rio Mesa Solar Energy Generating Facility (Rio Mesa). In the paleontological assessment of the proposed Rio Mesa project it was found that at least two paleosols occur between six and seven feet below the modern ground surface of the Palo Verde Mesa (Stewart 2012).

Near-surface geology beneath the PSEGS site consists primarily of Quaternary alluvium, eolian and lacustrine sediments which increases in age with depth from Holocene at the surface to Pleistocene and older at depth (CDMG 1967; USGS 1989; USGS 1990; USGS 2006). Coarse-grained sediments grade laterally and are interbedded with lakebed deposits of similar ages. Pleistocene age older alluvium, which is exposed along the southwestern boundary of the site, underlies younger alluvium and lacustrine sediments. Older alluvium would likely be buried at progressively deeper depths beneath Holocene sediments to the northeast across the site.

The results of a site-specific comprehensive surficial field survey recorded one non-significant fossil occurrence that yielded a non-diagnostic vertebrate material within the project limits (Solar Millennium 2009b). The specimen was discovered on the ground surface and was considered to have been *ex-situ* (i.e. removed from its original place of fossilization) and transported an unknown distance and re-deposited on top of alluvial sediments (Solar Millennium 2009a). As a result of this interpretation, the fossil resource discovered on the surface within the limits of the project was not considered significant. However, recent paleontological research in the site region suggests that “specimens that might be regarded as *ex-situ* have not moved laterally and only moved a slight amount vertically.” (Stewart 2012). This alternative interpretation would indicate the likely presence of fossils beneath the location where the specimen was recovered.

The Riverside County Transportation and Land Management Agency (TLMA) has produced a paleontological sensitivity map of the county (RCLIS 2009). The mapping indicates that areas underlain by Playa Lake, eolian and younger alluvial deposits within and around the Palen Dry Lake basin have a high paleontological sensitivity rating. Younger alluvium upslope from the lake bed has a low sensitivity rating, and older alluvium is assigned an undetermined sensitivity rating, according to the TLMA.

Based on the above information, the paleontological resource sensitivity of undisturbed Quaternary alluvium and lacustrine sediments varies from low at depths less than 1.5 feet to high at depths below 1.5 feet. Since the depth to Pleistocene age sediments beneath Holocene deposits is unknown, staff concludes that all sediments beneath disturbed ground should initially be treated as highly sensitive. Where these units are mapped at the surface or may be present near the surface adjacent to these mapped areas, specifically along the northern and southern borders of the site, paleontological monitoring should be conducted during any excavation activity. Since the depth to Pleistocene age alluvial and lacustrine deposits is undetermined at present for the remainder of the site, any excavations that penetrate below 1.5 feet of the existing ground surface should be treated as having a high potential for impacting significant paleontological resources and would require paleontological monitoring. This depth is based on observations of possible older alluvium encountered in excavations advanced for the geomorphic reconnaissance report (Solar Millennium 2009a). This depth would likely increase from the northern and southern boundaries towards the center of the proposed PSEGS site. After subsurface field exploration, and monitoring of grading and trenching activities during proposed construction of the site, a qualified professional paleontologist could determine the appropriate depth above which the coarse and fine grained soils are Holocene in age, have a low sensitivity, and low potential for adverse impacts on paleontological resources. Where pylons are driven into soils with high sensitivity, the potential for adverse impacts on paleontological resources is undetermined.

These conclusions are based on SVP criteria, the Paleontologic Resource Assessments in the AFC (Solar Millennium 2009a), and the independent records searches and paleontologic review provided by McLeod (2009), the UCMP (2009); and RCLIA (2009). Existing Conditions of Certification **PAL-1** to **PAL-8** are designed to mitigate paleontologic resource impacts resulting from conventional excavation operations, as discussed above, to less than significant levels. These conditions would essentially require a worker education program in conjunction with the monitoring of earthwork activities by the PRS assigned to the project.

In areas where heliostats are to be supported by pylons that are vibro-inserted or pre-augured and vibro-inserted, adverse impacts to paleontological resources are likely to occur.

In order to adequately mitigate for the potential impacts to paleontological resources in the subsurface soils where heliostat pylons are proposed, a subsurface paleontological characterization must be performed in accordance with Condition of Certification **PAL-9**. The characterization will allow for the refinement of various mitigation options including fossil recovery and data collection, avoidance, and modifications of post insertion to be implemented as appropriate to ensure significant impacts are mitigated.

CONSTRUCTION IMPACTS AND MITIGATION

The design-level geotechnical evaluation, required for the project by the CBC (2010) and existing Condition of Certification **GEO-1,** should provide standard engineering design recommendations for mitigation of earthquake ground shaking; excessive settlement due to dynamic compaction and hydrocompaction; and potentially expansive soils.

Construction of the proposed project would directly remove approximately 3,794 acres from potential use for sand and gravel production under BLM's salable mineral program. In general, sand and gravel resources are widely available throughout the region. The primary consideration in the economic viability of sand and gravel operations is the transportation cost, which is driven by the proximity of the operation to its point of use. Although there is likely to be widespread development in the Chuckwalla Valley that would require sand and gravel resources, the site represents a small fraction of the total sand and gravel resource available within the valley such that removal of the 3,794-acre area from potential production is not expected to have any significant impact on potential future development. As a result, the PSEGS would not impact any current or reasonably foreseeable development of geologic resources. However, during construction, the project owner may need or desire to move sand and gravel either off-site or between the different units of the facility. Should this occur, the project owner would be required to comply with BLM regulations in 43 CFR Part 3600, which regulates the production and use of sand and gravel from public lands. Use of sand and gravel or other mineral materials within the boundaries of an authorized ROW is permitted; however, removal of these materials from an authorized ROW would require payment to the United States of the fair market value of those materials.

The proposed project would not have any direct or indirect impact on the production of locatable or leasable minerals outside of the proposed project boundaries. Although mineral occurrences have been claimed in the vicinity of the PSEGS site, there are no indications that these could become economic commercial operations. If they become economic operations, the existence of the proposed facility is not expected to interfere with the ability of the claimant to access those minerals. The only potential conflict would occur if the claimant or another person locates a new claim within the project boundaries. This could potentially occur, as the proposed project location has not been withdrawn from mineral entry. The potential for this scenario is expected to be low. If it did occur, conflicts between the surface use of the land for solar energy production and access to the subsurface minerals would be addressed in accordance with federal and Riverside County land use regulations. Therefore, the PSEGS would not impact any current or reasonably foreseeable development of mineral resources.

Significant paleontologic resources have been documented in the same or similar older alluvium deposits that are present in the general area of the project. Existing studies indicate the soils beneath the solar field are likely to contain Pleistocene age vertebrate fossils. Construction of the proposed project will include grading, foundation excavation, utility trenching, pylon insertion and possibly drilled shafts. Staff considers the probability of encountering paleontologic resources to be generally high on portions of the site based on the soils profile, SVP assessment criteria, and the near surface occurrence of the sensitive geologic units. The potential for encountering fossils hosted in Quaternary alluvium will increase with the depth of cut. Excavations for ancillary facilities and new pipelines and on-site excavations that penetrate surficial Holocene age alluvium will have a higher probability of encountering potentially high sensitivity materials, although sensitive materials could occur nearer the surface. The proposed mitigation cannot avoid or reduce fossil disturbance associated with pylon insertion or drilled shaft foundations. Conditions of Certification **PAL-1** to **PAL-8** are designed to mitigate any paleontologic resource impacts, as discussed above, to a less than significant level. Conditions of Certification **PAL-1** to **PAL-8** are designed to mitigate potential impacts to paleontologic resources to less than significant levels in areas where conventional excavation operations occur. These Conditions of Certification essentially require a worker education program in conjunction with the monitoring of earthwork activities by a qualified professional paleontologist (paleontologic resource specialist [PRS]). In addition, the applicant proposed paleontological monitoring of geotechnical borings within the solar field in an attempt to assist with the evaluation of the paleontological sensitivity where pylons will be inserted. Staff agrees that the monitoring of the borings should be conducted and could be useful in further delineating sensitive paleontological resources. Staff has added the suggested language for additional monitoring to Condition of Certification **PAL-5**. Staff points out however, that this monitoring would not allow for mitigation of impacts if it is found there are extensive sensitive resources in the areas where pylons will be inserted.

However, with implementation of **PAL-9**, and if the CPM determines significant paleontological resources are statistically significant at the site, the project owner will be required to implement one of the following mitigation measures:

A. Provide an assessment of how avoidance of the sensitive geologic units containing significant paleontological resources may be accomplished so impacts can be minimized.

B. Where avoidance cannot be achieved in all or part of the solar field the Project Owner shall provide an assessment of alternative foundations design and construction methods that may be used in the areas where significant paleontological resources are identified.

C. Where avoidance and alternative foundation design and construction cannot be accomplished the project owner shall conduct additional excavation and collection of paleontological resources for curation such that the collection adequately assesses the scientific significance of the site and preserves a cross-section of material that can be used for future analysis and the benefit of public appreciation.

If the results of the subsurface paleontological characterization show that there are no or limited significant paleontological resources in the solar field where pylons will be driven, the CPM may find that monitoring and mitigation in accordance with Condition of Certification **PAL-1** through **PAL-8** are adequate to ensure no significant impacts would occur.

Earthwork would be halted any time potential fossils are recognized by either the paleontologist or the worker. For finds deemed significant by the PRS, earthwork cannot restart until all fossils in that strata, including those below the design depth of excavation, are collected. When properly implemented, the Conditions of Certification would yield a net gain to the science of paleontology since fossils that would not otherwise have been discovered can be collected, identified, studied, and properly curated. A PRS would be retained, for the project by the project owner, to produce a monitoring and mitigation plan, conduct the worker training, and oversee the monitoring.

During the excavation monitoring, the PRS can and often does petition the Energy Commission for a change in the monitoring protocol. Most commonly, this is a request for less monitoring after sufficient monitoring has been performed to ascertain that there is little chance of finding significant fossils. In other cases, the PRS can propose increased monitoring due to unexpected fossil discoveries or in response to repeated out-of-compliance incidents by the earthwork contractor. In the case of the PSEGS site, the PRS would determine an appropriate depth above which undisturbed alluvial deposits are Holocene in age, have a low paleontologic sensitivity, and have little chance of containing significant fossils. The PRS could then recommend decreased monitoring for excavations above that depth. Paleontologic sensitivity of Pleistocene age sediments below the determined depth would remain high and would require continued monitoring. Based upon the literature and archives search, field surveys, and compliance documentation for the proposed PSEGS, the project owner has proposed monitoring and mitigation measures to be followed during the excavation stage of project construction. Staff believes that the facility can be designed and constructed to minimize the effect of geologic hazards and impacts to potential paleontologic resources at the site during project design life.

OPERATION IMPACTS AND MITIGATION

Operation of the proposed project should not have any adverse impact on geologic, mineralogic, or paleontologic resources because significant additional ground disturbance would not occur. Since the CBC (2010) requires that the facility be designed to withstand strong ground shaking, impacts due to seismic events should not significantly impact the structural integrity or operation of the facility.

NON-OPERATION AND FACILITY CLOSURE IMPACTS AND MITIGATION

The future non-operation and facility closure of the project should not negatively affect geologic, mineralogic, or paleontologic resources since the ground disturbed during plant facility closure would have been already disturbed, and mitigated as required, during construction and operation of the project.

CUMULATIVE IMPACTS

The **EXECUTIVE SUMMARY** section provides information on the potential cumulative solar and other development projects in the project area. Together, these existing, proposed and potential projects comprise the cumulative scenario which forms the basis of the cumulative impact analysis for the proposed project. In summary, these projects are:

- Existing projects on BLM, State, and private lands, as shown on **Executive Summary Attachment A – Figure 1** and in **Executive Summary Attachment A – Table 1.** Forseeable renewable energy projects on BLM, state, and private lands, as shown on **Executive Summary Attachment A – Figure 1** and in **Executive Summary Attachment A – Table 2**. Although not all of those projects are expected to complete the environmental review processes, or be funded and constructed, the list is indicative of the large number of renewable projects currently proposed in California.
- Projects submitted and on-hold as shown on **Executive Summary Attachment A – Figure 1** and **Executive Summary Attachment A –Table 3** presents projects submitted but that are on hold.

These projects are defined within a geographic area that has been identified by the Energy Commission and BLM as covering an area large enough to provide a reasonable basis for evaluating cumulative impacts for all resource elements or environmental parameters. Most of these projects have, are, or will be required to undergo their own independent environmental review under CEQA and/or NEPA. Even if the cumulative projects described in the **Executive Summary** have not yet completed the required environmental processes, they were considered in this cumulative impact analysis.

GEOGRAPHIC SCOPE OF ANALYSIS

The geographic extent of potential impact to geologic, mineralogic, and paleontologic resources would be generally limited to the PSEGS site. Potential cumulative effects, as they pertain to geologic hazards, are essentially limited to regional subsidence due to ground water withdrawal. Impacts associated with strong ground shaking and dynamic compaction are not cumulative in nature and would not add to potential cumulative impacts to the facility.

EFFECTS OF PAST AND PRESENT PROJECTS

Historic ground water withdrawals on the order of 48,000 ac-ft/yr and associated impacts to ground water levels did not result in any documented subsidence in the proposed project area even with increases in effective stress on clay layers present at depth. During operation. the proposed PSEGS would consume approximately 201 ac-ft/yr, which is not expected to significantly affect regional subsidence in the geographic area. Additional groundwater information is contained in the **SOIL AND WATER RESOURCES** section.

Paleontologic resources have been documented in the general area of the project. As the value of paleontologic resources is associated with their discovery within a specific geologic host unit, the potential impacts to paleontologic resources due to conventional excavation construction activities will be mitigated as required by Conditions of Certification **PAL-1** through **PAL-8**. Implementation of these conditions should result in a net gain to the science of paleontology by allowing fossils that would not otherwise have been found to be recovered, identified, studied, and preserved. Cumulative impacts, in consideration with other nearby similar projects, should be either neutral (no fossils encountered) or positive (fossils encountered, preserved, and identified). Construction associated with past and present projects could add to fossil discoveries which would enhance our understanding of the prehistoric climate, geology, and geographic setting of the region for the benefit of current and future generations. The potential impacts to paleontologic resources in areas where heliostat pylons are proposed for insertion, construction activities will be mitigated as required by Condition of Certification **PAL-9**. Similar to recovery of fossils in the course of conventional site construction, this characterization effort would yield recovery of fossils representative of those that would be damaged from pylon insertion.

EFFECTS OF REASONABLY FORESEEABLE FUTURE PROJECTS

Foreseeable Projects in the Project Area

Several future foreseeable projects identified in **Executive Summary Attachment A – Table 2** are located within the Chuckwalla Valley. Such projects would most likely include ground water pumping of similar magnitude to the PSEGS; however, the combined effect of these projects would still result in much less than the historic rate of 48,000 ac-ft/yr, which did not result in any documented regional subsidence, such that significant impacts to regional subsidence would not be expected. Therefore, there would be no significant cumulative contribution to regional subsidence from foreseeable renewable projects in the Chuckwalla Valley. Additional information on ground water withdrawal is contained in the **SOIL AND WATER RESOURCES** section.

Foreseeable Renewable Projects in the California Desert

Several future foreseeable renewable projects in the California Desert, as shown in **Executive Summary Attachment A –Table 2**, would be located within the Chuckwalla Valley. Such projects would most likely include ground water pumping of similar magnitude to the PSEGS; however, the combined effect of these projects would still result in much less than the historic rate of 48,000 ac-ft/yr, which did not result in any documented regional subsidence, such that significant impacts to regional subsidence would not be expected. Therefore, there would be no significant cumulative contribution to regional subsidence from foreseeable renewable projects in the California Desert. Additional information on ground water withdrawal is contained in the **SOIL AND WATER RESOURCES** section.

CONTRIBUTION OF THE PALEN SOLAR ELECTRIC GENERATING SYSTEM TO CUMULATIVE ANALYSIS

Construction

The construction of the PSEGS is not expected to require any significant amount of ground water pumping such that impacts to regional subsidence are not expected.

Sand and gravel resources are present at the site and could be used during construction to minimize importation of such materials from other commercially available sources in the area, thereby minimizing impacts to current commercially available sand and gravel resources. In addition, sand and gravel resources are present throughout the regional area. Therefore, construction of the PSEGS would not impact any reasonably foreseeable development of sand and gravel resources.

The construction of the PSEGS would include excavation and grading at the site. Proper monitoring of excavations at the proposed PSEGS facility during construction could result in fossil discoveries, which would enhance our understanding of the prehistoric climate, geology, and geographic setting of the region for the benefit of current and future generations.

As stated in the PSPP AFC, “the destruction of fossils as a result of human-caused ground disturbance has a significant cumulative impact, as it makes biological records of ancient life permanently unavailable for study by scientists… Construction of the PSPP has the potential to result in the destruction of sub-surface paleontological resources via breakage and crushing related to ground-disturbing activities during grading for the proposed facilities (e.g., solar field, power block, ancillary facilities, drainage channels, and access road) [and from the installation of 140,000 heliostat pylons]. Project ground disturbance and terrain modification…of sediments, has the potential to adversely affect an unknown quantity of fossils that may occur on or underneath the surface in areas containing paleontologically sensitive geologic units.” (Solar Millennium 2009a).

Potential impacts to paleontologic resources would be mitigated through worker training and monitoring by qualified paleontologists, as required by Conditions of Certification, **PAL-1** through **PAL-8** in areas where soils are exposed by conventional excavation operations.

Conversely, where heliostat pylons are vibro-inserted into soils with high paleontological sensitivity, fossils will be destroyed with no opportunity for discovery or recovery.

Under the site's current classification of paleontological sensitivity, it must be concluded that significant adverse impacts to paleontological resources would result from the proposed method of pylon insertion. Similar to recovery of fossils in the course of conventional site construction, implementation of Condition of Certification **PAL-9** would yield recovery of fossils representative of those that would be damaged from pylon insertion.

Operation

The operation of the PSEGS is expected to result in increased annual ground water pumping in the geographic area, from the current 2,000 ac-ft/yr to approximately 2,200 ac-ft/yr. Historic ground water withdrawals on the order of 48,000 ac-ft/yr did not result in any documented subsidence in the proposed project area. Since operation of the PSEGS would only contribute a minor amount of additional ground water withdrawal to the overall amount in the Chuckwalla Valley and since this cumulative amount is only a fraction of historic pumping levels that did not result in any documented subsidence, operation of the PSEGS is not expected to impact regional subsidence in the Chuckwalla Valley.

Operation of the PSEGS is not expected to require any significant excavation or grading such that impacts to geologic, mineralogic, and paleontologic resources are expected.

Non-operation and Facility Closure

Non-operation and facility closure of the PSEGS is not expected to require any significant amount of ground water pumping such that impacts to regional subsidence are not expected. In addition, potential sand and gravel resources would become available again following the facility closure.

Closure of the project should not negatively affect geologic, mineralogic, or paleontologic resources since the ground disturbed during facility closure would have been already disturbed, and mitigated as required, during construction and operation of the project. As a result, facility closure of the PSEGS would not contribute to cumulative impacts to geologic, mineralogic, and paleontologic resources, but rather would make existing sand and gravel resources available, and would allow for potential procurement of paleontologic resources that would otherwise remain unknown.

OVERALL CONCLUSION

Based on its independent research and review, Energy Commission staff believes that the potential is low for significant adverse impacts to the proposed project from geologic hazards during its design life and to potential geologic and mineralogic resources from the construction, operation, and closure of the proposed project.

The proposed project area is currently not used for mineral production, nor is it under claim, lease, or permit for the production of locatable, leasable, or salable minerals. Sand and gravel resources are present at the site and could potentially be a source of salable resources; however, such materials are present throughout the regional area such that the PSEGS should not have a significant impact on the availability of such resources. There are no other known viable geologic or mineralogic resources at the PSEGS site.

Potential impacts to paleontologic resources would be mitigated through worker training and monitoring by qualified paleontologists, as required by Conditions of Certification, **PAL-1** through **PAL-8** in areas where soils are exposed by conventional excavation operations and by **PAL-9** in areas where pylons will be vibro-inserted.

COMPLIANCE WITH LORS

Federal, state, or local/county laws, ordinances, regulations, and standards applicable to the proposed project were detailed in **Geology and Paleontology Table 1**. Staff anticipates that the project would be able to comply with most applicable LORS. However, as proposed, the project would not comply with “Measures for Assessment and Mitigation of Adverse Impacts to Non-Renewable Paleontological Resources: Standard Procedures” as developed by the Society of Vertebrate Paleontologists. These Measures paraphrase Section 6302 of the Paleontological Resources Preservation Act (PRPA) which mandates that federal agencies "*shall manage and protect paleontological resources on Federal land using scientific principles and expertise.*" In addition, as proposed, the project would not comply with Bureau of Land Management (BLM) Instructional Memorandum 2008-009 which requires the Potential Fossil Yield Classification (PFYC) system to be used to classify paleontological resource potential on public lands in order to assess possible resource impacts and mitigation needs for Federal actions involving surface disturbance, land tenure adjustments, and land-use planning. Memorandum 2008-009 also provides up-to-date methodologies for assessing paleontological sensitivity and management guidelines for paleontological resources on lands managed by the Bureau of Land Management

NOTEWORTHY PUBLIC BENEFITS

The science of paleontology is advanced by the discovery, study and curation of new fossils. These fossils can be significant if they represent a new species, verify a known species in a new location and/or if they include parts of similar specimens that had not previously been found preserved. In general, most fossil discoveries are the result of excavations, either purposeful in known or suspected fossil localities or as the result of excavations made during earthwork for civil improvements or mineral extraction. Proper monitoring of excavations at the proposed PSEGS facility, in accordance with an approved Paleontological Monitoring and Mitigation Plan, could result in fossil discoveries which would enhance our understanding of the prehistoric fossil record, or the climate, geology, and geographic setting of the region for the benefit of current and future generations. In addition, subsurface paleontological characterization of site soils could also yield beneficial information and become the basis of significance determination of adverse impact in areas penetrated by heliostat pylons.

RESPONSE TO COMMENTS

STATE OF CALIFORNIA, ENERGY RESOURCES CONSERVATION AND DEVELOPMENT COMMISSION/BASIN AND RANGE WATCH, KEVIN EMMERICH AND LAURA CUNNINGHAM, COMMENTS ON THE PRELIMINARY STAFF ASSESSMENT, TN # 200078, JULY 28, 2013:

Comment: Potentially sensitive and valuable paleontological resources have been discovered at the Palen project site. Heliostat foundation construction consisting of pre-drilling and vibratory pedestal insertion could destroy all fossils encountered where installation takes place in the fossil bearing sediments.

Pre-drilling involves rotating and boring a solid steel drill auger into the ground. This construction method would crush or break any fossils that might be present. A Supplemental Paleontological Resources Delineation Report should be prepared before approval. In it should be maps and drawings of all facilities and ground disturbance. A monitoring and sampling plan should be made. If significant fossils are found, a plan should be given for how construction will be halted. Potentially sensitive and valuable paleontological resources have been discovered at the Palen project site. Heliostat foundation construction consisting of pre-drilling and vibratory pedestal insertion could destroy all fossils encountered where installation takes place in the fossil bearing sediments.

Staff Response: Energy Commission staff requested that the applicant provide a Paleontological Resources Delineation Plan capable of addressing the issues identified by staff in the PSA and summarized in the Basin and Range Watch comment above. The applicant submitted a “Paleontological Resources Characterization” as Data Response DR 76-1. The information presented in DR 76-1 did not address all of the items requested in the Data Request and the submission was not sufficiently compelling to refute either the data presented in the PSA or new information gleaned from discussions with BLM staff regarding paleontological resources discovered at other solar project sites in the area. This information provides further support that the site likely contains areas of high paleontological sensitivity.

CONCLUSIONS

The project owner would comply with applicable LORS, provided that the existing Conditions of Certification are implemented and followed. The design and construction of the project, as amended, should have no adverse impact with respect to geologic hazards, or geologic and mineralogic, resources.

With implementation of **PAL-9**, and if the CPM determines significant paleontological resources are statistically significant at the site, the project owner may be required to implement one of the following mitigation measures:

D. Provide an assessment of how avoidance of the sensitive geologic units containing significant paleontological resources may be accomplished so impacts can be minimized.

E. Where avoidance cannot be achieved in all or part of the solar field the Project Owner shall provide an assessment of alternative foundations design and construction methods that may be used in the areas where significant paleontological resources are identified.

F. Where avoidance and alternative foundation design and construction cannot be accomplished the project owner shall conduct additional excavation and collection of paleontological resources for curation such that the collection adequately assesses the scientific significance of the site and preserves a cross-section of material that can be used for future analysis and the benefit of public appreciation.

If the results of the subsurface paleontological characterization show that there are no or limited significant paleontological resources in the solar field where pylons will be driven, the CPM may find that monitoring and mitigation in accordance with Condition of Certification **PAL-1** through **PAL-8** are adequate to ensure no significant impacts would occur.

Staff proposes to ensure compliance with LORS through the adoption of the conditions of certification listed below.

CONDITIONS OF CERTIFICATION

Staff has proposed modifications to the **Geology and Paleontology** Conditions of Certification as shown below. (**Note:** Deleted text is in ~~strikethrough~~; new text is **bold and underlined**)

GEO-1 The Soils Engineering Report required by Section 180~~2A~~**3** of the 20~~07~~**10** CBC should specifically include laboratory test data, associated geotechnical engineering analyses, and a thorough discussion of potential hydro-compaction or dynamic compaction; the presence of expansive clay soils; and the presence of corrosive soils. The report should also include recommendations for ground improvement and/or foundation systems necessary to mitigate these potential geologic hazards, if present.

Verification: The project owner shall include in the application for a grading permit a copy of the Soils Engineering Report which addresses the potential for liquefaction; settlement due to compressible soils, ground water withdrawal, hydro-compaction, or dynamic compaction; and the possible presence of expansive clay soils, and a summary of how the results of the analyses were incorporated into the project foundation and grading plan design for review and comment by the Chief Building Official (CBO). A copy of the Soils Engineering Report, application for grading permit and any comments by the CBO are to be provided to the CPM at least 30 days prior to grading.

PAL-1 The project owner shall provide the compliance project manager (CPM) with the resume and qualifications of its paleontological resource specialist (PRS) for review and approval. If the approved PRS is replaced prior to completion of project mitigation and submittal of the Paleontological Resources Report, the project owner shall obtain CPM approval of the replacement PRS. The project owner shall keep resumes on file for qualified paleontological resource monitors (PRMs). If a PRM is replaced, the resume of the replacement PRM shall also be provided to the CPM.

The PRS resume shall include the names and phone numbers of references. The resume shall also demonstrate to the satisfaction of the CPM the appropriate education and experience to accomplish the required paleontological resource tasks.

As determined by the CPM, the PRS shall meet the minimum qualifications for a vertebrate paleontologist as described in the Society of Vertebrate Paleontology (SVP) guidelines of 1995. The experience of the PRS shall include the following:

1. Institutional affiliations, appropriate credentials, and college degree;
2. Ability to recognize and collect fossils in the field;
3. Local geological and biostratigraphic expertise;
4. Proficiency in identifying vertebrate and invertebrate fossils; and
5. At least three years of paleontological resource mitigation and field experience in California and at least one year of experience leading paleontological resource mitigation and field activities.

The project owner shall ensure that the PRS obtains qualified paleontological resource monitors to monitor as he or she deems necessary on the project. Paleontologic resource monitors (PRMs) shall have the equivalent of the following qualifications:

- BS or BA degree in geology or paleontology and one year of experience monitoring in California; or
- AS or AA in geology, paleontology, or biology and four years' experience monitoring in California; or
- Enrollment in upper division classes pursuing a degree in the fields of geology or paleontology and two years of monitoring experience in California.

Verification:

(1) At least 60 days prior to the start of ground disturbance, the project owner shall submit a resume and statement of availability of its designated PRS for on-site work.

(2) At least 20 days prior to ground disturbance, the PRS or project owner shall provide a letter with resumes naming anticipated monitors for the project, stating that the identified monitors meet the minimum qualifications for paleontological resource monitoring required by the condition. If additional monitors are obtained during the project, the PRS shall provide additional letters and resumes to the CPM. The letter shall be provided to the CPM no later than one week prior to the monitor's beginning on-site duties.

(3) Prior to the termination or release of a PRS, the project owner shall submit the resume of the proposed new PRS to the CPM for review and approval.

PAL-2 The project owner shall provide to the PRS and the CPM, for approval, maps and drawings showing the footprint of the power plant, construction lay-down areas, and all related facilities. Maps shall identify all areas of the project where ground disturbance is anticipated. If the PRS requests enlargements or strip maps for linear facility routes, the project owner shall provide copies to the PRS and CPM. The site grading plan and plan and profile drawings for the utility lines would be acceptable for this purpose. The plan drawings should show the location, depth, and extent of all ground disturbances and be at a scale between 1 inch = 40 feet and 1 inch = 100 feet. If the footprint of the project or its linear facilities changes, the project owner shall provide maps and drawings reflecting those changes to the PRS and CPM.

If construction of the project proceeds in phases, maps and drawings may be submitted prior to the start of each phase. A letter identifying the proposed schedule of each project phase shall be provided to the PRS and CPM. Before work commences on affected phases, the project owner shall notify the PRS and CPM of any construction phase scheduling changes.

At a minimum, the project owner shall ensure that the PRS or PRM consults weekly with the project superintendent or construction field manager to confirm area(s) to be worked the following week and until ground disturbance is completed.

Verification:

(1) At least 30 days prior to the start of ground disturbance, the project owner shall provide the maps and drawings to the PRS and CPM.

(2) If there are changes to the footprint of the project, revised maps and drawings shall be provided to the PRS and CPM at least 15 days prior to the start of ground disturbance.

(3) If there are changes to the scheduling of the construction phases, the project owner shall submit a letter to the CPM within 5 days of identifying the changes.

PAL-3 The project owner shall ensure that the PRS prepares, and the project owner submits to the CPM for review and approval, a paleontological resources monitoring and mitigation plan (PRMMP) to identify general and specific measures to minimize potential impacts to significant paleontological resources. Approval of the PRMMP by the CPM shall occur prior to any ground disturbance. The PRMMP shall function as the formal guide for monitoring, collecting, and sampling activities and may be modified with CPM approval. This document shall be used as the basis of discussion when on-site decisions or changes are proposed. Copies of the PRMMP shall reside with the PRS, each monitor, the project owner’s on-site manager, and the CPM.

The PRMMP shall be developed in accordance with the guidelines of the Society of Vertebrate Paleontology (SVP 1995) and shall include, but not be limited, to the following:

1. Assurance that the performance and sequence of project-related tasks, such as any literature searches, pre-construction surveys, worker environmental training, fieldwork, flagging or staking, construction monitoring, mapping and data recovery, fossil preparation and collection, identification and inventory, preparation of final reports, and transmittal of materials for curation will be performed according to PRMMP procedures;

2. Identification of the person(s) expected to assist with each of the tasks identified within the PRMMP and the conditions of certification;

3. A thorough discussion of the anticipated geologic units expected to be encountered, the location and depth of the units relative to the project when known, and the known sensitivity of those units based on the occurrence of fossils either in that unit or in correlative units;

4. An explanation of why, how, and how much sampling is expected to take place and in what units. Include descriptions of different sampling procedures that shall be used for fine-grained and coarse-grained units;

5. A discussion of the locations of where the monitoring of project construction activities is deemed necessary, and a proposed plan for monitoring and sampling;

6. A discussion of procedures to be followed in the event of a significant fossil discovery, halting construction, resuming construction, and how notifications will be performed;

7. A discussion of equipment and supplies necessary for collection of fossil materials and any specialized equipment needed to prepare, remove, load, transport, and analyze large-sized fossils or extensive fossil deposits;

8. Procedures for inventory, preparation, and delivery for curation into a retrievable storage collection in a public repository or museum, which meet the Society of Vertebrate Paleontology's standards and requirements for the curation of paleontological resources;

9. Identification of the institution that has agreed to receive data and fossil materials collected, requirements or specifications for materials delivered for curation and how they will be met, and the name and phone number of the contact person at the institution; and

10. A copy of the paleontological Conditions of Certification.

Verification: At least 30 days prior to ground disturbance, the project owner shall provide a copy of the PRMMP to the CPM. The PRMMP shall include an affidavit of authorship by the PRS and acceptance of the PRMMP by the project owner evidenced by a signature.

PAL-4 Prior to ground disturbance and for the duration of construction activities involving ground disturbance, the project owner and the PRS shall prepare and conduct weekly CPM-approved training for the following workers: project managers, construction supervisors, foremen, and general workers involved with or who operate ground-disturbing equipment or tools. Workers shall not excavate in sensitive units prior to receiving CPM-approved worker training. Worker training shall consist of an initial in-person PRS training or may utilize a CPM-approved video or other presentation format during the project kick off for those mentioned above. Following initial training, a CPM-approved video or other approved training presentation/materials, or in-person training may be used for new employees. The training program may be combined with other training programs prepared for cultural and biological resources, hazardous materials, or other areas of interest or concern. No ground disturbance shall occur prior to CPM approval of the Worker Environmental Awareness Program (WEAP), unless specifically approved by the CPM.

The WEAP shall address the possibility of encountering paleontological resources in the field, the sensitivity and importance of these resources, and legal obligations to preserve and protect those resources.

The training shall include:

1. A discussion of applicable laws and penalties under the law;
2. Good quality photographs or physical examples of vertebrate fossils for project sites containing units of high paleontologic sensitivity;
3. Information that the PRS or PRM has the authority to halt or redirect construction in the event of a discovery or unanticipated impact to a paleontological resource;
4. Instruction that employees are to halt or redirect work in the vicinity of a find and to contact their supervisor and the PRS or PRM;
5. An informational brochure that identifies reporting procedures in the event of a discovery;
6. A WEAP certification of completion form signed by each worker indicating that he/she has received the training; and
7. A sticker that shall be placed on hard hats indicating that environmental training has been completed.

<u>Verification:</u>

(1) At least 30 days prior to ground disturbance, the project owner shall submit the proposed WEAP, including the brochure, with the set of reporting procedures for workers to follow.

(2) At least 30 days prior to ground disturbance, the project owner shall submit the training program presentation/materials to the CPM for approval if the project owner is planning to use a presentation format other than an in-person trainer for training.

(3) If the owner requests an alternate paleontological trainer, the resume and qualifications of the trainer shall be submitted to the CPM for review and approval prior to installation of an alternate trainer. Alternate trainers shall not conduct training prior to CPM authorization.

(4) In the monthly compliance report (MCR), the project owner shall provide copies of the WEAP certification of completion forms with the names of those trained and the trainer or type of training (in-person or other approved format) offered that month. The MCR shall also include a running total of all persons who have completed the training to date.

PAL-5 The project owner shall ensure that the PRS and PRM(s) monitor consistent with the PRMMP all construction-related grading, excavation, trenching, and augering in areas where potential fossil-bearing materials have been identified, both at the site and along any constructed linear facilities associated with the project. In the event that the PRS determines full-time monitoring is not necessary in locations that were identified as potentially fossil bearing in the PRMMP, the project owner shall notify and seek the concurrence of the CPM.

<u>In addition to the monitoring activities above, the PRS shall monitor, consistent with the PRMMP, at least twenty (20) of the borings performed as part of the final geotechnical evaluation of the subsurface properties within the solar fields.</u>

The project owner shall ensure that the PRS and PRM(s) have the authority to halt or redirect construction if paleontological resources are encountered. The project owner shall ensure that there is no interference with monitoring activities unless directed by the PRS. Monitoring activities shall be conducted as follows:

1. Any change of monitoring from the accepted schedule in the PRMMP shall be proposed in a letter or email from the PRS and the project owner to the CPM prior to the change in monitoring and will be included in the monthly compliance report. The letter or email shall include the justification for the change in monitoring and be submitted to the CPM for review and approval.

2. The project owner shall ensure that the PRM(s) keep a daily monitoring log of paleontological resource activities. The PRS may informally discuss paleontological resource monitoring and mitigation activities with the CPM at any time.

3. The project owner shall ensure that the PRS notifies the CPM within 24 hours of the occurrence of any incidents of non-compliance with any paleontological resources conditions of certification. The PRS shall recommend corrective action to resolve the issues or achieve compliance with the conditions of certification.

4. For any significant paleontological resources encountered, either the project owner or the PRS shall notify the CPM within 24 hours, or Monday morning in the case of a weekend event, where construction has been halted because of a paleontological find.

The project owner shall ensure that the PRS prepares a summary of monitoring and other paleontological activities placed in the monthly compliance reports. The summary will include the name(s) of PRS or PRM(s) active during the month; general descriptions of training and monitored construction activities; and general locations of excavations, grading, and other activities. A section of the report shall include the geologic units or subunits encountered, descriptions of samplings within each unit, and a list of identified fossils. A final section of the report will address any issues or concerns about the project relating to paleontologic monitoring, including any incidents of non-compliance or any changes to the monitoring plan that have been approved by the CPM. If no monitoring took place during the month, the report shall include an explanation in the summary as to why monitoring was not conducted.

Verification: The project owner shall ensure that the PRS submits the summary of monitoring and paleontological activities in the MCR. When feasible, the CPM shall be notified 10 days in advance of any proposed changes in monitoring different from the plan identified in the PRMMP. If there is any unforeseen change in monitoring, the notice shall be given as soon as possible prior to implementation of the change.

PAL-6 The project owner, through the designated PRS, shall ensure that all components of the PRMMP are adequately performed including collection of fossil materials, preparation of fossil materials for analysis, analysis of fossils, identification and inventory of fossils, the preparation of fossils for curation, and the delivery for curation of all significant paleontological resource materials encountered and collected during project construction.

Verification: The project owner shall maintain in his/her compliance file copies of signed contracts or agreements with the designated PRS and other qualified research specialists. The project owner shall maintain these files for a period of three years after project completion and approval of the CPM-approved paleontological resource report (see Condition of Certification **PAL-7**). The project owner shall be responsible for paying any curation fees charged by the museum for fossils collected and curated as a result of paleontological mitigation. A copy of the letter of transmittal submitting the fossils to the curating institution shall be provided to the CPM.

PAL-7 The project owner shall ensure preparation of a Paleontological Resources Report (PRR) by the designated PRS. The PRR shall be prepared following completion of the ground-disturbing activities. The PRR shall include an analysis of the collected fossil materials and related information and submit it to the CPM for review and approval.

The report shall include, but ~~is~~ not be limited to, a description and inventory of recovered fossil materials; a map showing the location of paleontological resources encountered; determinations of sensitivity and significance; and the PRS' description of sensitivity and significance of those resources.

Verification: Within 90 days after completion of ground-disturbing activities, including landscaping, the project owner shall submit the PRR under confidential cover to the CPM.

PAL-8 The project owner, through the designated PRS, shall ensure that all components of the PRMMP are adequately performed, including collection of fossil material, preparation of fossil material for analysis, analysis of fossils, identification and inventory of fossils, preparation of fossils for curation, and delivery for curation of all significant paleontological resource materials encountered and collected during project construction. The project owner shall pay all curation fees charged by the museum for fossil material collected and curated as a result of paleontological mitigation. The project owner shall also provide the curator with documentation showing the project owner irrevocably and unconditionally donates, gives, and assigns permanent, absolute, and unconditional ownership of the fossil material.

Verification: Within 60 days after the submittal of the PRR, the project owner shall submit documentation to the CPM showing fees have been paid for curation and the owner relinquishes control and ownership of all fossil material.

PAL-9 The project owner shall prepare a paleontological characterization plan suitable to adequately assess the paleontological resources of the subsurface in the mirrored solar field area. The plan shall be provided to the compliance project manager (CPM) for review and approval. Following CPM approval of the plan, the project owner shall conduct the paleontological resources characterization of the subsurface in the solar field area. The characterization shall be conducted in accordance with the Bureau of Land Management (BLM) "Guidelines for Assessment and Mitigation of Potential Impacts to Paleontological Resources". The characterization shall include subsurface excavations within the proposed solar field to a depth equal to the maximum depth of panel post insertion. All excavations shall be logged and sampled by a qualified paleontologist under the direct supervision of the paleontological resource specialist (PRS). The number of excavations shall be statistically significant determined in accordance with current statistical procedures similar to those presented in *Information Technology, Learning, and Performance Journal, Vol. 19, No. 1, Spring 2001*. Following completion of the field work, the project owner shall document the findings and interpretations in a paleontological

characterization report. The paleontological characterization report shall contain:

1. Date(s) of the fieldwork and names of any personnel assisting with the fieldwork.

2. Brief description of project and expected impacts to paleontological resources.

3. A description of field methods used.

4. A summary of findings, including important discoveries.

5. A discussion of the significance of the findings/discoveries.

6. A description of potentially fossiliferous areas to allow for future assessment of sites, even if no fossils were located during the project monitoring.

7. A completed BLM locality form 8270-3 or equivalent for each new locality, using Universal Transverse Mercator (UTM) NAD 83 coordinates, and 1:24000 scale maps with new localities plotted using points or polygons as appropriate.

8. Locality forms, maps, and any other information containing specific fossil locations will be bound separately or assembled as a separate section to allow for preservation of confidential locality data.

9. List of specimen field numbers and field identifications of collected material, cross-referenced to the locality field number. This list may be submitted in electronic format, preferably in a spreadsheet format.

10. A summary of regional and local geology; this will reference earlier projects for relevant information.

11. A summary of regional and local paleontology; this will reference earlier projects for relevant information.

12. Potential impacts to paleontological resources resulting from the project.

13. Map of project area, indicating areas surveyed, known localities, and new discoveries.

14. Relevant photos, diagrams, tables to aid in explaining, clarifying, or understanding the findings.

If the CPM determines significant paleontological resources are statistically significant at the site the project owner will be required to implement one of the following:

A. Provide an assessment of how avoidance of the sensitive geologic units containing significant paleontological resources may be accomplished so impacts can be minimized. The CPM shall review and approve the assessment prior to implementation.

B. Where avoidance cannot be achieved in all or part of the solar field the Project Owner shall provide an assessment of alternative foundations design and construction methods that may be used in the areas where significant paleontological resources are identified. The CPM shall review and approve the assessment prior to implementation.

C. Where avoidance and alternative foundation design and construction cannot be accomplished the project owner shall conduct additional excavation and collection of paleontological resources for curation such that the collection adequately assesses the scientific significance of the site and preserves a cross-section of material that can be used for future analysis and the benefit of public appreciation.

If the results of the study show that there are no or limited significant paleontological resources in the solar field where pylons will be driven the CPM may find that monitoring and mitigation in accordance with Condition of Certification PAL-1 through PAL-8 are adequate to ensure no significant impacts.

Verification:

1) At least 90 days prior to the start of ground disturbance, the project owner shall submit the paleontological characterization plan to the CPM for review and approval.

2) At least 30 days prior to ground disturbance, the project owner shall initiate field work in the areas where ground disturbance will first be conducted. The field work shall proceed sequentially in areas scheduled for panel foundation installation and shall precede panel foundation installation by a period of not less than 7 days.

3) At least 30 days prior to ground disturbance, the project owner shall provide a panel foundation construction schedule to the CPM.

4) No more that 90 days after completion of panel foundation construction, the project owner shall provide the CPM a draft paleontological characterization report for review and comment.

5) The findings of the solar field paleontological characterization shall be incorporated into the PRR required in PAL -7, above.

Certification of Completion
Worker Environmental Awareness Program
Palen Solar Electric Generating System (09-AFC-7)

This is to certify these individuals have completed a mandatory California Energy Commission–approved Worker Environmental Awareness Program (WEAP). The WEAP includes pertinent information on cultural, paleontological, and biological resources for all personnel (that is, construction supervisors, crews, and plant operators) working on-site or at related facilities. By signing below, the participant indicates that he/she understands and shall abide by the guidelines set forth in the program materials. Include this completed form in the Monthly Compliance Report.

No.	Employee Name	Title/Company	Signature
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Cultural Trainer: ______________ Signature: _________________ Date: _/_/__

Paleo Trainer: ________________ Signature: _________________ Date: _/_/__

Biological Trainer: ____________ Signature: _________________ Date: _/_/__

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POWER PLANT EFFICIENCY

Testimony of Edward Brady

SUMMARY OF CONCLUSIONS

The Palen Solar Electric Generating System (PSEGS), if constructed and operated as proposed, would use solar energy to generate a minimum 98 percent of its annual electrical energy production. Fossil fuel, in the form of natural gas, would be used only to reduce startup time and to keep the temperature of the steam generation system above freezing temperatures. Compared to the project's expected overall production rate of approximately 1,412,300 megawatt-hours (MWh) per year, and compared to a typical fossil fuel-fired power plant of equal capacity, the amount of the annual power production from fossil fuel is insignificant at less than 2 percent (Palen 2012a, § 2.1-1).

The project would decrease dependence on fossil fuel, and would increase renewable energy generation. It would not create significant adverse effects on fossil fuel energy supplies or resources, would not require additional sources of energy supply, and would not consume fossil fuel energy in a wasteful or inefficient manner. No efficiency standards apply to this project. Staff therefore concludes that this project would present no significant adverse impacts on fossil fuel energy resources.

The modified PSEGS would occupy approximately 7.6 acres per megawatt (MW) of capacity, which approximates other similar solar power technologies.

INTRODUCTION

The proposed modified PSEGS would generate 500 MW (nominal net output) of electricity. PSEGS would be a solar thermal power plant built on an approximately 3,794-acre site in Riverside County, California. The project would use the solar thermal power tower technology to produce electrical power using steam turbine generators fed from solar steam generators. Fossil fuel, in the form of natural gas, would be used to reduce startup time and to keep the temperature of the steam generation system above freezing.

METHODOLOGY AND THRESHOLDS FOR DETERMINING ENVIRONMENTAL CONSEQUENCES

FOSSIL FUEL USE EFFICIENCY

One of the responsibilities of the Energy Commission is to make findings on whether the energy use by a power plant, including the proposed PSEGS, would result in significant adverse impacts on the environment, as defined in the California Environmental Quality Act. If the Energy Commission finds that the proposed modified project's energy consumption creates a significant adverse impact, it must further determine if there are feasible mitigation measures that could eliminate or minimize that impact, and then, require implementation of those mitigation measures.

In order to develop the Energy Commission's findings, this analysis will:

- examine whether the facility would likely present any adverse impacts upon energy resources; and if so,
- examine whether these adverse impacts are significant; and if so,
- examine if there are feasible mitigation measures or alternatives that could eliminate those adverse impacts or reduce them to a level of less-than-significance; and if so,
- recommend that the project implement those mitigation measures.

SOLAR LAND USE EFFICIENCY

Solar thermal power plants typically consume much less fossil fuel (usually in the form of natural gas) than other types of thermal power plants. Therefore, common measures of power plant efficiency such as those described above are less meaningful. So far as Energy Commission staff can determine, methods for determining the efficiency of a solar power plant have yet to be standardized; research has uncovered no meaningful attempt to quantify efficiency. The solar power industry appears to have begun discussing the issue, but a consensus has not emerged. In the absence of accepted standards, staff proposes the following approach.

Solar thermal power plants convert the sun's energy into electricity in three basic steps:

- Mirrors and/or collectors capture the sun's rays.
- This solar energy is converted into heat.
- This heat is converted into electricity, typically in a heat engine such as a steam turbine generator.

The effectiveness of each of these steps depends on the specific technology employed; the product of these three steps determines the power plant's overall solar efficiency. The greater the project's solar efficiency, the less land the plant must occupy to produce a given power output.

The most significant environmental impacts caused by solar power plants result from occupying large expanses of land. The extent of these impacts is likely in direct proportion to the number of acres affected. For this reason, staff evaluates the land use efficiency of proposed solar power plant projects. This efficiency is expressed in terms of power produced, or MW per acre, and in terms of energy produced, or annual MW-hours per acre. How efficiently a project uses land includes, but is not limited to, the site terrain and gradients, types of soils, the number of washes and waters of the US and state, and the technology. Staff calculates the relative efficiencies to verify that the project is consistent with similar technologies – not that one project is superior to another project. Specifically:

- For land use efficiency, the solar industry uses the ratio of acreage and nominal power output (acres/MW) and its reciprocal (MW/acre) interchangeably to compare land utilization of solar powered electrical generation systems.

- Energy-based solar land use efficiency is calculated by dividing the annual net electrical energy production in MW-hours per year by the total number of acres impacted by the power plant, which accounts for the fraction of energy production, morning start-up and nighttime freeze control utilizing non-renewable fuel sources such as natural gas and propane.
- Acreage is defined in the capacity and energy factors above as the area used directly as solar fields plus the common service area, but excluding access roads, transmission rights-of-way and utility corridors, and any mitigation areas.
- Where the method for maintaining start-up status is not otherwise identified, refer to **APPENDIX A** for a list of proxy combined cycle baseload generation facilities to calculate an equivalent start-up fuel factor and derive a "solar only" net annual energy generation.

See **Efficiency Table 1** below for a comparison of various solar and conventional electric power generation facilities in terms of land utilization, power generation efficiency and net energy generation efficiency.

PROPOSED MODIFIED PROJECT

The Final Decision describes the PSEGS as a solar thermal project using parabolic trough technology. Under the modified PSEGS, the troughs and associated heat transfer fluid (HTF) will be eliminated and PSEGS will be reconfigured to utilize BrightSource's solar tower technology consisting of two solar towers, associated power blocks, and heliostat fields. Power plant efficiency impacts from the modified project are expected to be similar to the approved project (see analysis below).

SETTING AND EXISTING CONDITIONS

The applicant proposes to build and operate PSEGS, a solar thermal power plant producing a total of 500 MW (nominal net output) and employing the power tower solar thermal technology. The project would consist of two units, each comprised of arrays of approximately 85,000 heliostat mirrors, solar steam generator heat exchangers, one steam turbine generator, and an air cooled condenser (Palen 2012a, § 2.2.1). Each 250 MW power tower would be surrounded by a circular array of heliostats with the closest radial array about 250 feet from the base of the 720-foot-tall tower and the farthest approximately 750 feet from the base of this tower. What would appear to be random spacing and partial rows would be designed to accommodate the topography of the site and minimize panel-to-panel shading as the sun runs a celestial chord across the hemispheric array (Palen 2012a, § 2.2.1.3).The project's power cycle would be based on a steam cycle (also known as the Rankine cycle). The solar receiver steam generator (SRSG) at the top of the 750-foot-tall tower structure would feed the steam turbine generators which would produce electric power.

Each unit of the project would utilize a natural gas-fired auxiliary boiler with 249 million Btu per hour (mmBtu/hr) thermal input to accelerate startup and have the solar system warm at first sunlight. A second nighttime restoration boiler with 10 mmBtu/hr thermal input would provide overnight freeze protection.

ASSESSMENT OF IMPACTS AND DISCUSSION OF MITIGATION

PROJECT ENERGY REQUIREMENTS AND ENERGY USE EFFICIENCY

PSEGS would consume insignificant amounts of fossil fuel for power generation. It would consume fossil fuel only to reduce startup time and provide nighttime freeze protection.

The project would consume natural gas at a maximum annual rate of 742,000 mmBtu (Palen 2012a, Table 2.2-2). Compared to a typical fossil fuel-fired power plant of equal capacity, and compared to the relatively considerable resources of fossil fuel in California (see below in **ADVERSE EFFECTS ON ENERGY SUPPLIES AND RESOURCES**), this rate is not significant. Natural gas is comparable in efficiency to common fossil fuels,[1] with a heat rate that is 1.8 percent higher than propane and 9.2 percent higher than diesel fuel.

The applicant estimates a full load thermodynamic efficiency of 43.6 percent for the proposed modified project (Palen 2012a, Figure 2.2-3A). There are currently no legal or industry standards for measuring the efficiency of solar thermal power plants. Staff compares the steam cycle efficiency of PSEGS to the average efficiency of contemporary fossil fuel steam turbines currently available in the market. The efficiency figures for these turbines range from 35 to 45 percent. The project's thermal efficiency of 43.6 percent is comparable to this industry range. Coupled with the 2 percent restriction on the use of natural gas for energy generation (Palen 2012a, § 2.2.1, Table 2.2-1), the solar-driven thermal steam cycle efficiency provides a simple, work-proven method of electric power generation, eliminating the heat exchange losses of an intermediate HTF circuit.

Therefore, staff considers the impact of the project's fuel consumption on energy supplies and energy efficiency to be less than significant.

ADVERSE EFFECTS ON ENERGY SUPPLIES AND RESOURCES

The applicant has described its sources of natural gas for the project (PSEGS 2012a, § 2.3) The project has access to an abundance of natural gas through the 200 psig gas transmission line that runs along Interstate Highway 10 (I-10). Owned by Southern California Gas Company, this pipeline is connected to natural gas resources from the Rocky Mountains, Canada and the southwest. The gas transmission system, of which the I-10 pipeline is part, has the capability of carrying up to 258.33 million cubic feet per hour ($mmft^3/hr$) from production areas in the Permian Basin of west Texas and the San Juan Basin of southern Colorado. The maximum natural gas demand from the project would be 0.53 $mmft^3/hr$; approximately 0.2 percent of this capacity. Therefore, it would be highly unlikely that the project would create a substantial increase in fossil fuel demand.

[1] Source: **APPENDIX A**, Biomass Energy Databook – 2011 – http://cta.orni.gof/bedb. LHV rates for natural gas (20,267 Btu/lbm/983 Btuh/CF), propane (19,904 Btu/lbm) fuel oil/diesel (18,397 Btu/lbm).

ADDITIONAL ENERGY SUPPLY REQUIREMENTS

There appears to be no real likelihood that PSEGS would require the development of additional energy supply capacity (see above in **ADVERSE EFFECTS ON ENERGY SUPPLIES AND RESOURCES**).

COMPLIANCE WITH ENERGY STANDARDS

No standards apply to the efficiency of PSEGS or other non-cogeneration projects.

ALTERNATIVES TO REDUCE WASTEFUL, INEFFICIENT, AND UNNECESSARY ENERGY CONSUMPTION

Staff typically evaluates the project alternatives to determine if alternatives exist that could reduce the project's fuel use. The evaluation of alternatives to the project (that could reduce wasteful, inefficient, or unnecessary energy consumption) requires the examination of the project's energy consumption.

Efficiency of Alternatives to the Project

Please see the project alternatives discussed below.

Alternative Generating Technologies

Alternative generating technologies for PSEGS are considered in PSEGS 2012a Petition to Amend. For purposes of this analysis, natural gas, oil, coal, nuclear, geothermal, biomass, hydroelectric, wind and solar photovoltaic technologies were all considered. Because this project would consume insignificant amounts of fossil fuel for power production, staff believes that the proposed modified project would not constitute a significant adverse impact on fossil fuel energy resources compared to feasible alternatives.

The solar insolation radiating on the earth's surface can be regarded as an energy resource. Since this energy is relatively inexhaustible, its consumption does not illicit the concerns endemic to fossil fuel consumption. What is of concern, however, is the extent of land area required to convert this solar energy into electricity. Setting aside hundreds or thousands of acres of land for solar power generation removes it from alternative uses.

As discussed above, Energy Commission staff is unaware of any accepted standards for evaluating the efficiency of a solar power plant such as PSEGS. As a substitute, staff tabulates the land use efficiency of the project (described above) and compares it to similar measures for other solar power plant projects that have passed through, or are passing through the Energy Commission's siting process; see **Efficiency Table 1**, below. It has not been determined how great a difference in land use would constitute a significant difference. The solar land use efficiency for a typical natural gas-fired combined cycle power plant is shown only for comparison.

A solar power project that occupies more land than another project holds the potential to produce more environmental impacts. PSEGS would produce power at the rate of 500 MW net, and would generate energy at the rate of 1,412,300 MW-hours net per year, while occupying 3,794 acres (Palen 2012a, Figures 1 and 2.1-4, Table 2.2-1).

Staff calculates the comparative land use and energy-based efficiencies below:

Land Use Efficiency: 500 MW ÷ 3,794 acres = **0.13 MW/acre**; or
3,794 acres ÷ 500 MW = **7.6 acres/MW**

Energy-Based Land Use Efficiency: 1,412,300 MWh/hr ÷ 3,794 acres = **372 MWh/year**

Alternatives to Reduce Solar Land Use Impacts

Building and operating a natural gas-fired combined cycle power plant would yield much greater land use efficiency than any solar power plant; see **Efficiency Table 1**. However, this would not achieve the basic project objective, to generate electricity from the renewable energy of the sun.

As seen in **Efficiency Table 1**, PSEGS, employing BrightSource's power tower technology, is slightly less efficient in the use of land than Hidden Hills SEGS which uses BrightSource's power tower technology as well, but more efficient than Ivanpah SEGS which also employs BrightSource's power tower technology. PSEGS is slightly more land-use-efficient than the original Calico Solar project, a Stirling Engine solar project. PSEGS's land use efficiency is in the midrange of the efficiency figures listed in **Efficiency Table 1**. Also, compared to the other projects listed in this table, PSEGS would burn more fossil fuel per acre of land and per MW; see the last two columns.

The modified PSEGS would occupy approximately 7.6 acres of land per MW of power generation, or 0.13 MW/acre. The approved PSPP would occupy approximately 2,970 acres of land for the solar field, common areas, and power blocks (Solar Millennium 2009a, AFC §§ 2.0, 2.1, 2.2.1), plus approximately 926 acres of land set aside for grading and drainage which would be required for the PSPP project (Palen 2013j, Supplement No. 3, p.1-1). Based on the total acreage (2,970+926=3,896) and the nominal gross output of 500 MW, the approved PSPP would occupy approximately 7.8 acres of land per MW of power generation, or 0.13 MW/acre. As seen here, from a land use efficiency standpoint, the modified project would be similar to the approved project.

Efficiency Table 1
Solar Land Use Efficiency[1]

Projects	Generating Capacity (MW net)	Annual Energy (mmBtu) net	Annual Fuel Consumption (mmBtu, lower heating value [LHV[1]])	Footprint (Acres)	Land Use Efficiency (MW/acre)	Land Use Efficiency (Energy–Based) (MWh/acre-year)	
						Total	Solar Only[2]
Palen Solar (09-AFC-7C)	**500**	**1,401,900**	**742,000**	**3,794**	**0.13**	**372**	**342**
Beacon Solar (08-AFC-2)	250	600,000	36,000	1,240	0.20	484	480
Hidden Hills SEGS (11-AFC-04)	500	1,412,000	94,907	3,097	0.16	463	458
Ivanpah SEGS (07-AFC-5)	400	960,000	432,432	3,744	0.11	256	238
Imperial Valley Solar (08-AFC-5)	750	1,620,000	0	6,500	0.12	249	249
Calico Solar (08-AFC-13)	850	1,840,000	0	8,200	0.11	224	224
Avenal Energy (08-AFC-1)[3]	600	3,023,000	24,792,786	25	24.0	120, 936	N/A

Notes:
1. LHV is Low Heating Value, or a measurement of the energy content of a fuel correcting for post-combustion water vapor.
2. Net energy output is reduced by natural gas-fired combined cycle proxy energy output; see **Efficiency Appendix A**.
3. Example natural gas-fired combined cycle plant.

Alternative Heat Rejection System

The applicant proposes to employ a dry cooling system (air-cooled condensers) as the means for rejecting power cycle heat from the steam turbines (Palen 2012a, § 2.2.1.4). An alternative heat rejection system would utilize evaporative cooling towers.

The local climate in the project area is characterized by high temperatures and low relative humidity (low wet-bulb temperature). In low temperatures and high relative humidity (low dry-bulb temperature), the air-cooled condenser performs relatively efficiently compared to the evaporative tower. However, at the project area (low wet-bulb temperature and high dry-bulb temperature) the air-cooled condenser performance is relatively poor compared to that of an evaporative cooling tower. Furthermore, the performance of the heat rejection system affects the performance of the steam turbine, which affects turbine efficiency and the net power output. However, an air cooled condensers uses a relatively small amount of water than an evaporative cooling tower. Although power production is marginally reduced by the use of an air cooled condenser, the benefit of reducing water consumption countervails the impact on power production at a desert site. Even though evaporative cooling could offer greater power production, resulting in higher efficiency, staff believes the applicant's selection of dry cooling is a reasonable tradeoff because it would prevent potentially significant environmental impacts that could result from consumption of the large quantities of water required by wet cooling.

CUMULATIVE IMPACT ANALYSIS

There are no nearby power plant projects or other projects consuming large amounts of fossil fuel that hold the potential for cumulative energy consumption impacts when aggregated with the project. This project controls its own use of natural gas by specifying 2 percent annual energy production as a limit (Palen 2012a, § 2.2.1). Where solar tower resources share regional locales, their unimpeded access to solar radiation does not place them in competition with other solar (or non-solar) facilities within their proximate.

As a renewable energy source, solar energy would have an influence on the daily power demand profile and technologies such as multi-stage generation that would have to emerge to enhance the efficient utilization of solar power. In the long term, these trends will serve to improve the power generation mix and provide the electricity grid system with accessible methods of managing and controlling generation facilities within their purview.

More immediately, staff believes that the construction and operation of the project would not create indirect impacts (in the form of additional fuel consumption) that would not have otherwise occurred without this project. Because the proposed modified project would consume significantly less fossil fuel than a typical fossil fuel-fired power plant, it should compete favorably in the California power market and replace older fossil fuel burning power plants. The project would therefore cause a positive impact on the cumulative amount of fossil fuel consumed for power generation.

COMPLIANCE WITH LORS

No federal, state, or local/county laws, ordinances, regulations, and standards (LORS) apply to the efficiency of this project.

NOTEWORTHY PUBLIC BENEFITS

PSEGS would employ an advanced solar thermal technology. Solar energy is renewable and unlimited. The project would have a less than significant adverse impact on nonrenewable energy resources. Consequently, the project would help in reducing California's dependence on fossil fuel-fired power plants.

RESPONSE TO COMMENTS

Staff received no comments relating to Power Plant Efficiency.

CONCLUSIONS

LAND USE

The modified PSEGS project would occupy approximately 7.6 acres per MW of power output, or 0.13 MW/acre; in the midrange of efficiency figures that include several other solar thermal power plant projects (see **Efficiency Table 1**).

FOSSIL FUEL ENERGY USE

The modified PSEGS project would use solar energy to generate most of its capacity, consuming insignificant amounts of fossil fuel for power production. The project would decrease reliance on fossil fuel, and would increase reliance on renewable energy resources. It would not create significant adverse effects on energy supplies or resources, would not require additional sources of energy supply, and would not consume energy in a wasteful or inefficient manner. No energy standards apply to this project.

Staff therefore concludes that this project would present no significant adverse impacts on energy resources. No cumulative impacts on energy resources are likely. Facility closure would not likely present significant impacts on electric system efficiency.

PROPOSED CONDITIONS OF CERTIFICATION/MITIGATION MEASURES

No conditions of certification are proposed.

REFERENCES

Palen 2012a – Palen Solar Holdings, LLC/Galati Blek, Scott Galati (TN 68910). Palen Solar Holdings LLC's Petition for Amendment, dated December 17, 2012. Submitted to CEC/C. Stora on December 18, 2012.

Palen 2013j – Galati Blek/Scott A. Galati (TN 70448). Palen Solar Holdings, LLC's Supplement No. 3, dated April 24, 2013. Submitted to CEC/C. Stora on April 24, 2013

Solar Millennium 2009a – Solar Millennium (TN 52939). Application for Certification, Volumes 1 & 2, dated 8/24/2009.

EFFICIENCY APPENDIX A
SOLAR POWER PLANT EFFICIENCY CALCULATION
GAS-FIRED PROXY

In calculating the efficiency of a solar power plant, it is desired to subtract the effect of natural gas burned for morning startup, cloudy weather augmentation and freeze protection. As an alternative, staff would use an average efficiency based on several recent baseload combined cycle power plant projects in the Energy Commission siting process. Baseload combined cycles were chosen because their intended dispatch most nearly mirrors the intended dispatch of solar plants, that is, operate at full load in a position high on the dispatch authority's loading order.

Examples of base load combined cycle "proxy" systems include:

Colusa Generating Station (06-AFC-9)

- Nominal 660 MW 2-on-1 Combined Cycle with GE Frame 7FA CGTs
- Air cooled condenser, evaporative inlet air cooling
- Efficiency with duct burners on: 666.3 MW @ 52.5% LHV
- Efficiency with duct burners off: 519.4 MW @ 55.3% LHV
- Efficiency (average of these two): **53.9% LHV**

San Gabriel Generating Station (07-AFC-2)

- Nominal 696 MW 2-on-1 Combined Cycle with Siemens 5000F CGTs
- Air cooled condenser, evaporative inlet air cooling
- Efficiency with duct burners on: 695.8 MW @ 52.1% LHV
- Efficiency with duct burners off: 556.9 MW @ 55.1% LHV
- Efficiency (average of these two): **53.6% LHV**

Avenal Energy (08-AFC-1)

- Nominal 600 MW 2-on-1 Combined Cycle with GE Frame 7FA CGTs
- Air cooled condenser, inlet air chillers
- Efficiency with duct burners on: 600.0 MW @ 50.5% LHV
- Efficiency with duct burners off: 506.5 MW @ 53.4% LHV
- Efficiency (average of these two): **52.0% LHV**

Average of these four power plants: **53.2% LHV**

POWER PLANT RELIABILITY

Testimony of Edward Brady

SUMMARY OF CONCLUSIONS

Based on a review of the Petition to Amend, staff concludes that, similar to the approved project, the modified project, referred to as the Palen Solar Electric Generating System (PSEGS) would be built and would operate in a manner consistent with industry norms for reliable operation. The project owner predicts an equivalent availability factor of between 92 and 98 percent for the modified project, which staff believes is achievable and comparable to the original unamended system proposed for Palen. (The equivalent availability factor of a power plant is the percentage of time it is available to generate power, accounting for both planned and unplanned outages.) No conditions of certification are proposed.

INTRODUCTION

In this analysis, California Energy Commission (Energy Commission) staff addresses the reliability issues of PSEGS to determine if the power plant is likely to be built in accordance with typical industry norms for reliable power generation. Staff uses this norm as a benchmark because it ensures that the resulting project would not be likely to degrade the overall reliability of the electric system it serves (see the “Setting” subsection, below).

The scope of this power plant reliability analysis covers:

- equipment availability;
- plant maintainability;
- fuel and water availability; and
- power plant reliability in relation to natural hazards.

Staff examined the project design criteria to determine if the project is likely to be built in accordance with typical industry norms for reliable power generation. While the project owner has predicted an availability factor of between 92 to 98 percent for PSEGS (Palen 2012a, § 3.1.4.1), staff has used industry norms as the benchmark, rather than the project owner’s projection, to evaluate the project’s reliability.

METHODOLOGY AND THRESHOLDS FOR DETERMINING ENVIRONMENTAL CONSEQUENCES

METHOD FOR DETERMINING RELIABILITY

The Energy Commission must make findings as to how a project is designed, sited, and operated in order to ensure its safe and reliable operation (Title 20, CCR § 1752[c]). Staff takes the approach that a project is acceptable if it does not degrade the reliability of the utility system to which it is connected. This is likely the case if a project is at least as reliable as other power plants on that system.

The equivalent availability factor is the percentage of time the power plant is available to generate power, accounting for both planned (maintenance) and unplanned outages (extreme inclement weather). For a solar power plant, the availability factor is a percentage of only daytime hours because the technology does not produce electricity at night. Measures of power plant reliability are based upon both the plant's actual ability to generate power when it is considered to be available and upon starting failures and unplanned (or forced) outages. For practical purposes, reliability can be considered a combination of these two industry measures, making a reliable power plant one that is available when called upon to operate. Throughout its intended 30-year life, PSEGS is expected to operate reliably (Palen 2012a, § 3.1.4). Power plant systems must be able to operate for extended periods without shutting down for maintenance or repairs. Achieving this reliability requires adequate levels of equipment availability, plant maintainability with scheduled maintenance outages, fuel and water availability, and resistance to natural hazards. Staff examines these factors for the project and compares them to industry norms. If the factors compare favorably for this project, staff may then conclude that PSEGS would be as reliable as other power plants on the electric system and would not degrade system reliability.

PROPOSED MODIFIED PROJECT

The Final Decision describes the approved project as a solar thermal project using parabolic trough technology. Under the modified project, the troughs and associated HTF will be eliminated and the PSEGS would be reconfigured to utilize BrightSource's solar tower technology consisting of two solar towers and associated power blocks and heliostat fields.

SETTING AND EXISTING CONDITIONS

In the restructured competitive electric power industry, the responsibility for maintaining system reliability falls largely to the state's control area operators, such as the California Independent System Operator (California ISO), that purchase, dispatch, and sell electric power throughout the state. Determining how the California ISO and other control area operators would ensure system reliability has been an ongoing effort. Protocols that allow sufficient reliability to be maintained under the competitive market system have been developed and put in place. "Must-run" power purchase agreements and "participating generator" agreements are two mechanisms that have been employed to ensure an adequate supply of reliable power.

The California ISO's mechanisms to ensure adequate power plant reliability apparently were devised under the assumption that the individual power plants that compete to sell power into the system will each exhibit a level of reliability similar to that of power plants of past decades. However, there has been valid cause to believe that, under free market competition, financial pressures on power plant owners to minimize capital outlays and maintenance expenditures may act to reduce the reliability of many power plants, both existing and newly constructed (McGraw-Hill 1994).[1] It is possible that, if significant numbers of power plants were to exhibit individual reliability sufficiently lower

[1] pg.11, Sanden, Gary et al., "Operational Experience in Competitive Electric Generation, McGraw-Hill's Independent Audit of US Non-Utility Powerplants", McGraw Hill Inc. (New York, 1994).

than this historical level, the assumptions used by California ISO to ensure system reliability would prove invalid, with potentially disappointing results. Accordingly, staff has recommended that power plant owners continue to build and operate their projects to the level of reliability to which all in the industry are accustomed.

As part of its plan to provide needed reliability, the project owner proposes to operate the 500-megawatt (MW) (net power output) PSEGS, a solar thermal power plant facility employing advanced solar power technology. This project, using renewable solar energy, would provide dependable power to the grid, generally during the hours of peak power consumption by the interconnecting utility(s). This project would help serve the need for renewable energy in California.

The project owner has indicated it expects the modified project to achieve an availability factor of between 92 and 98 percent (Palen 2012a, § 2.12). The project is anticipated to operate at an annual capacity factor of approximately 32 percent.[2]

ASSESSMENT OF IMPACTS AND DISCUSSION OF MITIGATION

EQUIPMENT AVAILABILITY

Equipment availability would be ensured by adoption of appropriate quality assurance/ quality control (QA/QC) programs during the design, procurement, construction, and operation of the plant and by providing for adequate maintenance and repair of the equipment and systems discussed below.

Quality Control Program

The project owner describes a QA/QC program (Palen 2012a, § 3.1.4.5) that is typical of the power industry. Equipment would be purchased from qualified suppliers based on technical and commercial evaluations. Suppliers’ personnel, production capability, past performance, QA programs, and quality history would be evaluated. The project owner would perform receipt inspections, test components, and administer independent testing contracts. Staff expects that implementation of this program would result in typical reliability of design and construction. To ensure this implementation, staff has proposed appropriate conditions of certification in the section of this document entitled **FACILITY DESIGN**.

PLANT MAINTAINABILITY

Equipment Redundancy

The PESGS project would be able to operate only when the sun is shining. Maintenance or repairs could be done when the plant is shut down at night. This would help to enhance the project’s reliability. The fact that the project would consist of two separate units operating separately provides inherent reliability. A single equipment failure cannot disable more than one unit, thus allowing the plant to continue to generate (at reduced output). The nature of solar thermal generating technology also provides inherent redundancy; the singular nature of the heliostats would allow for

[2] Derived from PSEGS Petition, Table 2.2.1: 1,412,300 MWh (500 MW x 8760 hours) = 0.322/32.2%.

reduced output generation if one heliostat, or even hundreds of heliostats, was to require service or repair. This redundancy would allow service or repair to be done during sunny days when the plant is in operation, if required. Major plant systems are designed with adequate redundancy to ensure their continued operation if equipment fails (Palen 2012a, § 3.1.4.2, Table 3.1-1). Approximately 85,000 heliostats per unit would provide an excess of reflective surface area to accommodate the queuing of heliostats through a standby position before focusing them on the solar receiver steam generator (SRSG) at the top of the power tower (Palen 2012a, §§ 2.2.1.2, 2.2.1.3). The requirement for providing excess reflective surface is based on the information provided by BrightSource for Hidden Hills Solar Electric Generating Systems and Rio Mesa Solar Electric Generating System projects, which have unit areas that provide the identical nominal capacity of 250 MW as PSEGS. In each case, the heliostats would be located to accommodate 1) specific topographical conditions for each unit site; 2) efficiency factors which account for panel shadowing, tower blockage, mirror spillage, transmittance characteristics of the mirrors and SRSG, and the characteristic cosine effect; 3) standby factor for bringing heliostats on- and off-line; and 4) panel reserves for handling offline maintenance and repair.

Maintenance Program

Equipment manufacturers provide maintenance recommendations for their products, and the project owner would most likely base the project's maintenance program on those recommendations. Such a program would encompass both preventive and predictive maintenance techniques. Maintenance outages would probably be planned for periods of low electricity demand. Staff expects that the project would be adequately maintained to ensure an acceptable level of reliability.

FUEL AND WATER AVAILABILITY

The long-term availability of fuel and of water for cooling or process use is necessary to ensure the reliability of any power plant. The need for reliable sources of fuel and water is obvious; lacking long-term availability of either source, the service life of the plant could be curtailed, threatening both the power supply and the economic viability of the plant.

Fuel Availability

The project owner has described its sources of natural gas for the modified project (Palen 2012a, § 2.3). The project has access to an abundance of natural gas through the 200 psig gas transmission line that runs along Interstate Highway 10. Owned by SoCal Gas, this pipeline is connected to natural gas resources spanning the Rocky Mountains, Canada and the southwest. The gas transmission system, of which the I-10 pipeline is a part, is an existing infrastructure that has the capability of carrying up to 6.2 billion cubic feet per day from production areas in the Permian Basin of west Texas and the San Juan Basin of southern Colorado.[3] The maximum possible natural gas demand from the project is 0.53 million cubic feet per hour, constituting about 2 percent of this

[3] U.S Energy Information Administration, "Natural Gas Pipelines in the Western Region, http://www.eia.gov/pub/oil_gas/analysis_publications/ngpipeline/western.html.

capacity. Therefore, it would be highly unlikely that the project would create a substantial increase in fossil fuel demand. Staff believes that there will be adequate fuel supply to meet the project's needs.

Water Supply Reliability

PSEGS has proposed to use well water for domestic and industrial water needs, including steam cycle makeup, mirror washing, service water and fire protection water. The project would be dry cooled, so no water would be required for power plant cooling. The quantities of water to be consumed by the project are relatively small compared to the capacity of the resource available, and it seems feasible to physically draw out the water for delivery to the project site. Thus, this source of water supply seems adequate. Therefore, staff concludes that this source of water supply is a reliable source of water for the project (see the **SOIL AND WATER RESOURCES** section of this document for a further discussion of water supply).

POWER PLANT RELIABILITY IN RELATION TO NATURAL HAZARDS

Natural forces can threaten the reliable operation of a power plant. Tsunamis (tidal waves) and seiches (waves in inland bodies of water) are not likely to present hazards for this project, but seismic shaking (earthquakes), flooding and high winds could present credible threats to the project's reliable operation (Solar Millennium 2009a, AFC §§ 2.5.6, 5.5.2, 5.17.2.9, Palen 2012a, § 3.1.3.4).

Seismic Shaking

No active faults are present within the project boundaries or within a 2.5 mile radius of the site (Palen 2012a, § 3.1.3.4); see the "Faulting and Seismicity" portion of the **GEOLOGY AND PALEONTOLOGY** section of this document. The project will be designed and constructed to the latest applicable LORS (Solar Millennium 2009a, AFC Appendix C). Compliance with current seismic design LORS represents an upgrading of performance during seismic shaking compared to older facilities since these LORS have been continually upgraded. Because it would be built to the latest seismic design LORS, this project would likely perform at least as well as, and perhaps better than, existing plants in the electric power system. Staff has proposed conditions of certification to ensure this; see the section of this document entitled **FACILITY DESIGN**. In light of the general historical performance of California power plants and the electrical system in seismic events, staff has no special concerns with the power plant's functional reliability during earthquakes.

Flooding

Portions of the site lie within a 100-year or 500-year flood plain (Solar Millennium 2009a, AFC § 5.17.1.3). Project features would be designed and built to provide adequate levels of flood resistance. Staff believes there are no special concerns with power plant functional reliability due to flooding. For further discussion, see **WATER RESOURCES** and **GEOLOGY AND PALEONTOLOGY**.

High Winds

High winds are common in the region of the site, which could potentially cause damage to the solar mirrors. Project features would be built to withstand wind loading; however, mirror arrays would have to be stowed during high winds to protect the mirrors. Design would be in accordance with applicable LORS, including the 2010 California Building Code (**Facility Design**). Staff believes there are no special concerns with power plant functional reliability due to wind.

COMPARISON WITH EXISTING FACILITIES

The North American Electric Reliability Corporation (NERC) maintains industry statistics for availability factors (as well as other related reliability data). The NERC regularly polls North American utility companies on their project reliability through its Generating Availability Data System (GADS) and periodically summarizes and publishes those statistics on the Internet at <http://www.nerc.com>. Energy Commission staff typically compares the project owner's claims for reliability to the statistical reliability of similar power plants. Because solar technology is relatively new and the technologies employed so varied, no NERC statistics are available for solar power plants. Staff's typical side-by-side comparison with other existing facilities thus does not apply. The project's power cycle is based on steam cycle, but the NERC data can be used as a benchmark.

Because natural gas is the primary type of fossil fuel used in California, staff finds it reasonable to compare the project's availability factor to the average availability factor of natural gas-fired fossil fuel units. Also, because the project's total net power output would be 500 MW, staff uses the NERC statistics for 400–599 MW units. The NERC reported an equivalent availability factor of 81.4 percent as the generating unit average during the years 2007 through 2011 for natural gas units of 400–599 MW (NERC 2012). The availability factor, which does not account for unplanned outages, comes in at 82.8 percent in the same period sample.

The PSEGS project would use triple-pressure (high, intermediate and low) condensing steam turbine technology. Steam turbines incorporating this technology have been on the market for many years and are expected to exhibit typically high availability. Also, because solar-generated steam is cleaner than combusted fossil fuel (i.e., natural gas), the PSEGS steam cycle units would likely require less frequent maintenance than units that burn fossil fuel, when subject to the same operating conditions. Therefore, the project owner's expectation of an annual availability factor of 92 to 98 percent (Palen 2012a, §§ 2.12, 3.1.4.1) appears reasonable when compared with the NERC figures throughout North America. In fact, these machines can be expected to outperform the fleet of various turbines (mostly older and smaller) that make up NERC statistics.

A concentrated solar power plant (CSP) is limited to daytime operation when the sun is shining. From a maintenance standpoint, scheduled short-term repairs can be made on a daily basis because of the diurnal nature of the solar energy supply. This feature would factor planned outages out of the availability calculations, leaving only unplanned outages as the singular event within the solar production day. The NERC data presented above reflects the downward trend of availability caused by the aging of the database sample used. Comparing the NERC data to a new facility does not fully reflect the benefits of current steam system technology to the determination of plant availability.

Counterpoint to high end availability would be operating conditions unique to CSP operation: 1) accommodation of planned maintenance that would necessarily extend longer than a nighttime period cycle; 2) the daily start-up cycle that would thermally stress the steam generation cycle system components more than continuous baseline operation; and 3) the interruption of power generation due to unforeseeable natural events such as cloud cover, wind storms and ground fog.

Rather than attempt derivation, staff looked at several existing CSPs with similar steam generation systems in duty and size: The Luz/NextEra Solar Electric Generating Systems SEGS III through IX.[4] Developed by Luz in the late 1990's and currently operated by NextEra, SEGS is located near Kramer Junction and Hinkley, California on the same desert plateau as PSEGS. The 2012 annual report for the SEGS project included availability factors which ranged from 86 percent to 92 percent.[5] Since these availability values are derived from real-time operation, the percentages already reflect the effects of extended planned maintenance, daily duty cycling and natural weather occurrences. By factoring out the intermediate HTF circuit and taking advantage of lessons learned from 10-15 years of CSP commercial experience, the project owner's 6 percent jump in availability range for PSEGS, i.e., 86-92 percent to 92-98 percent would not be unreasonable.

PROJECT-RELATED FUTURE ACTIONS

The Southern California Edison (SCE) Red Bluff Substation is expected to be operational in December, 2013. Staff concludes that there won't be any overlap of construction phase of SCE Red Bluff Substation and the PSEGS. The Red Bluff Substation would not impact the reliability of any power plant, including the proposed PSEGS, and therefore, no analysis is required.

NOTEWORTHY PUBLIC BENEFITS

This project, if successful, would help serve the need for renewable energy in California.

RESPONSE TO COMMENTS

Staff received no comments relating to Power Plant Reliability.

[4] SEGS III thru VII: Production Data in Compliance Report transmitted from Robert Fimbres/NextEra to Dale Rundquist/CEC dated 2/26/13. SEGS VIII and IX: Annual Compliance Report, SEGS VII & IX. Submitted to CEC, prepared by NextEra Energy Operation Services, LLC to Luz Solar Partners VIII & IX, Harper Lake, California.

[5] Discounting the January data, the plant's availability range and average would be 86-92 percent and 89 percent respectively. (This range is actually 81-92 percent, but the 81 percent low end value of this range includes a mid-winter January shutdown of all seven solar plants to install a design retrofit on the parabolic collector portion of the system and not related to the steam generation cycle.)

CONCLUSIONS

The project owner predicts an equivalent availability factor of between 92 and 98 percent, which staff believes is achievable and consistent with its own analyses. Based on a review of the proposal, staff concludes that the modified PSEGS would be built and would operate in a manner consistent with industry norms for reliable operation. No conditions of certification are proposed.

PROPOSED CONDITIONS OF CERTIFICATION

No Conditions of Certification are proposed.

REFERENCES

NERC (North American Electric Reliability Council). 2012. 2007–2011 Generating Availability Report.

Palen 2012a – Palen Solar Holdings, LLC/Galati Blek, Scott Galati (TN 68910). Palen Solar Holdings LLC's Petition for Amendment, dated December 17, 2012. Submitted to CEC/C. Stora on December 18, 2012.

Solar Millennium 2009a – Solar Millennium (TN 52937). Application for Certification Vol. 1 & 2, dated 8/24/2009.

TRANSMISSION SYSTEM ENGINEERING

Testimony of Laiping Ng and Mark Hesters

SUMMARY OF CONCLUSIONS

The proposed Palen Solar Electric Generating System (PSEGS) project has no substantial changes to Transmission System Engineering (TSE) compared to the original licensed Palen Solar Power Project (PSPP). Except for the change in generation technology, the generation output and the interconnection facilities remain unchanged. No new conditions or changes to conditions of certification are required.

The proposed interconnection facilities including the PSEGS 230 kV project switchyard, the 230 kV overhead generator tie-line, and its termination at the new Southern California Edison (SCE) Red Bluff substation, are acceptable and would comply with applicable laws, ordinances, regulations and standards (LORS).

The California Independent System Operator's (California ISO) approved PSEGS's conversion to solar tower from the original PSPP parabolic trough field technology. The California ISO's Transition Cluster Phase I and Phase II Interconnection Study Reports for the PSPP are applicable to the PSEGS.

The California ISO Transition Cluster Phase II Study Report – Group Report in SCE's Eastern Bulk System (Phase II Group Study) indicates the reliable interconnection and delivery of projects in the Eastern bulk system, which includes the PSEGS, would require the following upgrades to the existing or planned SCE transmission system:

- Replacement or upgrade of many circuit breakers at substations in the SCE system. Circuit breaker replacement generally occurs within the fence line of existing substation facilities.
- The use of new or expanded Special Protection Systems (SPS). These are essentially operating procedures that reduce the output of generators under specific conditions in order to avoid overloading transmission equipment.
- Reconductor of the drops of the Mira Loma–Vista 220 kV transmission line at the Vista substation. The "drops" are the portion of the line that comes into the substation.

The West of Devers upgrades, including reconductoring and relocation of four 220 kV transmission lines west of the Devers substation, have been identified in SCE transmission plans for several years starting in 2007 as needed to reliably serve future loads in the SCE service area and would therefore be needed to maintain system reliability even if the Eastern Bulk System generators were not constructed. Also, based on the SCE Devers-Palo Verde #2 Project upgrade timeline, the construction of the Red Bluff substation and looping the 2nd Colorado River–Devers 500 kV transmission line into the proposed Red Bluff substation is expected to be operational by the 3rd quarter of 2013.

INTRODUCTION

STAFF ANALYSIS

The Transmission System Engineering (TSE) analysis examines whether or not the facilities associated with the proposed interconnection conform to all applicable LORS required for safe and reliable electric power transmission. Staff's analysis evaluates the power plant switchyard, outlet line, termination facilities, and downstream facilities identified by the applicant. Additionally, under the California Environmental Quality Act (CEQA), the Energy Commission must conduct an environmental review of the "whole of the action," which may include facilities not licensed by the Energy Commission (California Code of Regulations, title 14, §15378). Therefore, the Energy Commission must identify the system impacts and necessary new or modified downstream transmission facilities (beyond the first point of the proposed interconnection) that are required for interconnection.

Energy Commission staff analyzes studies performed by the interconnecting authority, in this case the California ISO, to determine the impacts on the transmission grid from the proposed generator interconnection. Staff's analysis also identifies new or modified facilities downstream of the first point of interconnection that may be required as mitigation measures. The proposed project would connect to the SCE transmission network and requires analysis by SCE and approval of the California ISO.

CHANGING GENERATION TECHNOLOGY

On December 6, 2012, the Applicant filed a Modification Request to the California ISO for the change of the generation technology from parabolic trough field to solar tower. A response letter dated April 22, 2013, was sent to Chifong Thomas, Senior Director of the Transmission and Strategy for Brightsoruce Energy, Inc. from the California ISO. The California ISO letter stated that: "the ISO has not found a material impact on this change in generation technology; therefore, the conversion to solar tower is approved. Southern California Edison ("SCE") concurs with this analysis and the ISO will work with SCE and Brightsource to incorporate these modifications for the Project in an amendment to the LGIA".

As the change in generation technology has no material impact, the total generation output remains 500 MW, and the PSEGS interconnection would still be to the Red Bluff substation, the existing California ISO Phase I and Phase II Interconnection Studies are applicable to the new plant generation technology and configuration.

SOUTHERN CALIFORNIA EDISON'S ROLE

SCE is responsible for ensuring electric system reliability on its transmission system with the addition of the proposed transmission modifications, and determines both the standards necessary to ensure reliability and whether the proposed transmission modifications conform to existing standards. The California ISO will provide analysis in its Phase I and Phase II Interconnection Studies, and its approval for the facilities and changes required in its system for addition of the proposed transmission modifications.

California ISO'S Role

The California ISO is responsible for dispatching generating units in California, ensuring electric system reliability for all participating transmission owners and for developing the standards and procedures necessary to maintain system reliability. The California ISO will also determine the reliability impacts of the proposed transmission modifications on the SCE transmission system in accordance with all applicable reliability criteria. According to the California ISO Tariff, it will determine the need for transmission additions or upgrades downstream from the interconnection point to ensure reliability of the transmission grid. The California ISO performed the Phase I and Phase II Interconnection Studies and provided its analysis, conclusions, and recommendations. The Phase II Interconnection Study includes the California ISO conclusions and recommendations. If necessary, the California ISO will provide written and verbal testimony on its findings at the Energy Commission hearings.

LAWS, ORDINANCES, REGULATIONS, AND STANDARDS

- California Public Utilities Commission (CPUC) General Order 95 (GO-95), "Rules for Overhead Electric Line Construction", formulates uniform requirements for construction of overhead lines. Compliance with this order ensures adequate service and safety to persons engaged in the construction, maintenance and operation or use of overhead electric lines and to the public in general.
- California Public Utilities Commission (CPUC) General Order 128 (GO-128), "Rules for Construction of Underground Electric Supply and Communications Systems", formulates uniform requirements and minimum standards to be used for underground supply systems to ensure adequate service and safety to persons engaged in the construction, maintenance and operation or use of underground electric lines and to the public in general.
- The National Electric Safety Code, 2012 provides electrical, mechanical, civil and structural requirements for overhead electric line construction and operation.
- NERC/WECC Planning Standards: The Western Electricity Coordinating Council (WECC) Planning Standards are merged with the North American Electric Reliability Council (NERC) Planning Standards and provide the system performance standards used in assessing the reliability of the interconnected system. These standards require the continuity of service to loads as the first priority and preservation of interconnected operation as a secondary priority. Certain aspects of the NERC/WECC standards are either more stringent or more specific than the NERC standards alone. These standards provide planning for electric systems so as to withstand the more probable forced and maintenance outage system contingencies at projected customer demand and anticipated electricity transfer levels, while continuing to operate reliably within equipment and electric system thermal, voltage and stability limits. These standards include the reliability criteria for system adequacy and security, system modeling data requirements, system protection and control, and system restoration. Analysis of the WECC system is based to a large degree on NERC Standards TPL-001 through TPL-004 of the standards and "Table I. Transmission System Standards _ Normal and Emergency Conditions" and WECC Disturbance-Performance Table" and on Section I.D, "NERC and WECC Standards

for Voltage Support and Reactive Power". These standards require that the results of power flow and stability simulations verify defined performance levels. Performance levels are defined by specifying the allowable variations in thermal loading, voltage and frequency, and loss of load that may occur on systems during various disturbances. Performance levels range from no significant adverse effects inside and outside a system area during a minor disturbance (loss of load or a single transmission element out of service) to a level that seeks to prevent system cascading and the subsequent blackout of islanded areas during a major disturbance (such as loss of multiple 500 kV lines along a common right of way, and/or multiple generators). While controlled loss of generation or load or system separation is permitted in certain circumstances, their uncontrolled loss is not permitted (WECC Ongoing).

- North American Reliability Council (NERC) Reliability Standards for the Bulk Electric Systems of North America provide national policies, standards, principles and guidelines to assure the adequacy and security of the electric transmission system. The NERC Reliability Standards provide for system performance levels under normal and contingency conditions. With regard to power flow and stability simulations, while these Reliability Standards are similar to NERC/WECC Standards, certain aspects of the NERC/WECC Standards are either more stringent or more specific than the NERC Standards for Transmission System Contingency Performance. The NERC Reliability Standards apply not only to interconnected system operation but also to individual service areas (NERC Ongoing).
- California ISO Planning Standards also provide standards and guidelines to assure the adequacy, security and reliability in the planning of the California ISO transmission grid facilities. The California ISO Grid Planning Standards incorporate the NERC/WECC and NERC Reliability Planning Standards. With regard to power flow, stability simulations, Special Protection Systems and Load Interruption Standards, these Planning Standards are similar to the NERC/WECC or NERC Reliability Planning Standards for Transmission System Contingency Performance. However, the California ISO Standards also provide some additional requirements that are not address in the NERC / WECC standards, provide interpretations of the NERC/WECC criteria specific to the ISO grid, and identify whether specific criteria should be adopted. The California ISO Standards apply to all participating transmission owners interconnecting to the California ISO controlled grid. They also apply when there are any impacts to the California ISO grid due to facilities interconnecting to adjacent controlled grids not operated by the California ISO. The California ISO standards will be revised from time to time to ensure they are consistent with the current state of the electrical industry and in conformance with NERC Reliability Standards and WECC Regional Criteria (California ISO June, 23 2011).
- California ISO/FERC Electric Tariff provides guidelines for construction of all transmission additions/upgrades (projects) within the California ISO controlled grid. The California ISO determines the "Need" for the proposed modified project where it will promote economic efficiency or maintain system reliability. The California ISO also determines the Cost Responsibility of the proposed modified project and provides an Operational Review of all facilities that are to be connected to the California ISO grid (California ISO 2007a).

PROJECT DESCRIPTION

Palen Solar I, LLC originally proposed to construct, own and operate the PSPP. The original proposed project would be a concentrated solar thermal electric generating facility with two adjacent solar plants. Each solar generating plant would use a 300 MVA steam turbine generating unit for a combined net output of 530 MW. The project's planned operational date was summer 2013.

Generating Unit 1 requires a 9,200 foot long transmission line to the PSPP switchyard and Generating Unit 2 requires a 4,000 foot long transmission line. Each line would be connected to a common bus segment at the PSPP switchyard. The PSPP power would be transmitted from the PSPP switchyard to the SCE Red Bluff substation via an 8 mile long double circuit 230 kV transmission line. (PSPP 2009b, section 1.0, 2.6 and Figures 2.9, 2-14, 2-15, 2-16)

Palen Solar Holdings, LLC currently proposes to amend the original licensed PSPP and change the name to PSEGS. The proposed PSEGS project would be a solar thermal electric generating facility with two solar plants. Each solar generating plant would consist of a solar field and a power block. The PSEGS would uses heliostats to focus sun rays on a solar receiver steam generator (SRSG). The steam turbine generator (STG) will receive steam from the SRSG to generate electricity.

Each solar generating plant would have a steam turbine unit rated at 317 MVA with a power factor of 0.90, resulting in a maximum power output of 285 MW. For two solar generating plants, the maximum output would be 570 MW. Approximately 22 MW of the generating power would be used for auxiliary load. Thus, although the project owner has applied to the California ISO and the Energy Commission for only 500 MW of generation, the PSEGS could generate up to 548 MW. The project's planned operational date is approximately be the end of June 2016.

The STG would be connected through a 21 kV 10,000-ampere generator circuit breaker via a short 10,000-ampere isolated phase bus duct to the low side of its dedicated 190/253/315 MVA generator step-up (21/230 kV) transformer. The auxiliary power for each unit would be provided through its dedicated back-fed transformer (21/4.16/13.8 kV) which is connected between the STG circuit breaker and the low side of the step-up transformer through 10,000-ampere isolated phase bus duct.

For each generating unit, the 230 kV side of its step-up transformer would be connected through a 230 kV, 1,200 ampere disconnect switch and a 230 kV underground cable (XLPE copper cable between 1,250 kcmil and 1,750 kcmil) to the 230 kV project switchyard. Generating Unit 1 requires a 6,234 foot long underground cable to the project switchyard and Generating Unit 2 requires a 14,586 foot long underground cable. Each line would be connected to a common bus segment at the Palen project switchyard. The proposed Palen switchyard would consist of a 2,000 amps 230 kV circuit breaker, two 2,000 amps 230 kV disconnect switches and protection circuits (Palen 2012 A, section 2.1.3, 2.2.2, section 3.2.2 Figure 3.2-1, Figures 3.2-2, Palen 2013l).

SWITCHYARDS AND INTERCONNECTION FACILITIES

Power generated by the PSEGS would be transmitted from the project switchyard to the proposed SCE 500/230 kV Red Bluff substation via a 6.9 mile long single circuit 230 kV transmission line. The single circuit line would be built with twin-bundled, 795 kcmil conductors which are capable of carrying 1,814 amps at 75 degrees centigrade. The proposed overhead generator transmission line is rated to carry the full capacity of the 548 MW PSEGS. The 230 kV transmission line would be supported by mono-pole structures at approximately 1,100 foot intervals, and the final pole height would be determined during the detailed design phase of the transmission facilities. The applicant has proposed to extend the bus work within the breaker-and–a-half Red Bluff substation to interconnect the solar plant. The modification of the Red Bluff substation would consist of one new 230 kV 3,000 amp circuit breaker, and two 230 kV 3,000 amp disconnect switches. SCE and the applicant agreed to connect the PSEGS switchyard to the proposed Red Bluff 500/230 kV substation. Power would be distributed to the grid via transmission lines connected to the Red Bluff substation (Palen 2012a, section 2.1.3, 2.2.2, Figures 3.2-2, Palen 2013l, Palen 2013n).

ASSESSMENT OF IMPACTS AND DISCUSSION OF MITIGATION

For the interconnection of a proposed generating unit or transmission facility to the grid, the interconnecting utility and the control area operator are responsible for ensuring grid reliability. For the PSEGS, SCE and the California ISO are responsible for ensuring grid reliability.

The California ISO's generator interconnection study process is in transition from a serial process to an interconnection window cluster study process. The PSPP was studied under the window cluster process and the transmission reliability impacts of the proposed modified project were studied in the Phase I and Phase II Studies. The Phase I Study is similar to the former System Impact Study except it is now performed for a group of projects in the same geographical area of a utility that apply for interconnection in the same request window. The Phase II Study (former Facilities Study) is performed after generators in each cluster meet specific milestones required to stay in the generator interconnection queue. The Phase II Study is then performed based on the number of generators left in each cluster.

The Phase I and Phase II Studies for projects in the transition cluster were conducted to determine the preferred and alternative generator interconnection methods, and to identify any mitigation measures required to ensure system conformance with utility reliability criteria, NERC planning standards, WECC reliability criteria, and California ISO reliability criteria. Staff relies on the studies and any review conducted by the responsible agencies to determine the effect of the projects on the transmission grid and to identify any necessary downstream facilities or indirect project impacts required to bring the transmission network into compliance with applicable reliability standards (NERC 2006, WECC 2006, California ISO 2002a, 2007a & 2009a).

The Phase II Study analyzed the grid with and without the generator or generators in the cluster under conditions specified in the planning standards and reliability criteria. The standards and criteria defined the assumptions used in the study and established the thresholds by which grid reliability was determined. The studies must analyze the impact of the projects for their proposed first year(s) of operation and thus were based on a forecast of loads, generation and transmission. Load forecasts were developed by the interconnected utility, which was SCE in this case. Generation and transmission forecasts were based on the interconnection queue. The studies focused on thermal overloads, voltage deviations, system stability (excessive oscillations in generators and transmission system, voltage collapse, loss of loads or cascading outages), short circuit duties and substation evaluation.

Under the new California ISO LGIP, generators are able to choose between either “full capacity” or “energy only”, depending on whether or not the generator wants to have the right to generate energy 24 hours per day. A generator that chooses the full capacity option will be required to pay for transmission network upgrades that are needed to allow the generator to operate under virtually any system conditions and as such could sign contracts that allow them to provide capacity to utilities. Energy only generators would not pay for network transmission upgrades, and essentially would have access to as available transmission capacity, and would likely not be able to sign capacity contracts.

If the studies show that the interconnection of the project or cluster of projects causes the grid to be out of compliance with reliability standards, the study will then identify mitigation alternatives or ways in which the grid could be brought into compliance with reliability standards. If the interconnecting utility determines that the only feasible mitigation includes transmission modifications or additions that require CEQA review as part of the “whole of the action,” the Energy Commission must analyze those modifications or additions according to CEQA requirements. Where the Phase II Study identifies transmission modifications required for the reliable interconnection of a cluster of generators, staff will analyze the proposed generating project’s impact on individual reliability criteria violations to determine whether or not the identified mitigation measures are a reasonably foreseeable consequence of the proposed modified project.

SCOPE OF THE TRANSITION CLUSTER PHASE I AND PHASE II INTERCONNECTION STUDIES

The July 28, 2009, Transition Cluster Phase I Interconnection Study was prepared by the California ISO in coordination with SCE. Fifteen queue generation projects, including the proposed 500 MW PSPP in the Eastern Riverside County area with a total of 10,040 MW net generation output, were included in this cluster study. As of December 4, 2009 only five projects (2,200 MW) of the original 15 projects remained in the interconnection queue. Reducing the size of the cluster by 10 projects and over 7,000 MW meant the Phase 1 Study results for the cluster were not a reasonable forecast of the reliability impacts of the proposed modified project.

Generally staff relies on the California ISO Phase I/SIS to determine whether or not the proposed generation project will likely comply with reliability and to identify the transmission facilities required for reliable interconnection. For the Transition Cluster projects, the Phase I Study did not provide an accurate forecast of impacts of the PSPP on the SCE transmission grid. Therefore, staff has relied on the Phase II Group Study that was completed on July 8, 2010 and received on July 23, 2010, to determine the PSEGS impact on grid reliability and identify transmission upgrades for reliable interconnection.

The changes between the Transition Cluster Phase I and Phase II Studies for the Eastern Bulk System, included the withdrawal of ten generation projects totaling 7,490 MW, changing the point of interconnection of one generation project, and a reduction of 350 MW of generation from two projects. For study purposes, five generation projects totaling a maximum output of 2,200 MW were included in the SCE Transition Cluster base cases. During the study, three of these projects, PSPP, the Blythe Solar Power Project and the Genesis Solar Energy Project were seeking licenses from the California Energy Commission.

The Phase II Group Study modeled the PSPP with a net output of 500 MW. The base case was developed from WECC's 2013 Peak load and 2013 Off-Peak load base case series and included all major SCE transmission projects, and all proposed higher queued generation projects that will be operational by 2013. The Phase II Group Study pre-project base cases were modeled to include the Devers–Colorado River project (DCR), which is the California portion of Devers–Palo Verde 2 (DPV2), and the proposed 500 kV switchyard at Colorado River substation. The power flow studies were conducted with and without the proposed Transition Cluster Phase II projects connected to the SCE grid at each project's interconnection switchyard. The detailed study assumptions were described in the study. The power flow study assessed the Transition Cluster Phase II projects impact on thermal loading of the transmission lines and equipments. Transient and post-transient studies were conducted using the Peak load full loop base case to determine whether the Transition Cluster Phase II projects would create instability in the system following certain selected outages. Short circuit studies were conducted to determine if the Transition Cluster Phase II projects would overstress existing substation facilities. (Cal ISO 2010a)

PHASE II STUDY RESULTS FOR TRANSITION CLUSTER PROJECTS

Power Flow Study Results and Mitigation Measures

The Phase II Group Study identified pre-project overload criteria violations under 2013 Summer Peak and Off-Peak study condition. Pre-project overloads are caused by either existing system conditions or by projects with higher positions in the SCE's generator interconnection queue. The study concluded that the addition of the Phase II Transition Cluster projects would cause a number of pre-existing normal and /or emergency overloads to increase and would cause some new normal and emergency overloads (Cal ISO 2010a).

Results of the Phase II Group Study are detailed below. Where potential overloads were identified, mitigation was proposed to eliminate the potential reliability impact.

Normal Overloads (N-0)

The power flow study indicated that the Phase II Transition Cluster projects would cause three normal overloads under 2013 Peak load conditions and Off-Peak load conditions. The predicted overload facilities were the same for both Peak and Off-Peak load conditions.

Overloaded Transmission Facilities:

- Devers–San Bernardino 220 kV No. 1 line
- Devers–San Bernardino 220 kV No. 2 line
- Devers-Vista 220 kV No. 1 line

Recommended Mitigation:

A combination of congestion management for base case and contingency overloads, the West-of-Devers upgrade project, and the looping the 2nd Colorado River–Devers 500 kV transmission line into the Red Bluff substation are required to mitigate the power flow impacts caused by the project. The detailed electrical facilities needed to mitigate the overload criteria violations have been addressed and selected in the group report in SCE’s Eastern Bulk System.

Category B (N-1)

The power flow study indicated that the Phase II Transition Cluster projects would cause four N-1 overloads under 2013 Peak load conditions and Off-Peak load conditions. The predicted overload facilities were the same for both Peak and Off-Peak load conditions.

Overloaded Transmission Facilities:

- Devers–San Bernardino 230 kV No. 1 line
- Devers–San Bernardino 230 kV No. 2 line
- Devers-Vista 230 kV No. 1 line
- Devers-Vista 230 kV No. 2 line

Recommended Mitigation:

A combination of congestion management for base case and contingency overloads, the West-of-Devers upgrade project, and the looping the 2nd Colorado River–Devers 500 kV transmission line into the Red Bluff substation are required to mitigate the power flow impacts caused by the project. The detailed electrical facilities needed to mitigate the overload criteria violations have been addressed and selected in the group report in SCE’s Eastern Bulk System.

Category C (N-2)

The power flow study indicated that the Phase II Transition Cluster projects would cause five new N-2 overloads under 2013 Peak load conditions and Off-Peak load conditions. The three predicted overload facilities were the same for both Peak and Off-Peak load conditions. Additionally one new overload was revealed.

Overloaded Transmission Facilities:

- Devers–San Bernardino 220 kV No. 1 line
- Devers–San Bernardino 220 kV No. 2 line
- Devers-Vista 220 kV line No. 1 line
- Devers-Vista 220 kV No. 2 line
- Mira Loma–Vista 220 kV No. 2 line

Recommended Mitigation:

A combination of congestion management, the West-of-Devers upgrade project, and the looping the 2nd Colorado River–Devers 500 kV transmission line into the Red Bluff substation are required to mitigate the power flow impacts caused by the project. The detailed electrical facilities needed to mitigate the overload criteria violations have been addressed and selected in the group report in SCE's Eastern Bulk System.

Transient Stability Study Results and Mitigation Measures

Transient stability studies were conducted using the full loop base cases to ensure that the transmission system remained in operating equilibrium, as well as operating in a coordinated fashion, through abnormal operating conditions after the Phase II Transition Cluster projects became operational. Disturbance simulations were performed for a study period of 10 seconds to determine whether the Phase II Transition Cluster projects would create any system instability during line and generator outages. All outage cases were evaluated with the assumption that existing Special Protection Systems (SPS) or Remedial Action Schemes (RAS) would operate as designed. The most critical single contingency and double contingency outage conditions in the east and west of Devers area within the overall SCE Eastern Bulk System were evaluated. The transient study identified system instability during the N-2 outages. Therefore, an SPS has been proposed as a mitigation measure that will curtail the 1,400 MW of generation of the Phase II Transition Cluster projects. The proposed PSEGS project has been included in rearming the SPS. (Transition Cluster Phase II Interconnection Study Report, SCE's Eastern Bulk System, Appendix F Dynamic Stability Plots)

Reactive Power Deficiency Analysis Results

Reactive power deficiency analysis was performed in the group study. The reactive power deficiency analysis included power flow sensitivity analysis in the Eastern Bulk System. The study found no reactive deficiency from this PSEGS project to the SCE bulk system.

Short Circuit Study Results and Mitigation Measures

Short circuit studies were performed to determine the degree to which the addition of the Phase II Transition Cluster projects would increase fault duties at SCE's substations, adjacent utility substations, and the other 115 kV, 230 kV and 500 kV busses within the study area. The fault duties were calculated with and without the Phase II Transition Cluster projects to identify any equipment overstress conditions. All bus locations where the Phase II Transition Cluster projects increased the short circuit duty by 0.1 kA or more and where the short circuit duty was in excess of 60% of the minimum breaker nameplate rating are listed in Appendix H of the Transition Cluster Phase II Interconnection Study Report, SCE's Eastern Bulk System. With the addition of the Transition Cluster Phase II projects, the following overstressed circuit breakers were identified at the following substations: Vincent 500 kV substation – 11 breakers, Kramer 220 kV substation – 5 breakers, Windhub 220 kV substation – 9 breakers, and Antelope 66 kV substation – 2 breakers. Mitigation measures included the following:

- Vincent 500 kV substation: replace seven circuit breakers and upgrade four circuit breakers
- Kramer 220 kV substation: replace five circuit breakers
- Windhub 220 kV substation: sectionalize 220 kV bus
- Antelope 66 kV substation: operating procedure to reduce short circuit duty

CUMULATIVE IMPACTS

Staff has reviewed the list of existing and foreseeable projects as presented in the Cumulative Scenario section of this analysis. Staff's review considers whether the interconnection of PSEGS to SCE's transmission system along with other existing and foreseeable generation projects would conform to all LORS required for safe and reliable electric power transmission. The analysis described above under the heading Scope of the Transition Cluster Phase I and Phase II Interconnection Studies is conducted in coordination with, and with the approval of, the California ISO to consider existing and proposed generator interconnections to the transmission grid and the potential safety and reliability impacts under a number of conservative contingency conditions.

The cumulative marginal impacts to the safe and reliable operation of the transmission system due to the PSPP project, as identified in the Phase II Study, would be mitigated with the Energy Commission's and BLM's incorporation of the mitigation measures and Conditions of Certification set forth in this section.

COMPLIANCE WITH LORS

The proposed interconnection facilities including the PSEGS 230 kV project switchyard, generator 230 kV overhead tie line to the new SCE Red Bluff 230 kV substation, and its termination at the new 230 kV substation are adequate in accordance with industry standards and good utility practices, and are acceptable to staff. Staff believes that existing Conditions of Certification **TSE-1** through **TSE-7** will ensure the proposed PSEGS complys with applicable LORS:

1. Condition of Certification **TSE-1** will ensure that the preliminary equipment is in place for construction of the transmission facilities of the proposed project to comply with applicable LORS.

2. Condition of Certification **TSE-2** will ensure that the proper personnel are ready to manage and monitor the construction of the transmission facilities for the proposed project to comply with applicable LORS.

3. Condition of Certification **TSE-3** will ensure that any changes to the proposed transmission facilities would comply with applicable LORS.

4. Condition of Certification **TSE-4** will ensure that the final design of the proposed transmission facilities would comply with applicable LORS.

5. Condition of Certification **TSE-5** will ensure that the proposed project would be properly interconnected to the transmission grid. **TSE-5** also ensures that the generator output would be properly delivered to the transmission system.

6. Condition of Certification **TSE-6** will ensure that the project would synchronize with the existing transmission system and the operation of the facilities would comply with applicable LORS.

7. Condition of Certification **TSE-7** will ensure that the proposed project has been built to required specifications and the operation of the facilities would comply with applicable LORS.

The Phase II Interconnection Study indicates that the project interconnection would comply with all NERC/WECC planning standards and California ISO reliability criteria as long as the identified Reliability Network Upgrades are implemented.

RESPONSE TO COMMENTS

Staff received no comments relating to **Transmission System Engineering**.

CONCLUSIONS

The proposed PSEGS amendment project has no substantial changes to TSE compared to the original licensed PSPP. Except for the change in generation technology, the generation output and the interconnection facilities remain unchanged. No new conditions or changes to conditions of certification are required.

The proposed interconnection facilities including the PSEGS 230 kV project switchyard, the 230 kV overhead generator tie-line, and its termination at the new SCE Red Bluff substation, are acceptable and would comply with applicable LORS.

California ISO approved PSEGS's conversion to solar tower from the original PSPP parabolic trough field technology. The California ISO's Transition Cluster Phase I and Phase II Interconnection Study Reports for the PSPP are applicable to the PSEGS.

The California ISO Phase II Study Report – Group Report in SCE's Eastern Bulk System indicates the reliable interconnection and delivery of projects in the Eastern bulk system, which includes the PSEGS, would require the following upgrades to the existing or planned SCE transmission system:

- Replacement or upgrade of many circuit breakers at substations in the SCE system. Circuit breaker replacement generally occurs within the fence line of existing substation facilities.
- The use of new or expanded SPS. These are essentially operating procedures that reduce the output of generators under specific conditions in order to avoid overloading transmission equipment.
- Reconductor of the drops of the Mira Loma–Vista 220 kV transmission line at the Vista substation. The "drops" are the portion of the line that comes into the substation.
- The West of Devers upgrades, including reconductoring and relocation of four 220 kV transmission lines west of the Devers substation, have been identified in SCE transmission plans for several years starting in 2007 as needed to reliably serve future loads in the SCE service area and would therefore be needed to maintain system reliability even if the Eastern Bulk System generators were not constructed. Also, based on the SCE Devers-Palo Verde #2 Project upgrade timeline, the construction of the Red Bluff substation and looping the 2nd Colorado River–Devers 500 kV transmission line into the proposed Red Bluff substation is expected to be operational by 3rd quarter of 2013.

PROPOSED CONDITIONS OF CERTIFICATIONS

Staff has no proposed changes to the existing Conditions of Certification as provided below.

TSE-1 The project owner shall furnish to the CPM and to the CBO a schedule of transmission facility design submittals, a Master Drawing List, a Master Specifications List, and a Major Equipment and Structure List. The schedule shall contain a description and list of proposed submittal packages for design, calculations, and specifications for major structures and equipment. To facilitate audits by Energy Commission staff, the project owner shall provide designated packages to the CPM when requested.

Verification: Prior to the start of construction of the transmission facilities, the project owner shall submit the schedule, a Master Drawing List, and a Master Specifications List to the CBO and to the CPM. The schedule shall contain a description and list of proposed submittal packages for design, calculations, and specifications for major structures and equipment (see a list of major equipment below). Additions and deletions shall be made to the table only with CPM and CBO approval. The project owner shall provide schedule updates in the Monthly Compliance Report.

Breakers
Step-up transformer
Switchyard
Busses
Surge arrestors
Disconnects
Take-off facilities
Electrical control building
Switchyard control building
Transmission pole/tower
Grounding system

TSE-2 Before the start of construction, the project owner shall assign to the project an electrical engineer and at least one of each of the following:

a) a civil engineer;

b) a geotechnical engineer or a civil engineer experienced and knowledgeable in the practice of soils engineering;

c) a design engineer who is either a structural engineer or a civil engineer and fully competent and proficient in the design of power plant structures and equipment supports; or

d) a mechanical engineer (Business and Professions Code Sections 6704 et seq. require state registration to practice as either a civil engineer or a structural engineer in California).

The tasks performed by the civil, mechanical, electrical, or design engineers may be divided between two or more engineers as long as each engineer is responsible for a particular segment of the project, e.g., proposed earthwork, civil structures, power plant structures, or equipment support. No segment of the project shall have more than one responsible engineer. The transmission line may be the responsibility of a separate California registered electrical engineer. The civil, geotechnical, or civil and design engineer, assigned as required by **Facility Design** Condition **GEN-5**, may be responsible for design and review of the TSE facilities.

The project owner shall submit to the CBO, for review and approval, the names, qualifications, and registration numbers of all engineers assigned to the project. If any one of the designated engineers is subsequently reassigned or replaced, the project owner shall submit the name, qualifications, and registration number of the newly assigned engineer to the CBO for review and approval. The project owner shall notify the CPM of the CBO's approval of the new engineer. This engineer shall be authorized to halt earth work and require changes; if site conditions are unsafe or do not conform to the predicted conditions used as the basis for design of earth work or foundations.

The electrical engineer shall:

1. be responsible for the electrical design of the power plant switchyard, outlet, and termination facilities; and

2. sign and stamp electrical design drawings, plans, specifications, and calculations.

Verification: Prior to the start of rough grading, the project owner shall submit to the CBO for review and approval, the names, qualifications, and registration numbers of all the responsible engineers assigned to the project. The project owner shall notify the CPM of the CBO's approvals of the engineers within five days of the approval.

If the designated responsible engineer is subsequently reassigned or replaced, the project owner has five days in which to submit the name, qualifications, and registration number of the newly assigned engineer to the CBO for review and approval. The project owner shall notify the CPM of the CBO's approval of the new engineer within five days of the approval.

TSE-3 If any discrepancy in design and/or construction is discovered in any engineering work that has undergone CBO design review and approval, the project owner shall document the discrepancy and recommend corrective action (2001 California Building Code, Chapter 1, section 108.4, approval required; Chapter 17, section 1701.3, *Duties and Responsibilities of the Special Inspector;* Appendix Chapter 33, section 3317.7, *Notification of Noncompliance*). The discrepancy documentation shall become a controlled document and shall be submitted to the CBO for review and approval and refer to this condition of certification.

Verification: The project owner shall submit a copy of the CBO's approval or disapproval of any corrective action taken to resolve a discrepancy to the CPM within 15 days of receipt. If disapproved, the project owner shall advise the CPM, within five days, the reason for the disapproval, along with the revised corrective action required to obtain the CBO's approval.

TSE-4 For the power plant switchyard, outlet line and termination, the project owner shall not begin any construction until plans for that increment of construction have been approved by the CBO. These plans, together with design changes and design change notices, shall remain on the site for one year after completion of construction. The project owner shall request that the CBO inspect the installation to ensure compliance with the requirements of applicable LORS. The following activities shall be reported in the monthly compliance report:

a) receipt or delay of major electrical equipment;

b) testing or energization of major electrical equipment; and

c) the number of electrical drawings approved, submitted for approval, and still to be submitted.

Verification: Prior to the start of each increment of construction, the project owner shall submit to the CBO for review and approval the final design plans, specifications and calculations for equipment and systems of the power plant switchyard, and outlet line and termination, including a copy of the signed and stamped statement from the responsible electrical engineer verifying compliance with all applicable LORS, and send the CPM a copy of the transmittal letter in the next monthly compliance report.

TSE-5 The project owner shall ensure that the design, construction, and operation of the proposed transmission facilities will conform to all applicable LORS, and the requirements listed below. The project owner shall submit the required number of copies of the design drawings and calculations, as determined by the CBO. Once approved, the project owner shall inform the CPM and CBO of any anticipated changes to the design, and shall submit a detailed description of the proposed change and complete engineering, environmental, and economic rationale for the change to the CPM and CBO for review and approval.

a) The power plant outlet line shall meet or exceed the electrical, mechanical, civil, and structural requirements of CPUC General Order 95 or National Electric Safety Code (NESC); Title 8 of the California Code and Regulations (Title 8); Articles 35, 36 and 37 of the *High Voltage Electric Safety Orders*, California ISO standards, National Electric Code (NEC) and related industry standards.

b) Breakers and busses in the power plant switchyard and other switchyards, where applicable, shall be sized to comply with a short-circuit analysis.

c) Outlet line crossings and line parallels with transmission and distribution facilities shall be coordinated with the transmission line owner and comply with the owner's standards.

d) The project conductors shall be sized to accommodate the full output of the project.

e) Termination facilities shall comply with applicable SCE interconnection standards.

f) The project owner shall provide to the CPM:

   i) The Special Protection System (SPS) sequencing and timing if applicable,

   ii) A letter stating that the mitigation measures or projects selected by the transmission owners for each reliability criteria violation, for which the project is responsible, are acceptable, and

   iii) A copy of the executed LGIA signed by the California ISO and the project owner.

Verification: Prior to the start of construction or start of modification of transmission facilities, the project owner shall submit to the CBO for approval:

1. Design drawings, specifications, and calculations conforming with CPUC General Order 95 or National Electric Safety Code (NESC); Title 8 of the California Code and Regulations (Title 8); Articles 35, 36 and 37 of the *High Voltage Electric Safety Orders*, California ISO standards, National Electric Code (NEC) and related industry standards, for the poles/towers, foundations, anchor bolts, conductors, grounding systems, and major switchyard equipment;

2. For each element of the transmission facilities identified above, the submittal package to the CBO shall contain the design criteria, a discussion of the calculation method(s), a sample calculation based on "worst case conditions"[1] and a statement signed and sealed by the registered engineer in responsible charge, or other acceptable alternative verification, that the transmission element(s) will conform with CPUC General Order 95 or National Electric Safety Code (NESC); Title 8 of the California Code and Regulations (Title 8); Articles 35, 36 and 37 of the *High Voltage Electric Safety Orders*, California ISO standards, National Electric Code (NEC), and related industry standards;

3. Electrical one-line diagrams signed and sealed by the registered professional electrical engineer in charge, a route map, and an engineering description of the equipment and configurations covered by requirements **TSE-5** a) through f);

4. The Special Protection System (SPS) sequencing and timing if applicable shall be provided concurrently to the CPM.

[1] Worst-case conditions for the foundations would include for instance, a dead-end or angle pole.

5. A letter stating that the mitigation measures or projects selected by the transmission owners for each reliability criteria violation, for which the project is responsible, are acceptable, and

6. A copy of the executed LGIA signed by the California ISO and the project owner.

Prior to the start of construction of or modification of transmission facilities, the project owner shall inform the CBO and the CPM of any anticipated changes to the design that are different from the design previously submitted and approved and shall submit a detailed description of the proposed change and complete engineering, environmental, and economic rationale for the change to the CPM and CBO for review and approval.

TSE-6 The project owner shall provide the following Notice to the California Independent System Operator (California ISO) prior to synchronizing the facility with the California Transmission system:

1. At least one week prior to synchronizing the facility with the grid for testing, provide the California ISO a letter stating the proposed date of synchronization; and

2. At least one business day prior to synchronizing the facility with the grid for testing, provide telephone notification to the California ISO Outage Coordination Department.

<u>Verification:</u> The project owner shall provide copies of the California ISO letter to the CPM when it is sent to the California ISO one week prior to initial synchronization with the grid. The project owner shall contact the California ISO Outage Coordination Department, Monday through Friday, between the hours of 0700 and 1530 at (916) 351-2300 at least one business day prior to synchronizing the facility with the grid for testing. A report of conversation with the California ISO shall be provided electronically to the CPM one day before synchronizing the facility with the California transmission system for the first time.

TSE-7 The project owner shall be responsible for the inspection of the transmission facilities during and after project construction, and any subsequent CPM and CBO approved changes thereto, to ensure conformance with CPUC GO-95 or NESC, Title 8, CCR, Articles 35, 36 and 37 of the, “High Voltage Electric Safety Orders”, applicable interconnection standards, NEC and related industry standards. In case of non-conformance, the project owner shall inform the CPM and CBO in writing, within 10 days of discovering such non-conformance and describe the corrective actions to be taken.

<u>Verification:</u> Within 60 days after first synchronization of the project, the project owner shall transmit to the CPM and CBO:

1. “As built” engineering description(s) and one-line drawings of the electrical portion of the facilities signed and sealed by the registered electrical engineer in responsible charge. A statement attesting to conformance with CPUC GO-95 or NESC, Title 8, California Code of Regulations, Articles 35, 36 and 37 of the “High Voltage Electric Safety Orders”, and applicable interconnection standards, NEC, related industry standards.

2. An “as built” engineering description of the mechanical, structural, and civil portion of the transmission facilities signed and sealed by the registered engineer in responsible charge or acceptable alternative verification. “As built” drawings of the electrical, mechanical, structural, and civil portion of the transmission facilities shall be maintained at the power plant and made available, if requested, for CPM audit as set forth in the “Compliance Monitoring Plan”.

3. A summary of inspections of the completed transmission facilities, and identification of any nonconforming work and corrective actions taken, signed and sealed by the registered engineer in charge.

REFERENCES

California ISO (California Independent System Operator) Tariff, Ongoing, – California ISO Tariff Scheduling Protocol posted July 11, 2013, http://www.caiso.com/rules/Pages/Regulatory/Default.aspx.

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California ISO (California Independent System Operator) 2011a – California ISO Planning Standards.

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California ISO (California Independent System Operator) 2010a – Cal ISO **(**tn**:**57824**).** Redacted Phase II Study, dated 7/8/2010

CA ISO Transition cluster Phase 1 Interconnection Study Report dated August 05, 2009. Submitted on 10-09.

NERC (North American Electric Reliability Council) Ongoing – Reliability Standards for the Bulk Electric Systems of North America, http://www.nerc.com/pa/Stand/Pages/Default.aspx.

NESC (National Electric Safety Code) 2012 – IEEE Standards Association NESC Updated 2012.

Palen 2012 A – Palen Solar Holdings, LLC/Galati Blek, Scott Galati (TN 68910). Palen Solar Holdings LLC's Petition for Amendment, Dated December 17, 2012. Submitted to CEC/C. Stora on December 18, 2012

Palen 2013l – Galati Blek/Scott A. Galati (TN 70785). Palen Solar Holdings, LLC's Response to Workshop Queries, dated May 13, 2013. Submitted to CEC/C. Stora on May 13, 2013

Palen 2013n – Galati Blek/M. Fleming (TN 70980). Additional Tranmission System Engineering Information Related to SCE's Red Bluff Substation, date May 28, 2013. Submitted to CEC/Docket Unit on May 28, 2013

PSEGS 2009a – Palen Solar Energy Project. Application for Certification (AFC) for the PSEGS, Submitted on 08-30-2009.

PSEGS 2009b – Solar Millennium (tn: 54008). Data Adequacy Supplement, dated 10/26/2009

WECC (Western Electricity Coordinating Council) Reliability Standards – NERC/WECC Reliability Standards, http://www.wecc.biz/Standards/Pages/default.aspx.

DEFINITION OF TERMS

ACSR .... Aluminum cable steel reinforced.

AAC .... All Aluminum conductor.

ACSS .... Aluminum conductor steel-supported.

Ampacity .... Current-carrying capacity, expressed in amperes, of a conductor at specified ambient conditions, at which damage to the conductor is nonexistent or deemed acceptable based on economic, safety, and reliability considerations.

Ampere .... The unit of current flowing in a conductor.

Kiloampere (kA) .... 1,000 Amperes

Bundled .... Two wires, 18 inches apart.

Bus .... Conductors that serve as a common connection for two or more circuits.

Conductor .... The part of the transmission line (the wire) that carries the current.

Congestion .... Congestion management is a scheduling protocol, which provides that

Management .... dispatched generation and transmission loading (imports) would not violate criteria.

Emergency Overload . See Single Contingency. This is also called an L-1.

Hertz .... The unit for System Frequency.

Kcmil or KCM .... Thousand circular mil. A unit of the conductor’s cross sectional area, when divided by 1,273, the area in square inches is obtained.

Kilovolt (kV) .... A unit of potential difference, or voltage, between two conductors of a circuit, or between a conductor and the ground. 1,000 Volts.

Loop .... An electrical cul de sac. A transmission configuration that interrupts an existing circuit, diverts it to another connection and returns it back to the interrupted circuit, thus forming a loop or cul de sac.

MVAR or .... Megavolt Ampere-Reactive. One million Volt-Ampere-Reactive.

Megavars.................... Reactive power is generally associated with the reactive nature of motor loads that must be fed by generation units in the system.

Megavolt..................... A unit of apparent power, equals the product of the line voltage

Ampere (MVA) .... in kilovolts, current in amperes, the square root of 3, and divided by 1000.

Megawatt (MW) .... A unit of power equivalent to 1,341 horsepower.

Normal Operation/Normal Overload

When all customers receive the power they are entitled to without interruption and at steady voltage, and no element of the transmission system is loaded beyond its continuous rating.

N-1 Condition............. See Single Contingency.

Outlet.......................... Transmission facilities (circuit, transformer, circuit breaker, etc.) linking generation facilities to the main grid.

Power Flow Analysis . A power flow analysis is a forward looking computer simulation of essentially all generation and transmission system facilities that identifies overloaded circuits, transformers and other equipment and system voltage levels.

Reactive Power.......... Reactive power is generally associated with the reactive nature of inductive loads like motor loads that must be fed by generation units in the system. An adequate supply of reactive power is required to maintain voltage levels in the system.

Remedial Action .... A remedial action scheme is an automatic control provision,

Scheme (RAS) .... which, for instance, would trip a selected generating unit upon a circuit overload.

SSAC .... Steel Supported Aluminum Conductor.

SF6.............................. Sulfur hexafluoride is an insulating medium.

Single .... Also known as emergency or N-1 condition, occurs when one

Contingency .... major transmission element (circuit, transformer, circuit breaker, etc.) or one generator is out of service.

Solid Dielectric .... Copper or aluminum conductors that are insulated by solid

Cable polyethylene type insulation and covered by a metallic shield and outer polyethylene jacket.

SVC............................. Static VAR Compensator: An equipment made of Capacitors and Reactors with electronic controls for producing and controlling Reactive Power in the Power System.

Switchyard................. A power plant switchyard (switchyard) is an integral part of a power plant and is used as an outlet for one or more electric generators.

Thermal rating........... See ampacity.

TSE............................. Transmission System Engineering.

TRV............................. Transient Recovery Voltage

Tap.............................. A transmission configuration creating an interconnection through a sort single circuit to a small or medium sized load or a generator. The new single circuit line is inserted into an existing circuit by utilizing breakers at existing terminals of the circuit, rather than installing breakers at the interconnection in a new switchyard.

Undercrossing........... A transmission configuration where a transmission line crosses below the conductors of another transmission line, generally at 90 degrees.

Underbuild................. A transmission or distribution configuration where a transmission or distribution circuit is attached to a transmission tower or pole below (under) the principle transmission line conductors.

VAR............................. Voltage Ampere Reactive, a measure for Reactive power in the power system.

ALTERNATIVES

Testimony of Jeanine Hinde[1]

INTRODUCTION

This analysis evaluates a reasonable range of potentially feasible alternatives to the proposed Palen Solar Electric Generating System (PSEGS), also referred to as the proposed modified project in this staff assessment.

Staff reviewed the previous alternatives analysis for the licensed Palen Solar Power Project (PSPP) during the initial work to determine the scope of the analysis for the proposed modified project. The alternatives analysis for the PSPP retained three reconfigured alternatives, a reduced acreage alternative, and one off-site alternative for detailed analysis and comparison to the PSPP. Of the three reconfigured alternatives, the Commission Decision for the PSPP determined that Reconfigured Alternatives #2 and #3 would reduce impacts on Mojave fringe-toed lizard, sand dune habitat, and the sand transport corridor (California Energy Commission 2010a). Staff biologists identified mitigation measures that would reduce impacts on terrestrial wildlife species and sensitive habitats to less than significant for the two reconfigured alternatives. The Commission Decision approved construction and operation of either Reconfigured Alternative #2 or #3 using the parabolic trough technology proposed for the PSPP. No alternatives using other solar technologies were retained for detailed analysis in the previous alternatives analysis.

The proposed modified project would use BrightSource Energy's solar power tower (SPT) technology. Staff has selected three project alternatives for full analysis and comparison to the proposed modified project:

- No-Project Alternative
- Solar Photovoltaic Alternative with Single-Axis Tracking Technology
- Reduced Acreage Alternative with Solar Power Tower Technology

The PSEGS site was previously approved for development of a 500-megawatt (MW) parabolic trough project; therefore, construction and operation of a parabolic trough project at the approved site is a reasonably foreseeable outcome for use of the site should plans for the proposed modified project fail to proceed. For PSEGS, the No-Project Alternative evaluates the impacts of the proposed modified project compared to the impacts of constructing and operating either of the approved alternatives from the original PSPP.

[1] **Alternatives Appendix-1** lists other staff contributors to this analysis of project alternatives.

The Solar Photovoltaic (PV) Alternative would involve constructing and operating a utility-scale PV project using single-axis tracking technology at the PSEGS site with no change to the site boundary. The Reduced Acreage Alternative with Solar Power Tower (SPT) Technology would retain the solar tower unit and heliostat array from PSEGS Unit 1 (the western solar field), and it would include approximately 70 acres from the inside edge of PSEGS Unit 2 (the eastern solar plant) for a total of approximately 1,742 acres. Each of these alternatives is described below, under "Alternatives Evaluated in Detail."

The subsection below, "Alternatives Considered in the Previous Analysis for the PSPP," summarizes the off-site alternatives considered in the previous alternatives analysis.

Staff concludes that constructing and operating Reconfigured Alternative #2 or #3 (i.e., the No-Project Alternative) would avoid or substantially reduce certain impacts on **Biological Resources**, **Cultural Resources**, and **Visual Resources**. For impacts on **Biological Resources**, staff concludes that impacts on the sand transport corridor, sand dunes, and the Mojave fringe-toed lizard would be "somewhat less than PSEGS." Staff identifies a potentially significant impact on avian species that could remain *significant and unavoidable* even after mitigation. For impacts on **Visual Resources**, staff identifies a *significant and unavoidable* impact from glint and glare effects of the high-profile solar receiver steam generators. These two impacts would not occur with construction and operation of Reconfigured Alternative #2 or #3:

- **Biological Resources** – Potential impacts on avian species from exposure to concentrated solar flux.
- **Visual Resources** – Glint or glare effects from high-profile solar receiver steam generators.

If reducing or avoiding several direct and indirect environmental impacts is a critical factor, then either Reconfigured Alternative #2 or #3 would be environmentally superior to the proposed modified project.

Staff concludes that constructing and operating the Solar PV Alternative with Single-Axis Tracking Technology would avoid or substantially reduce several impacts on **Biological Resources**, **Cultural Resources**, **Traffic and Transportation**, and **Visual Resources**.

Without the SPTs, three impacts identified by staff as *potentially significant* or *significant and unavoidable* under the proposed modified project would not occur with construction and operation of the Solar PV Alternative:

- **Biological Resources** – Potential impacts on avian species from exposure to concentrated solar flux.
- **Traffic and Transportation** – Solar receiver glare impacts that could be hazardous to motorists and pilots.
- **Visual Resources** – Glint or glare effects from high-profile solar receiver steam generators.

For **Cultural Resources**, **Traffic and Transportation**, and **Visual Resources** impacts, the Solar PV Alternative with its much lower vertical profile and reduced potential for operational glint and glare effects would offer the potential to develop mitigation measures that would go furthest toward reducing impacts on these resources.

If reducing or avoiding several direct and indirect environmental impacts and improving the effectiveness of mitigation measures are the critical factors, then the Solar PV Alternative with Single-Axis Tracking Technology would be environmentally superior to the proposed modified project.

For the Reduced Acreage Alternative with SPT Technology, staff identifies several impacts on **Biological Resources** that would be "much less than PSEGS," and staff considers this to be the primary benefit of this alternative compared to the proposed modified project. If lessening several impacts on biological resources is the critical factor, then the Reduced Acreage Alternative would be somewhat superior to the proposed modified project.

The subsection below, "Summary Conclusions for the Project Alternatives," provides further information on staff's conclusions.

CEQA REQUIREMENTS

As lead agency for the PSEGS, the California Energy Commission (Energy Commission) is required to consider and discuss alternatives to the proposed modified project. The guiding principles for the selection of alternatives for analysis in an environmental impact report (EIR) are provided by the California Environmental Quality Act Guidelines (State CEQA Guidelines) (Cal. Code Regs., tit. 14, § 15000 et seq.). Section 15126.6 of the State CEQA Guidelines indicates that the alternatives analysis must:

- describe a range of reasonable alternatives to the project, or to the location of the project, which would feasibly attain most of the basic objectives of the project;
- consider alternatives that would avoid or substantially lessen any significant environmental impacts of the proposed project, including alternatives that would be more costly or would otherwise impede the project's objectives; and
- evaluate the comparative merits of the alternatives.

These regulations also apply to the document used as a substitute for an EIR in a certified program (Cal. Code Regs., tit. 14, §§ 15251 and 15252).

The lead agency is responsible for selecting a range of project alternatives for examination and must publicly disclose its reasoning for selecting those alternatives (Cal. Code Regs., tit. 14, § 15126.6[a]). CEQA does not require an EIR to "consider every conceivable alternative to a project. Rather it must consider a reasonable range of potentially feasible alternatives…." The range of reasonable alternatives must be selected and discussed in a manner that fosters meaningful public participation and informed decision making (Cal. Code Regs., tit. 14, § 15126.6[f]). That is, the range of alternatives presented in this analysis is limited to ones that will inform a reasoned choice by Energy Commission decision makers. Under the "rule of reason," an EIR "need not consider an alternative whose effect cannot be reasonably ascertained and whose implementation is remote and speculative" (Cal. Code Regs., tit. 14, § 15126.6[f][3]).

The lead agency is also required to (1) evaluate a "no-project alternative," (2) identify alternatives that were initially considered but then rejected from further evaluation, and (3) identify the "environmentally superior alternative" (Cal. Code Regs., tit. 14, § 15126.6).

Alternatives may be eliminated from detailed consideration by the lead agency if they fail to meet most of the basic project objectives, are infeasible, or could not avoid any significant environmental effects (Cal. Code Regs., tit. 14, § 15126.6[c]).

ALTERNATIVES SCREENING AND PROJECT OBJECTIVES

The ideal process to select alternatives to include in the alternatives analysis begins with the establishment of project objectives. Section 15124 of the State CEQA Guidelines addresses the requirement for a statement of objectives (Cal. Code Regs., tit. 14, § 15124[b]):

> *A clearly written statement of objectives will help the lead agency develop a reasonable range of alternatives to evaluate in the EIR and will aid the decision makers in preparing findings or a statement of overriding considerations, if necessary. The statement of objectives should include the underlying purpose of the project.*

The underlying purpose of the PSEGS is to implement California's Renewables Portfolio Standard (RPS) program, which was established in 2002 under Senate Bill (SB) 1078, accelerated in 2006 under SB 107, and expanded in 2011 under SB X 1-2. Other related legislation has altered specific parts of the RPS program. The RPS program requires a retail seller of electricity to increase procurement from eligible renewable energy resources to 33 percent of total procurement by 2020. The California Public Utilities Commission (CPUC) and the Energy Commission are jointly responsible for implementing the program.

The importance of achieving these renewable energy goals was emphasized with the enactment of Assembly Bill (AB) 32, the California Global Warming Solutions Act of 2006, which sets aggressive greenhouse gas (GHG) reduction goals for the state.

The Renewable Energy Resources Program (SB 107) states that the Energy Commission's program objective is "to increase, in the near term, the quantity of California's electricity generated by in-state renewable electrical generation facilities, while protecting system reliability, fostering resource diversity, and obtaining the greatest environmental benefits for California residents" (Pub. Resources Code, § 25740.5[c]).

In February 2013, the project owner submitted a right-of-way (ROW) application and revised Plan of Development (POD) to the U.S. Bureau of Land Management (BLM) for the PSEGS. In July 2013, BLM published a draft supplemental environmental impact statement (SEIS) for the PSEGS (BLM 2013a). The PSEGS SEIS lists the project owner's objectives from the revised POD, starting with the owner's primary objective:

- Deliver 500 megawatts of renewable electrical energy to the regional electrical grid to fulfill its existing approved power purchase agreements (PPAs) for electrical sales from the facility.

These other project objectives address developing the PSEGS at a site that meets these criteria (BLM 2013a):

- Develop a solar thermal power plant at a site where some of the permits and other authorizations required for construction have been completed and/or obtained.
- Develop a site that is large enough to accommodate BrightSource Energy's Solar Power Tower technology.
- Develop a site that is in a BLM-designated Solar Energy Zone.
- Develop a site with an executed and approved Large Generator Interconnection Agreement for interconnection to a substation that would be operational in time to meet delivery of electricity under the approved PPAs.

Staff reviewed the project objectives from the Commission Decision for the licensed PSPP and assessed their applicability to the proposed modified project. Staff retained some of those original project objectives and incorporated other basic objectives that are consistent with the state's renewable energy goals:

- Safely and economically construct and operate a utility-scale solar energy project of up to 500 megawatts.
- Develop a renewable energy facility that will supply clean, renewable electricity, and assist Southern California Edison in satisfying its California Renewables Portfolio Standard program goals.
- Ensure construction and operation of a renewable electrical generation facility that will meet permitting requirements and comply with applicable laws, ordinances, regulations, and standards.
- Develop a renewable energy facility in a timely manner that will avoid or minimize significant environmental impacts to the greatest extent feasible.
- Develop a renewable energy facility in an area with high solar value and minimal slope.

Staff has given little consideration to the project owner's contractual obligations in this analysis of project alternatives. Also, staff's analysis broadens the alternatives analysis to allow full consideration of two renewable solar technologies other than BrightSource Energy's SPT technology. This approach is consistent with CEQA's purpose for an alternatives analysis. Staff briefly discusses some of the details from the project owner's objectives (e.g., the PPAs) in the subsections below addressing, “Potential Feasibility Issues,” for the alternatives.

RESPONSE TO COMMENTS

Comments were submitted by intervenors and others on the alternatives analysis for the proposed PSEGS. These comments are summarized, and staff’s responses are provided below.

STATE OF CALIFORNIA, ENERGY RESOURCES CONSERVATION AND DEVELOPMENT COMMISSION/CENTER FOR BIOLOGICAL DIVERSITY, LISA T. BELENKY, STATUS REPORT, TN # 70180, MARCH 29, 2013:

The Center for Biological Diversity (CBD) submitted comments on the preliminary staff assessment (PSA) stating that the alternatives proposed for analysis are inadequate and do not provide the needed range or address avoidance of all significant impacts (Center for Biological Diversity 2013). CBD commented that the alternatives analysis must look at alternative sites.

CEQA does not require that an alternatives analysis evaluate alternatives that would avoid *all* significant impacts of a proposed project. The State CEQA Guidelines requires an EIR to describe “a range of reasonable alternatives to the project, *or* to the location of the project, which would feasibly attain most of the basic objectives of the project but would avoid or substantially lessen *any* of the significant effects of the project, and evaluate the comparative merits of the alternatives” (Cal Code Regs., tit. 14, § 15126.6[a]) (emphasis added). This analysis evaluates project alternatives that could potentially reduce or avoid one or more of the environmental impacts of the proposed PSEGS.

In developing the alternatives analysis, staff reviewed the alternatives analysis from the Commission Decision on the original PSPP, including its analysis of several off-site alternatives. This approach is consistent with the State CEQA Guidelines requirements for an analysis of alternative locations, which states that limited new analysis is required “[w]here a previous document has sufficiently analyzed a range of reasonable alternative locations and environmental impacts for projects with the same basic purpose, the lead agency should review the previous document” (Cal Code Regs., tit. 14, § 15126.6[f][2][c]). As described above under, “Alternatives Considered in the Previous Analysis for the PSPP,” the Commission Decision concluded that the impacts of those alternatives would generally be similar to the impacts of Reconfigured Alternative #2 or #3. No off-site alternative evaluated under the PSPP was determined to be feasible.

CEQA does not establish a requirement for the number of alternatives to be evaluated. The proposed PSEGS is on a site that is approved for development of a utility-scale solar energy project, and as described in BLM's draft SEIS, it is the subject of the ROW application submitted by the project owner for the PSEGS. Given these facts, it is unlikely that any alternative site would be found to be potentially feasible (i.e., capable of being accomplished in a successful manner within a reasonable period of time). The work required to obtain site control and complete the required environmental clearances to allow development to proceed would likely render such an alternative infeasible. Staff's alternatives analysis includes a detailed analysis of on-site alternatives that could feasibly attain most of the basic objectives of the project.

CBD commented on the large-scale industrial areas in many parts of southern and central California that could be converted to solar centers and thus should be considered an alternative to the proposed PSEGS. CBD commented that the alternatives analysis should explore use of distributed generation solar energy production as well as efficiency upgrades and conservation.

Staff observes that no alternative sites are identified that could be considered potentially feasible alternatives to the proposed PSEGS. The range of alternatives required in an EIR is governed by the "rule of reason," meaning that an EIR need only set forth those alternatives necessary to permit a reasoned choice. Under the "rule of reason," an EIR "need not consider an alternative whose effect cannot be reasonably ascertained and whose implementation is remote and speculative" (Cal. Code Regs., tit. 14, § 15126.6[f][3]). Discussions are provided below on staff's review of potential off-site alternatives. Please see the discussions under the subsections, "Alternatives Considered in the Previous Analysis for the PSPP," and "Alternatives Considered But Eliminated from Detailed Consideration for the Proposed PSEGS."

Distributed generation and energy efficiency are discussed in detail below.

STATE OF CALIFORNIA, ENERGY RESOURCES CONSERVATION AND DEVELOPMENT COMMISSION/BASIN AND RANGE WATCH, LAURA CUNNINGHAM AND KEVIN EMMERICH, COMMENTS ON THE PSA, TN # 200078, JULY 28, 2013:

Basin and Range Watch submitted comments on the PSA stating that the PSEGS alternatives analysis should consider a brownfield site alternative[2], a Westland Solar Park alternative, and a distributed generation alternative (Basin and Range Watch 2013).

[2] The term, "brownfield site," generally refers to a piece of industrial or commercial property that is abandoned or underused and often environmentally contaminated.

Similar to staff's response to CBD's comments, no alternative brownfield site is identified that could be analyzed as a potentially feasible alternative to the proposed PSEGS. If a specific brownfield site was identified that could accommodate a utility-scale renewable solar project such as PSEGS, an environmental analysis of the site would be necessary to determine the comparative environmental effects of such an alternative. Because no site is identified, no such analysis is possible.

Westlands Solar Park is a combined public and private effort to master plan renewable development and infrastructure for large scale solar projects on approximately 24,000 acres of disturbed land in Westlands Water District, which is located in Fresno and Kings counties on the west side of the San Joaquin Valley. Regional developed uses near Westlands Solar Park include rural residential areas and several small- to medium-size communities within approximately 5 miles to 10 miles of the site. The Westlands Solar Park has initial planning estimates for development of phased projects totaling up to approximately 2,400 MWs of solar arrays by 2025. As stated in the State CEQA Guidelines, among the factors that may be taken into account when addressing the feasibility of alternatives is "whether the proponent can reasonably acquire, control, or otherwise have access to the alternative site…" (Cal. Code Regs., tit. 14, § 15126.6[f][1]). The PSEGS project owner does not own or otherwise have development rights to lands at Westlands Solar Park. Also, construction and operation of a solar power plant with SPT technology at Westlands Solar Park would be completely inconsistent with the planned intent to develop the area with much lower profile solar PV arrays. Development of any type of solar energy project by the PSEGS project owner at Westlands Solar Park is extremely speculative, and it is not evaluated further in this staff assessment.

Basin and Range Watch also requested inclusion of a No-Project Alternative. For PSEGS, the No-Project Alternative evaluates the impacts of the proposed modified project compared to the impacts of constructing and operating either of the approved alternatives from the original PSPP. In this instance, the No-Project Alternative does not mean that existing conditions would persist at the site absent the proposed modified project. Please see the discussion below under "No-Project Alternative."

The distributed generation category of renewable energy is discussed below.

COLORADO RIVER INDIAN TRIBES, WAYNE PATCH SR., COMMENTS ON THE PSA, TN # 200075, JULY 29, 2013:

Colorado River Indian Tribes submitted comments on the PSA objecting to the absence of a review of project alternatives (Colorado River Indian Tribes 2013). Staff acknowledges that the PSA did not include an analysis of alternatives. To correct the lack of an alternatives analysis in the PSA, this final staff assessment evaluates a reasonable range of potentially feasible alternatives to the proposed PSEGS, in accordance with CEQA.

ALTERNATIVES CONSIDERED IN THE PREVIOUS ANALYSIS FOR THE PSPP

REVIEW OF ALTERNATIVE PROJECT CONFIGURATIONS FOR THE PSPP

In response to scoping comments on the original PSPP, the project site was reconfigured to avoid the northern third of the site (Energy Commission 2010a). This Reconfigured Alternative separated Unit 1 of the proposed PSPP into two polygons. Unit 2 would have been retained at approximately the same location with an altered site boundary. The total project site acreage would have increased by approximately 180 acres. The Commission Decision concluded that the significant impacts from this Reconfigured Alternative would have been nearly the same as those identified for the proposed PSPP, and it was not approved by the Energy Commission.

The original PSPP alternatives analysis evaluated a smaller parabolic trough project with a net generating electrical capacity of 375 megawatts (MWs). The original Reduced Acreage Alternative would have required approximately 25 percent less acreage compared to the original PSPP. This alternative would have altered the site boundaries for Units 1 and 2 to avoid sand dune habitat, Mojave fringe-toed lizard habitat, and designated Desert Tortoise Critical Habitat. The Commission Decision concluded that the original Reduced Acreage Alternative would reduce, but not eliminate, immitigable impacts on land use and visual resources. The conversion of desert lands and open space at the site and impacts on cultural resources were determined to be cumulatively considerable impacts of this alternative. The Commission Decision concluded that Reconfigured Alternative #2 or #3, with implementation of mitigation measures, would have effects that would be similar to the original Reduced Acreage Alternative while retaining the PSPP’s full electrical capacity of 500 MWs. The original Reduced Acreage Alternative was not approved by the Energy Commission.

REVIEW OF OFF-SITE ALTERNATIVES FOR THE PSPP

<u>North of Desert Center Alternative</u>

Scoping comments on the original PSPP requested consideration of an alternative site on disturbed, private lands. In response to those comments, staff included an alternative at the North of Desert Center site for full analysis and comparison to the PSPP (Energy Commission 2010b). The preliminary study area for this alternative covered approximately 5,800 acres; approximately 37 landowners own property at the alternative site. Of the total acreage, approximately 873 acres are under federal ownership and are probably managed by BLM. Most of the remaining site is under private ownership. It was determined that this alternative would require an approximately 4.6-mile-long transmission line that would follow an existing Southern California Edison (SCE) 161-kilovolt (kV) transmission line that crosses the site.

Surrounding land uses include the small community of Desert Center, which is a little over 2 miles from the site. The small resort community of Lake Tamarisk is less than 1 mile from the site. Segments of Desert Center Rice Road (State Route 177) cross the site; sparse rural development is located along this route.

Staff concluded that construction and operation of a 500-MW parabolic trough project at the North of Desert Center site would reduce impacts on biological resources primarily because most of the study area was fallow agricultural land with lower biological value overall compared to the original PSPP site. Staff concluded that impacts on visual resources impacts would be similar to the PSPP. Cultural resources staff determined that construction and operation of a parabolic trough project at the North of Desert Center site would reduce impacts on cultural resources compared to the PSPP although a complete archaeological and built-environment survey would be required to verify preliminary conclusions for those resources. Desert Center Airport is a small, private-use airport near the east side of the alternative site. Chuckwalla Valley Raceway is a public-use raceway at the Desert Center Airport. The previous alternatives analysis identified a potentially significant impact from constructing and operating a renewable solar power plant adjacent to the Desert Center Airport. The impact of converting agricultural land at the alternative site to a non-agricultural use could have required mitigation to reduce the impact to less than significant.

The Commission Decision for the original PSPP proceeding concluded that the North of Desert Center off-site alternative would have impacts similar to the proposed PSPP (Energy Commission 2010a). The Commission Decision also concluded that negotiations to acquire many privately-owned properties for this alternative would have delayed the PSPP to an extent that would have rendered it uneconomical (or infeasible).

Off-Site Alternatives That Were Not Evaluated in Detail for the PSPP

The staff assessment for the original PSPP reviewed these other potential off-site alternatives:

- Cibola Alternative
- Palen Pass Alternative
- Desert Center Alternative
- Palo Verde Alternative

These other off-site alternatives were not evaluated in detail because they failed to meet most of the project objectives or would not have reduced or avoided the significant impacts of the original PSPP.

ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED CONSIDERATION FOR THE PROPOSED PSEGS

Staff evaluated a 500-MW SPT with Lower Tower Height Alternative and an SPT with Energy Storage Alternative and determined that the impacts of the proposed modified project would not be reduced or avoided with construction and operation of these alternatives at the PSEGS site. Overviews of these two alternatives are provided below. Staff researched and analyzed the potential for the *distributed generation* category of renewable energy production to be a potentially feasible alternative to the proposed project; the analysis and related conclusions are provided below. *Energy efficiency* strategies are critical to reducing energy consumption in the state. A discussion of energy efficiency is provided below to acknowledge the importance of achieving all cost-effective energy efficiency for the state. No potentially feasible off-site alternatives are identified that could reduce or avoid the significant impacts of the PSEGS.

SPT with Lower Tower Height Alternative

Overview

Staff evaluated an alternative that could resemble the Ivanpah Solar Electric Generating System (ISEGS), which is under construction near the Nevada state border in San Bernardino County. ISEGS includes three 460-foot-tall metal power towers (Ivanpah 1, 2, and 3) surrounded by three solar fields of heliostats. The total acreage of the ISEGS solar fields is approximately 3,238 acres, and the three projects have a total electrical capacity of 370 MWs. Compared to ISEGS, the proposed PSEGS would include two 750-foot-tall solar power towers in two heliostat fields that would cover approximately 3,576 acres and have an electrical capacity of 500 MWs. Land use efficiency would be reduced under this alternative. In other words, the SPT with Lower Tower Height Alternative would require more acres per MW of capacity. Staff estimates that the total electrical capacity of this alternative could be somewhat less than PSEGS.

Staff considered whether the lower tower height of this alternative would reduce or avoid impacts on biological resources, and avian species in particular; visual resources; and cultural resources. For these and the other environmental resources analyzed in this staff assessment, staff estimates that impacts would generally be the same or similar to the proposed PSEGS.

Decision to Eliminate the SPT with Lower Tower Height Alternative from Detailed Consideration

Biological Resources

The SPT with Lower Tower Height Alternative would not avoid or substantially reduce impacts on biological resources. Terrestrial impacts and all other biological resources impacts would be similar to the proposed modified project, with the exception of impacts on avian species. Power tower technology concentrates solar flux in the airspace over the heliostat field. Concentrated solar flux has the potential to blind, kill, or injure any flighted species that is exposed. The severity of injury depends on the duration of exposure as well as the intensity of the flux. With a 460-foot-tall power tower, staff expects that the location of the flux field would be lowered, roughly commensurate with the tower height. With the 750-foot power tower of the proposed PSEGS, the portion of the flux field considered to be dangerous (over 5 kilowatts per square meter) occupies a volume around each power tower, starting around 300 feet in elevation (Rio Mesa Solar I and II, LLCs 2012a). With a 460-foot power tower, the flux field would also be lower, but staff assumes the field to occupy the same approximate volume of airspace.

Depending on the elevation of the flux field, different suites of species would likely be impacted. A lower tower could reduce impacts on migrating birds, but would potentially have greater impacts on avian and bat species present year-round. Resident species of birds, such as meadowlark (*Sturnella neglecta*), a ground-feeding bird, could have a higher potential to enter an airspace containing concentrated flux. Little data is available on at-risk species, and therefore a more robust, empirical analysis is not possible. However, significant reductions in risk of injury or death due to flux exposure would not be a reasonable conclusion for an SPT alternative with a lower power tower height.

Another adverse impact associated with SPT technology is the risk of avian collision with project features, generation-tie lines, and heliostats. The reflective surfaces of heliostats, when viewed from a distance, may create the appearance of water; smooth surfaces, such as glass PV panels or heliostat mirrors, may polarize light. Both of these unintentional consequences are suspected to attract birds to a site where they may collide with heliostat surfaces (or the surfaces of other solar collectors) and either suffer instant mortality, or likely succumb to injuries shortly thereafter. A lower power tower would not eliminate this potential risk of attraction of avian, bat, and insect species. Further descriptions and analysis of potential impacts on avian species (e.g., risk of collision with project features) are provided below for each of the project alternatives; see the “Biological Resources” subsections under, “Alternatives Evaluated in Detail.”

Cultural Resources

Construction and operation of the SPT with Lower Tower Height Alternative would not substantively alter the primary significant impacts of the proposed modified project on cultural resources, namely the profound visual intrusion of the proposed PSEGS two, 750-foot power towers across a significant portion of western Chuckwalla Valley. The physical destruction of the relatively modest set of archaeological deposits and built-environment ruins on the facility site, while technically significant under the licensed PSPP, is of secondary significance relative to the visual impacts of the proposed PSEGS throughout the broader valley. The reduction of the SPT height from approximately 750 feet to approximately 460 feet would not greatly reduce the stark visual impact of the towers’ bright solar receiver steam generators (SRSGs) on cultural resources. Therefore, the impact of this alternative on cultural resources would be similar to the visual impact of the proposed PSEGS. No impacts on cultural resources would be reduced or avoided under the SPT with Lower Tower Height Alternative.

Visual Resources

As described in the **VISUAL RESOURCES** section of this staff assessment, the proposed PSEGS site is located on a broad, flat, desert plain that is bordered by rugged mountain ranges. The area of potential visual effect (i.e., the visual sphere of influence [VSOI]) is extensive and encompasses much of the Chuckwalla Valley and the site-facing slopes and ridgelines of the surrounding mountains. Staff concludes that the extreme glare from the proposed modified project's two solar receivers would be seen from the Chuckwalla Mountains Wilderness and Palen McCoy Wilderness at distances of as little as 4½ miles. Staff concludes that the proposed PSEGS would be highly prominent in views from sensitive viewing locations and that no feasible mitigation measures would reduce visual resources impacts to less-than-significant levels.

Given the level terrain of the Chuckwalla Valley and the high visibility of the site from the surrounding mountain ranges, staff concludes that the SPT with Lower Tower Height Alternative would not reduce the project's VSOI to any great extent. Because land use efficiency for this alternative would be somewhat lower than PSEGS, the total area covered by a single solar field of heliostats would be greater for an alternative with a lower power tower. For near to far middleground views, the bright solar reflection off the heliostat mirrors from the horizontal plane could affect a somewhat larger area compared to the proposed PSEGS. However, in general, visual resources impacts from the disruptive effects of glint and glare would be similar to the proposed modified project, and no visual resources impacts would be reduced or avoided under this alternative.

SPT with Energy Storage Alternative

Overview

An SPT with Energy Storage Alternative would combine solar thermal technology with added molten-salt storage at the site. Thermal energy storage (TES) allows solar energy to be captured during the day and retained in a liquid salt heat transfer fluid. Liquid salt has inherent TES properties. In its liquid state, salt has a viscosity similar to water. Salt remains in a liquid state at very high temperatures whereas water turns to steam. A fossil fuel source (either liquefied petroleum gas [propane] or compressed natural gas) is required prior to plant start-up for the initial melting, heating, and conditioning of the salt thermal storage medium. No other fossil fuel supply is required for plant operations.

An SPT with energy storage power plant requires heliostats to concentrate the sun's rays on the water-filled solar boiler at the top of the central receiver tower in each solar field. The resulting high-temperature, pressurized steam is piped through a conventional steam turbine generator to produce electricity. To store the heat, some of the steam produced during the day is used to superheat molten salts held in a tank. The heat retained in the molten salts is available to convert water to steam, which is used to run the plant's steam turbine generators to produce electricity during solar transients (e.g., cloud cover), and during early evening and early morning hours.

This technology offers some additional stability and flexibility of generator operation inherent with liquid salt solar systems that is similar to that associated with the proposed PSEGS' supplemental natural gas firing. Because this technology uses liquid salt, a medium that can be heated to a very high temperature, the steam cycle is efficient. Because the liquid salt can be stored with very little heat loss, this system allows power to be generated on demand during the day or night regardless of short-term weather fluctuations.

Solar thermal technologies with energy storage can store excess energy when on-line generation exceeds load (Energy Commission 2011a). Adding thermal storage to a concentrating solar power plant can result in generation of dispatchable electricity depending on daily resource constraints.

To accomplish the approximate electrical capacity of 500 MWs of the proposed PSEGS, adding energy storage components would likely require a larger power plant site. Additional acreage would be needed to accommodate the molten-salt storage tanks, and additional heliostats would be required to generate heat for the thermal storage component. BrightSource Energy has stated that adding thermal storage requires the addition of at least 18 percent more heliostats to the solar field (Rio Mesa Solar I, II, and III, LLCs 2012b).

Rice Solar Energy Project (RSEP) is a 150-MW SPT project that was approved for construction and operation by the Energy Commission in December 2010. SolarReserve will develop RSEP on approximately 1,500 acres of private land in the Colorado Desert in eastern Riverside County. Full site mobilization and the start of construction are planned for March 2014.

SolarReserve's projects include a central receiver tower surrounded by heliostats. Instead of super heating water in the solar boiler at the top of the tower, the sun's rays directly heat molten salt that can be stored to generate electricity late at night. The technology used by SolarReserve allows large quantities of thermal energy to be captured and retained for several days and extracted on demand (Energy Commission 2010c). SolarReserve expects RSEP to generate stable, predictable, and controllable electricity.

Decision to Eliminate the SPT with Energy Storage Alternative from Detailed Consideration

Staff's alternatives analysis for the Hidden Hills Solar Electric Generating System (HHSEGS) included detailed environmental analyses of an SPT alternative with added molten-salt storage. The HHSEGS was proposed to use BrightSource Energy's SPT technology, and of the project alternatives evaluated for the HHSEGS, the SPT with Energy Storage Alternative was most similar to the HHSEGS. For most environmental resources, comparative impacts for the SPT with Energy Storage Alternative were determined to be similar to the HHSEGS project (Energy Commission 2012a). For impacts that would correlate to the extent of the HHSEGS site footprint, potentially greater impacts were identified for this alternative because of the possible need to expand the site boundary for the molten-salt storage tanks and additional heliostats. Staff concluded that potential impacts on groundwater resources could increase proportionally with increased water usage under the energy storage alternative, and that impacts relating to groundwater depletion would be somewhat greater than HHSEGS. Staff concluded that impacts on many plant and wildlife species would either be similar to or somewhat greater than the HHSEGS.

The PSEGS is proposed to use the same technology as the previously evaluated HHSEGS; therefore, this alternative is also most similar to the proposed PSEGS. Staff concluded that no significant impact identified for the HHSEGS would be avoided or substantially lessened under the SPT with Energy Storage Alternative. Staff assumes that a comparative analysis of the impacts of the proposed PSEGS to this alternative would reach the same or very similar conclusions as those in the HHSEGS alternatives analysis. For this reason, the SPT with Energy Storage Alternative has been eliminated from detailed consideration in this alternatives analysis.

Off-Site Alternatives

Overview

As described above, several off-site alternatives were evaluated in the previous analysis for the PSPP, including the North of Desert Center Alternative. Use of this alternative site to construct a 500-MW SPT power plant similar to the proposed modified project could potentially cause impacts on visual resources that would be much greater than the PSEGS. Impacts on local residents, the Desert Center Airport, and recreational visitors to the Chuckwalla Valley Raceway from the effects of glint and glare would be significant. Impacts on avian species would be similar to the proposed PSEGS. Construction and operation of a renewable solar power plant using SPT technology at the North of Desert Center Alternative site would probably have impacts similar to or somewhat greater than the proposed PSEGS. Although it is unknown how many residences may be located at the North of Desert Center Alternative site, staff presumes that displacement of residents could be an impact of a utility-scale solar project at this site.

The vertical scale of the proposed PSEGS with its two SPTs topped by the SRSGs would be much greater compared to the parabolic trough technology for the previously approved project. In theory, if a new, potential off-site alternative was identified, construction of a utility-scale solar energy project using SPT technology would be highly unlikely to reduce environmental impacts on visual resources, cultural resources, or biological resources. Any off-site alternative at a disturbed site is likely to be closer to developed areas, and potential impacts on local residents and adjacent developed uses from construction and operation of the PSEGS at such a site would be greater compared to the approved sites for the PSPP (i.e., Reconfigured Alternatives #2 and #3). Potential impacts on avian species could be similar to the PSEGS regardless of the site location. Site specific analyses would be needed to reach conclusions for comparative impacts on cultural resources and terrestrial wildlife species and sensitive habitats. None of the off-site alternatives from the previous analysis were determined overall to reduce or avoid impacts of the PSPP. For a project using SPT technology, it is unlikely that a different off-site alternative would cause lesser impacts on critical environmental resources. It is improbable that an off-site alternative could be identified where it would be feasible to achieve site control and use within a reasonable time frame.

In July 2012, BLM and the U.S. Department of Energy (DOE) published the *Final Programmatic Environmental Impact Statement (PEIS) for Solar Energy Development in Six Southwestern States* (BLM and DOE 2012). The Record of Decision (ROD) for the Solar PEIS was issued a few months later. The Riverside East Solar Energy Zone (SEZ) is one of the extensive regions encompassing public lands in the southwestern states that was subject to environmental review and determined to be appropriate for development of renewable energy projects with implementation of design features to reduce the environmental impacts of those projects. The PSEGS site is in the Riverside East SEZ, and most of the PSEGS site appears to be in an area delineated as "developable" (BLM and DOE 2012).

The Desert Renewable Energy Conservation Plan (DRECP) is a multiagency conservation and planning document intended to guide solar and other renewable energy project siting in the Mojave and Colorado/Sonoran deserts of California, and provide for the conservation and management of certain species, habitats and natural communities that may be affected by those projects. The state and federal agencies that are developing the DRECP are collectively called the Renewable Energy Action Team (REAT) agencies. The Draft Preliminary Conservation Strategy (Draft PCS) is a key part of the DRECP that was published by the REAT agencies in October 2011 (Energy Commission 2011b). The Draft PCS identified preliminary renewable energy study areas (RESAs) based on the presence of available renewable energy resources and a lower potential for conflicts with conservation goals. The preliminary conservation strategy map of the RESAs includes approximately 382,390 acres in east Riverside County near Blythe. The Blythe RESA encompasses an area around Interstate 10 (I-10) that overlaps extensively with the Riverside East SEZ.

The REAT agencies are developing the DRECP alternatives for consideration in the Draft DRECP, which is planned for publication in 2013. In a January 2013 publication on the *Description and Comparative Evaluation of Draft DRECP Alternatives*, four of the preliminary DRECP alternatives were noted to retain the entire Riverside East SEZ as a *development focus area* (DFA) under the DRECP (REAT 2013). The other three were noted to retain portions of the Riverside East SEZ as a DFA. Staff observes that the alternatives analyzed in the forthcoming Draft DRECP, including the preferred alternative, may be different than the preliminary DRECP alternatives presented in the January 2013 REAT publication (REAT 2013). The DRECP will ultimately only cover and provide permit streamlining for renewable energy generation projects inside DFAs. Although the PSPP site is approved for a utility-scale solar energy project, the extent of the DFA in the project area and its relationship to the PSPP site is undetermined.

Conclusion for Off-Site Project Locations

The PSEGS site was licensed by the Energy Commission in 2010 for construction and operation of either Reconfigured Alternative #2 or #3. The Commission Decision for the PSPP concluded that no off-site alternative would present a feasible alternative to the licensed site, and the environmental analyses resulted in conclusions that impacts of the off-site alternatives would generally be similar to the PSPP evaluated in 2009–2010. The PSEGS site is within the Riverside East SEZ, which indicates at least its potential suitability for development of a renewable energy facility. No off-site location is identified that would avoid or substantially lessen any of the significant effects of the proposed modified project. No feasible alternative locations are identified for the proposed PSEGS where site control and use could be obtained in a reasonable time frame.

Distributed Generation

Overview

Governor Jerry Brown's Clean Energy Jobs Plan identifies a goal of installing 20,000 MWs of new renewable capacity by 2020, including 12,000 MWs of localized electricity generation close to consumer loads and transmission and distribution lines (i.e., distributed generation [DG])[3] (Energy Commission 2011a). These targeted renewable capacity goals support California's RPS program goals. In 2010, the state had more than 10,000 MWs of installed renewable capacity that provided nearly 16 percent of total retail sales of electricity. Of that amount, about 3,000 MWs represents DG, and there is an additional estimated 6,000 MWs of DG either under development or authorized under existing programs (Energy Commission 2011a and 2013).

Distributed solar facilities vary in size from kilowatts to tens of megawatts and do not require transmission to get to the areas where the electricity is used. Renewable DG technologies like small PV can be located in industrial areas on previously disturbed land or on existing residential, industrial, or commercial buildings. Standards, codes, and fees vary widely for DG projects, and land use requirements for identical systems can vary significantly from jurisdiction to jurisdiction. Efforts at the national, state, and local levels are underway to identify and provide solutions to barriers to permitting renewable DG facilities (Energy Commission 2011a).

2012 Integrated Energy Policy Report

The *2012 Integrated Energy Policy Report (IEPR) Update* was adopted by the Energy Commission in February 2013. The main element of the 2012 IEPR Update is the Energy Commission's Renewable Action Plan with five overarching strategies (Energy Commission 2011a and 2013):

- *Strategy 1* – Identify and prioritize geographic areas for renewable utility-scale and DG development.

[3] The total 20,000 MWs from the Governor's Clean Energy Jobs Plan includes 8,000 MWs of utility-scale renewable capacity from wind, solar, and geothermal projects.

- *Strategy 2* – Evaluate costs and benefits of renewable projects.
- *Strategy 3* – Minimize interconnection costs and time at the transmission and distribution levels.
- *Strategy 4* – Promote incentives for projects that create in-state jobs and economic benefits.
- *Strategy 5* – Promote and coordinate existing financing and incentive programs for critical stages in the renewable development continuum.

A comprehensive set of recommended actions relating to each strategy was developed based on discussions at public workshops and comments submitted by community stakeholders, industry representatives, and state and local agency participants. A few of the strategies and recommended actions are discussed here.

Recommendations for Strategy 1 include incorporating DG energy development zones into utility distribution system investment plans and local planning processes (Energy Commission 2013). The aim is to develop a process that can be replicated by local jurisdictions in the state to analyze the suitability of areas for DG and place priority on developing those areas. Where possible, the DG zones should be targeted to areas where system upgrades and modernization are anticipated, which could allow for increased penetration of DG resources. Actions and implementation steps include a directive for the Energy Commission and CPUC to work with each IOU to establish pilot working groups to (1) create maps identifying DG renewable energy development zones, and (2) demonstrate how improved coordination between utility infrastructure planning can build markets that better support high penetrations of renewable DG.

A separate but related recommendation requires coordination with local governments to identify renewable energy development zones as preferred areas for all sizes and technology types of renewable energy projects. Actions and implementation steps include a directive for the Energy Commission to coordinate with utilities and interested local jurisdictions to create and identify renewable energy development zone overlay maps to include in comprehensive land use and infrastructure plans.

Another recommendation for Strategy 1 is to continue developing renewable energy on government property, including renewable DG. A barrier to installing renewable DG on state properties relates to the financing of state buildings with lease revenue bonds, which requires notification and approval of the bond owners before development of the property can proceed. To overcome this barrier, an action step is identified for the Department of General Services, Department of Finance, and State Treasurer's Office to jointly develop a standardized method to expedite renewable DG installations on properties financed with state revenue bonds.

Challenges for Strategy 3 identify a lack of comprehensive distribution system planning, which is expected to result in interconnection delays, lost opportunities to deploy DG strategically, and increased costs. Recommendations for distribution interconnection include several action steps for the Energy Commission, CPUC, California Independent System Operator (CAISO), local governments, environmental groups, and utilities to take to build transparency into distribution planning. The goal is to develop a modern and smart distribution network that can actively accommodate high levels of DG.

Distributed Generation Programs

CPUC oversees two incentive programs for customer-side of the meter DG (also called *on-site generation* or *self generation*) for customers in the territories of Pacific Gas & Electric Company (PG&E), San Diego Gas & Electric (SDG&E), and SCE (CPUC 2013). The customer-side DG programs include several existing, new, and emerging distributed energy sources, including solar electric. The Energy Commission oversees related incentive programs.

The programs supporting on-site solar projects include CPUC's California Solar Initiative, the Energy Commission's New Solar Homes Partnership, and a variety of solar programs offered through publicly owned utilities. The overall goal of these programs, known collectively as Go Solar California, is to encourage Californians to install 3,000 MWs of solar energy systems on homes and businesses by 2016 (CPUC 2013). Generation from these facilities may or may not be able to produce excess electricity exported to the distribution or transmission system, but all are connected to the electric grid (Energy Commission 2011a).

CPUC has implemented policies and programs related to procurement of utility-side DG (also called *wholesale* or *system-side generation*) (CPUC 2013). Under its investor-owned utility (IOU) solar PV programs, CPUC authorized PG&E, SDG&E, and SCE to own and operate PV facilities and to execute solar PV PPAs with independent power producers through a competitive solicitation process. Based on decisions issued by CPUC in 2009 and 2010, these programs will yield up to 1,100 MWs of new solar PV capacity in the next few years. The energy produced under the solar PV programs will contribute to meeting the state's RPS program goals.

CPUC provides incentives for the development of DG through its Self-Generation Incentive Program (SGIP) (CPUC 2013). This program provides financial incentives for installing new, qualifying, self-generation equipment that meets all or a portion of the electric energy needs of a facility. SGIP administrators include PG&E, SCE, Southern California Gas Company, and the California Center for Sustainable Energy. Eligible fuels for eligible SGIP generating technologies include several renewable and non-renewable fuels. In 2009, SB 412 modified SGIP to require identification of distributed energy resources that will contribute to GHG reduction goals.

CPUC's Renewable Auction Mechanism (RAM) was created for the procurement of renewable DG projects generating from 3 MWs up to 20 MWs of electricity. RAM is open to all renewables (e.g., solar PV, small hydro, biogas, wind, and geothermal). CPUC adopted RAM in 2010 to encourage development of resources that can use existing transmission and distribution infrastructure and contribute to the state's RPS program in the near term. CPUC initially authorized the large IOUs to procure 1,000 MWs through RAM by holding four competitive auctions over 2 years. Total procurement was expanded in early 2012 to 1,299 MWs. Project eligibility and viability is determined by the IOUs based on the offerer's ability to demonstrate the following:

- *Site Control* – 100 percent site control obtained through direct ownership, lease, or an option to lease or purchase that may be exercised when the RAM contract is awarded.
- *Development Experience* – One member of the development team has completed at least one project of similar technology and capacity or has begun construction of at least one other similar project.
- *Commercialized Technology* – The project is based on a commercialized technology.
- *Interconnection Application* – An interconnection application has been filed.

The first two RAM auctions resulted in approval of 30 renewable DG contracts for a total of 400 MWs of electricity. Of those totals, 28 projects totaling 370 MWs are online or on schedule (CPUC 2013). The third RAM auction closed at the end of December 2012. The IOUs executed 21 contracts for 337 MWs; of those that received CPUC's approval in May 2013, 17 contracts are on schedule for a total of 258 MWs. Most of the contracts are for solar PV projects. The fourth RAM auction closed at the end of June 2013.

Under three recent CPUC decisions in 2012 and 2013, CPUC granted, in part, SCE's and SDG&E's respective petitions for modification to merge each utility's solar PV programs into the RAM program. SCE's program targeted small rooftop projects (1–2 MWs), and SDG&E's program targeted small ground-mount projects (1–5 MWs). By merging the utility solar programs into RAM, CPUC is attempting to minimize ratepayer expenditures on renewable DG and provide a more efficient DG procurement process.

The 2012 IEPR Update addresses recommendations to minimize overall risks and maximize the value of the renewable portfolios, including a suggested action item for CPUC to evaluate RAM projects and assess the costs and benefits of siting those projects. For example, the CPUC should identify whether projects would be located in areas identified by utilities as having low costs for transmission and distribution. The 2012 IEPR Update recommends that CPUC consider changes to the RAM selection criteria based on the cost and benefit data findings (Energy Commission 2013).

Decision to Eliminate Renewable Energy Distributed Generation from Detailed Consideration as an Alternative to the PSEGS

Comments received during the proceedings for other siting cases for large-scale renewable energy projects have stated that the alternatives analyses for such central station projects must include the distributed generation photovoltaic (DGPV) category of renewable energy generation. Both *concentrated* and *distributed* types of systems result in production of electricity from renewable sources (i.e., both use solar technologies). However, the characteristics of the DG category of renewable energy generation make it an impracticable alternative in the context of a CEQA alternatives analysis. In no instance has a potential site for a DGPV alternative been proposed.

As discussed above, CEQA does not require consideration of “every conceivable alternative to a project…” (Cal Code Regs., tit. 14, § 15126.6[a]). CEQA does not require consideration of “an alternative whose effect cannot be reasonably ascertained and whose implementation is remote and speculative” (Cal Code Regs., tit. 14, § 15126.6[f][3]). Staff concludes that a DGPV alternative is unlikely to provide a feasible alternative to the proposed modified project for the reasons discussed below:

- *Lack of Defined Projects with Sites* – Compared to a large project such as the PSEGS that is proposed for construction on a defined site, a *renewable DG alternative* is amorphous and impossible to analyze. Some renewable DG projects are carried out by proponents and agencies at defined sites; however, the existence of renewable DG projects does not mean that a DG alternative as a category of renewable energy generation could be a valid alternative to a larger generation project such as the PSEGS. Achieving a level of electrical generation comparable to the proposed PSEGS would require putting together many small-scale (approximately 1–5 MWs each) sites that could, in theory, include rooftop and ground-mount PV systems. Even if such sites could be identified, it is unreasonable to assume the PSEGS project owner could obtain access to and use of multiple small sites that are owned and controlled by other people or organizations. As discussed below, participation in on-site generation programs is voluntary. The feasibility of a renewable DG alternative is extremely speculative.
- *Voluntary Participation in On-site Generation Programs* – Participation in the state’s on-site generation incentive programs (described above) is based on decisions made by individual residents and property and business owners. Participation in the incentive programs is elective; no laws or regulations mandate installation of on-site renewable energy systems; and utilities do not approve or deny DG systems on private property. Although the importance of the state’s DG incentive programs cannot be overstated, it is not possible to treat a conglomeration of DGPV (or other types of DG) projects as a potentially feasible alternative to a utility-scale renewable energy project such as the proposed modified project.
- *Failure to Meet Critical Project Objectives* – The basic project objectives for the PSEGS include developing a renewable energy facility that will contribute to meeting the state’s RPS program goals. Based on electricity supply and demand forecast reports prepared by Energy Commission staff, as well as expert witness testimony in prior proceedings (e.g., the HHSEGS and the ISEGS siting cases), renewable DG projects alone would not supply enough electricity to meet the state’s mandated RPS program goals. Achieving the RPS program goals requires energy generation from a mix of renewable sources, and not merely one to the exclusion of others. Various agency publications identify the need to increase renewable generating capacity from DG and utility-scale sources; both are essential to successfully meeting RPS program goals. Therefore, rejection of the proposed PSEGS on the grounds that some renewable DG projects will be built would be inconsistent with the state’s RPS program objectives. Such a decision would also be inconsistent with the PSEGS goals of helping to meet such objectives.

Energy Efficiency

In 2003, the principal energy agencies in the state jointly created and adopted the *Energy Action Plan* (EAP), which identifies goals and actions to eliminate energy outages and excessive price spikes in electricity and natural gas (Energy Commission and CPUC 2003). The EAP states the importance of having reasonably priced and environmentally sensitive energy resources to support economic growth and attract new investments that will provide jobs and prosperity for California consumers and taxpayers. The EAP envisions a "loading order" of energy resources to guide agency decisions: (1) the agencies will optimize all strategies for increasing conservation and energy efficiency to minimize increases in electricity and natural gas demand, (2) recognizing that new generation is necessary and desirable, the agencies intend to meet the need first by renewable energy resources and distributed generation, and (3) because the preferred resources require both sufficient investment and adequate time to "get to scale," the agencies will support additional clean, fossil-fueled, central station generation (Energy Commission and CPUC 2003). Section 454.5(b) of the California Public Utilities Code addresses requirements for an electrical corporation's proposed procurement plan, including the requirement to "first meet its unmet resource needs through all available energy efficiency and demand reduction resources that are cost effective, reliable, and feasible."

In 2008, an update to the EAP was published that examines the state's ongoing actions in the context of global climate change following passage of AB 32. The updated EAP iterates how the EAP represents a collaborative process that is subject to change and updating over time. The EAP does not supersede or replace the extensive efforts of the Energy Commission's IEPR, which remains the overall guiding document on energy policy. The IEPR addresses a wide range of issues pertaining to the state's electricity, natural gas, and transportation fuel sectors. The EAP is intended to capture recent changes in the policy landscape and describe activities to accomplish those policies (Energy Commission and CPUC 2008).

In its discussion on energy efficiency, the 2008 EAP update refers to strategies identified in the 2006 *California Climate Action Team Report*, explaining that "nearly one-quarter of the emission reductions identified from existing or known strategies in 2020 would come from some form of energy efficiency investment, either through improved building codes or appliance standards, utility energy efficiency programs, or smart growth strategies" (Energy Commission and CPUC 2008). The 2008 EAP update discusses the significance of AB 2021, which was enacted in 2006 to further the goal of achieving all cost-effective energy efficiency. AB 2021 requires the Energy Commission, in consultation with CPUC, to develop statewide energy efficiency potential estimates and targets for California's investor-owned and publicly owned utilities. Progress toward meeting the targets is reported in the last biennial IEPR (Energy Commission 2012b). In December 2011, Energy Commission staff published the final report, *Achieving Cost-Effective Energy Efficiency for California 2011–2020*, which summarizes utility progress and recommends improvements for publicly owned utility efficiency efforts (Energy Commission 2012b).

The 2008 EAP update also discusses CPUC's strategic planning process to develop comprehensive, long-term strategies for making energy efficiency a way of life for Californians. CPUC adopted California's first *Long-Term Efficiency Strategic Plan* in 2008, which was developed through a collaborative process with CPUC's regulated utilities—PG&E, SCE, SDG&E, and Southern California Gas Company—and many other key stakeholders. The long-term plan provides a statewide roadmap to maximize achievement of cost-effective energy efficiency in California's electricity and natural gas sectors from 2009 through 2020 and beyond. CPUC's 2011 update to the *Energy Efficiency Strategic Plan* (CPUC 2011) is a comprehensive plan with goals and strategies covering all major economic sectors in the state.

As described in the 2011 IEPR, California's energy efficiency policies, programs, and energy standards for buildings and appliances in the last three decades have contributed to keeping the state's per capita electricity consumption relatively constant while energy use in the rest of the country has increased by approximately 40 percent (Energy Commission 2012b). In addition to achieving all cost-effective energy efficiency, California's energy efficiency policies include reducing energy use in existing buildings and achieving *zero net energy* building standards. Reducing building energy use to zero net energy is accomplished by combining greater energy efficiency and on-site clean energy production.

In its discussion on reducing energy use in existing buildings, the 2011 IEPR states that more than half of the state's 13 million residential units and more than 40 percent of commercial buildings were built before building and appliance efficiency standards were implemented (Energy Commission 2012b). AB 758 directed the Energy Commission to develop, adopt, and implement a comprehensive statewide program to reduce energy consumption in existing buildings and report on that effort in the IEPR. The Energy Commission shares responsibility with CPUC, local governments, and utilities to coordinate residential and commercial building retrofit programs. Completion of needs assessments and development of action plans is continuing. Other joint efforts are planned and intended to achieve improved compliance with building and appliance standards and ensure that energy efficiency measures and equipment are properly installed and delivering savings.

The Energy Commission, CPUC, and the California Air Resources Board have adopted a goal of achieving zero net energy building standards by 2020 for residential buildings and 2030 for commercial buildings (Energy Commission 2012b). In June 2011, CPUC released its *2010–2012 Zero Net Energy Action Plan* for the commercial building sector. The Energy Commission regularly updates its building efficiency standards to reflect new technologies and strategies consistent with the goal of achieving 20 to 30 percent energy savings in each triennial update. Appliance standards are being updated to include electronics and other devices plugged into electrical outlets.

Decision to Eliminate Energy Efficiency Strategies from Detailed Consideration as an Alternative to the PSEGS

The loading order specified in the EAP does not bind the Energy Commission to analyze particular project alternatives, and energy efficiency measures alone would not satisfy the project objectives and are not intended to replace all central station renewable energy facilities in the state. The proposed PSEGS does not reduce or eliminate opportunities for promoting conservation and energy efficiency in the state.

ALTERNATIVES EVALUATED IN DETAIL

CEQA requires consideration of “a reasonable range of potentially feasible alternatives that will foster informed decision making and public participation. An EIR is not required to consider alternatives which are infeasible” (Cal. Code Regs., tit. 14, § 15126.6[a]). Feasible is defined as “capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic, environmental, legal, social, and technological factors” (Cal. Code Regs., tit. 14, § 15364).

Project alternatives were selected based on their potential to satisfy most of the basic project objectives discussed above under, “Alternatives Screening and Project Objectives,” and their potential to reduce or avoid the significant impacts identified for the proposed modified project.

Staff has selected three project alternatives for full analysis and comparison to the proposed modified project:

- No-Project Alternative
- Solar Photovoltaic Alternative with Single-Axis Tracking Technology
- Reduced Acreage Alternative with Solar Power Tower Technology

The proposed PSEGS would contribute to a net reduction in GHG emissions from power generation. Net GHG emissions for the state’s integrated electric system will decline when new renewable power plants are added that: (1) meet eligibility requirements for renewable energy resources in the state; (2) improve the overall efficiency, or GHG emission rate, of the electric system; and (3) serve increasing load (i.e., energy use) or energy capacity needs more efficiently, and with fewer GHG emissions, compared to fossil-fueled generation. Each of the project alternatives would result in a net benefit in reducing GHG emissions. Because solar thermal power plants with energy storage may not require a natural gas supply for project operations, they may displace more fossil fuel use and are more effective at reducing GHG emissions compared to solar thermal power plants without energy storage. As discussed above, staff concludes that an SPT with energy storage alternative would not substantially reduce or avoid direct and indirect environmental impacts of the proposed PSEGS; therefore, an alternative with energy storage is not included in this alternatives analysis.

Summary discussions are provided below comparing the environmental effects of the proposed modified project to the project alternatives. Environmental impacts that could potentially occur under a project alternative but that would not occur under the PSEGS are also discussed. A summary table comparing the potential impacts of the proposed modified project to the potential impacts of the project alternatives is provided in **ALTERNATIVES APPENDIX-2**.

NO-PROJECT ALTERNATIVE

Overview

The State CEQA Guidelines require that, among other alternatives, a no-project alternative shall be evaluated in relation to the proposed project. The no-project alternative analysis must “discuss the existing conditions at the time…environmental analysis is commenced, as well as what would be reasonably expected to occur in the foreseeable future if the project were not approved, based on current plans and consistent with available infrastructure and community services” (Cal. Code Regs., tit. 14, § 15126.6[e][2]). As required by CEQA, a No-Project Alternative has been included to allow a comparison of the impacts of approving the proposed PSEGS with the impacts of not approving the proposed PSEGS.

The State CEQA Guidelines discuss possible ways for the discussion of the no-project alternative to proceed. “If disapproval of the project under consideration would result in predictable actions by others, such as the proposal of some other project, this ‘no project’ consequence should be discussed. In certain instances, the no project alternative means ‘no build’ wherein the existing environmental setting is maintained. However, where failure to proceed with the project will not result in preservation of existing environmental conditions, the analysis should identify the practical result of the project’s non-approval and not create and analyze a set of artificial assumptions that would be required to preserve the existing physical environment” (Cal. Code Regs., tit. 14, § 15126.6 [e][3][B]).

The PSEGS site was previously approved by the Energy Commission for development of two, adjacent and identical 250-MW parabolic trough power plants with a net generating electrical capacity of 500 MWs. Reconfigured Alternatives #2 and #3 both received the Energy Commission’s approval in December 2010 (Energy Commission 2010a). Staff considers construction and operation of either of the two approved alternatives at the PSEGS site a reasonably foreseeable outcome for use of the site should plans for the proposed modified project fail to proceed. For PSEGS, the No-Project Alternative evaluates the impacts of the proposed modified project to the impacts of constructing and operating either of the approved alternatives from the original proceeding for the PSPP. **Alternatives Figures 1a** and **1b** show the site layouts for Reconfigured Alternatives #2 and #3. Staff’s conclusions for the potential environmental impacts of the No-Project Alternative are based on the analyses and conclusions in the 2010 Commission Decision for the original PSPP.

The proposed PSEGS is located entirely on public lands under BLM management. As stated above, BLM published a draft SEIS for the PSEGS in July 2013 (BLM 2013a). BLM's alternatives analysis in the draft SEIS carried forward the Preferred Alternative and No Action Alternative A that were previously analyzed in the May 2011 final EIS on the PSPP[4]. As described in BLM's draft SEIS, No Action Alternative A would deny ROW application CACA-48810 for the PSEGS, and the ROW grant would not be authorized. BLM's alternatives analysis states that the Solar PEIS Plan Amendment identifying "the [PSEGS] area as suitable for any type of solar energy development would be in effect for future projects. This includes prioritization of solar energy development in the Solar Energy Zone" (BLM 2013a). BLM's description of No Action Alternative A implies that development of the PSEGS site for generation of solar energy is a probable outcome should the current ROW application be denied.

As described in the Commission Decision for the PSPP, development of a parabolic trough project using one of the two approved site plans would have an overall disturbance area of up to approximately 4,365 acres (Energy Commission 2010a). Reconfigured Alternative #2 would disturb about 35 more acres compared to Reconfigured Alternative #3. (As originally proposed, the total disturbance area may have included a relatively small number of acres for the generation tie-line and roadway connection outside of the project site.)

The site boundary for the previously approved Reconfigured Alternative #2 includes approximately 284 acres of private land. Reconfigured Alternative #3 includes one 40-acre parcel under private ownership. The original project applicant had an option to purchase the 40-acre parcel that was part of Reconfigured Alternative #3 (Energy Commission 2010a). The altered site boundary for the PSEGS avoids the privately-owned land that was inside the fence line for the previously approved alternatives.

The PSEGS site slopes gently from the southwest to the northeast with a decrease in elevation to the northeast. The site contains native vegetation, including vegetated and unvegetated ephemeral washes entering the site from the south and fanning out across the site as the slope decreases. The I-10 corridor and concomitant drainage improvements have impaired natural flows throughout the valley. Surface waters drain to the Palen Dry Lake, northeast of the modified project site, and remain wholly within the Chuckwalla Valley. The site borders an active sand transport corridor, and much of the site has sandy soils and is rather sparsely vegetated. Portions of the site are uneven and hummocky. The site is undeveloped and unimproved desert open space. No site grading or earth movement was initiated at the site following approval of the original PSPP, and site conditions are substantially the same as they were in 2009–2010 during the original proceeding.

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[4] The Preferred Alternative evaluated by BLM is the same as the Energy Commission's approved alternatives for the PSPP; BLM's "Options 1 and 2" correspond to the Energy Commission's approved Reconfigured Alternatives #2 and #3.

Parabolic Trough Technology

A parabolic trough system converts solar radiation into electricity using sunlight to heat a thermal fluid, typically synthetic oil. Parabolic trough power plants like the approved PSPP consist of horizontal, trough-shaped solar collectors that are arranged in parallel rows and aligned on a north-south horizontal axis. Each parabolic trough collector has a linear parabolic-shaped reflector that focuses the sun's rays on a linear receiver tube (i.e., heat collection element) suspended at the focal point of the curve-shaped collector. The trough rotates east to west to track the sun during the day, heating the heat transfer fluid (HTF) circulating in the collection element. The heated HTF is then piped through a series of heat exchangers where it releases its stored heat to generate high pressure steam. The steam is then fed to a traditional steam turbine generator where electricity is produced. **Alternatives Figures 2a** and **2b** show photographs of parabolic trough project facilities.

Beginning in 1984, nine solar power plants using parabolic trough technology were constructed in the Mojave Desert in San Bernardino County. Solar Electric Generating Systems (SEGS) III through VII are at Kramer Junction (**Alternatives Figure 2a**), SEGS VIII and IX are at Harper Lake, and SEGS I and II are at Daggett near Barstow. The nine SEGS projects have a combined total capacity of 354 MWs. Natural gas-fired facilities provide additional operational flexibility for each of the SEGS projects. These power plants cover a combined total of more than 1,600 acres.

In 2008 and 2009, the Energy Commission received AFCs for several renewable energy projects that were proposed to use parabolic trough technology, including the PSPP. Staff is monitoring construction of two of the projects that were licensed by the Energy Commission in September 2010—the Abengoa Mojave Solar Project (AMSP) and the Genesis Solar Energy Project (GSEP).

AMSP is near Harper Lake in San Bernardino County, about 9 miles northwest of the community of Hinkley. The SEGS VIII and IX facilities are immediately northwest of the AMSP site. GSEP is in the Sonoran Desert of east central Riverside County, about 25 miles west of Blythe. Each project consists of two 125-MW power plants for a combined total capacity of 500 MWs. Commercial operation of AMSP is anticipated in July 2014. Commercial operation of the two GSEP power plants is anticipated to occur consecutively in November 2013 and the second quarter of 2014. When construction of AMSP is finished, it will cover approximately 1,765 acres. GSEP will cover approximately 1,800 acres. Natural gas-fired auxiliary boilers will provide equipment and HTF freeze protection for each 125-MW power island for the two projects. AMSP will use wet cooling, and maximum operational water use for the project will total approximately 2,160 afy. GSEP will use dry cooling, requiring approximately 202 afy. The proposed PSEGS would require approximately 201 afy for project operations.

Construction and operation of the proposed PSEGS, including the common area and construction laydown area, would cover approximately 3,794 acres. Staff assumes that the disturbance area for the No-Project Alternative with construction of either Reconfigured Alternative #2 or #3 would affect an area up to roughly 570 acres larger than the area for the proposed modified project.

Site grading and earthwork for a parabolic trough project generally requires removal of all vegetation and mass grading to level the site. The approved PSPP would require excavation for foundations and underground systems and a total cut and fill volume of approximately 4.5 million cubic yards (Energy Commission 2010a). The proposed PSEGS would require approximately 0.2 million cubic yards of cut and fill (Palen Solar Holdings 2012).

Potential to Attain Project Objectives

Reconfigured Alternatives #2 and #3 both received the Energy Commission's approval in December 2010; therefore, this alternative (i.e., the No-Project Alternative) would satisfy the project objective addressing development of a solar thermal power plant at a site where some authorizations for construction have been obtained. This alternative would satisfy the project objective to develop a site that is in a BLM-designated SEZ. Staff assumes that this alternative could achieve the same energy capacity as the previously approved PSEGS, which was designed with an energy capacity of 500 MWs. This alternative could potentially contribute to meeting the state's RPS program goals. This alternative could potentially satisfy the project objectives addressing the requirement to comply with applicable laws, ordinances, regulations, and standards (LORS) and avoid or minimize significant impacts to the greatest extent feasible. This alternative would satisfy the project objective to develop a renewable energy facility in an area with high solar value and minimal slope.

Construction and operation of Reconfigured Alternative #2 or #3 could potentially satisfy most of the project objectives, although it is uncertain whether the change of technology back to parabolic trough would allow development of this alternative in a timely manner. See the discussions below under, "Environmental Analysis," for general analyses of the potential environmental effects of this alternative compared to the proposed modified project.

Potential Feasibility Issues

The Petition to Amend for the proposed modified project states that each of the two 250-MW units has an approved PPA (Palen Solar Holdings 2012). The project owner's objectives address fulfilling its existing approved PPAs for electrical sales from the facility. Approval of the PPAs by CPUC demonstrates that CPUC deems the PSEGS appropriate for helping to meet the state's RPS program goals. Once a PPA is approved, submittal of an amended advice letter to CPUC requesting an amended PPA is required unless the change to the project was accounted for in the original PPA (e.g., a PPA that allows a change in technology). It is unknown whether changing the technology of the PSEGS back to a parabolic trough project would require amending the PPAs. It is also unknown whether CPUC would approve amendments to the PPAs allowing the change, if such approvals would be necessary.

The Petition to Amend also states that Palen Solar Holdings has a Large Generator Interconnection Agreement (LGIA) with CAISO for 500 MWs of interconnection rights to deliver electricity from the PSEGS to SCE's Red Bluff Substation (Palen Solar Holdings 2012). CAISO is focused on advancing projects in the queue to commercial operation. A schedule delay could result in a project's failure to meet its milestones and a breach of the LGIA. Changing the project technology back to a parabolic trough technology could at least cause a project schedule delay, and it is not known at what point a project schedule delay would affect project viability.

BLM is considering the project owner's ROW application and revised POD for the PSEGS and has published a draft SEIS for the project (BLM 2013a). Changing the technology back to a parabolic trough project could require submittal of another revised POD to BLM, which would also delay the project schedule.

Environmental Analysis

Alternatives Table 1 summarizes the comparison of impacts of the proposed PSEGS to the same or similar potential impacts under the No-Project Alternative with construction and operation of either Reconfigured Alternative #2 or #3. Any differences in impacts that occur from comparing Reconfigured Alternative #2 and #3 to the proposed PSEGS are shown in the table. The comparisons of impacts to the proposed modified project are conveyed using these terms in a graded scale:

- Much less than PSEGS
- Less than PSEGS
- Somewhat less than PSEGS
- Similar to PSEGS
- Same as PSEGS
- Somewhat greater than PSEGS
- Greater than PSEGS
- Much greater than PSEGS

Impact conclusions for the proposed modified project and the comparative impacts for the alternatives are shown using these abbreviations:

— = no impact

B = beneficial impact

LS = less-than-significant impact, no mitigation required

SM or PSM = significant or potentially significant impact that can be mitigated to less than significant

SU or PSU = significant and unavoidable or potentially significant and unavoidable impact that cannot be mitigated to less than significant

For the following two topic areas, no comparative analysis of the alternatives is necessary:

- *Noise and Vibration*. No significant impacts are identified for the proposed modified project, and comparative noise and vibration impacts would be similar for the project alternatives; therefore, no comparative analysis is included for noise and vibration.
- *Transmission Line Safety and Nuisance*. The proposed modified project and the project alternatives would be installed at the PSEGS site, and the point of interconnection at the Red Bluff Substation would not change. The length and location of the 230-kV transmission line connecting the proposed modified project to the substation is assumed to be the same for the project alternatives. All federal, state, and local regulations and standard industry practices that apply to the proposed modified project would also apply to the project alternatives.

Comparative discussions for each environmental topic area listed below follow **Alternatives Table 1**. As stated above, **ALTERNATIVES APPENDIX-2** contains a complete summary table comparing the potential impacts of the proposed modified project to the potential impacts of the project alternatives.

Alternatives Table 1
Summary Comparison of Impacts of the Proposed PSEGS to the No-Project Alternative

Environmental Effect	Proposed PSEGS	No-Project Alternative
		Reconfigured Alternative #2 or #3
Air Quality		
Construction-related emissions	SM (locally)	Similar to PSEGS (SM)
Project operations emissions	SM (locally)	Somewhat greater than PSEGS (SM)
Reduction in greenhouse gases	B (system wide)	Similar to PSEGS (B)
Biological Resources		
Impacts on special-status plant species	SM	Greater than PSEGS (SM)
Impacts on waters of the state	SM	Much greater than PSEGS (SM)
Impacts on desert tortoise	SM	Greater than PSEGS (SM)
Impacts on special-status terrestrial wildlife species (kit fox, American badger)	SM	Greater than PSEGS (SM)
Potential impacts on avian species from collisions with project features	PSU	Similar to PSEGS (PSU)
Potential impacts on avian species from exposure to concentrated solar flux	PSU	—
Potential impacts on groundwater dependent ecosystems	SM	Somewhat greater than PSEGS (SM)
Impacts on sand transport corridor	SM	Somewhat less than PSEGS (SM)
Impacts on sand dunes and Mojave fringe-toed lizard	SM	Somewhat less than PSEGS (SM)
Cultural Resources		
Potential to substantively degrade, directly or indirectly, prehistoric or historical archaeological resources *on* the facility site, resources recommended or assumed to be historically significant *(see cultural resources note)*	PSM	Somewhat greater than PSEGS (SM)
Potential to substantively degrade, directly or indirectly, prehistoric or historical archaeological resources *beyond* the facility site, resources recommended or assumed to be historically significant	SU	Much less than PSEGS (SM)
Potential for cumulatively considerable degradation of prehistoric or historical archaeological resources *beyond* the facility site, resources recommended or assumed to be historically significant	SU	Much less than PSEGS (PSM)
Potential impacts on significant built-environment cultural resources *on* the site	LS	Similar to PSEGS (LS)
Potential impacts on a significant built-environment cultural resource (Desert Center) *beyond* the site	SU	Much less than PSEGS (LS)
Potential to substantively degrade, directly or indirectly, ethnographic resources *on* the facility site, resources recommended or assumed to be historically significant	PSM	Similar to PSEGS (PSM)

Alternatives Table 1
Summary Comparison of Impacts of the Proposed PSEGS to the No-Project Alternative

Environmental Effect	Proposed PSEGS	No-Project Alternative
		Reconfigured Alternative #2 or #3
Potential for cumulatively considerable degradation of ethnographic resources *on* the facility site, resources recommended or assumed to be historically significant	LS	Similar to PSEGS (LS)
Potential to substantively degrade, directly or indirectly, ethnographic resources *beyond* the facility site, resources recommended or assumed to be historically significant	SU	Much less than PSEGS (PSM)
Potential for cumulatively considerable degradation of ethnographic resources *beyond* the facility site, resources recommended or assumed to be historically significant	SU	Much less than PSEGS (PSM)
Cultural resources note: "Site" means the facility site proper and does not include linear or ancillary infrastructure away from the facility site.		
Fire Protection		
Construction-Related Impacts		
Impacts on the Riverside County Fire Department	SM	Somewhat greater than PSEGS (SM)
Project Operations Impacts		
Become familiar with and plan for emergency responses	SM	Less than PSEGS (SM)
Conduct plan reviews, inspections, and permitting	SM	Somewhat greater than PSEGS (SM)
Fire response	SM	Much greater than PSEGS (SM)
Hazardous materials spill response	SM	Much greater than PSEGS (SM)
Rescue	SM	Somewhat less than PSEGS (SM)
Emergency medical services	SM	Same as PSEGS (SM)
Geology and Paleontology		
Potential impacts from strong seismic shaking	SM	Much less than PSEGS (SM)
Potential impacts from soil failure caused by liquefaction, hydrocollapse, and/or dynamic compaction	SM	Much less than PSEGS (SM)
Potential impacts on paleontological resources	SM	Less than PSEGS (SM)
Potential impacts on geological or mineralogical resources	—	—
Hazardous Materials Management		
Construction-Related Impacts		
Potential for spills or other releases of hazardous materials to occur on-site	SM	Same as PSEGS (SM)
Potential for spills or other releases of hazardous materials to occur off-site	LS	Same as PSEGS (LS)
Project Operations Impacts		
Potential for spills or other releases of hazardous materials to occur on-site	SM	Much greater than PSEGS (SM)

Alternatives Table 1
Summary Comparison of Impacts of the Proposed PSEGS to the No-Project Alternative

Environmental Effect	Proposed PSEGS	No-Project Alternative
		Reconfigured Alternative #2 or #3
Potential for spills or other releases of hazardous materials to occur off-site	LS	Much greater than PSEGS (SM)
Land Use		
Compatibility with land use plan, policy, or regulation	SM	Somewhat greater than PSEGS (SM)
Public Health		
Potential for project construction to cause air toxics-related or other impacts that could affect public health	LS	Somewhat greater than PSEGS (LS)
Potential for project operations to cause air toxics-related or other impacts that could affect public health	PSM	Similar to PSEGS (PSM)
Socioeconomics		
Environmental justice population within 6-mile buffer.	—	—
Induce substantial population growth in an area, either directly or indirectly	LS	Similar to PSEGS (LS)
Displace substantial numbers of people and/or existing housing, necessitating the construction of replacement housing elsewhere	LS	Similar to PSEGS (LS)
Adversely impact acceptable levels of service for police protection, schools, and parks and recreation	LS	Similar to PSEGS (LS)
Increased property taxes, construction and operation employment income, and increased state and local taxes and fees	B	Similar to PSEGS (B)
Soil and Water Resources		
Soil erosion by wind and water during project construction	SM	Much greater than PSEGS (SM)
Soil erosion by wind and water during project operations	PSM	Less than PSEGS (PSM)
Water quality impacts from contaminated storm water runoff	SM	Somewhat greater than PSEGS (SM)
Water quality impacts from storm damage	PSM	Greater than PSEGS (PSM)
Water quality impacts from power plant operations	SM	Similar to PSEGS (SM)
Water quality impacts from sanitary waste	SM	Similar to PSEGS (SM)
Potential impacts from on-site and off-site flooding	PSM	Less than PSEGS (PSM)
Potential to impede or redirect 100-year flood flows, as shown on Federal Emergency Management Agency maps	—	—
Potential impacts on local wells	PSM	Somewhat greater than PSEGS (PSM)
Potential impacts on groundwater basin balance	PSM	Somewhat greater than PSEGS (PSM)

Alternatives Table 1
Summary Comparison of Impacts of the Proposed PSEGS to the No-Project Alternative

Environmental Effect	Proposed PSEGS	No-Project Alternative
		Reconfigured Alternative #2 or #3
Traffic and Transportation		
Potential damage to roads	PSM	Less than PSEGS (PSM)
Level of service on roads and highways – construction	PSM	Less than PSEGS (PSM)
Level of service on roads and highways – operation/post-construction	LS	Similar to PSEGS (LS)
Solar collector glint and glare impacts on motorists and pilots	PSM	Much less than PSEGS (PSM)
Solar receiver glare impacts that could be hazardous to motorists and pilots	PSM	Much less than PSEGS (LS)
Visual Resources		
Construction-Related Impacts		
Potential for adverse impacts on scenic vistas	SM	Greater than PSEGS (SM)
Potential to substantially damage scenic resources within a state scenic highway	LS	Similar to PSEGS (LS)
Potential to substantially degrade the existing visual character or quality of the site and its surroundings	SM	Greater than PSEGS (SM)
Potential to create a new source of substantial light or glare which would adversely affect day or nighttime views in the area	SM	Similar to PSEGS (SM)
Project Operations Impacts		
Potential for adverse impacts on scenic vistas	SU	Somewhat less than PSEGS (SU)
Potential to substantially damage scenic resources within a state scenic highway	LS	Similar to PSEGS (LS)
Potential to substantially degrade the existing visual character or quality of the site and its surroundings	SU	Less than PSEGS (SU)
Potential to create a new source of substantial light or glare which would adversely affect day or nighttime views in the area *(individual effects listed below)*		
Glint or glare effects from project structures other than the reflective surfaces of solar collectors (i.e., heliostats, parabolic troughs, PV panels)	SM	Similar to PSEGS (SM)
Glint or glare effects from the solar collectors	SM	Similar to PSEGS (SM)
Glint or glare effects from high-profile solar receiver steam generators	SU	—
Light or glare from nighttime lighting effects, including Federal Aviation Administration safety lighting	SM	Similar to or less than PSEGS (SM)
Waste Management		
Potential for unexploded ordnance to be present at the project site	PSM	Similar to PSEGS (PSM)
Potential for impacts on human health and the environment relating to past or present soil or water contamination	LS	Similar to PSEGS (LS)
Potential for impacts on human health and the environment	LS	Much greater than

Alternatives Table 1
Summary Comparison of Impacts of the Proposed PSEGS to the No-Project Alternative

Environmental Effect	Proposed PSEGS	No-Project Alternative
		Reconfigured Alternative #2 or #3
relating to potential waste discharges		PSEGS (PSM)
Potential for disposal or diversion of project materials to cause impacts on existing waste disposal or diversion facilities	LS	Similar to PSEGS (LS)

Air Quality

The number and type of emitting sources during project operations with implementation of the previously approved Reconfigured Alternative #2 or #3 (i.e., the No-Project Alternative for this analysis) would be similar to those of the proposed PSEGS; however, this alternative would use a heat transfer fluid (HTF) in the receiver tubes of the parabolic mirrors during project operations. When HTF leaks from project apparatus (e.g., piping, flanges, etc.), it vaporizes into small amounts of volatile organic compounds (VOCs), which are ozone precursors. The local air district would most likely require controls to minimize fugitive ozone precursor impacts at the project site. Overall, due to these VOC emissions, air quality impacts during project operation would be **somewhat greater than PSEGS**. Construction-related emissions and impacts would be **similar to PSEGS** for this alternative. Similar to the proposed modified project, this alternative would cause an overall, system wide, cumulative reduction in GHG emissions from power plants; because this alternative would require the use of auxiliary equipment necessary to operate a solar thermal power plant, the effect of reducing GHG emissions would be **similar to PSEGS**. However, more stringent mitigation measures would be required compared to the proposed modified project to ensure that the impacts from constructing and operating Reconfigured Alternative #2 or #3 would not be considered cumulatively significant for ozone.

Biological Resources

The proposed PSEGS would cover an approximately 3,794-acre site, a reduction in footprint of roughly 570 acres, or approximately 13 percent, as compared to Reconfigured Alternative #2, which has a slightly larger footprint than Reconfigured Alternative #3. Therefore, impacts on desert tortoise (*Gopherus agassizii*) and other special-status terrestrial wildlife species such as kit fox (*Vulpes macrotis*) and American badger (*Taxidea taxus*) (excluding Mojave fringe-toed lizard), as well as impacts on special-status plant species, would all be **greater than PSEGS**.

Either Reconfigured Alternatives #2 or #3 would cause adverse impacts on Mojave fringe-toed lizard (*Uma scoparia*), and these impacts were considered mitigable in the 2010 Commission Decision for the original PSPP. Impacts on sand dune habitat and sand transport corridors, and the Mojave fringe-toed lizard have been modeled independently by staff (Desert Research Institute 2013) and assessed by the project owner (Palen Solar Holdings 2013). While the outcomes of these modeling efforts are somewhat inconsistent, some trends are clear. In general, for the No-Project

Alternative, direct effects on sand transport corridor Zones II and III would be **somewhat less than PSEGS**. Indirect effects on Zone II and Zone III would also be **somewhat less than PSEGS** for the No-Project Alternative. Although Mojave fringe-toed lizard habitat largely encompasses sand dunes, this species uses other areas for foraging and to move from patch to patch of sand dune habitat. The distribution of Mojave fringe-toed lizards is naturally fragmented because of its obligate habitat specificity to loose sand, which is a patchy habitat type. Many local populations of this species are quite small, with small patches of sand supporting small populations of lizards. Environmental changes that stabilize sand, affect sand resources, or block sand movement corridors would also affect this species. Therefore, impacts on Mojave fringe-toed lizard would be **somewhat less than PSEGS**.

Excluding habitat loss, adverse impacts on avian species stem from two primary sources: potential injury or mortality from collisions with project features, and potential injury or mortality from exposure to solar flux. Staff is not able to quantify the risk of collision from either project design feature; however, given that collisions have been documented at both parabolic trough facilities and power tower facilities, staff considers the risk of collisions to be **similar to PSEGS**. A parabolic trough facility would not concentrate solar flux; therefore, **no impacts** would occur from exposure to concentrated solar flux with implementation of Reconfigured Alternative #2 or #3.

Soil and Water Resources staff concludes that potential impacts on the groundwater basin would be somewhat greater than the PSEGS under Reconfigured Alternative #2 or #3. Underground water may be accessed by certain types of vegetation, called phreatophytic vegetation, or phreatophytes. Phreatophytic vegetation is rare, with limited distribution, and often supports rare or special-status plants and animals, and may, in certain cases, be themselves considered a special-status plant or habitat. Examples of groundwater dependent ecosystems and plants in the project vicinity include honey mesquite woodlands, alkali sink scrubs, playa lake beds, jackass clover stands, stabilized and partially stabilized dunes, and microphyll woodlands (ironwood and palo verde desert wash woodlands). Assuming that the ability of groundwater dependent ecosystems to access groundwater is directly proportional to the level of underground water, impacts on groundwater dependent ecosystems would be **somewhat greater than PSEGS**.

The project owner has proposed a low-impact design for the heliostat solar field. Under the proposed PSEGS, approximately 27 percent of the site would be completely developed, and the rest of the site would be largely undisturbed. However, ongoing vegetation management and operational activities such as mowing, vegetation removal, and mirror washing could continue to degrade remnant native habitat. Parabolic trough projects require leveled ground whereas the proposed PSEGS would not require complete site grading. Therefore, construction of either of the No-Project Alternative configurations (i.e., Reconfigured Alternative #2 or #3) would cause impacts on on-site drainages (and waters of the state) that would be **much greater than PSEGS**.

Cultural Resources

Construction and operation of Reconfigured Alternative #2 or #3 would increase the lateral extent and the depth of physical ground disturbance on the facility site due to the extensive earthwork that would be required for parabolic trough technology. Therefore, staff concludes that the potential for either reconfigured alternative to substantively degrade, directly or indirectly, significant prehistoric or historical archaeological resources *on* the facility site would be **somewhat greater than PSEGS**.

The greatest difference in the comparative impacts of Reconfigured Alternative #2 or #3 to the proposed PSEGS relates to the character of their respective vertical profiles. The vertical profile of parabolic trough structures would be far less intrusive compared to the PSEGS solar power towers topped by brightly glowing SRSGs. The reduced visual presence of the previously approved Reconfigured Alternative #2 or #3 decreases the potential for either alternative configuration to substantively degrade the historical significance, directly or indirectly, of the broad, landscape-scale archaeological resources that are of primary concern to staff, or of other archaeological resources *beyond* the facility site, and this impact would be **much less than PSEGS**. The profound visual intrusion that the proposed PSEGS 750-foot-tall solar power towers would cast across a significant portion of western Chuckwalla Valley far exceeds, in extent and disruptive character, the potential visual intrusion of the approved alternatives' parabolic troughs, which would be approximately 25 feet tall across the solar fields, or the approximately 100-foot-tall cooling tower structure that would be required for a parabolic trough project. Construction and operation of Reconfigured Alternative #2 or #3 would greatly reduce the severe degradation of the visual integrity of the subject resources compared to construction and operation of the proposed PSEGS. The consequent hampered ability of the resources to convey their historical significance would be far less severe with construction and operation of Reconfigured Alternative #2 or #3.

The potential impacts on built-environment resources from construction and operation of the proposed PSEGS vary greatly, for impacts on and off the facility site, and differ significantly from the potential impacts of Reconfigured Alternative #2 or #3. The potential impacts on built-environment resources *on* the facility site were determined to be less than significant in the Commission Decision for the PSPP. Staff concludes that the potential impacts of the proposed PSEGS on built-environment resources *on* the site would also be less than significant, and these impacts would be **similar to PSEGS**. Potential impacts on built-environment resources *beyond* the facility site were found to be less than significant under the original PSPP due to the parabolic trough project's relatively low vertical profile. As one consequence of the much higher vertical profile of the proposed PSEGS, which staff concludes would result in significant and immitigable impacts on off-site built-environment resources, construction and operation of Reconfigured Alternative #2 or #3 would cause impacts on built-environment resources that would be **much less than PSEGS**.

No specific, unique and discrete known ethnographic resources are located within the physical footprints of the approved sites for the PSPP or the proposed PSEGS site. However, a larger cultural landscape with ethnographic, associative, and information values covers much of Chuckwalla Valley, including the PSEGS site, and the flanks of the surrounding mountains. Staff's comparative alternatives analysis of ethnographic resources considers the impacts of the project alternatives on the ethnographic values of the larger surrounding cultural landscape as a whole, and the ethnographic values of 11 traditional cultural places, all of which are *beyond* the respective footprints of Reconfigured Alternative #2 or #3 and the proposed PSEGS. These traditional cultural places are all contributing elements to the larger landscape. Because the geographic extent of the cultural landscape is much greater than that of the proposed PSEGS facility site, or those of the previously approved alternatives, impacts on the parts of the subject landscape that include any of those facility sites would be **similar to PSEGS** and could be reduced to less than significant with implementation of appropriate mitigation measures. However, beyond the PSEGS footprint, the severity of the visual intrusions of the parabolic trough technology of the previously approved alternatives would be greatly decreased compared to the direct impacts of the solar power towers of the proposed PSEGS. As a consequence, the impacts of Reconfigured Alternative #2 or #3 would be **much less than PSEGS**.

The potential cumulative impact of Reconfigured Alternative #2 or #3 on the full complement of cultural resources *beyond* the facility site, archaeological, built-environment, and ethnographic resources, would be **much less than PSEGS**. Due to the scarcity of more robust information on the character of the inventory of cultural resources beyond the facility site, staff assumes at least the possibility of a significant visual impact; however, the scope of the area in which the previously approved alternatives have the potential to cast such an effect, relative to any number of the Mojave Desert's landscape-scale cultural resources, makes it unlikely that the impact would be cumulatively considerable. Any significant direct, indirect, or cumulative visual impact that would occur from construction and operation of Reconfigured Alternative #2 or #3, given such an impact's potential to be noticeable compared to the landscape-scale resources, could most likely be reduced to less than significant with implementation of appropriate mitigation measures.

Fire Protection

Fire protection services include six areas where the Riverside County Fire Department (RCFD) would provide services and encumber significant time and funds that would have to be mitigated regardless of the technology proposed at a utility-scale solar plant site (e.g., the proposed PSEGS site):

1. Become familiar with and plan for emergency responses to a facility using a solar energy technology new to Riverside County

2. Conduct plan reviews, inspections, and permitting

3. Provide fire response

4. Provide hazardous materials (hazmat) spill response

5. Provide rescue

6. Provide Emergency Medical Services (EMS)

Construction-Related Impacts

Compared to the proposed PSEGS, construction of the previously approved Reconfigured Alternative #2 or #3 would require approximately the same level of service from the RCFD, and impacts on the RCFD would be approximately the same as the proposed PSEGS. Of the services listed above, construction of Reconfigured Alternative #2 or #3 using parabolic trough technology would require a somewhat greater level of effort to conduct plan reviews, inspections, and permitting.

The need for fire response would increase under this alternative near the end of construction and just prior to commissioning/operations when these activities would occur simultaneously. The increased need for fire response would relate to the presence at the site of very large volumes (over 2 million gallons) of HTF and an increased risk of explosion and fire from two large propane tanks.

Hazardous materials use during construction activities would remain about the same for all alternatives compared to the proposed modified project. During construction of any large-scale desert solar project, hazardous materials would include use of paint, solvents, gasoline, diesel fuel, motor oil, lubricants, and welding gases. Impacts on the RCFD from hazardous materials use during construction would be about the same as the proposed PSEGS. However, due to the on-site presence of very large volumes of HTF and other larger amounts of hazardous materials, this alternative would increase the need for hazmat spill response near the end of construction and prior to commissioning/operations when these activities would overlap. Because a parabolic trough project does not include construction of extremely tall structures analogous to the 750-foot SPTs of the proposed PSEGS, construction of Reconfigured Alternative #2 or #3 would not have the added construction safety concern and the potential need to conduct a high-angle technical rescue in the event of worker injury.

During the construction phases of large-scale desert solar projects, site grading, construction of buildings and solar collectors, and structures that are similar to those required at traditional power plant facilities would occur in a very hot desert environment. The work would subject workers to potential heat stress that could require EMS response. The impacts on EMS response would be approximately the same regardless of the solar technology.

Overall, construction-related direct and cumulative impacts on the RCFD under the No-Project Alternative would be **somewhat greater than PSEGS**.

Project Operations Impacts

Operation of Reconfigured Alternative #2 or #3 (parabolic trough technology) would require use of vast amounts of HTF while solar power tower technology does not use any similar HTF. HTF is a highly combustible mixture of two hydrocarbons that is also highly flammable at operating temperatures and pressures. Solar parabolic trough technology also requires use of large amounts of other hazardous materials such as acids and caustics, and the originally licensed project would also require storage of large amounts of propane, a highly flammable gas that poses a significant risk of explosion and off-site consequences. Therefore, implementation of the previously approved Reconfigured Alternative #2 or #3 would result in the operation of a solar power plant that would involve the transportation, storage, and use of very large amounts of hazardous materials. The risk of an accidental release or spill would be much greater than PSEGS. Impacts on fire response and hazardous materials spill response would be **much greater than PSEGS** for the No-Project Alternative. A somewhat greater level of effort relating to plan reviews, inspections, and permitting would increase impacts on the RCFD compared to the proposed PSEGS. This impact would be **somewhat greater than PSEGS**.

Operation of a solar parabolic trough power plant would not have workers in an enclosed 750-foot-tall SPT and thus the need for a high-angle technical rescue of an injured worker would not be present under this alternative. Impacts on rescue services would be **somewhat less than PSEGS**.

Geology and Paleontology

Significant paleontological resources have been documented within Pleistocene sediments in the site vicinity. Similar deposits of high paleontologic sensitivity are likely to be present at the site beneath a thin veneer of recent (Holocene) alluvium of low paleontologic sensitivity at an undetermined but potentially shallow depth.

Construction of the previously approved Reconfigured Alternative #2 or #3 would require substantial site grading and excavation. These activities would include site leveling, establishment of drainage systems and structures, excavation of trenches for pipelines and utilities, excavations for ancillary structure foundations, and drilled shaft foundations for support of parabolic trough mirror sections. Installation of a parabolic trough system would involve construction of parallel rows of mirrors suspended on level, linear lattice structures supported by drilled pier foundations. Using conventional excavation methods, fossils encountered during construction would be uncovered, discovered, collected and recorded, thereby contributing to the scientific understanding of the paleoclimate and paleobiology of the area.

The proposed PSEGS would use a different construction method. The PSEGS would involve installation of approximately 170,000 individual pole structures (pylons) to support heliostat mirrors in a concentric ring configuration. The pylons would be installed by vibro-insertion methods. Each pylon would be attached to a specialized piece of equipment that would drive each pylon through the soil column to a final depth of approximately 12 feet below ground surface. This method of construction does not use excavation, and there is no retrieval of subsurface soils or any fossils contained within those soils. In effect, any fossils that are in the path of pylon insertion would be permanently destroyed with no recovery, discovery or scientific benefit realized.

Given the construction method and number of heliostat pedestal foundations proposed for the PSEGS project, staff concludes in the **GEOLOGY AND PALEONTOLOGY** section of this staff assessment that the potential impact on paleontological resources is significant. To mitigate the impact on paleontological resources, staff recommends that a subsurface site characterization be conducted in the solar field prior to the start of ground disturbance. The characterization will allow for the refinement of various mitigation options, including fossil recovery and data collection, avoidance, and modification of pylon insertion to be implemented as appropriate to ensure significant impacts are mitigated to a less-than-significant level.

Staff concludes that even though mitigation measures would be accomplished prior to construction of the proposed PSEGS, the extensive excavation during construction of either Reconfigured Alternative #2 or #3 would result in the discovery, recovery, and curation of an abundance of fossils that could be present in subsurface soils. Therefore, the overall impacts on paleontological resources from construction of either Reconfigured Alternative #2 or #3 would be **less than PSEGS**. Under the No-Project Alternative, implementation of appropriate mitigation measures would reduce potentially significant impacts on paleontological resources to less than significant.

The parabolic trough system that would be installed under Reconfigured Alternative #2 or #3 would not require the deep or otherwise specialized foundations that would be required for the tall solar receiver towers of the proposed PSEGS project. With the elimination of tall tower structures, either of the reconfigured alternatives would have a decrease in seismic susceptibility compared to the PSEGS.

The overall potential for impacts to occur from all identified geologic hazards for Reconfigured Alternative #2 or #3 would be **much less than PSEGS**. Mitigation measures to reduce the risk of damage to the facility from identified geologic hazards would remain the same regardless of the project technology.

The PSPP area is not currently used for mineral production, nor is it under claim, lease, or permit for the production of locatable, leasable, or salable minerals. Sand and gravel resources are present at the site and could potentially be a source of salable resources; however, such materials are present throughout the regional area such that the original PSPP would not cause a significant impact on the availability of such resources. There are no other known viable geologic or mineralogic resources at the project site. The overall impacts on geologic or mineralogic resources from construction and operation of Reconfigured Alternative #2 or #3 would be the same as the proposed PSEGS, and **no impact** would occur.

Hazardous Materials Management

Construction-Related Impacts

As described above under "Fire Protection," construction activities for large-scale desert solar projects involve the use of various hazardous materials. However, no acutely toxic hazardous materials would be used on any site during construction of the previously approved Reconfigured Alternative #2 or #3, and none of these materials would pose a significant potential for off-site impacts as a result of the quantities on-site, the materials' relative toxicity and physical state, and/or their environmental mobility. Any potential impact of spills or other releases of these materials would be limited to the site because of the small quantities involved, their infrequent use (and therefore reduced chances of release), and/or the temporary containment berms used by construction contractors. Petroleum hydrocarbon-based motor fuels, mineral oil, lube oil, and diesel fuel are all very low volatility and represent limited off-site hazards even when used in larger quantities. Construction-related impacts for hazardous materials management would be the **same as PSEGS**.

Project Operations Impacts

As described above under "Fire Protection," operation of Reconfigured Alternative #2 or #3 (parabolic trough technology) would require use of vast amounts of highly combustible HTF. Solar parabolic trough technology also requires use of large amounts of other hazardous materials and storage of large amounts of propane, a highly flammable gas. Therefore, implementation of the previously approved Reconfigured Alternative #2 or #3 would result in the construction and operation of a solar power plant that would involve the transportation, storage, and use of very large amounts of hazardous materials. The risk of an accidental release or spill would be **much greater than PSEGS** for the No-Project Alternative.

Land Use

The 2010 Commission Decision approved the site for development of a 500-MW parabolic trough project with an overall disturbance area of up to approximately 4,365 acres. As noted in the **LAND USE** section of this staff assessment, the proposed modified project would be located entirely on public land administered by BLM and within the federal California Desert Conservation Area (CDCA) Plan area. The project area is in the "Multiple-Use Class M" land use category, which allows construction and operation of electrical generation plants. As discussed above, the PSEGS site is encompassed by BLM's Riverside East SEZ. These designations also apply to the previously approved Reconfigured Alternatives #2 and #3.

Unlike the proposed PSEGS, the approved PSPP Reconfigured Alternatives #2 and #3 include some private land—284 acres for Reconfigured Alternative #2 and 40 acres for Reconfigured Alternative #3 (**Alternatives Table 2**).

Alternatives Table 2
Comparative Site Disturbance Areas for the No-Project Alternative

	No-Project Alternative	
Proposed PSEGS	**Reconfigured Alternative #2**	**Reconfigured Alternative #3**
3,794-acre overall disturbed area, including the 218-acre common area (acreage does not include linear features)	4,365-acre overall disturbance area, including about 284 acres of private land (acreage may not include linear features)	4,330-acre overall disturbance area, including a 40-acre private parcel (acreage may not include linear features)

The inclusion of private land would require compliance with the Riverside County General Plan; the Riverside County Desert Center Area Plan land designation, "Open Space Rural;" and the Zoning Code designations W-2 (Controlled Development Areas), N-A (Natural Assets), and General Provisions. Implementation of the previously approved Reconfigured Alternative #2 or #3 would also have to comply with Ordinance No. 348.4705 (approved in May 2013), which amended Riverside County's Ordinance 348 to permit "solar power plants" on lots ten (10) acres or larger with Riverside County's (County) approval of a conditional use permit (CUP). With implementation of Reconfigured Alternative #2 or #3, the County's requirement for a CUP would be subsumed in the Energy Commission's licensing process.

Reconfigured Alternative #2 or #3 would need to comply with Riverside County Board of Supervisors Policy Number-29 (B-29), which requires solar power plant owners to annually pay Riverside County $150 for each acre of land involved in the power production process. This payment would increase annually by 2 percent after 2013.

BLM did not finalize the Record of Decision (ROD), amend the CDCA Plan, or issue a right-of-way (ROW) grant for the original PSPP. In February 2013, the project owner submitted a revised Plan of Development to BLM for the PSEGS. Should BLM approve issuance of a ROW grant for the PSEGS, two CDCA Plan amendments would be required—one would allow the solar generation facility and the other would allow the generation tie-line outside of the designated corridor (BLM 2013a). Staff recommends Condition of Certification **LAND-1** for the proposed PSEGS, which requires the project owner to provide documentation of the approved BLM ROW grant and a project-specific amendment to the CDCA Plan prior to the start of construction. **LAND-1** would also apply to Reconfigured Alternative #2 or #3. Like the proposed PSEGS, construction and operation of Reconfigured Alternative #2 or #3 would require compliance with applicable federal land use LORS.

Alternatives Table 2 shows that the proposed PSEGS would disturb between 536 and 571 fewer acres compared to the PSPP depending on the site configuration. Staff concludes that because Reconfigured Alternative #2 or #3 would involve a greater amount of disturbed land and would require compliance with Riverside County LORS, land use impacts of this alternative would be **somewhat greater than PSEGS**.

Public Health

Construction-Related Impacts

Construction-related combustion emissions and impacts under Reconfigured Alternative #2 or #3 would be similar to the proposed PSEGS. Public health risks include exhaust from diesel-fueled engines (such as trucks, graders, cranes, welding machines, electric generators, air compressors, and water pumps). According to staff's analysis in the **PUBLIC HEALTH** section of this staff assessment, the calculated cancer risk and non-cancer Hazard Index from diesel particulate matter are all below the significance levels. Other potential risks to public health during construction relate to exposure to Valley Fever in contaminated soil and fugitive dust disturbed during site preparation. As for the concerns of Valley Fever affecting the general population, staff considers the mitigation measures proposed in the **AIR QUALITY** section of this staff assessment adequate to prevent all fugitive dust plumes from leaving the project site boundary. As long as the dust plumes are kept within the project boundary, no significant impact would remain concerning the potential for Valley Fever to adversely affect the general population and public health. Therefore, no significant construction-related impacts on public health would occur, and no mitigation measures are required.

However, the PSEGS site is in an area where Valley Fever is endemic. Construction could disturb a certain percentage of top soil that could harbor the *Coccidioides* spores, possibly exposing humans to the risk of Valley Fever. People such as on-site workers could be exposed from inhaling these fungal spores from wind-blown dust generated from soil excavation during construction activities. Parabolic trough technology requires significant grading and leveling of the site, and disturbance of the top soil during construction and the quantity of cut and fill would be greater compared to the proposed PSEGS. Also, the project footprint of the proposed PSEGS (3,794 acres) is less than either Reconfigured Alternative #2 (4,365 acres) or Reconfigured Alternative #3 (4,330 acres). The reduced project footprint under PSEGS would also reduce the total area of disturbance and decrease the potential risk of exposure to Valley Fever. Because of the slightly increased risk of exposure to Valley Fever under the No-Project Alternative, public health impacts during project construction would be **somewhat greater than PSEGS**.

Project Operations Impacts

Operation of the previously approved Reconfigured Alternative #2 or #3 would require the use of similar equipment and apparatus for project operations compared to the proposed PSEGS. For both technologies, toxic air emissions would occur from auxiliary boilers, nighttime preservation boilers, wet surface air condenser (WSAC) units, emergency electric generator systems, emergency fire pump systems, and vehicles and equipment that would be used to clean the mirrors. Therefore, during project operations, the amounts and types of air toxics emitted by Reconfigured Alternative #2 or #3 would be similar to those emitted by the proposed PSEGS. Such emissions would occur at low levels, and this alternative would not pose a significant risk from the emissions of concern in the public health analysis.

For both technologies, the potential exists for bacterial growth (i.e., *Legionella*) to occur in the cooling towers and structures of the power plant cooling systems such as the WSAC in the proposed PSEGS. The public health impact from potential exposure to *Legionella* would be **similar to PSEGS**. For PSEGS, the impact is reduced to less than significant with implementation of Condition of Certification **PUBLIC HEALTH-1**. The same mitigation measure would apply to Reconfigured Alternative #2 or #3.

Reconfigured Alternative #2 or #3 would require use of an HTF in the receiver tubes of the parabolic mirrors during project operations. The HTF could cause emissions of small amounts of VOCs from potential leaks of HTF from flanges or that could be lost during routine maintenance activities such as HTF pipeline repair or replacement. Potential VOC emissions would occur at low levels and would not pose a significant public health risk; therefore, the public health impacts under this alternative would be **similar to PSEGS**.

Socioeconomics

The No-Project Alternative would require a smaller construction workforce, a larger operations workforce, and a longer construction period.

Staff concludes in the **SOCIOECONOMICS** section of this staff assessment that construction and operation of the PSEGS would not cause a significant adverse direct or indirect impact or contribute to a cumulative socioeconomic impact on the area's housing, schools, law enforcement services, or parks and recreation. Staff also concludes that the proposed modified project would not induce substantial population growth or displacement of population, or induce substantial increases in demand for housing, parks, or law enforcement services. Even with the increase in the operations workforce and construction schedule, the socioeconomic impacts of this alternative would be **similar to PSEGS**.

Construction and operation of this alternative would generate employment income and associated state and local sales taxes similar to what would be generated for the proposed PSEGS. Section 17620 of the Education Code (school impact fees) would not apply, as no habitable buildings would be constructed on private land. Property taxes would be assessed on the private land for the non-exempt improvements (Cal. Revenue and Taxation Code, § 73) associated with this alternative. The economic benefits would be **similar to PSEGS**.

Soil and Water Resources

The parabolic trough technology of the previously approved Reconfigured Alternative #2 or #3 would require traditional power plant facilities similar to PSEGS; therefore, potential impacts caused by the disposal of industrial wastewater would be **similar to PSEGS**. However, the added risk of accidental leaks or spills of HTF would increase the potential impacts of contaminated storm water runoff for the No-Project Alternative. This is an impact that would be unique to parabolic trough technology; therefore, potential impacts related to contaminated storm water runoff would be **somewhat greater than**

PSEGS. Domestic sanitary waste would still need a septic system for proper disposal, so these impacts would be the **similar to PSEGS**.

A technical limitation for parabolic trough facilities is the need for very flat terrain. Because the piping interconnecting the troughs has a very low tolerance for change in slope, the parabolic troughs need to be on less than 2 percent slope, and preferably less than 1 percent. The additional amount of total soil disturbance would significantly increase due to the need to level the site for installation of parabolic troughs. Although the project footprint of PSEGS is roughly 570 acres less (13 percent) than the footprint for the approved Reconfigured Alternative #2, the amount of earthwork required would be reduced by about 95 percent (0.2 million cubic yards compared to 4.5 million cubic yards). As a result, impacts related to soil erosion during construction would be **much greater than PSEGS** for either configuration of the No-Project Alternative.

The need for flat terrain results in very different approaches to storm water management between the two technologies. For both approved facility layouts of the No-Project Alternative, large channels would have been constructed just within the project borders to divert off-site flows away from the solar fields. These channels would help protect the site from off-site flows contributing to on-site flooding. Because the proposed PSEGS would allow existing on-site flooding to continue, impacts from on-site flooding of the No-Project Alternative would be **less than PSEGS**. However, potential impacts of these diversion channels on water quality from storm damage would be **greater than PSEGS** because flows from multiple existing ephemeral channels would combine, which would increase discharge rates and runoff volumes. Implementation of mitigation measures would reduce potential storm damage impacts to less than significant. Impacts from 100-year flood flows (as shown on the Federal Emergency Management Agency [FEMA] maps) do not apply because the published maps show that the 100-year flood plain is not present at or near the proposed PSEGS site.

Both configurations of the No-Project Alternative would utilize soil stabilizers within the solar fields to reduce the amount of dust deposited on the solar collectors (dust adversely affects the efficiency of solar trough technology). Therefore, despite the fact that many more acres of land would be graded and leveled, impacts relating to soil erosion during operations likely would be **less than PSEGS**. In addition, the flat slopes and grading would prevent on-site runoff from concentrating, resulting in shallow sheet flow which minimizes the potential for surface erosion.

Parabolic trough technology and solar power tower technology employ a similar steam cycle, so operational water use for the No-Project Alternative would be similar to PSEGS because both projects would use dry cooling. However, the overall water use of the No-Project Alternative would be much greater than PSEGS, roughly twice as much (14,750 acre-feet [af] compared to 7,160 af). This is due to the significant amount of earthwork during construction of the No-Project Alternative and increased water use for ongoing activities such as regular mirror washing of parabolic troughs compared to mirror washing of heliostats. For purposes of impact analysis, it is assumed that any withdrawals exceeding the average natural recharge and exceeding a significant percentage of the total amount of stored groundwater would cause a significant impact.

Because the Chuckwalla Valley Groundwater Basin (CVGB) is estimated to have a positive groundwater balance (inflow exceeds outflow) by approximately 2,600 afy, neither PSEGS nor the No-Project Alternative would result in basin overdraft. And although the difference in water use of the No-Project Alternative would be about 7,590 af more than PSEGS, total water use by the proposed PSEGS or this alternative would be very small compared to the CVGB storage capacity of 15,000,000 af. Because the PSEGS or this alternative would reduce the amount of total stored groundwater by less than a tenth of 1 percent, potential impacts of the No-Project Alternative on the CVGB and local well owners would generally be **somewhat greater than PSEGS**.

Traffic and Transportation

Potential Damage to Roads

During peak construction of the previously approved Reconfigured Alternative #2 or #3, the average daily workforce would be approximately 1,141 workers, which is less than the 2,311 workers required daily during peak construction of the proposed PSEGS. The number of daily one-way truck trips during peak construction of the original PSPP would be 40, which is less than the 90 peak daily one-way trips projected for the proposed PSEGS. Because the original PSPP would generate fewer construction and heavy-haul truck trips, road damage would be **less than PSEGS** under the No-Project Alternative. Mitigation measures similar to those recommended for the proposed modified project would reduce potential damage impacts on roadways to less than significant.

Level of Service on Roads and Highways – Construction

As discussed above, the No-Project Alternative would generate less construction traffic than the PSEGS; therefore, impacts on level of service (LOS) would be **less than PSEGS**. Like the proposed modified project, implementation of appropriate mitigation measures (e.g., a traffic control plan) would reduce this impact to less than significant.

Level of Service on Roads and Highways – Operation/Post-Construction

The number of daily operations employees required for the previously approved Reconfigured Alternative #2 or #3 is 134, which is more than the 100 daily employees needed for the proposed PSEGS. However, for both projects, the minimal number of trips generated by operations employees would have a negligible impact on traffic LOS. Therefore, impacts would be **similar to PSEGS**. No mitigation measures would be required.

Solar Collector Glint and Glare Impacts on Motorists and Pilots

The mirrored surfaces of various solar collectors are designed to concentrate the sun's rays on a receiver such as the SRSG at the top of the SPTs for the proposed modified project. The parabolic trough technology of Reconfigured Alternative #2 or #3 uses parabolic mirrors, which refocus solar radiation onto a receiver tube located at the focal point of the parabola. Highly reflective solar collectors from utility-scale solar projects have the potential to cause glint and glare effects and an intrusive bright nuisance, which can be distractive and uncomfortable to motorists and pilots in the area.

Compared to reflections from the proposed PSEGS's nearly planar heliostat mirrors, parabolic mirror reflections are much more diffuse and produce a greatly reduced glare effect as a function of viewing range. Therefore, solar collector glint and glare impacts under the No-Project Alternative would be **much less than PSEGS**. Mitigation measures similar to those recommended for the proposed modified project would reduce potential nuisance effects of glint and glare to less than significant.

Solar Receiver Glare Impacts That Could be Hazardous to Motorists and Pilots

Unlike the proposed PSEGS heliostats (mirrors) and SPTs, parabolic trough technology uses parabolic mirrors which refocus the radiation on a receiver tube located at the focal point of the parabola. Although the receiver tube glows and can be a source of glare, the receiver tubes are spatially distributed across the entire mirror field, as each individual receiver tube is associated with an individual parabolic mirror. This is unlike the PSEGS's brightly glowing solar receivers at the tops of the SPTs in which the glare source is concentrated at a single location from all of the active heliostat mirrors. Therefore, solar receiver glare impacts under the No-Project Alternative would be **much less than PSEGS**. Glare impacts from Reconfigured Alternative #2 or #3 would be less than significant, and no mitigation measures would be required. See the subsection below, "Visual Resources," for an assessment of the potential glint and glare effects of the alternatives on the visual and aesthetic environment.

Visual Resources

As described above, the PSEGS site was licensed by the Energy Commission in 2010 for construction and operation of either Reconfigured Alternative #2 or #3. Reconfigured Alternative #2 would consist of an approximately 4,365-acre parabolic trough solar energy project. This approved alternative would cover a larger area than the proposed 3,794-acre PSEGS, but would not include the SPTs topped by the brightly glowing SRSGs and the heliostats of the proposed PSEGS. Reconfigured Alternative #2, like the proposed PSEGS, would include a power transmission line from the project site extending westward to the Red Bluff Substation.

Compared to Reconfigured Alternative #2, Reconfigured Alternative #3 would disturb approximately 4,330 acres (an area less than 1 percent smaller) in a similar layout and location. Either approved alternative would employ the same technology and facilities and require the same transmission line to the Red Bluff Substation. For these reasons, Reconfigured Alternative #3 would have similar effects on scenic vistas, scenic resources, visual quality, and light and glare as Reconfigured Alternative #2.

Potential for Adverse Impacts on Scenic Vistas

Construction-Related Impacts: Construction of Reconfigured Alternative #2 or #3 (i.e., the No-Project Alternative) would cause temporary visual impacts due to the presence of equipment, materials, and a large workforce at the project site and along the transmission line route, an increase in visible traffic along I-10 and access roads, and large dust clouds generated by grading activities. A feature of parabolic trough technology is the need for very level sites over large areas. Consequently, required project grading during construction of Reconfigured Alternative #2 or #3 would be extensive. As described above, the approved parabolic trough alternatives of the PSPP would require a total cut and fill volume of approximately 4.5 million cubic yards whereas the proposed PSEGS would require approximately 0.2 million cubic yards of cut and fill. The proposed PSEGS heliostat mirror fields consist of independently mounted units that do not require project-wide grading or perfectly level sites. Consequently, grading-related construction impacts of this alternative on scenic vistas would be **greater than PSEGS**.

Project Operations Impacts: No designated scenic vistas were identified in the study area, but panoramic and highly scenic vistas from two BLM Wilderness Areas (Palen McCoy Wilderness and Chuckwalla Mountains Wilderness) would be affected by this alternative. Reconfigured Alternative #2 or #3 would not have two solar receivers with an extremely bright glare, but would have two fields of parabolic reflectors that would cover a larger area than the heliostat fields of the proposed PSEGS. This alternative would have similar industrial-type characteristics and be prominently visible from the two Wilderness Areas. The introduction of industrial characteristics and structural/textural visual contrast would result in substantial adverse effects on these scenic vistas. The impact on scenic vistas would be **somewhat less than PSEGS** because the solar trough alternatives would not have the strong form contrast of the two 750-foot-tall solar towers, or the strong glare contrast of the SRSGs at the tops of the SPTs. However, the parabolic trough structures would be approximately 25 feet tall, and the form/texture contrast of the parabolic trough mirror fields would be strong and would be a significant and unavoidable impact of implementing Reconfigured Alternative #2 or #3.

Potential to Substantially Damage Scenic Resources within a State Scenic Highway

The PSEGS site is located adjacent to the north side of I-10, which is not listed as an eligible State Scenic Highway, and no notable scenic features or historic structures are located within the site. Therefore, construction of Reconfigured Alternative #2 or #3 would not substantially damage scenic resources within a state scenic highway. This impact would be **similar to PSEGS**. The impact of operation of Reconfigured Alternative #2 or #3 on scenic resources within a state scenic highway would be **similar to PSEGS**.

Potential to Substantially Degrade the Existing Visual Character or Quality of the Site and its Surroundings

Construction-Related Impacts: As discussed above, the extent of site grading required for Reconfigured Alternative #2 or #3 would be greater than for the proposed PSEGS. Construction impacts of this alternative on visual quality would thus be **greater than PSEGS**.

Project Operations Impacts: Reconfigured Alternative #2 or #3 would introduce a field of prominent parabolic mirror structures with industrial characteristics into the views from State Route (SR) 177, the Desert Center area, I-10, Corn Springs Road, nearby Wilderness Areas, Joshua Tree National Park, and a few residences within the project viewshed. The area of Reconfigured Alternative #2 or #3 would be up to approximately 570 acres larger than PSEGS, but this alternative would not include the highly visible vertical structures of the SPTs or generate extreme glare from the SRSGs at the tops of the towers. However, the additional increment of form and glare contrast under the proposed PSEGS due to the very tall solar towers and brightly glowing solar receivers would be substantial compared to the approved parabolic trough projects. The impact of Reconfigured Alternative #2 or #3 on visual quality would thus be **less than PSEGS**, although this alternative would also result in a substantial degradation of the existing visual quality of the site and its surroundings.

Potential to Create a New Source of Substantial Light or Glare Which Would Adversely Affect Day or Nighttime Views in the Area

Construction-Related Impacts: Some construction activity could take place at night during construction of Reconfigured Alternative #2 or #3, with lighting impacts that would be **similar to PSEGS**.

Project Operations Impacts: Non-mirrored surfaces of the facilities of Reconfigured Alternative #2 or #3 (mirror support structures, mirror backs, power block generation facilities, operations and maintenance [O&M] facilities, etc.) could introduce reflected glare into the visual environment if the structures were light colored or included unpainted metal components, an impact that would be **similar to PSEGS**. Like the proposed modified project, with the effective implementation of Condition of Certification **VIS-1** requiring preparation and implementation of a surface treatment plan, Reconfigured Alternative #2 or #3 would not cause excessive glare from such non-mirrored components.

Glint effects, that is, inadvertent, very bright reflections of the sun’s image off the parabolic reflectors under certain conditions, could present a disruptive visual distraction for motorists and other viewers, which would represent a significant glint or glare impact of Reconfigured Alternative #2 or #3 due to the potential intensity of the effect. This glint impact would be **similar to PSEGS**. With implementation of proposed Condition of Certification **TRANS-7**, stray glint impacts from solar reflection off the heliostats under the proposed PSEGS would be less than significant. Although the causes of stray glint impacts are somewhat different under a parabolic trough project compared to the proposed PSEGS, similar mirror positioning and control and monitoring measures could be applicable to a parabolic trough project. Thus, staff assumes that inadvertent stray glint impacts could be reduced to a less-than-significant level with implementation of a similar mitigation measure under Reconfigured Alternative #2 or #3.

Compared to the proposed PSEGS, Reconfigured Alternative #2 or #3 would not include extremely tall solar towers with solar receivers, and would not generate strong on-going, operational SRSG glare that would be similar in any way to the proposed PSEGS. The impact of Reconfigured Alternative #2 or #3 due to on-going operational glare from solar receivers would not occur; therefore, **no impact** would occur compared to PSEGS.

Reconfigured Alternative #2 or #3 could generate nighttime light pollution from its operational lighting, and this impact would be **similar to PSEGS**. As with the proposed modified project, the effective implementation of Condition of Certification **VIS-4** (VIS-3 from the 2010 Commission Decision on the PSPP) would reduce this alternative's off-site, operation-related lighting impacts to less than significant.

Reconfigured Alternative #2 or #3 would not have solar towers that would require Federal Aviation Authority (FAA) safety lighting, and **no impact** would occur.

Waste Management

The Commission Decision for the original PSPP evaluated effects of the approved Reconfigured Alternatives #2 and #3 on waste management. Based on current estimates provided by the project owner, disposal of non-hazardous and hazardous waste generated by the proposed PSEGS would be approximately the same as the originally licensed project (i.e., the No-Project Alternative) and would not adversely impact either Class III or Class I landfill capacity. This impact would be **similar to PSEGS**. The original PSPP would require the use of HTF, which must be disposed of as a hazardous waste. The potential for discharge of HTF could result in significant environmental impacts. Because SPT technology does not use any similar HTF, this impact would be **much greater than PSEGS**.

Potential impacts relating to soil and water contamination and the potential presence of unexploded ordnance (UXO) at the site would be **similar to PSEGS**. A UXO Identification, Training, and Reporting Plan would still be required, which would include site worker training and procedures for UXO investigation, removal, and disposal.

SOLAR PHOTOVOLTAIC (PV) ALTERNATIVE WITH SINGLE-AXIS TRACKING TECHNOLOGY

Overview

Solar PV technology involves the direct conversion of photons (i.e., sunlight) into electricity. PV modules (also called solar panels) absorb solar radiation and convert it into direct current electricity. This direct current power is then converted into alternating current electricity for delivery to the electrical grid system. This conversion occurs when direct current (DC) flows through a device called an *inverter*, which converts the electrical characteristics to alternating current (AC) that can be tied to the power distribution system for power delivery. The electrical current produced is directly dependent on how much light strikes the module. Multiple PV panels are wired together to form an array, an arrangement that increases the total system output. PV technology does not involve thermal energy or the production of steam to power turbines. PV systems are relatively simple to operate and maintain and require little water for project operations compared to solar thermal energy systems.

The Solar PV Alternative would involve constructing and operating a utility-scale, single-axis tracking PV project at the proposed PSEGS site. PV trackers using single-axis (east-west) tracking maximize the panels' absorption of sunlight during the day and throughout the year. Tracking PV modules produce more electricity annually compared to fixed-tilt modules.

The April 2012 Desert Renewable Energy Conservation Plan Stakeholder Committee Meeting included a review of an update to the renewable energy calculator that was developed by Energy Commission staff to use as a tool for framing an understanding of renewable energy supply and demand for the 2040 planning horizon. Partly in response to comments on an earlier version of the 2040 planning scenario, the acreage requirement for all central station solar projects, including solar thermal and PV project types, was reduced from 9.1 acres per MW to 7 acres per MW. Although it was acknowledged at the meeting that scenarios will vary depending partly on the portfolio[5], the modified efficiency ratio is considered to be plausible and reasonable. Adjustments to the portfolio will be made every 5 years during the planning horizon.

Alternatives Table 3 lists five utility-scale, single-axis tracking PV projects that are approved and at different stages of development in California. Based on the generating capacities and acreage requirements for these sample projects, staff assumes that a single-axis tracking solar PV project with an electrical capacity similar to the proposed PSEGS could be constructed at the project site with no change to the site boundary. Operational water use for the PV projects listed in the table ranges from approximately 12.4 afy for the California Valley Solar Ranch Project to approximately 15–22 afy for the McCoy Solar Energy Project. The proposed modified project would require 201 afy for project operations.

The Solar PV Alternative would not require a natural gas supply; therefore, this alternative would not require a new extension of the existing Southern California Gas distribution system to the project site boundary.

The previous alternatives analysis for the licensed PSPP eliminated a utility-scale PV alternative from detailed consideration, stating that it would require more extensive site grading and a stormwater management system that would be greater than the PSPP (Energy Commission 2010b). Based on staff's current review of several utility-scale PV projects in the state, developers are installing systems that minimize site grading and removal of on-site vegetation. Site restoration and revegetation is typically required to repair and restore areas that were disturbed during construction. Similar to the supporting piers for the heliostats, PV module supports are installed to allow stormwater flows to cross the site. In addition to the projects shown in **Alternatives Table 3**, PV projects are being installed in the state to minimize site disturbance and avoid or minimize cut and fill grading, including the Desert Sunlight Solar Farm Project in the Chuckwalla Valley and the Topaz Solar Farm Project on the Carrizo Plain. Therefore, the analysis of the Solar PV Alternative in this staff assessment has conclusions that

[5] The portfolio includes central station solar thermal, central station PV, wind, biomass/fuels, geothermal, utility-side distributed generation, and small rooftop solar.

are different based on currently available information on potential environmental impacts from PV systems. Further details are provided following **Alternatives Table 3** on two of the PV projects reviewed by staff.

Alternatives Table 3
Summary Descriptions of Five Approved Single-Axis Tracking Photovoltaic Projects in California

<table>
<tr><th>Project Name and Location</th><th>PV Technology</th><th colspan="2">Energy Capacity and Acres</th><th>Schedule</th></tr>
<tr><td>California Valley Solar Ranch Project, northeastern edge of the Carrizo Plain in southeastern San Luis Obispo County</td><td>Crystalline silicon PV panels attached to SunPower T0 Tracker® system (1,032 tracker units in ten arrays); single-axis tracking; about 757,320 solar panels</td><td colspan="2">250 MWs; 1,500 acres</td><td>Project approved April 2011 and will be fully operational in 2013</td></tr>
<tr><td>Unit 1 of the McCoy Solar Energy Project, Riverside County approximately 13 miles northwest of Blythe</td><td>PV panels using single-axis trackers.</td><td colspan="2">250 MWs; 2,186 acres</td><td>Record of Decision issued March 2013 on the whole 750-MW project; construction completion end of 2016</td></tr>
<tr><td>Quinto Solar PV Project, Merced County approximately 11 miles north of San Luis Reservoir</td><td>SunPower 425-watt monocrystalline solar panels attached to SunPower T0 Tracker® system; about 306,720 solar panels mounted on approximately 2,900 single-axis trackers</td><td colspan="2">110 MWs; permanent structures (solar arrays, operation and maintenance structures, inverters, etc.) will cover approximately 528 acres of the 1,012-acre project site</td><td>Project approved 2012 and will be fully operational late 2014</td></tr>
<tr><td>Antelope Valley Solar Project I, Kern and Los Angeles counties in the Tehachapi area</td><td rowspan="2">SunPower 425-watt monocrystalline solar panels attached to SunPower T0 Tracker® system; about 1.875 million solar panels</td><td>325 MWs</td><td rowspan="2">Modified project site will cover approximately 4,642 acres; permanent structures will cover approximately 2,152 acres of the total site</td><td rowspan="2">Construction began in 2013 and power generation will begin in 2015</td></tr>
<tr><td>Antelope Valley Solar Project II, Kern and Los Angeles counties in the Tehachapi area</td><td>276 MWs</td></tr>
<tr><td colspan="5">Sources: Ekstrom, pers. comm., 2012; Randolph, pers. comm., 2012; San Luis Obispo County Planning and Building Department 2011; DOE 2011; BLM 2012; Kern County Planning and Community Development Department 2012; Merced County Planning and Community Development Department 2012.</td></tr>
</table>

California Valley Solar Ranch Project

The SunPower T0 Tracker® technology is described in the final environmental assessment (EA) for the California Valley Solar Ranch (CVSR) Project and provides an example of the type of technology that could potentially be installed at the PSEGS site. At the CVSR Project site on the Carizzo Plain, the T0 Tracker technology allows more efficient use of the site due to its tolerance for slope variations (DOE 2011). This tracker technology has a low profile, typically 5 to 6 feet above the ground when oriented in the horizontal position (or slightly higher in limited areas at the site with steeper slopes). No permanently shaded areas are created by the panels. The trackers use low-impact penetrating foundations that are driven directly into the ground without the need for concrete foundations. Each foundation has a footprint of approximately 4½ inches. The tracker and low-impact penetrating foundation structures and mechanical assemblies are made of galvanized steel. **Alternatives Figure 3a** shows a photograph of a typical T0 Tracker.

For the CVSR Project, the array blocks (i.e., sets of PV panels) cover approximately 6 to 6½ acres. The inverters (described above) are centrally located in each array block. Many array blocks compose a single array. **Alternatives Figures 3a and 3b** provide photographs of some of the single-axis tracking PV arrays at the CVSR Project site.

As described in the final EA for the CVSR Project, power is transmitted from the inverters to the substation through medium-voltage AC collection lines running underground and overhead. The poles supporting the medium-voltage AC lines are typically about 50 feet tall. The final EA estimates that the electrical collection lines will require approximately 200 utility poles. The power is converted from 34.5 kV to 230 kV at the CVSR Project substation. A new, approximately 4-mile-long overhead 230-kV interconnection line is connecting the CVSR Project to the existing PG&E 230-kV Morro Bay-Midway transmission line at a new switching station. **Alternatives Figure 4** shows the solar arrays and major project features for the CVSR Project for illustrative purposes. As depicted in **Alternatives Figure 4**, PV arrays may be configured in noncontiguous areas of different sizes and shapes.

Most of the CVSR Project will be constructed on approximately 1,500 acres. As described in the final EA for the CVSR Project, site preparation for installation of trackers requires grading of about 315 acres, excluding grading for fire access roads around the arrays (DOE 2011). The project's interior road system requires construction of approximately 24 miles of roadway covering about 80 acres. Of the total 1,500 acres, approximately 90 acres are expected to be subject to permanent disturbance. This acreage does not include construction of the interconnection line, which is expected to permanently disturb approximately 16 acres.

Installation of the SunPower T0 Tracker® system generally does not require grubbing (removal of vegetation); vegetation is only removed in areas where grading occurs. As described by a representative of the project developer for the CVSR Project, strict procedures are followed for top soil retention in disturbed areas (Ekstrom, pers. comm., 2013). Following ground disturbance, the top soil and seed bank that was removed during construction is returned and redistributed over the disturbed area to revegetate the site, in accordance with the agency-approved Habitat Restoration and Revegetation Plan. **Alternatives Figure 3a** includes a photograph showing grasses beneath the arrays.

McCoy Solar Energy Project

BLM recently issued the ROD approving construction and operation of the McCoy Solar Energy Project (MSEP), a 750-MW solar PV project in Riverside County near Blythe, California (BLM 2013b). The approved project will be constructed in two units with Unit 1 covering approximately 2,259 acres inside the project's fence line. Of that total, approximately 477 acres are under County jurisdiction and outside of BLM's right-of-way grant boundary; an EIR is being prepared by the County for the portion of the MSEP that will be constructed on private land. Unit 1 will have a generating capacity of up to 250 MW. The power generated by Unit 1 of the MSEP will be sold to Southern California Edison (SCE) under a PPA that was approved by CPUC in June 2012.

The project developer for the MSEP has not yet selected a solar panel supplier for Unit 1 (Neville, pers. comm., 2013). The panels will either be thin film (cadmium telluride [CdTe]) or polycrystalline silicon; either type of panel can be installed on a single-axis tracking system. The energy generation efficiency of the MSEP will vary depending on the type of panel that is selected and installed.

Because the MSEP site is nearly flat, minimal grading and earthwork will be used at the site (BLM 2013b). Stormwater drainage will be designed to maintain existing surface water hydrology and drainage wherever possible. PV tracking and framing structures will generally be installed to follow the existing land contours. Localized grading will be used only to compensate for major variations in topography while avoiding significant impacts on existing surface hydrology. Although not anticipated, if large areas require grading, a disc and roll technique would be used rather than conventional cut and fill grading (BLM 2012). Adopted mitigation measures include a measure (APM BIO-2p) to develop and implement a revegetation plan to restore temporarily disturbed areas (BLM 2013b). Even so, the biological resources analysis in the final EIS for the MSEP assumes that the entire MSEP site would be subject to permanent ground disturbance, including temporary laydown areas that would be converted to the solar field following construction (BLM 2012).

Potential to Attain Project Objectives

Ongoing approval and construction of utility-scale PV projects in California and Nevada indicate the suitability of using PV technology for development of a large, renewable energy power plant with a capacity of several hundred MWs. It is possible that the PSEGS 3,576-acre solar field area could be used for design and layout of a single-axis tracking PV project to achieve close to the 500-MW capacity of the proposed modified project. The site plan for the CVSR project shows noncontiguous polygons forming the array boundaries for that project (**Alternatives Figure 4**), which demonstrates that single-axis tracker systems do not necessarily require extensive, uninterrupted areas for the layout of solar array fields. Assuming that configuring a single-axis tracking PV project has some inherent flexibility, this alternative could potentially satisfy the project objectives to comply with applicable LORS and avoid or minimize significant impacts to the greatest extent feasible. The environment of the PSEGS site is unlike the CVSR project site on the Carrizo Plain, and further study would be necessary to devise a site plan for the layout of single-axis PV trackers at the PSEGS site. This alternative would satisfy the project objective to develop a renewable energy facility in an area with high solar value and minimal slope.

This alternative would not satisfy the project owner's objective to develop a solar thermal power plant at a site where some authorizations for construction have been obtained. The Energy Commission's prior licensing of the PSEGS site for a solar thermal electric generation facility would not apply to the Solar PV Alternative (see the discussion below under "Potential Feasibility Issues"). BLM would be the primary permitting authority, and staff assumes that submittal of a revised POD to BLM would be required. Given the change of permitting authority, it is unknown whether this alternative could satisfy the project objectives to construct and operate a utility-scale solar energy project and assist SCE in satisfying its RPS program goals.

The Solar PV Alternative could potentially satisfy many of the project objectives, although it is uncertain whether the change of technology would allow development of this alternative in a timely manner. See the discussions below under, "Environmental Analysis," for general analyses of the potential environmental effects of this alternative compared to the proposed modified project.

Potential Feasibility Issues

The Petition to Amend for the proposed modified project states that each of the two 250-MW units has an approved PPA with SCE (Palen Solar Holdings 2012). It is unknown whether changing the technology of the PSEGS to single-axis PV trackers would require amending the PPAs. It is also unknown whether CPUC would approve amendments to the PPAs allowing the change, if such approvals would be necessary.

As stated above, Palen Solar Holdings has an LGIA with CAISO for 500 MWs of interconnection rights to deliver electricity from the PSEGS to SCE's Red Bluff Substation (Palen Solar Holdings 2012). A schedule delay could result in a project's failure to meet its milestones and a breach of the LGIA. Changing the project technology to solar PV could at least cause a project schedule delay, and it is not known at what point a project schedule delay would affect project viability.

The Warren-Alquist Act was amended in 2012 to allow certain solar thermal power plants that were certified by the Energy Commission to be converted, in whole or in part, to a solar PV technology and reviewed by the Energy Commission as an amendment to the originally licensed project. For a project located on BLM-managed land, issuance of an ROD by BLM would have been required before September 1, 2011 (Pub. Resources Code, § 25500.1[a]). Because the PSPP did not receive an ROD, the Energy Commission would not retain jurisdiction if a change to a solar PV technology was proposed at the site. In this instance, BLM would be the primary permitting authority, and changing the project technology to solar PV at the PSEGS site would presumably require submittal of a revised POD to BLM, which would also delay the project.

Environmental Analysis

Alternatives Table 4 presents a summary comparison of impacts of the proposed PSEGS to the same or similar potential impacts of the Solar PV Alternative with Single-Axis Tracking Technology. Comparative discussions for each environmental topic area follow the table.

Alternatives Table 4
Summary Comparison of Impacts of the Proposed PSEGS to the Solar Photovoltaic Alternative with Single-Axis Tracking Technology

Environmental Effect	Proposed PSEGS	Solar PV Alternative
Air Quality		
Construction-related emissions	SM (locally)	Similar to PSEGS (SM)
Project operations emissions	SM (locally)	Less than PSEGS (SM)
Reduction in greenhouse gases	B (system wide)	Somewhat greater than PSEGS (B)
Biological Resources		
Impacts on special-status plant species	SM	Similar to PSEGS (SM)
Impacts on waters of the state	SM	Similar to PSEGS (SM)
Impacts on desert tortoise	SM	Similar to PSEGS (SM)
Impacts on special-status terrestrial wildlife species (kit fox, American badger)	SM	Similar to PSEGS (SM)
Potential impacts on avian species from collisions with project features	PSU	Similar to PSEGS (PSU)
Potential impacts on avian species from exposure to concentrated solar flux	PSU	—
Potential impacts on groundwater dependent ecosystems	SM	Somewhat less than PSEGS (SM)
Impacts on sand transport corridor	SM	Somewhat less than PSEGS (SM) *(see biological resources note)*
Impacts on sand dunes and Mojave fringe-toed lizard	SM	Somewhat less than PSEGS (SM) *(see biological resources note)*
Biological resources note: Comparative impacts for the Solar PV Alternative for indirect impacts on the sand transport corridor, sand dune habitat, and Mojave fringe-toed lizard cannot reasonably be characterized without further data and use of a sand transport model.		
Cultural Resources		
Potential to substantively degrade, directly or indirectly, prehistoric or historical archaeological resources *on* the facility site, resources recommended or assumed to be historically significant *(see cultural resources note)*	PSM	Similar to PSEGS (PSM)

Alternatives Table 4
Summary Comparison of Impacts of the Proposed PSEGS to the Solar Photovoltaic Alternative with Single-Axis Tracking Technology

Environmental Effect	Proposed PSEGS	Solar PV Alternative
Potential to substantively degrade, directly or indirectly, prehistoric or historical archaeological resources *beyond* the facility site, resources recommended or assumed to be historically significant	SU	Much less than PSEGS (SM)
Potential for cumulatively considerable degradation of prehistoric or historical archaeological resources *beyond* the facility site, resources recommended or assumed to be historically significant	SU	Much less than PSEGS (SM)
Potential impacts on significant built-environment cultural resources *on* the site	LS	Similar to PSEGS (LS)
Potential impacts on a significant built-environment cultural resource (Desert Center) *beyond* the site	SU	Much less than PSEGS (SM)
Potential to substantively degrade, directly or indirectly, ethnographic resources *on* the facility site, resources recommended or assumed to be historically significant	PSM	Similar to PSEGS (PSM)
Potential for cumulatively considerable degradation of ethnographic resources *on* the facility site, resources recommended or assumed to be historically significant	LS	Similar to PSEGS (LS)
Potential to substantively degrade, directly or indirectly, ethnographic resources *beyond* the facility site, resources recommended or assumed to be historically significant	SU	Much less than PSEGS (SM)
Potential for cumulatively considerable degradation of ethnographic resources *beyond* the facility site, resources recommended or assumed to be historically significant	SU	Much less than PSEGS (SM)
Cultural resources note: "Site" means the facility site proper and does not include linear or ancillary infrastructure away from the facility site.		
Fire Protection		
Construction-Related Impacts		
Impacts on the Riverside County Fire Department	SM	Much less than PSEGS (SM)
Project Operations Impacts		
Become familiar with and plan for emergency responses	SM	Much less than PSEGS (SM)
Conduct plan reviews, inspections, and permitting	SM	Much less than PSEGS (SM)
Fire response	SM	Much less than PSEGS (SM)
Hazardous materials spill response	SM	Much less than PSEGS (SM)
Rescue	SM	Somewhat less than PSEGS (SM)
Emergency medical services	SM	Much less than PSEGS (SM)
Geology and Paleontology		
Potential impacts from strong seismic shaking	SM	Much less than PSEGS (SM)
Potential impacts from soil failure caused by liquefaction, hydrocollapse, and/or dynamic compaction	SM	Much less than PSEGS (SM)

Alternatives Table 4
Summary Comparison of Impacts of the Proposed PSEGS to the Solar Photovoltaic Alternative with Single-Axis Tracking Technology

Environmental Effect	Proposed PSEGS	Solar PV Alternative
Potential impacts on paleontological resources	SM	Somewhat less than PSEGS (SM)
Potential impacts on geological or mineralogical resources	—	—
Hazardous Materials Management		
Construction-Related Impacts		
Potential for spills or other releases of hazardous materials to occur on-site	SM	Same as PSEGS (SM)
Potential for spills or other releases of hazardous materials to occur off-site	LS	Same as PSEGS (LS)
Project Operations Impacts		
Potential for spills or other releases of hazardous materials to occur on-site	SM	Much less than PSEGS (SM)
Potential for spills or other releases of hazardous materials to occur off-site	LS	Much less than PSEGS (LS)
Land Use		
Compatibility with land use plan, policy, or regulation	SM	Similar to PSEGS (SM)
Public Health		
Potential for project construction to cause air toxics-related or other impacts that could affect public health	LS	Similar to PSEGS (LS)
Potential for project operations to cause air toxics-related or other impacts that could affect public health	PSM	Less than PSEGS (LS)
Socioeconomics		
Environmental justice population within 6-mile buffer.	—	—
Induce substantial population growth in an area, either directly or indirectly.	LS	Similar to PSEGS (LS)
Displace substantial numbers of people and/or existing housing, necessitating the construction of replacement housing elsewhere.	LS	Similar to PSEGS (LS)
Adversely impact acceptable levels of service for police protection, schools, and parks and recreation.	LS	Similar to PSEGS (LS)
Increased property taxes, construction and operation employment income, and increased state and local taxes and fees.	B	Similar to PSEGS (B)
Soil and Water Resources		
Soil erosion by wind and water during project construction	SM	Somewhat less than PSEGS (SM)
Soil erosion by wind and water during project operations	PSM	Less than PSEGS (PSM)
Water quality impacts from contaminated storm water runoff	SM	Somewhat greater than PSEGS (SM)
Water quality impacts from storm damage	PSM	Somewhat greater than PSEGS (PSM)
Water quality impacts from power plant operations	SM	Much less than PSEGS (SM)
Water quality impacts from sanitary waste	SM	Similar to PSEGS (SM)
Potential impacts from on-site and off-site flooding	PSM	Similar to PSEGS (PSM)

Alternatives Table 4
Summary Comparison of Impacts of the Proposed PSEGS to the Solar Photovoltaic Alternative with Single-Axis Tracking Technology

Environmental Effect	Proposed PSEGS	Solar PV Alternative
Potential to impede or redirect 100-year flood flows, as shown on Federal Emergency Management Agency maps	—	—
Potential impacts on local wells	PSM	Somewhat less than PSEGS (PSM)
Potential impacts on groundwater basin balance	PSM	Somewhat less than PSEGS (PSM)
Traffic and Transportation		
Potential damage to roads	PSM	Less than PSEGS (PSM)
Level of service on roads and highways – construction	PSM	Less than PSEGS (PSM)
Level of service on roads and highways – operation/post-construction	LS	Similar to PSEGS (LS)
Solar collector glint and glare impacts on motorists and pilots	PSM	Much less than PSEGS (PSM)
Solar receiver glare impacts that could be hazardous to motorists and pilots	PSM	—
Visual Resources		
Construction-Related Impacts		
Potential for adverse impacts on scenic vistas	SM	Less than PSEGS (SM)
Potential to substantially damage scenic resources within a state scenic highway	LS	Similar to PSEGS (LS)
Potential to substantially degrade the existing visual character or quality of the site and its surroundings	SM	Similar to PSEGS (SM)
Potential to create a new source of substantial light or glare which would adversely affect day or nighttime views in the area	SM	Similar to PSEGS (SM)
Project Operations Impacts		
Potential for adverse impacts on scenic vistas	SU	Less than PSEGS (SU)
Potential to substantially damage scenic resources within a state scenic highway	LS	Similar to PSEGS (LS)
Potential to substantially degrade the existing visual character or quality of the site and its surroundings	SU	Less than PSEGS (SU)
Potential to create a new source of substantial light or glare which would adversely affect day or nighttime views in the area *(individual effects listed below)*		
Glint or glare effects from project structures other than the reflective surfaces of solar collectors (i.e., heliostats, parabolic troughs, PV panels)	SM	Much less than PSEGS (PSM)
Glint or glare effects from the solar collectors	SM	Much less than PSEGS (PSM)
Glint or glare effects from high-profile solar receiver steam generators	SU	—
Light or glare from nighttime lighting effects, including Federal Aviation Administration safety lighting	SM	Less than PSEGS (SM)
Waste Management		
Potential for unexploded ordnance to be present at the project site	PSM	Similar to PSEGS

Alternatives Table 4
Summary Comparison of Impacts of the Proposed PSEGS to the Solar Photovoltaic Alternative with Single-Axis Tracking Technology

Environmental Effect	Proposed PSEGS	Solar PV Alternative
		(PSM)
Potential for impacts on human health and the environment relating to past or present soil or water contamination	LS	Similar to PSEGS (LS)
Potential for impacts on human health and the environment relating to potential waste discharges	LS	Similar to PSEGS (LS)
Potential for disposal or diversion of project materials to cause impacts on existing waste disposal or diversion facilities	LS	Similar to PSEGS (LS)

Air Quality

The number of permitted fuel-consuming and air pollutant emitting sources would be significantly fewer under the Solar PV Alternative. Construction-related emissions and impacts would be **similar to PSEGS** for this alternative. Operational impacts relating to criteria pollutant emissions for a utility-scale PV project would include normal maintenance truck activity, possibly including periodic fire water pump engine testing, and use of water trucks coinciding with the infrequent work to wash the PV modules. Use of fossil fuel-fired supplemental boiler operation is not required under this alternative. Impacts on air quality from operation of the Solar PV Alternative would be **less than PSEGS**. The Solar PV Alternative would not require the auxiliary equipment (e.g., auxiliary boilers for freeze protection and fast startup) necessary to operate a solar thermal power plant; therefore, this alternative would generate GHG emissions that would be somewhat less than PSEGS. This alternative would cause an overall, system wide, cumulative reduction in GHG emissions from power plants that would be **somewhat greater than PSEGS**.

The Solar PV Alternative would not worsen current conditions or make a cumulatively considerable contribution to any significant cumulative impact associated with air quality.

Biological Resources

Solar PV technology would employ single-axis tracking PV technology at the proposed PSEGS site. It is assumed that the Solar PV Alternative would use a low-impact design that would minimize on-site grading and possibly entail management of native vegetation under the solar panels by mowing. It is possible that no grading would be necessary under most of the solar panels for the Solar PV Alternative, which is similar to the project owner's proposed vegetation management in the heliostat field for the PSEGS. Assuming the same project site boundary under this alternative, impacts on special-status plant species and waters of the state would be **similar to PSEGS**.

The PV Alternative would remove habitat occupied by desert tortoise and other special-status terrestrial wildlife species; this alternative would cause other direct and indirect impacts such as weed proliferation and increased dust. These impacts would be **similar to PSEGS**.

Impacts on avian species would occur through conversion of the project site from native habitat to a solar farm and potential collisions with project features such as PV panels and transmission lines. This technology does not require central collector towers (e.g., an SPT at the center of a heliostat array) or concentrate solar energy over a heliostat field; therefore, **no impacts** on avian species would occur from exposure to solar flux.

Little research-based data is available to determine the extent of collision impacts on avian species from either the PV or solar power tower technologies. Similar to concentrating solar power technology, the PV Alternative would have the potential to cause a *mirage* effect from the appearance of the sky reflected off the solar panels when viewed from a distance. Installation of heliostats could also cause an increase in polarized light pollution (PLP), which typically occurs from light reflecting off of dark colored anthropogenic structures, and has been demonstrated to be generated from even low-reflectance PV panels (Horváth et al. 2009). It is unknown to what extent this phenomenon is occurring or will occur from the surfaces of mirrored heliostats at newly developed SPT project sites (e.g., the ISEGS site). PLP caused by anthropogenic structures can alter the ability of wildlife to seek out suitable habitat and elude or detect the presence of predators (Horváth et al. 2010). It has also been documented that PLP can affect some organisms’ ability to detect natural polarized light patterns in the sky, which can negatively affect navigation ability and ultimately affect dispersal and reproduction (Horváth et al. 2009). Polarizing surfaces are also known to disrupt insect behavior, causing some insects to react as though the surface is water, and depositing eggs on polarizing surfaces (Horváth et al. 2009). The extent to which heliostats could serve as an attractant to avian species is unknown.

Reports of collisions are becoming more common as large-scale PV and concentrating SPT facilities are developed in the desert. Solar PV panels absorb rather than reflect solar energy. The reflective characteristics of the smooth, dark surfaces of PV panels are much different compared to the mirrored surfaces of the SPT heliostats that reflect the sun’s rays to the SRSGs. However, the glass surfaces of PV panels can and do reflect the sky. The reflective characteristics of PV panels likely vary depending on the position of the sun, viewing angle, tilt of the panels, and other variables (please see **Alternatives Figures 3a** and **Figure 3b** for representative photographs of PV arrays). PV solar arrays sometimes reflect the sky, including clouds, and can appear lighter in color. At other times and under different conditions, the PV arrays may appear dark like a still body of water. While it remains unclear how wildlife (primarily birds and bats, but also insects) perceive solar fields, and if the solar collectors are attractive under certain conditions, it is well documented that solar fields, including large PV array fields, can pose risks to birds or bats.

At the Desert Sunlight Solar Farm project site, a PV installation of a few thousand acres, birds have been documented to have collided with the panels or other project features (Pagel and Baird, pers. comms., 2013). The majority of the species impacted has been identified as migrant waterbirds that would not typically be found foraging in desert habitat, and whose presence would not have been expected to occur at the PV project site. A federally endangered species, the Yuma clapper rail (*Rallus longirostris yumanensis*), was among the recorded mortalities. Similarly, at the GSEP site, featuring reflective parabolic trough technology, waterbirds rarely found in the desert have collided with the mirrored troughs, or been found on-site, unable to fly, with no obvious injury. Both the GSEP and Desert Sunlight Solar Farm are in construction in Riverside County, between the Colorado River to the east and the proposed PSEGS site to the west. All three of these projects may be expected to encounter the same general suites of resident and migrant avian species. Of the injuries and mortalities that have occurred, reported incidents include birds being found overheated and/or stressed with no clear indication of the causes. Of the reported injuries or mortalities, some have occurred in association with evaporation ponds and as a result of collisions with perimeter fencing and other project features.

The extent and severity of potential collision impacts on avian species under the Solar PV Alternative is unquantifiable; however, given that collisions have been noted for various solar thermal collectors (e.g., parabolic troughs and heliostats) as well as PV panels, staff considers the potential risks of collisions or inducement to land on project site structures is likely **similar to PSEGS**. Impacts on avian species stemming from habitat loss could be mitigated to below a level of significance. For the Solar PV Alternative, impacts relating to collisions and other sources of injury or mortality associated with the facility could be significant. Staff recommends implementation of mitigation measures described in the **BIOLOGICAL RESOURCES** section of this staff assessment; however, a level of uncertainty exists as to the severity of the impact and the possible affected species. Staff considers these impacts on avian species to be significant, particularly if state or federally listed threatened, endangered, or other special-status species were impacted. Impacts could remain cumulatively significant after implementation of all feasible mitigation measures.

PV solar power plants require less operational water use, and less groundwater pumping, compared to the proposed modified project. Therefore, potential impacts on groundwater dependent plants and wildlife species would be **somewhat less than PSEGS**.

The PV alternative would use numerous individual driven foundation elements to support the PV panels, similar to PSEGS, and would eliminate the deep or otherwise specialized foundations required for the SPTs of the proposed modified project; however, the power towers would be located in a portion of the solar field that is outside of the active sand transport corridor. Because no specific single-axis tracking PV system is identified for this alternative, the number and diameter of the supporting piers for the PV modules is unknown compared to those required for the proposed PSEGS. Unlike the PSEGS project, the PV alternative would require fewer and smaller structures overall (no power towers, turbines, and steam condenser) and foundations. Assuming the same project footprint, direct impacts on the sand transport corridor, sand dunes, and Mojave fringe-toed lizard would likely be **somewhat less than PSEGS**. Without having a specific PV tracker technology identified for the project site, and in the absence of the modeling effort that would be needed to draw impact conclusions, staff is unable to make a comparative determination of the indirect impacts on sand transport corridors or for impacts on sand dunes and Mojave fringe-toed lizard.

Cultural Resources

Construction and operation of the Solar PV Alternative would require roughly the same extent of ground disturbance as the proposed PSEGS. The extent of the visual intrusion on cultural resources *beyond* the site compared to the proposed modified project would be **much less than PSEGS**, while the extent of physical disturbance of resources *on* the facility site compared to the proposed modified project would be **similar to PSEGS**.

The overall scale of the Solar PV Alternative and its vertical profile would be substantially less than PSEGS, given this alternative's lack of extremely tall structures that would be analogous in any way to the proposed PSEGS solar power towers. Compared to the approximately 750-foot-tall power towers and 12-foot vertical profile of the heliostat arrays of the proposed modified project, the vertical profile of the PV module arrays could be approximately 8 feet tall at maximum tilt. The PV arrays would be substantially less visible from most portions of the broad, landscape-scale resources that are the primary subjects of staff's concern; and where the terrain would allow views of portions of the PV arrays, the level of the visual intrusion in the landscape would be **much less than PSEGS**. In addition to the dramatically reduced vertical scale of the Solar PV Alternative, the lower reflectivity of the glass surfaces of the PV panels would be less intrusive compared to the mirrored heliostats. The overall physical disturbance of the portions of the cultural resources on the facility site, although minor relative to the overall size of landscape-scale resources, would nonetheless be roughly comparable to the degree of resource disturbance that would occur from the proposed modified project. Staff characterizes the net effect of this alternative on historical resources, primarily due to its much reduced visual presence relative to the proposed modified project, as **much less than PSEGS**.

Fire Protection

Construction-Related Impacts

Compared to the proposed PSEGS, construction of the Solar PV Alternative would require approximately the same level of service from the RCFD, and impacts on the RCFD would be approximately the same as the proposed PSEGS. Of the six RCFD services listed above (see the subsection, "Fire Protection, for the No-Project Alternative), construction of the Solar PV Alternative would require a much lower level of effort to conduct plan reviews, inspections, and permitting.

As described above for the comparison of impacts on fire protection under the "No-Project Alternative," hazardous materials use during construction activities and the impact on the RCFD relating to hazmat spill response would remain about the same for all alternatives compared to the proposed modified project.

Because the Solar PV Alternative does not include construction of extremely tall structures analogous to the 750-foot-tall SPTs of the proposed PSEGS, construction of this alternative would not have the added construction safety concern and the potential need to conduct a high-angle technical rescue in the event of worker injury. Under the Solar PV Alternative, no work in a confined space would be required during construction and little risk from fire would exist. Overall, construction-related direct and cumulative impacts on the RCFD under the Solar PV Alternative would be **much less than PSEGS**.

Project Operations Impacts

Solar PV technology, regardless of the type used, presents a far less need for the transportation, storage and use of hazardous materials than either solar parabolic trough or solar power tower technology and thus the need for hazardous materials spill response would be minimal. PV systems do not use steam generators because receiver units directly generate electricity and thus do not require the steam boilers, generators, steam condensers, and/or auxiliary heat rejection equipment associated with renewable solar thermal technologies. As a result, hazardous materials transportation, storage, and use would be minimal and workers exposure to spills would be **much less than PSEGS** for the Solar PV Alternative.

During operation of a PV facility, hazardous chemicals would be used and stored in relatively small amounts and represent limited risks of spills and need for response because of their small quantities, low volatility, and/or low toxicity. At the PSEGS site, several factors influence staff's conclusion that the risk of a release of hazardous materials would be extremely low:

1. Hazardous materials would very likely be delivered and stored in chemical "totes," which are designed to meet strict safety standards and thus have an excellent safety record of structural integrity and minimal spills.

2. Totes are self-contained units that do not involve the transfer of the hazardous material from a tanker truck to a large storage tank. They are delivered already containing the hazardous material.

3. The chance that more than one would fail at the same time is extremely remote.

4. The maximum volume of each tote is likely to be 400 gallons or less and each tote would be required to be placed within a secondary spill containment area to limit the spread of any spilled materials, thus limiting the size of the pool of material available for evaporation and dispersion.

5. Previous modeling at other power plants by staff of far greater amounts of various hazardous materials, including ammonia and sulfuric acid, spilling onto a road show very limited dispersion and the distance to a level of less than a significant airborne concentration is usually only a short distance. A spill into a containment area would have even a lesser dispersion distance.

However, solar PV panels present a unique safety hazard in that individual PV panels will continue to be energized and can generate electricity even when disconnected or covered unless the covering is composed of 100 percent light-blocking material. And, PV panels remain energized even when disconnected from the grid and during cloud cover. It is also estimated that at night, the light from facility light poles is powerful enough to re-energize a PV panel to a level that could present a shock hazard.

Therefore, even after disconnecting from the grid, PV panels are capable of discharging current to an object or a person. Standard regulations of the Occupational Safety and Health Administration requiring “Lockout/Tagout” of electrical systems are not sufficient to eliminate the threat posed by a PV panel or multiple panels to on-site workers, and consequently, impacts on rescue and EMS response. Emergency response personnel engaged in rescue or fire suppression are also at risk of coming into contact with electrified PV panels. This unique aspect of EMS and rescue response is not present with the other alternatives because once a circuit is cut (or locked-out) the current stops and workers are protected; this is the case for a project using parabolic trough technology or the SPT technology for the proposed PSEGS. For the Solar PV Alternative, the impact pertaining to the potential need for rescue services would be **somewhat less than PSEGS**.

Even with this added hazard to workers, staff concludes that the Solar PV Alternative would cause a lower impact on emergency services compared to the proposed PSEGS. Overall, impacts on emergency services during project operations for the Solar PV Alternative would be **much less than PSEGS**.

Geology and Paleontology

Primarily, the Solar PV Alternative would use numerous individual driven foundation elements to support the PV panels, similar to PSEGS, but would not require the deep or otherwise specialized foundations that would be required for the solar receiver towers of the proposed modified project. The elimination of deep foundations would decrease the potential for encountering fossil bearing strata; however, like the proposed modified project, impacts from the potential destruction of undiscovered paleontological resources would be a significant impact of this alternative.

Similar to the PSEGS project, solar PV panel foundation elements would be driven into the ground, potentially encountering and destroying buried fossils. Because no specific single-axis tracking PV system is identified for this alternative, the number and diameter of the supporting piers for the PV modules is unknown compared to those required for the proposed PSEGS.

Unlike the PSEGS project, the PV Alternative would require fewer and smaller structures (no towers, turbines, and steam condenser) and foundations required for support of these fewer and smaller structures would be similarly reduced. Therefore, construction of the Solar PV Alternative (driven panel post foundations coupled with decreased size and number of structure foundations) would cause impacts on paleontological resources that would be **somewhat less than PSEGS**.

The net effect to the Solar PV Alternative from geological hazards would be less than the PSEGS project. Due to elimination of tall tower structures, the project as a whole would have a decrease in seismic susceptibility. Potential impacts from strong seismic shaking would be **much less than PSEGS**. Potential impacts from soil failure mechanisms would also be **much less than PSEGS**.

Hazardous Materials Management

Construction-Related Impacts

As discussed above, the construction phases of any large-scale desert solar project would require the use of various hazardous materials posing similar on-site risks of spillage or other releases. For the Solar PV Alternative, construction-related hazardous materials impacts would be the **same as PSEGS**.

Project Operations Impacts

As discussed above under “Fire Protection,” solar PV technology presents a far less need for the transportation, storage, and use of hazardous materials than either solar parabolic trough or SPT technology. As a result, hazardous materials transportation, storage, and use would be **much less than PSEGS**.

During operation of a PV facility, hazardous chemicals such as cleaning agents, water treatment chemicals, welding gasses, oils, activated carbon, and other various chemicals would be used and stored in relatively small amounts and represent limited off-site hazards because of their small quantities, low volatility, and/or low toxicity. At the PSEGS site, several factors influence staff’s conclusion that the risk of off-site impacts from a release of hazardous materials would be extremely low:

1. Hazardous materials would very likely be delivered and stored in chemical “totes,” which are designed to meet strict safety standards and thus have an excellent safety record of structural integrity and minimal spills.

2. Totes are self-contained units that do not involve the transfer of the hazardous material from a tanker truck to a large storage tank. They are delivered already containing the hazardous material.

3. The chance that more than one would fail at the same time is extremely remote.

4. The maximum volume of each tote is likely to be 400 gallons or less, and each tote would be required to be placed within a secondary spill containment area to limit the spread of any spilled materials, thus limiting the size of the pool of material available for evaporation and dispersion.

5. Previous modeling at other power plants by staff of far greater amounts of various hazardous materials, including ammonia and sulfuric acid, spilling onto a road show very limited dispersion and the distance to a level of less than a significant airborne concentration is usually only a short distance. A spill into a containment area would have even a lesser dispersion distance.

6. The nearest off-site public receptors are 25 feet and 3,500 feet northwest of the PSEGS fence line and thus no matter where the small quantities of hazardous materials were placed on the site under this alternative, no off-site consequences would be expected if a spill was to occur.

Therefore, staff concludes that hazardous materials use for the Solar PV Alternative would pose a less than significant risk to the public and would be **much less than PSEGS**.

Land Use

The Solar PV Alternative would involve constructing and operating a utility-scale, single-axis tracking PV project at the proposed PSEGS site. The proposed PSEGS would be located entirely on public land administered by BLM and within the federal CDCA Plan area. The project area is in the “Multiple-Use Class M” land use category, which allows construction and operation of electrical generation plants. As discussed above, the PSEGS site is encompassed by BLM’s Riverside East SEZ. These designations also apply to the Solar PV Alternative. Like the proposed modified project, this alternative includes no private land, and no part of the site would be subject to Riverside County’s jurisdictional authority.

In February 2013, the project owner submitted a revised Plan of Development to BLM for the PSEGS. Should BLM approve issuance of a ROW grant for the PSEGS, two CDCA Plan amendments would be required—one would allow the solar generation facility and the other would allow the generation tie-line outside of the designated corridor (BLM 2013a). Staff recommends Condition of Certification **LAND-1** for the proposed PSEGS, which requires the project owner to provide documentation of the approved BLM ROW grant and a project-specific amendment to the CDCA Plan prior to the start of construction. **LAND-1** would also apply to the Solar PV Alternative. Like the proposed PSEGS, construction and operation of this alternative would require compliance with applicable federal land use LORS. Land use impacts of the Solar PV Alternative would be **similar to PSEGS**.

Public Health

Construction-Related Impacts

Construction-related combustion emissions and impacts would be similar to the proposed PSEGS for the Solar PV Alternative. Public health risks include diesel exhaust from diesel-fueled engines (such as trucks, graders, cranes, welding machines, electric generators, air compressors, and water pumps). According to staff’s analysis in the **PUBLIC HEALTH** section of this staff assessment, the calculated cancer risk and non-cancer Hazard Index from diesel particulate matter (DPM) are below the significance levels. Potential risks to public health during earth-moving construction activities would also be associated with exposure to Valley Fever in contaminated soil and fugitive dust disturbed during site preparation. As for the concerns of Valley Fever affecting the general population, staff considers the mitigation measures recommended in the **AIR QUALITY** section of this staff assessment adequate for the purposes of preventing all fugitive dust plumes from leaving the project boundary. As long as the dust plumes are kept within the project boundary, no significant risk would remain for Valley Fever to adversely affect the general population and public health. Therefore, no significant construction-related impacts on public health would occur, and no mitigation measures would be required. Much like the extent of site disturbance required for installation of the heliostats for the proposed PSEGS, construction of utility-scale single-axis tracking PV projects is being accomplished without extensive site grading. With the overall extent of site disturbance considered to be similar, public health impacts of the Solar PV Alternative would be **similar to PSEGS**.

Project Operations Impacts

The Solar PV Alternative would not cause minor combustion-related boiler emissions. Cooling towers and the equipment required for a traditional power plant would not be needed for the Solar PV Alternative. Infrequent washings of PV panels would be required. DPM emissions from the use of mobile sources (i.e., vehicle systems of mirror washing equipment and site support vehicles) for washing the PV panels would be less for the Solar PV Alternative compared to the proposed PSEGS. The heliostats that would be installed under the proposed modified project would require weekly washings with the potential for more frequent washings to be required. Based on staff's review of several sample utility-scale PV installations, washing of PV modules is required once or twice per year.

Some high-performance solar PV panel cells are known to contain small amounts of cadmium, selenium, and arsenic, and these substances could be emitted if any solar cells were broken during operation and maintenance activities. However, even with the possibility of PV panel cell breakage, staff does not consider any such emission hazards to be significant for public health and no mitigation measures would be required. Please refer to staff's "Waste Management" analysis (below) for more information on management and handling of PV panels. As described above, because this alternative would not cause emissions of toxic air contaminants from boiler combustion and cooling towers, staff considers the overall potential public health risks from the Solar PV Alternative to be **less than PSEGS**. The reduced frequency of washing the solar collectors (i.e., the PV panels compared to the heliostats of the proposed PSEGS) would reduce DPM emissions under this alternative.

Socioeconomics

For the Solar PV Alternative with Single-Axis Tracking Technology, the construction and operations workforce would likely be smaller and the phased construction schedule could be longer compared to the PSEGS. The construction schedule for a typical utility-scale PV project allows initial phases to be connected to the grid without the need for the entire project to be completed and operational. Also, the delivery of hundreds of thousands of PV panels for a utility-scale PV project could require multiple shipments of panels (Perez, pers. comm., 2013). Staff concludes in the **SOCIOECONOMICS** section of this staff assessment that construction and operation of the proposed PSEGS would not cause significant adverse direct or indirect socioeconomic impacts on public services. Even with the phased construction schedule that could increase the overall construction schedule by several months, the socioeconomic impacts of this alternative would be **similar to PSEGS**.

Construction and operation of this alternative would generate employment income and associated state and local sales taxes that would be similar to those for the proposed PSEGS. Like PSEGS, this alternative is on federal land; therefore, Section 17620 of the Education Code (school impact fees) would not apply and no property taxes would be paid. The economic benefits would **be similar to PSEGS**.

Soil and Water Resources

Solar PV systems do not use steam generators because receiver units (i.e., PV solar panels) directly generate electricity and thus do not require the steam boilers, generators, steam condensers, and/or auxiliary heat rejection equipment generally associated with a traditional power plant. As a result, characteristic impacts on water quality caused by the presence of power plant facilities would be **much less than PSEGS** for the Solar PV Alternative, namely the disposal of industrial wastewater and the risk of storm water exposure to industrial chemicals. Domestic sanitary waste would still need a septic system for proper disposal, and impacts relating to sanitary waste would be **similar to PSEGS**.

As discussed below under, “Waste Management,” depending on the type of PV module, use of PV panels could cause the release of hazardous CdTe waste if panels were damaged. The inadvertent discharge of hazardous waste during a large storm event would increase the potential for water quality impacts from storm damage to **somewhat greater than PSEGS**.

Much like the flow-through installation of heliostats, installation of the PV panels would not necessarily require significant site grading. Assuming that a single-axis tracking solar PV project with an electrical capacity similar to the proposed PSEGS could be constructed at the project site with no change to the site boundary, the potential for on-site/off-site flooding for the Solar PV Alternative would be **similar to PSEGS**. Impacts from 100-year flood flows (as shown on the FEMA maps) do not apply because the published maps show that the 100-year flood plain is not present at or near the proposed site.

Compared to the proposed PSEGS, the Solar PV Alternative would not require a temporary concrete batch plant for a solar tower or large foundations, or a temporary assembly building to construct heliostats. This alternative would not require the same level of construction activities needed to build traditional power plant facilities, which would result in less excavation, heavy equipment, personnel, and truck traffic compared to PSEGS. The Solar PV Alternative and the proposed PSEGS would need similar areas for construction laydown and temporary parking. Based on these factors, the impacts from the Solar PV Alternative relating to soil erosion during construction would be **somewhat less than PSEGS**.

Because of the decrease in frequency for washing of PV panels compared to what would be required to maintain the heliostats of PSEGS, this alternative would create less dust overall from washer vehicles driving on the dirt roads. Impacts relating to soil erosion during project operations would be **less than PSEGS**.

The Solar PV Alternative would require less water for project operations, given the less frequent washings required for PV solar panels. Operational water use is estimated to decrease by roughly 90 percent under the Solar PV Alternative (approximately 15 acre-feet per year [afy] compared to 201 afy). For purposes of impact analysis, it is assumed that any withdrawals exceeding the average natural recharge and exceeding a significant percentage of the total amount of groundwater in storage would cause a significant impact. Because the Chuckwalla Valley Groundwater Basin (CVGB) is estimated to have a positive groundwater balance by approximately 2,600 afy, neither PSEGS nor the Solar PV Alternative would result in basin overdraft. And although the difference in water use of the Solar PV Alternative over 30 years would be about 5,580 af less than PSEGS, total water use by the proposed PSEGS or this alternative would be very small compared to the CVGB's storage capacity of 15,000,000 af. Because the PSEGS or this alternative would reduce the amount of total stored groundwater by less than a tenth of 1 percent, potential impacts of the Solar PV Alternative on the CVGB and local well owners would be **somewhat less than PSEGS**.

Traffic and Transportation

Potential Damage to Roads

Staff reviewed four recently approved single-axis tracking solar photovoltaic facilities and found that construction of these projects required an average of 1.40 peak construction workers per MW of power generated, which is less than the 4.62 peak construction workers per MW required for the proposed PSEGS (BLM 2012, Kern County Planning and Community Development Department 2012, Merced County Planning and Community Development Department 2012, San Luis Obispo County Planning and Building Department 2011). The proposed PSEGS also would require 90 daily one-way truck trips during peak construction, which is considered by staff to be a fairly high number. Because the proposed PSEGS would involve more peak workers and truck trips, damage to roads near the project site would be **less than PSEGS** under the Solar PV Alternative with Single-Axis Tracking Technology. Mitigation measures similar to those recommended for the proposed modified project would reduce potential damage impacts on roadways to less than significant.

Level of Service on Roads and Highways – Construction

As discussed above, the Solar PV Alternative would likely generate less construction traffic than the proposed PSEGS; therefore, impacts on LOS would be **less than PSEGS**. Like the proposed modified project, implementation of appropriate mitigation measures (e.g., a traffic control plan) would reduce this impact to less than significant.

Level of Service on Roads and Highways – Operation/Post-Construction

The number of operations employees for the Solar PV Alternative with power output similar to the proposed PSEGS would likely be lower than the number of PSEGS operations employees. The solar PV projects reviewed by staff would require an average of 0.03 operations workers per MW generated, while the proposed PSEGS would have higher staffing levels at approximately 0.2 operations workers per MW generated. However, for all projects, the minimal number of trips generated by operations employees would have a negligible impact on traffic LOS. Therefore, impacts would be **similar to PSEGS**. No mitigation measures would be required.

Solar Collector Glint and Glare Impacts on Motorists and Pilots

In contrast to the PSEGS's heliostats (mirrors), solar PV panels absorb rather than reflect solar energy. Therefore, nuisance glint and glare impacts on motorists and pilots would be **much less than PSEGS**. Mitigation measures such as screening the site perimeter could be required to reduce any potential glint or glare impacts on motorists to less than significant. It is unlikely that any potential glint or glare from the solar panels would have any effect on pilots.

Solar Receiver Glare Impacts That Could be Hazardous to Motorists and Pilots

This alternative would not include glare-producing SRSGs and power towers, and as discussed earlier, PV panels absorb the vast majority of sunlight and do not have the same reflective characteristics as the mirrored heliostats. Also, the solar panels do not reflect any solar energy to heat a fluid circulating in a receiver. Therefore, the Solar PV Alternative would cause **no impact**.

Visual Resources

PV systems do not use steam generators because receiver units directly generate electricity and thus do not require the solar towers topped by solar receivers, steam boilers, generators, or steam condensers associated with the proposed PSEGS. This alternative would include solar arrays of PV modules (solar panels) at the PSEGS site with no change to the site boundary. The 230-kV transmission line from the project site to the Red Bluff Substation would use the same linear corridor as the proposed PSEGS.

Potential for Adverse Impacts on Scenic Vistas

Construction-Related Impacts: Construction of the PV Alternative would cause temporary visual impacts due to the presence of equipment, materials, and a workforce at the project site and along the transmission line route, an increase in visible traffic along I-10 and access roads, and large dust clouds generated by grading activities. The area of disturbance and construction period of this alternative would be generally similar to the proposed PSEGS project. As described above, the Solar PV Alternative would use numerous individual driven foundation elements to support the PV panels, similar to PSEGS, but would not require the deep or otherwise specialized foundations that would be required for the proposed modified project. Construction of power blocks and other large facilities under the proposed PSEGS would not be necessary under the PV

Alternative. The construction-related impacts of this alternative on scenic vistas would thus be **less than PSEGS**.

Project Operations Impacts: No designated scenic vistas were identified in the PSEGS study area, but panoramic and highly scenic vistas from the Palen McCoy Wilderness and Chuckwalla Mountains Wilderness would be affected by this alternative. The PV Alternative would not have two solar receivers with an extremely bright glare. Under this alternative, solar arrays of PV modules would be installed at the proposed PSEGS site that could appear similar to PSEGS in apparent extent and with similar industrial characteristics when viewed from the two Wilderness Areas. Blocks of single-axis PV tracker units have a lower vertical profile than solar-tower heliostats. For example, the SunPower T0 Tracker® units typically extend 5–6 feet above the ground and increase to approximately 8 feet at maximum tilt. The tops of the proposed PSEGS heliostat array fields would be approximately 12 feet tall. Although the overall site footprint would be comparable to the PSEGS, the vertical profile would be much lower and the intensity of the visual effect would likely be reduced compared to the proposed PSEGS. The potential for this alternative to substantially degrade the existing visual character or quality of the site and its surroundings would be **less than PSEGS**. However, like the proposed PSEGS, this impact would remain significant and unavoidable under the Solar PV Alternative.

The visual characteristics of the affected project area would differ compared to the proposed PSEGS. Under the proposed PSEGS, the mirror field would exhibit diffuse and direct reflections (*lake-surface* effects). The PV units would also exhibit sky reflection, but would be much less bright, presenting a darker-colored appearance much of the time. In addition, PV projects would not require large-scale power block facilities like those required for solar thermal technologies. Because of the overall lower height of the array fields, lower reflectivity of the solar collectors, and lack of power blocks, the Solar PV Alternative would be less visible from viewpoints at distances of at least a few miles compared to the previously approved PSPP. Finally, the PV Alternative would not include solar towers and SRSGs. Consequently, the impact on scenic vistas would be **much less than PSEGS**. This alternative would be visible from both Wilderness Areas and the introduction of an expansive area with industrial characteristics and strong color and texture contrast would likely result in substantial adverse effects on these elevated vistas. The impact on scenic vistas would remain significant and unavoidable.

Potential to Substantially Damage Scenic Resources within a State Scenic Highway

The PSEGS site is located adjacent to the north side of I-10, which is not listed as an eligible State Scenic Highway, and no notable scenic features or historic structures are located within the site. Therefore, construction of the PV Alternative would not substantially damage scenic resources within a state scenic highway. This impact would be **similar to PSEGS**. Project operations impacts of the PV Alternative on scenic resources within a state scenic highway would be **similar to PSEGS**.

Potential to Substantially Degrade the Existing Visual Character or Quality of the Site and its Surroundings

Construction-Related Impacts: As discussed above, the area of disturbance and construction period of the PV Alternative would generally be similar to the proposed PSEGS project. Both PV tracker arrays and solar tower heliostats would be installed using numerous individual driven foundations. Construction impacts of this alternative on visual quality would be **similar to PSEGS**.

Project Operations Impacts: The PV Alternative would involve installation of an expanse of structures with industrial characteristics into the views from I-10, Corn Springs Road, and nearby Wilderness Areas. However, because of this alternative's lower profile and lack of tall or highly-reflective features, the PV Alternative would have a less intense visual effect compared to the proposed PSEGS, and would have a much smaller overall area of visual effect. It is likely that visual effects on SR 177, Desert Center, and Joshua Tree National Park would be negligible due to distance (approximately 10 miles or more from the project site). The impact of the PV Alternative on visual quality would thus be **less than PSEGS**. However, this alternative would result in a substantial degradation of the existing visual character or quality of the site and its surroundings as viewed from elevated viewpoints within nearby Wilderness Areas.

Potential to Create a New Source of Substantial Light or Glare Which Would Adversely Affect Day or Nighttime Views in the Area

Construction-Related Impacts: Some construction activity could take place at night during construction of the Solar PV Alternative, with lighting impacts that would be **similar to PSEGS**.

Project Operations Impacts: Non-mirror surfaces of the solar modules of the PV Alternative have the potential to introduce reflected glare into the visual environment. However, the PV Alternative would not require power blocks and the large, prominent structures of traditional power plant facilities. This impact would thus be **much less than PSEGS**. Like the proposed modified project, with the effective implementation of Condition of Certification **VIS-1** from the PSPP 2010 Commission Decision, the PV Alternative would not cause excessive glare from surfaces of structures other than the PV modules (e.g., inverters in the array blocks, O&M facilities, perimeter fencing, etc.).

Glint effects, that is, inadvertent, very bright reflections of the sun's image off the solar panels under certain conditions, could present a disruptive visual distraction for motorists and other viewers under some circumstances. However, these reflections would be much less bright and intrusive than similar glint effects from mirrored surfaces of the PSEGS heliostats due to the much lower reflectivity of PV panel surfaces compared to mirrors. This glint impact would be **much less than PSEGS**.

Compared to the proposed PSEGS, the Solar PV Alternative would not include anything analogous to the solar towers with solar receivers, and would not generate strong SRSG glare that would be similar in any way to the proposed PSEGS. The impact of the PV Alternative relating to glare from solar receivers would not occur; therefore, **no impact** would occur compared to PSEGS.

The PV Alternative could generate nighttime light pollution from its operational lighting, although with far fewer large or high-profile power plant structures, this impact would likely be **less than PSEGS**. As with the proposed modified project, the effective implementation of Condition of Certification **VIS-4** (VIS-3 from the 2010 Commission Decision on the PSPP) would reduce the PV Alternative's off-site, project operations lighting impacts to less than significant.

The PV Alternative would not have solar towers that would require FAA safety lighting, and **no impact** would occur.

Waste Management

Construction and operation of the Solar PV Alternative at the PSEGS site could have impacts **similar to PSEGS**. PV modules can be made of silicon or CdTe. Broken or damaged silicon PV modules are not considered hazardous, and would be similar to the heliostat materials. Broken or damaged CdTe PV modules would likely be transported to the manufacturer for recycling as universal waste and not be considered hazardous waste requiring landfill disposal.

Potential impacts relating to soil and water contamination and the potential presence of UXO at the site would be **similar to PSEGS**. A UXO Identification, Training, and Reporting Plan would still be required, which would include site worker training and procedures for UXO investigation, removal, and disposal.

REDUCED ACREAGE ALTERNATIVE WITH SOLAR POWER TOWER TECHNOLOGY

Overview

The Reduced Acreage Alternative with SPT Technology would involve reducing the total project acreage of the proposed modified project and retaining the solar tower unit and heliostat array from PSEGS Unit 1 (the western solar field). **Alternatives Figures 5a** and **5b** show staff's concept for the Reduced Acreage Alternative. The technology for the Reduced Acreage Alternative would be the same as described for the proposed PSEGS. This alternative includes approximately 70 acres from PSEGS Unit 2 (the eastern solar field). The additional acreage would allow a small expansion of the Unit 1 solar field while avoiding an extensive area of desert dry wash woodland habitat in the PSEGS eastern solar field (**Alternatives Figure 5a**). This alternative would avoid a portion of the sand transport corridor that extends into the northeast portion of the proposed PSEGS solar fields (**Alternatives Figure 5b**).

With the addition of acreage from Unit 2, the solar field area for the Reduced Acreage Alternative would cover approximately 1,742 acres. The adjacent 218-acre common area and construction lay down area adjacent to PSEGS Unit 1 would be retained. Like the proposed PSEGS, the generation tie-line would connect at the north side of the heliostat array field. The proposed natural gas pipeline would require rerouting for this alternative.

Potential to Attain Project Objectives

Development of an approximately 250-MW SPT project at the proposed PSEGS site could partially satisfy the project objectives to construct and operate a utility-scale solar energy project and assist SCE in satisfying its RPS program goals; however, the total proposed 500-MW capacity would not be achieved. This alternative could potentially satisfy the project objective to develop a solar thermal power plant at a site where some authorizations for construction have been obtained, although the licensed site would not be fully used to produce renewable energy. This alternative does not propose another use for the remainder of the site (the eastern solar field) should it not be developed for the proposed PSEGS. This alternative would satisfy the project objective to develop a site that is in a BLM-designated SEZ.

The Reduced Acreage Alternative with SPT Technology would likely satisfy the project objective to meet permitting requirements and comply with applicable LORS. This alternative would satisfy the project objective to develop a renewable energy facility in an area with high solar value and minimal slope.

Environmental impacts on some resources would be reduced under this alternative compared to the proposed modified project, particularly when there is a direct correlation between project acreage and the extent of the impact. This alternative could meet the project objective to avoid or minimize significant impacts to the greatest extent feasible. See the discussions below under, “Environmental Analysis,” for general analyses of the environmental effects of this alternative compared to the proposed modified project, including an analysis of comparative biological resources impacts.

The Reduced Acreage Alternative with SPT Technology could potentially satisfy many of the project objectives, although the total energy capacity would be reduced.

Potential Feasibility Issues

Staff presumes that the two solar plants under the proposed modified project are each the subject of one of the approved PPAs. If the total electrical capacity was reduced to approximately 250 MWs under the Reduced Acreage Alternative with SPT Technology, it is unknown whether an amendment to either of the approved PPAs by CPUC would be required. Reducing the project’s electrical capacity by approximately one-half would presumably affect the project owner’s LGIA with CAISO, which is for 500 MWs of interconnection rights. It is not known the extent to which eliminating most of the eastern solar field from the PSEGS site would affect the project schedule, although it is assumed that a schedule delay could affect project viability for the one 250-MW project.

As stated above, BLM is considering the project owner's ROW application and revised POD for the PSEGS and has published a draft SEIS for the project (BLM 2013a). Changing the project to reduce one of the 250-MW projects could require revising the POD for resubmittal to BLM, which would also delay the schedule.

Environmental Analysis

Alternatives Table 5 presents a summary comparison of impacts of the proposed modified project to the same or similar potential impacts of the Reduced Acreage Alternative with SPT Technology. Comparative discussions for each environmental topic area follow the table.

Alternatives Table 5
Summary Comparison of Impacts of the Proposed PSEGS to the Reduced Acreage Alternative with SPT Technology

Environmental Effect	Proposed PSEGS	Reduced Acreage Alternative with SPT Technology
Air Quality		
Construction-related emissions	SM (locally)	Somewhat less than PSEGS (SM)
Project operations emissions	SM (locally)	Similar to PSEGS (SM)
Reduction in greenhouse gases	B (system wide)	Similar to PSEGS (B)
Biological Resources		
Impacts on special-status plant species	SM	Much less than PSEGS (SM)
Impacts on waters of the state	SM	Much less than PSEGS (SM)
Impacts on desert tortoise	SM	Much less than PSEGS (SM)
Impacts on special-status terrestrial wildlife species (kit fox, American badger)	SM	Much less than PSEGS (SM)
Potential impacts on avian species from collisions with project features	PSU	Less than PSEGS (PSU)
Potential impacts on avian species from exposure to concentrated solar flux	PSU	Less than PSEGS (PSU)
Potential impacts on groundwater dependent ecosystems	SM	Somewhat less than PSEGS (SM)
Impacts on sand transport corridor	SM	Less than PSEGS (SM) *(see biological resources note)*
Impacts on sand dunes and Mojave fringe-toed lizard	SM	Less than PSEGS (SM) *(see biological resources note)*
Biological resources note: Comparative impacts for the Reduced Acreage Alternative for indirect impacts on the sand transport corridor, sand dune habitat, and Mojave fringe-toed lizard cannot reasonably be characterized without further data and use of a sand transport model.		

Alternatives Table 5
Summary Comparison of Impacts of the Proposed PSEGS to the Reduced Acreage Alternative with SPT Technology

Environmental Effect	Proposed PSEGS	Reduced Acreage Alternative with SPT Technology
Cultural Resources		
Potential to substantively degrade, directly or indirectly, prehistoric or historical archaeological resources *on* the facility site, resources recommended or assumed to be historically significant *(see cultural resources note)*	PSM	Less than PSEGS (PSM)
Potential to substantively degrade, directly or indirectly, prehistoric or historical archaeological resources *beyond* the facility site, resources recommended or assumed to be historically significant	SU	Similar to PSEGS (SU)
Potential for cumulatively considerable degradation of prehistoric or historical archaeological resources *beyond* the facility site, resources recommended or assumed to be historically significant	SU	Similar to PSEGS (SU)
Potential impacts on significant built-environment cultural resources *on* the site	LS	Similar to PSEGS (LS)
Potential impacts on a significant built-environment cultural resource (Desert Center) *beyond* the site	SU	Similar to PSEGS (SU)
Potential to substantively degrade, directly or indirectly, ethnographic resources *on* the facility site, resources recommended or assumed to be historically significant	PSM	Similar to PSEGS (PSM)
Potential for cumulatively considerable degradation of ethnographic resources *on* the facility site, resources recommended or assumed to be historically significant	LS	Similar to PSEGS (LS)
Potential to substantively degrade, directly or indirectly, ethnographic resources *beyond* the facility site, resources recommended or assumed to be historically significant	SU	Similar to PSEGS (SU)
Potential for cumulatively considerable degradation of ethnographic resources *beyond* the facility site, resources recommended or assumed to be historically significant	SU	Similar to PSEGS (SU)
Cultural resources note: "Site" means the facility site proper and does not include linear or ancillary infrastructure away from the facility site.		
Fire Protection		
Construction-Related Impacts		
Impacts on the Riverside County Fire Department	SM	Same as PSEGS (SM)
Project Operations Impacts		
Become familiar with and plan for emergency responses	SM	Same as PSEGS (SM)
Conduct plan reviews, inspections, and permitting	SM	Same as PSEGS (SM)
Fire response	SM	Same as PSEGS (SM)
Hazardous materials spill response	SM	Same as PSEGS (SM)
Rescue	SM	Same as PSEGS (SM)
Emergency medical services	SM	Same as PSEGS (SM)
Geology and Paleontology		
Potential impacts from strong seismic shaking	SM	Somewhat less than PSEGS (SM)
Potential impacts from soil failure caused by liquefaction, hydrocollapse, and/or dynamic compaction	SM	Somewhat less than PSEGS (SM)

Alternatives Table 5
Summary Comparison of Impacts of the Proposed PSEGS to the Reduced Acreage Alternative with SPT Technology

Environmental Effect	Proposed PSEGS	Reduced Acreage Alternative with SPT Technology
Potential impacts on paleontological resources	SM	Less than PSEGS (SM)
Potential impacts on geological or mineralogical resources	—	—
Hazardous Materials Management		
Construction-Related Impacts		
Potential for spills or other releases of hazardous materials to occur on-site	SM	Same as PSEGS (SM)
Potential for spills or other releases of hazardous materials to occur off-site	LS	Same as PSEGS (LS)
Project Operations Impacts		
Potential for spills or other releases of hazardous materials to occur on-site	SM	Same as PSEGS (SM)
Potential for spills or other releases of hazardous materials to occur off-site	LS	Same as PSEGS (LS)
Land Use		
Compatibility with land use plan, policy, or regulation	SM	Similar to PSEGS (SM)
Public Health		
Potential for project construction to cause air toxics-related or other impacts that could affect public health	LS	Less than PSEGS (LS)
Potential for project operations to cause air toxics-related or other impacts that could affect public health	PSM	Less than PSEGS (PSM)
Socioeconomics		
Environmental justice population within 6-mile buffer.	—	—
Induce substantial population growth in an area, either directly or indirectly.	LS	Somewhat less than PSEGS (LS)
Displace substantial numbers of people and/or existing housing, necessitating the construction of replacement housing elsewhere.	LS	Somewhat less than PSEGS (LS)
Adversely impact acceptable levels of service for police protection, schools, and parks and recreation.	LS	Somewhat less than PSEGS (LS)
Increased property taxes, construction and operation employment income, and increased state and local taxes and fees.	B	Somewhat less than PSEGS (B)
Soil and Water Resources		
Soil erosion by wind and water during project construction	SM	Less than PSEGS (SM)
Soil erosion by wind and water during project operations	PSM	Less than PSEGS (PSM)
Water quality impacts from contaminated storm water runoff	SM	Less than PSEGS (SM)
Water quality impacts from storm damage	PSM	Less than PSEGS (PSM)
Water quality impacts from power plant operations	SM	Less than PSEGS (SM)
Water quality impacts from sanitary waste	SM	Somewhat less than PSEGS (SM)

Alternatives Table 5
Summary Comparison of Impacts of the Proposed PSEGS to the Reduced Acreage Alternative with SPT Technology

Environmental Effect	Proposed PSEGS	Reduced Acreage Alternative with SPT Technology
Potential impacts from on-site and off-site flooding	PSM	Less than PSEGS (PSM)
Potential to impede or redirect 100-year flood flows, as shown on Federal Emergency Management Agency maps	—	—
Potential impacts on local wells	PSM	Somewhat less than PSEGS (PSM)
Potential impacts on groundwater basin balance	PSM	Somewhat less than PSEGS (PSM)
Traffic and Transportation		
Potential damage to roads	PSM	Somewhat less than PSEGS (PSM)
Level of service on roads and highways – construction	PSM	Less than PSEGS (PSM)
Level of service on roads and highways – operation/post-construction	LS	Similar to PSEGS (LS)
Solar collector glint and glare impacts on motorists and pilots	PSM	Less than PSEGS (PSM)
Solar receiver glare impacts that could be hazardous to motorists and pilots	PSM	Somewhat less than PSEGS (PSM)
Visual Resources		
Construction-Related Impacts		
Potential for adverse impacts on scenic vistas	SM	Less than PSEGS (SM)
Potential to substantially damage scenic resources within a state scenic highway	LS	Similar to PSEGS (LS)
Potential to substantially degrade the existing visual character or quality of the site and its surroundings	SM	Less than PSEGS (SM)
Potential to create a new source of substantial light or glare which would adversely affect day or nighttime views in the area	SM	Less than PSEGS (SM)
Project Operations Impacts		
Potential for adverse impacts on scenic vistas	SU	Somewhat less than PSEGS (SU)
Potential to substantially damage scenic resources within a state scenic highway	LS	Similar to PSEGS (LS)
Potential to substantially degrade the existing visual character or quality of the site and its surroundings	SU	Somewhat less than PSEGS (SU)
Potential to create a new source of substantial light or glare which would adversely affect day or nighttime views in the area (individual effects listed below)		
Glint or glare effects from project structures other than the reflective surfaces of solar collectors (i.e., heliostats, parabolic troughs, PV panels)	SM	Similar to PSEGS (SM)
Glint or glare effects from the solar collectors	SM	Similar to PSEGS (SM)
Glint or glare effects from high-profile solar receiver steam generators	SU	Somewhat less than PSEGS (SU)
Light or glare from nighttime lighting effects, including Federal Aviation Administration safety lighting	SM	Somewhat less than PSEGS (SM)

Alternatives Table 5
Summary Comparison of Impacts of the Proposed PSEGS to the Reduced Acreage Alternative with SPT Technology

Environmental Effect	Proposed PSEGS	Reduced Acreage Alternative with SPT Technology
Waste Management		
Potential for unexploded ordnance to be present at the project site	PSM	Similar to or less than PSEGS (PSM)
Potential for impacts on human health and the environment relating to past or present soil or water contamination	LS	Similar to or less than PSEGS (LS)
Potential for impacts on human health and the environment relating to potential waste discharges	LS	Similar to or less than PSEGS (LS)
Potential for disposal or diversion of project materials to cause impacts on existing waste disposal or diversion facilities	LS	Less than PSEGS (LS)

Air Quality

Exhaust emissions from heavy-duty diesel construction equipment and fugitive particulate matter (dust) emissions would be approximately half the emissions of the proposed modified project due to the reduced number of heliostats and one less power tower. Exhaust emissions would also be caused by workers commuting to and from the work sites, trucks hauling equipment and supplies to the sites, and crew trucks (e.g., derrick trucks, bucket trucks, pickups). With this alternative, the number of workers commuting would be reduced and the duration of the construction during which the workers would be commuting would be reduced by approximately one-half. Exhaust emissions from the worker and delivery vehicles would be half those of the proposed modified project. The total area of site disturbance would be approximately half that of the proposed PSEGS, and emissions of particulate matter during construction would be less than PSEGS; however, the comparative reduction in particulate matter would likely be negligible. The construction emissions of this alternative would be **somewhat less than PSEGS**. No decrease in construction-related emissions would occur with construction of the generation tie-line, which would remain the same length as with the proposed modified project.

The operational emissions from the Reduced Acreage Alternative with SPT Technology would be **similar to PSEGS**. Appropriate mitigation measures for the Reduced Acreage Alternative with SPT Technology would likely involve similar, locally-oriented recommendations such as the conditions of certification presented in the **Air Quality** section of this staff assessment. It is likely that the alternative would comply with the South Coast Air Quality Management District rules and regulations.

The Reduced Acreage Alternative with SPT Technology would produce about half less energy than the proposed PSEGS. As with the proposed 500-MW project, a 250-MW project would cause some GHG emissions. However, the 250-MW project would help meet the RPS program goals in California and would result in a net cumulative reduction of energy generation and GHG emissions from new and existing fossil fuel-fired electricity resources. These system impacts would result in a net reduction in GHG emissions across the electricity system providing energy and capacity to California. Thus, as with the proposed PSEGS, the Reduced Acreage Alternative with SPT Technology would result in a cumulative overall reduction in GHG emissions from power plants; because this alternative would require the use of auxiliary equipment necessary to operate a solar thermal power plant, the effect of reducing GHG emissions would be **similar to PSEGS**.

Biological Resources

This alternative would reduce the total project acreage to approximately 1,960 acres, which includes the 218-acre common area/construction laydown area. This alternative was developed by retaining the solar tower unit and heliostat array from PSEGS Unit 1 (the western solar field), and would include approximately 70 acres from PSEGS Unit 2 (the eastern solar plant). A total of three special-status plant species are known to be located on the proposed modified project site, and would require mitigation to reduce the impacts to less than significant. The three plant species are ribbed cryptantha (*Cryptantha costata*), Harwood's milkvetch (*Astragalus insularis var. harwoodii*), and California ditaxis (*Ditaxis serrata var. californica*). This alternative would avoid all impacts on mapped populations of ribbed cryptantha, and eliminate impacts on one mapped population of Harwood's milkvetch. Impacts on California ditaxis would be unchanged, as they occur along the generation tie-line. The Reduced Acreage Alternative would therefore reduce impacts on two rare plant species identified at the project site, and these impacts would be **much less than PSEGS**.

Jurisdictional waters of the state enter the project site from the south, fanning out across the alluvium. The Reduced Acreage Alternative would reduce impacts on on-site vegetation, including waters of the state, desert dry wash woodland, and unvegetated ephemeral dry washes. Impacts on these habitats of special concern would be **much less than PSEGS**. This alternative would also cause direct impacts on aeolian sand corridors Zone II and Zone III that would be **less than PSEGS**, although staff notes that indirect effects would be described only through modeling, an exercise that was not conducted for this alternatives analysis. This analysis describes only direct impacts. Impacts on Mojave fringe-toed lizard would also likely be **less than PSEGS**; however, uncertainty exists in the degree to which impacts would be reduced. Mojave fringe-toed lizard inhabit dune habitat, and therefore, a full description of direct and indirect effects on the sand transport corridor would be necessary for staff to complete an analysis of effects on Mojave fringe-toed lizard and sand dune habitat.

Terrestrial wildlife on the site vary from the highly mobile kit fox and American badger, to the relatively stationary desert tortoise. Surveys for these species were conducted in 2009, 2010, and 2013 during surveys for the generation tie-line. Elimination of the Unit 2 (eastern) power tower and heliostat field would likely reduce impacts on kit fox, desert tortoise, and American badger foraging habitat and burrows or burrow complexes. The burrowing owl, a state species of special concern, has been documented within the Unit 2 area, but not the Unit 1 area. Given that several years have passed since on-site surveys for burrowing owl were conducted, staff is unclear as to the current distribution and population of burrowing owl on-site, but regardless, the Reduced Acreage Alternative would reduce impacts on habitat that is suitable for burrowing owl, and therefore, impacts on this species under this alternative would be **much less than PSEGS**.

The Reduced Acreage Alternative would eliminate one solar power tower and its associated heliostat field. Similar to the proposed modified project, the structures associated with this alternative could attract birds. It is unknown the extent to which eliminating one solar field would reduce the potential for collisions with project features. By the same reasoning, it is unknown the extent to which eliminating one solar field would reduce the potential for exposure to concentrated solar flux. Staff concludes that impacts on avian species would be **less than PSEGS**, to an unquantifiable degree, with elimination of one of the two solar fields. Potential impacts on the groundwater basin would be somewhat less than PSEGS (see the subsection below, “Soil and Water Resources”); therefore, the impacts on groundwater dependent vegetation and associated plant and wildlife species would also be **somewhat less than PSEGS**.

Cultural Resources

Construction and operation of the Reduced Acreage Alternative would reduce the extent of ground disturbance at the project site. Because the overall vertical profile of the Reduced Acreage Alternative compared to the proposed PSEGS would remain essentially the same, this alternative would produce a similar level of visual intrusion on resources *beyond* the facility site. Staff characterizes the net effect of this alternative on historical resources as **similar to PSEGS**.

Fire Protection

Construction-Related Impacts

Compared to the proposed PSEGS, construction of the Reduced Acreage Alternative with SPT Technology would require approximately the same level of service from the RCFD, and impacts on the RCFD would be approximately the **same as PSEGS**.

Project Operations Impacts

Fire protection associated with the Reduced Acreage Alternative with SPT Technology would essentially be the **same as PSEGS**. While there would be lower volumes of hazardous materials on the site and one less power tower and its power block and solar field, and thus less of a need for hazardous materials spill and rescue response, the differences would result in negligible differences in impacts.

Geology and Paleontology

The Reduced Acreage Alternative with SPT Technology would reduce the total project acreage of the proposed modified project and involve building the solar tower unit and heliostat array for PSEGS Unit 1 (the western solar field).

Because the ground disturbance from the Reduced Acreage Alternative would be approximately one-half of that associated with the proposed PSEGS, potential impacts on paleontological resources would be correspondingly reduced and are considered **less than PSEGS**. Because one less SPT would be erected on the site, potential impacts on the facility from geologic hazards (i.e., impacts from strong seismic shaking) would be **somewhat less than PSEGS**. No changes to the proposed mitigation measures would be required.

Hazardous Materials Management

Construction-Related Impacts

As discussed above, the construction phases of any large-scale desert solar project would require the use of various hazardous materials posing similar on-site risks of spillage or other releases. For the Reduced Acreage Alternative with SPT Technology, construction-related hazardous materials impacts would be **similar to PSEGS**.

Project Operations Impacts

Hazardous materials use associated with the Reduced Acreage Alternative with SPT Technology would be essentially the **same as PSEGS**. While there would be lower volumes of hazardous materials on the site due to the elimination of one power tower and its power block and solar field, the differences would result in negligible differences in impacts.

Land Use

The Reduced Acreage Alternative with SPT Technology would reduce the total project acreage to approximately 1,960 acres and retain the solar tower unit and heliostat array from PSEGS Unit 1 (the western solar field). The technology for this alternative would be the same as described for the proposed PSEGS. The Reduced Acreage Alternative would provide benefits compared to the proposed PSEGS (e.g., reduced impacts on terrestrial species and habitats).

The project area is in BLM's "Multiple-Use Class M" land use category, which allows construction and operation of electrical generation plants. The PSEGS site is encompassed by BLM's Riverside East SEZ. These designations also apply to the Reduced Acreage Alternative. Like the proposed modified project, this alternative includes no private land, and no part of the site would be subject to Riverside County's jurisdictional authority.

Should BLM approve issuance of a ROW grant for the PSEGS, two CDCA Plan amendments would be required—one would allow the solar generation facility and the other would allow the generation tie-line outside of the designated corridor (BLM 2013a). Staff recommends Condition of Certification **LAND-1** for the proposed PSEGS, which requires the project owner to provide documentation of the approved BLM ROW grant and a project-specific amendment to the CDCA Plan prior to the start of construction. **LAND-1** would also apply to the Reduced Acreage Alternative. Like the proposed PSEGS, construction and operation of this alternative would require compliance with applicable federal land use LORS. Land use impacts of the Reduced Acreage Alternative would be **similar to PSEGS**.

Public Health

Construction-Related Impacts

Since the technologies are the same for both the Reduced Acreage Alternative with SPT Technology and the proposed PSEGS, construction-related emissions and impacts would be the same. However, the amounts of construction-related emissions and impacts of this alternative would be approximately half that of the proposed PSEGS since the project footprint would be decreased from approximately 3,794 acres to approximately 1,742 acres (not including the 218-acre common area/construction laydown area). Public health impacts for this alternative would be **less than PSEGS**. Like the proposed PSEGS, no significant impacts would occur, and no mitigation measures would be required for construction-related emissions.

Project Operations Impacts

Since the technologies are the same for both the Reduced Acreage Alternative with SPT Technology and the proposed PSEGS, project operations emissions would be the same per unit of capacity. However, the amounts of emissions and impacts from operation of this alternative would be approximately half that of the proposed PSEGS due to the reduced number of boilers and extent of mirror washing. For the Reduced Acreage Alternative with SPT Technology, the potential for exposure to *Legionella* would remain with operation of the WSAC units at Power Block 1 of the western solar field. For PSEGS, the impact is reduced to less than significant with implementation of Condition of Certification **PUBLIC HEALTH-1**. The same mitigation measure would apply to this alternative. Overall, the operational emissions from the Reduced Acreage Alternative with SPT Technology would be **less than PSEGS**.

Socioeconomics

This alternative proposes one solar power tower, compared with the two solar power towers proposed for PSEGS. Staff concludes in the **SOCIOECONOMICS** section of this staff assessment that construction and operation of the PSEGS would not cause significant adverse direct or indirect socioeconomic impacts on public services.

With the reduction of the equipment installed for this alternative, the workforce for project construction and operations would be smaller overall and the duration of construction would be shorter. Given the smaller construction and operations workforces required and shorter construction schedule, the socioeconomic impacts for this alternative would be **somewhat less than PSEGS**.

Construction and project operation of this alternative would generate employment income and associated state and local sales taxes that would be somewhat less than the PSEGS. Like PSEGS, this alternative is on federal land; therefore, Section 17620 of the Education Code (school impact fees) would not apply and no property taxes would be paid. The economic benefits of this alternative would be **somewhat less than PSEGS**.

Soil and Water Resources

The Reduced Acreage Alternative with SPT Technology would involve reducing the total project site acreage and effectively only building the solar tower unit and heliostat array for PSEGS Unit 1 (the western solar field).

Because the footprint for the Reduced Acreage Alternative would decrease to roughly half that of PSEGS, impacts relating to soil erosion during construction (grading of roadways and power plant construction) and operations (heliostat washing and vegetation maintenance) would be **less than PSEGS**. Operation of one power plant compared to two would decrease the volume of process wastewater and contamination of storm water runoff; therefore, these impacts would be **less than PSEGS**. The amount of domestic sanitary waste disposed in septic systems would decrease, so these impacts would be **somewhat less than PSEGS**.

Because at least half of off-site flows pass through PSEGS Solar Unit 1, impacts from flood flows and flooding for the Reduced Acreage Alternative would be **less than PSEGS**. Also, by avoiding storm damage impacts in the Solar Unit 2 solar field, the overall impacts of storm water damage for the Reduced Acreage Alternative would be **less than PSEGS**. Impacts from 100-year flood flows (as shown on FEMA maps) do not apply because the published maps show that the 100-year flood plain is not present at or near the proposed site.

The Reduced Acreage Alternative would require less operational water use for process and heliostat washing compared to the proposed PSEGS. Assuming installation of approximately half the total number of heliostats compared to PSEGS, operational water use could be reduced up to half of the total amount under this alternative. For purposes of impact analysis, it is assumed that any withdrawals exceeding the average natural recharge and exceeding a significant percentage of the total amount of groundwater in storage would cause a significant impact. Because the Chuckwalla Valley Groundwater Basin (CVGB) is estimated to have a positive groundwater balance by approximately 2,600 afy, neither PSEGS nor the Reduced Acreage Alternative would result in basin overdraft. And although the difference in water use for this alternative would be about 3,580 af less than PSEGS, total water use by the proposed PSEGS or this alternative would be very small compared to the CVGB's storage capacity of 15,000,000 af. Because the PSEGS or this alternative would reduce the amount of total stored groundwater by less than a tenth of 1 percent, potential impacts of the Reduced Acreage Alternative on the CVGB and local well owners would generally be **somewhat less than PSEGS**.

Traffic and Transportation

Potential Damage to Roads

This alternative would result in a smaller project to develop, and therefore fewer construction workers and a shorter construction period. However, heavy haul trucks that could damage roads would be used for both this alternative and the proposed PSEGS. For these reasons, road damage would be **somewhat less than PSEGS**. Mitigation measures similar to those recommended for the proposed modified project would reduce potential damage impacts on roadways to less than significant.

Level of Service on Roads and Highways – Construction

This alternative would result in a smaller project to develop, and therefore fewer construction workers and a shorter construction period. For these reasons, impacts on LOS would be **less than PSEGS**. Like the proposed modified project, implementation of appropriate mitigation measures (e.g., a traffic control plan) would reduce this impact to less than significant.

Level of Service on Roads and Highways – Operation/Post-Construction

The Reduced Acreage Alternative would be smaller than the proposed PSEGS and would probably require fewer employees to operate. However, for both the Reduced Acreage Alternative and the proposed PSEGS, the minimal number of trips generated by operations employees would have a negligible impact on traffic LOS. Therefore, impacts would be **similar to PSEGS**. No mitigation measures would be required.

Solar Collector Glint and Glare Impacts on Motorists and Pilots

This alternative would involve installation of approximately half the number of heliostats required for the proposed PSEGS. Also, by omitting most of Unit 2 (the eastern solar plant), this alternative would eliminate many of the heliostats that would be located closest to I-10. For these reasons, glint and glare impacts on motorists and pilots would be **less than PSEGS**. Mitigation measures similar to those recommended for the proposed modified project would reduce potential nuisance effects from glint and glare to less than significant.

Solar Receiver Glare Impacts That Could be Hazardous to Motorists and Pilots

This alternative involves construction of one solar power tower instead of two; therefore, glare impacts on motorists and pilots from the SRSG would be **somewhat less than PSEGS**. However, like the proposed modified project, the potential for glare from the SRSG to cause hazardous operating conditions for motorists and pilots would be potentially significant, and implementation of appropriate mitigation measures (e.g., a solar power tower luminance monitoring plan) would be required to reduce this impact to less than significant.

Visual Resources

The Reduced Acreage Alternative would, like the proposed PSEGS, deploy a field of heliostats aimed at a solar power tower, but would be approximately half the acreage of the PSEGS, with one rather than two solar towers. This alternative, like the PSEGS, would include a power transmission line from the project site to the Red Bluff Substation.

Potential for Adverse Impacts on Scenic Vistas

Construction-Related Impacts: Construction of the Reduced Acreage Alternative would cause temporary visual impacts due to the presence of equipment, materials, and a workforce, at the project site and along the transmission line route, an increase in visible traffic along I-10 and access roads, and large dust clouds generated by grading activities. The type of construction would be similar to the PSEGS, but the area of disturbance would be smaller and the construction period would be shorter. Construction impacts of this alternative on scenic vistas would thus be **less than PSEGS**.

Project Operations Impacts: No designated scenic vistas were identified in the PSEGS study area, but panoramic and highly scenic vistas from the Palen McCoy Wilderness and Chuckwalla Mountains Wilderness would be affected by this alternative. The Reduced Acreage Alternative would be smaller, but have similar industrial characteristics when viewed from the two Wilderness Areas. The predominant visual impact of the Reduced Acreage Alternative would result from the extremely bright glare of the single solar receiver. This alternative would be prominently visible from both wilderness areas and the introduction of industrial characteristics, structural visual contrast, and extremely bright glare would result in substantial adverse effects on these vistas. Although the overall affected area of visibility could be somewhat less under the Reduced Acreage Alternative compared to PSEGS, the probable difference in the extent of the viewshed would be comparatively minor and would not reduce potential impacts on the Wilderness Areas to a less-than-significant level. The impact on scenic vistas would be **somewhat less than PSEGS** but would be a significant and unavoidable impact of this alternative.

Potential to Substantially Damage Scenic Resources within a State Scenic Highway

The PSEGS site is located adjacent to the north side of I-10, which is not listed as an eligible State Scenic Highway, and no notable scenic features or historic structures are located within the site. Therefore, construction of the Reduced Acreage Alternative would not substantially damage scenic resources within a state scenic highway. This impact would be **similar to PSEGS**. The impact of operation of the Reduced Acreage Alternative on scenic resources within a state scenic highway would be **similar to PSEGS**.

Potential to Substantially Degrade the Existing Visual Character or Quality of the Site and its Surroundings

Construction-Related Impacts: As discussed above, the type of construction of the Reduced Acreage Alternative would be similar to the proposed PSEGS, but the area of disturbance would be smaller and the construction period would be shorter. Construction impacts of this alternative on visual quality would thus be **less than PSEGS**.

Project Operations Impacts: The Reduced Acreage Alternative would introduce prominent structures with industrial characteristics into the views from SR 177, the Desert Center area, I-10, Corn Springs Road, nearby Wilderness Areas, Joshua Tree National Park, and a few nearby residences. This alternative would be substantially smaller in area than the proposed PSEGS, but would include a solar tower generating strong glare that would be prominently visible and have strong visual effects over substantially the same viewshed as under PSEGS. This glare effect would be less intense than under PSEGS, but would remain considerable. The area of desert floor affected as seen from elevated Wilderness Area viewpoints would be reduced, therefore, the strong form and color contrast from the mirrored heliostat fields would affect a smaller portion of the Wilderness Areas. However, the strong glare effects would extend over roughly the same area as under the proposed PSEGS. Due to the smaller area (approximately 1,960 acres, including the common area) and single solar tower of the Reduced Acreage Alternative, the impact on visual quality would thus be **somewhat less than PSEGS**, but this alternative would result in a substantial degradation of the existing visual quality of the site and its surroundings.

Potential to Create a New Source of Substantial Light or Glare Which Would Adversely Affect Day or Nighttime Views in the Area

Construction-Related Impacts: Some construction activity could take place at night during construction of the Reduced Acreage Alternative, with lighting impacts that would extend over a much smaller area and thus be **less than PSEGS**.

Project Operations Impacts: Non-mirrored surfaces of the facilities of the Reduced Acreage Alternative have the potential to introduce reflected glare into the visual environment if the structures were light colored or included unpainted metal components, and this impact would be **similar to PSEGS**. Like the proposed modified project, with the effective implementation of Condition of Certification **VIS-1** from the PSPP 2010 Commission Decision, the Reduced Acreage Alternative would not cause excessive glare from non-mirrored surfaces (e.g., metallic or painted structures).

Glint effects, that is, inadvertent, very bright reflections of the sun's image off the heliostats under certain conditions, could present a disruptive visual distraction for motorists and other viewers, which would represent a significant glare impact of the Reduced Acreage Alternative due to the potential intensity of the effect. This glint impact would be **similar to PSEGS**. With implementation of proposed Condition of Certification **TRANS-7**, stray glint impacts from solar reflection off the heliostats under the Reduced Acreage Alternative could be reduced to a less-than-significant level.

The Reduced Acreage Alternative would include one solar tower with a solar receiver, rather than two; nevertheless, the single tower would generate strong on-going operational glare that would affect substantially the same viewshed as the proposed PSEGS. Although the overall affected area of visibility could be somewhat less under the Reduced Acreage Alternative compared to PSEGS due to the single tower configuration, the difference in the extent of the viewshed would be comparatively minor, and would not reduce potential impacts on the Wilderness Areas to a less-than-significant level. The impact of the Reduced Acreage Alternative due to glare from solar receivers would thus be **somewhat less than PSEGS**, but the glare impact would remain significant and unavoidable for this alternative.

The Reduced Acreage Alternative could generate nighttime light pollution from its operational lighting, but because there would be only one power block rather than two, this impact would be **somewhat less than PSEGS**. As with the proposed modified project, the effective implementation of Condition of Certification **VIS-4** (VIS-3 from the 2010 Commission Decision on the PSPP) would reduce the Reduced Acreage Alternative's off-site, operation-related lighting impacts to less than significant.

The Reduced Acreage Alternative would have a solar tower that would require FAA safety lighting, and this impact would be **similar to PSEGS**.

Waste Management

The Reduced Acreage Alternative with SPT Technology would involve reducing the total project acreage of the proposed modified project and effectively only building the solar tower unit and heliostat array for PSEGS Unit 1 (the western solar field). The smaller project site would result in less construction and operation waste. Potential impacts on disposal or diversion facilities would be **less than PSEGS**. The location of the SPT for PSEGS Unit 1 would be the same as the proposed modified project. Similar to the proposed modified project, staff would require investigation and remediation of soil and groundwater contamination, if it was encountered during construction and operation of this alternative. Site characterization and remediation requirements would remain the same as for the proposed PSEGS. Site worker training for potential UXO would still be required as would preparation of a UXO Identification, Training, and Reporting Plan. Potential impacts from UXO would be **similar to or less than PSEGS**. Although the reduction in acreage would reduce the potential area of exposure to unidentified UXO, it is unknown where on the site UXO could occur, or if UXO is present on the site at all.

PROJECT ALTERNATIVES COMPARED TO THE PROPOSED MODIFIED PROJECT

The environmental effects of constructing and operating the proposed modified project are described in detail for each resource topic in the **ENVIRONMENTAL ASSESSMENT** section of this staff assessment. The summary table shown in **ALTERNATIVES APPENDIX-2** compares the environmental impacts of the proposed PSEGS to the same or similar impacts that would be expected to occur with construction and operation of the project alternatives. **ALTERNATIVES APPENDIX-2** is included at the end of the Alternatives section.

ENGINEERING ASSESSMENT OF THE ALTERNATIVES

POWER PLANT EFFICIENCY AND RELIABILITY

Introduction

Comparing alternative solar power generation systems to the solar technology of the proposed PSEGS affords the opportunity to see if the project owner's system is better than any potentially viable alternative. This engineering analysis compares the solar thermal parabolic trough technology of the previously approved Reconfigured Alternatives #2 and #3 and the alternative using solar PV with single-axis tracking technology to the solar power tower (SPT) technology of the proposed PSEGS.

The key performance characteristics of an electric power generation facility are its ability to 1) produce electricity using a source of energy in as efficient a manner as possible, and 2) reliably deliver electricity upon demand. The following is an efficiency and reliability comparison among the three types of systems associated with the alternative technologies discussed in this analysis, which use solar energy as their source of electric generation.

Analysis

How efficiently a project uses land includes, but is not limited to, the site terrain and gradients, types of soils, the number and acreage of washes and waters of the U.S. and the state, and the technology. Staff calculates the relative efficiencies to verify that the project is consistent with similar technologies—not that one project is better than another project. Using land area (acre), power output (megawatt [MW]), and annual energy production (megawatt hours per year [MWh/yr]), the metric values relating to land use for the No-Project Alternative (parabolic trough), the proposed PSEGS (SPT) and the Solar PV Alternative with Single-Axis Tracking Technology yield power-based land use ratios ranging from 0.12 to 0.17 MW/acre[6] (Palen Solar Holdings 2012, NextEra Blythe Solar Energy Center 2013, Solar Millenium and Chevron Energy Solutions 2009). For energy based ratios, the range is from 337 to 372 MWh/acre-year. As a result, the comparison ratios for all three distinct technologies indicate that they are within the typical range of efficiencies expected of similar projects employing various solar technologies.

The parabolic trough technology of the No-Project Alternative requires an intensely graded, almost flat solar field to maintain a 1 percent maximum slope on the HTF (heat transfer fluid) piping. The solar collector field grading for the proposed PSEGS is not as intense because the heliostat pylons can be varied to follow the terrain and/or avoid washes or sensitive areas. However, the SPT heliostat spacing requires open pockets in its radial array to avoid steep heliostat angles in relation to the solar power tower. Additionally, the SPT collector field includes at least 15 percent excess collectors

[6] The power-based ratio is power output (MW) divided by land use area (acres). The energy based ratio is the annual energy production (MWh/year) divided by land use area (acres).

(relative to the parabolic trough) that are in standby and to account for the degradation of reflective arrays at certain angles. The rectangular Cartesian layout (x-y axis) of the PV Alternative with Single-Axis Tracking Technology provides more compactness than the two solar thermal technologies, but still has to be designed to avoid projecting shadows. Single-axis tracking brings the PV performance up to comparability with the two solar thermal technologies. Although there are incremental differences in the conversion efficiency of PV panels—12 percent for thin film cadmium telluride (CdTe) versus 15 percent for polycrystalline (Palo Verde Solar I 2012)—the variability of field conditions and the array geometry diminish the effect of the incremental differences among PV conversion efficiencies.

Given the major differences in design and operating characteristics, the differences in power and energy production when proportioned to land area are more similar than different. The comparison ratios for all three distinct technologies indicate that they are within the typical range of efficiencies expected of similar projects employing various solar technologies.

The events that prevent a facility from being available to deliver electricity are planned and unplanned outages. A key system characteristic is its ability to deliver power in response to demand. In the case of solar thermal and PV technologies, the *planned* available hours can only occur during daytime hours when the sun is visible in the sky. Within this solar timeframe, *unplanned* events like cloud covers, sandstorms, and technical failures would be factored into the predicted plant availability. Unlike the PV system, solar thermal systems like the parabolic trough (the No-Project Alternative) and the SPT (proposed PSEGS) have the advantage of load following through intermittent climatic events. The PV Tracking Alternative output closely follows the solar radiation, and output instantaneously reduces at the inception of adverse weather conditions.

Conclusion

The operation and performance of the three alternative systems presented above are comparable in efficiency. Their range of performance by factoring land area, power capacity, and energy production validates this parity.

In order to improve plant availability over existing generation of solar facilities, all three technologies must effectively use the diurnal nighttime window for covering planned maintenance and unplanned outage issues.

A notable disadvantage of the PV Tracking Alternative compared to the other two technologies discussed in this analysis is that the output of the PV system instantaneously reduces at the inception of adverse weather conditions.

TRANSMISSION SYSTEM ENGINEERING

No differences in impacts on transmission system engineering are identified for the previously approved Reconfigured Alternative #2 or #3 compared to the proposed modified project. The same is true of the Solar PV Alternative with Single-Axis Tracking Technology. Compared to the proposed PSEGS, these alternatives would generate at the same amount of power output and would interconnect to the Red Bluff Substation, as currently planned for the proposed modified project. Power would be distributed to the same transmission system. Therefore, the downstream transmission system impacts would be **similar to PSEGS**. Due to the reduction in power output for the Reduced Acreage Alternative with SPT Technology, this alternative could reduce the potential impacts on the downstream transmission system compared to the proposed PSEGS. However, no new or significant impacts would occur to the transmission system from any of the alternatives. For all the project alternatives, no new or different mitigation measures would be required.

ENVIRONMENTALLY SUPERIOR ALTERNATIVE

The project alternatives that are included in staff's analysis are those that could potentially attain most of the basic objectives of the project while avoiding or substantially lessening the significant impacts of the proposed project.

SUMMARY CONCLUSIONS FOR THE PROJECT ALTERNATIVES

No-Project Alternative

Staff compared the impacts of the previously approved Reconfigured Alternative #2 and #3 (i.e., the No-Project Alternative) to the same or similar impacts for the proposed PSEGS. In no instance did staff identify noteworthy differences in impacts between Reconfigured Alternatives #2 and #3, and for all intents and purposes, impacts under the No-Project Alternative apply to either of the approved alternatives from the original proceeding.

Under the proposed PSEGS, several impacts would remain either *potentially significant and unavoidable* or *significant and unavoidable* after mitigation. These impacts could potentially be reduced to less than significant under the No-Project Alternative with implementation of mitigation measures:

- **Cultural Resources** – Potential to substantively degrade, directly or indirectly, prehistoric or historical archaeological resources *beyond* the facility site, resources recommended or assumed to be historically significant.
- **Cultural Resources** – Potential for cumulatively considerable degradation of prehistoric or historical archaeological resources *beyond* the facility site, resources recommended or assumed to be historically significant.
- **Cultural Resources** – Potential impacts on a significant built-environment cultural resource (Desert Center) *beyond* the site.
- **Cultural Resources** – Potential to substantively degrade, directly or indirectly, ethnographic resources *beyond* the facility site, resources recommended or assumed to be historically significant.
- **Cultural Resources** – Potential for cumulatively considerable degradation of ethnographic resources *beyond* the facility site, resources recommended or assumed to be historically significant.

This alternative would not involve construction of any structures resembling the power towers of the proposed PSEGS. Staff identifies a potentially significant impact on avian species that could remain *significant and unavoidable* even after mitigation. For impacts on **Visual Resources**, staff identifies a *significant and unavoidable* impact from glint and glare effects of the high-profile solar receiver steam generators. These two impacts would not occur with construction and operation of Reconfigured Alternative #2 or #3:

- **Biological Resources** – Potential impacts on avian species from exposure to concentrated solar flux.
- **Visual Resources** – Glint or glare effects from high-profile solar receiver steam generators.

In general, staff concludes that without the solar power towers that would be constructed under the proposed modified project, some impacts on **Biological Resources**, **Cultural Resources**, **Geology and Paleontology**, **Traffic and Transportation**, and **Visual Resources** would be less than PSEGS, to varying degrees, under this alternative.

For **Biological Resources**, impacts on avian species from the effects of exposure to concentrated solar flux in the airspace over the solar collector array fields would not occur under this alternative, whereas under the proposed PSEGS, the impact could remain significant and unavoidable after mitigation. The extent and nature of adverse impacts from the No-Project Alternative are uncertain, but could include injury and mortality due to collisions with project features and possibly other physiological stress mechanisms. Depending on the severity of the impacts and the species affected, these impacts could remain significant and unavoidable after implementation of all feasible mitigation measures. Biological resources staff concludes that direct effects on sand transport Zones II and III and indirect effects on Zone III would be “somewhat less than PSEGS” under this alternative. Impacts on Mojave fringe-toed lizard would also be “somewhat less than PSEGS.” Like the proposed modified project, implementation of appropriate mitigation measures could reduce impacts on the sand transport corridor, sand dunes, and Mojave fringe-toed lizard to less than significant.

For potentially significant impacts on avian species from collisions with the solar collectors and other equipment, staff concludes that the impacts would be “similar to PSEGS” even though the absence of the SPTs under this alternative would eliminate the potential for avian species to collide with those extremely tall structures. Biological resources staff recommends mitigation measures for impacts on avian species from potential collisions with project structures or exposure to solar flux (please refer to Conditions of Certification **BIO-16a** and **BIO-16b** in the **BIOLOGICAL RESOURCES** section of this staff assessment). With implementation of all feasible mitigation measures, cumulative impacts could remain significant and unavoidable.

Cultural Resources staff concludes that Reconfigured Alternative #2 or #3 would have a much lower potential to substantively degrade prehistoric or historical archaeological resources *beyond* the site compared to the proposed PSEGS. This alternative would also greatly reduce direct and cumulative impacts relating to degradation of ethnographic resources *beyond* the site. Under the proposed PSEGS, no feasible mitigation measures are identified to reduce these impacts to less than significant, and they would remain significant and unavoidable. Because of the reduced severity of the visual intrusion of the parabolic trough technology on the cultural landscape that covers much of the Chuckwalla Valley and the flanks of the surrounding mountains, these direct and cumulative impacts could be reduced to less than significant with implementation of appropriate mitigation measures.

As one consequence of the much higher vertical profile of the proposed PSEGS, which staff concludes would result in significant and immitigable impacts on off-site built-environment resources, staff concludes that construction and operation of Reconfigured Alternative #2 or #3 would cause impacts on built-environment resources *beyond* the site that would be "much less than PSEGS."

Although construction of Reconfigured Alternative #2 or #3 would require substantial site grading and excavation, the conventional excavation methods used to install the parabolic trough system allows retrieval of subsurface soils or any fossils contained within those soils. Any fossil discoveries would be uncovered, collected, and recorded according to professional standards and practices, and impacts on **Paleontological Resources** could be reduced to less than significant. Under the proposed modified project, installation of the pylons supporting the heliostat mirrors would cause the permanent loss and destruction of any fossils that could be present in subsurface soils. Staff recommends a subsurface site characterization prior to the start of ground disturbance to allow refinement of mitigation options for impacts on those resources; implementation of Condition of Certification **PAL-9** would reduce impacts on paleontological resources to less than significant.

For **Geological Resources** impacts, the overall potential for impacts to occur from all identified geologic hazards for Reconfigured Alternative #2 or #3 would be "much less than PSEGS." Mitigation measures to reduce the risk of damage to the facility from geologic hazards would remain the same regardless of the project technology.

Traffic and Transportation staff concludes that the sun's reflection off the parabolic mirrors of this alternative would be much more diffuse and produce a greatly reduced glare effect compared to the nearly planar heliostat mirror collectors of the proposed PSEGS. The potential for the solar collectors to cause distractive and uncomfortable glint and glare impacts on motorists and pilots in the project area would be "much less than PSEGS." Mitigation measures similar to those recommended for the proposed modified project would reduce potential nuisance effects of glint and glare to less than significant. Under the proposed modified project, the potential for glare effects from the SPTs (i.e., the solar receivers) to cause hazardous conditions for motorists and pilots is considered potentially significant. Given that this alternative would not include power towers topped by brightly glowing SRSGs, the potential for glare impacts to cause hazardous operating conditions for motorists and pilots would be “much less than PSEGS.” Hazardous glare impacts from Reconfigured Alternative #2 or #3 would be less than significant, and no mitigation measures would be required.

Several impacts on **Visual Resources** under this alternative are described as “similar to PSEGS.” However, this alternative would not include any structures resembling the extremely tall power towers topped by brightly glowing SRSGs, and no adverse impacts on visual resources would occur relating to the glint and glare effects of the solar receivers. This impact would remain significant and unavoidable under the proposed PSEGS. The increased project site footprint for this alternative would increase the extent of the solar collector fields and possibly the extent of the project area across the horizontal plane. Although the prominence of the facility would be reduced without the SPTs in views from the Wilderness Areas, this alternative would have similar industrial-type characteristics that would contrast greatly with the landscape. Staff concludes that the impact on scenic vistas would be “somewhat less than PSEGS.”

Implementation of Reconfigured Alternative #2 or #3 would increase the project site footprint and require up to approximately 570 more acres compared to the proposed modified project. As a result of the increased acreage, impacts on special-status plant species, desert tortoise, and other special-status terrestrial wildlife species (excluding Mojave fringe-toed lizard) would be “greater than PSEGS.” Because of the greater extent of site grading that is required for parabolic trough projects, impacts on on-site drainages and jurisdictional waters would be “much greater than PSEGS.” Implementation of appropriate mitigation measures would reduce these impacts on **Biological Resources** to less than significant.

Due to the use of a highly combustible HTF and large quantities of other combustible and hazardous materials, impacts on fire response and hazardous materials spill response would be “much greater than PSEGS” under this alternative. Impacts on **Fire Protection**, **Hazardous Materials Management**, and **Waste Management** would be reduced to less than significant with implementation of appropriate mitigation measures.

For the topic of **Land Use**, the impact addressing compatibility with applicable plans, policies and regulations is “somewhat greater than PSEGS” due to the additional requirement to comply with the Riverside County General Plan and several ordinances and policies addressing solar development on unincorporated county land.

For impacts on **Soil and Water Resources**, staff concludes that increased earthwork during project construction would greatly increase the potential for soil erosion by wind and water during project construction. Although this impact would be “much greater than PSEGS,” implementation of standard mitigation measures would reduce this construction-related impact to less than significant. Most other impacts on soil and water resources are considered to be “somewhat greater than PSEGS” or “greater than PSEGS,” and these impacts would be reduced to less than significant with implementation of appropriate mitigation measures.

For the topics of **Air Quality** and **Public Health**, staff concludes that comparative impacts would be “similar to PSEGS” or “somewhat greater than PSEGS” with no change to the comparative impact conclusions. However, more stringent mitigation measures would be required to ensure that the impacts from constructing and operating Reconfigured Alternative #2 or #3 would not be considered cumulatively significant for ozone.

The avoidance or substantial reduction of several impacts on **Biological Resources**, **Cultural Resources**, **Geology and Paleontological Resources**, and **Visual Resources** is considered an environmental benefit of this alternative compared to the proposed PSEGS. For impacts on **Biological Resources**, staff concludes that impacts on the sand transport corridor, sand dunes, and the Mojave fringe-toed lizard would be “somewhat less than PSEGS.” Other impacts on biological resources that are considered “greater than PSEGS” could be reduced to less than significant with implementation of appropriate mitigation measures. If reducing or avoiding several direct and indirect environmental impacts is a critical factor, then either Reconfigured Alternative #2 or #3 would be environmentally superior to the proposed modified project.

Although construction and operation of Reconfigured Alternative #2 or #3 could potentially attain most of the basic project objectives, it is unknown how and to what extent changing the project technology back to a parabolic trough technology could affect project viability.

Solar PV Alternative with Single-Axis Tracking Technology

Under the proposed PSEGS, several impacts on **Cultural Resources** would remain *significant and unavoidable* after mitigation. These impacts could potentially be reduced to less than significant under this alternative with implementation of mitigation measures:

- **Cultural Resources** – Potential to substantively degrade, directly or indirectly, prehistoric or historical archaeological resources *beyond* the facility site, resources recommended or assumed to be historically significant.
- **Cultural Resources** – Potential for cumulatively considerable degradation of prehistoric or historical archaeological resources *beyond* the facility site, resources recommended or assumed to be historically significant.
- **Cultural Resources** – Potential impacts on a significant built-environment cultural resource (Desert Center) *beyond* the site.
- **Cultural Resources** – Potential to substantively degrade, directly or indirectly, ethnographic resources *beyond* the facility site, resources recommended or assumed to be historically significant.
- **Cultural Resources** – Potential for cumulatively considerable degradation of ethnographic resources *beyond* the facility site, resources recommended or assumed to be historically significant.

This alternative would not involve construction of any structures resembling the power towers of the proposed PSEGS, and three impacts identified by staff as *potentially significant* or *significant and unavoidable* under the proposed modified project would not occur with construction and operation of the Solar PV Alternative:

- **Biological Resources** – Potential impacts on avian species from exposure to concentrated solar flux.
- **Traffic and Transportation** – Solar receiver glare impacts that could be hazardous to motorists and pilots.
- **Visual Resources** – Glint or glare effects from high-profile solar receiver steam generators.

Without the SPTs that would be constructed for the proposed modified project, staff concludes that some impacts on **Biological Resources**, **Cultural Resources**, **Fire Protection**, **Geological Resources**, **Hazardous Materials Management**, **Public Health**, **Traffic and Transportation**, and **Visual Resources** would be less than PSEGS, to varying degrees, under this alternative.

For **Biological Resources**, the Solar PV Alternative would not concentrate solar flux, thereby eliminating a significant and unavoidable impact of the proposed PSEGS. The solar collectors installed at utility-scale renewable solar facilities—both the reflective surfaces of the mirrored heliostats and parabolic troughs and the less reflective glass solar PV panels—definitely pose collision hazards for avian species. For potentially significant impacts on avian species from collisions with the solar PV panels, transmission lines, and other equipment, staff concludes that the impacts would be "similar to PSEGS." For the proposed PSEGS, biological resources staff is recommending mitigation measures for impacts on avian species relating to potential collisions with project structures or exposure to solar flux (Conditions of Certification **BIO-16a** and **BIO-16b** in the **BIOLOGICAL RESOURCES** section of this staff assessment). Under the Solar PV Alternative, with implementation of all feasible mitigation measures, indirect and cumulative collision impacts could remain significant after mitigation.

Biological resources staff concludes that impacts on special-status plant species, waters of the state, and desert tortoise and other special-status terrestrial wildlife species would be "similar to PSEGS." Potential impacts on groundwater dependent plants and wildlife species would be "somewhat less than PSEGS." Direct impacts on the sand transport corridor, sand dunes, and Mojave fringe-toed lizard would likely be "somewhat less than PSEGS." A sand transport model is not available for this alternative; therefore, staff is unable to reach defensible comparative impact conclusions for potential indirect impacts on the sand transport corridor, sand dunes, and the Mojave fringe-toed lizard.

For **Cultural Resources**, staff concludes that the Solar PV Alternative would have a much lower potential to substantively degrade prehistoric or historical archaeological resources *beyond* the site compared to the proposed PSEGS. This alternative would also greatly reduce direct and cumulative impacts relating to degradation of ethnographic resources *beyond* the site. Staff concludes that the Solar PV Alternative would cause impacts on built-environment resources *beyond* the site that would be "much less than PSEGS." These direct and cumulative impacts could be reduced to less than significant with implementation of appropriate mitigation measures.

For **Fire Protection** impacts, staff concludes that construction-related direct and cumulative impacts on the Riverside County Fire Department under the Solar PV Alternative would be "much less than PSEGS." Because of the reduced need to transport, store, and use hazardous materials under this alternative, the potential for exposure to hazardous materials would be "much less than PSEGS." Overall, impacts on emergency services during project operations for the Solar PV Alternative would be "much less than PSEGS." Mitigation measures like those required for the proposed PSEGS would reduce impacts relating to **Fire Protection** and **Hazardous Materials Management** to less than significant.

Impacts relating to **Geology and Paleontology** would be "much less than PSEGS" or "somewhat less than PSEGS." The elimination of deep foundations would decrease the potential for encountering fossil bearing strata. Because traditional power plant structures on large foundations would not be required for the Solar PV Alternative, impacts on paleontological resources would be "somewhat less than PSEGS." The overall potential for impacts to occur from all identified geologic hazards for this alternative would be "much less than PSEGS." Mitigation measures would reduce the risk of damage from geologic hazards to less than significant.

For **Public Health** impacts, this alternative would not cause emissions of toxic air contaminants from boiler combustion and cooling towers, and staff considers the overall potential public health risks from the Solar PV Alternative to be "less than PSEGS." Because the Solar PV Alternative does not require a power plant cooling system, no public health impact would occur under this alternative relating to potential exposure to bacterial growth in the cooling systems that are required for traditional power plants.

For **Traffic and Transportation** impacts, staff concludes that the less reflective qualities of the PV panels compared to the heliostat mirrors would greatly reduce potential nuisance glint and glare impacts on motorists, and this impact would be "much less than PSEGS." This alternative would not include glare-producing SRSGs and power towers, and the potential for glare impacts to cause hazardous conditions for motorists and pilots would not occur under the Solar PV Alternative.

For **Visual Resources** impacts, staff concludes that the greatly reduced vertical profile and visual prominence of the structures for the Solar PV Alternative would reduce the potential for this alternative to cause adverse impacts on scenic vistas during project operations. This alternative would also greatly reduce the potential to substantially degrade the existing visual character or quality of the site and its surroundings. Staff concludes that both impacts would be "less than PSEGS." However, due to the substantial contrast of any utility-scale renewable solar facility with the landscape, these impacts would remain significant and unavoidable after mitigation.

This alternative would not include any structures resembling the extremely tall power towers topped by brightly glowing SRSGs, and no adverse impacts on **Visual Resources** would occur from the glint and glare effects of the proposed PSEGS solar receivers. Under the proposed PSEGS, this impact would remain significant and unavoidable.

The Solar PV Alternative would not require the bulky power block structures of the proposed PSEGS, and the potential effects of reflected glint or glare would be "much less than PSEGS." Due to the lower reflectivity of PV panels compared to heliostat mirrors, the potential for glint or glare to present a disruptive visual distraction for motorists and other viewers would be "much less than PSEGS." Like the proposed PSEGS, these potential **Visual Resources** impacts would be reduced to less than significant with implementation of appropriate mitigation measures.

For **Air Quality** impacts, emissions of criteria air pollutants during project operations would be "less than PSEGS," and like the proposed PSEGS, all air quality impacts would be reduced to less than significant.

For impacts on **Soil and Water Resources**, staff concludes that characteristic impacts on water quality caused by the presence of traditional power plant facilities would be "much less than PSEGS" for the Solar PV Alternative. Other impacts on soil and water resources are considered "somewhat less than PSEGS," "somewhat greater than PSEGS," or "similar to PSEGS," and these impacts would be reduced to less than significant with implementation of appropriate mitigation measures.

The avoidance or substantial reduction of several impacts on **Biological Resources**, **Cultural Resources**, **Traffic and Transportation**, and **Visual Resources** is considered an environmental benefit of this alternative compared to the proposed PSEGS. For **Biological Resources**, the primary benefit of this alternative compared to the proposed PSEGS is the elimination of the potential effects of solar flux on avian species. For **Cultural Resources**, **Traffic and Transportation**, and **Visual Resources** impacts, the Solar PV Alternative with its much lower vertical profile and reduced potential for operational glint and glare effects would offer the potential to develop mitigation measures that would go furthest toward reducing impacts on these resources.

If reducing or avoiding several direct and indirect environmental impacts and improving the effectiveness of mitigation measures are the critical factors, then the Solar PV Alternative with Single-Axis Tracking Technology would be environmentally superior to the proposed modified project.

Although construction and operation of the Solar PV Alternative could potentially attain many of the basic project objectives, it is unknown whether and to what extent the change of project technology would affect project viability.

Reduced Acreage Alternative with SPT Technology

For most environmental resources, comparative impacts under this alternative are described as "less than PSEGS," "somewhat less than PSEGS," "similar to PSEGS," or "same as PSEGS." Of the impacts on **Biological Resources**, the Reduced Acreage Alternative would avoid all impacts on mapped populations of the special-status plant species, ribbed cryptantha.

Although some of the **Biological Resources** impacts would be reduced under this alternative compared to PSEGS, staff concludes that all of these impacts would be significant. Implementation of mitigation measures would reduce these impacts to less-than-significant levels:

- Impacts on special-status plant species
- Impacts on waters of the state
- Impacts on desert tortoise
- Impacts on special-status terrestrial wildlife species (kit fox, American badger)
- Impacts on sand transport corridor
- Impacts on sand dunes and Mojave fringe-toed lizard[7]

For **Biological Resources** impacts, staff concludes that impacts on special-status plant species would be "much less than PSEGS" under this alternative. The Reduced Acreage Alternative would avoid impacts on mapped populations of ribbed cryptantha and eliminate impacts on one mapped population of Harwood's milkvetch, both of which are considered special-status species under CEQA. Impacts on waters of the state, desert dry wash woodland, and unvegetated ephemeral dry washes would be reduced under this alternative. Staff concludes that direct impacts on aeolian sand corridors Zone II and Zone III would be "less than PSEGS." Impacts on Mojave fringe-toed lizard would likely be "less than PSEGS." Staff concludes that impacts on kit fox, desert tortoise, and American badger would be "much less than PSEGS." The Reduced Acreage Alternative would greatly reduce impacts on burrowing owl habitat, and as a result, impacts on this species would likely be "much less than PSEGS." The potential impact on groundwater dependent ecosystems would be "somewhat less than PSEGS." Like the proposed modified project, implementation of appropriate mitigation measures would reduce these biological resources impacts to less-than-significant levels. Potential impacts on avian species from the effects of exposure to solar flux and collisions with project structures are estimated to be "less than PSEGS," although the impacts could remain significant and unavoidable after mitigation.

For impacts on **Cultural Resources**, staff characterizes the net effect of this alternative on prehistoric and historical resources as "similar to PSEGS." For impacts on **Geology**

[7] Without a predictive model to project impacts, indirect impacts on the sand transport corridor, sand dunes, and the Mojave fringe-toed lizard are unquantifiable.

and Paleontology, the impact on paleontological resources would be “less than PSEGS.” This alternative would omit Unit 2 (the eastern solar plant) and many of the heliostats that would be located closest to I-10, and glint and glare impacts from the heliostats would be “less than PSEGS.” The same mitigation measures proposed for PSEGS to reduce solar collector glint and glare impacts would apply to this alternative. For **Traffic and Transportation** and **Visual Resources**, no significant impacts would be greatly reduced or avoided under this alternative.

Staff identifies several impacts on **Biological Resources** that would be “much less than PSEGS,” and staff considers this to be the primary benefit of this alternative compared to the proposed modified project. If reducing the overall extent of impacts on biological resources is the critical factor, then the Reduced Acreage Alternative would be somewhat superior to the proposed modified project.

Although the Reduced Acreage Alternative could potentially attain many of the basic project objectives, it is unknown how eliminating the eastern solar plant would affect project viability.

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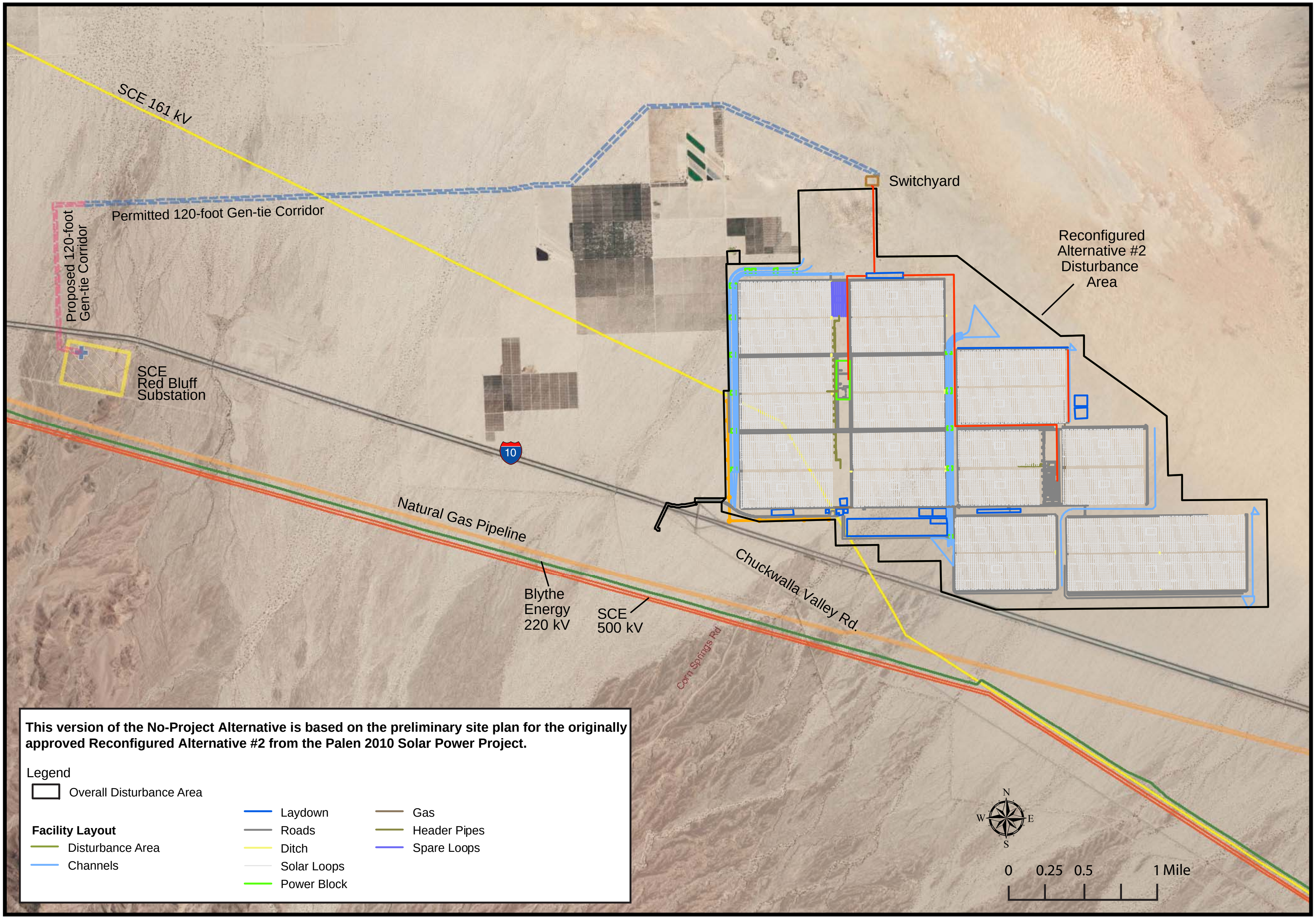
ALTERNATIVES APPENDIX-1: STAFF CONTRIBUTORS TO THE COMPARATIVE ANALYSIS OF ALTERNATIVES

This appendix lists staff responsible for specific technical analyses in the **ALTERNATIVES** section of this staff assessment. Staff names are listed with their area of technical expertise.

Technical Area	Staff
Air Quality	Jacquelyn Leyva Record
Biological Resources	Carol Watson Chris Huntley
Cultural Resources	Michael D. McGuirt, RPA Thomas M. Gates, Ph.D.
Fire Protection	Alvin Greenberg, Ph.D.
Geology and Paleontology	Casey W. Weaver, CEG
Hazardous Materials Management	Alvin Greenberg, Ph.D.
Land Use	James Adams
Power Plant Efficiency and Reliability	Edward Brady, P.E. Shahab Khoshmashrab, P.E.
Public Health	Huei-An (Ann) Chu, Ph.D.
Socioeconomics	Lisa Worrall
Soil and Water Resources	Marylou Taylor, P.E.
Traffic and Transportation	Andrea Koch-Eckhardt David Flores Gregg Irvin, Ph.D. Alvin Greenberg, Ph.D.
Transmission System Engineering	Laiping Ng Mark Hesters
Visual Resources	William Kanemoto Gregg Irvin, Ph.D.
Waste Management	Christopher Dennis, PG

ALTERNATIVES - FIGURE 1a

Palen Solar Electric Generating System - No-Project Alternative, Reconfigured Alternative #2 Site Layout



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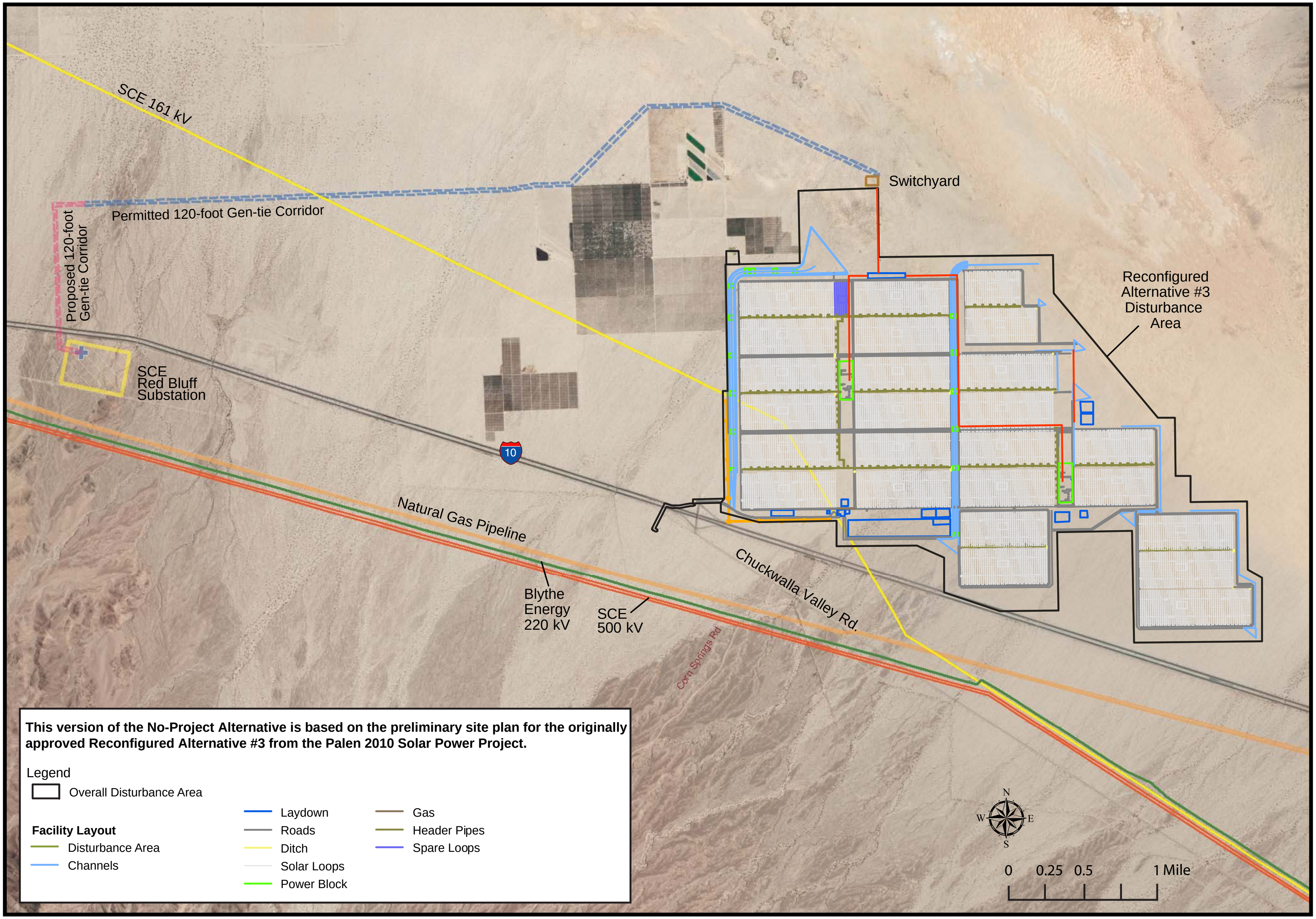
SOURCE: AECOM, PSPP Reconfigured Alternative 2 Facility Layout, Palen Solar 1 2010 (Biological Resources Data Package, Fig 4)

ALTERNATIVES - FIGURE 1b
Palen Solar Electric Generating System - No-Project Alternative, Reconfigured Alternative #3 Site Layout



SOURCE: AECOM, PSPP Reconfigured Alternative 3 Facility Layout, Palen Solar 1 2010 (Biological Resources Data Package, Fig 5)

ALTERNATIVES - FIGURE 2a

Palen Solar Electric Generating System - No-Project Alternative, Examples of Parabolic Trough Project Facilities

Two views of the Solar Electric Generating Systems Projects at Kramer Junction

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Source: Michael Clayton & Associates

ALTERNATIVES - FIGURE 2b

Palen Solar Electric Generating System - No-Project Alternative, Examples of Parabolic Trough Project Facilities

Parabolic troughs like those originally proposed to be used at the Blythe Solar Power Project in California

Source: Energy Commission

Typical Solar Collector Assembly for Parabolic Trough Installation

Source: Palen Solar 1 2010

ALTERNATIVES - FIGURE 3a

Palen Solar Electric Generating System - Solar Photovoltaic Alternative with Single-Axis Tracking Technology

Typical T0 Tracker

Source: U.S. Department of Energy 2011

California Valley Solar Ranch Project

Source: GUNTHER Portfolio

ALTERNATIVES - FIGURE 3b

Palen Solar Electric Generating System - Solar Photovoltaic Alternative with Single-Axis Tracking Technology

California Valley Solar Ranch Project PV Array

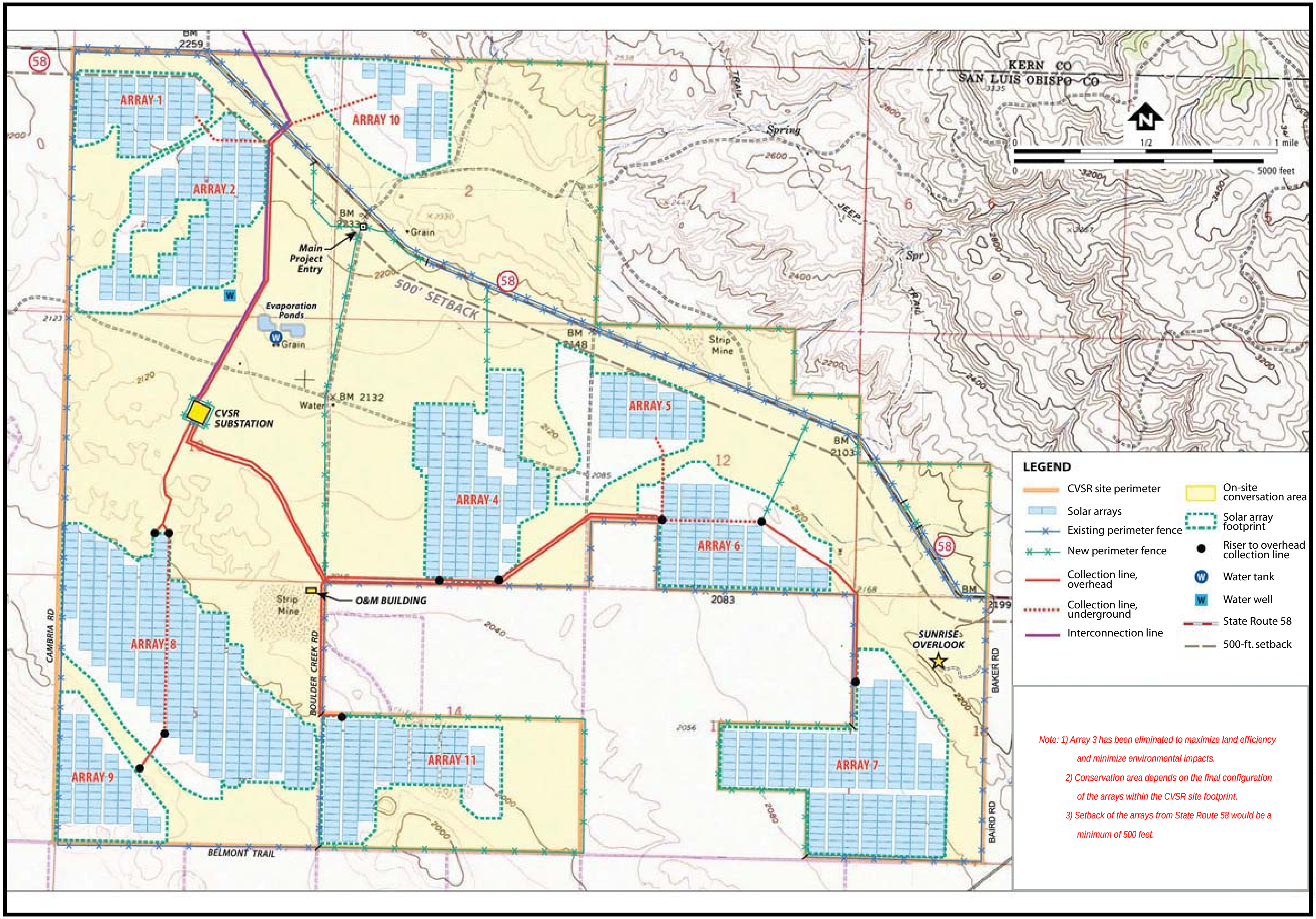
Source: GUNTHER Portfolio

California Valley Solar Ranch Project Showing Inverter

Source: GUNTHER Portfolio

ALTERNATIVES - FIGURE 4

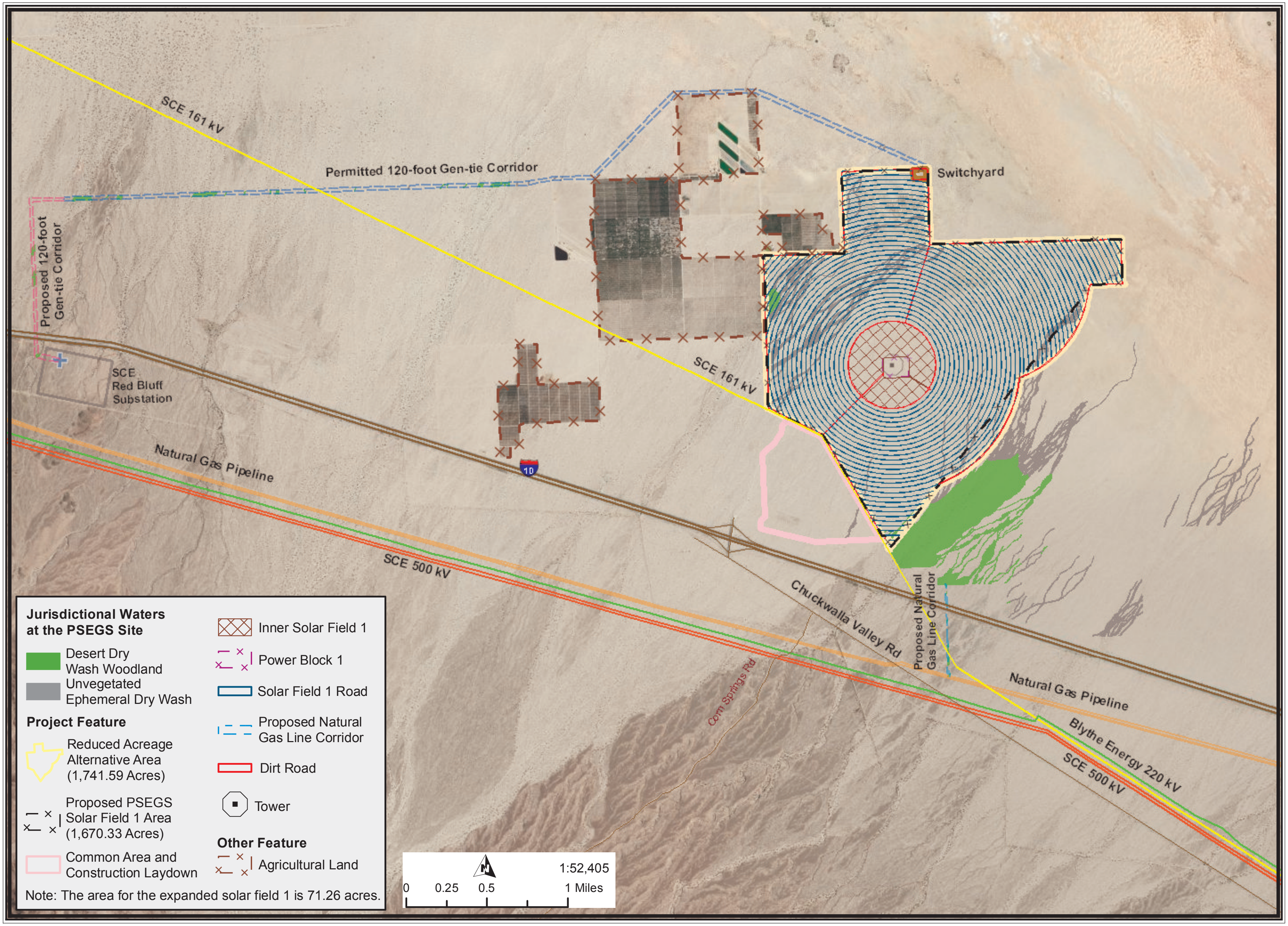
Palen Solar Electric Generating System - PV Solar Arrays and Major Project Features, California Valley Solar Ranch Project



SOURCE: U.S. Department of Energy 2011

ALTERNATIVES - FIGURE 5a

Palen Solar Electric Generating System - Reduced Acreage Alternative

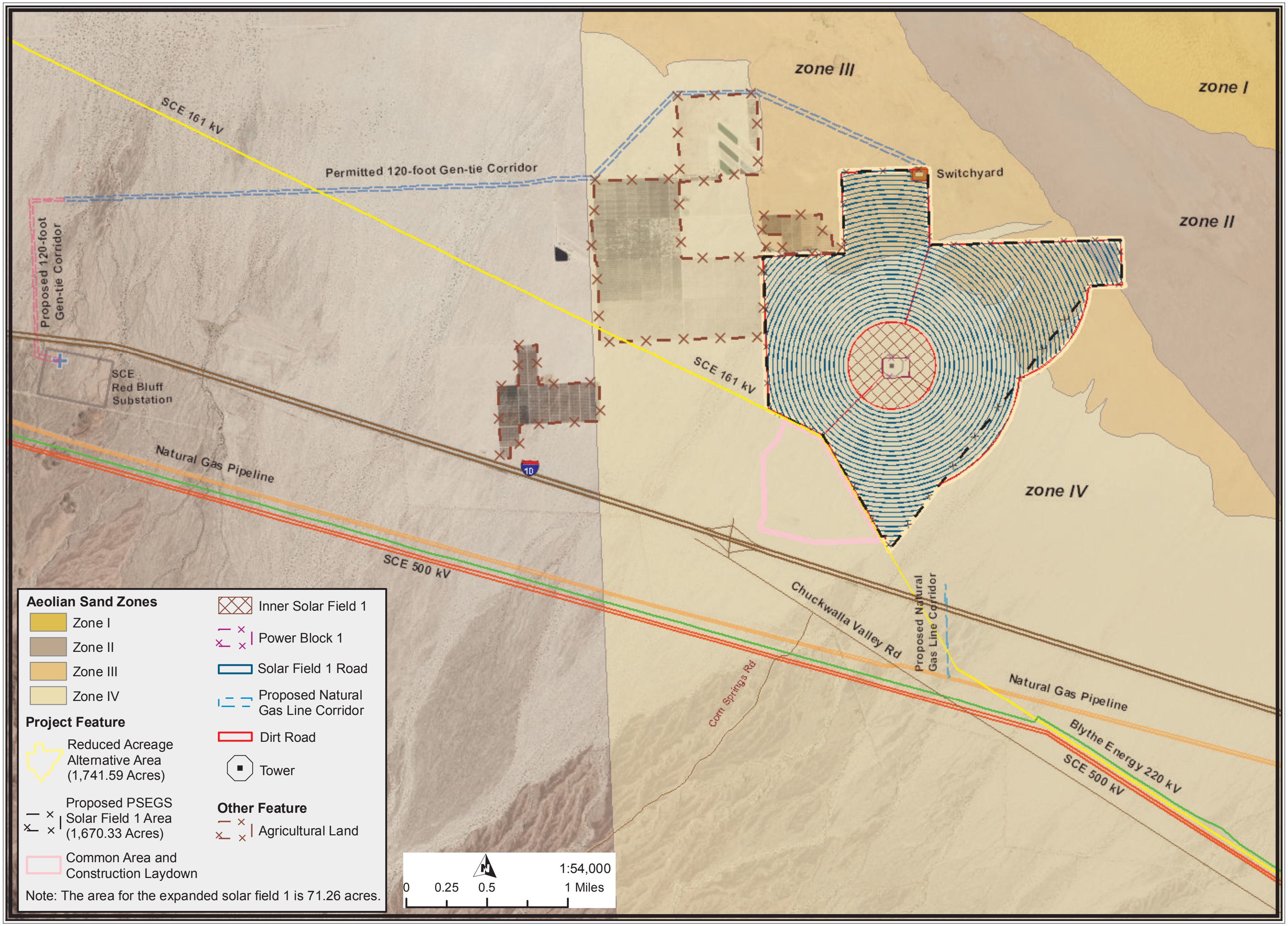


CALIFORNIA ENERGY COMMISSION - SITING,TRANSMISSION AND ENVIRONMENTAL PROTECTION DIVISION

SOURCE: SOURCE: Bing Aerial, BrightSource - May 2013, OpenStreetMap - May 2013, CEC Transmission Line, Natural Gas Line - June 2013

ALTERNATIVES - FIGURE 5b

Palen Solar Electric Generating System - Reduced Acreage Alternative



CALIFORNIA ENERGY COMMISSION - SITING,TRANSMISSION AND ENVIRONMENTAL PROTECTION DIVISION

SOURCE: SOURCE: Bing Aerial, BrightSource - May 2013, OpenStreetMap - May 2013, CEC Transmission Line, Natural Gas Line - June 2013

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Transmission System Engineering	Laiping Ng Mark Hesters
Visual Resources	William Kanemoto Gregg Irvin, Ph.D.
Waste Management	Christopher Dennis, PG

Alternatives Appendix-2
Summary Comparison of Impacts of the Project Alternatives to the Proposed Modified Project
(Please see explanatory notes at the bottom of the table)

Environmental Effect	Proposed PSEGS	No-Project Alternative	Solar PV Alternative with Single-Axis Tracking Technology	Reduced Acreage Alternative with SPT Technology
		Reconfigured Alternative #2 or #3		
Air Quality				
Construction-related emissions	SM (locally)	Similar to PSEGS (SM)	Similar to PSEGS (SM)	Somewhat less than PSEGS (SM)
Project operations emissions	SM (locally)	Somewhat greater than PSEGS (SM)	Less than PSEGS (SM)	Similar to PSEGS (SM)
Reduction in greenhouse gases	B (system wide)	Similar to PSEGS (B)	Somewhat greater than PSEGS (B)	Similar to PSEGS (B)
Biological Resources				
Impacts on special-status plant species	SM	Greater than PSEGS (SM)	Similar to PSEGS (SM)	Much less than PSEGS (SM)
Impacts on waters of the state	SM	Much greater than PSEGS (SM)	Similar to PSEGS (SM)	Much less than PSEGS (SM)
Impacts on desert tortoise	SM	Greater than PSEGS (SM)	Similar to PSEGS (SM)	Much less than PSEGS (SM)
Impacts on special-status terrestrial wildlife species (kit fox, American badger)	SM	Greater than PSEGS (SM)	Similar to PSEGS (SM)	Much less than PSEGS (SM)
Potential impacts on avian species from collisions with project features	PSU	Similar to PSEGS (PSU)	Similar to PSEGS (PSU)	Less than PSEGS (PSU)
Potential impacts on avian species from exposure to concentrated solar flux	PSU	—	—	Less than PSEGS (PSU)
Potential impacts on groundwater dependent ecosystems	SM	Somewhat greater than PSEGS (SM)	Somewhat less than PSEGS (SM)	Somewhat less than PSEGS (SM)

Alternatives Appendix-2
Summary Comparison of Impacts of the Project Alternatives to the Proposed Modified Project
(Please see explanatory notes at the bottom of the table)

Environmental Effect	**Proposed PSEGS**	**No-Project Alternative**	**Solar PV Alternative with Single-Axis Tracking Technology**	**Reduced Acreage Alternative with SPT Technology**
		Reconfigured Alternative #2 or #3		
Impacts on sand transport corridor	SM	Somewhat less than PSEGS (SM)	Somewhat less than PSEGS (SM) *(see biological resources note)*	Less than PSEGS (SM) *(see biological resources note)*
2 Impacts on sand dunes and Mojave fringe-toed lizard	SM	Somewhat less than PSEGS (SM)	Somewhat less than PSEGS (SM) *(see biological resources note)*	Less than PSEGS (SM) *(see biological resources note)*
Biological resources note: Comparative impacts for the Solar PV Alternative and the Reduced Acreage Alternative for indirect impacts on the sand transport corridor, sand dune habitat, and Mojave fringe-toed lizard cannot reasonably be characterized without further data and use of a sand transport model.				
Cultural Resources				
Potential to substantively degrade, directly or indirectly, prehistoric or historical archaeological resources *on* the facility site, resources recommended or assumed to be historically significant *(see cultural resources note 1)*	PSM	Somewhat greater than PSEGS (SM)	Similar to PSEGS (PSM)	Less than PSEGS (PSM)
Potential to substantively degrade, directly or indirectly, prehistoric or historical archaeological resources *beyond* the facility site, resources recommended or assumed to be historically significant	SU	Much less than PSEGS (SM)	Much less than PSEGS (SM)	Similar to PSEGS (SU)

Alternatives Appendix-2
Summary Comparison of Impacts of the Project Alternatives to the Proposed Modified Project
(Please see explanatory notes at the bottom of the table)

Environmental Effect	Proposed PSEGS	No-Project Alternative	Solar PV Alternative with Single-Axis Tracking Technology	Reduced Acreage Alternative with SPT Technology
		Reconfigured Alternative #2 or #3		
Potential for cumulatively considerable degradation of prehistoric or historical archaeological resources *beyond* the facility site, resources recommended or assumed to be historically significant	SU	Much less than PSEGS (PSM)	Much less than PSEGS (SM)	Similar to PSEGS (SU)
Potential impacts on significant built-environment cultural resources *on* the site	LS	Similar to PSEGS (LS)	Similar to PSEGS (LS)	Similar to PSEGS (LS)
3 Potential impacts on significant built-environment cultural resources (Desert Center, Eagle Mountain Mine) *beyond* the site	SU	Much less than PSEGS (LS)	Much less than PSEGS (SM)	Similar to PSEGS (SU)
Potential to substantively degrade, directly or indirectly, ethnographic resources *on* the facility site, resources recommended or assumed to be historically significant	PSM	Similar to PSEGS (PSM)	Similar to PSEGS (PSM)	Similar to PSEGS (PSM)
Potential for cumulatively considerable degradation of ethnographic resources *on* the facility site, resources recommended or assumed to be historically significant	LS	Similar to PSEGS (LS)	Similar to PSEGS (LS)	Similar to PSEGS (LS)
Potential to substantively degrade, directly or indirectly, ethnographic resources *beyond* the facility site, resources recommended or assumed to be historically significant	SU	Much less than PSEGS (PSM)	Much less than PSEGS (SM)	Similar to PSEGS (SU)
Potential for cumulatively considerable degradation of ethnographic resources *beyond* the facility site, resources recommended or assumed to be historically significant	SU	Much less than PSEGS (PSM)	Much less than PSEGS (SM)	Similar to PSEGS (SU)
Cultural resources note: For all alternatives, “site” means the facility site proper and does not include linear or ancillary infrastructure away from the facility site.				

Alternatives Appendix-2
Summary Comparison of Impacts of the Project Alternatives to the Proposed Modified Project
(Please see explanatory notes at the bottom of the table)

Environmental Effect	Proposed PSEGS	No-Project Alternative	Solar PV Alternative with Single-Axis Tracking Technology	Reduced Acreage Alternative with SPT Technology
		Reconfigured Alternative #2 or #3		
Fire Protection				
Construction-Related Impacts				
Impacts on the Riverside County Fire Department	SM	Somewhat greater than PSEGS (SM)	Much less than PSEGS (SM)	Same as PSEGS (SM)
Project Operations Impacts				
4 Become familiar with and plan for emergency responses	SM	Less than PSEGS (SM)	Much less than PSEGS (SM)	Same as PSEGS (SM)
Conduct plan reviews, inspections, and permitting	SM	Somewhat greater than PSEGS (SM)	Much less than PSEGS (SM)	Same as PSEGS (SM)
Fire response	SM	Much greater than PSEGS (SM)	Much less than PSEGS (SM)	Same as PSEGS (SM)
Hazardous materials spill response	SM	Much greater than PSEGS (SM)	Much less than PSEGS (SM)	Same as PSEGS (SM)
Rescue	SM	Somewhat less than PSEGS (SM)	Somewhat less than PSEGS (SM)	Same as PSEGS (SM)
Emergency medical services	SM	Same as PSEGS (SM)	Much less than PSEGS (SM)	Same as PSEGS (SM)
Geology and Paleontology				
Potential impacts from strong seismic shaking	SM	Much less than PSEGS (SM)	Much less than PSEGS (SM)	Somewhat less than PSEGS (SM)

Alternatives Appendix-2
Summary Comparison of Impacts of the Project Alternatives to the Proposed Modified Project
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Environmental Effect	Proposed PSEGS	No-Project Alternative	Solar PV Alternative with Single-Axis Tracking Technology	Reduced Acreage Alternative with SPT Technology
		Reconfigured Alternative #2 or #3		
Potential impacts from soil failure caused by liquefaction, hydrocollapse, and/or dynamic compaction	SM	Much less than PSEGS (SM)	Much less than PSEGS (SM)	Somewhat less than PSEGS (SM)
Potential impacts on paleontological resources	SM	Less than PSEGS (SM)	Somewhat less than PSEGS (SM)	Less than PSEGS (SM)
Potential impacts on geological or mineralogical resources	—	—	—	—
Hazardous Materials Management				
Construction-Related Impacts				
Potential for spills or other releases of hazardous materials to occur on-site	SM	Same as PSEGS (SM)	Same as PSEGS (SM)	Same as PSEGS (SM)
Potential for spills or other releases of hazardous materials to occur off-site	LS	Same as PSEGS (LS)	Same as PSEGS (LS)	Same as PSEGS (LS)
Project Operations Impacts				
Potential for spills or other releases of hazardous materials to occur on-site	SM	Much greater than PSEGS (SM)	Much less than PSEGS (SM)	Same as PSEGS (SM)
Potential for spills or other releases of hazardous materials to occur off-site	LS	Much greater than PSEGS (SM)	Much less than PSEGS (LS)	Same as PSEGS (LS)
Land Use				
Compatibility with land use plan, policy, or regulation	SM	Somewhat greater than PSEGS (SM)	Similar to PSEGS (SM)	Similar to PSEGS (SM)

Alternatives Appendix-2
Summary Comparison of Impacts of the Project Alternatives to the Proposed Modified Project
(Please see explanatory notes at the bottom of the table)

Environmental Effect	Proposed PSEGS	No-Project Alternative	Solar PV Alternative with Single-Axis Tracking Technology	Reduced Acreage Alternative with SPT Technology
		Reconfigured Alternative #2 or #3		
Public Health				
Potential for project construction to cause air toxics-related or other impacts that could affect public health	LS	Somewhat greater than PSEGS (LS)	Similar to PSEGS (LS)	Less than PSEGS (LS)
Potential for project operations to cause air toxics-related or other impacts that could affect public health	PSM	Similar to PSEGS (PSM)	Less than PSEGS (LS)	Less than PSEGS (PSM)
Socioeconomics				
Environmental justice population within 6-mile buffer	—	—	—	—
Induce substantial population growth in an area, either directly or indirectly	LS	Similar to PSEGS (LS)	Similar to PSEGS (LS)	Somewhat less than PSEGS (LS)
Displace substantial numbers of people and/or existing housing, necessitating the construction of replacement housing elsewhere	LS	Similar to PSEGS (LS)	Similar to PSEGS (LS)	Somewhat less than PSEGS (LS)
Adversely impact acceptable levels of service for police protection, schools, and parks and recreation	LS	Similar to PSEGS (LS)	Similar to PSEGS (LS)	Somewhat less than PSEGS (LS)
Increased property taxes, construction and operation employment income, and increased state and local taxes and fees	B	Similar to PSEGS (B)	Similar to PSEGS (B)	Somewhat less than PSEGS (B)
Soil and Water Resources				
Soil erosion by wind and water during project construction	SM	Much greater than PSEGS (SM)	Somewhat less than PSEGS (SM)	Less than PSEGS (SM)

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Alternatives Appendix-2
Summary Comparison of Impacts of the Project Alternatives to the Proposed Modified Project
(Please see explanatory notes at the bottom of the table)

Environmental Effect	Proposed PSEGS	No-Project Alternative	Solar PV Alternative with Single-Axis Tracking Technology	Reduced Acreage Alternative with SPT Technology
		Reconfigured Alternative #2 or #3		
Soil erosion by wind and water during project operations	PSM	Less than PSEGS (PSM)	Less than PSEGS (PSM)	Less than PSEGS (PSM)
Water quality impacts from contaminated storm water runoff	SM	Somewhat greater than PSEGS (SM)	Somewhat greater than PSEGS (SM)	Less than PSEGS (SM)
Water quality impacts from storm damage	PSM	Greater than PSEGS (PSM)	Somewhat greater than PSEGS (PSM)	Less than PSEGS (PSM)
Water quality impacts from power plant operations	SM	Similar to PSEGS (SM)	Much less than PSEGS (SM)	Less than PSEGS (SM)
Water quality impacts from sanitary waste	SM	Similar to PSEGS (SM)	Similar to PSEGS (SM)	Somewhat less than PSEGS (SM)
Potential impacts from on-site and off-site flooding	PSM	Less than PSEGS (PSM)	Similar to PSEGS (PSM)	Less than PSEGS (PSM)
Potential to impede or redirect 100-year flood flows, as shown on Federal Emergency Management Agency maps	—	—	—	—
Potential impacts on local wells	PSM	Somewhat greater than PSEGS (PSM)	Somewhat less than PSEGS (PSM)	Somewhat less than PSEGS (PSM)
Potential impacts on groundwater basin balance	PSM	Somewhat greater than PSEGS (PSM)	Somewhat less than PSEGS (PSM)	Somewhat less than PSEGS (PSM)

Alternatives Appendix-2 Summary Comparison of Impacts of the Project Alternatives to the Proposed Modified Project (Please see explanatory notes at the bottom of the table)				
Environmental Effect	**Proposed PSEGS**	**No-Project Alternative**	**Solar PV Alternative with Single-Axis Tracking Technology**	**Reduced Acreage Alternative with SPT Technology**
		Reconfigured Alternative #2 or #3		
Traffic and Transportation				
Potential damage to roads	PSM	Less than PSEGS (PSM)	Less than PSEGS (PSM)	Somewhat less than PSEGS (PSM)
Level of service on roads and highways – construction	PSM	Less than PSEGS (PSM)	Less than PSEGS (PSM)	Less than PSEGS (PSM)
8 Level of service on roads and highways – operation/post-construction	LS	Similar to PSEGS (LS)	Similar to PSEGS (LS)	Similar to PSEGS (LS)
Solar collector glint and glare impacts on motorists and pilots	PSM	Much less than PSEGS (PSM)	Much less than PSEGS (PSM)	Less than PSEGS (PSM)
Solar receiver glare impacts that could be hazardous to motorists and pilots	PSM	Much less than PSEGS (LS)	—	Somewhat less than PSEGS (PSM)
Visual Resources				
Construction-Related Impacts				
Potential for adverse impacts on scenic vistas	SM	Greater than PSEGS (SM)	Less than PSEGS (SM)	Less than PSEGS (SM)
Potential to substantially damage scenic resources within a state scenic highway	LS	Similar to PSEGS (LS)	Similar to PSEGS (LS)	Similar to PSEGS (LS)
Potential to substantially degrade the existing visual character or quality of the site and its surroundings	SM	Greater than PSEGS (SM)	Similar to PSEGS (SM)	Less than PSEGS (SM)

Alternatives Appendix-2
Summary Comparison of Impacts of the Project Alternatives to the Proposed Modified Project
(Please see explanatory notes at the bottom of the table)

Environmental Effect	**Proposed PSEGS**	**No-Project Alternative**	**Solar PV Alternative with Single-Axis Tracking Technology**	**Reduced Acreage Alternative with SPT Technology**
		Reconfigured Alternative #2 or #3		
Potential to create a new source of substantial light or glare which would adversely affect day or nighttime views in the area	SM	Similar to PSEGS (SM)	Similar to PSEGS (SM)	Less than PSEGS (SM)
Project Operations Impacts				
Potential for adverse impacts on scenic vistas	SU	Somewhat less than PSEGS (SU)	Less than PSEGS (SU)	Somewhat less than PSEGS (SU)
9 Potential to substantially damage scenic resources within a state scenic highway	LS	Similar to PSEGS (LS)	Similar to PSEGS (LS)	Similar to PSEGS (LS)
Potential to substantially degrade the existing visual character or quality of the site and its surroundings	SU	Less than PSEGS (SU)	Less than PSEGS (SU)	Somewhat less than PSEGS (SU)
Potential to create a new source of substantial light or glare which would adversely affect day or nighttime views in the area *(individual effects listed below)*				
Glint or glare effects from project structures other than the reflective surfaces of solar collectors (i.e., heliostats, parabolic troughs, PV panels)	SM	Similar to PSEGS (SM)	Much less than PSEGS (PSM)	Similar to PSEGS (SM)
Glint or glare effects from the solar collectors	SM	Similar to PSEGS (SM)	Much less than PSEGS (PSM)	Similar to PSEGS (SM)
Glint or glare effects from high-profile solar receiver steam generators	SU	—	—	Somewhat less than PSEGS (SU)
Light or glare from nighttime lighting effects, including Federal Aviation Administration safety lighting	SM	Similar to or less than PSEGS (SM)	Less than PSEGS (SM)	Somewhat less than PSEGS (SM)

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(Please see explanatory notes at the bottom of the table)

Environmental Effect	Proposed PSEGS	No-Project Alternative	Solar PV Alternative with Single-Axis Tracking Technology	Reduced Acreage Alternative with SPT Technology
		Reconfigured Alternative #2 or #3		
Waste Management				
Potential for unexploded ordnance to be present at the project site	PSM	Similar to PSEGS (PSM)	Similar to PSEGS (PSM)	Similar to or less than PSEGS (PSM)
Potential for impacts on human health and the environment relating to past or present soil or water contamination	LS	Similar to PSEGS (LS)	Similar to PSEGS (LS)	Similar to or less than PSEGS (LS)
Potential for impacts on human health and the environment relating to potential waste discharges	LS	Much greater than PSEGS (PSM)	Similar to PSEGS (LS)	Similar to or less than PSEGS (LS)
Potential for disposal or diversion of project materials to cause impacts on existing waste disposal or diversion facilities	LS	Similar to PSEGS (LS)	Similar to PSEGS (LS)	Less than PSEGS (LS)

Notes: The comparison of impacts to the proposed modified project is conveyed, for most impacts, using these terms in a graded scale:

- Much less than PSEGS
- Less than PSEGS
- Somewhat less than PSEGS
- Similar to PSEGS
- Same as PSEGS
- Somewhat greater than PSEGS
- Greater than PSEGS
- Much greater than PSEGS

Notes: Impact conclusions for the proposed modified project and the comparative impacts for the alternatives are shown using these abbreviations:

— = no impact
B = beneficial impact
LS = less-than-significant impact, no mitigation required
SM or PSM = significant or potentially significant impact that can be mitigated to less than significant
SU or PSU = significant and unavoidable or potentially significant and unavoidable impact that cannot be mitigated to less than significant

COMPLIANCE CONDITIONS
AND
COMPLIANCE MONITORING PLAN

Testimony of Eric Veerkamp

INTRODUCTION

The project's **Compliance** Conditions of Certification, including a Compliance Monitoring Plan (Compliance Plan), were established as required by Public Resources Code section 25532. The Compliance Plan, applicable to the Palen Solar Electric Generating System (PSEGS), provides a means for assuring that the facility is constructed, operated, and closed in compliance with public health and safety, environmental, all other applicable laws, ordinances, regulations, and standards (LORS), and the conditions adopted by the Energy Commission and specified in the written Decision on the Amendment, or otherwise required by law.

The Compliance Plan is composed of elements that:

- set forth the duties and responsibilities of the Compliance Project Manager (CPM), the project owner or operator (project owner), delegate agencies, and others;
- set forth the requirements for handling confidential records and maintaining the compliance record;
- state procedures for settling disputes and making post-certification changes;
- state the requirements for periodic compliance reports and other administrative procedures necessary to verify the compliance status of all Energy Commission-approved conditions of certification;
- establish contingency planning, facility non-operation protocols, and closure requirements; and
- establish a tracking method for the technical area conditions of certification that contain measures required to mitigate potentially adverse project impacts associated with construction, operation, and closure to less than a level of significance. Each technical condition of certification also includes one or more verification provisions that describe the means of assuring that the condition has been satisfied.

REVISED COMPLIANCE CONDITIONS

Recent compliance monitoring experience on large solar projects demonstrated the need to revise the **Compliance** Conditions of Certification to improve compliance enforcement. The list below summarizes the revisions.

- Definitions for specific terms pertinent to compliance monitoring, including, “Start of Construction,” “Start of Commercial Operation,” “Non-Operation and Closure,” “Site Assessment and Pre-Construction Activities,” and “Site Mobilization and Construction,” among others;

- A new subsection and expanded discussion of “Roles and Responsibilities” and new sections for “Pre-Construction and Pre-Operation Compliance Meeting” and “Energy Commission Record;” and
- New condition of certification addressing “Non-Operation” and “Facility Closure Planning.”

KEY PROJECT DEFINITIONS

The following terms and definitions help determine when various conditions of certification are implemented.

Project Certification

Project certification occurs on the day the Energy Commission dockets its Decision after adopting it at a publically noticed Business Meeting or hearing. At that time, all Energy Commission conditions of certification become binding on the project owner and the proposed facility.

Site Assessment and Pre-Construction Activities

The below-listed site assessment and pre-construction activities may be initiated or completed prior to the start of construction, subject to the CPM’s approval of the specific site assessment or pre-construction activities.

Site assessment and pre-construction activities include the following, but only to the extent the activities are minimally disruptive to soil and vegetation and will not affect listed or special-status species or other sensitive resources:

1. the installation of environmental monitoring equipment;
2. a minimally invasive soil or geological investigation;
3. a topographical survey;
4. any other study or investigation, such as preconstruction surveys and tortoise clearance work determine the environmental acceptability or feasibility of the use of the site for any particular facility; and,
5. any minimally invasive work to provide safe access to the site for any of the purposes specified in 1-4 above.

Site Mobilization and Construction

When a condition of certification requires the project owner to take an action or obtain CPM approval prior to the start of construction, or within a period of time relative to the start of construction, that action must be taken, or approval must be obtained, prior to any site mobilization or construction activities, as defined below.

Site mobilization and construction activities are those necessary to provide site access for construction mobilization and facility installation, including both temporary and permanent equipment and structures, as determined by the CPM.

Site mobilization and construction activities include, but are not limited to:

1. ground disturbance activities like grading, boring, trenching, leveling, mechanical clearing, mowing, grubbing, and scraping;

2. site preparation activities, such as access roads, temporary fencing, trailer and utility installation, construction equipment installation and storage, equipment and supply laydown areas, borrow and fill sites, temporary parking facilities, and chemical spraying and controlled burns; and,

3. permanent installation activities for all facility and linear structures, including access roads, fencing (including tortoise fencing), utilities, parking facilities, equipment storage, mitigation and landscaping activities, and other installations, as applicable.

System Commissioning and Decommissioning

Commissioning activities are designed to test the functionality of a facility's installed components and systems to ensure safe and reliable operation. Although decommissioning is often synonymous with facility closure, specific decommissioning activities also systematically test the removal of such systems to ensure a facility's safe closure. For compliance monitoring purposes, commissioning examples include interface connection and utility pre-testing, "cold" and "hot" electrical testing, system pressurization and optimization tests, grid synchronization, and combustion turbine "first fire." Decommissioning activity examples include utility shut down, system depressurization and de-electrification, structure removal, and site reclamation.

Start of Commercial Operation

For compliance monitoring purposes, "commercial operation" or "operation" begins once commissioning activities are complete, the certificate of occupancy has been issued, and the power plant has reached reliable steady-state electrical production. At the start of commercial operation, plant control is usually transferred from the construction manager to the plant operations manager. Operation activities can include a steady state of electrical production, or, for "peaker plants," a seasonal or on-demand operational regime to meet peak load demands.

Non-Operation and Closure

Non-operation is time-limited and can encompass part or all of a facility. Non-operation can be a planned event, usually for minor equipment maintenance or repair, or unplanned, usually the result of unanticipated events or emergencies.

Closure is a facility shutdown with no intent to restart operation. It may also be the cumulative result of unsuccessful efforts to re-start over an increasingly lengthy period of non-operation, condemned by inadequate means and/or lack of a viable plan. Facility closures can occur due to a variety of factors, including, but not limited to, irreparable damage and/or functional or economic obsolescence.

ROLES AND RESPONSIBILITIES

Provided below is a generalized description of the compliance roles and responsibilities for Energy Commission staff (staff) and the project owner for the construction and operation of the PSEGS:

COMPLIANCE PROJECT MANAGER RESPONSIBILITIES

The CPM's compliance monitoring and project oversight responsibilities include:

1. ensuring that the design, construction, operation, and closure of the project facilities are in compliance with the terms and conditions of the Decision;

2. resolving complaints;

3. processing post-certification project amendments for changes to the project description, conditions of certification, ownership or operational control, and requests for extension of the deadline for the start of construction (see **COM-10** for instructions on filing a Petition to Amend or to extend construction start date);

4. documenting and tracking compliance filings; and,

5. ensuring that compliance files are maintained and accessible.

The CPM is the central contact person for the Energy Commission during project pre-construction, construction, operation, emergency response, and closure. The CPM will consult with the appropriate responsible parties when handling compliance issues, disputes, complaints, and amendments.

All project compliance submittals are submitted to the CPM for processing. Where a submittal requires CPM approval, the approval will involve appropriate Energy Commission technical staff and management. All submittals must include searchable electronic versions (.pdf, MS Word, or equivalent files).

Pre-Construction and Pre-Operation Compliance Meeting

The CPM usually schedules pre-construction and pre-operation compliance meetings prior to the projected start-dates of construction, plant operation, or both. These meetings are used to assist the Energy Commission and the project owner's technical staff in the status review of all required pre-construction or pre-operation conditions of certification, and take proper action if outstanding conditions remain. In addition, these meetings ensure, to the extent possible, that the Energy Commission's conditions of certification do not delay the construction and operation of the plant due to last-minute unforeseen issues or a compliance oversight. Pre-construction meetings held during the certification process must be publicly noticed unless they are confined to administrative issues and processes.

Energy Commission Record

The Energy Commission maintains the following documents and information as public records, in either the Compliance files or Dockets files, for the life of the project (or other period as specified):

1. all documents demonstrating compliance with any legal requirements relating to the construction, operation, and closure of the facility;

2. all Monthly and Annual Compliance Reports (MCRs, ACRs) filed by the project owner;

3. all project-related complaints of alleged noncompliance filed with the Energy Commission; and,

4. all petitions for project or condition of certification changes and the resulting staff or Energy Commission action.

CHIEF BUILDING OFFICIAL DELEGATION AND AGENCY COOPERATION

Under the California Building Code Standards, while monitoring project construction and operation, staff acts as, and has the authority of, the Chief Building Official (CBO). Staff may delegate CBO responsibility to either an independent third-party contractor or a local building official. However, staff retains CBO authority when selecting a delegate CBO, including the interpretation and enforcement of state and local codes, and the use of discretion, as necessary, in implementing the various codes and standards. The delegate CBO will also be responsible to facilitate compliance with all environmental Conditions of Certification, including Cultural Resources, and the implementation of all appropriate codes and standards and Energy Commission requirements. The CBO shall conduct on-site (including linear facilities) reviews and inspections at intervals necessary to fulfill those responsibilities. The project owner will pay a delegate CBO fees necessary to cover the costs of these reviews and inspections

PROJECT OWNER RESPONSIBILITIES

The project owner is responsible for ensuring that all conditions of certification in the PSEGS Decision are satisfied. The project owner will submit all compliance submittals to the CPM for processing unless the conditions specify another recipient. The **Compliance** Conditions regarding post-certification changes specify measures that the project owner must take when modifying the project's design, operation, or performance requirements, or to transfer ownership or operational control. Failure to comply with any of the conditions of certification may result in a correction order, an administrative fine, certification revocation, or any combination thereof, as appropriate. A summary of the **Compliance** Conditions of Certification is included as **Compliance Table 1** at the end of this Compliance Plan.

COMPLIANCE ENFORCEMENT

The Energy Commission's legal authority to enforce the terms and conditions of its Decision are specified in Public Resources Code sections 25534 and 25900. The Energy Commission may amend or revoke a project certification and may impose a civil penalty for any significant failure to comply with the terms or conditions of the Decision. The Energy Commission's actions and fine assessments would take into account the specific circumstances of the incident(s).

PERIODIC COMPLIANCE REPORTING

Many of the conditions of certification require submittals in the MCRs and ACRs. All compliance submittals assist the CPM in tracking project activities and monitoring compliance with the terms and conditions of the PSEGS Decision. During construction, the project owner or an authorized agent will submit compliance reports on a monthly basis. During operation, compliance reports are submitted annually. These reports and the requirements for an accompanying compliance matrix are described below.

NONCOMPLIANCE COMPLAINT PROCEDURES

Any person or agency may file a complaint alleging noncompliance with the conditions of certification. Such a complaint will be subject to review by the Energy Commission pursuant to Title 20, California Code of Regulations, section 1237, but, in many instances, the issue(s) can be resolved by using an informal dispute resolution process. Both the informal and formal complaint procedures, as described in current state law and regulations, are summarized below. Energy Commission staff will follow these provisions unless superseded by future law or regulations. The California Office of Administrative Law provides on-line access to the California Code of Regulations at http://www.oal.ca.gov/.

Informal Dispute Resolution Process

The following informal procedure is designed to resolve code and compliance interpretation disputes stemming from the project's conditions of certification and other LORS. The project owner, the Energy Commission, or any other party, including members of the public, may initiate the informal dispute resolution process. Disputes may pertain to actions or decisions made by any party, including the Energy Commission's delegate agents.

This process may precede the formal complaint and investigation procedure specified in Title 20, California Code of Regulations, section 1237, but is not intended to be a prerequisite or substitute for it. This informal procedure may not be used to change the terms and conditions of certification in the Decision, although the agreed-upon resolution may result in a project owner proposing an amendment. The informal dispute resolution process encourages all parties to openly discuss the conflict and reach a mutually agreeable solution. If a dispute cannot be resolved, then the matter must be brought before the full Energy Commission for consideration via the complaint and investigation procedure specified in Title 20, California Code of Regulations, section 1237.

Request for Informal Investigation

Any individual, group, or agency may request that the CPM conduct an informal investigation of alleged noncompliance with the Energy Commission's conditions of certification. Upon receipt of an informal investigation request, the CPM will promptly provide both verbal and written notification to the project owner of the allegation(s), along with all known and relevant information of the alleged noncompliance. The CPM will evaluate the request and, if the CPM determines that further investigation is necessary, will ask the project owner to promptly conduct a formal inquiry into the matter and provide within seven days a written report of the investigation results, along with corrective measures proposed or undertaken. Depending on the urgency of the matter, the CPM may conduct a site visit and/or request that the project owner provide an initial verbal report within 48 hours.

Request for Informal Meeting

In the event that either the requesting party or Energy Commission staff are not satisfied with the project owner's investigative report or corrective measures, either party may submit a written request to the CPM for a meeting with the project owner. The request shall be made within 14 days of the project owner's filing of the required investigative report. Upon receipt of such a request, the CPM will attempt to:

1. immediately schedule a meeting with the requesting party and the project owner, to be held at a mutually convenient time and place;

2. secure the attendance of appropriate Energy Commission staff and staff of any other agencies with expertise in the subject area of concern, as necessary; and

3. conduct the meeting in an informal and objective manner so as to encourage the voluntary settlement of the dispute in a fair and equitable manner.

After the meeting, the CPM will promptly prepare and distribute copies to all parties, and to the project file, of a summary memorandum that fairly and accurately identifies the positions of all parties and any understandings reached. If no agreement was reached, the CPM will direct the complainant to the formal complaint process provided under Title 20, California Code of Regulations, section 1237.

Formal Dispute Resolution Procedure

Any person may file a complaint with the Energy Commission's Dockets Unit alleging noncompliance with a Commission Decision adopted pursuant to Public Resources Code section 25500. Requirements for complaint filings and a description of how complaints are processed are in Title 20, California Code of Regulations, section 1237.

POST-CERTIFICATION CHANGES TO THE ENERGY COMMISSION DECISION

The project owner must petition the Energy Commission pursuant to Title 20, California Code of Regulations, section 1769, to modify the design, operation, or performance requirements of the project and/or the linear facilities, or to transfer ownership or operational control of the facility. **It is the responsibility of the project owner to contact the CPM to determine if a proposed project change should be considered a project modification pursuant to section 1769.** Implementation of a project modification without first securing Energy Commission approval may result in an enforcement action including civil penalties in accordance with Public Resources Code, section 25534.

Below is a summary of the criteria for determining the type of approval process required, and reflects the provisions of Title 20, California Code of Regulations, section 1769, at the time this Compliance Plan was drafted. If the Energy Commission modifies this regulation, the language in effect at the time of the requested change shall apply. Upon request, the CPM can provide sample formats of these submittals.

Amendment

The project owner shall submit a Petition to Amend the Energy Commission Decision, pursuant to Title 20, California Code of Regulations, section 1769 (a), when proposing modifications to the design, operation, or performance requirements of the project and/or the linear facilities. If a proposed modification results in an added, changed, or deleted condition of certification, or makes changes causing noncompliance with any applicable LORS, the petition will be processed as a formal amendment to the Decision, triggering public notification of the proposal, public review of the Energy Commission staff's analysis, and approval by the full Energy Commission.

Change of Ownership and/or Operational Control

Change of ownership or operational control also requires that the project owner file a petition pursuant to section 1769 (b). This process requires public notice and approval by the full Commission. The petition shall be in the form of a legal brief and fulfill the requirements of section 1769 (b).

Staff-Approved Project Modification

Modifications that do not result in additions, deletions, or changes to the conditions of certification, that are compliant with the applicable LORS, and that will not have significant environmental impacts, may be authorized by the CPM as a staff-approved project modification pursuant to section 1769 (a) (2). Once the CPM files a Notice of Determination of the proposed project modifications, any person may file an objection to the CPM's determination within 14 days of service on the grounds that the modification does not meet the criteria of section 1769 (a) (2). If there is a valid objection to the CPM's determination, the petition must be processed as a formal amendment to the Decision and must be considered for approval by the full Commission at a publically noticed Business Meeting or hearing.

Verification Change

Each condition of certification (except for the **Compliance** Conditions) has one or more means of verifying the project owner's compliance with the provisions of the condition. These verifications specify the actions and deadlines by which a project owner demonstrates compliance with the Energy Commission-adopted conditions. A verification may be modified by the CPM without requesting a Decision amendment if the change does not conflict with any condition of certification, does not violate any LORS, and provides an effective alternative means of verification.

EMERGENCY RESPONSE CONTINGENCY PLANNING AND INCIDENT REPORTING

To protect public health and safety and environmental quality, the conditions of certification include contingency planning and incident reporting requirements to ensure compliance with necessary health and safety practices. A well-drafted contingency plan avoids or limits potential hazards and impacts resulting from serious incidents involving personal injury, hazardous spills, flood, fire, explosions or other catastrophic events and ensures a comprehensive timely response. All such incidents must be reported immediately to the CPM and documented. These requirements are designed to build from "lessons learned" limit the hazards and impacts, anticipate and prevent recurrence, and provide for the safe and secure shutdown and re-start of the facility.

FACILITY CLOSURE

The Energy Commission cannot reasonably foresee all potential circumstances in existence when a facility permanently closes. Therefore, the closure conditions provided herein strive for the flexibility to address circumstances that may exist at some future time. Most importantly, facility closure must be consistent with all applicable Energy Commission conditions of certification and the LORS in effect at that time.

Although a non-operational facility may intend to resume operations, if it remains non-operational for longer than one year and the project owner does not present a viable plan to resume operation, the Energy Commission can conclude that closure is imminent and direct the project owner to commence closure procedures under the jurisdiction and guidance of the Bureau of Land Management.

Prior to submittal of the facility's Final Closure Plan to the Energy Commission, the project owner and the CPM will hold a meeting to discuss the specific contents of the plan. In the event that significant issues are associated with the plan's approval, the CPM will hold one or more workshops and/or the Commission may hold public hearings as part of its approval procedure.

With the exception of measures to eliminate any immediate threats to public health and safety or to the environment, facility closure activities cannot be initiated until the Energy Commission approves the Final Closure Plan and Cost Estimate and the project owner complies with any requirements the Commission may incorporate as conditions of approval of the Final Closure Plan.

COMPLIANCE CONDITIONS OF CERTIFICATION

Staff has proposed modifications to the **Compliance** Conditions of Certification as shown below. Deleted text is in ~~strikethrough~~. New text is **bold** and **underlined**. New text that should remain bold in the final Decision is in *italics*. New text that should remain underlined in the final Decision is double-underlined.

COM-1: **Unrestricted Access**~~Compliance-1~~. The project owner shall take all steps necessary to ensure that the CPM, responsible Energy Commission staff, and delegate agencies or consultants have unrestricted access to the facility site, related facilities, project-related staff, and the records maintained on-site to facilitate audits, surveys, inspections, and general or closure-related site visits. Although the CPM will normally schedule site visits on dates and times agreeable to the project owner, the CPM reserves the right to make unannounced visits at any time, whether such visits are by the CPM in person or through representatives from Energy Commission staff, delegate agencies, or consultants. ~~The CPM, responsible Energy Commission staff, and delegated agencies or consultants shall be guaranteed and granted unrestricted access to the power plant site, related facilities, project-related staff, and the records maintained on-site for the purpose of conducting audits, surveys, inspections, or general site visits. Although the CPM will normally schedule site visits on dates and times agreeable to the project owner, the CPM reserves the right to make unannounced visits at any time.~~

COM-2: **Compliance Record**~~Compliance-2~~. The project owner shall maintain electronic copies of all project files and submittals on-site, or at an alternative site approved by the CPM, for the operational life and closure of the project. The files shall also contain at least one hard copy of:

1. **the facility's Application for Certification;**
2. **all amendment petitions and Energy Commission orders;**
3. **all finalized original and amended structural plans and "as-built" drawings for the entire project;**
4. **all citations, warnings, violations, or corrective actions applicable to the project; and,**
5. **the most current versions of any plans, manuals, and training documentation required by the conditions of certification or applicable LORS.**

Energy Commission staff and delegate agencies shall, upon request to the project owner, be given unrestricted access to the files maintained pursuant to this condition. ~~The project owner shall maintain project files on-site or at an alternative site approved by the CPM for the life of the project, unless a lesser period of time is specified by the conditions of certification. The~~

~~files shall contain copies of all "as-built" drawings, documents submitted as verification for conditions, and other project-related documents.~~

~~Energy Commission staff and delegate agencies shall, upon request to the project owner, be given unrestricted access to the files maintained pursuant to this condition.~~

COM-3: Compliance Verification Submittals~~Compliance-3~~. Verification lead times associated with the start of construction or closure may require the project owner to file submittals during the AFC process, particularly if construction is planned to commence shortly after certification. The verification procedures, unlike the conditions, may be modified as necessary by the CPM.

A cover letter from the project owner or an authorized agent is required for all compliance submittals and correspondence pertaining to compliance matters. *The cover letter subject line shall identify the project by AFC number, cite the appropriate condition of certification number(s), and give a brief description of the subject of the submittal.* When submitting supplementary or corrected information, the project owner shall reference the date of the previous submittal and the condition(s) of certification applicable.

All reports and plans required by the project's conditions of certification shall be submitted in a searchable electronic format (.pdf, MS Word or Excel, etc.) and include standard formatting elements such as a table of contents, identifying by title and page number, each section, table, graphic, exhibit, or addendum. All report and/or plan graphics and maps shall be adequately scaled and shall include a key with descriptive labels, directional headings, a bar scale, and the most recent revision date.

The project owner is responsible for the content and delivery of all verification submittals to the CPM, whether the actions required by the verification were satisfied by the project owner or an agent of the project owner. All submittals shall be accompanied by an electronic copy on an electronic storage medium, or by e-mail, as agreed upon by the CPM. If hardcopy submittals are required, please address as follows:

Christine Stora, Compliance Project Manager
Palen Solar Electric Generating System (09-AFC-7C)
California Energy Commission
1516 Ninth Street (MS-2000)
Sacramento, CA 95814

~~Each condition of certification is followed by a means of verification. The verification describes the Energy Commission's procedure(s) to ensure post-certification compliance with adopted conditions. The verification procedures, unlike the Conditions, may be modified as necessary by the CPM.~~

~~Verification of compliance with the conditions of certification can be accomplished by the following:~~

1. ~~monthly and/or annual compliance reports, filed by the project owner or authorized agent, reporting on work done and providing pertinent documentation, as required by the specific conditions of certification;~~

2. ~~appropriate letters from delegate agencies verifying compliance;~~

3. ~~Energy Commission staff audits of project records; and/or~~

4. ~~Energy Commission staff inspections of work, or other evidence that the requirements are satisfied.~~

~~Verification lead times associated with start of construction may require the project owner to file submittals during the certification process, particularly if construction is planned to commence shortly after certification.~~

~~A cover letter from the project owner or authorized agent is required for all compliance submittals and correspondence pertaining to compliance matters.~~ **~~The cover letter subject line shall identify the project by AFC number, the appropriate condition(s) of certification by condition number(s), and a brief description of the subject of the submittal~~**~~. The project owner shall also identify those submittals~~ **~~not~~** ~~required by a condition of certification with a statement such as: "This submittal is for information only and is~~ **~~not~~** ~~required by a specific condition of certification." When submitting supplementary or corrected information, the project owner shall reference the date of the previous submittal and Energy Commission submittal number.~~

~~The project owner is responsible for the delivery and content of all verification submittals to the CPM, whether such condition was satisfied by work performed by the project owner or an agent of the project owner.~~

~~All hardcopy submittals shall be addressed as follows:~~

~~Dale Rundquist~~
~~Compliance Project Manager~~
~~(09-AFC-7C)~~
~~California Energy Commission~~
~~1516 Ninth Street (MS-2000)~~
~~Sacramento, CA 95814~~

~~Those submittals shall be accompanied by a searchable electronic copy, on a CD or by e-mail, as agreed upon by the CPM.~~

~~If the project owner desires Energy Commission staff action by a specific date, that request shall be made in the submittal cover letter and shall include a detailed explanation of the effects on the project if that date is not met.~~

COM-4: Pre-Construction Matrix and Tasks Prior to Start of Construction~~Compliance-4~~. Prior to start of construction, the project owner shall submit to the CPM a compliance matrix including **only** those conditions that must be fulfilled before the start of construction. The matrix shall be included with the project owner's first compliance submittal or prior to the first pre-construction meeting, whichever comes first~~. It will~~ , and shall be submitted in a format similar to ~~the description~~that described below.

~~Construction shall not commence until the pre-construction matrix is submitted, all pre-construction conditions have been complied with, and the CPM has issued a letter to the project owner authorizing construction. Various lead times for submittal of compliance verification documents to the CPM for Conditions of Certification are established to allow sufficient Staff time to review and comment and, if necessary, allow the project owner to revise the submittal in a timely manner. This will ensure that project construction may proceed according to schedule.~~

Site mobilization and construction activities shall not start until all of the following occur: the project owner has submitted the pre-construction matrix and compliance verifications pertaining to all pre-construction conditions of certification; and the CPM has issued an authorization-to-construct letter to the project owner. The deadlines for submitting various compliance verifications to the CPM allow sufficient staff time to review and comment on, and if necessary, allow the project owner to revise the submittal in a timely manner. These procedures help ensure that project construction proceeds according to schedule. Failure to submit required compliance documents by the specified deadlines may result in delayed authorizations to commence various stages of the project.

~~Failure to submit compliance documents within the specified lead time may result in delays in authorization to commence various stages of the project.~~

~~If the project owner anticipates commencing project construction as soon as the project is certified,~~ **If the project owner anticipates site mobilization immediately following project certification,** it may be necessary for the project owner to file compliance submittals prior to project certification. **In these instances, compliance verifications can be submitted in advance of the required deadlines and the anticipated authorizations to start construction. The project owner must understand that submitting compliance verifications prior to these authorizations is at the owner's own risk. Any approval by Energy Commission staff prior to project certification is subject to change based upon the Commission Decision, or amendment thereto, and early staff compliance approvals do not imply that the Energy Commission will certify the project for actual construction and operation.** ~~Compliance submittals should be completed in advance where the necessary lead time for a required compliance event extends beyond the~~

~~date anticipated for start of construction. The project owner must understand that the submittal of compliance documents prior to project certification is at the owner's own risk. Any approval by Energy Commission staff is subject to change, based upon the Commission Decision.~~

~~**Compliance Reporting**~~

~~There are two different compliance reports that the project owner must submit to assist the CPM in tracking activities and monitoring compliance with the terms and conditions of the Energy Commission Decision. During construction, the project owner or authorized agent will submit Monthly Compliance Reports. During operation, an Annual Compliance Report must be submitted. These reports, and the requirement for an accompanying compliance matrix, are described below. The majority of the conditions of certification require that compliance submittals be submitted to the CPM in the monthly or annual compliance reports.~~

COM-5: **Compliance Matrix**~~Compliance-5~~. ~~A compliance matrix shall be submitted by the project owner to the CPM along with each~~ The project owner shall submit a compliance matrix to the CPM with each ~~Monthly and Annual Compliance Report~~MCR and ACR. The compliance matrix ~~is intended to~~ provides the CPM with the ~~current~~ status of all conditions of certification in a spreadsheet format. The compliance matrix shall identify:

1. the technical area;
2. the condition number;
3. a brief description of the verification action or submittal required by the condition;
4. the date the submittal is required (e.g., 60 days prior to construction, after final inspection, etc.);
5. the expected or actual submittal date;
6. the date a submittal or action was approved by the CBO, CPM, or delegate agency, if applicable;
7. the compliance status of each condition, e.g., "not started," "in progress," or "completed" (include the date); and
8. if the condition was amended, **the updated language and the date the amendment was proposed or approved.** ~~the date of the amendment.~~

The CPM can provide a template for the compliance matrix upon request. ~~Satisfied conditions shall be placed at the end of the matrix.~~

COM-6: Monthly Compliance Reports and Key Events List~~Compliance-6~~. The first ~~Monthly Compliance Report~~ MCR is due one (1) month following the ~~Energy Commission business meeting date upon which the project was approved, the~~ docketing of the project's Decision, unless otherwise agreed to by the CPM. The first ~~Monthly Compliance Report~~ MCR shall include the AFC number and an initial list of dates for each of the events identified on the Key Events List ~~found at the end of this section of the Decision~~. (The Key Events List form is found at the end of this Compliance Plan.)

During **project** pre-construction**,** ~~and~~ construction**, or closure** ~~of the project~~, the project owner or authorized agent shall submit an ~~original and an~~ electronic searchable version of the ~~Monthly Compliance Report~~ **MCR** within ten (10) **business** days after the end of each reporting month, unless otherwise specified by the CPM. ~~Monthly Compliance Reports~~ **MCRs** shall be clearly identified for the month being reported. The searchable electronic copy may be filed on an electronic storage medium or by e-mail, subject to CPM approval. The compliance verification submittal condition provides guidance on report production standards, and the ~~Monthly Compliance Report~~ **MCR** shall contain, at a minimum:

1. a summary of the current project construction status, a revised/updated schedule if there are significant delays, and an explanation of any significant changes to the schedule;

2. documents required by specific conditions to be submitted along with the ~~Monthly Compliance Report~~ **MCR**~~.~~**;** ~~E~~**e**ach of these items shall be identified in the transmittal letter, as well as the conditions they satisfy**,** and submitted as attachments to the ~~Monthly Compliance Report~~ **MCR**;

3. an initial, and thereafter updated, compliance matrix showing the status of all conditions of certification;

4. a list of conditions that have been satisfied during the reporting period, and a description or reference to the actions that satisfied the condition;

5. a list of any submittal deadlines that were missed, accompanied by an explanation and an estimate of when the information will be provided;

6. a cumulative list~~ing~~ of any approved changes to **the** conditions of certification;

7. a list~~ing~~ of any filings submitted to, ~~or~~**and** permits issued by, other governmental agencies during the month;

8. a projection of project compliance activities scheduled during the next two months**;** ~~T~~**t**he project owner shall notify the CPM as soon as any changes are made to the project construction schedule that would affect compliance with conditions of certification;

9. a list~~ing~~ of the month's additions to the on-site compliance file; and

10. a list~~ing~~ of complaints, notices of violation, official warnings, and citations received during the month, a description of the **actions taken to date to resolve** ~~resolution of the resolved actions,~~ **the issues**; and the status of any unresolved actions.

~~All sections, exhibits, or addendums shall be separated by tabbed dividers or as acceptable by the CPM.~~

COM-7: **Annual Compliance Reports**~~Compliance-7~~. After construction is complete, the project owner shall submit searchable electronic ~~Annual Compliance Reports~~ACRs instead of ~~Monthly Compliance Reports~~MCRs. ~~The~~ ACRs ~~reports are~~ shall be completed for each year of commercial operation, may be required for a specified period after decommissioning to monitor closure compliance, as specified by the CPM, and are due ~~to the CPM~~ each year on a date agreed to by the CPM. ~~Annual Compliance Reports shall be submitted over the life of the project, unless otherwise specified by the CPM.~~ The searchable electronic ~~copy~~copies may be filed on an electronic storage medium or by e-mail, subject to CPM approval. Each ~~Annual Compliance Report~~ ACR shall include the AFC number, identify the reporting period, and ~~shall~~ contain the following:

1. an updated compliance matrix showing the status of all conditions of certification (fully satisfied conditions do not need to be included in the matrix after they have been reported as completed);

2. a summary of the current project operating status and an explanation of any significant changes to facility operations during the year;

3. documents required by specific conditions to be submitted along with the ~~Annual Compliance Report~~ **ACR**. Each of these items shall be identified in the transmittal letter with the condition it satisfies, and submitted as attachments to the ~~Annual Compliance Report~~ **ACR**;

4. a cumulative list~~ing~~ of all post-certification changes approved by the Energy Commission or ~~cleared by~~ the CPM;

5. an explanation for any submittal deadlines that were missed, accompanied by an estimate of when the information will be provided;

6. a list~~ing~~ of filings submitted to, or permits issued by, other governmental agencies during the year;

7. a projection of project compliance activities scheduled during the next year;

8. a list~~ing~~ of the year's additions to the on-site compliance file;

9. an evaluation of the ~~on-site~~ **Site Contingency Plan, including amendments and plan updates** ~~contingency plan for unplanned facility closure, including any suggestions necessary for bringing the plan up to date (see Compliance Conditions for Facility Closure addressed later in this section)~~; and

10. a list~~ing~~ of complaints, notices of violation, official warnings, and citations received during the year, a description of **how the issues were resolved**~~the resolution of any resolved matters~~, and the status of any unresolved matters.

COM-8: Confidential Information~~Compliance-8~~. Any information that the project owner ~~deems~~designates as confidential shall be submitted to the Energy Commission's Executive Director with an application for confidentiality, pursuant to Title 20, California Code of Regulations, section 2505 (a). Any information ~~that is determined to be confidential shall be kept confidential~~ deemed confidential pursuant to the regulations will remain undisclosed, as provided ~~for~~ in Title 20, California Code of Regulations, section 2501~~, et. seq~~.

COM-9: Annual Energy Facility Compliance Fee. Pursuant to the provisions of section 25806 (b) of the Public Resources Code, the project owner is required to pay an annually adjusted compliance fee. Current compliance fee information is available on the Energy Commission's website at http://www.energy.ca.gov/siting/filing_fees.html. The project owner may also contact the CPM for the current fee information. The initial payment is due on the date the Energy Commission dockets its final Decision. All subsequent payments are due by July 1 of each year in which the facility retains its certification.

COM-10: Amendments, Staff-Approved Project Modifications, Ownership Changes, and Verification Changes. The project owner shall petition the Energy Commission, pursuant to Title 20, California Code of Regulations, section 1769, to modify the design, operation, or performance requirements of the project or linear facilities, or to transfer ownership or operational control of the facility. The CPM will determine whether staff approval will be sufficient or whether Commission approval will be necessary. ~~based upon whether or not the proposed amendment(s) result in changed, added, or deleted conditions of certification or the changes cause noncompliance with any applicable LORS.~~ **It is the project owner's responsibility to contact the CPM to determine if a proposed project change triggers the requirements of section 1769.** Section 1769 details the required contents for a Petition to Amend an Energy Commission Decision. The only change that can be requested by means of a letter to the CPM is a request to change the verification method of a condition of certification.

Implementation of a project modification without first securing Energy Commission, or Energy Commission staff approval, may result in an enforcement action, including civil penalties, in accordance with section 25534 of the Public Resources Code. If the Energy Commission's rules

regarding amendments are revised, the rules in effect at the time the change is requested shall apply.

COM-11: Reporting of Complaints, Notices, and Citations~~Compliance 9~~. Prior to the start of construction or decommissioning, the project owner shall send a letter to property owners within one (1) mile of the project, notifying them of a telephone number to contact project representatives with questions, complaints, or concerns. If the telephone is not staffed twenty-four (24) hours per day, it shall include automatic answering with a date and time stamp recording.

The project owner shall respond to all recorded complaints within twenty-four (24) hours or the next business day. The project site shall post the telephone number on-site and make it easily visible to passersby during construction, operation, and closure. The project owner shall provide the contact information to the CPM who will post it on the Energy Commission's web page at http://www.energy.ca.gov/sitingcases/palen/. The project owner shall report any disruption to the contact system or telephone number change to the CPM promptly, to allow the CPM to update the Energy Commission's facility webpage accordingly.

In addition to including all complaints, notices, and citations included with the MCRs and ACRs, within ten (10) days of receipt, the project owner shall report, and provide copies to the CPM, of all complaints, including noise and lighting complaints, notices of violation, notices of fines, official warnings, and citations. Complaints shall be logged and numbered. Noise complaints shall be recorded on the form provided in the *Noise and Vibration* Conditions of Certification. All other complaints shall be recorded on the complaint form (Attachment A) at the end of this Compliance Plan.

COM-12: Emergency Response Site Contingency Plan. No less than sixty (60) days prior to the start of commercial operation, or other date agreed to by the CPM, the project owner shall submit for CPM review and approval, *an Emergency Response* Site Contingency Plan (Contingency Plan). The Contingency Plan shall evidence a facility's coordinated emergency response and recovery preparedness for a series of reasonably foreseeable emergency events. The CPM may require the updating of the Contingency Plan over the life of the facility. Contingency Plan elements include, but are not limited to:

1. **a site-specific list and direct contact information for persons, agencies, and responders to be notified for an unanticipated event;**

2. **a detailed and labeled facility map, including all fences and gates, the windsock location (if applicable), the on- and off-site assembly areas, and the main roads and highways near the site;**

3. **a detailed and labeled map of population centers, sensitive receptors, and the nearest emergency response facilities;**

4. **a description of the on-site, first response and backup emergency alert and communication systems, site-specific emergency response protocols, and procedures for maintaining the facility's contingency response capabilities, including a detailed map of interior and exterior evacuation routes, and the planned location(s) of all permanent safety equipment;**

5. **an organizational chart including the name, contact information, and first aid/emergency response certification(s) and renewal date(s) for all personnel regularly on-site;**

6. **a brief description of reasonably foreseeable, site-specific incidents and accident sequences (on- and off-site), including response procedures and protocols and site security measures to maintain twenty-four-hour site security;**

7. **procedures for maintaining contingency response capabilities; and**

8. **the procedures and implementation sequence for the safe and secure shutdown of all non-critical equipment and removal of hazardous materials and waste (see also specific conditions of certification for the technical areas of *Public Health, Solid Waste Management, Hazardous Materials Management*, and *Worker Safety*).**

COM-13: Incident-Reporting Requirements. Within one (1) hour, the project owner shall notify the CPM or Compliance Office Manager, by telephone and e-mail, of any incident at the power plant or appurtenant facilities that results or could result in any of the following:

1. **reduction in the facility's ability to respond to dispatch (excluding forced outages caused by protective equipment or other typically encountered shutdown events);**

2. **health and safety impacts on the surrounding population;**

3. **property damage off-site;**

4. **response by off-site emergency response agencies;**

5. **serious on-site injury;**

6. **serious environmental damage; or**

7. **emergency reporting to any federal, state, or local agency.**

The notice shall describe the circumstances, status, and expected duration of the incident.

If warranted, as soon as it is safe and feasible, the project owner shall implement the safe shutdown of any non-critical equipment and removal of any hazardous materials and waste that pose a threat to public health and safety and to environmental quality (also, see specific conditions of certification for the technical areas of *Hazardous Materials Management* and *Solid Waste Management*).

Within one (1) week ~~of the occurrence~~ of the incident, the project owner shall submit to the CPM a detailed incident report, which shall include, as appropriate ~~to the incident~~, the following information:

1. **a brief description of the incident, including its date, time, and location;**
2. **a description of the cause of the incident, or likely causes if it is still under investigation;**
3. **the location of any off-site impacts;**
4. **description of any resultant impacts;**
5. **a description of emergency response actions associated with the incident;**
6. **identification of responding agencies;**
7. **identification of emergency notifications made to ~~other~~ federal, state, and/or local agencies;**
8. **identification of any hazardous materials released and an estimate of the quantity released;**
9. **a description of any injuries, fatalities, or property damage that occurred as a result of the incident;**
10. **fines or violations assessed or being processed by other agencies;**
11. **name, phone number, and e-mail address of the appropriate facility contact person having knowledge of the event; and**
12. **corrective actions to prevent a recurrence of the incident.**

The project owner shall maintain all incident report records for the life of the project, including closure. After the submittal of the initial report for any incident, the project owner shall submit to the CPM copies of incident reports within twenty-four (24) hours of a request.

COM-14: Non-Operation. If the facility ceases operation temporarily, either planned or unplanned, for longer than one (1) week (or other CPM-approved date), but less than three (3) months (or other CPM-approved date), the project owner shall notify the CPM, interested agencies, and nearby property owners. Notice of planned non-operation shall be given at least two (2) weeks prior to the scheduled date. Notice of unplanned non-operation shall be provided no later than one (1) week after non-operation begins.

For any non-operation, a Repair/Restoration Plan for conducting the activities necessary to restore the facility to availability and reliable and/or improved performance shall be submitted to the CPM within one (1) week after notice of non-operation is given. If non-operation is due to an unplanned incident, temporary repairs and/or corrective actions may be undertaken before the Repair/Restoration Plan is submitted. The Repair/Restoration Plan shall include:

1. **identification of operational and non-operational components of the plant;**
2. **a detailed description of the repair or restoration activities;**
3. **a proposed schedule for completing the repair or restoration activities;**
4. **an assessment of whether or not the proposed activities would require changing, adding, and/or deleting any conditions of certification and/or would cause noncompliance with any applicable LORS; and**
5. **planned activities during non-operation, including any measures to ensure continued compliance with all conditions of certification and LORS.**

Written updates to the CPM for non-operational periods, until operation resumes, shall include:

1. **progress relative to the schedule;**
2. **developments that delayed or advanced progress or that may delay or advance future progress;**
3. **any public, agency, or media comments or complaints; and**
4. **projected date for the resumption of operation.**

During non-operation, all applicable conditions of certification and reporting requirements remain in effect. If, after one (1) year from the date of the project owner's last report of productive Repair/Restoration Plan work, the facility does not resume operation or does not provide a plan to resume operation, the Executive Director may assign suspended status to the facility and recommend commencement of permanent closure activities.

1. **If the facility has a closure plan, the project owner shall update it and submit it for Energy Commission review and approval.**

2. **If the facility does not have a closure plan, the project owner shall develop one consistent with the requirements in this Compliance Plan and submit it for Energy Commission review and approval.**

COM-15: Facility Closure Planning. **To ensure that a facility's eventual permanent closure and long-term maintenance do not pose a threat to public health and safety and/or to environmental quality, the project owner shall coordinate with the Energy Commission to plan and prepare for eventual permanent closure.**

A. Provisional Closure Plan and Estimate of Permanent Closure Costs

To assure satisfactory long-term site maintenance and adequate closure for "the whole of a project," the project owner shall submit a Provisional Closure Plan and Cost Estimate for CPM review and approval within sixty (60) days after the start of commercial operation. The Provisional Closure Plan and Cost Estimate shall consider applicable final closure plan requirements, including interim and long-term, post-closure site maintenance costs, and reflect:

1. **facility closure costs at a time in the facility's projected life span when the mode and scope of facility operation would make permanent closure the most expensive;**

2. **the use of an independent third party to carry out the permanent closure; and**

3. **no use of salvage value to offset closure costs.**

The Provisional Closure Plan and Cost Estimate shall provide for a phased closure process and include but not be limited to:

1. **comprehensive scope of work and itemized budget;**
2. **closure plan development costs;**
3. **dismantling and demolition;**
4. **recycling and site clean-up;**
5. **mitigation and monitoring direct, indirect, and cumulative impacts;**
6. **site remediation and/or restoration;**

7. <u>interim operation and post-closure monitoring and maintenance, including long-term equipment replacement costs; and</u>

8. <u>contingencies.</u>

<u>The project owner shall include an updated Provisional Closure Plan and Cost Estimate in every fifth-year ACR for CPM review and approval. Each updated Provisional Closure Plan and Cost Estimate shall reflect the most current regulatory standards, best management practices, and applicable LORS.</u>

<u>B. Final Closure Plan and Cost Estimate</u>

<u>At least three (3) years prior to initiating a permanent facility closure, the project owner shall submit for Energy Commission review and approval, a Final Closure Plan and Cost Estimate, which includes any long-term, post-closure site maintenance and monitoring. Final Closure Plan and Cost Estimate contents include, but are not limited to:</u>

1. <u>a statement of specific Final Closure Plan objectives;</u>

2. <u>a statement of qualifications and resumes of the technical experts proposed to conduct the closure activities, with detailed descriptions of previous power plant closure experience;</u>

3. <u>identification of any facility-related installations not part of the Energy Commission certification, designation of who is responsible for these, and an explanation of what will be done with them after closure;</u>

4. <u>a comprehensive scope of work and itemized budget for permanent plant closure and long-term site maintenance activities, with a description and explanation of methods to be used, broken down by phases, including, but not limited to:</u>

    a. <u>dismantling and demolition;</u>

    b. <u>recycling and site clean-up;</u>

    c. <u>impact mitigation and monitoring;</u>

    d. <u>site remediation and/or restoration;</u>

    e. <u>post-closure maintenance; and</u>

    f. <u>contingencies.</u>

5. <u>a revised/updated Final Cost Estimate for all closure activities, by phases, including long-term, post-closure site monitoring and maintenance costs, and replacement of long-term post-closure equipment;</u>

6. <u>a schedule projecting all phases of closure activities for the power plant site and all appurtenances constructed as part of the Energy Commission-certified project;</u>

7. <u>an electronic submittal package of all relevant plans, drawings, risk assessments, and maintenance schedules and/or reports, including an above- and below-ground infrastructure inventory map and registered engineer's or delegate CBO's assessment of demolishing the facility; additionally, for any facility that permanently ceased operation prior to submitting a Final Closure Plan and Cost Estimate and for which only minimal or no maintenance has been done since, a comprehensive condition report focused on identifying potential hazards;</u>

8. <u>all information additionally required by the facility's conditions of certification applicable to plant closure;</u>

9. <u>an equipment disposition plan, including:</u>

a. <u>recycling and disposal methods for equipment and materials; and</u>

b. <u>identification and justification for any equipment and materials that will remain on-site after closure;</u>

10. <u>a site disposition plan, including but not limited to:</u>

    a. <u>proposed rehabilitation, restoration, and/or remediation procedures, as required by the conditions of certification and applicable LORS,</u>

    b. <u>long-term site maintenance activities, and</u>

    c. <u>anticipated future land-use options after closure;</u>

11. <u>identification and assessment of all potential direct, indirect, and cumulative impacts and proposal of mitigation measures to reduce significant adverse impacts to a less-than-significant level; potential impacts to be considered shall include, but not be limited to:</u>

    a. <u>traffic</u>

    b. <u>noise and vibration</u>

    c. <u>soil erosion</u>

    d. <u>air quality degradation</u>

    e. <u>solid waste</u>

    f. <u>hazardous materials</u>

    g. <u>waste water discharges</u>

h. contaminated soil

12. identification of all current conditions of certification, LORS, federal, state, regional, and local planning efforts applicable to the facility, and proposed strategies for achieving and maintaining compliance during closure;

13. updated mailing list or listserv of all responsible agencies, potentially interested parties, and property owners within one (1) mile of the facility;

14. identification of alternatives to plant closure and assessment of the feasibility and environmental impacts of these; and

15. description of and schedule for security measures and safe shutdown of all non-critical equipment and removal of hazardous materials and waste (see conditions of certification for *Public Health*, *Solid Waste Management*, *Hazardous Materials Management*, and *Worker Safety*).

If an Energy Commission-approved Final Closure Plan and Cost Estimate is not implemented within one (1) year of its approval date, it shall be updated and re-submitted to the Commission for supplementary review and approval. If a project owner initiates but then suspends closure activities, and the suspension continues for longer than one (1) year, or subsequently abandons the facility, the Energy Commission may access the required financial assurance funds to complete the closure. The project owner remains liable for all costs of contingency planning and closure.

~~PLANNED CLOSURE (COMPLIANCE-10)~~

~~In order to ensure that a planned facility closure does not create adverse impacts, a closure process that provides for careful consideration of available options and applicable laws, ordinances, regulations, standards, and local/regional plans in existence at the time of closure will be undertaken. To ensure adequate review of a planned project closure, the project owner shall submit a proposed facility closure plan to the Energy Commission for review and approval at least 12 months (or other period of time agreed to by the CPM) prior to the commencement of closure activities. The project owner shall file 120 copies (or other number of copies agreed upon by the CPM) of a proposed facility closure plan with the Energy Commission.~~

~~The plan shall:~~

1. ~~identify and discuss any impacts and mitigation to address significant adverse impacts associated with proposed closure activities and to address facilities, equipment, or other project related remnants that will remain at the site;~~

2. ~~identify a schedule of activities for closure of the power plant site, transmission line corridor, and all other appurtenant facilities constructed as part of the project;~~

3. ~~identify any facilities or equipment intended to remain on site after closure, the reason, and any future use; and~~

4. ~~address conformance of the plan with all applicable laws, ordinances, regulations, standards, and local/regional plans in existence at the time of facility closure, and applicable conditions of certification.~~

~~Prior to submittal of the proposed facility closure plan, a meeting shall be held between the project owner and the Energy Commission CPM for the purpose of discussing the specific contents of the plan.~~

~~In the event that there are significant issues associated with the proposed facility closure plan's approval, or if the desires of local officials or interested parties are inconsistent with the plan, the CPM shall hold one or more workshops and/or the Energy Commission may hold public hearings as part of its approval procedure.~~

~~As necessary, prior to or during the closure plan process, the project owner shall take appropriate steps to eliminate any immediate threats to public health and safety and the environment, but shall not commence any other closure activities until the Energy Commission approves the facility closure plan.~~

~~UNPLANNED TEMPORARY CLOSURE/ON-SITE CONTINGENCY PLAN (COMPLIANCE-11)~~

~~In order to ensure that public health and safety and the environment are protected in the event of an unplanned temporary facility closure, it is essential to have an on-site contingency plan in place. The on-site contingency plan will help to ensure that all necessary steps to mitigate public health and safety impacts and environmental impacts are taken in a timely manner.~~

~~The project owner shall submit an on-site contingency plan for CPM review and approval. The plan shall be submitted no less than 60 days (or other time agreed to by the CPM) prior to commencement of commercial operation. The approved plan must be in place prior to commercial operation of the facility and shall be kept at the site at all times.~~

~~The project owner, in consultation with the CPM, will update the on-site contingency plan as necessary. The CPM may require revisions to the on-site contingency plan over the life of the project. In the annual compliance reports submitted to the Energy Commission, the project owner will review the on-site contingency plan, and recommend changes to bring the plan up to date. Any changes to the plan must be approved by the CPM.~~

~~The on-site contingency plan shall provide for taking immediate steps to secure the facility from trespassing or encroachment. In addition, for closures of more than 90 days, unless other arrangements are agreed to by the CPM, the plan shall provide for removal of hazardous materials and hazardous wastes, draining of all chemicals from storage tanks and other equipment, and the safe shutdown of all equipment. (Also see specific Conditions Of Certification for the technical areas of **Hazardous Materials Management** and **Waste Management.**)~~

~~In addition, consistent with requirements under unplanned permanent closure addressed below, the nature and extent of insurance coverage, and major equipment warranties must also be included in the on-site contingency plan. In addition, the status of the insurance coverage and major equipment warranties must be updated in the annual compliance reports.~~

~~In the event of an unplanned temporary closure, the project owner shall notify the CPM, as well as other responsible agencies, by telephone, fax, or e-mail, within 24 hours and shall take all necessary steps to implement the on-site contingency plan. The project owner shall keep the CPM informed of the circumstances and expected duration of the closure.~~

~~If the CPM determines that an unplanned temporary closure is likely to be permanent, or for a duration of more than 12 months, a closure plan consistent with the requirements for a planned closure shall be developed and submitted to the CPM within 90 days of the CPM's determination (or other period of time agreed to by the CPM).~~

~~UNPLANNED PERMANENT CLOSURE/ON-SITE CONTINGENCY PLAN (COMPLIANCE-12)~~

~~The on-site contingency plan required for unplanned temporary closure shall also cover unplanned permanent facility closure. All of the requirements specified for unplanned temporary closure shall also apply to unplanned permanent closure.~~

~~In addition, the on-site contingency plan shall address how the project owner will ensure that all required closure steps will be successfully undertaken in the event of abandonment.~~

~~In the event of an unplanned permanent closure, the project owner shall notify the CPM, as well as other responsible agencies, by telephone, fax, or e-mail within 24 hours and shall take all necessary steps to implement the on-site contingency plan. The project owner shall keep the CPM informed of the status of all closure activities.~~

~~A closure plan, consistent with the requirements for a planned closure, shall be developed and submitted to the CPM within 90 days of the permanent closure or another period of time agreed to by the CPM.~~

~~POST CERTIFICATION CHANGES TO THE ENERGY COMMISSION DECISION: AMENDMENTS, OWNERSHIP CHANGES, STAFF APPROVED PROJECT MODIFICATIONS AND VERIFICATION CHANGES (COMPLIANCE-13)~~

~~The project owner must petition the Energy Commission pursuant to Title 20, California Code of Regulations, section 1769, in order to modify the project (including linear facilities) design, operation or performance requirements, and to transfer ownership or operational control of the facility.~~ **~~It is the responsibility of the project owner to contact the CPM to determine if a proposed project change should be considered a project modification pursuant to section 1769.~~** ~~Implementation of a project modification without first securing Energy Commission, or Energy Commission staff approval, may result in enforcement action that could result in civil penalties in accordance with section 25534 of the Public Resources Code.~~

~~A petition is required for **amendments** and for **Staff approved project modifications** as specified below. Both shall be filed as a "Petition to Amend." Staff will determine if the change is significant or insignificant. For verification changes, a letter from the project owner is sufficient. In all cases, the petition or letter requesting a change should be submitted to the CPM, who will file it with the Energy Commission's Dockets Unit in accordance with Title 20, California Code of Regulations, section 1209.~~

~~The criteria that determine which type of approval and the process that applies are explained below. They reflect the provisions of Section 1769 at the time this condition was drafted. If the Commission's rules regarding amendments are amended, the rules in effect at the time an amendment is requested shall apply.~~

KEY EVENTS LIST

PROJECT: ______________________________

DOCKET #: ______________________________

COMPLIANCE PROJECT MANAGER: ______________________________

EVENT DESCRIPTION	DATE
Certification Date	
Obtain Site Control	
On-line Date	
POWER PLANT SITE ACTIVITIES	________________
Start Site Assessment/Pre-construction	
Start Site Mobilization/Construction	
Begin Pouring Major Foundation Concrete	
Begin Installation of Major Equipment	
Completion of Installation of Major Equipment	
First Combustion of Gas Turbine	
Obtain Building Occupation Permit	
Start Commercial Operation	
Complete All Construction	
TRANSMISSION LINE ACTIVITIES	________________
Start T/L Construction	
Synchronization with Grid and Interconnection	
Complete T/L Construction	
FUEL SUPPLY LINE ACTIVITIES	________________
Start Gas Pipeline Construction and Interconnection	
Complete Gas Pipeline Construction	
WATER SUPPLY LINE ACTIVITIES	________________
Start Water Supply Line Construction	
Complete Water Supply Line Construction	

CONDITION NUMBER	SUBJECT	DESCRIPTION
COM-1	Unrestricted Access	The project owner shall grant Energy Commission staff and delegate agencies or consultants unrestricted access to the power plant site.
COM-2	Compliance Record	The project owner shall maintain project files on-site. Energy Commission staff and delegate agencies shall be given unrestricted access to the files.
COM-3	Compliance Verification Submittals	The project owner is responsible for the delivery and content of all verification submittals to the CPM, whether conditions were satisfied by work performed by the project owner or his agent.
COM-4	Pre-construction Matrix and Tasks Prior to Start of Construction	Construction shall not commence until all of the following activities/submittals have been completed: • Project owner has submitted a pre-construction matrix identifying conditions to be fulfilled before the start of construction; • Project owner has completed all pre-construction conditions to the CPM's satisfaction; and • CPM has issued a letter to the project owner authorizing construction.
COM-5	Compliance Matrix	The project owner shall submit a compliance matrix (in a spreadsheet format) with each Monthly and Annual Compliance Report, which includes the current status of all **Compliance** Conditions of Certification.
COM-6	Monthly Compliance Reports and Key Events List	During construction, the project owner shall submit Monthly Compliance Reports (MCRs) which include specific information. The first MCR is due 1 month following the docketing of the Energy Commission's Decision on the project and shall include an initial list of dates for each of the events identified on the Key Events List.
COM-7	Annual Compliance Reports	After construction ends, and throughout the life of the project, the project owner shall submit Annual Compliance Reports (ACRs) instead of Monthly Compliance Reports.
COM-8	Confidential Information	Any information the project owner designates as confidential shall be submitted to the Energy Commission's Executive Director with a request for confidentiality.
COM-9	Annual Fees	Required payment of the Annual Energy Facility Compliance Fee.
COM-10	Amendments, Staff-Approved Project Modifications, Ownership Changes, and Verification Changes	The project owner shall petition the Energy Commission to delete or change a condition of certification, modify the project design or operational requirements, and/or transfer ownership or operational control of the facility. [next page]
COM-11	Reporting of Complaints, Notices, and Citations	Prior to the start of construction, the project owner shall provide all property owners within a 1-mile radius a telephone number to contact project representatives with questions, complaints, or concerns. The project owner shall respond to all recorded complaints within 24 hours. Within 10 days of receipt, the project owner shall report to the CPM all notices, complaints, violations, and citations.

COM-12	Site Contingency Plan	No less than 60 days prior to the start of commercial operation, the project owner shall submit an Emergency Response Site Contingency Plan to ensure protection of public health and safety and environmental quality during a response to an emergency.
COM-13	Incident-Reporting Requirements	The project owner shall notify the CPM within 1 hour of an incident and submit a detailed incident report within 30 days, maintain records of incident report, and submit public health and safety documents with employee training provisions.
COM-14	Non-Operation	No later than 2 weeks prior to a facility's planned non-operation, or no later than 2 weeks after the start of unplanned non-operation, the project owner shall notify the CPM, interested agencies and nearby property owners of this status. During non-operation, the project owner shall provide written updates to the CPM.
COM-15	Facility Closure Planning	Within 60 days after initiating commercial operation, the project owner shall submit a Provisional Closure Plan and Cost Estimate for permanent closure. At least 3 years prior to closing, the project owner shall submit a Final Closure Plan and Cost Estimate.

ATTACHMENT 1
COMPLAINT REPORT / RESOLUTION FORM

Complaint Log Number:____________________________ Docket Number:________________________________

Project Name:____

COMPLAINANT INFORMATION

Name:____ Phone Number:____________________________

Address:____

COMPLAINT

DATE COMPLAINT RECEIVED:__________________________ TIME COMPLAINT RECEIVED:____________________

COMPLAINT RECEIVED BY: ☐ TELEPHONE ☐ IN WRITING (COPY ATTACHED)

DATE OF FIRST OCCURRENCE:____

DESCRIPTION OF COMPLAINT (INCLUDING DATES, FREQUENCY, AND DURATION):________________________

____

____

FINDINGS OF INVESTIGATION BY PLANT PERSONNEL:____

____

____

DOES COMPLAINT RELATE TO VIOLATION OF A CEC REQUIREMENT? ☐ YES ☐ NO

DATE COMPLAINANT CONTACTED TO DISCUSS FINDINGS:____

DESCRIPTION OF CORRECTIVE MEASURES TAKEN OR OTHER COMPLAINT RESOLUTION:_______________________

____

____

DOES COMPLAINANT AGREE WITH PROPOSED RESOLUTION? ☐ YES ☐ NO

IF NOT, EXPLAIN:____

____

CORRECTIVE ACTION

IF CORRECTIVE ACTION NECESSARY, DATE COMPLETED:____

DATE FIRST LETTER SENT TO COMPLAINANT (COPY ATTACHED):_______________________________________

DATE FINAL LETTER SENT TO COMPLAINANT (COPY ATTACHED):_______________________________________

OTHER RELEVANT INFORMATION:____

____

____

"This information is certified to be correct."

PLANT MANAGER SIGNATURE:________________________________ DATE:_____________________________

(ATTACH ADDITIONAL PAGES AND ALL SUPPORTING DOCUMENTATION, AS REQUIRED)

DECLARATION OF
James Adams

I**, James Adams,** declare as follows:

1. I am presently employed by the California Energy Commission in the Environmental Office of the Siting, Transmission and Environmental Protection Division as a Planner II.

2. A copy of my professional qualifications and experience is attached hereto and incorporated by reference herein.

3. I prepared the staff testimony on **Land Use** for the **Palen Solar Electric Generating System Final Staff Assessment,** based on my independent analysis of the Application for Certification and supplement hereto, data from reliable documents and sources, and my professional experience and knowledge.

4. It is my professional opinion that the prepared testimony is valid and accurate with respect to the issue addressed therein.

5. I am personally familiar with the facts and conclusions related in the testimony and if called as a witness could testify competently thereto.

I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge and belief.

Dated: August 5, 2013 Signed: James Adams

At: Sacramento, California

James S. Adams
Environmental Protection Office
California Energy Commission
1516 Ninth Street
Sacramento, CA 95814-5504
PH (916) 653-0702, FAX (916) 654-3882
Jim.Adams@energy.ca.gov

5/1999
Present **Environmental Planner**

Review applications for certification to acquire permits from the California Energy Commission to build electric generating power plants. Specific technical fields include socioeconomics and traffic and transportation.

11/1997
Present **Energy and Resource Consultant**

Provide clients with technical expertise on various issues related to natural resource use and development. Current activities include managing an Intervention by the Redwood Alliance before the California Public Utilities Commission regarding the decommissioning of the Humboldt Bay Power Plant's nuclear reactor.

9/1994--
10/1997 **Senior Analyst - Safe Energy Communication Council (SECC)**

Responsible for developing and/or implementing campaigns on various energy issues involving the promotion of energy efficiency and renewable energy and advocating less reliance on nuclear power. Managed educational outreach efforts to newspaper editorial writers throughout the U.S. to encourage coverage of energy issues. Participated in meetings and negotiations with key Clinton administration officials, members of Congress and staff, national coalitions, and grassroots organizations on important energy issues (e.g. U.S. Department of Energy Budget for Fiscal Years 1996-1998). Successfully raised $140,000 from private foundations to support SECC activities.

6/1978--
12/1992 **Principal Consultant - Redwood Alliance**

Provided consulting services to the Alliance; a renewable energy/political advocacy organization. Major responsibilities included managing and/or participating in several interventions/appearances before the California Public Utilities Commission, California Energy Commission, California Legislature, U.S. Congress and the U.S. Nuclear Regulatory Commission. Issues included electric utility planning options, greater reliance on energy efficiency and renewable energy, nuclear power economic analyses, decommissioning cost estimates, and nuclear waste management and disposal.

2/1983--
8/1986 **Natural Resource Specialist**
Assisted private consulting, firms, non-profit corporations and government agencies in various projects related to the enhancement and protection of national forests in Northern California and Southern Oregon. This included contracts with the U.S. Forest Service, Fish and Wildlife Service, National Park Service, the California Coastal Conservancy, and private landowners.

6/1978--
1999 Consultant/Journalist/Paralegal/Lobbyist
Throughout the period of work outlined above, I have written a considerable amount of news articles and reports connected to ongoing-projects and issues of personal interest. The leg, al/administrative interventions have required extensive paralegal work to support attorneys, and technical expertise to identify and assist consultants. In addition, many of the projects required consulting services and lobbying, at the local, state and federal level whenever necessary, as well as working with the print and television media as appropriate.

From 1978 through 1984 1 served on the Board of Directors for two locals non-profit agencies devoted to sustainable community development, Redwood Community Development Council and Redwood Community Action Agency (RCAA). I also was hired on staff at RCAA as a natural resource specialist which is explained more fully above. I am proficient with computers, printers, fax machines and related equipment.

EDUCATION

M.A. Social Science. Political science and natural resources emphasis. California State University at Humboldt. Graduated December 1988.

B.A. Political Science. Political and economic aspects of natural resource development, with a particular emphasis in forest ecology and appropriate technology. California State University at Humboldt. Graduated June 1978.

Academic
Honors. Member of PI GAMMU MU Honor Society since 1986.

MILITARY SERVICE

7/1969--
9/1975 U.S. Navy. Air Traffic Controller.
Honorable Discharge.

DECLARATION OF
Edward Brady

I, **Edward Brady,** declare as follows:

1. I am presently employed by the California Energy Commission in the Engineering Office of the Siting, Transmission and Environmental Protection Division as a Mechanical Engineer.

2. A copy of my professional qualifications and experience is attached hereto and incorporated by reference herein.

3. I prepared the staff testimony on **Power Plant Efficiency and Reliability** for the **Palen Solar Electric Generating System Final Staff Assessment,** based on my independent analysis of the Application for Certification and supplement hereto, data from reliable documents and sources, and my professional experience and knowledge.

4. It is my professional opinion that the prepared testimony is valid and accurate with respect to the issue addressed therein.

5. I am personally familiar with the facts and conclusions related in the testimony and if called as a witness could testify competently thereto.

I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge and belief.

Dated: 8/2/13 Signed: Edward Brady

At: Sacramento, California

Edward James Brady
Mechanical Engineer

Summary of Experience

Forty years of experience in the profession of mechanical engineering as a staff engineer to the California Energy Commission, engineering consultant, design group supervisor in a major power plant project, senior engineer for a gas and electric utility, sales and design engineer for a contractor, and instructor in a community college.

Education

- BSME, Santa Clara University, 1972
- Graduate Engineering Studies, Santa Clara University
- Graduate Business Studies, University of San Francisco
- Continuing Education, UC Extension

Professional Registration

- Mechanical Engineer (M17924) California
  (25505) Washington
  (33082) Colorado
  (9248, Inactive) Nevada

- Civil Engineer (C36194) California

Affiliations

- American Society of Mechanical Engineers (ASME), Member
- American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE), Member
- International Code Council (ICC), Member
- International Association of Plumbing and Mechanical Officials (IAPMO), Member
- National Fire Protection Association (NFPA), Member

Curriculum Vitae

2011 – Present	**Staff Mechanical Engineer**, California Energy Commission, Siting, Transmission, and Environmental Protection Division (STEP). Performs analysis of generating capacity, reliability, efficiency, noise and vibration, and the mechanical, civil, electrical, and structural aspects of power plant siting and construction cases.
1988-2011	**Principal Mechanical Engineer,** Brady Engineering. Provided design and consulting services for the permitting and construction of industrial and commercial facilities, and residential buildings in the fields of heating, ventilating air conditioning (HVAC), plumbing, fire protection and energy analyses.
1984-1988	**Design Group Supervisor,** Joint PG&E and Bechtel Project. Worked as the mechanical group supervisor responsible for the design modifications required for the licensing of Diablo Canyon Power Plant, Units 1 and 2.
1980-1988	**Senior Mechanical Engineer,** PG&E Civil Engineering Department, Architectural Section. Provided work group supervision and design of building mechanical systems for common utility plant facilities (CUP) and balance of plant systems for power production facilities.
1977-1980	**Mechanical Engineer,** PG&E Civil Engineering Department, Architectural Section. Provided HVAC and plumbing design for CUP and power production facilities.
1974-1977	**Instructor,** San Francisco Community College District, John O'Connell Evening School. Provided apprenticeship training in the technical fields of HVAC and refrigeration.
1977	**Design Engineer,** Charles and Braun Consulting Engineers, San Francisco. Worked as a staff designer in the fields of HVAC and plumbing for commercials facilities include a sentence detention facilities and a proto-type regional facility for a federal agency.
1972-1976	**Sales and Design Engineer,** Scatena York Company, San Francisco. Worked as a sales and design engineer for a refrigeration contractor, which provided design and installation of refrigeration systems for supermarkets and cold storage facilities.

Power Plant/Utility Experience

California Energy Commission, Rio Mesa Solar Electric Generation Station (RMSEGS). 500 MW Solar Power Tower. Riverside County

, Hidden Hills Solar Electric Generating Station (HHSEGS). 500 MW Solar Power Tower. Inyo County.

, Hydrogen Energy California (HECA). 405 MW Combined Cycle, Fuel Gasification, CO_2 Sequestration, Ammonia Production. Kern County

, Quail Brush Generating Project (QBGP). 1100 MW Reciprocating Engine Electric Generation. City of San Diego

, Huntington Beach Energy Project (HBEP). 939 MW Combined Cycle. City of Huntington Beach.

, Redondo Beach Energy Project (RBEP). 496 MW Combined Cycle. City of Redondo Beach, Los Angeles County.

PG&E , Diablo Canyon Power Plant, Units 1 and 2. Licensing of safety related systems.
, Diablo Canyon Power Plant, Administration Building, SLO County Emergency Response Building

, Geysers Power Plant, Units 16, 17, 20, and 21. Ventilation and cooling for turbine building and hazardous waste disposal facilities, administration building.

, Helms Pumped Storage Facility, Kern County. Smoke control ventilation for underground transformer vaults.

, Humboldt No. 3, Eureka. Decommissioning of nuclear facility and construction of hazardous materials storage and handling.

, Moss Landing Power Plants, Units 1 through 6, Monterey County

, Morro Bay Power Plant, Morro Bay

, Hunters Point Power Plant, San Francisco

, Potrero Power Plant, San Francisco. Combined Cycle

, Gas Transmission Facilities, Line 300 and 400, Topock and Corning Compressor Stations, McDonald Island and Brentwood Gas Storage Facilities

, Central Computer Facilities, San Francisco and Vacaville

, 77 Beale Street, San Francisco. Energy Management System

, 215 Market Street, San Francisco. Boiler Replacement

, Underground Fuel Tank Replacement. Upgrade of more than 500 gallon fuel storage tanks to meet double containment requirements.

, Contra Costa Power Plants, Unit 1 through 6, Water Treatment

, Pittsburg Power Plants, Unit 1-5, Water Treatment Facilities

, Avon, Martinez and Oleum (AVO), Water Treatment Upgrade

, Tiger Creek Powerhouse, North Fork Feather River

, Kirchoff No. 2 Pump Storage Facility.

, Technical Support Services, Marketing Department

South Bay Sanitary Authority, 1400 Radio Road, Redwood Shores. Gas piping and boiler conversion.

DECLARATION OF
Huei-An (Ann) Chu, Ph.D.

I, **Huei-An (Ann) Chu,** declare as follows:

1. I am presently employed by the California Energy Commission in the Engineering Office of the Siting, Transmission and Environmental Protection Division as a Air Resources Engineer.

2. A copy of my professional qualifications and experience is attached hereto and incorporated by reference herein.

3. I prepared the staff testimony on **Public Health** for the **Palen Solar Electric Generating System Final Staff Assessment,** based on my independent analysis of the Application for Certification and supplement hereto, data from reliable documents and sources, and my professional experience and knowledge.

4. It is my professional opinion that the prepared testimony is valid and accurate with respect to the issue addressed therein.

5. I am personally familiar with the facts and conclusions related in the testimony and if called as a witness could testify competently thereto.

I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge and belief.

Dated: 8/2/2013 Signed: Huei-An Chu

At: Sacramento, California

Huei-An (Ann) Chu

1600 Tamarack Ln, Davis, CA 95616
Phone: 530-899-9604, Email: Ann.Chu@energy.ca.gov
Citizenship Status: Green Card

EDUCATION

PhD, Environmental Sciences and Engineering, 05/2006
School of Public Health, University of North Carolina at Chapel Hill
Area of Specialization: Environmental Risk Assessment, Environmental Management and Policy, Risk-Based Regulation, Biostatistics, Environmental Epidemiology

MEM, Environmental Management, 05/2000
School of Forestry and Environmental Studies, Yale University, New Haven, CT

MS, Environmental Engineering, 06/1998
National Taiwan University, Taipei, Taiwan

BA, Geography, with honors, 06/1996
National Taiwan University, Taipei, Taiwan

SKILLS

Language: Fluent in Chinese and English.

Computer software and programming skills: HARP, SAS, Stata, Minitab, ArcGIS, ArcView, ArcInfo, Stella, Crystal Ball, ISC, ERMapper, Microsoft Excel, PowerPoint, Word.

WORK EXPERIENCE

Air Resources Engineer, California Energy Commission, 1/12/2012 - Present
- Independently performs responsible, varied analyses assessing air quality and public health impacts of energy resource use and large electric power generation projects in California.
- Model air quality and public health impacts of stationary sources using HARP (Hot Spot Analysis and Reporting Program).
- Identify air quality and public health impacts of stationary sources and measures to mitigate these impacts following California Environmental Quality Act and regulations of US EPA (including the National Environmental Policy Act), ARB, and the Districts.
- Collect, analyze, and evaluate data on the effects of air pollutants and power plant emissions on human health, and the environment.
- Ensure conditions of certification are met and recommending enforcement actions for violations.

Research Associate, Taiwan Development Institute, 10/01/2010 – 12/31/2011
- Provided professional consultation for the environmental risk assessment of Taiwan's techno-industrial development initiatives
- Reviewed the environmental risk assessment reports of Taiwan's techno-industrial development initiatives
- Presented in various distinguished lecturer series about environmental risk assessment

Consultant, Chu Consulting, 08/2007 - 07/2010
- Conducted a cumulative risk assessment to evaluate the risk associated with the emissions of VOCs from a petrochemical plants in southern Taiwan
- Used EPA's ISC3 model (based on Gaussian dispersion model) to simulate the dispersion and deposition of VOCs from this petrochemical plant to the neighboring areas, then used ArcGIS to spatially combine the population data and VOC simulation data (and further calculated risks)

- Built a framework of risk-based decision making to set the emission levels of VOCs to reduce people's exposure and the risk of experiencing health problems
- Presented in conference: SRA 2007
- Awarded: CSU-Chico BBS Faculty Travel Funds (2007)

Environmental Justice Intern, Clean Water for North Carolina (CWFNC), Summer, 2005
- Reviewed and critiqued key state environmental policies and the federal EPA Public Participation Policy.
- Interviewed impacted communities, member organizations of the NC Environmental Justice Network, state policy officials about how those policies are actually implemented.
- Wrote a report about the survey and review of environmental justice needs for key state policies.
- Report Publication: "Achieving Environmental Justice in North Carolina Public Participation Policy" (Aug, 2005).

Volunteer, New Haven Recycles and Yale Recycling, 08/1998 – 05/2000
- Promoted recycling and conservation
- Checked trash cans (chosen randomly) and recycling bins at each entryway of residential college, then gave grades.

Volunteer, Urban Resource Initiative (URI), Summer, 1998
- Planted trees for local community of New Haven for a better and sustainable environment

RESEARCH EXPERIENCE

Postdoctoral Research

Department of Public Health Sciences, University of California, Davis, 07/01/2010 - present
Research advisor: Dr. Deborah H. Bennett and Dr. Irva Hertz-Picciotto
- Work on two projects: NIEHS-funded ***Childhood Autism Risks from Genetics and Environment (CHARGE)*** and EPA-funded ***Study of Use of Products and Exposure Related Behavior*** **(*SUPERB)***.
- Perform statistical and quantitative analyses with SAS to analyze collected house dust data and children's urine concentrations of metabolites.
- Conduct exposure assessment to investigate if pesticides, flame retardants, and phthalates are risk factors for children autism.
- Conduct exposure assessment to explore the relationships between children's exposure to phthalate, benzophenone-3 (oxybenzone), triclosan, and parabens, and the use of personal care products.
- Produce scholarly peer-reviewed publications of methodology and findings, and write the final reports of both projects.

Carolina Environmental Program, University of North Carolina at Chapel Hill, 01/01/2006 – 12/31/2006
Research advisor: Dr. Douglas J. Crawford-Brown
- Applied a framework of risk-based decision-making to perchlorate in drinking water. (Awarded: SRA Annual Meeting Travel Award 2006)
- Conducted a material and energy flow analysis (MEFA) to quantify the overall environmental impact of Bank of America operations, and quantitatively analyze the strategies BOA might adopt to reduce these impacts and achieve sustainability. (Report Publication: "Environmental Footprint Assessment")

Doctoral Research, 08/2000-12/2005

Department of Environmental Sciences and Engineering, School of Public Health, University of North Carolina at Chapel Hill
Research advisor: Dr. Douglas J. Crawford-Brown
- Dissertation topic: "**A framework of Risk-Based Decision Making by Characterizing Variability and Uncertainty Probabilistically: Using Arsenic in Drinking Water as an Example**".
- Conducted risk assessment for arsenic in drinking water.
- Conducted theoretical analysis on the variability and uncertainty issues of risk assessment.

- Conducted a meta-analysis to improve dose-response assessment.
- Conducted analytical and numerical analysis to build a new framework of risk-based decision-making which can be applied coherently across the regulation decisions for different contaminants.
- Presented in conferences: APPAM (2004), SRA (2004, 2005 and 2006), DESE Seminar (2005), CEP Symposium on Safe Drinking Water (2006).
- Awarded: SRA Annual Meeting Student Travel Award (2004 & 2005), UNC-CH Graduate School Travel Grants (2004), UCIS Doctoral Research Travel Awards (2002).

Master’s Research

School of Forestry and Environmental Studies, Yale University, 08/1999 - 06/2000
Research advisor: Dr. Xuhui Lee

- Master’s project: “**Forest Stand Dynamics and Carbon Cycle**”.
- Research project: “Monitoring Forest CO_2 Uptaking”
- Used remote sensing (ERMapper) to investigate the role of forest in the uptake of CO_2.
- Awarded from Teresa Heinz Scholars for Environmental Research Program (2000) and Klemme Award (1999).

Graduate Institute of Environmental Engineering, National Taiwan University, 06/1996 - 06/1998
Research advisor: Dr. Shang-Lien Loh

- Master’s thesis: “**The Loads of Air Pollutants from Urban Areas on a Neighboring Dam and its Water Quality**”
- Research Projects: “Research on Air Pollutant Deposition in Urban Areas” and “the Fate and Flow of Recyclable Materials”
- Used Gaussian’s Dispersion model (ISC3) to investigate the loads of air pollutants on dam water.

TEACHING EXPERIENCE

Lecturer

Department of Environmental Studies, California State University at Sacramento

- Environmental Politics and Policy, Fall 2011

Department of Geological & Environmental Science, California State University at Chico

- Environmental Risk Assessment, Spring 2009 & 2010
- Applied Ecology, Spring 2008
- Pollution Ecology, Fall, 2007

Department of Geography & Planning, California State University at Chico

- Seminar in Applied Geography & Planning – Environmental Regulation and Policy, Fall, 2007

Department of Forestry and Environmental Resources, North Carolina State University

- Environmental Regulation, Fall, 2006

Teaching Assistant

Department of Environmental Sciences and Engineering, UNC-Chapel Hill

- Environmental Risk Assessment, Spring, 2002
- Introduction to Environmental Science, Fall, 2001
- Analysis and Solution of Environmental Problems, Fall, 2001

Lab Instructor

Department of Environmental Sciences and Engineering, UNC-Chapel Hill

- Biology for Environmental Science, Fall, 2000

Graduate Institute of Environmental Engineering, National Taiwan University

- Water Quality Analysis, Fall, 1997

AWARDS and HONORS

- CSU-Chico BBS Faculty Travel Funds, 2007
- Member of Society of Risk Analysis (SRA), 2006-2008
- SRA Annual Meeting Student Travel Award, 2004-2006
- UNC-CH Graduate School Travel Grants, 2004
- Member of Association for Public Policy Analysis and Management (APPAM), 2004-2005
- UCIS Doctoral Research Travel Awards, 2002
- Graduate Student Teaching and Research Assistantships, 2000-2005
- Teresa Heinz Scholars for Environmental Research Program, 2000
- Yale Forestry & Environmental Studies, Klemme Award, 1999

PUBLICATIONS (SELECTED LIST)

Huei-An Chu, Deborah H. Bennett, Irva Hertz-Picciotto, “Phthalates in relation to autism and developmental delay: Exploratory analyses from the CHARGE Study”. (In preparation)

Huei-An Chu, Deborah H. Bennett, Irva Hertz-Picciotto, “Peronal Care Products: Possible Sources of Children Phthalate Exposure”. (In preparation)

Huei-An Chu and Douglas J. Crawford-Brown, “A Probabilistic Risk Assessment Framework to Quantify the Protectiveness of Alternative MCLs for Arsenic in Drinking Water”, *Journal of American Water Works Association*. (Being revised)

Huei-An Chu and Douglas J. Crawford-Brown, “Letter to the Editor: Inorganic Arsenic in Drinking Water and Bladder Cancer: A Meta-Analysis in Dose-Response Assessment”, *International Journal of Environmental Research and Public Health*, 2007, 4(4), 340-341.

Huei-An Chu and Douglas J. Crawford-Brown, “Inorganic Arsenic in Drinking Water and Bladder Cancer: A Meta-Analysis in Dose-Response Assessment”, *International Journal of Environmental Research and Public Health* 2006, 3(4), 316-322.

S.L. Lo and **H.A. Chu**, “Evaluation of Atmospheric Deposition of Nitrogen to the Feitsui Reservoir in Taipei”, *Water Science & Technolog*y, 2006, 53(2), 337-344.

CSE Consulting and the UNC Carolina Environmental Program (CEP), “Environmental Footprint Assessment”, Report for Bank of America, Aug, 2006.

Huei-An Chu, “Achieving Environmental Justice in North Carolina Public Participation Policy”, Report for Clean Water for North Carolina (CWFNC), Aug, 2005.

Huei-An Chu, “Arsenic and its Health Implications”, Report for University Center for International Studies Graduate Travel Awards, 2002.

PRESENTATIONS (SELECTED LIST)

Guest Speaker, “Human Health Risk Assessment – Arsenic in Drinking Water as an Example”. Tunghai University, Taichuang, Taiwan. (December 16th, 2010)

Guest Speaker, “Environmental Problems in Developing Countries”, Course Title: <u>Developing Countries</u>, Department of Economics, CSU-Chico (October 31st, 2008)

“Cumulative Risk Assessment for Volatile Organic Compounds (VOCs) from Petrochemical Plants in Southern Taiwan”. Oral Presentation in Society of Risk Analysis (SRA) 2007 Annual Meeting, San Antonio, TX. (December, 2007)

Guest Speaker, “Arsenic in Drinking Water”, Course Title: <u>Environmental Geology</u>, CSU-Chico. (November 13th, 2007)

“Risk-Based Environmental Regulation for Arsenic in Drinking Water”, Oral Presentation in Department of Environmental Health Seminar, East Tennessee State University (February 2nd, 2007)

“A Framework of Risk-based Decision Making by Characterizing Variability and Uncertainty Probabilistically: Using Arsenic in Dinking Water as an Example”, Oral Presentation in Society of Risk Analysis (SRA) 2006 Annual Meeting, Baltimore. MD. (December, 2006)

“A New Policy Tool to Choose Water Quality Goals under Uncertainty”, Poster Presentation in Society of Risk Analysis (SRA) 2006 Annual Meeting, Baltimore. MD. (December, 2006)

“A framework of Risk-Based Decision Making by Characterizing Variability and Uncertainty Probabilistically: Using Arsenic in Drinking Water as an Example”, Oral Presentation for National Center for Environmental Assessment (NCEA), Environmental Protection Agency (EAP). (October 26th, 2006)

“Probabilistic Risk Assessment for Arsenic in Drinking Water”, Poster Presentation in Carolina Environmental Program (CEP) 2006 Symposium on Safe Drinking Water, Chapel Hill, NC. (March, 2006)

“Probabilistic Risk and Margins of Safety for Water Borne Arsenic”, Poster Platform Presentation in Society of Risk Analysis (SRA) 2005 Annual Meeting, Orlando, FL. (December, 2005)

“Using Meta-Analysis in Dose-Response Analysis – Risk Assessment of Arsenic in Drinking Water as an Example”, Poster Platform Presentation in Society of Risk Analysis (SRA) 2004 Annual Meeting, Palm Springs, CA. (December, 2004)

DECLARATION OF
Ann Crisp

I, **Ann Crisp,** declare as follows:

1. I am presently employed by the California Energy Commission in the Environmental Office of the Siting, Transmission and Environmental Protection Division as a Staff Biologist.

2. A copy of my professional qualifications and experience is attached hereto and incorporated by reference herein.

3. I helped prepare the staff testimony on **Biological Resources** for the **Palen Solar Electric Generating System Final Staff Assessment,** based on my independent analysis of the Application for Certification and supplement hereto, data from reliable documents and sources, and my professional experience and knowledge.

4. It is my professional opinion that the prepared testimony is valid and accurate with respect to the issue addressed therein.

5. I am personally familiar with the facts and conclusions related in the testimony and if called as a witness could testify competently thereto.

I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge and belief.

Dated: 8/2/2013 Signed: Ann Crisp

At: Sacramento, California

Ann M. Crisp

Employment History

California Energy Commission

Planner II – Staff Biologist *03/2010 to present*

As a staff biologist with the Energy Commission, Ms. Crisp analyzes the biological resource components of energy facilities siting applications to assess resource impacts, develop mitigation, and to evaluate compliance with applicable local, state, and federal laws, ordinances, regulations, and standards. This requires working closely with biological resource protection and management agencies, subject matter experts, and Energy Commission consultants as well as with other Energy Commission staff to ensure the best available information is included in staff analyses.

Robertson-Bryan, Inc.

Staff Biologist *11/2006 to 03/2010*

Ms. Crisp's duties with Robertson-Bryan, Inc. included development of technical study reports and presentations based on the conclusions of field studies for the Middle Fork American River Project (MFP) Integrated Licensing Process for the Placer County Water Agency. She conducted field studies in preparation of the biological resources component of the MFP and the Big Creek System Alternative Licensing Process for Southern California Edison Company (SCE) including wildlife reconnaissance surveys, protocol-level wildlife surveys (including bald eagle wintering and nesting surveys and California red-legged frog surveys) and botanical surveys (including special-status plant species, noxious weeds, and plants of cultural concern for Native Americans). Ms. Crisp prepared documents supporting various management plans as part of the Big Creek No. 4 Traditional Licensing Process for SCE, including yearly monitoring reports for the Sediment Management Plan, Noxious Weed Management Plan, and Valley Elderberry Longhorn Beetle Management Plan. She also prepared and reviewed technical reports and California Environmental Quality Act (CEQA)/National Environmental Policy Act (NEPA) chapters on terrestrial resources.

Pacific States Marine Fisheries Commission/ California Department of Fish and Game

Research Technician *03/2006 to 11/2006*

While working with the California Department of Fish and Game through a partnership with the Pacific States Marine Fisheries Commission, Ms. Crisp conducted various focused wildlife surveys including reptile and amphibian cover board surveys, small mammal mark-recapture surveys, burrowing owl nest surveys, and California tiger salamander larval surveys. She collaborated on design and execution vegetation sampling protocol at multiple survey areas.

California Department of Fish and Game

Scientific Aid *11/2005 to 01/2006*

Ms. Crisp led tours of the Nimbus Fish Hatchery to provide information on the function of the hatchery and fish biology to school groups and the general public.

Humboldt State Foundation / California Department of Fish and Game

Wildlife Research Assistant *03/2005 to 10/2005*

While working with the California Department of Fish and Game (CDFG) through a partnership with the Humboldt State Foundation, Ms. Crisp conducted field-based vegetation sampling to classify vegetation types/wildlife habitats on multiple CDFG Wildlife Areas and Ecological Reserves. She was responsible for data management and preparation for inclusion in a statewide database. Ms. Crisp also conducted focused wildlife surveys including reptile and amphibian cover board surveys, small mammal live-trapping surveys, and nocturnal mammal spotlight surveys.

Oregon State University

Research Technician *06/2004 to 09/2004*

Ms. Crisp conducted bat surveys and vegetation inventories and assessments on a bat survey crew in western Oregon. This included collecting data on bat activity using Anabat II detectors, capturing bats using mist nets and H-nets and collecting biological samples and morphological data and vegetation sampling.

Sacramento Regional County Sanitation District – Bufferlands

Senior Student Intern *07/2003 to 03/2004*

Ms. Crisp assisted with various habitat restoration and management projects within the 2,650-acres surrounding the Sacramento Regional Wastewater Treatment Plant. She conducted waterfowl and shorebird surveys as well as sensitive species surveys. Other duties included landscape maintenance and water quality monitoring.

EDUCATION

Wildlife, Fish, and Conservation Biology *BS*
University of California, Davis *June 2004*

Natural Science *AA*
College of Marin *June 1998*

DECLARATION OF
Christopher Dennis

I, **Christopher Dennis,** declare as follows:

1. I am presently employed by the California Energy Commission in the Engineering Office of the Siting, Transmission and Environmental Protection Division as an Engineering Geologist.

2. A copy of my professional qualifications and experience is attached hereto and incorporated by reference herein.

3. I prepared the staff testimony on **Waste Management** for the **Palen Solar Electric Generating System Final Staff Assessment,** based on my independent analysis of the Application for Certification and supplement hereto, data from reliable documents and sources, and my professional experience and knowledge.

4. It is my professional opinion that the prepared testimony is valid and accurate with respect to the issue addressed therein.

5. I am personally familiar with the facts and conclusions related in the testimony and if called as a witness could testify competently thereto.

I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge and belief.

Dated: August 1, 2013 Signed: C.B.M

At: Sacramento, California

CHRISTOPHER DENNIS, PG, CHG

EXPERIENCE SUMMARY

Mr. Dennis is a licensed Professional Geologist and Certified Hydrogeologist with the State of California, and a California Qualified Stormwater Practioner/Developer. Mr. Dennis has over 20 years of professional technical and management experience. Fourteen of those years, he worked in private industry as a consultant. For the last six years, he has worked in the Energy Commissions Siting, Transmission and Environmental Protection Division. Mr. Dennis has been a portfolio manager for several major oil companies and the East Bay Municipal Utility District. He actively managed Unocal CERT, ExxonMobil, and ChevronTexaco pipeline, service station, bulk fueling, and terminal sites.

EDUCATION/REGISTRATION/CERTIFICATIONS

Pepperdine Law School, Certificate in Dispute Resolution, 1997
Whittier College of Law, J.D., 1996
California State University, Fullerton, B.S. Geology, 1989
Certified Hydrogeologist, State of California #963
Professional Geologist, State of California #7184
Qualified Stormwater Practioner/Developer #767
OSHA-SARA 40-Hour Hazardous Waste Activity Training 29 CFR 1910.120

PROFESSIONAL HISTORY

2007 to Current California Energy Commission, Engineering Geologist
2004 to 2007 Science Applications International Corporation, Senior Geologist
2004 to 2004 Bay Consulting Services, LLC, Principal
2001 to 2004 Cambria Environmental Technology, Inc., Office Manager, Senior Geologist
2000 to 2001 Alisto Engineering, Inc, Senior Geologist
1998 to 2000 Alton Geoscience-TRC, Inc., Senior Geologist
1993 to 1995 GeoResearch, Inc., Project Manager
1990 to 1993 AeroVironment, Inc., Staff Geologist
1989 to 1990 Applied Geosciences, Inc., Technician

2007 to Current, California Energy Commission, Sacramento, CA
Engineering Geologist
Siting, Transmission, and Environmental Protection Division

One of the primary functions of the Energy Commission is CEQA review of license applications to build and operate power plants 50 MW and greater in California. In the Energy Commission's Engineering Office, Mr. Dennis helps fulfill this function by working through and managing a wide variety of CEQA and environmental policy issues. The product of this effort is expressed in expert testimony and staff analysis for siting new power plants and power plant compliance activity. His testimony and analyses cover soil and water resource management, waste management, geological hazards, and paleontological resource management. He participates as a technical speaker at public workshops as needed.

He has worked on simple-cycle, combined cycle, cogeneration, geothermal, and large-scale thermal solar power plants, and is familiar with most of the major power plants in construction and operation in California today. He has conducted construction and operation compliance inspections at many of these plants. Mr. Dennis also works on the Energy Commission's water policy, having help bring it to the foreground with his final staff assessment for the Abengoa Solar project license. When issues involving Energy Commission or state policy, Mr. Dennis participates in meetings with his deputy director where he provides input on his assessments and recommendations.

A list of power plant siting cases for which he has authored assessments, in whole or in part follows: Abengoa Solar (Solar Thermal), Chevron USA (Natural Gas), CPV Sentinel (Natural Gas), Imperial Solar

(Solar Thermal), Ivanpah SEGS (Solar Thermal), Palmdale Hybrid (Natural Gas-Solar Thermal), Quail Brush (Natural Gas), Rio Mesa SEGF (Solar Thermal), and San Joaquin Solar (Solar Thermal-Biomass). Mr. Dennis also works on power plant construction and operation compliance, some of which are: Abengoa Solar, Colusa, CPV Sentinel, Elk Hills, geothermal power plants, Henrietta, Inland Empire, Ivanpah SEGS, La Paloma, Marsh Landing, MountainView, TID Almond, SEGS III-VII, SEGS VII & IX, and Sutter.

Mr. Dennis has developed a broad knowledge of CEQA/NEPA impact analysis and mitigation involving water resources, water quality, soil resources, erosion hazards, geologic resources and hazards, paleontological resources, and waste management. The assessments he has authored involve basin-wide water management, basin overdraft, water quality, water conservation, recycled water, water transfers, groundwater recharge, flood potential, and wind/water soil erosion. He has worked on groundwater basin modeling, basin water balance estimates, and evaluations of groundwater drawdown impacts to groundwater quality, biology, and other groundwater users. He has also evaluated potential impacts from geologic hazards related to faults, earthquake related ground shaking, landslides, subsidence, compressive and expansive soils, and flood potential.

Mr. Dennis manages the Energy Commission’s Quarterly Fuel and Energy Reporting (QFER) program for the water use and wastewater generation of all power plants 20 MW and greater in California. He designed the forms used to collected the QFER water and wastewater data and developed a database to manage the data collected, and through the course of this data collection effort, developed constructive working relationships with plant operators. The QFER water and wastewater information collected is used by news agencies, federal and state agencies, and members of the public.

Mr. Dennis trains and manages students to assist him with the QFER data collection and power plant construction and operation compliance oversight. He has been frequently asked to act as the Unit Supervisor when the supervisor is away on vacation, and works with other Energy Commission employees and government agencies to focus on tasks and resolve issues.

2004 to 2007, Science Applications International Corporation, Sacramento, CA
Senior Geologist/Project Manager
Consultant for Chevron, Northern California

Mr. Dennis managed environmental compliance for several former crude oil and Bunker C pipeline right-of-way and pump stations sites within the Central California region. He consolidated all groundwater monitoring and sampling for the portfolio into one program and managed that program. He developed and implemented new written field QA/QC procedures for the entire portfolio of sites, and developed and implemented an analytical laboratory evaluation plan. He also initiated low-flow groundwater sampling from wells and the use of pre-packed filter screens in open boreholes to reduce water turbidity in samples collected, allowing laboratory detection limits to be low enough for polynuclear aromatic hydrocarbon impacted groundwater risk-assessment evaluation. He initiated a crude oil remediation study for the portfolio. Mr. Dennis also developed workplans and conducted subsurface soil and groundwater investigations and prepared reports documenting the results of those investigations. He developed a soil vapor survey workplan and installed multiple completion soil vapor wells. He also worked with a GIS team to incorporate all pertinent site data into a web-based GIS and geo-reference the GIS as appropriate. This portfolio required a significant amount of front-end planning and coordination. Mr. Dennis developed and managed all site budgets and billing, and performed annual staff reviews. As a senior project manager, Mr. Dennis was the geologist in responsible-charge for the work performed by other geologist in the office and while conducting work in the field.

2004 to 2004, Bay Consulting Services, LLC, Rocklin, CA
Consultant/Principal Owner

Mr. Dennis developed the company from a concept to a viable business. Provided environmental consulting services for Chevron Corp. projects and other environmental companies. Completed several closure requests with Tier I/II risk analysis. Conducted company billing and accounting.

2001 to 2004, Cambria Environmental Technology, San Ramon and Rocklin, CA
Senior Geologist/Office Manager
Consultant for Chevron and East Bay Municipal Utility District

Mr. Dennis started Cambria's Rocklin office and grew that office to a staff of over 12 in less than a year through initiative and hard work. He worked as a liaison for the client and regulators, developed and managed all site budgets and billing, and performed annual staff reviews, hiring, and employment termination.

Chevron, Northern California. Mr. Dennis managed environmental compliance for a portfolio of 40 to 60 Chevron Corp. service stations and bulk fuel plants in Northern California. He developed workplans and conducted subsurface soil and groundwater investigations for these sites, some of which were located in the sensitive Lake Tahoe area. Each site was unique with its own operational history and hydrogeologic conditions. He achieved regulatory closure of over 30 Chevron sites by application of active remediation and by demonstration that attenuation processes would naturally cleanup the refined fuel products in the soil and groundwater.

To bring these sites to regulatory closure, Mr. Dennis initially prepared workplans to develop an understanding of the site history, hydrogeologic conditions, and to identify the extent, concentration, and type of fuel product in the subsurface associated with the site. The workplans included regulatory record searches, aerial photographs evaluations, the design of soil borings and groundwater monitoring well networks for subsurface geology and aquifer characterization. Mr. Dennis then conducted site investigations pursuant to these regulatory approved workplans.

The site investigations included the drilling soil borings, logging of soil borings, and the collection of soil samples from the vadose zone, capillary fringe, and saturated zones for chemical and physical analyses and grab-groundwater samples for chemical analyses. Based on these results and field judgment, Mr. Dennis was responsible for the completion of soil vapor extraction wells and groundwater monitoring wells in accordance with industry guidelines and best professional practice. He also was the geologist in responsible-charge for the preparation of reports that evaluated the data collected and made conclusions and recommendations based on the results of the evaluation. As a senior project manager, Mr. Dennis was the geologist in responsible-charge for the work performed by other geologist in the office and while conducting work in the field.

Mr. Dennis helped develop and received State Underground Storage Tank (UST) Fund pre-approved for approximately 100 low-risk ChevronTexaco sites as part of a management transfer initiative. He also worked with Caltrans on a freeway (CA I-80) expansion project that required excavation and dewatering beneath a former Chevron site. Mr. Dennis worked with Caltrans to build into the Caltrans request for bid specifications for handling petroleum impacted excavated soils and water. As a result of this effort, the expansion project is now complete and the former Chevron site remediated.

East Bay Municipal Utility District, Northern California. Mr. Dennis brought to Cambria a three-year, $275K/yr maximum EBMUD contract. The contract focused on pre-trenching activity soil sampling/analysis for potential contaminant identification and soil disposal. He developed a small group of professionals to manage this portfolio. As part of this project, Mr. Dennis managed several EPA SW-846 statistical soil analysis projects at District landfill sites with volumes up to approximately 180,000 cubic yards of landfilled soil. He created and surveyed statistical grids on the landfills and characterized the soil for removal to Class III or Class II landfills. He also conducted site investigations and quarterly groundwater monitoring projects at EBMUD facilities at the Camanche and Pardee Reservoirs.
2000 to 2001, Alisto Engineering, Lafayette, CA
Senior Geologist/Project Manager
Consultant for Caltrans and Industrial Facilities

Caltrans, Northern California. Mr. Dennis conducted site investigations at Caltrans sites and conducted statistical analyses of the soil from the shoulders of several Caltrans highways in Southern California. He performed the statistical analyses to determine hazard levels of lead in the soil, which would assist in soil management planning in proposed highway construction corridors. The statistical analyses were performed on sample populations ranging from approximately 80 to 300.

Industrial Facilities, Northern California. Mr. Dennis also conducted site investigations at several industrial sites in Northern California. He developed storm water pollution prevention plans (SWPPPs) for development projects in downtown San Jose and a Caltrans project along CA I-680. Mr. Dennis worked as a liaison for clients and regulators, and developed and managed all site budgets and billing for both the industrial facilities and Caltrans projects.

1998 to 2000, Alton Geoscience-TRC, Concord, CA
Senior Geologist/Project Manager
Consultant for ExxonMobil and Quick Stop Markets

ExxonMobil and Quick Stop Markets, Northern California. Mr. Dennis managed environmental compliance for a portfolio of ExxonMobil and Quick Stop Markets service station and bulk fuel plant sites. He developed workplans and conducted subsurface soil and groundwater investigations. Mr. Dennis achieved regulatory closure of over 30 of these sites by application of active remediation and demonstration that attenuation processes would naturally cleanup the refined fuel products in the soil and groundwater. Site investigations included the drilling and logging of soil borings, and collection of soil samples from the vadose, capillary fringe, and saturated zones for chemical and physical analyses and grab-groundwater samples were collected for chemical analyses. Based on these results and field judgment, Mr. Dennis was responsible for the completion of soil vapor extraction wells and groundwater monitoring wells in accordance with industry guidelines and best professional practice. He was also responsible for the preparation of reports that evaluated the data collected and made conclusions and recommendations based on the results of the evaluation. Mr. Dennis also managed the application of high vacuum, dual-phase (soil vapor and groundwater) extraction at several of these sites.

Notably, after two years of negotiations, technical presentations, and meetings, Mr. Dennis secured the recession of a RWQCB cleanup and abatement order and site closure for a former bulk plant on the sensitive Napa River. This bulk fuel plant was one of several along the river and where the tidal influences on the river affected the petroleum product in the groundwater. Plumes of liquid and dissolved phase hydrocarbons were present in the groundwater at adjacent sites and at the subject site.

1993 to 1995, Project Manager, GeoResearch, Long Beach, CA
Staff Geologist/Project Manager
Consultant for Unocal CERT

Unocal CERT, Southern California. Mr. Dennis managed environmental compliance for a portfolio of Unocal CERT projects in Southern California. He developed workplans and conducted subsurface soil and groundwater investigations for these sites. He frequently utilized mobile laboratories to assist in the placement of soil borings, vapor extraction, and groundwater wells. He conducted risk assessments, site assessments, tanks pulls, station demolitions, aquifer and vapor extraction tests, and remediation system designs and installations.

1990 to 1993 Staff Geologist, AeroVironment, Monrovia, CA
Staff Geologist/Project Manager
Consultant for Industrial Sites and Air Force Base Projects

Industrial Sites and Air Force Base Projects, Southern California. Mr. Dennis managed industrial projects and participated on government projects as a project geologist. He was a team leader during field documentation over 400 former homestead sites at Edwards AFB using GPS technology. This documentation included well locations, archaeological finds, and biological concerns. Mr. Dennis helped develop a database to manage all the data collected. He also conducted groundwater sampling according to AFCEE protocols and conducted soil-vapor and geophysical surveys at Vandenberg AFB. He was a member of the design team of a mobile soil-vapor laboratory that housed a gas chromatograph for sample analysis, and was lead designer of an insitu soil-vapor sample collection system. Mr. Dennis also managed two field teams for monitoring landfill vapor emissions and subsurface migration at active San Bernardino and Riverside County operated landfills, wrote the standard operating procedures for the fieldwork, conducted field training, and prepared quarterly AQMD reports. He also developed the contract for and managed quarterly groundwater monitoring and sampling at the Powerine Oil Refinery in Santa Fe Springs.

PUBLICATIONS

2007 and 2011 Integrated Energy Policy Report, California Energy Commission (one of many authors)
California Energy Commission Final Staff Assessments
Numerous Phase I Environmental Site Assessments
Numerous Groundwater Monitoring Reports
Numerous Site Investigation Workplans
Numerous Site Investigation and Remediation Reports

AWARDS

California Energy Commission Superior Accomplishment Award, 2010

DECLARATION OF
DAVID FLORES

I, **David Flores** declare as follows:

1. I am presently employed by the California Energy Commission in the Siting, Transmission and Environmental Protection Division as a **Planner 3-Supervisor.**

2. A copy of my professional qualifications and experience is attached hereto and incorporated by reference herein.

3. I reviewed and approved staff's testimony on **Traffic and Transportation** for the Palen Solar Electric Generating System based on my staff's independent analysis of the Application for Certification and supplements thereto, data from reliable documents and sources, and their professional experience and knowledge.

4. It is my professional opinion that the prepared testimony is valid and accurate with respect to the issue addressed therein.

5. I am personally familiar with the facts and conclusions related in the testimony and if called as a witness could testify competently thereto.

I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge and belief.

Dated: September 5, 2013 Signed: ______________________

At: Sacramento, California

DAVID FLORES

WORK EXPERIENCE

November 2009 to Present **Planner 3-Supervisor.** California Energy Commission, Energy Facilities Siting and Protection Division.

Perform a variety of supervisory, administrative, and analytical tasks. As supervisor, I am responsible for a staff of technical specialists and consultants performing analysis in the areas of natural gas power plant and solar thermal siting, electrical transmission line corridor planning, electrical transmission line corridor planning and energy policy/planning.I also provide staff support at public workshops and as a liaison to citizen committees.

September. 1998 to November 2009

Planner 2. California Energy Commission, Energy Facilities Siting and Protection Division.

Provide written technical analysis of proposed energy planning, conservation, transmission design, and development programs on land use, visual and traffic and transportation resources. Specific tasks include: the analysis of potential impacts; identification of suitable mitigation measures; preparation of testimony; participate in public workshops; present sworn testimony during evidentiary hearings, and propose monitoring to ensure compliance with local, state and federal environmental laws and regulations.

March 29,1988 to September 12, 1998

Senior Planner. County of Yolo Planning and Public Works Department

Senior Planner - Current and Advanced Planning (Resources Management and Planning)

Responsibilities included the following:

Administered the establishment of Planning schedules and timeframe completion schedules to four, associate planners; Administration and staff support to Planning Commission and Board of Supervisors; Staff support and liaison to citizen's committees. Preparation of Environmental documents (Negative Declarations, preparation of Environmental Impact Reports and Categorical Exemptions) in accordance with State and Federal Regulations.

June 1, 1976
to March 25, 1988 **Manager of Resources** Citizens Utilities Company of California

Responsibilities included the following:

Coordinated, planned and developed semi-annual and annual construction and operating and maintenance budgets for all Northern California operations. Assisted in the development of rate and fee schedules before the California Public Utilities Commission for all Northern California Operations. Directed five employees and twenty-five employees in the outlying California operations. Extensive experience in specification writing, project planning and scheduling, construction management, site supervision and effective customer relations for outlying areas.

EDUCATION

California State University @ Sacramento
University of California @Davis
Major: Environmental Studies
Minor: Business Administration

DECLARATION OF
Alvin Greenberg, Ph.D.

I, **Alvin Greenberg, Ph.D.** declare as follows:

1. I am presently a consultant to the California Energy Commission, Siting, Transmission, and Environmental Protection Division.

2. A copy of my professional qualifications and experience is attached hereto and incorporated by reference herein.

3. I helped prepared the staff testimony on **Hazardous Materials Management, Biological Risk Assessment of Avian Exposure to Concentrated Solar Radiation, Assessment of Impacts of Glint and Glare on Vehicles Traveling on I-10, and Worker Safety/Fire Protection** for the modified **Palen Solar Electric Generating System** (09-AFC-7C), based on my independent analysis of the Petition for Amendment dated December 17, 2012 and supplements hereto, responses to staff data requests, data from reliable documents and sources, and my professional experience and knowledge.

4. It is my professional opinion that the prepared testimony is valid and accurate with respect to the issue addressed therein.

5. I am personally familiar with the facts and conclusions related in the testimony and if called as a witness could testify competently thereto.

I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge and belief.

Dated: July 31, 2013 Signed: [signature]

At: San Rafael, California

Risk Science Associates

37 Mt. Whitney Dr., Suite A, San Rafael, Ca. 94903
415-479-7560 fax 415-479-7563
e-mail agreenberg@risksci.com

Name & Title: **Alvin J. Greenberg, Ph.D., QEP**
Principal Toxicologist

Dr. Greenberg has had over two decades of complete technical and administrative responsibility as a team leader in the preparation of human and ecological risk assessments, air quality assessments, hazardous materials handling and risk management/prevention, infrastructure vulnerability assessments, occupational safety and health, hazardous waste site characterization, interaction with regulatory agencies in obtaining permits, and conducting lead surveys and studies. He has particular expertise in the assessment of dioxins, lead, diesel exhaust, petroleum hydrocarbons, mercury, the intrusion of subsurface contaminants into indoor air, and the preparation and review of public health/public safety sections of EIRs/EISs. Dr. Greenberg's expertise in risk assessment has led to his appointment as a member of several state and federal advisory committees, including the California EPA Advisory Committee on Stochastic Risk Assessment Methods, the US EPA Workgroup on Cumulative Risk Assessment, the Cal/EPA Peer Review Committee of the Health Risks of Using Ethanol in Reformulated Gasoline, the California Air Resources Board Advisory Committee on Diesel Emissions, the Cal/EPA Department of Toxic Substances Control Program Review Committee, and the DTSC Integrated Site Mitigation Committee. Dr. Greenberg is the former Chair of the Bay Area Air Quality Management District Hearing Board, a former member of the State of California Occupational Health and Safety Standards Board (appointed by the Governor), and former Assistant Deputy Chief for Health, California OSHA. And, since the events of 9/11, Dr. Greenberg has been the lead person for developing vulnerability assessments, power plant security programs, and conducting safety and security audits of power plants for the California Energy Commission and has assisted the CEC in the assessment of safety and security issues for proposed LNG terminals. In addition to providing security expertise to the State of California, Dr. Greenberg was the Team Leader and main consultant to the State of Hawaii on the updating of their Energy Emergency Preparedness Plan.

Years Experience: 32

Education:

B.S. 1969 Chemistry, University of Illinois Urbana

Ph.D. 1976 Pharmaceutical/Medicinal Chemistry, University of California, San Francisco

Postdoctoral Fellowship 1976-1979 Pharmacology/Toxicology, University of California, San Francisco

Postgraduate Training 1980 Inhalation Toxicology, Lovelace Inhalation Toxicology Research Institute, Albuquerque, NM

Professional Registrations:

Board Certified as a Qualified Environmental Professional (QEP)
California Registered Environmental Assessor - I (REA) (program discontinued in 2012)
Fellow of the American Institute of Chemists (FAIC)

Professional Affiliations:

Society for Risk Analysis
American Chemical Society
National Fire Protection Association

Technical Boards and Committee Memberships - Present:

Squaw Valley Technical Review Committee
(appointed 1986)

Technical Boards and Committee Memberships - Past:

July 1996 – March 2002
Member, Bay Area Air Quality Management District Hearing Board
(Chairman 1999-2002)
September 2000 – February 2001
Member, State Water Resources Control Board Noncompliant Underground Tanks Advisory Group
January 1999 – June 2001
Member, California Air Resources Board Advisory Committee on Diesel Emissions
January 1994 - September 1999
Vice-Chairman, State Water Resources Control Board Bay Protection and Toxic Cleanup Program Advisory Committee
September 1998
Member, US EPA Workgroup on Cumulative Risk Assessment
April 1997 - September 1997
Member, Cal/EPA Private Site Manager Advisory Committee
January 1986 - July 1996
Member, Bay Area Air Quality Management District Advisory Council
(Chairman 1995-96)
January 1988 - June 1995
Member: California Department of Toxic Substance Control Site Mitigation Program Advisory Group
January 1989 - February 1995
Member: Department of Toxics Substances Control Review Committee, Cal-EPA

October 1991 - February 1992
Chair: Pollution Prevention and Waste Management Planning Task Force of the Department of Toxics Substances Control Review Committee, Cal-EPA

September 1990 - February 1991

Member: California Integrated Waste Management Board Sludge Advisory Committee

September 1987 - September 1988

ABAG Advisory Committee on Regional Hazardous Waste Management Plan

March 1987 - September 1987

California Department of Health Services Advisory Committee on County and Regional Hazardous Waste Management Plans

January 1984 - October 1987

Member, San Francisco Hazardous Materials Advisory Committee

March 1984 - March 1987

Member, Lawrence Hall of Science Toxic Substances and Hazardous Materials Education Project Advisory Board

Jan. 1, 1986 - June 1, 1986

Member, Solid Waste Advisory Committee, Governor's Task Force on Hazardous Waste

Jan. 1, 1983 - June 30, 1985

Member, Contra Costa County Hazardous Waste Task Force

Sept. 1, 1982 - Feb. 1, 1983

Member, Scientific Panel to Address Public Health Concerns of Delta Water Supplies, California Department of Water Resources

<u>Present Position</u>

January 1983- present

Owner and principal with Risk Sciences Associates, a Marin County, California, environmental consulting company specializing in multi-media human health and ecological risk assessment, air pathway analyses, hazardous materials management-infrastructure security, environmental site assessments, review and evaluation of EIRs/EISs, preparation of public health and safety sections of EIRs/EISs, and litigation support for toxic substance exposure cases.

<u>Previous Positions</u>

Jan. 2, 1983 - June 12, 1984

Member, State of California Occupational Safety and Health Standards Board (Cal/OSHA), appointed by the Governor

Aug. 1, 1979 - Jan. 2, 1983
Assistant Deputy Chief for Health, California Occupational Safety and Health Administration

Feb. 1, 1979 - Aug. 1, 1979
Administrative Assistant to Chairperson of Finance Committee, Board of Supervisors, San Francisco

Jan. 1, 1976 - Feb. 1, 1979
Research Pharmacologist and Postdoctoral Fellow, Department of Pharmacology and Toxicology, School of Medicine, University of California, San Francisco

Jan. 1, 1975 - Dec. 31, 1975
Acting Assistant Professor, Department of Pharmaceutical Chemistry, University of California, San Francisco

Experience

General

Dr. Greenberg has been a consultant in Hazardous Materials Management and Security, Human and Ecological Risk Assessment, Occupational Health, Toxicology, Hazardous Waste Site Characterization, and Toxic Substances Control Policy for over 32 years. He has broad experience in the identification, evaluation and control of health and environmental hazards due to exposure to toxic substances. His experience includes Community Relations Support and Risk Communication through experience at high-profile sites and presentations at professional society meetings.

He has considerable experience in the review and evaluation of exposure via the air pathway - particularly to emissions from power plants, refineries, and diesel exhaust - and a thorough knowledge of the regulatory requirements through his experience at Cal/OSHA, the BAAQMD Hearing Board, as a consultant to the California Energy Commission, and in preparing such assessments for local government and industry. He has assessed exposures to diesel exhaust during construction and operations of stationary and mobile sources and has testified at evidentiary hearings numerous times on this subject.

He is presently assisting the California Energy Commission in assessing the risks to workers and the public of proposed power plants and hazardous wastes on those sites. His experience in hazard identification, exposure assessment, risk assessment, occupational safety and health, emergency response, and Critical Infrastructure Protection has made him a valuable part of the CEC team addressing this issue. He has conducted numerous evaluations of the safety and hazards of natural gas pipelines for the CEC and has presented his findings and recommendations at public meetings and evidentiary hearings.

He served for over five years as the Vice-chair of the California State Water Resources Control Board Advisory Committee convened to address toxic substances in sediments in bays, rivers, and estuaries. He has been a member of the Squaw Valley Technical Review Committee since 1986 establishing chemical application management plans at golf courses to protect surface and groundwater quality. He has also conducted numerous ecological risk assessments and characterizations, including those for marine and terrestrial habitats.

Dr. Greenberg has extensive experience in data collection and preparation of human and ecological risk assessments on numerous military bases and industrial sites with Cal/EPA DTSC and RWQCB oversight. He has also been retained to provide technical services to the Cal/EPA Department of Toxic Substances Control (preparation of human health risk assessments) and the Office of Environmental Health Hazard Assessment (review and evaluation of air toxics health risk assessments and preparation of profiles describing the acute and chronic toxicity of toxic air contaminants). He has also conducted several surveys of sites containing significant lead contamination from various sources including lead-based paint, evaluated potential occupational exposure to lead dust and fumes in industrial settings, prepared numerous human health risk assessments of lead exposure, and prepared safety and health plans for remedial investigation of lead contaminated soils. Dr. Greenberg is also a recognized expert on the requirements of California's Proposition 65 and has served as an expert on Prop. 65 litigation.

Sites with EPA, RWQCB and/or DTSC Oversight

Dr. Greenberg has specific experience in assessing human health and ecological risks at contaminated sites at the land/water interface, including petroleum contaminants, metals, mercury, and VOCs at several locations in California including Oxnard, Richmond, Avila Beach, Mare Island Naval Shipyard, San Diego, Hollister, San Francisco, Hayward, Richmond, the Port of San Francisco, and numerous other locations. He has used Cal/EPA methods, US EPA methods, and ASTM Risk Based Corrective Action (RBCA) and Cal/Tox methodologies. He is extremely knowledgeable about SWRCB and SF Bay RWQCB regulations on underground storage tank sites and with ecological issues presented by contaminated sediments including sediment analysis, toxicity testing, tissue analysis, and sediment quality objectives. Dr. Greenberg served on the State Water Resources Control Board Bay Protection and Toxic Cleanup Program Advisory Committee from 1994 until the end of the program in 1999.

Dr. Greenberg experience on many of these contaminated sites has been as a consultant to local governments, state agencies, and citizen groups. He assisted the City and County of San Francisco in developing local ordinance requiring soil testing (Article 20, Maher ordinance) and hazardous materials use reporting (Article 21, Walker ordinance). He served as the City of San Rafael's consultant to provide independent review and evaluation of the site characterization and remedial action plan prepared for a former coal gasification site. He was a consultant to a citizen group in northern California regarding exposure and risks due to accidental releases from a petroleum refinery and assisted in the assessment of risks due to crude petroleum contamination of a southern California beach. He has prepared a number of risk assessments addressing crude petroleum, diesel and gasoline contamination, including coordinating site investigations, environmental monitoring, and health risk assessment for the County of San Luis Obispo regarding Avila Beach subsurface petroleum contamination. That high-profile project lasted for over one year and Dr. Greenberg managed a team of experts with a budget of $750,000. Another high-profile project included the preparation of an extensive comprehensive human and ecological risk assessment for the Hawaii Office of Space Industry on rocket launch impacts and transportation/storage of rocket fuels at the southern end of the Big Island of Hawaii. Dr. Greenberg's risk assessments were part of the EIS for the project. Dr. Greenberg also worked on another high-profile project conducting Air Pathway Analysis of off-site and on-site impacts from landfill gas constituents, including indoor and outdoor air measurements, air dispersion modeling, flux chamber investigations, and health risk assessment for the County of Santa Barbara. Dr. Greenberg has conducted RI/FS work, prepared health risk assessments, evaluated hazardous waste sites and hazardous materials use at numerous locations in California, Hawaii, Oregon, Minnesota, Michigan, and New York. He has considerable experience in the development of clean-up standards and the development of quantitative risk assessments for site RI/FS work at CERCLA sites, as well as site closures, involving toxic substances and petroleum hydrocarbon wastes. He is experienced in working with both Region IX EPA and the State of California DTSC in negotiating clean-up standards based on the application of both site-specific and non site-specific health and ecological based clean-up criteria. He has significant experience in the development of site chemicals of concern list, quantitative data quality levels, site remedial design, the site closure process, the design and execution of data quality programs and verification of data quality prior to its use in the decision making process on large NPL sites.

Examples

Human Health Risk Assessments for the Ophir Road, 20th St., Durham, and Norcal Scrap Metal Recycling Sites (September 2010 – present)

Human Health Risk Assessment and Hazardous Material Assessment at the former Nestle Waters of North America, Inc. McCloud Site (August 2012)

Review and Evaluation of the Extent of Contamination and Risk Posed by the former Unocal Tank Farm Area, San Luis Obispo, CA (July 2009 – April 2011)

Review and Evaluation of the former Mill Hazardous Waste Site, North Fork, CA (2009)

The Avila Beach Health Study Phase 1: Reconnaissance Sampling Findings, Conclusions, and Recommendations. (July 1997) Volume 1: Baseline Human Health Risk Assessment. (May 1998)

The Avila Beach Health Study Phase 1, Volume 2: Environmental Monitoring. (May 1998)

Health Risk Assessment and Air Pathway Analysis for the Ballard Canyon Landfill, Santa Barbara County, Ca. (March 1999)

Screening Human Health Risk Assessment, Calculation of Soil Clean-up Levels, and Aquatic Ecological Screening Evaluation, Galilee Harbor, Sausalito, Ca. (May 1998)

Health Risk Assessment Due to Diesel Train Engine Emissions, Oakland, Ca. (June 1999)

Health Risk Assessment for Residual Mercury at the Deer Creek Facility, 3475 Deer Creek Road, Palo Alto, California. (July 1997)

Phase 2 Human Health Risk Assessment, Teledyne Inc., San Diego, Ca. (February 1997)

Human Health Risk Assessment, Teledyne Ryan Aeronautical, McCormick Selph Ordnance. Hollister, California. (December 1996)

Initial Phase Human Health Risk Assessment, Teledyne Inc., San Diego, Ca. (October 1996)

Human Health Risk Assessment, Ecological Screening Evaluation, and Development of Proposed Remediation Goals for the Flair Custom Cleaners Site, Chico, California (January 1996)

Human Health Risk Assessment for the X-3 Extrudate Project at Criterion Catalyst, Pittsburg, Ca. (November 1994)

Screening Health Risk Assessment and Development of Proposed Soil Remediation Levels at Hercules Plant #3, Culver City, Ca. (July 1993)

Ecological Screening Evaluation for the Altamont Landfill, Alameda County, Ca. (June, 1993)

Focused Ecological Risk Characterization, Hawaiian Electric Company, Keahole Generating Station Expansion, Hawaii (June 1993)

Human Health Risk Assessment for the Proposed Palima Point Space Launch Complex, prepared for the Hawaii Office of Space Industry (April 1993)

Ecological Risk Assessment for the Proposed Palima Point Space Launch Complex, prepared for the Hawaii Office of Space Industry (March 1993)

Human Health Risk Assessment for Current and Proposed Expanded Class II and Class III Operations at the Altamont Sanitary Landfill, Alameda County, Ca.
(March, 1993)

Screening Health Risk Assessment for the Proposed Expansion of the West Marin Sanitary Landfill, Point Reyes Station, Ca.
(March, 1993)

Health Risk Assessment for the Proposed Expansion of the Forward, Inc. Landfill, Stockton, Ca. (September 14, 1992)

Health Risk Assessment for the Rincon Point Park Project, San Francisco, Ca. Prepared for Baseline Environmental Consulting and the San Francisco Redevelopment Agency.
(August 10, 1992)

Health Risk Assessment for the South Beach Park Project, San Francisco, Ca. Prepared for Baseline Environmental Consulting and the San Francisco Redevelopment Agency.
(August 10, 1992)

Screening Health Risk Assessment and Development of Proposed Soil and Groundwater Remediation Levels, Kaiser Sand and Gravel, Mountain View, Ca. Prepared for Baseline Environmental Consulting (January 30, 1992)

Development of Proposed Soil Remediation Levels for the Marine Corps Air-Ground Combat Center, 29 Palms, California (May 30, 1991)

Preliminary Health Risk Assessment for the City of Pittsburg Redevelopment Agency, Pittsburg, California (May 29, 1991)

Military Bases

Dr. Greenberg has experience in conducting assessments at DOD facilities, including RI/FS work, preparation of health risk assessments, evaluation of hazardous waste sites and hazardous materials use at the following Navy sites in California: San Diego Naval Base; Marine Corps Air-Ground Combat Center, 29 Palms; Mare Island Naval Shipyard, Vallejo; Treasure Island Naval Station, San Francisco, Hunters Point Naval Shipyard, San Francisco, and the Marine Corps Logistics Base, Barstow. He worked with the U.S. Navy and the U.S. EPA in the implementation of Data Quality Objectives (DQO's) at MCLB, Barstow.

Examples

Review and Evaluation of the Remedial Investigation Report and Human Health Risk Assessment for the U. S. Naval Station at Treasure Island, Ca. (June 1999)

Screening Health Risk Assessment for the Proposed San Francisco Police Department's Helicopter Landing Pad at Hunters Point Shipyard, San Francisco, Ca. (September 1997)

Development of Proposed Soil Remediation Levels for the Marine Corps Air-Ground Combat Center, 29 Palms, California (May 30, 1991)

Health Risk Assessment for the Chrome Plating Facility, Mare Island Naval Shipyard, Vallejo, California (October 24, 1988)

Background Levels and Health Risk Assessment of Trace Metals present at the Naval Petroleum Reserve No.1, 27R Waste Disposal Trench Area, Lost Hills, California (August 12, 1988)

RCRA Facility Investigation (RFI) Work Plan of Lead Oxide Contaminated Areas, Mare Island Naval Shipyard, Vallejo, California. Prepared in conjunction with Kaman Sciences Corp. (August 14, 1989)

Hazardous Waste and Solid Waste Audit and Management Plan, Mare Island Naval Shipyard, Vallejo, California. Prepared in conjunction with Kaman Sciences Corp. (July 3, 1989)

Water Quality Solid Waste Assessment Test (SWAT) Proposal RCRA Landfill, Mare Island Naval Shipyard, Vallejo, California. Prepared in conjunction with Kaman Sciences Corp. (October 31, 1988)

Waste Disposal Facilities, Waste Haulers, Waste Recycling Facilities Report, Mare Island Naval Shipyard, Vallejo, California. Prepared in conjunction with Kaman Sciences Corp. (September 22, 1988)

Sampling and Analysis Plan, Health and Safety Plan, Site Characterization of Lead Oxide Contaminated Areas, Mare Island Naval Shipyard, Vallejo, California. Prepared in conjunction with Kaman Sciences Corp. (September 2, 1988)

Air Quality Solid Waste Assessment Test (SWAT) Proposal, Mare Island Naval Shipyard, Vallejo, California. Prepared in conjunction with Kaman Sciences Corp. (August 25, 1988)

Liquefied Natural Gas (LNG)

Dr. Greenberg assisted the CEC in the preparation of the "background" report on the risks and hazards of siting LNG terminals in California ("LNG in California: History, Risks, and Siting" July 2003) and consulted for the City of Vallejo on a proposed LNG terminal and storage facility at the former Mare Island Naval Shipyard. He has also conducted an evaluation and prepared comments on the risks, hazards, and safety analysis of the DEIS/DEIR for the City of Long Beach on a proposed LNG terminal at the Port of Long Beach (POLB) and conducted an analysis on vulnerability and critical infrastructure security for the CEC on this same proposed LNG terminal. He currently advises the CEC on the POLB LNG proposal on risks, hazards, human thresholds of thermal exposure, vulnerability, security, and represented the CEC at a U.S. Coast Guard briefing on the Waterway Suitability Assessment that included the sharing of SSI (Sensitive Security Information). He has presented technical information and analysis to the State of California LNG Interagency Working Group on thermal radiation public exposure criteria and safety/security at an east coast urban LNG terminal. (Both presentations are confidential owing to the nature of the material.) He has conducted numerous evaluations of the safety and hazards of natural gas pipelines for the CEC and has presented his findings and recommendations at public meetings and evidentiary hearings.

Infrastructure Security

Since 2002, Dr. Greenberg has been trained by and is working with the Israeli company SB Security, LTD, the most experienced and tested security planning and service company in the world. Since the events of 9/11, Dr. Greenberg has been the lead person for developing vulnerability assessments and power plant security programs for the California Energy Commission (CEC). In taking the lead for this state agency, Dr. Greenberg has interfaced with the California Terrorism Information Center (CATIC) and provided analysis, recommendations, and testimony at CEC evidentiary hearings regarding the security of power plants within the state. These analyses include the assessment of Critical Infrastructure Protection, threat assessments, criticality assessments, and the preparation of vulnerability assessments and off-site consequence analyses addressing the use, storage, and transportation of hazardous materials, recommendations for security to reduce the threat from foreign and domestic terrorist activities, perimeter security, site access by personnel and vendors, personnel background checks, management responsibilities for facility security, and employee training in security methods. Dr. Greenberg is the lead person in developing a model power plant security plan, vulnerability assessment matrix, and a security training manual for the CEC. The model security plan is used by power plants in California as guidance in developing and implementing security measures to reduce the vulnerability of California's energy infrastructure to terrorist attack. He has testified at several evidentiary hearings for the CEC on power plant security issues. He also leads an audit team conducting safety and security audits at power plants throughout California that are under the jurisdiction of the CEC. In addition to providing security expertise to the State of California, in August 2004, a team of experts led by Dr. Greenberg was awarded an 18-month contract by the State of Hawaii to update and improve the state's Energy Emergency Preparedness Plan and make recommendations for increased security of critical energy infrastructure on this isolated group of islands.

<u>Air Pathway Analysis</u>

Dr. Greenberg has prepared numerous Air Pathway Analyses and human health risk assessments, evaluating exposure at numerous locations in California, Hawai'i, Oregon, Minnesota, Michigan, and New York. He is experienced in working with Region IX EPA, the State of California DTSC, and the Hawai'i Department of Health Clean Air Branch in the application of both site-specific and non site-specific health risk assessment criteria.

Examples

Human Health Risk Assessment of Children's Exposure via the Air Pathway to Diesel Exhaust from School Buses (2007-2008)

Human Health Risk Assessment for the Open Burn/Open Detonation Operation at McCormick Selph, Inc., Hollister, Ca. (June 2003)

Air Quality and Human Health Risk Assessment for the Royal Oaks Industrial Complex, Monrovia, Ca. (January 2003)

Human Health Risk Assessment and Indoor Vapor Intrusion Assessment for the former Pt. St. George Fisheries Site, Santa Rosa, Ca. (October 2002)

Human Health Risk Assessment for the former Sargent Industries Site, Huntington Park, Ca. (July 2001)

Health Risk Assessment Due to Diesel Train Engine Emissions, Oakland, Ca. (June 1999)

The Avila Beach Health Study Phase 1: Reconnaissance Sampling Findings, Conclusions, and Recommendations. (July 1997) Volume 1: Baseline Human Health Risk Assessment. (May 1998)

The Avila Beach Health Study Phase 1, Volume 2: Environmental Monitoring. (May 1998)

Health Risk Assessment and Air Pathway Analysis for the Ballard Canyon Landfill, Santa Barbara County, Ca. (March 1999)

Human Health Risk Assessment, Teledyne Ryan Aeronautical, McCormick Selph Ordnance. Hollister, California. (December 1996)

Initial Phase Human Health Risk Assessment, Teledyne Inc., San Diego, Ca. (October 1996)

Human Health Risk Assessment for Current and Proposed Expanded Class II and Class III Operations at the Altamont Sanitary Landfill, Alameda County, Ca.
(March, 1993)

Focused Ecological Risk Characterization, Hawaiian Electric Company, Keahole Generating Station Expansion, Hawai'i (June 1993)

Human Health Risk Assessment for the Proposed Palima Point Space Launch Complex, prepared for the Hawai'i Office of Space Industry (April 1993)

Ecological Risk Assessment for the Proposed Palima Point Space Launch Complex, prepared for the Hawai'i Office of Space Industry (March 1993)

Human Health Risk Assessment Due to Emissions from a Medical Waste Incinerator, prepared for Kauai Veterans Memorial Hospital, Kauai, Hawai'i (1994)

Cancer Risk Assessment for the H-Power Generating Station, Campbell Industrial Park, Oahu, Hawai'i (1988)

Hazardous Materials Assessments, Waste Management Assessments, Worker Safety and Fire Protection Assessments, and Public Health Impacts Assessments

Dr. Greenberg also has significant experience as a consultant and expert witness for the California Energy Commission providing analysis, recommendations, and testimony in the areas of hazardous materials management, process safety management, waste management, worker safety and fire protection, and public health impacts for proposed power plant/cogeneration facilities. These analyses include the evaluation and/or preparation of the following:

- Off-site consequence analyses of the handling, use, storage, and transportation of hazardous materials,
- Risk Management Plans (required by the Cal-ARP) and Business Plans (required by H&S Code section 25503.5),
- Safety Management Plans (required by 8 CCR section 5189),
- Natural gas pipeline safety,
- Solid and hazardous waste management plans,
- Phase I and II Environmental Site Assessments,
- Construction and Operations Worker Safety and Health Programs,
- Fire Prevention Programs,
- Human health risk assessment from stack emissions and from diesel engines, and
- Mitigation measures to address PM exposure, including diesel particulates

Examples

- Almond 2 Power Plant Project, City of Ceres, Ca. 2009 – present. Public health.
- Watson Cogeneration Steam and Electric Reliability Project, Carson, Ca. 2009 – present. Public health.
- Hanford Combined-Cycle Power Plant (amendment), Kings County, Ca. 2008 – present. Public health.
- Henrietta Combined-Cycle Power Plant (amendment), Kings County, Ca. 2008 – present. Public health.
- Lodi Energy Center, Lodi, Cal. 2008 – present. Hazardous materials management, worker safety/fire protection.

- Marsh Landing Generating Station, City of Antioch, Ca. 2008 – present. Hazardous materials management, worker safety/fire protection.
- Palmdale Hybrid Power Plant, Palmdale, Ca. 2008 – present. Hazardous materials management, worker safety/fire protection, public health.
- Stirling Energy Systems Solar 1 Project, San Bernardino County, Ca. 2008 – present. Public health.
- Stirling Energy Systems Solar 2 Project, Imperial County, Ca. 2008 – present. Public health.
- San Joaquin Solar 1&2, Fresno County, Ca. 2008 – present. Hazardous materials management, worker safety/fire protection, public health.
- GWF Tracy Combined Cycle Power Plant, Tracy, Ca. 2008 – present. Hazardous materials management, worker safety/fire protection, public health.
- CPV Vaca Station Power Plant, Vacaville, Ca. 2008 – present. Hazardous materials management, worker safety/fire protection.
- Willow Pass Generating Station, Pittsburg, Ca. 2008 – present. Hazardous materials management, worker safety/fire protection, waste management.
- Avenal Energy Power Plant, Avenal, Ca. 2008 – 2009. Worker safety/fire protection, public health.
- Orange Grove Energy, San Diego County, Ca. 2008-2009. Public health.
- Riverside Energy Resource Center Units 3&4, Riverside, Ca. 2008 – 2009. Hazardous materials management.
- Canyon Power Plant, Anaheim, Ca. 2007 – present. Hazardous materials management, worker safety/fire protection, public health.
- Carlsbad Energy Center, Carlsbad, Ca. 2007 – present. Hazardous materials management, worker safety/fire protection, public health.
- Ivanpath Solar Electric Generating System, San Bernardino County, Ca. 2007 – present. Public health.
- Kings River Conservation District Community Power Project, City of Parlier, Ca. 2007 – 2009. Hazardous materials management, worker safety/fire protection.
- Chula Vista Energy Upgrade Project, Chula Vista, Ca. 2007 – 2009. Hazardous materials management, worker safety/fire protection.
- Chevron Richmond Power Plant Replacement Project, Richmond, Ca. 2007 – 2008. Hazardous materials management, public health.
- Humboldt Bay Generating Station, Eureka, Ca. 2006 – 2008. Hazardous materials management, worker safety/fire protection, waste management.
- El Centro Power Plant – Unit 3 Repower Project, El Centro, Ca. 2006 – 2007. Public health.
- San Francisco Energy Reliability Project, San Francisco, Ca. 2004 – 2006. Hazardous materials management, worker safety/fire protection, waste management, public health
- Inland Empire Energy Center, Romoland, Ca. 2002-3. hazardous materials, worker safety/fire protection, waste management, public health
- Malburg Generating Station Project, City of Vernon, Ca. 2002-3. hazardous materials, worker safety/fire protection, waste management, public health
- Blythe II, Blythe, Ca. 2002-3. hazardous materials, worker safety/fire protection,
- Palomar Energy Center, Escondido, Ca. 2002-3. hazardous materials, worker safety/fire protection, waste management, public health

- Cosumnes Power Project, Rancho Seco, Ca. 2002-3. hazardous materials, worker safety/fire protection, waste management, public health
- Tesla Power Project, Tesla, Ca. 2002-3. hazardous materials, worker safety/fire protection, waste management, public health
- San Joaquin Valley Energy Center, San Joaquin, Ca. 2002-3. hazardous materials, worker safety/fire protection, waste management
- Morro Bay Power Plant, Morro Bay, Ca., 2001-2: hazardous materials, worker safety/fire protection, waste management
- Potrero Power Plant Unit 7, San Francisco, Ca., 2001-2: hazardous materials, worker safety/fire protection
- El Segundo Power Redevelopment Project, El Segundo, Ca., 2001-2: hazardous materials, worker safety/fire protection, waste management
- Rio Linda Power Project, Rio Linda, Ca., 2001-2: hazardous materials, worker safety/fire protection, waste management, public health
- Pastoria II Energy Facility Expansion, Grapevine, Ca., 2001: hazardous materials, worker safety/fire protection
- East Altamont Energy Center, Byron, Ca., 2001-2: hazardous materials, worker safety/fire protection
- Magnolia Power Project, Burbank, Ca., 2001-2: hazardous materials, worker safety/fire protection, waste management, public health
- Russell City Energy Center, Hayward, Ca., 2001-2: hazardous materials, worker safety/fire protection, waste management
- Woodbridge Power Plant, Modesto, Ca., 2001: hazardous materials, worker safety/fire protection, waste management
- Colusa Power Plant Project, Colusa County, Ca., 2001-2: hazardous materials, worker safety/fire protection, waste management, public health
- Valero Refinery Cogeneration Project, Benicia, Ca., 2001: hazardous materials, worker safety/fire protection
- Ocotillo Energy Project, Palm Springs, Ca., 2001: hazardous materials, worker safety/fire protection
- Gilroy Energy Center Phase II Project, Gilroy, Ca., 2001-2: hazardous materials, worker safety/fire protection
- Los Esteros Critical Energy Facility, San Jose, Ca., 2001-2: hazardous materials, worker safety/fire protection, waste management, public health
- Roseville Energy Facility, Roseville, Ca., 2001-2: hazardous materials, worker safety/fire protection, waste management, public health
- Spartan Power, San Jose, Ca., 2001-2: hazardous materials, worker safety/fire protection, waste management, public health
- Inland Empire Energy Center, Romoland, Ca., 2001-2: hazardous materials, worker safety/fire protection, waste management, public health
- South Star Cogeneration Project, Taft, Ca., 2001-2: hazardous materials, worker safety/fire protection, waste management, public health
- Tesla Power Plant, Eastern Alameda County, Ca., 2001-2: hazardous materials, worker safety/fire protection, waste management, public health
- Tracy Peaker Project, Tracy, Ca., 2001-2: hazardous materials, worker safety/fire protection, waste management, public health

- Henrietta Peaker Project, Kings County, Ca., 2001: hazardous materials, worker safety/fire protection, waste management, public health
- Central Valley Energy Center, San Joaquin, Ca., 2001-2: hazardous materials, worker safety/fire protection, waste management, public health
- Cosumnes Power Plant, Rancho Seco, Ca., 2001-2: hazardous materials, worker safety/fire protection, waste management, public health
- Los Banos Voltage Support Facility, Western Merced County, Ca., 2001-2: waste management, public health
- Palomar Energy Project, Escondido, Ca., 2001-2: hazardous materials, worker safety/fire protection, waste management, public health
- Metcalf Energy Center, San Jose, Ca., 2000-1: hazardous materials
- Blythe Power Plant, Blythe, Ca., 2000-1: hazardous materials
- San Francisco Energy Co. Cogeneration Project, San Francisco, Ca., 1994-5: hazardous materials
- Campbell Soup Cogeneration Project, Sacramento, Ca., 1994: hazardous materials
- Proctor and Gamble Cogeneration Project, Sacramento, Ca., 1993-4: hazardous materials
- San Diego Gas and Electric South Bay Project, Chula Vista, Ca., 1993: hazardous materials
- SEPCO Project, Rio Linda, Ca., 1993: hazardous materials
- Shell Martinez Manufacturing Complex Cogeneration Project, Martinez, Ca., 1993: hazardous materials and review and evaluation of EIR

<u>Occupational Safety and Health/Health and Safety Plans/Indoor Air Quality</u>

Dr. Greenberg has significant experience in occupational safety and health, having directed the development, adoption, and implementation of over 50 different Cal/OSHA regulations, including airborne contaminants (>450 substances), lead, asbestos, confined spaces, and worker-right-to-know (MSDSs). He has conducted numerous occupational health surveys and has extensive experience in the sampling and analysis of indoor air quality at residences, workplaces, and school classrooms. He is currently the team leader conducting safety and security audits at power plants throughout California for the California Energy Commission. Safety issues audited include compliance with regulations addressing several safety matters, including but not limited to, confined spaces, lockout/tagout, hazardous materials, and fire prevention/suppression equipment.

Examples

Occupational Safety and Health Audit and Air Pathway Assessment for a Composting System at the Cold Canyon Landfill, San Luis Obispo County (2010)

Review and Evaluation of Public and Worker Safety Issues at the proposed SES LNG Facility, Port of Long Beach. prepared for the City of Long Beach. (November 2005)

Confidential safety and security audit reports for 18 power plants in California. prepared for the California Energy Commission. (January 2005 through March 2006)

Report on the Accidental release and Worker Exposure to Anhydrous Ammonia at the BEP I Power Plant, Blythe, Ca. prepared for the California Energy Commission. (October 2004)

Investigation of a Worker Death in a Confined Space, La Paloma Power plant. prepared for the California Energy Commission. (July 2004)

Preliminary Report on Indoor Air Quality in Elementary School Portable Classrooms, Marin County, Ca. (December 1999)

Health Risk Assessment Due to Diesel Train Engine Emissions, Oakland, Ca. (June 1999)

Air Pathway Analysis for the Ballard Canyon Landfill. Submitted to the County of Santa Barbara, (March 1999)

Review and Evaluation of the Health Risk Assessment for Outdoor and Indoor Exposures at the Former Golden Eagle Refinery Site, Carson, Ca. (May 1998)

The Avila Beach Health Study Phase 1: Reconnaissance Sampling Findings, Conclusions, and Recommendations. (July 1997) Volume 1: Baseline Human Health Risk Assessment. (May 1998)

The Avila Beach Health Study Phase 1, Volume 2: Environmental Monitoring. (May 1998)

Phase 2 Human Health Risk Assessment, Teledyne Inc., San Diego, Ca. (February 1997)

Determination of Occupational Lead Exposure at a Tire Shop in Placerville, Ca. (April 1993)

Development of an Environmental Code of Regulations for Hazardous Waste Treatment Facilities on La Posta Indian Tribal lands, San Diego County, Ca. (August 1992)

Sampling and Analysis Plan, Health and Safety Plan, Site Characterization of Lead Oxide Contaminated Areas, Mare Island Naval Shipyard, Vallejo, California. Prepared in conjunction with Kaman Sciences Corp. (September 2, 1988)

Mercury Contamination

Dr. Greenberg has prepared and/or reviewed several human health and ecological risk assessments regarding mercury contamination in soils, sediments, and indoor surfaces. Dr. Greenberg served on the State Water Resources Control Board Bay Protection and Toxic Cleanup Program Advisory Committee from 1994 until the end of the program in 1999.

Examples

Review and evaluation of a human health risk assessment of ingestion of sport fish caught from San Diego Bay and which contain tissue levels of mercury and PCBs (November 2004 – present)

Screening Human Health Risk Assessment, Calculation of Soil Clean-up Levels, and Aquatic Ecological Screening Evaluation, Galilee Harbor, Sausalito, Ca. (May 1998)

Health Risk Assessment for Residual Mercury at the Deer Creek Facility, 3475 Deer Creek Road, Palo Alto, California. (July 1997)

Human Health Risk Assessment Due to Emissions from a Medical Waste Incinerator, prepared for Kauai Veterans Memorial Hospital, Kauai, Hawai'i (1994)

DECLARATION OF
Mark Hesters

I, **Mark Hesters,** declare as follows:

1. I am presently employed by the California Energy Commission in the Engineering Office of the Siting, Transmission and Environmental Protection Division as a Senior Transmission Planner.

2. A copy of my professional qualifications and experience is attached hereto and incorporated by reference herein.

3. I helped prepare the staff testimony on **Transmission System Engineering** for the **Palen Solar Electric Generating System Final Staff Assessment,** based on my independent analysis of the Application for Certification and supplement hereto, data from reliable documents and sources, and my professional experience and knowledge.

4. It is my professional opinion that the prepared testimony is valid and accurate with respect to the issue addressed therein.

5. I am personally familiar with the facts and conclusions related in the testimony and if called as a witness could testify competently thereto.

I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge and belief.

Dated: 8/1/13 Signed: ______________________

At: Sacramento, California

Mark Hesters

916-654-5049
mark.hesters@energy.state.ca.us

Qualifications

- Analyzed the reliability impacts of electric power plants for nine years.
- As an expert witness, produced written and oral testimony in numerous California Energy Commission proceedings on power plant licensing.
- Expertise in power flow models (GE PSLF and PowerWorld), production cost models (GE MAPS), Microsoft word-processing, spreadsheet and database programs.
- Contributing author to many California Energy Commission reports.
- Represented the Energy Commission in the development of electric reliability and planning standards for California.

Experience

Senior Electrical Engineer

2005-Present California Energy Commission, Sacramento, CA

- Program manager of the transmission system engineering analysis for new generator Applications of Certification.
- Lead the development of transmission data collection regulations.
- Overhauled the transmission data adequacy regulations for the Energy Commission's power plant certification process.
- Participated in the analysis of regional transmission projects.
- Technical lead for Commission in regional planning groups.
- Energy Commission representative to the Western Electric Coordinating Council Operations Committee.

Associate Electrical Engineer

1998–2005 California Energy Commission, Sacramento, CA

- Lead transmission systems analyst for power plant licensing under 12-month, 6-month and 21-day licensing processes.
- Provided expert witness testimony on the potential transmission impacts of new power plants in California Energy Commission licensing hearings.
- Authored chapters for California Energy Commission staff reports on regional transmission issues.
- Studied the economics of transmission projects using electricity production simulation tools.
- Analyzed transmission systems using the GE PSLF and PowerWorld load flow models.
- Collected and evaluated transmission data for California and the Western United States

Electric Generation Systems Specialist

1990–1998 California Energy Commission, Sacramento, CA

- Lead generation planner for southern California utilities.
- Analyzed electric generation systems using complex simulation tools.
- Provided analysis on the impact of resource plans on air quality and electricity costs for California Energy Commission reports.
- Developed modeling characteristics for emerging technologies.
- Evaluated resource plans.

Education

1985–1989 University of California at Davis Davis, CA

- B.S., Environmental Policy Analysis and Planning

DECLARATION OF
Jeanine Hinde

I, **Jeanine Hinde,** declare as follows:

1. I am presently employed by the California Energy Commission in the Environmental Office of the Siting, Transmission and Environmental Protection Division as a Planner II.

2. A copy of my professional qualifications and experience is attached hereto and incorporated by reference herein.

3. I helped prepare the staff testimony on **Alternatives** for the **Palen Solar Electric Generating System Final Staff Assessment,** based on my independent analysis of the Application for Certification and supplement hereto, data from reliable documents and sources, and my professional experience and knowledge.

4. It is my professional opinion that the prepared testimony is valid and accurate with respect to the issue addressed therein.

5. I am personally familiar with the facts and conclusions related in the testimony and if called as a witness could testify competently thereto.

I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge and belief.

Dated: August 6, 2013 Signed: Jeanine Hinde

At: Sacramento, California

JEANINE M. HINDE

Professional Experience

Planner II **February 2010–Present**

California Energy Commission, Sacramento, CA

Environmental Office of the Siting, Transmission, and Environmental Protection Division

Generalist skilled in research and analysis and preparing environmental assessments for siting of a variety of power plant projects filed with the Energy Commission. Analyzes project-related impacts on land use, agricultural resources, and visual resources. Evaluates project conformance with applicable laws, ordinances, regulations, and standards. Preparing the visual resources analysis for the Huntington Beach Energy Project, a 939-MW natural gas-fired plant that is proposed to replace the AES Huntington Beach Generating Station. Preparing the alternatives analysis for a project proposed to amend the previously approved 500-MW Palen Solar Power Project and change the technology from one renewable solar thermal technology to another. Prepared the alternatives analysis for a proposed 500-MW solar power tower project in the eastern Mojave Desert. Prepared the land use analyses for a 159-MW geothermal power plant in Imperial County and a 174-MW electrical generating plant in Ceres.

Environmental Analyst and Project Coordinator **2004–2009**

EDAW-AECOM, Sacramento, CA

Coordinated preparation of environmental studies to satisfy the California Environmental Quality Act (CEQA) and the National Environmental Policy Act and related permitting and regulatory requirements. Contributed to the preparation of regulatory compliance documents for projects addressing flood protection, wastewater management, water quality, habitat restoration, and urban development. As an assistant project manager, contributed to the preparation, technical review, and distribution of a variety of environmental compliance documents for projects that included a levee repair project on the Feather and Yuba Rivers, a levee seepage project on the San Joaquin River near the Sacramento-San Joaquin Delta (Delta), a wastewater treatment plant improvement project in Atwater, and a habitat restoration project adjacent to the middle Sacramento River. As an analyst, prepared environmental impact analyses for resource topics that included land use; agricultural resources; visual/aesthetic resources; public services, utilities and service systems; hazardous materials; recreation; and geology, soils, and mineral resources. Prepared mitigation monitoring and reporting program documents and assisted with fulfilling CEQA noticing and filing requirements.

Environmental Analyst, Independent Consultant **2003–2004**

Sackheim Consulting, Fair Oaks, CA

Researched and wrote the aesthetics analyses for the CEQA documents on related neighborhood electrical distribution projects in the Natomas and Elkhorn areas of Sacramento. Prepared a similar analysis for a project in Elk Grove. Assisted with the analyses addressing potential impacts on cultural resources and issues related to hazards and hazardous materials.

Environmental Specialist II **1986–1997**

Jones & Stokes Associates, Sacramento, CA

Evaluated impacts on land use, visual resources, and recreation for several state and federal projects, including a water supply management program in the East Bay, a project addressing long-term management of resources in the Delta and Suisun Marsh, and a military operations project at Camp Roberts. Provided technical review and coordinated preparation of report sections prepared by staff, and assisted with research and documentation of required federal, state, and local permits and approvals for inclusion in regulatory compliance plans.

Education

B.A. Geography, California State University, Chico

DECLARATION OF
Chris Huntley

I, **Chris Huntley,** declare as follows:

1. I am presently employed by **Aspen Environmental Group** as a **Senior Biologist**.

2. A copy of my professional qualifications and experience is attached hereto and incorporated by reference herein.

3. I helped prepare the staff testimony on **Biological Resources** for the **Palen Solar Electric Generating System Final Staff Assessment,** based on my independent analysis of the Application for Certification and supplement hereto, data from reliable documents and sources, and my professional experience and knowledge.

4. It is my professional opinion that the prepared testimony is valid and accurate with respect to the issue addressed therein.

5. I am personally familiar with the facts and conclusions related in the testimony and if called as a witness could testify competently thereto.

I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge and belief.

Dated: August 6, 2013 Signed: Chris Huntley

At: **Agoura Hills, CA**

CHRISTIAN S. HUNTLEY

Senior Associate/Biological Group Manager, Southern California

Academic Background

Graduate Studies, Biology, California State University Northridge
BA, Biology, University of California at Santa Cruz, 1992

Professional Experience

Mr. Huntley has 15 years of experience with Aspen conducting CEQA/NEPA analysis to support large scale electrical transmission and energy projects. He has extensive local experience in the Mojave and Colorado Deserts working on several large scale infrastructure projects including solar thermal, photovoltaic, and electrical transmission lines. Mr. Huntley has worked as an extension of CDFW staff to address effects to Mohave ground squirrel, desert tortoise, and bighorn sheep in the Lucerne Valley and for a suite of sensitive resources in southern California. Mr. Huntley has broad experience conducting biological assessments, managing large-scale construction and restoration projects, and supporting agency clients with permitting tasks including compliance with California Department of Fish and Wildlife (CDFW) 1600 and 2081 permits, US Fish and Wildlife Service (USFWS) Section 7 process, Regional Board 401 compliance, and US Army Corps (Corps) 404 permits. Recently Mr. Huntley worked as a member of an interagency team with the BLM, CDFW, and USFWS to identify and approve mitigation lands for desert tortoise, fringe toed lizards, burrowing owls, and State Waters. Supported by a solid background in biology and a practical knowledge of BLM procedures, CEQA/NEPA, USDA Forest Service requirements, regulatory consultation, and over a decade of construction management experience; Mr. Huntley is able to prepare and develop effective CEQA/NEPA documents and maintain objectivity during the regulatory process. Some of the relevant projects Mr. Huntley has worked on are described below.

Aspen Environmental Group...1998-present

Energy Experience

- **Palen Solar Energy Project (formerly PSPP Project), California Energy Commission, Biologist (2013-present).** Mr. Huntley is preparing the desert tortoise, rare plant, state waters, and burrowing owl impact analysis for the 3,947 acre solar energy project located east of Palm Springs California.
- **Hidden Hills Solar Energy Generating Station, California Energy Commission, Biologist (2012-2013).** Mr. Huntley prepared sections of the the biological resources analysis of the Staff Assessment for this 3,700 acre solar energy project located in Inyo County, California. Key issues included burrowing owl, desert tortoise, bighorn sheep, golden eagles and migratory birds.
- **Calico Solar Project (formerly SES Solar One Project), California Energy Commission, Biologist (2009-2010).** Mr. Huntley prepared the biological resources analysis of the Staff Assessment/EIS for this solar energy project proposed by Calico Solar, LLC. The proposed project would be located in San Bernardino County and included the construction and operation of an 850 MW Stirling engine solar generation facility, which would include approximately 34,000 SunCatcher solar dish Stirling systems on approximately 8,230 acres. Key issues include potential impacts to desert tortoise, Mojave fringe-toed lizard, Nelson's bighorn sheep, burrowing owl, and golden eagle, as well as large-scale modifications to existing drainages and interference with regional wildlife movement.
- **Palmdale Hybrid Power Plant, California Energy Commission, Biologist (2009-present).** Mr. Huntley is preparing the biological resources analysis of the Staff Assessment for this power generation project proposed by the City of Palmdale. The proposed project would be located in northern Los Angeles County and includes the construction and operation of a 570 MW hybrid combined-cycle and solar thermal electrical generation facility, which would include an approximate 333-acre plant site and a

35.6-mile transmission line to connect the project to the existing Southern California Edison (SCE) Vincent Substation, as well as four pipelines to transport water, gas, and wastewater (ranging from 1.5 to 7.4 miles in length). Key issues include potential impacts to Swainson's hawk, desert tortoise, Mojave ground squirrel, and golden eagle.

- **Rice Solar Energy Project, California Energy Commission, Biologist (2009-2010).** Mr. Huntley is contributing to the biological resources analysis of the Staff Assessment/EIS prepared for this solar energy project proposed by Rice Solar Energy, LLC (a wholly owned subsidiary of SolarReserve, LLC). The proposed project would include a 150 MW solar generation facility consisting of up to 17,500 solar-tracking heliostats, a central tower, and associated infrastructure and appurtenant structures. The solar field site would be located on approximately 1,410 acres of privately owned land in eastern Riverside County. In addition, a 10-mile 230 kV generator tie-line would be constructed to interconnect the project with Western Area Power Administration's existing Parker-Blythe transmission line. The new transmission line would traverse lands primarily under the jurisdiction of the Bureau of Land Management (BLM). The new transmission line would also require the construction of a new 4.6-mile access road, also largely located on BLM lands. Key issues include potential impacts to desert tortoise and golden eagle, and potential impacts to birds in general from the solar technology.
- **Amonix Solar Energy Development, California Department of Fish and Game, Biologist (2012).** Mr. Huntley worked as an extension of CDFG (CDFW) staff for this photo voltaic energy project in the Lucerne Valley. Formerly the Chevron Energy project; work on this facility was suspended in 2012.
- **Emergency Siting Team Power Plant Development, California Energy Commission, Compliance Project Manager.** For two years, Mr. Huntley's duties included management of technical staff for the completion of CEQA equivalent environmental permitting for over nine new emergency power plants, review of applicant submittals, drafting of Memoranda of Understanding with Chief Building Officials, conducting audits of building officials, and coordinating with affected agencies to resolve concerns with potential resource impacts. Other duties included maintaining contractor construction milestones, compliance monitoring and reporting, development of mitigation measures and conflict resolution for power plant compliance issues.
- **Coastal Power Plant Study, California Energy Commission, Deputy Project Manager/Biologist.** Mr. Huntley conducted biological surveys at 21 coastal power plants as part of the Energy Commission's coastal power plant study. Site visits characterized habitat within the footprint of the power plant, landscaping, and identified potential environmental and permitting issues associated with potential expansion of the power plants.
- **Hydroelectric Power Plant Inventory Study, California Energy Commission, Deputy Project Manager/Natural Resources Analyst.** Mr. Huntley coordinated a team that collected power and environmental data on over 200 hydroelectric power plants located in California. Physical power data included electrical output, system upgrades, water storage capacity and peaking availability. Environmental information included developing a data base addressing sensitive species issues, fish screens and ladders, monitoring parameters and a map of known hydroelectric facilities and barriers to anadromous fish passage. Mr. Huntley also obtained water use information on thermal power plants in support of the Energy Commission's bi-annual environmental performance report.
- **Topaz Solar Farm EIR, San Luis Obispo County, Issue Area Coordinator/Biologist (2009-2011).** Mr. Huntley served as the issue area coordinator for natural resources on this solar energy project proposed by Topaz Solar Farms, LLC (wholly owned by First Solar, Inc.). The proposed project would consist of a 550 MW solar photovoltaic energy generating facility on approximately 6,200 acres in the Carrizo Plain area of eastern San Luis Obispo County. Key issues included potential impacts to San Joaquin kit fox, jurisdictional drainages, vernal pools, rare plants, and nesting birds.

- **California Valley Solar Ranch EIR, San Luis Obispo County, Issue Area Coordinator/Biologist (2009-2011).** Mr. Huntley served as the issue area coordinator for biological resources on this solar energy project. The proposed project involved construction and operation of a 250 MW photovoltaic solar power plant in the unincorporated portion of eastern San Luis Obispo County. The project would be owned by High Plains Ranch II, LLC, a wholly owned subsidiary of SunPower Corporation Systems. A 3.5-acre substation and approximately 2.5 miles of 230 kV transmission would be required to connect to the existing Pacific Gas and Electric (PG&E) Midway to Morro Bay 230 kV transmission line. The project is one of two solar power plants proposed in the Carrizo Plain. Key issues include potential impacts to San Joaquin kit fox, blunt-nosed leopard lizard, and giant kangaroo rat.
- **Panoche Valley Solar Farm EIR, County of San Benito, Biologist (2010-present).** Mr. Huntley is technical support for this large-scale solar energy project. The proposed project would consist of a 420 MW solar energy generation facility on approximately 4,717 acres in the Panoche Valley of southeastern San Benito County. The facility would consist of 1,822,800 solar photovoltaic panels and associated infrastructure. Key issues include potential impacts to California tiger salamander, blunt-nosed leopard lizard, San Joaquin antelope squirrel, giant kangaroo rat, San Joaquin kit fox, San Joaquin coachwhip, mountain plover, golden eagle, northern harrier, burrowing owl, loggerhead shrike, and American badger. In addition, suitable habitat for the following special-status species exists at the project site: vernal pool fairy shrimp, Swainson's hawk, western spadefoot, California horned lizard, merlin, pallid bat, and western mastiff bat.
- **Pacific Wind Energy Project EIR, Kern County, Biologist (2009-2010).** Mr. Huntley oversaw the preparation of the biological resources analysis of this EIR evaluating a proposed 250 MW wind energy generation facility in the Mojave region of Kern County. The proposed project would be located on approximately 8,300 acres in the Tehachapi Wind Resource Area. Key issues include potential impacts to birds and bats from the wind turbines as well as potential impacts to desert tortoise, California condor, Swainson's hawk, and golden eagle.
- **Alta–Oak Creek Mojave Project EIR, Kern County, Biologist (2008-2009).** Mr. Huntley oversaw the preparation of the biological resources analysis of this Initial Study and EIR evaluating a proposed 800 MW wind development in the Tehachapi Wind Resource Area. The proposed project site consists of three distinct land areas comprising a total of approximately 10,750 acres. Key issues include potential impacts to birds and bats from the wind turbines as well as potential impacts to desert tortoise, California condor, Swainson's hawk, golden eagle, and Bakersfield cactus.

Transmission Line Experience

- **Downs Substation and Transmission Line Project IS/MND, California Public Utilities Commission (2010-present), Issue Area Coordinator/Biologist.** Mr. Huntley acted as issue area coordinator for biological resources on this transmission line upgrade to be completed by Southern California Edison in the Mojave Desert. Key issues included desert tortoise, Mohave ground squirrel, and burrowing owls. Portions of this project span lands administered by the BLM.
- **Devers–Palo Verde Transmission Line Project No. 2 EIR/EIS, California Public Utilities Commission (CPUC)/Bureau of Land Management (BLM), Issue Area Coordinator/Biologist (2005-present).** Mr. Huntley acted as issue area coordinator for biological resources on this 230-mile 500 kV transmission line upgrade to be completed by SCE. This project crosses key wildlife areas including the KOFA Wildlife Sanctuary, the San Bernardino National Forest, the Mojave and Sonoran Desert habitats, and sections of the Riverside Multiple Species Conservation Area. Currently, Mr. Huntley is supporting the biological monitoring team responsible for implementing CPUC and BLM monitoring requirements during construction of the project.

- **Tehachapi Renewable Transmission Project, CPUC/US Forest Service, Issue Area Coordinator/Biologist (2007-present).** Mr. Huntley is acting as the issue area coordinator and principal author for biological resources on this 500 kV transmission line project proposed by SCE in support of wind energy projects. This transmission line is 173 miles in length and includes two separate segments that cross the Angeles National Forest (ANF). Some of the key issues on this project include potential impacts to Mojave ground squirrel, desert tortoise, arroyo toads, California condors, spotted owl, and a host of forest sensitive plant and wildlife species. As part of the project, Mr. Huntley mapped over 190 riparian related features and completed extensive surveys of the ANF. Mr. Huntley managed an extensive biological staff and organized the completion of comprehensive botanical surveys for the proposed right-of-way. Other key issues involve the coordination with State Park, Forest Service, and resource agency staff.
- **Antelope Transmission Project, Segments 2 & 3 EIR, CPUC/US Forest Service, Issue Area Coordinator/Biologist (2006-2011).** Mr. Huntley acted as issue area coordinator for biological resources on this 500 kV transmission line proposed by SCE in support of wind energy projects. Key issues on this project include potential impacts to Mojave ground squirrel, California red-legged frog, burrowing owl, and rare plants. As part of this project, Mr. Huntley conducted focused surveys for arroyo toads and coordinated ESA compliance with the USFS and USFWS. As part of the project Mr. Huntley completed the BE/BA to comply with the provisions of the ESA and the Management Indicator Species Report for ANF compliance. Currently, Mr. Huntley provides technical assistance to monitoring staff.
- **El Casco Sub-Transmission Project EIR, CPUC, Issue Area Coordinator/Biologist (2006-present).** Mr. Huntley acted as issue area coordinator for biological resources and completed the impact analysis section of the EIR for this 17-mile sub-transmission line upgrade to be completed by SCE. This line is located in the Western Riverside Multiple Species Conservation Area and crosses areas supporting several federally protected species including least Bell's vireo, southwestern willow flycatcher, and Stephens' kangaroo rat. Currently, Mr. Huntley provides technical assistance to monitoring staff.
- **Antelope-Pardee Transmission Project EIR/EIS-BE/BA, CPUC/US Forest Service, Issue Area Coordinator/Biologist (2005-2010).** Mr. Huntley was the issue area coordinator for biological resources on this 500 kV transmission line upgrade to be completed by SCE. Key issues on this project included compliance with the US Forest Service Forest Plan and sensitive species including California condor, burrowing owl, and rare plants. Mr. Huntley reviewed and prepared the Biological Resource Section for the EIR/EIS, developed project alternatives, coordinated with Forest Service staff, and conducted sensitive species surveys for arroyo toad in support of this project. Currently, Mr. Huntley provides technical assistance to monitoring staff.
- **SCE Valley-Auld Power Line Project, CPUC, Environmental Monitor.** Conducted inspections of construction of this 11-mile power line upgrade for compliance with the project's Mitigated Negative Declaration mitigation measures and compliance plans. Other tasks included review of pre-construction compliance materials, maintaining inspection documentation, and coordination with SCE and its subcontractors.
- **Sunset Substation IS/MND and Biological Site Assessment, City of Banning, Biologist (2006-2007).** Mr. Huntley prepared the biology section of the IS/MND as a subcontractor to R. W. Beck. In addition, Mr. Huntley conducted burrowing owl surveys and managed surveys for Los Angeles pocket mouse at select locations along the proposed right-of-way.
- **Viejo System Project IS/MND, CPUC, Biologist.** Conducted biological surveys and completed the biological section of the Initial Study and Mitigated Negative Declaration for SCE's transmission line upgrade project.

Pipeline Experience

- **Santa Fe Pacific Pipeline, CPUC, Environmental Monitor.** Inspected construction of three petroleum distribution station sites for compliance with approved project mitigation measures and compliance plans.
- **Line 401 PG&E Redwood Expansion Project, CPUC, Lead Environmental Monitor.** Under contract to the CPUC, Mr. Huntley acted as Lead Environmental Monitor and supervised two environmental monitors in the field on the implementation of the CPUC's conditions of approval for construction of this 14-mile natural gas pipeline. Responsibilities included: supervision, guidance and development of environmental monitors, onsite field monitoring, compliance review and mitigation development of pre-construction plans, and mitigation compliance documentation. Other duties included review of variance and temporary extra work space (TEWS) requests; recommendations for CPUC issuance of Notices to Proceed with construction and variance approvals; approval of TEWS requests; preparation of weekly reports for all monitoring activity; and coordination with PG&E, construction managers and subcontractors, local municipalities, affected and interested agencies and the public.
- **Horsethief Creek Road Repairs Project, IS/MND and Biological Assessment, California Department of Water Resources, Biologist/Project Manager (2005-2009).** Mr. Huntley prepared the biological resource section and managed the completion of the IS/MND and the BA for construction of an all weather road at Horsethief Creek located near Lake Silverwood in San Bernardino County. Mr. Huntley also assisted DWR through formal consultation with the USFWS. The project was intended to provide an all-weather access to DWR facilities while avoiding impacts to federally endangered arroyo toads. Mr. Huntley also managed and conducted several of the sensitive species surveys required for this project including arroyo toad, two-striped garter snake, and southwestern pond turtles. Mr. Huntley managed the monitoring efforts at the site to comply with permit regulations identified by the Biological Opinion.

NEPA Experience

- **Littlerock Dam and Reservoir Restoration Project EIR/EIS-BE/BA, Palmdale Water District/US Forest Service, Deputy Project Manager/Biologist (2004-present).** Mr. Huntley is currently acting as deputy project manager and project biologist for the sediment removal activities associated with the Littlerock Dam and Reservoir in the ANF. Mr. Huntley is working to develop project alternatives for sediment disposal while avoiding impacts to federally endangered arroyo toads. Mr. Huntley is managing the sensitive species surveys for this project and completing the biological resources section of the EIR/EIS, Management Indicator Species Report, and BE/BA.
- **Newhall Ranch Project, California Department of Fish and Game, Biological Coordinator and CDFG Reviewer (2005-2009).** Mr. Huntley provided biological expertise and assisted CDFG staff in reviewing and revising the EIR/EIS for the proposed 6,000-acre Newhall Development Plan EIR/EIS in Santa Clarita. Primary issues concern the land use conversion of several thousand acres of wild lands and agricultural areas located in and adjacent to the Santa Clara River. This region is known to support numerous threatened and endangered species including least Bell's vireo, southwestern willow flycatcher, California condor, arroyo toad, unarmored three-spine stickleback, and San Fernando Valley spineflower. Other concerns associated with the development include wildlife movement corridors, and effects to riparian habitats. Mr. Huntley reviewed, commented and revised the environmental documents, scheduled and coordinated meetings with resource professionals and agency staff, and provided technical review of the document. Mr. Huntley will be assisting CDFG staff in the response to comments on the Draft EIR/EIS.

- **Matilija Dam Ecosystem Restoration Project EIR/EIS, US Army Corps of Engineers, Biologist.** Mr. Huntley conducted biological surveys and assisted in the completion of the EIS/EIR to assess impacts to sensitive biological resources located on Matilija Creek and the Ventura River downstream of the of the Matilija Dam. The analysis focused on potential impacts associated with dam removal on sensitive species known to occur on the Ventura River and the beneficial impacts of the restoration of spawning territory for the endangered Evolutionary Significant Unit of Southern Steelhead.
- **Fort Irwin Environmental Baseline Survey Reports, US Army Corps of Engineers, Project Manager/Biologist (2005).** Mr. Huntley managed the preparation of two Environmental Baseline Survey reports near Fort Irwin, San Bernardino County to support the land acquisition of over 95 parcels by the US Army for the Fort Irwin National Training Center. Mr. Huntley conducted site investigations, documented existing biological conditions and managed the preparation of the report.

Selected Technical Experience/Training and Certifications

- SWPPP trained 2006
- California Energy Commission Outstanding Performance Award, 2001
- CDFG Scientific Collecting Permit for pond turtle and garter snake.
- Certified Caltrans Horizontal Directional Drilling Inspector 2001
- Desert Tortoise Handling Workshop, Ridgecrest, California 2001
- CEC Expert Witness Training 2001
- Railroad Right-of-Way Safety Training 2002
- Small boat handling, licensed and certified since 1993
- Research Scuba-diving certification and training since 1989

DECLARATION OF
Gregg Irvin, Ph.D.

I, **Gregg Irvin**:

1. I am presently employed by Spectrus, Ltd. As the President.
2. A copy of my professional qualifications and experience is attached hereto and incorporated by reference herein.
3. I helped prepare the staff testimony on **Traffic and Transportation** and **Visual Resources** for the **Palen Solar Electric Generating System,** based on my independent analysis of the Application for Certification and supplements hereto, data from reliable documents and sources, and my professional experience and knowledge.
4. It is my professional opinion that the prepared testimony is valid and accurate with respect to the issue addressed therein.
5. I am personally familiar with the facts and conclusions related in the testimony and if called as a witness could testify competently thereto.

I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge and belief.

Dated: 07/31/2013 Signed: Gregg Irvin

At: Sacramento, California

July 2013

GREGG E. IRVIN, PH.D.
3731 Blossom Heath Road
Dayton, OH 45419
937-271-2715

EMPLOYMENT

2005-Present President, Spectrus, Ltd.
1996-2005 Principal Partner and Director of Operations, Mobium Enterprises, Inc.
1994-1997 Executive Director, Assistive Technologies Group
1996-2000 Employee Consultant, National Security Studies and Strategies Group, Science Applications International Corporation (SAIC), McLean, VA.
1993-1996 Assistant Vice President, SAIC, Dayton, OH.
1995-1996 Division Manager, Human Systems Technology Division, SAIC
1992-1995 Division Manager, Aerospace Systems Division, SAIC
1990-1991 Chief Scientist, Human Performance Technology Division, SAIC
1989-1990 Senior Scientist, Human Performance Technology Division, SAIC
1986-2000 Director, ICON Consultants, Birmingham, AL & Dayton, OH.
1985-1989 Senior Research Scientist, Systems Research Laboratories, Dayton, Ohio.
1984-1985 Visual Neurophysiologist, Vision Science Research Center, University of Alabama Medical School at Birmingham.

EDUCATION

1982-1984 National Eye Institute, Postdoctoral Fellow, Electrophysiology, Vision Science Research Center, School of Optometry, University of Alabama Medical School at Birmingham.
1981-1982 Postdoctoral Research Associate, Visual Neurophysiology, Department of Physiological Optics, School of Optometry, University of Alabama Medical School at Birmingham.
1981 Ph.D. Physiological Psychology, Syracuse University.
1976 B.A. Psychology, Syracuse University.

AWARDS/FELLOWSHIPS/DISTINCTIONS

1995-2003 Adjunct Faculty, Department of Biomedical and Human Factors Engineering, Wright State University, Dayton, OH.
1982-1984 National Eye Institute, Individual National Research Service Award
1979 Behavioral Neurobiology Scholarship, Cold Spring Harbor Research Laboratory, Syracuse University School of Engineering, Institute for Sensory Research.
1978-1980 Graduate Fellowships in Biopsychology (two awards), Syracuse University.
1977-1978 Graduate Fellowship in Physiological Psychology, Syracuse University.
1976-1977 Research Associate, Visual Psychophysics Laboratory, Syracuse University.

PROFESSIONAL SUMMARY

Dr. Irvin is a sensory neurophysiologist/ psychologist with a multidisciplinary background in visual science related fields including; applied experimental psychology, sensory perception, visual physiology and psychophysics, human systems interface, advanced image processing, human information processing, human perception and performance, mathematical visualization, neurobiology and human factors engineering.

Dr. Irvin is president of Spectrus, Ltd. Spectrus is a diversified small business providing services in engineering, human factors, neuroscience, physics, chemistry and life sciences. Spectrus develops advanced sensing technologies for indirect view multispectral and hyperspectral applications, which incorporate proprietary spectral mapping principles and (active and passive) frequency agile sensing capabilities. Spectrus also provides sensory modeling, image understanding, computational vision, specialized spectral sampling applications, advanced Human-System Interface development, and multidisciplinary sensing strategy services.

Dr. Irvin has strong leadership and managerial skills with a record of success in leading major research and development programs. This includes Air Force Research Laboratory programs developing physiologically based computer vision systems (stereovision, detection, and texture generation), low-observable technologies, and multispectral adaptive and passive camouflage, concealment and deception technologies. Efforts include developing and interfacing both head-steerable and advanced helmet mounted displays with integrated multisensor fusion capabilities for strategic aircraft, developing imaging architectures, information visualization technologies, and display technologies incorporating specialized chromatic, motion, and texture processing. Contributions to visual science include a model of developmental amblyopia, various models of human visual detection, studies of information transfer to primate visual cortex, and structure-function studies of neuronal morphology and visual information processing. Dr. Irvin's experience and qualifications span basic and applied advanced research and development, and technology transfer and application. Dr. Irvin has been featured in National Geographic "The Sense of Sight" and in a PBS NOVA documentary "The Disguises of War."

EMPLOYMENT EXPERIENCE

Spectrus, Ltd. (2005-Present)

President, Spectrus, Ltd. is an Ohio based Limited Liability Company established in January 2005 and provides consulting services to Government and industry. Dr. Irvin is the president and sole partner in Spectrus, Ltd. Spectrus represents a reorganization of Mobium Enterprises, Inc. and Mobium, Inc., for which Dr. Irvin was the president of both.

Representative Research and Development Efforts at Spectrus: Note: Multiple program summaries deleted due to classification issues.

***Security Lighting Development Program*.** (2011-). Consultant to Acuity Brands Lighting, Inc., Northeast Innovation Center (NEIC) for the development of RGB LED lighting hardware, software and supporting algorithms for visual, physiological and psychological disruption and disabling human performance effects. Lead developer for strategic architecture design and disruptive algorithm development to support a modular and adaptable security lighting system for a variety of industrial and government applications.

Solar Power Plant Develop for the California Energy Commission. (2010-). Providing analytic and modeling support to Traffic and Transportation, Visual Resources, and Biological Resources for the assessment of the visual impacts of heliostat mirror fields and solar power towers for proposed Solar Electric Generation Facilities (SEGF). Ongoing and past research includes determining the magnitude of visual and thermal effects (e.g., glint, glare, aesthetics, avian mortality), their level of significance, and the development of potential mitigating procedures for the proposed Calico, Rio Mesa, and Hidden Hills SEGFs.

Raytheon CV-22 Helmet Mounted Display. (2011) Subcontract to Raytheon for proposal development and review for the Boeing Defense Space and Security Division CV-22 Helmet Mounted Cueing System (HMCS). Activities included HDM architecture and functional capabilities for HMD interfaces, processing and control equipment, NVG capability, resolution, field of view, eye relief and exit pupil, display brightness and internal contrast ratios, luminance uniformities, and helmet tracking, slew and acceleration rates, latency and readout stability.

Mobium Enterprises, Inc. (1996-2005)

Principal partner, Director of Operations of Mobium Enterprises, Inc. Mobium is an Ohio C Corporation headquartered in Dayton, with offices in Alabama, Colorado, Massachusetts and New York. Mobium is active on local, state and national levels promoting strategic alliances between and among academe, industry, and government for the development of seminal technologies to enhance human perception and performance. Mobium seeks to reveal broader markets for the commercialization of human-systems technologies by emphasizing common needs and by emphasizing flexible modular technology that can be adapted to meet a variety of needs. Mobium is actively involved in a variety of joint technology development initiatives.

Mobium commercialization ventures include: a) a patented and licensed fluid jet array technology to reduce fluid precursor requirements to prepare thin films in semiconductor manufacturing, b) a differential ultra-violet filter technology (patent pending) for fabrication into optical filters using liquid and polymeric hosts, c) SWIFT – Stored Waveform Inverse Fourier Transform software package for the design of gradient index optical filters (patent in process), d) a plasma based ultra-thin film corrosion-inhibiting primer coating technology for stainless steel and aluminum to replace toxic chromium primer techniques (joint development venture in process). Additionally, Mobium is engaged in a software development project entitled MathWeb™. MathWeb™ is a Java-based tensor analysis and display package that is designed to run on distributed and heterogeneous networks and parallel computers.

Mobium provides expertise in advanced optical design and the analysis of multispectral imagery. Principals of Mobium have served as consultants to the U.S. Air Force on advanced human-system interfaces, and man-machine integration. Mobium personnel also have designed camouflage for the U.S. and European Armies and are aware of a broad range of programs sponsored by the DoD, NASA, DARPA, and other agencies concerned with the acquisition and interpretation of multispectral imagery. Mobium has developed a suite of sequential algorithms for enhancing the visualization and display of complex data sets and has examined the human factors that constrain the performance of integrated sensor suites in Uninhabited Aerial Vehicles.

Dr. Irvin's focus within Mobium is on the development of advanced sensing capabilities to facilitate human perception and performance. Dr. Irvin specializes in information extraction and enhancement through the application of advanced spectral sampling methodologies and the subsequent information transformation and representation for specialized human-in-the-loop applications.

Representative Research and Development Efforts at Mobium: Note: Multiple program summaries deleted due to classification issues.

Human-Systems Technology For Uninhabited Aerial Vehicle (UAV) Ground Stations. Provided support to Air Force Armstrong Laboratory Phase I SBIR program (AL/CF). The approach is based on a structured methodology for the development and commercialization of human-systems technology. The Technical Objectives are to: (1) identify human-systems interfaces (HSI) and virtual-reality (VR) technologies that require development to ensure the maturity necessary for a UAV VR control station or center, (2) propose a UAV VR concept demonstration supporting intelligent aiding, decision support, and mission management flexibility, and (3) identify issues and design tradeoffs involving human performance variables and VR properties.

Unmanned Combat Air Vehicle (UCAV) Program Support. Program Manager. Provided support to Raytheon E-Systems as a team member within the UCAV Ground Segment IPT to enhance the Unmanned Combat Aerial Vehicle (UCAV) IRAD project execution. Support focused on the: 1) study, analysis, identification and development of advanced Human Systems Interface (HSI) and Human Computer Interaction (HCI) functionality segmentation, 2) the inclusion of Automated Decision Aids to support HSI and HCI, and 3) analysis and identification of relevant technology domains pertinent to HSI technology insertion related to the UCAV Ground Station. Mobium provided trade study documents and support to the various Program Milestone and Technical Interchange Meetings.

Collaborative Commercialization, Research and Development Efforts with Syracuse University:

Dr. Irvin managed Mobium Enterprises extensive joint relationship with the Scalable Concurrent Programming (SCP) Laboratory at Syracuse University (SU) for technology development and commercialization through technology transfer. From 1999-2002 Mobium engaged in a variety of collaborative research and development programs with SU that include Distributed Real-Time Sensors Project and the Information Resiliency: Strategic Concepts for Assurance and Recovery Project. As a result of these collaborations Mobium maintained an office at the Syracuse University CASE (Computer Applications and Software Engineering) Center providing support to the SU research team on a daily basis. A brief description of the joint SU-Mobium initiatives and the resulting commercial technologies are as follows:

Distributed Real-Time Sensor Fusion. Project Manager. In a collaborative research effort with the SU-CASE center investigated the use of multiple sensors to increase the capability of intelligent system dealing with multi-sensor fusion and integration (MFI). Mobium developed distributed spectral-screening PCT algorithms for fusing hyper-spectral images in remote sensing applications. The algorithms provided intrusion tolerance from information warfare attacks using the framework of computational resiliency. Dynamically regenerative replication algorithms were integrated with replication-based fault tolerance mechanisms to respond to intrusion attacks and system failures. The utilization of application independent library technologies masked the details of communication protocols required to achieve dynamic replication and reconfiguration in distributed applications.

Computational Resiliency, Heterogeneous Reliable Applications. Project Manager. In conjunction with the Center for Systems Assurance (CSA) and the Computer Applications and Software Engineering Center at Syracuse University this initiative investigated the development of distributed computing systems to provide fault-tolerance through group communication based active replication, automatic reconfiguration and recovery from the attacks and failures, and load balancing over heterogeneous resources. The research focused on intrusion detection, high-confidence design, network security, information assurance, computer forensics, process migration, split/merge of processes, and camouflage techniques to achieve reasonable resiliency goals within defined predictive analytical models of performance assessment.

Remote Sensing Multispectral Image Exploitation. This joint initiative involves the development of advanced parallel algorithms and display technologies to facilitate the real-time data acquisition and exploitation of multispectral image streams. The resulting technology suite, currently in the final stages of development for proof-of-concept demonstration, provides the basis for commercial products to support various terrestrial and airborne remote sensing applications (e.g., land resource management, agricultural and crop monitoring, military target identification), and medical applications (e.g., multispectral endoscopy and ophthalmology). This initiative involves the development of: a) adaptive temporal-spectral real-time multispectral image acquisition, b) optimized real-time decorrelation and compression algorithms, c) advanced human-system interface for physiologic information bandwidth optimization, and d) the development of supporting distributed and concurrent computer architectures. A multispectral image exploitation algorithm suite is currently under development to support the Spectral Embedding Methodologies R&D Program for the development of next-generation sensor hardening for direct and indirect-view airborne military optical systems.

Cyber-Eye™ Multispectral Camera Systems. A natural outgrowth of the collaboration for multispectral image exploitation was the development of a multispectral imaging camera system to support laboratory and field data acquisition. The result was the design and development of a family of high-speed digital multispectral imaging systems supported by high performance multiprocessing. The Cyber-Eye camera series includes multispectral digital imaging systems capable of real-time 12 spectral band image acquisitions and processing at 120 frames per second. The commercialization of these systems is in process. A Cyber-Eye system was developed for the Air Force to support the Spectral Embedding Methodologies program referenced above.

MathWeb™. MathWeb is a tensor-based applications development product specifically designed to support distributed concurrent and heterogeneous computing environments. This commercial product has been used in a variety of government and industry applications. One such application in the final development stages is an integrated suite of image processing tools for real-time processing of multispectral and hyperspectral sensor data, image exploitation, and unique visualization techniques for human-system interface. Both the Cyber-Eye Multispectral Camera Systems and I-STORM incorporate MathWeb as the basis operating system.

Assistive Technologies Group (1994-1996)

ATG develops consortia and strategic alliances, and serves as a technology and information broker to support biobehavioral technology transfer initiatives.

Dr. Irvin founded and served as executive director of the Assistive Technologies Group (ATG). ATG's mission is to develop and transition advanced federal technologies to a sustainable national industrial capability within the commercial market of assistive technologies for Americans with disabilities. As a not-for-profit company, ATG served to promote and participate in research on limitations to human perception and performance that are due to disabling physiological or environmental conditions, and, promote and participate in the development of technology that can restore or enhance otherwise impaired human perception and performance. ATG nurtured links between research and technology development by promoting biobehavioral research that is commensurate with engineering descriptions and specifications. ATG is active on local, state and national levels to promote strategic alliances between academe, industry and government to develop seminal technologies that can identify or ameliorate biomedical constraints on human behavior. ATG has established a Memorandum of Agreement

(MOA) with the Federal Laboratory Consortium for Technology Transfer, Midwest Region (FLC-MW) to define and translate assistive technology requirements, identify and select federal technologies for transfer, and, to develop, prototype and produce assistive technologies that are economically viable and commercially sustainable. ATG is a member of the FLC-MW Roundtable and serves as the Internet Gatekeeper for technology transfer for assistive technologies.

Past Research and Development Efforts at ATG:

Needs Assessment for Federal Technology Transfer for Individuals with Developmental Disabilities. Project Manager. State Grant Plan 95-6 Ohio Department of Mental Retardation and Developmental Disabilities, Ohio Developmental Disabilities Planning Council (ODDPC). This effort seeks to expand the technological solutions to selected problems encountered by individuals with disabilities. End user requirement assessments and technology evaluations are conducted to produce descriptions of abilities and disabilities in a classification framework that can provide appropriate requirement-technology linkages. Mechanisms of translation are applied between engineering and biobehavioral domains for the analysis of specific functional life activities and the selection of potential supporting technologies. The approach seeks to reveal how common dimensional descriptions of both human and system capabilities and limitations can facilitate purposeful technology synthesis. The approach will demonstrate how a variety of technologies and their combination can produce a general purpose and modular technology bundle that can be easily adapted to special purpose device implementations that fulfill a variety of functional activities and achieve maximum population inclusion.

Ohio Initiative in Human Systems Technology. Project Manager. State Grant Tech-96-035 Ohio Department of Development, Ohio Science and Technology Council (ODOD/OSTC). This effort developed support for a center of excellence for the advancement of the emerging industry of assistive human-systems technology and seeks to establish the State of Ohio on the leading edge of this industry. The Human Systems Technology Center would provide business access to state-of-the-art biobehavioral research and technology performed in-house or obtained through linkages with federal laboratories, universities and other institutions; provide access to education and training programs, conferences, seminars and other networking opportunities; and provide access to services that reveal the biobehavioral needs of the general population and that translate these needs into commensurate technology solutions. Activities include the identification of; the needs and market for human-systems technology; the resources for human-system technology development; mechanisms for matching needs and resources in human-systems technology, and; government, industry and academic partners.

Employee Consultant, Science Applications International Corporation (1996-2000)

Provided consulting services to the National Securities Studies and Strategies Group at SAIC, McLean, VA. Corporate support includes business development, facilitating inter-corporation strategic alliances, developing marketing strategies and supporting various marketing initiatives. Technical support is also provided to select programs. A recent program win included the Crew Centered Design Technology (CCDT) Advanced Development Project at AFRL/HE

Past Employee Consulting Efforts at SAIC:

Sensor Support to Special Operations Forces. Provided support to the Defense Advanced Research Projects Agency, Sensor Technology Office (DARPA/STO) for the identification of advanced sensor technologies to support the Special Operations Commands. As the lead for sensor technology assessment and applications support was provided to define current sensor capabilities and limitations across the full spectrum of available and in-development sensing technologies. The program goal was the identification of advanced sensing technologies that can facilitate the mission requirements of the Air Force, Army, Navy, Marine, and Joint Special Operations Forces.

NATO Special Group of Experts in Camouflage, Concealment and Deception. Provided invitational support to NATO AC/243, Special Group of Experts in Camouflage, Concealment and Deception (SGE/CCD), Working Group A: Measurements and Backgrounds, for the conduct of a three year multi-national program entitled "Background Characterization for Camouflage Pattern Development." Program support was provided for: the development of multispectral camouflage patterns that accurately replicate background texture, the identification of US multispectral camouflage capabilities, test site selection and characterization metrics, test design and performance evaluation metrics, and test conduct to the Chairman of NATO AC/243 SGE/CCD WG-A at the US Army CECOM, Research Development & Engineering Center, Night Vision & Electronic Sensors Directorate (AMSEL-RD-NV-CD-CCD).

Survivability Integration (SURVINT) - Force Survivability and Weapons of Mass Destruction. Provided support to the Defense Special Weapons Agency (DWSA), Electronic Systems Directorate, Survivability Assessments Division for the integration of DWSA research efforts to maximize the survivability of US forces and associated systems and infrastructure against a variety of wartime threats, to include conventional weapons, improved conventional weapons, and weapons of mass destruction. A prototype Survivability Simulation and Planning System (SSPS) was developed for the interactive analysis and planning of the employment of extant and future survivability assets to address global wartime contingencies at the unit/airbase, Joint Task Force, and Theater levels. Responsibilities included scenario definition, technology identification, selection of signature and force-on-force models, and task leadership for visual, electro-optic and thermal countermeasures and modeling.

Science Applications International Corporation (1989-1996)

Corporate responsibilities included serving as an SAIC Assistant Vice President, management of the Human Systems Technology Division, and direct supervision of the Human Performance Data Management Division. Functions included Corporate, Group and Division financial and technical planning, personnel management, marketing, and Program Management for multiple technical efforts. Managed all human factors and human engineering support for the Armstrong Laboratory, Human Engineering Division, Crew Systems Integration Branch (AL/CFHI) Strategic Integration Design Evaluation Facility (SIDEF) support contract (5yr, 16M) at Wright-Patterson Air Force Base, Ohio. The Air Force Service Effort Description Area for SIDEF is Human Systems Interface: Performance Assessment and Design. The SIDEF research objective is to: a) apply multiplace/distributed human-systems design research, evaluations and assessment tools to prototype crew station designs and systems for evaluation in current (B-1, B-2) and future automated multiplace cockpits, b) assess impacts of crew aiding technologies on multiplace crew performance, workload and situational awareness, and c) conduct information requirements analysis and conceptual workstation interface designs for distributed information warfare architectures. The Multiplace and Distributed Crew Systems

Technologies Program functional research and development areas include: a) Crew-Centered Aiding, Advanced Reconnaissance, Surveillance, and Target Acquisition, b) Design Assessment for Advanced Crew Systems, c) Crew Systems for Information Management and Display Technologies, d) Systems Engineering Design and Technical Analysis.

Past Research and Development Efforts at SAIC:

B-1 Sustaining Research Support Program. Human Factors lead. This Human-Systems Interface (HSI) Research Program provided the AL/CFHI Multi-Operator Design Assessment Laboratory (MODAL) and the B-1 SPO (ASC/YD) with a rapid response capability to address current and emerging issues by providing the Human Factors and Engineering expertise to address Multi-Operator Crew Aided Systems problem domains in the context of a B-1 research simulator. Human Factors research activities included: the review and analysis of multiplace/distributed human-systems design research, evaluations and assessment tools; conceptual development and prototyping of components to support crew station designs and systems for evaluation in current B-1 and future automated multiplace cockpits; development and assessment of crew aiding technologies on multiplace crew performance, workload and situational awareness; and the conduct of information requirements analyses and conceptual workstation interface designs for distributed information architectures.

B-2 Sustaining Research Support Program. Human Factors lead. This Human-Systems Interface (HSI) Research Program provided the AL/CFHI Multi-Operator Design Assessment Laboratory (MODAL) and the B-2 SPO with a rapid response capability to address current and emerging issues by providing the capability to prototype crewstation designs and multiplace and distributed crew systems, and provided the human factors capabilities to address Multi-Operator Crew Aided Systems and Human System Interface research for multiplace cockpit control and display-related issues in the context of a B-2 research simulator and associated research tools.

Multispectral Aerosol Obscurant Effects on Synthetic Aperture Radar Target Acquisition Program. Project Manager. Provided support to the U. S. Army Edgewood Research, Development and Engineering Center, and the Naval Surface Warfare Center, Warfare Systems Department, Countermeasures Division, Research Branch to examine human target acquisition performance using Synthetic Aperture Radar (SAR) systems in an air-to-ground offensive when defensive multispectral obscurants (MSO) are deployed. A high-resolution ground mapping radar simulator and specialized image processing algorithms were used to conduct experiments to determine separable MSO attenuation and backscatter effects on man-machine system performance during SAR target acquisition and designation processes. The research addressed multiple target classes in operationally representative simple and complex background target environments. Research objectives included development of optimized image processing algorithms to maximize an operator's ability to "see-through" various obscurant countermeasures, and, development of optimized obscurant designs.

Tactical Decision Aid Human Performance Modeling and Analysis Program. Project Manager. Provided support to the Wright Laboratory, Avionics Directorate, Electro-Optics Branch (WL/AARI) and the Phillips Laboratory, Geophysics Directorate, Atmospheric Sciences Division (PL/PGA) in the development, implementation and integration of visual detection, identification and recognition ranging algorithms to enhance the various Tactical Decision Aid (TDA) models (Infrared, Direct View, Electro-Optical and Television TDAs') predictive capabilities. The visual system algorithms were based on a space/spatial frequency pyramid representation incorporating physiologic adaptive luminance and contrast gain control mechanisms. Laboratory analysis and psychophysical experimentation supported the parameterization and subsequent integration into the Air Combat Targeting Electro-Optical Simulation Program (ACT/EOS) mission planning effort. The project provided Air Force mission planners accurate human performance predictive capabilities of target data embedded in Geographic Information Systems (GIS) and Global Positioning Systems (GPS) derived reference environments combined with satellite imagery and the simulation of how real-world weather effects various sensor imaging capabilities. The approach allowed for high value complex target classes and complex backgrounds to be incorporated into the various TDA models and the ACT/EOS with accurate predictive modeling capabilities.

Camouflage, Concealment, Deception and Obscuration (CCDO) Program. Project Manager. Providing human factors, human engineering, and research technical-analytic support to AL/CFH for concept development and both laboratory and field, test and evaluation of various CCDO techniques to support Air Base Operability and Survivability (ABOS) initiatives. Research includes the design, development, and implementation of an advanced Texture Image Processing System (TIPS) to enable the conduct of research for the development and evaluation of spatial camouflage and disruptive patterns. Multispectral texture generation algorithm concepts are being developed for the development and evaluation of site-specific urban and foliated spatial camouflage patterning.

B-2 Cursor Design and Mechanization Program. Sponsored by the B-2 Systems Program Office (SPO), this program supported human factors research in the AL/CFHI B-2 simulator for the development and optimization of display cursor design and mechanization. Responsibilities included cursor mechanization design, and experimental design and evaluation in B-2 mission relevant contexts for Synthetic Aperture Radar (SAR) updates, and using a simulation of the Global-Positioning Aided Targeting System (GATS).

Fixed Facility Camouflage, Concealment and Deception Joint Test and Evaluation (JCCD): Test Design. Project Manager for Program Test Design. Provided support to the Office of the Secretary of Defense, Under Secretary of Defense, Acquisition, (OSD USD(A)), Weapons Systems Assessment, Special Test and Evaluation Program (WSA/STEP) and the JCCD Joint Test Force for the development and conduct of the JCCD Test and Evaluation program (4yr, 32M). Developed JCCD Program Test Design (PTD) document. This defined program test objectives, methodology, procedures, scenario requirements, and all test site requirements including ground and airborne instrumentation, data reporting formats, flight operation requirements, and environmental and safety assessments. Subsequent support was provided to develop the Program Test Plan, Program Database Management and Analysis Plan, Target Characterization Requirements, and Program Human Factors Plan. Created the Human Performance Data Management Division, to support the ongoing JCCD program conduct for the quantitative evaluation of the effectiveness of CCD against all modern threat weapons systems.

Laser Guided Weapons Countermeasures Program. Sponsored by the Defense Weapons Systems Agency and the Air Force Aeronautical Systems Center (ASC/YQ), this program is developing active countermeasure (CM) systems to defeat threat laser guided weapon systems. Responsibilities included analysis, development and systems specification for laser designation detection and signal processing, CM response algorithms, CM laser transmitters, beam transport systems, end optics, damage minimization zones, and evaluation of the adaptability of the proposed CM defensive systems against future precision guided weapon threats.

Deceptive Technique Evaluation Program. Project Manager. Camouflage, Concealment and Deception (CCD) research efforts involved (a) the development and evaluation of hybrid CCD techniques (b) the development and evaluation of aircraft masking patterns (c) experimentation on the perceptual basis of the deceptive effectiveness of 2-D decoys and masking patterns (d) luminance and chrominance tonedown strategies for air base facilities (e) large scale static and dynamic visual disruption techniques, (f) fixed facility decoy and signature reduction and enhancement techniques, and (g) requirements specifications for spectral properties of false operating surfaces. Supported various CCD field evaluations including Dusty Demo, Gallant Eagle and Creek Shadow. Responsibilities included all aspects of (a) data acquisition and analysis for visual, infrared and radar treatments (b) aircrew pre-brief, de-brief and questionnaire development, and (c) radar bomb scoring data and head-up display (HUD) analysis for various fighter aircraft sensor imagery.

Ideal Masking Pattern Program. Project Manager. Under Air Force Armstrong Laboratory, Directors Funding initiative developed a biologically-based parallel image processing system to compute optimal 2-dimensional spatial camouflage and masking patterns. The resulting Advanced Texture Image Processing System (ATIPS) combines spatially global (Fourier), spatially local (physiologic) and traditional image processing technologies into a common processing architecture for the rendering of ideal camouflage/ masking designs for any arbitrary environmental scenario.

Aim Sight Phase I Development Program. Human Systems Interface (HIS) lead designing, interfacing, and demonstrating advanced man-machine interfaces (MMI) in a full mission simulation for the B1-B and advanced strategic aircraft. Developed multisensor integration concepts and crew coordination and control integration concepts for a head-steerable FLIR (forward-looking infrared) imaging system applied to a night vision airborne reconnaissance search task and weapons delivery for strategic relocatable targets. Developed a virtual environment MMI demonstration capability provided to the Visually Coupled Airborne Systems Simulator (VCASS) Super Cockpit Program.

Optical Countermeasures (OCM) Program. Project Manager. Provided technical and experimental direction in the development, analysis and evaluation of various laser countermeasures against the human visual system and sensor/weapons systems. Research was conducted to evaluate OCM effects on aircrew performance including aircraft control, visual acuity, contrast sensitivity, visual perimetry and target detection, identification, and designation. Research efforts included the development of an interactive flight simulation capability for the evaluation of laser OCM on aircrew performance within the context of mission relevant scenarios for air base attack operations. Developed first approved protocol for direct intraocular laser exposure in humans to support research efforts.

The 4th Space Warning Squadron (4 SWS), Mobile, Survivability Improvement Program. Sponsored by the Defense Weapons Systems Agency, Strategic Command and Control Division (DWSA/NASC) this program improved the survivability of the Air Force Space Command, 21st Space Wing, 4 SWS during deployed ballistic missile warning operations. The program included analysis of exploitable identifying signatures for all operational phases and deployment locations across both the strategic and tactical conflict engagement spectrum to develop a comprehensive multispectral deceptive program. Responsibilities included task leadership for signature analysis and deceptive technique development for visual, thermal, radar, electronic, acoustic, and olfactory signature reduction.

ACE and SHAPE Alternate War Headquarters Deceptive Practices Programs. Provided technical analysis and test planning support to the Defense Nuclear Agency for both the Allied Command Europe (ACE), and the Supreme Headquarters Allied Program in Europe (SHAPE) Alternate War Headquarters Deceptive Practices Programs (ACE AWHQ/DPP, and SHAPE AWHQ/DPP). Developed and provided various CCD concepts, technologies and techniques for AWHQs (both existing and interim) and supported subsequent field testing for HQ AFCENT at the NATO Camouflage of Mobile Command and Control Elements (CAMCOE Phase II and III) exercises to evaluate CCD effectiveness.

Project CABLE. Project Manager. In conjunction with WL/AARI, ASC/YQ, and AL/CFH established a Memorandum of Understanding with the German Military Defense, Forschungsinstitut fur Optik (FGAN-FfO), and Industrieanlagen - Betribsgesellschaft (IABG/WVT), Military Installations and Image Processing to conduct the Joint German-US Project CABLE, (Camouflage of Air Bases, example Leipheim) to implement and field test various CCD measures designed to defeat airborne infrared acquisition systems. Developed program test plan for CCD treatments, data acquisition and analysis, sensor and imagery analysis, pilot pre-brief, interview and questionnaire. Developed and implemented visual/thermal decoys and masking patterns for field-test and conducted subsequent laboratory analysis and experimentation with field imagery.

Multispectral Smoke Obscuration Modeling. Project Manager. Developed a Silicon Graphics based flight simulation capability for the Aeronautical Systems Center, Integrated Engineering/Technology Management Directorate, Crew Systems Branch (ASC/EN) to research Infrared Smoke Obscuration Requirements for the denial of air to ground target acquisition. Conducted research program using simulated LANTIRN imagery to evaluate target acquisition as a function of airborne obscurant density using an equivalent contrast reduction technique.

Additional research efforts on SIDEF with significant support roles include:

Concept I Demonstration. Human factors lead in the development and implementation of image extraction algorithms for evaluating the performance of computer vision systems for image recognition and Automatic Target Cueing (ATC) using synthetic aperture radar (SAR) imagery. In support of the Strategic Relocatable Target (SRT) Program developed a Signal Detection Theory paradigm to evaluate man-machine system performance for real-time air-to-ground SRT acquisition using the Strategic Avionics Battle-management Evaluation Research (SABER) simulator.

Advanced Target Acquisition System (ATAS) Conceptual Studies. Assisted Strategic Air Command (SAC) in establishing system performance requirements for ATAS deployment concepts and configurations, and evaluate ATAS performance with flight simulation experimentation for various SAC missions.

Radar Warning Receiver Human Factors Study. Designed and conducted research to evaluate human performance, situation awareness and workload for an integrated vs. stand-alone radar warning receiver in the B1-B defense management system configuration.

Strategic Mission Analysis. Developed a B-1 relocatable target mission, conceptual control and display concepts, and supported simulation studies to evaluate human-system performance.

Automatic Map Cueing Evaluation. Conducted B1-B OSO task analysis, mission decomposition and development, and conduct experiments to evaluate new Automatic Map Cueing system.

Phase II Color Research. Designed and tested man-machine interface (MMI) concepts and advanced defensive display color formats for the B1-B Defensive System Officer's displays.

Additional research has included support to the Aeronautical Systems Center (ASC/XR) Specialized Short Term Development Planning Support contract. Support was provided to the Human Systems Division (HSC/XR):

a) In visual requirements analysis and future technology assessment for the ***Tactical Night Vision Program***, and the ***Night Vision Goggles Requirements Analysis and Technology Assessment Program***. Contributions included requirements analysis, technology assessment, mission analysis and trade studies for future night vision goggle and integrated helmet mounted display/sight systems for night low level visual navigation, targeting and weapon delivery.

b) In visual requirements analysis for the ***Close Air Support/Battlefield Air Interdiction and Reconnaissance Night Attack Sensor System Program***. Contributions included determining Tactical Air Command vision requirements for fixed and head-steered navigation, targeting and information (NTI) systems (both HMD and NVG targeting) to support Army operations with 24-hour CAS, BAI, and RECCE missions for the F-16.

Past efforts also included a compartmentalized program for the design, research and development for advanced sensor and display technology applications combining sensor fusion, real-time physiologic image processing, and multispectral hybrid display applications.

Systems Research Laboratories (1985-1989)

Concurrent program manager for the Optical Countermeasures (OCM) and the Camouflage, Concealment and Deception (CCD) programs at the Armstrong Aerospace Medical Research Laboratory (AAMRL) under the Human Engineering Support contract. While managing these two programs grew the full-time technical support staff from one to seven individuals. Management responsibilities included budget control, proposal development and directing a team of human factors and engineering personnel. Research responsibilities included problem definition, preparation and review of experimental protocols, conducting experiments, resource control and allocation, and documentation of results.

OCM research assessed visual performance for various aircraft and weapons systems to develop effective deployment and defense strategies for various optical countermeasure techniques. Direct interocular exposure to various threat lasers dominated the research programs. These included: dynamic target acquisition and visual tracking performance, measures of transient visual field losses, the effects of windscreens and personnel protective visors, spectral analysis of various optical media, quantification of beam profiles and scatter effects, and measures of spatial contrast sensitivity in the presence of structured exposures as a function of wavelength, target contrast, and adaptation level. Developed a review concerning metrics of eye safety with respect the thermal, photoacoustic, and photochemical hazards involved in laser exposure.

CCD research involved the development and evaluation of camouflage, concealment and deception related practices. This included active and passive aircraft visual signature reduction, air base luminance and chrominance tonedown strategies, the use of 2-D silhouette decoys, and deceptive 2-D masking and shape disruptive patterning analysis. Research efforts also included developing a physiologically based vision model to predict detection thresholds of arbitrary space-time separable stimuli using a 4-D foveated space/spatial-frequency Gabor pyramid representation. Developed a new methodology for the derivation of optimal masking patterns and camouflage design based on psychophysical theories of visual system processing of pattern information.

University of Alabama at Birmingham Medical School (1984-1985)

Visual Neurophysiologist, Vision Science Research Center. Conducted detailed measures of spatial modulation transfer functions of physiologically identified neurons in the lateral geniculate nucleus (LGN) of Galago crassicaudatus, a prosimian primate. Difference-of-Gaussians modeling of center-surround organization for single-cell spatial contrast sensitivity functions was used to test current models of spatial receptive-field organization and to derive parameters specifying receptive-field spatial and sensitivity attributes for analysis. The results demonstrated fundamental differences in the spatial organization of the W, X, and Y LGN cell classes which mediate the relay of visual information to primary visual cortex. A comparison with other visual processing and physiologic response characteristics provided a better understanding of spatial processing in the primary visual pathway.

EDUCATIONAL EXPERIENCE

National Eye Institute Postdoctoral Fellow (1982-1984)

University of Alabama Medical School at Birmingham, Vision Science Research Center. Developed technologies and instrumentation necessary to conduct intracellular recording with horseradish peroxidase (HRP) staining techniques. Developed and implemented procedures for manufacturing and beveling glass capillary micropipettes, extracellular and intracellular recording techniques and instrumentation, physiological classification of neuronal response properties, iontophoresis of HRP, histological processing and histochemical staining of brain tissue, and morphological reconstruction of neurons. These inclusive techniques allowed the recovery of the complete detailed morphology of individual neurons in the Superior Colliculus of the tree shrew after physiological classification in the temporal and spatial domains using computer driven stimuli. These structure-function studies allowed a direct comparison between the information processing capacities of individual neurons and their specific morphological structure. Analysis examined relationships between physiologic response properties, cellular morphology, and connectivity.

Postdoctoral Research Associate, Visual Neurophysiology (1981-1982)

University of Alabama Medical School at Birmingham, Department of Physiological Optics. In a collaborative effort with Vanderbilt University Departments of Cell Biology and Psychology examined the receptive-field organization of relay cells in the lateral geniculate nucleus (LGN) of both normal and monocularly deprived Galago, a prosimian primate.

The studies in normal Galago demonstrated that W, X, and Y relay cells are segregated by LGN laminae in accordance with cell size distributions. Additionally, cells histologically localized to the interlaminar zones (ILZs) of the LGN exhibit W-cell response properties; a new finding consistent with the similar morphology and anatomical connections that ILZs share with W-cell LGN laminae across mammalian species. This significant discovery strongly supports the conclusions that: a) both the ILZs and koniocellular layers in the Galago LGN convey W-like visual information from retina to cortex, and, b) in higher primates the W-cell pathway is preserved in the LGN intercalated layers, and that the full compliment of W, X, and Y pathways participate in the encoding and transmission of visual information from retina to cortex.

Provided the first report of the effects of monocular deprivation on the physiological response properties of relay cells in the LGN of a primate. Comparison of physiologically identified relay cells histologically localized to deprived vs. non-deprived LGN laminae revealed no alteration in the distribution of functional properties of any cell class despite a reduction in cell size of the deprived LGN laminae. This result disallowed previous models of deprivation induced amblyopia based on a direct competition between X and Y retinal afferents for post-synaptic targets within the main layers of the LGN. Proposed a new model of developmental amblyopia in primates that resulted from cortical changes due to reduced input from the deprived LGN laminae rather than to a selective loss of input from a particular functional cell class.

Graduate Research Fellow, Biopsychology Program (1978-1980)

Syracuse University, Department of Psychology. Doctoral Thesis: "Psychophysical Determinants of Temporal Processing in the Human Fovea." Measured foveal temporal processing characteristics using a combination of the Two-Pulse paradigm and Stiles' two color increment threshold technique. The results demonstrated that, in the temporal domain, the fovea behaves as a low-pass filter at absolute threshold independent of stimulus size. In the light adapted state, low-pass filter characteristics are observed provided stimulus size is within the limits of intensity-area reciprocity. Beyond these limits, foveal filter characteristics are band-pass and exhibit a progressively increasing low frequency attenuation (greater inhibitory effects) either as a function of increasing stimulus size or background luminance. Additionally, the results demonstrated the necessity for temporal processing models to accurately account for temporal probability summation effects.

Graduate Research Fellow, Physiological Psychology Program (1977-1978)

Syracuse University, Department of Psychology, Visual Psychophysics Laboratory. Investigated monoptic and dichoptic contributions to temporal brightness enhancement, demonstrating that the Broca-Sulzer effect originates before the combination of the individual monocular pathways at the cortical level. Also, isolated and characterized the contributions of sustained and transient mechanisms to brightness enhancement effects utilizing a unique spatio-temporal stimulus paradigm to produce and control selective transient adaptation.

Characterized brightness and darkness sensations in the human fovea using multidimensional and suprathreshold scaling techniques. Discovered and characterized asymmetries between brightness and darkness percepts in terms of sensation magnitude, flash durations producing maximal sensation, and in the minimal luminance changes necessary for brightness and darkness enhancement effects to be produced. Demonstrated that brightness and darkness sensations are generated by separate neuronal systems.

Graduate Research Associate (1976-1977)

Syracuse University, School of Engineering, Institute for Sensory Research, and Department of Psychology, Visual Psychophysics Laboratory. Investigated contextual determinants of perceived length illusions using absolute magnitude estimation. Demonstrated that when all visual cues to context are eliminated, including contextual reference cues based on the limits of the visual field, the Horizontal-Vertical Illusion does not exist. Additionally, investigated methodological determinants of the Law of Size Constancy by scaling perceived line length as a function of viewing distance. Perceived length obeys the Law of Size Constancy when viewing distance is varied within sessions, whereas, across sessions perceived length increases as an inverse function of viewing distance.

Undergraduate Research Assistant (1974-1976)

Syracuse University, Department of Psychology. Supported National Eye Institute grant research "Mechanisms of Visual Sensitivity". Investigated spatial dependence of rod-cone interactions measured on scotopically equated adapting fields using the Crawford early light and dark adaptation paradigm. Temporal profiles of size dependent rod-cone interactions during transient light adaptation were characterized. Additionally investigated spectral sensitivity of Stiles π–mechanisms to incremental and decremental stimuli, suprathreshold two-pulse interaction, adaptive independence of the Stiles π_0 mechanism, blue cone spatial and temporal integration, and perceptual correlates of on- and off- center pathways.

REPRESENTATIVE PUBLICATIONS, PRESENTATIONS, AND REPORTS

Note: Over 150 references deleted due to classification issues.

1) Irvin, G.E., Irvin, J.G., Riccio, G.E., McDonald, P.V. and Skelly, J.J. *Advanced Human-Systems Technology for Uninhabited Aerial Vehicle (UAV) Ground Control Segments (GCS).* Laboratory Report. U.S. Air Force Research Laboratory, Human Effectiveness Directorate, Crew Systems Interface Division (AFRL/HECP). AFRL-HE-WP-TR-2000-0068, January 2000.

2) Irvin, G.E. *Technology Transfer and Applications from Industry-Academe Alliance*. Invited presentation Distributed Real-Time Sensors Program, Syracuse University, Computer Science Scalable Concurrent Programming Laboratory, October 20, 1999.

3) Irvin, G.E. *Spectral Mapping: A Perceptual Components Approach to Exploitation of Multispectral Imagery*. American Society for Photogrammetery & Remote Sensing and Resource Technology Institute (ASPRS-RTI), Tampa, FL, April, 1998.

4) McDonald, P.V., Riccio, G.E., Irvin, G.E. & Bloomberg, J.J. *Multimodal Perception of Multicriterion Control of Nested Systems: II. Constraints on Crew Members During Space Vehicle Abort, Entry and Landing*. National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, NASA TP-1998-3703v2, April, 1998.

5) Ramer, D.P., Irvin, G.E., Heaton, H.H. & Malek, D.A. *Multispectral Aerosol Obscurant Effects on Synthetic Aperture Radar Target Acquisition Study*. Proceedings of the Smoke/Obscurants Symposium XIX: Vol.1. U.S. Army Chemical Research, Development and Engineering Center, ERDEC-TR-223, STC TR-3123, April, 1997

6) Irvin, G.E., Aleva, D.L., Gaska, J.P. & Jacobson, L.D. *Human Performance Aiding for Tactical Decision Aids and Mission Performance Aids: A Model of Human Visual Performance for the Weather Impact Decision Aid (WIDA) Electro-Optical Simulation (ACT/EOS).* Armstrong Laboratory, Crew Systems Directorate, Human Engineering Division, Systems Integration Branch, AL/CFHI, AL/CF-TR-1996-0121, March 1996.

7) Irvin, G.E., Gaska, J.P. & Jacobson, L.D. *Human Performance Model (HPM): A General Model of Human Visual Discrimination Developed to Predict Human-System Performance for use in Tactical Decision Aids and Mission Performance Aids*. Phillips Laboratory, Directorate of Geophysics, Air Force Material Command, Hanscom AFB, MA, PL-TR-95-2092, December 1995.

8) Irvin, G.E. Invited Panelist, Symposium Synopsis Discussion Panel. Sixth Annual Camouflage, Concealment and Deception Symposium, Revolutionizing CCD for the Next Century, American Defense Preparedness Association, Combat Survivability Division, U.S. Navy Fleet Combat Training Center Atlantic, Virginia Beach, VA., September, 1995.

9) Watts, K., Hogan, G. & Irvin, G.E. *Fourth Space Warning Squadron Survivability Improvement Program: Phase II Survivability Exercise Report* (U). Defense Weapons Systems Agency, Strategic Command and Control Division (DWSA/NASC), Technical Report DNA-TR-95-66, June 1995.

10) Irvin, G.E. & Riccio, G.E. *User-Centered Approach to Strategic Alliances for Technology Transfer from the Federal Laboratories*. Invited presentation at the NTTC Forum on Commercialization of Disability Technologies: Overseeing the Commercialization and Marketing Gaps. Sponsored by the National Technology Transfer Center, American Chemical Society, Washington, DC, and April 1995.

11) Irvin, G.E. & Heaton, H.H. *Human Performance Evaluation of the Effects of Multispectral Aerosol Obscurants on Synthetic Aperture Radar Target Acquisition and Designation*. Invited presentation at U.S. Army, Edgewood Research, Development and Engineering Center, Research and Technology, Modeling and Simulation Team (SCBRD/RTM), Aberdeen Proving Ground, MD, April 1995.

12) Doyal, J.A., Irvin, G.E. & Ramer, D.P. *Operator Cursor Positioning Performance on Navigational Update and Target Positioning Tasks: Evaluation of Gain Functions for the B-2 Radar-Embedded Cursor System* (U). Armstrong Laboratory, Crew Systems Directorate, Human Engineering Division, Crew Systems Integration Branch, AL/CFHI, AL/CF-TR-1995-0106, April 1995.

13) Doyal, J.A., Irvin, G.E. & Ramer, D.P. *Evaluation of Gain Functions for the B-2 Radar-Embedded Cursor System*. Air Force Systems Command, B-2 Systems Program Office, IFC Integrated Product Team, Cockpit Integration Group, ASC/YSDS, 79 pp., January 1995.

14) Irvin, G.E. *Federal Technology Transfer for the Development of Assistive Technologies*. Invited presentation at the Improvement of Assistive Technology Devices for Home Care of Persons with Physical Impairments Conference, Sponsored by the Medical College of Wisconsin, Office of Research and Technology, and, Center for Biomedical Engineering and Biomathematics, Milwaukee, WI, June 1994.

15) Stengle, J.D., Heaton, H.H., Finch, S., Hopper, J., Irvin, G.E., Irvin, J.G., et. al. *Systems Engineering Design and Technical Analysis for Strategic Avionics Crew Station Design Evaluation Facility (SACDEF)* Armstrong Laboratory, Crew Systems Directorate, Human Engineering Division, Crew Systems Integration Branch, AL/CFHI-TR-1994-0074, May, 1994.

16) Irvin, G.E. *Toward a New Methodology for the Development of Assistive Technologies*. Invited presentation at the Forum on Technology Transfer and People with Disabilities,

Sponsored by the National Technology Transfer Center, American Chemical Society, Washington, DC, March 1994.

17) Irvin, G.E., Wilson, D.L., Gaska, J.P. and Jacobson, L.D. *Human Performance Modeling and Analysis Program for Mission Planning Aids*. Weather Impact Decision Aids (WIDA) for Operation of Electro-Optical and Radio Frequency Systems, Requirements and Technical Interchange Meeting, Las Vegas, NE, March 1994.

18) Irvin, G.E. *Quantitative Methodologies for the Development and Evaluation of Camouflage Systems*. Visiting Scientists Invitational Colloquium, Headquarters U.S. Army, Belvoir Research, Development and Engineering Center, Night Vision and Electronic Sensors Directorate, Visionics and Image Signal Processing Division (AMSEL-RD-NV-D), Ft. Belvoir, VA, March 1994.

19) Irvin, G.E., Casagrande, V.A., Norton, T.T. *Center-Surround Relationships of Magnocellular, Parvocellular and Koniocellular Relay Cells in Primate Lateral Geniculate Nucleus*. Visual Neuroscience, 10, 363-373, 1993.

20) Irvin, G.E. *Technology Transfer for Developmental Disabilities*. Invited presentation to the Ohio Developmental Disabilities Planning Council, Columbus, OH, December 1993.

21) Irvin, G.E. *The Assistive Technologies Group Technology Transfer Initiative*. Forum on Technology Transfer for Developmental Disabilities. Sponsored by the Assistive Technologies Group at Wright State University, Dayton, OH, December 1993.

22) Irvin, G.E. & Wilson, D.L. *Texture Image Processing System for the Development and Evaluation of Multispectral Spatial Patterning*. Fourth Annual Camouflage, Concealment and Deception Symposium, CCD for Joint/Combined Contingency Operations, American Defense Preparedness Association, Combat Survivability Division, Eglin AFB, FL., October, 1993.

23) Irvin, G.E. *Ohio Consortium for the Development of Assistive Technologies*. Presentation by the Assistive Technologies Group to Federal Laboratory Consortium for Technology Transfer and Air Force Armstrong Laboratory. Dayton, OH, September, 1993.

24) Wilson, D.L. & Irvin, G.E. *Human Performance Modeling of Target Detection, Identification, and Recognition Ranges for Application in Tactical Decision Aids*. Fourth Annual Ground Target Modeling and Validation Conference, U.S. Army Tank-Automotive Research, Development and Engineering Center, and, U.S. Army Belvoir Research, Development and Engineering Center. Warren, MI, August 1993.

25) Irvin, G.E. *The Future Threat from Precision Guided Weapons and Strategies for Defeat by Advanced Optical Modulation Techniques*. Laser Countermeasures Program IPR, Defense Nuclear Agency and Aeronautical Systems Division, Air Base Operability and Survivability Branch (ASC/YQ), Eglin Air Force Base, August, 1993.

26) Irvin G.E. *Vision Research in the Department of Defense*. Visiting Scholars Program Invitational. Vision Science Research Center, School of Optometry Department of Physiological Optics, University of Alabama at Birmingham, AL, April, 1993.

27) Irvin G.E., Doyal J.A. & Koch R.D. *Experimental Approach to the Evaluation of Radar Obscurant Requirements for Effective Disruption of Air-to-Ground Target Acquisition*. Proceedings of the Smoke/Obscurants Symposium XVII: Early Entry Survivability. U.S. Army

Chemical and Biological Defense Agency, Edgewood Research, Development and Engineering Center, Research and Technology Directorate, Vol. 1, pp. 171-183, 1993.

28) Irvin G.E., Jacobson L.D. & Gaska J.P. *Human Performance Modeling to Improve Tactical Decision Aid Ranging Algorithm Predictions*. Electro-Optical Tactical Decision Aid Conference, Las Vegas, NE., March, 1993.

29) Irvin, G.E. *Joint Camouflage, Concealment and Deception (JCCD) Joint Test and Evaluation Program Test Design*. Office of the Secretary of Defense, Under Secretary of Defense, Acquisition, (OSD USD(A)), Weapons Systems Assessment, Special Test and Evaluation Program (WSA/STEP), 126 pp., September 1992.

30) Irvin, G.E. and Dowler, M.G. *Modeling Requirements for Human Performance Evaluation Metrics for Airborne Tactical Decision Aids: Pyramidal Representations, and, Adaptive Luminance and Contrast Gain Control*. Invited Presentation, Wright Laboratory, Avionics Directorate, (WL/AARI), Dayton, OH, September, 1992.

31) Irvin, G.E. *Multimedia Information Analysis Procedures for a New Fiducial Aimpoint Scoring Methodology to Support Air-to-Ground Multispectral Target Acquisition Field Testing using the Global Positioning Systems (GPS) based Tactical Air Combat Training System (TACTS)*. Invited Presentation at Headquarters, Joint Camouflage, Concealment and Deception Joint Test and Evaluation Program (JCCD), Vicksburg, MS, September, 1992.

32) Irvin, G.E., Gaska, J.P. and Jacobson, L.D. *Joint Space/Spatial Frequency Representation Architectures to Support Prediction of Airborne Visual Detection, Identification and Recognition Ranges of Complex Target Classes in Complex Backgrounds*. Invited Presentation at Phillips Laboratory, Geophysics Directorate, Atmospheric Sciences Division (PL/PGA), May, 1992.

33) Irvin, G.E., Dowler, M.G. *Physiological-Based Computational Approach to Camouflage and Masking Patterns*. Automatic Object Recognition II, Psychophysics for Easier Pattern Recognition, SPIE Symposium on Optical Engineering and Photonics in Aerospace Sensing, Vol. 1700, pp. 481-488, April, 1992.

34) Irvin, G.E. *Program Test Design Architecture for the Fixed Facility Joint Camouflage, Concealment and Deception Joint Test and Evaluation Program*. Joint Test and Evaluation Working Group Meeting, Reno, NV, February, 1992.

35) Donohue, T.R., Irvin, G.E., Doyal, J.A. & Dowler, M.G. *Creek Shadow Camouflage, Concealment and Deception (CCD) Demonstration Final Report: Experimental Results and Complete Data Bases of Pilot Questionnaires, Radar Bomb Scoring and Head-Up Display Imagery and Voice Analysis*. Armstrong Laboratory, Crew Systems Directorate, Human Engineering Division, Crew Systems Integration Branch, AL/CFHI, CCD-ILR-92:01, 1992. (UNCLASSIFIED).

36) Irvin, G.E. *Second Generation Camouflage, Concealment and Deception Approaches*. American Defense Preparedness Association, Combat Survivability Division Symposium on Camouflage, Concealment and Deception, A Combat Multiplier. US Marine Corps Station, Quantico, VA., November 1991.

37) Irvin, G.E. *Visual Detection Simulator: A Physiologically Based Computational Approach to Human Visual Threshold Prediction*. Invited presentation at USAF Human Systems Division

Armstrong Laboratory Advisory Group Conference on Applied Spatial Vision Models for Target Detection and Recognition. San Antonio, TX., March 1991.

38) Irvin, G.E., Keep, G.F., Dowler, M.G. *2-Dimensional Aircraft Decoys Based on Perspective Rendition: Overview and Experimental Results*. Aerospace Medical Association, Cincinnati, OH., May 1991.

39) Keep, G.F., Donohue, T.R., Irvin, G.E. & Dowler, M.D. *Development and Evaluation of a Two-Dimensional KC-135/AWACS Decoy: Laboratory Evaluations and CREEK SHADOW Field Testing*. Headquarters Strategic Air Command, HQ SAC/XOBS, 27pp., January, 1991.

40) Irvin, G.E. *Visual Perception Factors Related to Pilot Target Acquisition in the Presence of Camouflage, Concealment and Deception Techniques*. Eighth Joint Test and Evaluation CCD Working Group, USAF Air Base Operability Office, Eglin AFB, FL., January, 1991.

41) Irvin, G.E., Doyal, J.A., Keep, G.F. & Dowler, M.G. *The Evaluation of 2-Dimensional Silhouette Decoys of KC-135 Aircraft Using Computer Based Flight Simulation*. Armstrong Laboratory, Crew Systems Directorate, Human Engineering Division, Crew Systems Integration Branch, AL/CFHI, CCD-ILR-91:03, 1991 (UNCLASSIFIED).

42) Irvin, G.E., Donohue, T.R. & Dowler, M.G. *Evaluation and Specification of Chromaticity Coordinants for an Effective Concrete False Operating Surface (FOS) (U)*. Armstrong Laboratory, Crew Systems Directorate, Human Engineering Division, Crew Systems Integration Branch, AL/CFHI, CCD-ILR-91:01, 1991 (UNCLASSIFIED).

43) Irvin, G.E., Dowler, M.G. *The Effects of Continuous-Wave Laser Countermeasures and Laser Protective Visors on Simulated Terrain Following and Targeting Accuracy (U)*. Proceedings of the Ocular Hazards in Flight and Remedial Measures Symposium, Advisory Group for Aerospace Research and Development, London, U.K. Oct, 1990. (Secret).

44) Irvin, G.E., Urban, K.E. & Dowler, M.G. *Psychophysical Evaluation of Personnel Protective Visors: Acuity, color discrimination and contrast sensitivity (U)*. Armstrong Aerospace Medical Research Laboratory, Human Systems Division, Air Force Systems Command. OCM-ILR-89:02, 1989, (Secret).

45) Irvin, G.E., Urban, K.E., Spravka, J.J. & Kang, R.N. *The Effects of Pulsed and Continuous Wave Optical Countermeasures on Target Detection Performance (U)*. Armstrong Aerospace Medical Research Laboratory, Human Systems Division, Air Force Systems Command. OCM-ILR-89:01, 1989, (Secret).

46) Norton, T.T., Casagrande, V.A., Irvin, G.E. & Sesma, M.A. *Contrast sensitivity functions of W-, X- and Y-like relay cells in lateral geniculate nucleus of Bush Baby (Galago crassicaudatus)*. J. Neurophysiology, 59:6, 1639-1656, 1988.

47) Irvin, G.E. & Kuyk, T.K. *Camouflage Concealment and Deception Guidelines Manual (U)*. Prepared by ICON Consultants and Systems Research Laboratories for Armstrong Aerospace Medical Research Laboratory, Human Systems Division, Air Force Systems Command. 222 pp., 1988, (UNCLASSIFIED).

48) Irvin, G.E., Kang, R.N., Spravka, J.J. & O'Neal, M.R. *Correlational Investigation of Contrast Sensitivity and Visual Acuity in the Detection of Approaching Aircraft*. Aviation, Space and Environmental Medicine, 59:4, 463, 1988.

49) Irvin, G.E. *Overview of Current and Future Research Efforts of the Camouflage, Concealment and Deception Program at Armstrong Aerospace Medical Research Laboratory*. Joint Service Camouflage, Concealment and Deception Research Technical Coordinating Meeting, Invited Presentation, Naval Civil Engineering Laboratory, Port Hueneme, CA, October, 1987.

50) Irvin, G.E. & Kang, R.N. *Perimetry Measures of Transient Visual Field Loss in the Presence of Foveal Laser Exposures in Humans (U)*. Sixth DoD Conference on Directed Energy Weapons: Vulnerability, Survivability and Effects. Joint Technical Coordinating Group on Aircraft Survivability. National Bureau of Standards, Gaithersburg, MD, May 1987, (Secret).

51) Irvin, G.E., Norton, T.T., Sesma, M.A. & Casagrande, V.A. *W-like Response Properties of Interlaminar Zone Cells in the Lateral Geniculate Nucleus of a Primate (Galago Crassicaudatus)*. Brain Research, 362, 254-270, 1986.

52) Irvin, G.E., Norton, T.T. & Casagrande, V.A. *Receptive-field Properties Derived from Spatial Contrast Sensitivity Measurements of Primate Lateral Geniculate Nucleus Cells*. Invest. Ophthal. and Vis. Sci. Suppl., 27, 1986.

53) Casagrande, V.A. Irvin, G.E., Norton, T.T., Sesma, M.A. & Petry, H.M. *Difference of Gaussian Model of Contrast Sensitivity Functions from W-, X- and Y-like Cells in Primate Lateral Geniculate Nucleus*. Investigative Ophthal. and Visual Science, 27, 1986.

54) Irvin, G.E. *New Concepts of Neural Organization from Intracellular Injection of Neurons: Morphological Organization of Physiologically Identified Neurons in the Superior Colliculus*. Invited Lecture, Southeastern Regional Neuroscience Symposium, Birmingham, AL. 1985.

55) Irvin, G.E. & Norton, T.T. *Structure Function Relationships of Visual Neurons in the Tree Shrew Superior Colliculus*. Southeast Regional Nerve Net Symposium, Invited Lecture, C.V. Whitney Laboratories, St. Augustine, FL., Mar, 1984.

56) Sesma, M.A., Irvin, G.E., Kuyk, T.K., Norton, T.T. & Casagrande, V.A. *Effects of Monocular Deprivation on the Lateral Geniculate Nucleus in a Primate*. Proc. National Academy of Science, 18, 2255-2259, 1984.

57) Irvin, G.E. *The Primate Superior Colliculus; the Functional Implications of our Current Understanding of Anatomy, Physiology, and Psychophysics*. Invited Lectures (two), Current Topics in Optometry and Visual Science, Vision Science Research Center, School of Optometry Medical Center, University of Alabama in Birmingham, May, 1984.

58) Irvin, G.E. *Neurophysiological, Anatomical, and Psychophysical Basis of On- and Off-center Mechanisms in the Mammalian Visual System and their Implications for Current Theoretical Models of Visual Information Processing*. Invited Lecture, Current Topics in Optometry and Visual Science, Vision Science Research Center, School of Optometry, The Medical Center, University of Alabama in Birmingham, April, 1984.

59) Irvin, G.E., Norton, T.T., Sesma, M.A. & Casagrande, V.A. *W-like Receptive Field Properties of Interlaminar Cells in Primate Lateral Geniculate Nucleus*. Society for Neuroscience, 10, 297, 1984.

60) Irvin, G.E. *Relationships Between Visual Information Processing Characteristics of Individual Neurons and Cellular Morphologies Derived from Intracellular Horseradish Peroxidase Staining Techniques*. Invitational Lecture Series, Departments of Cell Biology and

Psychology, and, Departments of Electrical and Biomedical Engineering, Vanderbilt University, Nashville, TN, March 1984.

61) Irvin, G.E., Norton, T.T. & Kuyk, T.K. *Morphology of Physiologically Identified Neurons in the Superior Colliculus of the Tree Shrew*. Invest. Ophthal. and Vis. Sci. Suppl., 24, 224, 1983.

62) Irvin, G.E., Sesma, M.A., Kuyk, T.K., Norton, T.T. & Casagrande, V.A. *Visual Response Latencies and Contrast Sensitivity Functions in Primate Lateral Geniculate Nucleus after Monocular Deprivation*. Soc. Neurosci. 9, 25, 1983.

63) Irvin, G.E. *Mechanisms of Color Vision in Tupia Glis; the Basis of Dichromacy*. Invited Lecture, Department of Physiological Optics, School of Optometry Medical School, University of Alabama at Birmingham, AL, April, 1982.

64) Irvin, G.E., Sturr, J.F. & Kobus, D.A. *Foveal Two-Pulse Summation Characteristics*. Investigative Ophthalmology and Visual Science, 22, 123, 1982.

65) Irvin, G.E. *Psychophysical Determinants of Temporal Processing in the Human Fovea*. Doctoral Dissertation in BioPsychology, Syracuse University, 189 pp., October, 1981.

66) Irvin, G.E. *Psychophysical Basis for Statistical Signal-to-Noise Measures of the Efficiency of Central Visual Mechanisms*. Invited Lecture, Visual Psychophysics Lab, Dept. of Psychology, Syracuse University, September, 1981.

67) Irvin, G.E. *Psychophysical Correlates of ON- and OFF-center pathways*. Invited Lecture, Department of Physiological Optics, School of Optometry/The Medical School, University of Alabama at Birmingham, AL, June, 1981.

68) Irvin, G.E. & Verrillo, R.T. *Absolute Magnitude Estimation of Line Length as a Function of Contrast, Line Orientation, and Viewing Distance*. Eastern Psychological Association, Hartford, CT, April 1980.

69) White, T.W., Irvin, G.E. & Williams, M.C. Asymmetry in the Brightness and Darkness Broca-Sulzer Effects. Vision Research, 20, 723-726, 1980.

70) Irvin, G.E. *Isolating the Contribution of Sustained and Transient Visual Mechanisms to Subjective Brightness using a Spatio-temporal Adaptation Paradigm*. Invited Lecture, Visual Psychophysics Laboratory, Department of Psychology, Syracuse University, March, 1980.

71) Irvin, G.E. *An Anatomical Investigation into the Possible Existence of Differential Projections from the Parvocellular Laminae of Lateral Geniculate Nucleus to Striate Cortex in Macaque Monkey*. Doctoral Thesis Proposition, Manuscript #1, 35 pp., July, 1979.

72) Irvin, G.E. & Verrillo, R.T. *Size Constancy and the Absolute Magnitude Estimation of Line Length*. Sensory Processes, 3, 275-285, 1979.

73) Verrillo, R.T. & Irvin, G.E. *Absolute Magnitude Estimation of Line Length as a Function of Orientation and Contrast Polarity*. Sensory Processes, 3, 261-274, 1979.

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75) Gaska, J.P., Sturr, J.F. & Irvin, G.E. *Small Adapting Fields Favor Rod-Cone Interaction During Early Light Adaptation*. J. Opt. Soc. Am., 69, 1453, 1979.

76) Irvin, G.E. *The Segregation of On- and Off-Center Responses in the Mammalian Visual Pathway*. Invited Lecture, Anatomy of Sensory Systems, School of Engineering, Institute for Sensory Research, Syracuse University, October, 1978.

77) White, T.W., Irvin G.E. & Williams M.C. *Evidence Supporting a Retinal Interpretation of the Broca-Sulzer Effect*. Investigative Ophthalmology and Visual Science, 18, 131, 1978.

DECLARATION OF
William Kanemoto

I**, William Kanemoto,** declare as follows:

1. I am presently under contract with Aspen Environmental Group to provide environmental technical assistance to the California Energy Commission. Under Contract No. 700-11-027, I am serving as a Visual Resource Specialist to provide Peak Workload Support for the Energy Facility Siting Program and for the Energy Planning Program.

2. A copy of my professional qualifications and experience is attached hereto and incorporated by reference herein.

3. I helped prepare the staff testimony on **Visual Resources** for the **Palen Solar Electric Generating System Final Staff Assessment,** based on my independent analysis of the Application for Certification and supplement hereto, data from reliable documents and sources, and my professional experience and knowledge.

4. It is my professional opinion that the prepared testimony is valid and accurate with respect to the issue addressed therein.

5. I am personally familiar with the facts and conclusions related in the testimony and if called as a witness could testify competently thereto.

I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge and belief.

Dated: 8-2-13 Signed: [signature]

At: **Oakland, California**

William Kanemoto

Principal Investigator, Visual Analysis and Visual Simulation

Professional Experience:

Principal
William Kanemoto & Associates, Oakland, California, 1993 - Present

William Kanemoto is Principal of William Kanemoto & Associates, an environmental consulting practice specializing in visual analysis and computer visualization in the context of environmental review. He has served as principal investigator for visual analysis and simulation on a wide range of major infrastructure and development projects over the past 26 years. Mr. Kanemoto received an *Outstanding Performance Award from the California Energy Commission* for his visual analysis of numerous major power plant applications on behalf of the CEC between 2000 and 2002. He also received recognition from the *California Association of Environmental Professionals* for visual analysis, computer simulation, animation, and video production for the Stanford Sand Hill Road Projects EIR, prepared by EIP Associates and judged 'Best State-Wide EIR of 1997'

Associate Director
Environmental Simulation Laboratory,
Institute of Urban and Regional Development &
Center for Environmental Design Research
University of California, Berkeley, 1994 - 2000

Instructed graduate students in the College of Environmental Design, U.C. Berkeley, served as consultant on various major planning projects in the San Francisco Bay Area, and conducted design collaborations with counterparts at Keio University and ARK CyberUniversity in Tokyo, Japan via the internet.

Principal Investigator/Project Manager
Dames & Moore, San Francisco/Oakland, California, 1988-1992

Served as principal investigator of numerous visual analyses for major infrastructure projects throughout the U.S., in Europe, and in Asia. Gained extensive familiarity with the application of a wide range of professionally accepted visual assessment techniques in the context of CEQA, NEPA, and related regulatory requirements of the CPUC, CEC, FERC, DOT, Cal SHPO, BCDC, U.S. Forest Service, BLM, National Park Service, and other public agencies.

Project Manager
LSA Associates, Pt. Richmond, California, 1987-1988

Project manager and planner on environmental impact reports for various residential and commercial development projects in northern California.

Environmental Planner
Holton Associates, Berkeley, California, 1984-1987

Preparation of various resource and regulatory studies including EIRs, FERC Exhibit Es, Section 404 alternative analyses, riparian restoration studies, and cumulative impact methodology studies for EPRI and Sierra County, CA.

Academic Background:

M. Landscape Architecture, University of Michigan, Ann Arbor, 1982
B.A. Liberal Arts (Honors), University of California, Santa Cruz, 1973

Selected Relevant Experience

- *Visual Analysis, Rio Mesa Solar Project.* Visual analysis for CEC Preliminary Staff Assessment of solar thermal project in Riverside County.
- *Visual Analysis, California Energy Commission*. Visual analysis, expert witness testimony for environmental review of numerous major power plant applications throughout California. Conducted visual analysis for staff assessment of 6 'fast-track' thermal solar power plant applications in 2009 – 2010, and of numerous other applications since 2001.
- *Topaz Solar Project EIR.* San Luis Obispo County. Visual analysis of solar PV project in Carizzo Plain.
- *Fresno to Bakersfield High Speed Train EIR/S.* California High-Speed Rail Authority. Prepared visual analysis and 20+ simulations for the Fresno to Bakersfield High Speed Train Fresno to Bakersfield EIR/S.
- *Santa Rosa Incremental Recycled Water Program.* Visual simulations of a wide range of water treatment, storage, conveyance, and injection facilities were prepared at locations throughout Sonoma County.
- *Las Gallinas Water Storage EIR, Marin MWD.* Visual analysis and simulation.
- *Shaver Grade Pipeline Improvements*, Marin MWD. Visual simulations.
- *Tennessee Hollow Watershed Restoration EA,* Presidio National Park, GGNRA, San Francisco
- *Ventura Keys and Arundell Barranca Watershed Water Quality Improvements Video*. A video incorporating live footage and computer visualization was produced and presented in public meetings, on cable television, and distributed publicly on tape cassette.
- *Alta Infill II Wind Power Project EIR.* Visual analysis and simulation of wind project adjoining BLM lands within the Tehachapi Wind Resource Area.
- *Visual Impact Assessment Technical Reports*, Caltrans District 4. On-call visual analysis for numerous highway improvement projects throughout District 4.
- *San Onofre Nuclear Generating Station Steam Generator Replacement EIR,* CPUC
- *Diablo Canton Nuclear Generating Station Steam Generator Replacement EIR,* CPUC
- *BART to Silicon Valley EIR/S,* BART/SCVTA*.* numerous computer simulations of proposed BART Stations and associated facilities in Milpitas, downtown San Jose, and Santa Clara. Tasks included realistic simulation of then-unbuilt San Jose City Hall, from design drawings of Meier and Partners, and recently completed simulations of proposed Diridon Station parking structure, BART station, and future environs.
- *Encinal Project,* Oakland CA. Visual analysis, computer simulations, and computer-generated shadow studies for a proposed high-rise project in downtown Oakland. Study included 3D computer baseline modeling of a 20-block area of downtown Oakland.
- *Santa Clara Street-Alum Rock LRT/BRT Project,* SCVTA. Produced visual analysis and computer simulations of proposed LRT line from downtown San Jose to Capitol Avenue.
- *Highway 152/156 Interchange Project VIA*. Produced visual impact assessment technical report per Caltrans requirements, and computer simulations of a new interchange project in southern Santa Clara County for SCVTA.
- *Tasman Light Rail/Great Mall Station, Santa Clara County*. Prepared computer simulations of a proposed elevated light rail station for the Santa Clara Valley Transportation Agency.
- *Capitol Safety Barrier EIR*, Sacramento, CA. Prepared computer simulations of proposed barrier and entrance structure designs surrounding the State Capitol, to address concerns of visual compatibility with the highly sensitive historic landmark.
- *Stanford University Medical Center Improvements, Stanford Shopping Center Improvements EIR.* Computer simulations of two major projects on Stanford campus.
- *Stanford West/Sand Hill Road Projects EIR*, Stanford University. Visual analysis and extensive computer simulation of a 300+ unit apartment complex, a 680 + unit senior housing development and health center, major improvements to the Stanford Shopping Center, and construction of a major arterial roadway, for the City of Palo Alto. Computer animation and video presentation of Sand Hill Road projects were produced for presentation at public hearings and on cable TV.

DECLARATION OF
Steven Kerr

I, **Steven Kerr,** declare as follows:

1. I am presently employed by the California Energy Commission in the Environmental Office of the Siting, Transmission and Environmental Protection Division as a Planner II.

2. A copy of my professional qualifications and experience is attached hereto and incorporated by reference herein.

3. I helped prepare the staff testimony on **Alternatives** for the **Palen Solar Electric Generating System Final Staff Assessment,** based on my independent analysis of the Application for Certification and supplement hereto, data from reliable documents and sources, and my professional experience and knowledge.

4. It is my professional opinion that the prepared testimony is valid and accurate with respect to the issue addressed therein.

5. I am personally familiar with the facts and conclusions related in the testimony and if called as a witness could testify competently thereto.

I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge and belief.

Dated: 8/2/13 Signed: [signature]

At: Sacramento, California

Steven Kerr

Professional Experience:

California Energy Commission — Sacramento, CA
January 2012-Present — *Planner II*

- Review power plant applications and amendments for socioeconomic, land use, transportation, and visual impacts.
- Evaluate projects in accordance with CEQA, the California Energy Commission siting regulations, and federal, state and local laws, ordinances, regulations, standards (LORS).
- Participate in public workshops and hearings regarding proposals.
- Write environmental analysis documents.

Thomas P. Kerr Inc. — Sacramento, CA
August 2011-January 2012 — *Property Manager*

- Management of properties and assets throughout California and Oregon.
- Assist in the preparation of mobile home park closure impact report for Port of San Luis.
- Use various software applications to produce and review billing and financial records.
- Work with local agencies to coordinate infrastructure improvements.

Ground(ctrl) — Sacramento, CA
February 2010-August 2011 — *Director of Customer Support*

- Coordinate and provide customer support for A-list musical artist fan clubs, online stores, e-mail marketing, ticketing, aggressive online marketing, and much more.
- Resolve escalated customer support issues, credit card disputes, and Better Business Bureau cases.
- Supervise and train customer support team members and interns.

City of Sacramento — Sacramento, CA
General Services Department — *Customer Service Representative*
July 2009-February 2010

- Perform concurrently multiple customer service related duties for all City of Sacramento departments by phone/email.
- Interpret and apply City regulations and procedures as applicable to billing, fees, and collections.
- Learn and explain the organization, procedure and operation details of the City.
- Use a variety of business software applications and assess maps.

City of Sacramento — Sacramento, CA
Development Services Department — *Assistant Planner*
February 2007-July 2009

- Project manager for various residential, commercial, industrial, and office development projects.
- Assist customers with zoning, design review, preservation, environmental, subdivision code, and sign questions, both at the public counter and by phone/email.
- Provide customers with required entitlement information, fee estimates, and accept applications for proposed development projects.
- Review applications and plans for consistency with City Codes, General Plan, and applicable community plans, specific plans and planned unit development guidelines.
- Present projects at community meetings and work with neighborhood association leaders on controversial projects.
- Write staff reports and conditions of approval.
- Present projects at Zoning Administrator, Planning Commission, and City Council public hearings.
- Research development and entitlement histories of parcels.

City of Atascadero — Atascadero, CA
Community Development Department — *Planning Intern*
March 2005-June 2006

- Prepare environmental review documents.
- Review business licenses and building permits.
- Draft letters and staff reports.
- Respond to questions from the public on planning and zoning related issues.
- Access and update information in GIS and Excel

Education:

2005-2006 California State Polytechnic University, San Luis Obispo, CA
Coursework toward MS in Public Policy

2000-2005 California State Polytechnic University, San Luis Obispo, CA
Bachelor of Science in City and Regional Planning

DECLARATION OF
Shahab Khoshmashrab

I, **Shahab Khoshmashrab,** declare as follows:

1. I am presently employed by the California Energy Commission in the Engineering Office of the Siting, Transmission and Environmental Protection Division as a Senior Mechanical Engineer.

2. A copy of my professional qualifications and experience is attached hereto and incorporated by reference herein.

3. I prepared the staff testimony on **Noise and Vibration** and **Facility Design** for the **Palen Solar Electric Generating System Final Staff Assessment,** based on my independent analysis of the Application for Certification and supplement hereto, data from reliable documents and sources, and my professional experience and knowledge.

4. It is my professional opinion that the prepared testimony is valid and accurate with respect to the issue addressed therein.

5. I am personally familiar with the facts and conclusions related in the testimony and if called as a witness could testify competently thereto.

I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge and belief.

Dated: 8/1/2013 Signed: [signature]

At: Sacramento, California

Shahab Khoshmashrab
Senior Mechanical Engineer

Experience Summary

Eighteen years experience in the mechanical, civil, structural, and manufacturing engineering fields involving engineering and manufacturing of various mechanical components and building structures. This experience includes QA/QC, construction/licensing of electric generating power plants, analysis of noise pollution, and engineering and policy analysis of thermal power plant regulatory issues.

Education

- California State University, Sacramento-- Bachelor of Science, Mechanical Engineering
- Registered Professional Engineer (Mechanical), California
  License No. M 32883, Exp. 9/30/2014

Professional Experience

2001-Current—Senior Mechanical Engineer – Siting, Transmission, and Environmental Protection Division – California Energy Commission

- Perform analysis of generating capacity, system reliability and safety, energy efficiency, noise and vibration, jurisdictional determination, and the mechanical, civil, electrical, and structural aspects of power plants during licensing, construction, and operation.

- As the Facility Design Unit's lead, or senior, review and manage the work of technical staff (other engineers) and contractors; ensure project deadlines are met; and ensure that projects propose and implement the most energy efficient technologies to satisfy project objectives while protecting the environment;

- Independently review and evaluate Applications for Certification to ensure compliance of power plants and related facilities with applicable laws, ordinances, regulations, and standards and California Environmental Quality Act, or CEQA;

- Prepare and recommend to the Siting Committee, conditions of certification (including mitigation measures) under which power plants should be licensed, constructed and operated;

- Present oral and written expert testimonies in support of analysis at evidentiary hearings held before the Siting Committee and the public; and

- Assist the California Energy Commission in policy making related to power generation.

1998-2001—Structural Engineer – Rankin & Rankin

Engineered concrete foundations, structural steel and sheet metal of various building structures including energy related structures such as fuel islands. Performed energy analysis/calculations of such structures and produced both structural plans and detailed shop drawings using AutoCAD.

1995-1998—Manufacturing Engineer – Carpenter Advanced Technologies

Managed manufacturing projects of various mechanical components used in high tech medical and engineering equipment. Directed inspection of first articles. Wrote and implemented QA/QC procedures and occupational safety procedures. Conducted developmental research of the most advanced manufacturing machines and processes including writing of formal reports. Developed project cost analysis. Developed/improved manufacturing processes.

DECLARATION OF
Andrea Koch

I, **Andrea Koch,** declare as follows:

1. I am presently employed by the California Energy Commission in the Environmental Office of the Siting, Transmission and Environmental Protection Division as an Environmental Planner II.

2. A copy of my professional qualifications and experience is attached hereto and incorporated by reference herein.

3. I helped prepare the staff testimony on **Traffic and Transportation** for the **Palen Solar Electric Generating System Final Staff Assessment,** based on my independent analysis of the Application for Certification and supplement hereto, data from reliable documents and sources, and my professional experience and knowledge.

4. It is my professional opinion that the prepared testimony is valid and accurate with respect to the issue addressed therein.

5. I am personally familiar with the facts and conclusions related in the testimony and if called as a witness could testify competently thereto.

I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge and belief.

Dated: 8/1/13 Signed: Andrea Koch

At: Sacramento, California

ANDREA KOCH

PROFESSIONAL EXPERIENCE

CALIFORNIA ENERGY COMMISSION, December 2009 – Present
Siting, Transmission, and Environmental Protection Division, Sacramento, California
Environmental Planner II- Perform environmental review of power plant applications.

- Review power plant applications for traffic and transportation and land use impacts.
- Write environmental analysis documents.

CITY OF SACRAMENTO, June 2007 – July 2009
Planning Department, Long-Range Planning Division, Sacramento, California
Assistant Planner- Performed long-range city planning for Sacramento.

- Coordinated review of the Draft 2030 General Plan, a comprehensive citywide land use plan.
- Prepared Ben Ali and Hagginwood neighborhood plans. Worked with City staff and community members to identify strategies for resolving neighborhood issues, such as infrastructure deficiencies.
- Reviewed 70 development applications, analyzing their consistency with City policy and providing written feedback to applicants.

COUNTY OF SANTA CRUZ, June 2005 – June 2007
Planning Department, Environmental Planning Division, Santa Cruz, California
Resource Planner II- Performed resource planning for Santa Cruz County.

- Reviewed development permit applications to ensure their consistency with regulations for creeks, wetlands, grading, geologic hazards, erosion control, and sensitive plant and animal species.
- Wrote staff reports analyzing development proposals and providing recommendations to the Environmental Planning Division Manager.
- Performed an average of 5 weekly pre-construction meetings and final inspections at project sites to ensure that development was consistent with County regulations and required mitigations.
- Regularly assisted the public with resource planning questions, both in-person and over the phone.

COUNTY OF MONTEREY, November 2004 – June 2005
Planning Department, Marina, California
Assistant Planner- Performed current planning for Monterey County.

- Reviewed development permit applications for consistency with County regulations.
- Prepared and presented staff reports for development applications. Reports provided recommendations to the Zoning Administrator.
- Assisted the public with zoning questions, both in-person and over the phone.

EDUCATION

California Polytechnic State University, San Luis Obispo, California

- Master of City and Regional Planning, Concentration in Environmental Planning, 2004

University of California, Davis

- Bachelor of Science in Wildlife, Fish, & Conservation Biology, Concentration in Conservation Biology, 2002
- Graduated with High Honors and a Department Citation

DECLARATION OF
Nicholas Lancaster

I, **Nicholas Lancaster,** declare as follows:

1. I am presently employed by the Desert Research Institute, Nevada System of Higher Education, in the Division of Earth and Ecosystem Sciences as a Research Professor.

2. A copy of my professional qualifications and experience is attached hereto and incorporated by reference herein.

3. I helped prepare the staff testimony on **Biological Resources** for the **Palen Solar Electric Generating System Final Staff Assessment,** based on my independent analysis of the Application for Certification and supplement hereto, data from reliable documents and sources, and my professional experience and knowledge.

4. It is my professional opinion that the prepared testimony is valid and accurate with respect to the issue addressed therein.

5. I am personally familiar with the facts and conclusions related in the testimony and if called as a witness could testify competently thereto.

I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge and belief.

Dated: 06/08/2013 Signed: ____________________

At: Reno, Nevada

NICHOLAS LANCASTER

Research Professor - Division of Earth and Ecosystem Sciences
Desert Research Institute
2215 Raggio Parkway
Reno, NV 89512
775-673-7304
Nick.Lancaster@dri.edu

Education

B.A	1971	Geography, University of Cambridge (College Exhibitioner and Scholar)
M.A.	1975	Geography, University of Cambridge
Ph.D.	1977	Geography, University of Cambridge

Positions held

2005-2008	Senior Director, Center for Arid Lands Environmental Management, Desert Research Institute
2003-2005	Program Coordinator, Earth Surface Dynamics Program, U.S. Geological Survey, Reston, Virginia
2002-present	Distinguished Research Associate, School of Geography, University of Oxford
2000	Acting Deputy Director, Division of Earth and Ecosystem Sciences, Desert Research Institute
1999-2009	Adjunct Professor, Department of Geography, University of Guelph, Ontario, Canada
1994-present	Research Professor, Quaternary Sciences Center (now Division of Earth and Ecosystem Sciences), Desert Research Institute
1991-1994	Associate Research Professor, Quaternary Sciences Center, Desert Research Institute
1989-1990	Visiting Assistant Professor, Department of Geology, Arizona State University
1986-1988	Faculty Research Associate, Department of Geology, Arizona State University
1984-1985	Visiting Faculty Research Associate, Planetary Geology Group, Department of Geology, Arizona State University
1984-1997	Visiting Lecturer, Department of Geological Sciences, University of Texas, November 1984
1983-1985	Lecturer and Senior Research Officer, Department of Environmental and Geographical Science, University of Cape Town, South Africa
1980-1982	Research Officer, Desert Ecological Research Unit, Gobabeb, Namibia
1978-1979	Assistant Lecturer, Department of Geography, University of the Witwatersrand, South Africa
1973-1978	Lecturer in Soil Science/Hydrology, Chancellor College, University of Malawi
1971-1973	NERC Research Studentship, Department of Geography, University of Cambridge

Honors and Awards

2007: Regents Researcher Award, NSHE
2002: Nominated for Researcher of the Year, UCCSN
2002: Distinguished visiting researcher, School of Geography, University of Oxford
2001: El-Baz Award for Desert Research, Quaternary Geology and Geomorphology Division, Geological Society of America
2000: Outstanding Faculty Member, University and Community College System of Nevada.
2000: Hart Fellowship, University of Sheffield
1997: Distinguished Career Award, Association of American Geographers, Geomorphology Specialty Group
1995: Nominated for Researcher of the Year, UCCSN
1994: Dandini Medal of Science, Desert Research Institute
1993: Gladys W. Cole Research Award for Geomorphology, Geological Society of America
1992: Outstanding Faculty Member, University of Nevada System

Membership in Professional Societies

Fellow: Royal Geographical Society, Geological Society of America
Member: Association of American Geographers, International Association of Sedimentologists, British Geomorphological Research Group, American Quaternary Association, Sigma Xi, American Association for the Advancement of Science, International Society for Aeolian Research

Professional Service

Editorial Positions

2011 Guest Editor (with Xiaoping Yang and David Thomas) *Special Issue of Quaternary Science Reviews* – Spatial and temporal complexity in Quaternary desert datasets: implications for interpreting past dryland dynamics and understanding potential future changes
2010-present Guest Editor (with Joh Henschel) *Special Issue of Journal of Arid Environments – Namib Desert*
2009-present Co-Editor (with Andreas Baas and Doug Sherman), *Treatise on Geomorphology, Volume 11, Aeolian Geomorphology*, Elsevier.
1992-present Editorial Board member, *Geomorphology*
1998-present Editorial Board member, *Earth Surface Processes and Landforms*
1999-present Editorial Board member, *Sedimentology*
2001-present Editorial Board member, *Quaternary Research*
2006-2007 Guest Editor, *Journal of Geophysical Research, Earth Surface,* Special section on aeolian processes
1996, 2004,
2006-2008 Guest Editor, *Geomorphology,* Special Volumes on Aeolian Processes from ICAR conferences
2000 Guest Editor, *Quaternary International,* Special volume from IGCP 413 Workshop: Linkages between fluvial, lacustrine and aeolian systems, Desert Studies Center, Zzyzx, California
1996 Guest Editor, *Earth Surface Processes and Landforms,* Special Issue on Aeolian Processes

1991	Guest Editor (with K. Pye) Aeolian Sediments Ancient and Modern: International Association of Sedimentologists, Special Paper 16.

Review Panels and Working Groups

2011	Scientific Advisory Panel Member California Desert Renewable Energy Conservation Plan
2011	AAAS Research Competitiveness Program Review Panel for King Abdulaziz City for Science and Technology.
2011	Member Mars Science Laboratory Participating Scientist review panel
2007-present	Leader, INQUA Project 0704, Sand seas and dune fields of the world: a digital Quaternary atlas
2006-2009	International Association of Geomorphologists Working Group on the Geomorphic Implications of Global Environmental Change
2006	DRI representative to International Arid Lands Consortium (IALC) Research and Demonstration Awards Committee (RADAC)
2005-present	Member, Academic Committee, Key Laboratory of Desert and Desertification, Cold and Arid Regions Research Institute, Chinese Academy of Sciences
2005-2008	National Park Service Working Group on monitoring of geologic resources in national parks
2004	Panel Member, Earth System History Program, National Science Foundation
2004-2011	Member and sometime Vice-Chair, National Academy of Sciences, U.S. National Committee for International Union for Quaternary Research (INQUA)
2003	Secretary General, INQUA Commission for Terrestrial Processes, Environments and Deposits
1998	Member – Advisory Board, International Conference on Aeolian Research
2002-2008	International Union of Geological Sciences (IGCP) — member, Project 500: Dryland Changes, Past, Present, and Future
1999-2002	IGCP Project 413 — member, Understanding Future Dryland Changes from Past Dynamics
1993-1998	IGCP Project 349 — Member and sometime U.S. Coordinator, Desert Margins and Paleomonsoons
1986-1992	IGCP Project 252 — Member, Past and Future Evolution of Deserts
1983-1985	IGCP Project 184 — Member, Palaeohydrology of the Low Latitude Deserts

Conferences and Workshops Organized

2010	2nd Planetary Dunes Workshop, Alamosa, CO, co-organizer
2009	Titan Dunes workshop, DRI, SNSC
2009	Dunes Atlas Workshop, School of Geography, Oxford University
2007	1st Planetary Dunes Workshop, Alamogordo, NM, co-organizer
2001-2003	XVI INQUA Conference, Reno.
2000	IGCP 413, Linkages between Fluvial, Lacustrine and Aeolian systems, Workshop at Desert Studies Center, Zzyzx, California, October 2000
1994	Workshop on the Response of Eolian Processes to Global Change, Desert Studies Center, Zzyzx, California, March 1994 (ICAR III)

Session Chairs

2010	Co-organizer: Symposium - Dust in the Earth System, AAAS Annual Meeting, San Diego
2009	Co-chair: Geomorphology session at GSA, Portland
2009	Co-organizer: Symposium - Origin and Evolution of Deserts, AAAS Annual Meeting, Chicago
2007	Convenor, Symposium on Quaternary climate change in deserts, INQUA, Cairns, Australia.
2002	Convenor, Topical Session T105, Response of Dryland Geomorphic Systems to Climate Change and Variability, Geological Society of America
1997	Convenor, Theme Session, Arid Lands Geomorphology, Geological Society of America
1993	Chair, Geological Society of America, Cordilleran and Rocky Mountain Sections Meeting, Reno
1991	Co-Advocate and Session Chair (with D.F. Ritter), Theme Session 5: Global Warming and Geologic Evidence of Aridification during Late Quaternary Time, Geological Society of America Annual Meeting
1990	Co-Convenor (with K. Pye), Symposium on Aeolian Sediments and Processes, International Sedimentological Congress, Nottingham, U.K.

Positions in Professional Societies

2005-2010	Founding President, International Society for Aeolian Research (ISAR)
1992-1993	Chair, SEPM Aeolian Sediments and Processes Research Group
1985	Secretary, Southern African Society for Quaternary Research
1982-1985	Executive Committee Member, Southern African Society for Quaternary Research

Invited Participation in Meetings and Working Groups

2010	Invited presentation (with Stephen Scheidt), AGU Fall Meeting Session
2010	Invited keynote speaker, Global Sand Seas: past, present, future, Royal Geographical Society, London, UK.
2010	Presidential Address, ICAR VII, Argentina
2002	Invited speaker, GSA Annual Meeting, Pardee Symposium, *There and Back Again: Terrestrial Approaches to Extraterrestrial Problems*
1997	Invited observer, *Management Scale Ecosystem Research Workshop,* DoD/ DOE/EPA Strategic Environmental Research and Development Program, Warrenton, Virginia
1996	Invited keynote speaker, International Conference on Desert Development on the Arab Gulf Countries, Kuwait, *Understanding the dynamics of aeolian sand transport systems - an overview of recent progress*
1991	Invited speaker, Los Angeles County Museum of Natural History Symposium, *Southern California Climate, Trends and extremes of the past 2000 years*
1991	Invited speaker, GSA Annual Meeting, Quaternary Geology and Geomorphology Division Symposium: *Quaternary climatic change in arid and semiarid western North America: evidence from the Great Basin, Desert Southwest, and Great Plains*

1990	Invited speaker, NATO Advanced Research Workshop, *Sand, Dust and Soil in their Relation to Aeolian and Littoral Processes,* Sandbjerg, Denmark
1989	Invited speaker, 28th International Geological Congress, Washington D.C., Symposium on Aeolian Sediments
1989	Invited speaker and symposium participant, American Association for the Advancement of Science, Annual Meeting, NASA Ames Research Center, Aeolian Consortium, 1986-1991
1987	Invited speaker, GSA Annual Meeting, History of Geology Division Symposium: *History of Studies of Arid Lands, Ancient and Modern*
1987	Panel member, SEPM Bedforms and Bedding Structures Research Symposium, S.E.P.M. Mid Year Meeting, Austin, Texas
1986	Invited Speaker and Panel Member, 17th Binghamton Symposium in Geomorphology, *Aeolian Geomorphology*
1985	Invited speaker, Geological Society of America Penrose Conference, Geomorphic and Stratigraphic Indicators of Climatic Change in Arid and Semiarid Environments, Lake Havasu City, Arizona

Field Trips and Short Courses

1999	Leader, Cenozoic Landforms and Deposits of the Western Kalahari and Central Namib Desert, Namibia, *XV INQUA Congress Field Excursion B9*
1996	Co-leader (with K. Adams and others), Friends of the Pleistocene Pacific Cell, Fall field trip to Lake Lahontan Basin
1994	Co-leader (with S.G. Wells and others), G.S.A. Cordilleran Section field trip, Quaternary Stratigraphy and Dating Methods: Understanding Geologic Processes and Landscape Evolution in Southern California
1990	Co-leader (with O.K. Davis and others), G.S.A. Cordilleran Section field trip, Quaternary and Environmental Geology of the Northeastern Gulf of California
1988:	Convenor (with R. Greeley), Dynamics of aeolian processes, Graduate College Faculty Research Conference, Arizona State University
1988	Contributor, Short Course on Aeolian Processes for Kuwait Institute of Scientific Research, Arizona State University
1983	Co-Leader, International Symposium on Late Cenozoic Palaeoclimates of the Southern Hemisphere, Swaziland; Post symposium field excursion to Kalahari and Namib Deserts, September 1983
1983	Co-organizer (with J.C. Vogel and J. Deacon), Workshop on the Evidence for Late Quaternary Climatic change in Southern Africa, Johannesburg

Guest Lectures and Seminars

2008	Texas A&M University, Department of Geography
2004	Rutgers University, Department of Geological Sciences, Quaternary Studies Program
2004	University of Oxford, Department of Geography
2003	University of Pittsburgh, Department of Geological Sciences
2000, 2004	University of Sheffield, Department of Geography
1999	University of California, Santa Barbara, Department of Geography
1999	University of Nebraska, Lincoln, Department of Geosciences
1998	Trent University, Ontario, Canada, Department of Geography

1993, 1996, 1998	University of Guelph, Ontario, Canada, Department of Geography
1993	University of Nevada, Las Vegas, Department of Geology
1991	University of Nevada, Reno, Department of Geography
1989	University of California, Los Angeles, Department of Geography
1989	University of Southern California, Department of Geography
1989, 1993	Arizona State University, Department of Geography
1988	Northern Arizona University, Department of Geology
1987, 1990	University of Arizona, Department of Geosciences
1985	University of California, Berkeley, Department of Geography
1984, 1988	University of Texas at Austin, Department of Geological Sciences

Organizing Committees

2007, 2010	Planetary Dunes Workshops
2003	Secretary General INQUA Congress, Reno
2000	Hot Topics Chair, Geological Society of America, Annual Meeting, Reno
1998	DRI/Army Research Office: New Research Directions in Desert Surfacial Processes and Landscape Dynamics on Military Lands, Desert Studies Center, Zzyzx, California
1997	International Symposium: Changing Water Regimes in Drylands, Desert Research Institute
1990	IGCP Project 252 Past and Future Evolution of Deserts Annual Meeting, Tucson, Arizona
1983	International Symposium on Late Cenozoic Palaeoclimates of the Southern Hemisphere, Swaziland

Manuscript Reviews

Science, Sedimentology, Journal of the Geological Society of London, Journal of Sedimentary Research, Journal of Geology, Geology, Geological Society of America Bulletin, Journal of Geophysical Research, Earth Surface Processes and Landforms, Geomorphology, Geography, Catena, South African Geographical Journal, Palaeoecology of Africa, Association of American Geographers Annals, University of Arizona Press, Canadian Journal of Earth Sciences, Quaternary Research, Remote Sensing of Environment (and many others)

Grant Reviews

Council for Scientific and Industrial Research (Foundation for Research Development, South Africa)
National Geographic Society
United States Geological Survey
National Science Foundation
NASA
Natural Environment Research Council (UK)
Australian Research Council
Norwegian Research Council
Israel-USA Bi-National Science Foundation

Desert Research Institute Committees

2008 -2010	Institute Promotions Committee (chair 2009)
2006	Reallocation Committee (Facilities Working Group)
2006	DEES Promotions Committee (chair)
2005-2007	Research Affairs Committee
2002	Search Committee, CIASTA Director
1999-2000	Co-chair, Search Committee for Division of Earth and Ecosystem Sciences Director
1999	Division of Earth and Ecosystems Science Council
1999-2001	Institute Promotions Committee
1998	Organizing Committee, New Research Directions in Desert Surface Processes in and Landscape Dynamics on Military Lands, Desert Studies Center, Zzyzx, April 1998
1998-2001	Chair, Organizing Committee, Symposium on Changing Water Regimes in Drylands
1997, 2000, 2005-present	J.O. Davis Scholarship Selection Committee
1996-1997	Chair, Search committee for fluvial geomorphologist, QSC
1996-1997	Promotions Committees, DRI and QSC
1995	Search Committee for EEEC Center Director
1995-1998	Status of Women Committee
1995-1996	Strategic Planning Group
1995- 2000	Dandini Medal Committee (chair, 1999)
1995	Computer Committee
1994-1996	Northern Nevada Science Center Steering Committee
1994 -1998	Chair, Colin Warden Memorial Endowment Committee

NSHE Committees

2002	Member, Nevada Space Grant Consortium
1999	UCCSN Teaching Award Committee
1993-1996	Nevada Consortium on Geology, Geophysics and Geochronology
1996-1998	Nevada EPSCoR Proposal Development Panel Member.

UNR Committees

1999-2003	Curriculum Committee, Department of Geological Sciences

Grants and Contracts

Current

2011-present	Co-I NASA MFRP – Dune trends and atmospheric modeling
2009-present	Co-PI, GBUAPCD – Keeler Dunes history and dynamics
2008-present	Co-PI Nevada NSF EPSCoR – Nevada Infrastructure for Climate Change Science, Education, and Outreach -National Science Foundation Cooperative Agreement EPS-0814372
2007-present	PI, INQUA Project 0704, Sand seas and dune fields of the world: a digital Quaternary atlas

Past

2010-2011	Co-PI SLOAPCD – Oceano Dunes dust emissions
2010-2011	PI - British Petroleum – Pipelines and dune mobility
2009-2010	PI- Otis Bay – Ash Meadows restoration
2007-2011	Co-PI NASA ESPCoR Planetary Surfaces
2008-2010	Co-I, Israel Bi-national Science Foundation – Negev Dunes (with Haim Tsoar and Dan Muhs)
2006-2010	Principal Investigator, Visualization of sand dune and sand sea development, DOD/STTC.
2006-2008	Principal Investigator, Fringe toed lizard habitat study, Coachella Valley, CA, USGS Denver
2003-2008	Co-Principal Investigator (with Michael Ramsey, University of Pittsburgh) Eolian processes in arid regions, NASA Earth Sciences Division.
2003-2006	Co-PI, (with Dave Loope and Clint Rowe), Collaborative Research: Paleometeorological records from sand dunes and eolian sandstones, National Science Foundation
2003-2006	Co-Principal Investigator, Airflow and Sediment Transport in Complex Terrains on Mars: A Shear Stress Partitioning Approach, NASA Mars Fundamental Research Program
2002-2006	Principal Investigator, ACS/PRF: Internal Sedimentary structure of desert dunes
2002-2003	Principal Investigator, Nevada Space Grant, Sand transport pathways
2001-2003	Co-Principal Investigator, National Science Foundation, Aeolian Processes in the McMurdo Dry Valleys, Antarctica
2001-2002	Principal Investigator, US Geological Survey, Sand transport at Owens Lake,
2001	Co-PI (with R. Webb, USGS), Long-term sand supply to Coachella Valley fringe-toed lizard (*uma inornata*) habitat in the northern Coachella Valley, California
2000-2001	Principal Investigator, Bureau of Land Management, Dune dynamics in the Christmas Valley, Oregon
2000-2002	Co-PI (with Jack Gillies): USDA, Influence of dryland vegetation on sediment transport by wind
1999-2000	Principal Investigator, USGS, Mojave Desert wind erosion study,
1999	Principal Investigator, NOAA, Climate change research - Analysis of data from Geomet stations

1999-2002	Co-PI (with Jack Gillies), National Science Foundation, Fundamental studies of the dust emission process
1999-2000	PI: Twentynine Palms IT/LP Science Advisory Team, Tierra Data Systems
1998-2001	Principal Investigator, National Science Foundation, Relations between sand transport rates and natural desert vegetation cover
1998–2001	Principal Investigator, Great Basin Unified Air Pollution Control District, Studies of managed vegetation as a control for dust emissions from Owens Lake, California (includes 4 separate contracts)
1997-1998	Principal Investigator, USGS, Wind erosion studies
1996-1997	Principal Investigator, NASA, Orbital radar studies of the McMurdo Dry Valleys, Antarctica
1995-1997	Principal Investigator, Great Basin Unified Air Pollution Control District, Studies of effect of natural vegetation on sand transport
1993-1996	Principal Investigator, Department of Energy, Great Basin Paleoenvironmental Studies, Geomorphology
1993-1996	Principal Investigator, Desert Research Institute, Internal Project Assignment, SIR-C Radar Data Analysis
1993	Principal Investigator, Nature Conservancy, Coachella Valley Preserves Project
1993-1994	Luminescence Dating Laboratory Equipment Grant, E.L. Cord Foundation
1993-1994	Aeolian Processes at Owens Lake, CA., Great Basin Unified Air Pollution Control District
1992-1999	Principal Investigator, Soil Remediation studies and wind erosion potential, Nevada Test Site, Department of Energy (multiple contracts)
1992-1996	Princiopql Investigator, E.L. Cord Foundation, Quaternary Geochronology Laboratory equipment
1992-1994	Principal Investigator, National Science Foundation, Earth Sciences Division, Global Change Program, Response of eolian geomorphic systems to climatic change
1992-1994	Principal Investigator, Evolution of the Namib Sand Sea, National Geographic Society
1992-1993	Co-Principal Investigator, Bioanthropology Foundation, Remote Sensing Studies In Egypt
1992-1993	Principal Investigator, Desert Research Institute, Internal Project Assignment, Stratigraphic studies of Lake Lahontan shoreline deposits
1991-1992	Principal Investigator, American Water Development: Potential effects of groundwater abstraction on Great Sand Dunes National Monument
1991	National Research Council, Travel Grant for INQUA Meeting, Beijing, China, August 1991
1990-1994	Project Coordinator, NATO Cooperative Research Program: Thermoluminescence dating of aeolian deposits in the Mojave Desert (with Ann Wintle and Helen Rendell, U.K.)
1990-1992	Principal Investigator, Development of Kelso Dunes, Mojave Desert, California, National Geographic Society
1989-1991	Principal Investigator, Formation of super bounding surfaces in modern sand seas, National Science Foundation, Earth Sciences Division
1989-1998	Associate, Earth Observing System Radar Facility Instrument Team (with G.G. Schaber and others)
1989-1990	Principal Investigator, Investigator Incentive Award, Arizona State University

1988-1989	Principal Investigator, Research Incentive Award, Arizona State University
1988-1997	Co-Investigator (with R. Greeley and others) NASA Shuttle Imaging Radar (SIR-C) Experiment
1987-1991	Co-Investigator (with R. Greeley), Martian Aeolian Processes, NASA Planetary Geology Program
1987	Co-Investigator, (with G. Kocurek) Reservoir characterization of aeolian deposits Unocal
1984-1985	Principal Investigator, Aeolian and dune processes in the Namib Sand Sea. C.S.I.R. Foundation for Research Development and University of Cape Town Research Committee
1984-1985	Principal Investigator, Dynamics of deflation hollows at Elands Bay. University of Cape Town Research Committee
1983	Principal Investigator, Dune systems in the southwestern Kalahari: Harry Openheimer Institute for African Studies, University of Cape Town
1983-1986	Principal Investigator, Late Quaternary Environments in southern Africa. C.S.I.R. Atmosphere and Climate Programme
1979	Principal Investigator, Fixed Dune Systems in the Kalahari. Senate Research Grant, University of the Witwatersrand
1974-1978	Principal Investigator, Lake Chilwa Quaternary History: University of Malawi Research and Publications Committee
1972-1973	Ph.D. fieldwork in Botswana: Royal Geographical Society, Royal Society, University of Cambridge (Smuts Memorial Fund, Philip Lake Fund)

Graduate Student Advising

Current Advisees

Pepe, Nate, “*Quaternary dunes in northern Nevada*”, Department of Geological Sciences, University of Nevada, Reno (MS).

Cupp, K., “*Leeside deposits of aeolian dunes- an experimental approach*”, Department of Geological Sciences, University of Nevada, Reno (PhD).

Past Advisees (MS)

Cupp, K., “*Stratigraphy of Lake Lahontan Deposits*”, Department of Geological Sciences, University of Nevada, Reno, 1993-1997.

Jacobson, S., "*Geomorphic effects of forest fires*", Department of Geological Sciences, University of Nevada, Reno, 1996-1997.

Current Ph.D. committees (UNR)

Okamoto, Sohei, “*Advanced software frameworks for climate change research*”, Department of Computer Science.

Wriston, Teresa, “*Geoarchaeology in western Zimbabwe*”, Department of Anthropology.

Hutson, Jared, “*Paleoenvironmental reconstruction of Middle Stone Age sites using faunal assemblages*”, Department of Anthropology.

Past Ph.D. committees (UNR)

Butt, A., " *Stream channel morphology in the Lake Tahoe Basin*" Hydrological Sciences Program, University of Nevada, Reno, 2000

Adams, K., " *Tectonics and Lake Lahontan Shorelines*", Department of Geological Sciences, University of Nevada, Reno, 1993-1997.

Stirling, M., "*Seismic hazards in southern California*", Department of Geological Sciences, University of Nevada, Reno, 1993-1998.

De Polo, C. "*Estimation of slip rates in the Great Basin using geomorphic criteria*", Department of Geological Sciences, University of Nevada, Reno, 1993-1998.

Ph.D. committees (other institutions)

Scheidt, S., "*Remote sensing in arid regions*", Department of Geological Sciences, University of Pittsburgh, 2000-2009.

Sweezy, C., "*Response of eolian depositional systems to climate and tectonics, Tunisia*", Department of Geological Sciences,University of Texas at Austin, 1992-1997.

Bach, A.J., "*Climatology of dust in southern California*", Department of Geography, Arizona State University. 1992-1996.

Frank, A., "*Airflow patterns over eolian dunes: implications for dune behavior and distribution*", Department of Geological Sciences,University of Texas at Austin. 1991-1994.

Lee, J. , "*The effect of desert shrubs on shear stress from the wind*", Department of Geography, Arizona State University. 1986-90

Sweet, M."*Eolian dune airflow dynamics: implications for dune migration, deposits and spacing*", Department of Geological Sciences,University of Texas at Austin. 1986-1989

Blount, G., "*Regional aeolian dynamics from remote sensing. Origin of the Gran Desierto, Sonora, Mexico*", Department of Geology, Arizona State University. 1986-1988.

Past M.S. Committees (UNR):

Sgambatti, Matt, "*Immersive Visualization and Analysis of Ground Penetrating Radar Data*", Department of Domputer Sciences

Thompson, S., *"Aspects of martian geology",* Department of Geological Sciences, University of Nevada, Reno, 2006-2010

Willoughby, C. *" Neotectonics in the Ruby Mountains, Nevada",* Department of Geological Sciences, University of Nevada, Reno, 1996-1997.

Sloan, J., "*Response of the Eel River to catastrophic floods in 1954, 1964, and 1997*", Hydrological Sciences Program, University of Nevada, Reno, 1995-1997.

Epps, T. Department of Biology, University of Nevada, Reno, 1996.

M.S. Committees (other institutions):

Beveridge, C.A. , "*The Origin and Evolution of the Gran Desierto Sand Sea, Sonora, Mexico*", Department of Geological Sciences, University of Texas at Austin, 2004-2004

Crawley, D.M., *"A wind tunnel investigation of drag partition",* Department of Geography, University of Guelph, 2000

Edgett, K. "*Sand on Mars: the properties of dark intercrater deposits*", Department of Geology, Arizona State University, 1988-1990.

Jones, Lawrence S. "*Relationships between coastal eolian and shallow marine deposition in the Middle Jurassic Page Sandstone and Carmel Formation, south central Utah*", Department of Geology, Northern Arizona University, 1989-1990

Paisley, E.C.I. "*Discrimination of active and inactive sand from remote sensing: Kelso Dunes, Mojave Desert, California*", Department of Geology, Arizona State University, 1988-1990

Skypeck, A. "*Comparison of a Mars circulation model with aeolian features and deposits*", Arizona State University, 1987-1989.

External examiner:

D.Phil. thesis "*Late Quaternary paleoenvironmental reconstruction of the Arabian Peninsul*a", Helen Bray, Department of Geography, University of Oxford, 2004

Ph.D. thesis "*Remobilization of southern African desert dune systems by twenty-first century global warming*", Melanie Knight, Department of Geography, University of Sheffield, UK, 2004

Ph.D. thesis "The spatial and temporal geomorphology and surficial sedimentology of the Gurra Gurra crescentic dunes, Strzelecki Desert, Australia", Mark Anthony Bishop , University of Adelaide, 1997.

M.Sc. thesis "Wind erosion potential in the Cape Province" Jennifer Hallward, University of Cape Town. 1988.

MA thesis "The sedimentology and palaeoenviromental significance of vlei sediments on the Winterberg, South Africa". Felicity Dewey, Rhodes University, Grahamstown. 1988.

Ph.D. thesis "Genesis and ordering of longitudinal dunes", George Tseo, University of Adelaide. 1986.

M.A. thesis "The effects of land use on sediment input to Swartvlei", Janet Barker, University of Cape Town. 1985.

Undergraduate and Graduate Teaching

University of Nevada, Reno

Fall 2006	Advanced Geomorphology (GEOL 441-641), with T. Bullard and K.Adams
Fall 2002	Earth Surface Processes and Sediments (GEOL 202), with J. Trexler
Fall 2002	Advanced Geomorphology (GEOL 441-641), with T. Bullard
Fall 2001	Earth Surface Processes and Sediments (GEOL 202), with J. Trexler
Fall 2000	Earth Surface Processes and Sediments (GEOL 202)), with J. Trexler
Spring 2001	Advanced Geomorphology (GEOL 441-641), with T. Bullard
Spring 1998, 1999,2000	Geomorphology (GEOL 341)
Fall 1996	Desert Geomorphology (GEOL 740)
Spring 1995	Paleolakes of the Great Basin (GEOL 702j)
Fall 1994	Regional Geomorphology of the Western United States (GEOL 701j)
Fall 1993	Geology of the Ice Ages (GEOL 745)
Spring 1993	Desert Geomorphology (GEOL 740)

Arizona State University

Fall 1990:	Introduction to Physical Geology (GLG 101C) Physical Geology Laboratory (GLG 103) Faculty Research Seminar (GLG 503)
Spring 1990:	Physical Geology Laboratory (GLG 103) Aeolian Geology (GLG 490/598)
Fall 1989:	Introduction to Physical Geology (GLG 101C) Faculty Research Seminar (GLG 503)
Fall 1988:	Introduction to Physical Geology (GLG 101C)

University of Cape Town

1985:	Introductory geomorphology course Upper division course in Geomorphic Processes Graduate course in desert geomorphology
1984-1985:	Graduate courses in geomorphology, arid lands surface processes

University of the Witwatersrand, Johannesburg

1978-1979:	Introductory geomorphology course, Upper division course on arid lands geomorphology

Chancellor College, University of Malawi

1973-1978:	Introductory courses in biogeography, field methods and surveying Upper division courses in soils, geomorphic processes, Quaternary environments

Outreach and creative activities

Film and television appearances

2003: KNPB Channel 5 Reno "Wild Nevada Series #203: Southern Sand Dunes"
http://www.knpb.org/WildNevada/Trip303.asp

1999: Burning Sands: Raging Sands□: Brando Quilici Productions/Discovery/RAI/Teleimages□
Producers: Brando Quilici/Executive: Steven Manuel□Writer: Robert Goldberg
http://www.brandoquilici.com/detail_01.asp

This film won the award for Best Writing at the Jackson Hole Wildlife Film Festival 2001
http://www.jhfestival.org/competition/winners.php#2001

DECLARATION OF
Geoff Lesh, PE

I, **Geoff Lesh,** declare as follows:

1. I am presently employed by the California Energy Commission in the Engineering Office of the Siting, Transmission and Environmental Protection Division as a Mechanical Engineer.

2. A copy of my professional qualifications and experience is attached hereto and incorporated by reference herein.

3. I helped prepare the staff testimony on **Traffic and Transportation** for the **Palen Solar Electric Generating System Final Staff Assessment,** based on my independent analysis of the Application for Certification and supplement hereto, data from reliable documents and sources, and my professional experience and knowledge.

4. It is my professional opinion that the prepared testimony is valid and accurate with respect to the issue addressed therein.

5. I am personally familiar with the facts and conclusions related in the testimony and if called as a witness could testify competently thereto.

I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge and belief.

Dated: Sept 9, 2013　　　Signed: Geoffrey C Lesh

At: Sacramento, California

Geoffrey Lesh, PE

WORK HISTORY

California Energy Commission   Mechanical Engineer   2002 - Current

- Analyze siting permit applications for gas-fired and solar-thermal power plants in the technical areas of hazardous materials management, fire safety, security, and worker safety plans
- Provide written and oral expert witness testimony at commission hearings on power plant fire protection plans, risk assessments, and adequacy of local fire departments
- Recommend mitigations as needed
- Inspect power plants during construction and operational phases
- Investigate accident, fire, and hazardous materials incidents at power plants

Self-Employed   Independent Investor   2000 - 2002

- Wrote market analysis computer software

Read-Rite Corp   Wafer Engineering Manager   1994 - 2000

- Designed and developed wafer manufacturing processes for computer data storage systems. Managed team of engineers and technicians responsible for developing wet and dry chemical processes for manufacturing, including process and safety documentation
- Managed process and equipment selection for manufacturing processes
- Processes included vacuum processed metals and ceramics, grinding-polishing, plating, etching, encapsulation, process troubleshooting, and SPC reporting

Dastek Corp   (Komag Joint Venture Start-up) Wafer Engineering Manager   1992 - 1994

- Developed wafer processes for new-technology recording head for hard disk drives
- Managed team of engineers and technicians
- This position included start-up of wafer fab, including line layout, purchase, installation, and startup of new process equipment, etc.

Komag, Inc   Alloy Development Manager   1989 - 1992

- Developed new vacuum-deposited recording alloys
- Responsible for planning and carrying-out tests, designing experiments, analyzing results, managing test lab conducting materials characterizations
- Extensive process modeling, experiment design and data analysis

Verbatim Corp (Kodak)   Process Development Manager   1983 – 1989

- Mechanical/materials engineering for computer disk manufacturing, including product, process, and equipment including metal-ceramic-plastic processes for optical disk development
- Production processes included metal plating, metal evaporation, reactive sputtering, laser-based photolithography, injection molding
- Steering Committee Member, Center for Magnetic Recording Research, UC San Diego
- Steering Committee Member, Institute for Information Storage Technology, Santa Clara University

IBM Corp   Mechanical/Process Engineer   1977 - 1983

- Product development for photocopiers, semiconductors, and computer data tape-storage systems

EDUCATION

Stanford University, Master of Science Degree	Materials Science and Engineering
UC-Berkeley, Bachelor of Science Degree (Double Major)	Mechanical Engineering, Materials Science and Engineering
University of Santa Clara, Graduate Certificate	Magnetic Recording Engineering

PROFESSIONAL LICENSES and CERTIFICATIONS

Registered Professional Engineer, California (PE)	Mechanical #M32576 Metallurgical #MT1940
Certified Safety Professional (CSP)	Board of Certified Safety Professionals
Certified Fire Protection Specialist (CFPS)	Certified Fire Protection Specialist Board (NFPA)
Certified Fire and Explosion Investigator (CFEI)	Board of National Association of Fire Investigators

OSHA 40-hr HAZWOPER Hazardous Materials Incident Training

PROFESSIONAL ASSOCIATIONS

American Society of Safety Engineers – Professional Member
Society of Fire Protection Engineers – Professional Member
National Fire Protection Association – Member
National Association of Fire Investigators – Member

PUBLICATIONS

All-Solid Lithium Electrodes with Mixed-Conductor Matrix, J. Electrocchem. Soc. 128, 725 (1981).

Proc. Symp. on Lithium Batteries, H.V. Venkatasetty, Ed., Electrochem Soc (1981), p. 467.

PATENTS

Method of Preparing Thermo-Magneto-Optic Recording Elements, US Patent# 4,892,634, (assigned to Eastman Kodak Co.)

DECLARATION OF
Laiping Ng

I, **Laiping Ng,** declare as follows:

1. I am presently employed by the California Energy Commission in the Engineering Office of the Siting, Transmission and Environmental Protection Division as an Associate Electrical Engineer.

2. A copy of my professional qualifications and experience is attached hereto and incorporated by reference herein.

3. I helped prepare the staff testimony on **Transmission System Engineering** for the **Palen Solar Electric Generating System Final Staff Assessment,** based on my independent analysis of the Application for Certification and supplement hereto, data from reliable documents and sources, and my professional experience and knowledge.

4. It is my professional opinion that the prepared testimony is valid and accurate with respect to the issue addressed therein.

5. I am personally familiar with the facts and conclusions related in the testimony and if called as a witness could testify competently thereto.

I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge and belief.

Dated: 8/2/2013 Signed: Laiping Ng

At: Sacramento, California

Laiping Ng
Associate Electrical Engineer

Education:

Master of Science: Electrical Engineering - Power
California State University, Sacramento

Bachelor of Science: Electrical Engineering - Power
California State University, Sacramento

Power Certificate – EPRI

Experience:

April 1999 – Present:

- Review and evaluate electrical transmission system sections of the application to ensure that the transmission engineering aspects of the power plant, switchyards, substations, and the related facilities comply with applicable laws, ordinances, regulations, and standards (LORS).

- Prepare written analysis, which address the issues of the adequacy of proposed projects to meet applicable LORS.

- Perform load flow studies and fault analysis.

- Coordinate with CAISO, WSCC and other regulatory agencies and coordinate with utilities companies in the review and evaluation of the power plant siting process.

May 1991 – April 1999:

- Prepared engineering bid specifications for recommended lighting and HVAC projects. Evaluated contractor bids and recommended contractors to customers. Reviewed RFPs and RFQs. Evaluated, selected, and managed engineering consultants. Administrated and coordinated contracts.

- Designed electrical systems for indoor and outdoor lighting and lighting controls. Assisted in design cooling systems and controls for school buildings and office buildings. Reviewed and checked electrical lighting designs and drawings. Analyzed designs and made recommendations for effective actions.

- Performed facility energy audits and field surveys on schools, offices, hospitals and county jail facilities to identify energy efficiency improvements and cost estimate with respect to lighting and HVAC systems. Inspected lighting and HVAC system equipment installation.

- Worked with regulatory agencies to conduct day-to-day basis works such as participated in Nonresidential Energy Efficiency Standards development teams. Prepared and updated Standards concentrating on interior building illumination and indoor and outdoor flood lighting.

DECLARATION OF
Obed Odoemelam, Ph.D.

I, **Obed Odoemelam,** declare as follows:

1. I am presently employed by the California Energy Commission in the Engineering Office of the Siting, Transmission and Environmental Protection Division as a Staff Toxicologist.

2. A copy of my professional qualifications and experience is attached hereto and incorporated by reference herein.

3. I prepared the staff testimony on **Transmission Line Safety and Nuisance** for the **Palen Solar Electric Generating System Final Staff Assessment,** based on my independent analysis of the Application for Certification and supplement hereto, data from reliable documents and sources, and my professional experience and knowledge.

4. It is my professional opinion that the prepared testimony is valid and accurate with respect to the issue addressed therein.

5. I am personally familiar with the facts and conclusions related in the testimony and if called as a witness could testify competently thereto.

I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge and belief.

Dated: 8/6/13 Signed: O Odoemelam

At: Sacramento, California

RESUME

DR. OBED ODOEMELAM

EDUCATION:

1979-1981 University of California, Davis, California. Ph.D., Ecotoxicology

1976-1978 University of Wisconsin, Eau Claire, Wisconsin. M.S., Biology.

1972-1976 University of Wisconsin, Eau Claire, Wisconsin. B.S., Biology

EXPERIENCE:

1989
The Present: California Energy Commission. Staff Toxicologist.

Responsible for the technical oversight of staffs from all Divisions in the Commission as well as outside consultants or University researchers who manage or conduct multi-disciplinary research in support of Commission programs. Research is in the following program areas: Energy conservation-related indoor pollution, power plant-related outdoor pollution, power plant-related waste management, alternative fuels-related health effects, waste water treatment, and the health effects of electromagnetic fields. Serve as scientific adviser to Commissioners and Commission staff on issues related to energy conservation. Serve on statewide advisory panels on issues related to multiple chemical sensitivity, ventilation standards, electromagnetic field regulation, health risk assessment, and outdoor pollution control technology. Testify as an expert witness at Commission hearings and before the California legislature on health issues related to energy development and conservation. Review research proposals and findings for policy implications, interact with federal and state agencies and industry on the establishment of exposure limits for environmental pollutants, and prepare reports for publication.

1985-1989 California Energy Commission.

Responsible for assessing the potential impacts of criteria and noncriteria pollutants and hazardous wastes associated with the construction, operation and decommissioning of specific power plant projects. Testified before the Commission in the power plant certification process, and interacted with federal and state agencies on the establishment of environmental limits for air and water pollutants.

1983-1985 California Department of Food and Agriculture.

Environmental Health Specialist.

Evaluated pesticide registration data regarding the health and environmental effects of agricultural chemicals. Prepared reports for public information in connection with the eradication of specific agricultural pests in California.

DECLARATION OF
Christine Stora

I, **Christine Stora,** declare as follows:

1. I am presently employed by the California Energy Commission in the Compliance Office of the Siting, Transmission and Environmental Protection Division as a Project Manager.

2. A copy of my professional qualifications and experience is attached hereto and incorporated by reference herein.

3. I prepared the staff testimony on the **Executive Summary, Introduction** and **Project Description** for the **Palen Solar Electric Generating System Final Staff Assessment,** based on my independent analysis of the Application for Certification and supplement hereto, data from reliable documents and sources, and my professional experience and knowledge.

4. It is my professional opinion that the prepared testimony is valid and accurate with respect to the issue addressed therein.

5. I am personally familiar with the facts and conclusions related in the testimony and if called as a witness could testify competently thereto.

I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge and belief.

Dated: 8/6/13 Signed: Christine Stora

At: Sacramento, California

CHRISTINE R. STORA

EXPERIENCE SUMMARY

Over nine years of project and staff management experience related to the development of energy projects in North America and other international locations. Technical focus on NEPA, and CEQA compliance, planning, permitting, and compliance monitoring.

PROFESSIONAL EXPERIENCE AND EDUCATION

CALIFORNIA ENERGY COMMISSION COMPLIANCE PROJECT MANAGER 06/2010 to Present

Manages power plant compliance for licensed power plants in California including solar, geothermal, and natural gas. Duties include oversight of power plant construction and ensuring that the conditions of certification are being met throughout construction, operation, and decommissioning of various power plants in California. Reviews petitions to amend existing licenses and gives recommendations to the Commission for approval or denial of requests. Coordinate with Commission technical staff, Certified Building Officers, other regulatory agencies, developers, contractors, and the public to ensure power projects are in compliance with all applicable conditions of certification and LORS. Working knowledge of CEQA, NEPA, and the Warren-Alquist Act.

Construction Compliance Project Manager for the following projects:

- Calpine's Los Esteros 2 Power Plant conversion of the simple-cycle power plant (Los Esteros I) to a combined-cycle with a total output of 320 MW located in north San Jose CA.
- GenOn's Marsh Landing Generating Station 760 MW simple-cycle power plant located in Antioch CA.
- Northern California Power Authority's Lodi Energy Center 255 MW combined-cycle power plant located in Lodi CA.
- Turlock Irrigation District's Almond 2 Power Plant 174 MW simple-cycle peaker located in Modesto CA.
- Calpine's Sutter Energy Center Grimes Pipeline, a 2.8 mile natural gas pipeline.

Amendment Project Manager:
Responsible for all Commission Amendments from 06/2010 to 4/2011. Duties included developing the Amendment Procedures Guidance Document for Compliance Project Managers at the Commission. Coordinate with technical staff, project owners and make recommendations to the Commission regarding changes.
Amendment Highlights:

- CE Obsidian Energy, LLC, Black Rock 1, 2, and 3 Geothermal Power Project amendment to increase generating capacity to 215 MW as a multi-flash, single-generator facility.

- Calpine's Sutter Energy Center (540 MW) amendment to install the 2.8 mile, 6 inch, Grimes natural gas pipeline.
- Turlock Irrigation District's Walnut Energy Center (250 MW) amendment to change annual water usage.
- Sacramento Municipal Utility District's (SMUD's) Consumnes Power Project (500 MW) amendment to inject digester gas from the Sacramento Regional Wastewater Treatment Plant into the natural gas supply line serving the CPP.

Operational Compliance Project Manager on various projects located throughout the state of California.

URS CORPORATION RENEWABLE ENERGY PROJECT AND STAFF MANAGER 11/2003 to 5/2010
Managed the Renewable Energy Group in the URS Sacramento office consisting of: Environmental Scientists, Real Estate Specialists, Marketing Staff and Biologists. As a Project Manager, I provided environmental planning services for international renewable energy clients through sitting, permitting, construction, and post construction, environmental monitoring and compliance. I coordinated multiple disciplines for NEPA and CEQA compliance documents (EISs/EIRs) and other environmental reports related to renewable energy development. I coordinated field surveys as the lead field technician (surveys included avian mortality studies for wind energy developments, wetland delineations, burrowing owl surveys, meteorological siting investigations, geotechnical investigations, and other technical disciplines). I also contributed to marketing and research efforts for the URS renewable energy marketing sector including attending conferences such as the annual Wind Power Conference held by the American Wind Energy Association (AWEA).

Professional awards and certifications include:

- URS Team Award for a Wind Energy Environmental Planning for a team I managed (February 2010)
- URS Monthly Outstanding Achievement Award for Marketing Efforts in the Renewable Energy Sector (December 2008)
- Individual Outstanding Achievement Award in Project Management (2007)
- URS Project Manager Certification (November 2007)

Assignment Highlights

Deputy Project Manager, Searchlight Wind Project, Searchlight, NV, Bureau of Land Management. Duke's Searchlight Wind Project is a 370 MW project consisting of up to 161 wind turbine generators. Provided wind energy planning services including the development of the Plan of Development, Environmental Assessment, and the EIS for the Searchlight Wind Power Project. Managed budget, schedule and technical staff in several URS offices for this effort.

Deputy Project Manager, Sacramento Municipal Utility District (SMUD) Solano Wind Project. November 2003 to March 2010. Responsible for overseeing budgets and schedule for all task orders. Monitored subcontractors and technical staff in a verity of efforts ranging from EIR preparation, biological field surveys, meteorological investigations, land acquisitions and other program activities. Proposal Manager for multiple efforts for this client. Developed program management plans and tracked tasks in MS Project. Managed task orders and staff. Contributed to strategic planning with client. Provided technical guidance and oversight to renewable energy technical staff.

Project Manager, Benicia Wind Project, Benicia CA, Silicon Valley Power (SVP). As a municipal utility SVP will be the lead agency for the EIR and other environmental documentation required for this 40 MW wind power project. Responsible for the direction of planning, environmental assessment, and consulting services provided to the client. These services include reviewing the Solano County General Plan and EIR's for surrounding projects in preparation of developing this project, assisting with the procurement, permitting, and installation of meteorological equipment, and contract negotiations.

Wind Contract Review Services, Gargau Wind Project, Rio de Janeiro, Brazil, for WestLB, Engineering Fatal Flaw Analysis. Assisted in engineering fatal flaw analysis. Documents under review included contractual agreements, the power purchase agreement, supply documents, balance of plant documents, and others. Provided project management support, including budget and schedule management for this project.

Project Management Assistance, Airtricity Asset Due Dilligance, USA and Canada, Confidential Client. Provided Project Management Assistance for an international technical team to assess the value and status of Airticity's operations for purchase by a private investing firm. At the time of the acquisition Airtricity was currently operating wind farms with around 210 MW installed capacity with an additional 880 MW to be operational by the end of 2008. Other Airtricity projects across US and Canada totaled more than 5,000 MW and were in an early development stage at the time of this project.

EDUCATION AND HONORS

Bachelor of Science Degree in Environmental Science from Humboldt State University (2003).

Academic honors include Cum Laude Honors Humboldt State University (2003) and Fall Presidential Scholar Humboldt State University (2001).

DECLARATION OF
Marylou Taylor, P.E.

I, **Marylou Taylor,** declare as follows:

1. I am presently employed by the California Energy Commission in the Engineering Office of the Siting, Transmission and Environmental Protection Division as an Associate Civil Engineer.

2. A copy of my professional qualifications and experience is attached hereto and incorporated by reference herein.

3. I prepared the staff testimony on **Soil and Water Resources** for the **Palen Solar Electric Generating System Final Staff Assessment,** based on my independent analysis of the Application for Certification and supplement hereto, data from reliable documents and sources, and my professional experience and knowledge.

4. It is my professional opinion that the prepared testimony is valid and accurate with respect to the issue addressed therein.

5. I am personally familiar with the facts and conclusions related in the testimony and if called as a witness could testify competently thereto.

I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge and belief.

Dated: 8-1-2013 Signed: Marylou Taylor

At: Sacramento, California

MARYLOU P. TAYLOR, PE

REGISTRATIONS/LICENCES:

California Professional Engineer License # C64353

EDUCATION:

B.S. Civil Engineering
University of California, Davis

PROFESSIONAL HISTORY:

Associate Civil Engineer 2010 to Present
California Energy Commission, Sacramento, CA
Duties within the GeoSciences Unit of the Engineering Office in the Siting, Transmission, and Environmental Protection Division include review and evaluation of applications for certification of thermal power plants within the state of California. The focus of the work is on sensitive project sites that may have issues involving groundwater and surface water resources, soil erosion, flooding potential, water quality and plant-derived wastewater generation and disposal. In addition, evaluate construction, operation and maintenance of the facilities and conduct investigations to determine if violations of the program's regulations, the Energy Commission's conditions of certification, or the California Environmental Quality Act (CEQA) have occurred.

Transportation Engineer, Civil 2000 to 2010
California Department of Transportation (Caltrans), District 3, Sacramento, CA
As Project Engineer in the Office of Design, identified storm water quality issues along public highways within the Tahoe Lake area and designed appropriate features in an effort to preserve and enhance the unique natural environment; and prepared reports evaluating alternatives and proposing a design concept and scope for development and programming.

Designed drainage systems for highways throughout Northern California to comply with Caltrans standards, including: analysis of site hydrology and hydraulic design; storm water management near impaired water bodies; and preparing layouts and construction details for contract plans.

Also performed engineering inspections of State contract construction projects and enforced contractor's compliance with plans and State specifications. Duties include: assisting Resident Engineer in re-designing areas where the contract plans conflicted with field conditions; performing inspections of construction site activities; and managing problems that develop in the field.

Waste Management Engineer 1997 to 2000
California Integrated Waste Management Board, Sacramento, CA
Reviewed and analyzed construction and demolition (C&D) waste handling, processing, and treatment technologies to minimize waste disposal and increase the use of recycled material into useful products. Organized outreach (workshops, conference booth, fact sheets) of C&D programs to industry audiences.

DECLARATION OF
Eric Veerkamp

I, **Eric Veerkamp,** declare as follows:

1. I am presently employed by the California Energy Commission in the Compliance Office of the Siting, Transmission and Environmental Protection Division as a Compliance Project Manager.

2. A copy of my professional qualifications and experience is attached hereto and incorporated by reference herein.

3. I prepared the staff testimony on **General Conditions** for the **Palen Solar Electric Generating System Final Staff Assessment,** based on my independent analysis of the Application for Certification and supplement hereto, data from reliable documents and sources, and my professional experience and knowledge.

4. It is my professional opinion that the prepared testimony is valid and accurate with respect to the issue addressed therein.

5. I am personally familiar with the facts and conclusions related in the testimony and if called as a witness could testify competently thereto.

I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge and belief.

Dated: 8/6/2013 Signed: [signature]

At: Sacramento, California

ERIC W. VEERKAMP, AICP

Compliance Project Manager

EDUCATION
B.S. Business Administration (Human Resources Mgmt.); Minor in Environmental Studies

PROF. AFFILIATIONS
American Institute of Certified Planners (AICP), American Planning Association (APA), Association of Professionals (AEP), Toastmaster International (past member)

COMMUNITY INVOLVEMENT
California Academic Decathlon volunteer, 2009; St. Robert School parent volunteer

Mr. Veerkamp has over 22 years of Planning, Environmental, and Project Management experience.

PLANNER III, COMPLIANCE PROJECT MANAGER

California Energy Commission (June 2011 – Present)

Mr. Veerkamp is currently the Compliance Project Manager for the Genesis Solar Energy Project (GSEP), which is currently under construction, approximately 70% complete. Mr. Veerkamp also has Compliance oversight responsibility on operational projects, including Metcalf, Colusa, Sunrise, Starwood, Metcalf, and Palmdale

PLANNER II

California Energy Commission (September 2010 – June 2011)

Mr. Veerkamp drafted the Land Use Preliminary Staff Assessment for the Hydrogen Energy, California (HECA) project, and the Final Staff Assessment for the Transmission Line Alternatives Analysis, supplementing the Traffic and Transportation Section for the Palmdale Hybrid Power Plant (PHPP). Mr. Veerkamp was also been assigned Traffic and Transportation and Visual compliance responsibilities for G.W. Tracy and Land Use and Socioeconomic compliance for Sutter.

INDEPENDENT CONTRACTOR

EData Corporation. (2010)

Drafted CEQA sections for proposed Jamul Indian Village commercial project in San Diego County, including Traffic and Transportation Alternatives Analysis, Visual Resources, and Land Use. Review and respond to public agency comments on NEPA EIS for proposed Soboba Tribal gaming facility, also in San Diego County.

SENIOR ASSOCIATE

Raney Planning & Management, Inc. (2006 – 2010)

With Raney Planning & Management, Inc., Mr. Veerkamp served as Housing Element Project Manager. Clients included the Cities of Calexico, El Centro, Brawley, Colfax, Hollister, and Oroville. Mr. Veerkamp also assisted with preparation of CEQA environmental documents, served the City of Wheatland as contract planning staff; and managed prevailing wage contracts for Laurin Associates (a division of Raney). Accomplishments include preparing an award winning City-wide Visioning document for the City of Wheatland, and a growth management rating system for the City of Hollister.

DECLARATION OF
Carol Watson

I, **Carol Watson,** declare as follows:

1. I am presently employed by the California Energy Commission in the Environmental Office of the Siting, Transmission and Environmental Protection Division as a Staff Biologist.

2. A copy of my professional qualifications and experience is attached hereto and incorporated by reference herein.

3. I helped prepare the staff testimony on **Biological Resources** for the **Palen Solar Electric Generating System Final Staff Assessment,** based on my independent analysis of the Application for Certification and supplement hereto, data from reliable documents and sources, and my professional experience and knowledge.

4. It is my professional opinion that the prepared testimony is valid and accurate with respect to the issue addressed therein.

5. I am personally familiar with the facts and conclusions related in the testimony and if called as a witness could testify competently thereto.

I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge and belief.

Dated: 8-6-2013 Signed: Carol Watson

At: Sacramento, California

Carol Watson
Sacramento, CA

WORK EXPERIENCE

California Energy Commission **2/2010 - Present**
Sacramento, CA
Siting Transmission & Environmental Protection Division

As staff biologist, primary duty analysis of power plants over 50MW: solar thermal, photovoltaic (pending litigation), natural gas, and coal technologies. Analyze applications to permit projects, conduct CEQA-certified regulatory program under the Warren-Alquist Act, perform scoping and coordination with resource agencies, the public, “intervenors” to the applicant’s process, formulate and recommend mitigation, and defend analysis under oath before Energy Commission Commissioners. Provide compliance oversight for permitted projects during all stages: construction, operation, and closure, and ensure proper implementation of mitigation and resolve biological-related construction issues. Synthesize developing regulations (REAT agency, DRECP Sec. 10 process among others) and relevant legislation to ensure Energy Commission compliance. Coordinate with— and negotiate— solutions with diverse entities as BLM, USWS, Water Quality Control Board, US Army Corps of Engineers, Governor’s Office liaisons to the Energy Commission, private interest groups, and solicitors working on behalf of these interests.

Parsons Corporation **10/2004 - 12/2009**
Las Vegas, Nevada

Principal Scientist

Worked in-house with client, Southern Nevada Water Authority. Served as Principal scientist from 11/2008 to 2/2010. Prepared Environmental Species Act Section 7 Permit for the Southern Nevada Water Authority Pipeline Project. Species included desert tortoise and 10 other Mojave and Great Basin aquatic and upland species. Perform general site surveys, spring snail counts, sage grouse telemetry, mist netting for bats, Amargosa toad surveys in Death Valley, Nevada, and assist the Nevada Department of Wildlife with bat telemetry studies.
From 2004-2008 served as project scientist. Duties included mapping riverbank vegetation of the Virgin river, from the lower reach in Nevada through the confluence with Lake Mead. Ground-truthed plant assemblages based on aerial imagery and 3-dimensional (stereoscopic) views of vegetation. Familiar with cadastral and rastral imagery analysis.
From 9/2005-11/2008 served on consultant basis. Prepared EIS/EIR analysis for impacts to peregrine falcon and special status bat species from the Gerald Desmond Bridge Project, in the Port of Long Beach, California.

Enercon **9/2005-11/2007**
Tulsa, Oklahoma

Project Biologist

Fulltime from 7/2008-11/2008, consulting status from 9/2005 to 5/2007. Served as project biologist, performing a range of work from baseline surveys for the Oklahoma Department of Transportation, preparing NEPA documents, preparing and responding to Requests for Proposals and Requests for Qualifications. Representative projects include coordination of environmental studies and preparation of an Environmental Assessment for the Federal Highway Administration, on behalf of Kellogg Engineering, in Rogers County, Oklahoma. Conducted public scoping and agency solicitation, attending county plenary sessions as technical environmental consultant. Prepared an Environmental Information Document for the Environmental Protection Agency for the expansion of the Rural Water District #3 Tacora Water Treatment plant in Rogers County, OK. Conduct protocol surveys for the federally endangered American burying beetle on behalf of clients such as Chesapeake Operating Systems, OKDOT, and Panther Energy Company, surveyed new pipeline routes from Oklahoma though northern Texas for OG&E.

Representative Project: City of Moreno Valley, Riverside Co., California. Prepared Caltrans' Natural Environment Study for improvements to SR-60 at the Moreno Beach Drive and Nason Street interchanges. Studies included oversight of a jurisdictional delineation of wetlands and waters of the U.S., and coordination with project engineers to determine project boundaries and impacts. Developed mitigation in conformance with the Western Riverside County Multiple Species Habitat Conservation Plan.

BonTerra Consulting **2/2004 – 10/2004**
Pasadena, California

Wildlife Biologist

Draft RFQ/RFP, perform general biological surveys on behalf of public and private sector clients, and prepare CEQA/NEPA documentation. Representative Project: Plum Canyon Development, Los Angeles Co., California: Conducted salvage (pitfall trapping & grubbing salvage) and relocation of sensitive and local populations of reptiles and amphibians. Species handled included Western spadefoot toad, coastal western whiptail, and silvery legless lizard. Coordinated with CDFG regarding species of special concern, drafting relocation plans, and assisted with developing a protocol to simulate and force spring emergence and subsequent relocation of spadefoot toads prior to grubbing.

Sapphos Environmental **12/2000-2/2003**
Pasadena, California

Wildlife Biologist

Responsible for all phases of project management and biological technical work. Responded to and prepared RFP/RFQ, designed and conducted environmental study sufficient to project details (*i.e.* determination and development of appropriate ESA, NEPA, CEQA, Clean Water Act permits); and prepared environmental documentation. Prepared and conducted all public noticing and scoping per regulations, and prepared as technical consultant before the county and city and planning committees of Ventura and Los Angeles.

Representative Project: Ahmanson Ranch, Ventura County, California: Conducted long-term monitoring of a population of California red-legged frog with detailed notes as to location, behavior, and conditions. Assisted permitted biologists in placing passive integrated transponders, or PIT tags, as part of a radio telemetry study designed to aid understanding of habitat use and foraging distances. Assisted with the preparation of a Biological Assessment for an Endangered Species Act Section 7 consultation. Managed the design and creation of enclosed habitat and a captive breeding program. Prepared monthly status reports, and conducted various studies at the Ahmanson Ranch, including San Fernando Valley spineflower introduction studies, seed counts and collections, and oak tree surveys and assessments.

EDUCATION

M.S. Zoology, Eastern Illinois University **2000**
Focus: environmental ecology; population dynamics
Paid Teacher's Assistantship

B.S., Biology, Western Michigan University 1998
Chemistry minor

RELEVANT TRAINING

CPR Certified (2011, Energy Commission)
Desert Tortoise Surveying, Monitoring, and Handling Workshop, (2000)
BLM certified to survey for the flat-tailed horned lizard (2001)
California red-legged frog workshop (2001)
Passed U.S. Fish and Wildlife Service survey exam for El Segundo blue butterfly (2002)
American Burying Beetle Bait-away Surveys and Pitfall Trapping (performed under a permitted biologist' supervision), 2006-2007.

DECLARATION OF
Casey Weaver, CEG

I, **Casey Weaver,** declare as follows:

1. I am presently employed by the California Energy Commission in the Engineering Office of the Siting, Transmission and Environmental Protection Division as a Engineering Geologist.

2. A copy of my professional qualifications and experience is attached hereto and incorporated by reference herein.

3. I prepared the staff testimony on **Geology and Paleontology** for the **Palen Solar Electric Generating System Final Staff Assessment,** based on my independent analysis of the Application for Certification and supplement hereto, data from reliable documents and sources, and my professional experience and knowledge.

4. It is my professional opinion that the prepared testimony is valid and accurate with respect to the issue addressed therein.

5. I am personally familiar with the facts and conclusions related in the testimony and if called as a witness could testify competently thereto.

I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge and belief.

Dated: 8/6/13 Signed: [signature]

At: Sacramento, California

CASEY W. WEAVER, PG, CEG
1621 Delta Drive
Woodland, CA 95695
(530) 662-0482

SUMMARY OF EXPERIENCE:

Certified Engineering Geologist with over 20 years of environmental and geotechnical consulting experience. Experience includes remedial investigations and feasibility studies (RI/FS), groundwater investigations, corrective action plans, landfill studies (SWATs, siting, closure), preliminary environmental site assessments (PESA, Phase I), regulatory compliance (RCRA/CERCLA), geotechnical investigation/evaluation, geologic hazard evaluations, active fault evaluations, seismic studies, landslide evaluation/repair, foundation suitability studies, personnel management and business development.

EDUCATION:

B.S. Geology, Humboldt State University, Arcata, CA, 1981
University of California, Davis Extension Courses

REGISTRATIONS/LICENCES/CERTIFICATIONS:

Certified Engineering Geologist, California
Registered Geologist, California, Oregon, Arizona
Registered Environmental Assessor
OSHA 1910.120 Hazardous Waste Operations and Emergency Response - 40hr
OSHA 1910.120 Hazardous Waste Operations and Emergency Response - Supervising Operations at Hazardous Waste Sites.

PROFESSIONAL HISTORY:

2008 to Present

Engineering Geologist
California Energy Commission, Sacramento, CA

Duties within the Geosciences Unit of the Engineering Office in the Siting, Transmission, Environmental Protection Division include review and evaluation of applications for certification of thermal power plants within the state of California. The focus of the work is on sensitive project sites that may have issues involving geologic hazards, paleontological, groundwater and surface water resources, soil erosion, flooding potential, water quality and plant-derived waste generation and disposal. In addition, evaluate construction, operation and maintenance of the facilities and conduct investigations to determine if violations of the program's regulations, the Energy Commission's conditions of certification, or the California Environmental Quality Act (CEQA) have occurred. Selected as the Energy Commission's seismic expert and CEC's representative on the multi-jurisdictional Independent Peer Review Panel which reviews and provides comments to major utilities regarding their seismic investigations and evaluations conducted for California's nuclear power plants.

2001 to 2008

Engineering Geologist
State Water Resources Control Board, Headquarters, Sacramento, CA

With the UST Enforcement Unit, under direction from the State Attorney General's Office, conducted inspections of UST systems to evaluate compliance with 1998 upgrade requirements. This work culminated in the largest settlement of its kind in the nation's history. In addition, conducted surveillance of unlawful discharges from remediation systems and conducted investigations of UST Fund fraud cases.

With the USTCF Technical Review Unit, evaluated the technical elements of USTCF claims.

With the Division of Financial Assistance, assisted with the development of program policy for the Agricultural Water Quality Grant Program ($46 million) and the Integrated Water Quality Grant Program ($380 million), participated in stakeholder workshops, contributed to multijurisdictional work groups for program development and implementation.

With the Office of Enforcement, conducted investigations of operator misconduct, wrote enforcement investigation reports and prepared disciplinary letters.

1998 to 2001

Senior Engineering Geologist
BSK & Associates, Rancho Cordova, CA

Designed and directed hydrogeologic investigations for use with environmental remediation projects. Supervised field personnel installing groundwater monitoring wells, conducting aquifer tests & SVE pilot tests, reviewed reports and workplans, and conducted business development.

Conducted review of Alquist-Priolo active fault hazard reports as county geologist for Kern County.

1993 to 1998

Senior Geologist, Geoscience Team Leader and RI/FS Task Leader
LAW Engineering and Environmental Services, Inc., Sacramento, CA

As Geoscience Team Leader, responsible for career development, training and personnel management of ten employees. This group consisted of 3 senior-level geologists, 4 project level geologists and scientists, 2 junior level geologists and 1 technician.

As RI/FS Task Leader, responsible for the development of cost estimates/budgets, preparation of Work Plans and Sampling and Analysis Plans, management of field activities, data collection and documentation associated with the investigation of 15 Installation Restoration Program sites at Beale Air Force Base awarded under several Delivery Orders with combined project budgets of $18 million. Also responsible for aerial photographic interpretations associated with a basewide (23,000 acres), Preliminary Assessment, and preparation of a basewide Hydrogeologic Evaluation Report.

1990 to 1993

Senior Project Manger/General Manager
Earthtec, Ltd., Roseville, CA

Management of Environmental Department, business development, preparation of cost estimates and proposals, client and regulatory agency interface, supervision and training, report writing, technical review, budget management, and quality control. Initiated and supported the development of company's wetland and wildlife departments. Typical projects included preliminary site assessments, soil vapor studies, detailed hydrogeologic evaluations, waste plume delineations, and development of remediation alternatives associated with landfills, service stations, bulk oil facilities and other potentially contaminated sites.

1981 to 1990

Project Geologist
SHN Group, Inc. Eureka, CA

Managed project work directed toward solving environmental issues at variably contaminated sites and provided geotechnical information for land development and construction. Responsibilities included development of cost estimates/budgets, planned and supervised field operations, collected and interpreted subsurface information, evaluated areas traversed by Alquist-Priolo Special Studies Zones and sites subject to slope stability hazards. Typical projects included geotechnical evaluations and geologic hazard studies for major subdivisions, hospitals, schools, lumber companies, run-of-the-river hydroelectric projects, underground storage tank sites, and solid waste landfills.

1979 to 1981 **Geologist/Seismologic Technician**
Woodward-Clyde Consultants, San Francisco, CA

Designed and operated a laboratory model to study surface effects of thrust faulting in connection with seismic evaluation studies for the PG&E Humboldt Bay nuclear reactor. In addition, installed and operated field seismographs in the Humboldt Bay region.

DECLARATION OF
Lisa Worrall

I, **Lisa Worrall**, declare as follows:

1. I am presently employed by the California Energy Commission in the Environmental Office of the Siting, Transmission and Environmental Protection Division as a Planner II.

2. A copy of my professional qualifications and experience is attached hereto and incorporated by reference herein.

3. I prepared the staff testimony on **Socioeconomics** for the **Palen Solar Electric Generating System Final Staff Assessment,** based on my independent analysis of the Application for Certification and supplement hereto, data from reliable documents and sources, and my professional experience and knowledge.

4. It is my professional opinion that the prepared testimony is valid and accurate with respect to the issue addressed therein.

5. I am personally familiar with the facts and conclusions related in the testimony and if called as a witness could testify competently thereto.

I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge and belief.

Dated: August 2, 2013 Signed: Lisa Worrall

At: Sacramento, California

LISA WORRALL

Summary

- Over eleven years of environmental analysis experience.
- Preparation of environmental documents in compliance with the California Environmental Quality Act (CEQA), National Environmental Policy Act (NEPA), California Energy Commission siting regulations, and federal, state and local laws, ordinances, regulations and standards (LORS).
- Projects include thermal power plants, private residential and commercial development, county and public works, and state transportation.

Employment Experience

California Energy Commission
Planner II Sacramento, California
January 2010 to Present

- Prepare an independent CEQA analysis of the environmental impacts from thermal power plants related to land use and socioeconomics.
- Evaluate projects in accordance with CEQA, the California Energy Commission siting regulations, and federal, state and local LORS.
- Review information provided by the project applicant and other resources to assess the environmental effects of energy facility proposals

Sacramento County Department of Environmental Review & Assessment
Associate Environmental Analyst Sacramento, California
April, 2006 – May, 2009

- Prepared a variety of environmental documents in compliance with CEQA, NEPA and local, state and federal LORS.
- Conducted project site assessments, reviewed engineering plans, and researched and interpreted scientific data for project impact analysis.
- Managed multiple public works and private development projects with a variety of environmental concerns and overlapping deadlines.
- Maintained effective relationships with other Sacramento County departments, agencies, and service providers to ensure comments and recommended conditions of project approval were obtained and any associated environmental impacts assessed.

Analytical Environmental Services Sacramento, California
Associate April, 2004 – October, 2005

- Interpreted highly technical traffic impact studies, utilizing the information to develop a traffic impact assessment chapter for use in a variety of environmental documents complying with CEQA, NEPA, and county and city transportation policies and codes.
- Managed the preparation of traffic studies, including developing the scope of study, securing the contract, and reviewing the work product.
- Managed multiple private development projects simultaneously under tight deadlines. Clients included Native American tribes and cities.
- Coordinated with state, county and city officials in the development of traffic study methodology, parameters and assumptions for proposed projects.

- Worked closely with transportation engineers to understand the complexities of each project's specific traffic impacts.

California Department of Transportation (Caltrans) Fresno, California
Associate Environmental Planner March, 2003 – March, 2004
Environmental Planner August, 2000 – March, 2003

- Prepared all levels of environmental documentation for transportation projects in compliance with CEQA and NEPA.
- Coordinated and interpreted environmental technical studies for incorporation into the environmental document and for explanation to other team members, agencies, and the public.
- Managed and represented environmental concerns with other functional units.
- Led and participated in public outreach events.
- Coordinated project development with other Caltrans departments, agencies and the public.

Education

California State University, Northridge May, 2000
Bachelor of Arts in Geography

PALEN SOLAR ELECTRIC GENERATING SYSTEM (09-AFC-7C)
FINAL STAFF ASSESSMENT – Part A

Amendment to Palen Solar Power Project

PREPARATION TEAM

Executive Summary .... Christine Stora

Introduction .... Christine Stora

Project Description .... Christine Stora

Environmental Assessment

~~Air Quality.. Jacquelyn Leyva Record~~

Biological Resources............Ann Crisp, William B. Haas, Chris Huntley, Nick Lancaster and
 .... Carol Watson

~~Cultural Resources............................ Matthew Braun, Thomas Gates, and Michael McGuirt~~

Hazardous Materials Management .... Alvin Greenberg, Ph.D.

Land Use... James Adams

Noise and Vibration .... Shahab Khoshmashrab

Public Health .... Huei-An (Ann) Chu, Ph.D.

Socioeconomics .... Lisa Worrall

Soil and Water Resources.. Marylou Taylor, P.E.

Traffic and Transportation .... David Flores, Alvin Greenberg, Ph.D., Gregg Irvin, Ph.D.,
 .... Andrea Koch and Geoff Lesh, PE

Transmission Line Safety and Nuisance .... Obed Odoemelam, Ph.D.

Visual Resources .... Gregg Irvin, Ph.D. and William Kanemoto

Waste Management .... Christopher Dennis, PG

Worker Safety and Fire Protection .... Alvin Greenberg, Ph.D.

Engineering Assessment

Facility Design .... Shahab Khoshmashrab

Geology and Paleontology .... Casey Weaver, CEG

Power Plant Efficiency... Edward Brady

Power Plant Reliability... Edward Brady

Transmission System Engineering.. Mark Hesters and Laiping Ng

Alternatives... Jeanine Hinde

Compliance Conditions and Compliance Monitoring Plan........................ Eric Veerkamp

Project Assistant... Alicia Campos and Marci Errecart