**STATE OF CALIFORNIA**

**Energy Resources Conservation and Development Commission**

| DOCKET |
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| 07-AFC-5 |
| DATE 12/18/09 |
| RECD. 07/16/10 |

In the Matter of: )
)
The Application for Certification for the ) Docket No. 07-AFC-5
**IVANPAH SOLAR ELECTRIC )**
**GENERATING SYSTEM** )
_____)

**SIERRA CLUB'S OPENING TESTIMONY AND WITNESS AND EXHIBITS LISTS**

December 18, 2009

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## SIERRA CLUB'S OPENING TESTIMONY AND WITNESS AND EXHIBITS LISTS

Pursuant to the Committee's revised scheduling order dated November 23, 2009, the Sierra Club provides the following opening testimony and witness and exhibits lists concerning the Ivanpah Solar Electric Generating System (ISEGS) evidentiary hearings scheduled for January, 2010.

The Sierra Club reserves the right to supplement or revise its testimony at any time up to and including the close of the evidentiary hearings.

### I. The Sierra Club's Contested Issue: Project Alternatives

The Sierra Club has reviewed the FSA, the applicant's opening testimony and other project-related materials and disputes that the ISEGS project will comply with applicable LORS. In fact, all evidence shows that the ISEGS project will result in significant, unmitigated impacts to biological resources, such as the state and federally threatened desert tortoise and eight special-status plant species. The FSA did not comply with applicable LORS because it omitted adequate protections for all of the biological resources impacted by the proposed project. And, related, the FSA failed to fully and adequately assess the Sierra Club's proposed alternative submitted to the Commission in June 2009. Proper investigation and disclosure of the Sierra Club's alternative would have shown that many of the ISEGS' project-related impacts to biological resources could have been avoided.

## II. Testimony Submitted

Testimony of Scott Cashen, Scientifically Valid Comparison of the FSA's I-15 Alternative's and Proposed Project's Impacts on Biological Resources; declaration; resume.

## III. Exhibit List

| Doc. No. | Author Title |
|---|---|
| 600 | Sierra Club's June 2009 letter proposing an alternative to the ISEGS' site configuration |
| 601 | Nussear KE, TC Esque, RD Inman, LL Gass, KA Thomas, CSA Wallace, JB Blainey, DM Miller, RH Webb. 2009. Modeling habitat of the desert tortoise (*Gopherus agassizii*) in the Mojave and parts of the Sonoran Deserts of California, Nevada, Utah, and Arizona: U.S. Geological Survey Open-File Report 2009-1102, 18 p. |
| 602 | Collis S, HW Avery. 2000. Proximate constraints affecting the reproductive output and mortality of desert tortoises [abstract]. Proceedings of the Desert Tortoise Council 2000 Symposium. pp. 12-13. |
| 603 | Curriculum Vitae for Jim Cornett |
| 604 | Cashen, Scott. Map of areas in the Project and I-15 alternative sites surveyed for desert tortoise burrows. |
| 605 | LaRue EL, Jr. 1992. Distribution of desert tortoise sign adjacent to Highway 395, San Bernardino County, California. Proceedings of the Desert Tortoise Council 1992 Symposium. pp. 190-204. |
| 606 | Nicholson L. 1978. The effects of roads on desert tortoise populations. Proceedings of the Desert Tortoise Council 1978 Symposium. pp. 127-129. |
| 607 | Boarman WI. 2002. Threats to Desert Tortoise Populations: A Critical Review of the Literature. U.S. Geological Survey, Western Ecological Research Center. Sacramento (CA): 86 p. |
| 608 | Boarman WI, M. Sazaki. 2006. A highway's road-effect zone for desert tortoises (*Gopherus agassizii*). Journal of Arid Environments 65:94-101. |
| 609 | CDFG. 2009 Oct 27. Comments on the Preliminary Staff Assessment and Recommendations for the Final Staff Assessment for the Ivanpah Solar Electric Generating System (CEC Docket # 07-AFC-5). Letter from Kevin Hunting, Deputy Director, Ecosystem Conservation Division to John Kessler, Program Manager, Siting, Transmission & Environmental Protection Division, California Energy Commission. |
| 610 | Thomas KA, T Keeler-Wolf , J Franklin, P Stine. 2004. Mojave Desert Ecosystem Program: Central Mojave Vegetation Mapping Database. Western Regional Center, US Geological Survey. Technical Report. |

**Documents Sierra Club Relied Upon, and Already Entered as Exhibits by the Applicant**

- CH2MHILL. 2009 Aug 12. Supplemental Data Response, Set 2I, Ivanpah Solar Electric Generating System (07-AFC-5). Letter from John Carrier, Program Manager to John Kessler, Project Manager, California Energy Commission.

- CH2MHILL. 2008 Sep 12. Data Response, Set 2D, Ivanpah Solar Electric Generating System (07-AFC-5). Letter from John Carrier, Program Manager to Che McFarlin, Project Manager, California Energy Commission.

- Garcia and Associates. 2008. Technical Report: Botanical Resources of the Ivanpah Solar Electric Generating System.

Dated: December 18, 2009

Respectfully submitted,

*Original Signed By:*

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**Testimony of Scott Cashen**
**Ivanpah Solar Electric Facility Generating System Project**

**Re: Biological Resource Impacts of the Ivanpah Solar Electric Facility Generating System Project**

**Docket 07-AFC-5**

**Qualifications**

## Education

I have a Master's of Science Degree in Wildlife and Fisheries Science from the Pennsylvania State University, University Park. The degree program included coursework in Landscape Ecology, Biometrics, Statistics, Conservation Biology, and Wetland Ecology. For my thesis, I conducted seven seasons of independent research on avian use of restored wetlands. The U.S. Fish and Wildlife Service subsequently used my technical report as a model for other habitat restoration monitoring projects in Pennsylvania.

## Work Experience

My employment experience has included work in the fields of wildlife biology, forestry, and natural resource consulting. Much of my work over the past two and a half years has involved review of environmental documents associated with development of large-scale solar energy facilities. To date, I have served as an expert witness on eight different solar projects, five of which are being sited in the Mojave Desert. I am currently entering the second year of a two-year contract I hold with the State of California to conduct surveys for the Peninsular bighorn sheep near Anza-Borrego Desert State Park. I serve as a member of the scientific review team responsible for assessing the effectiveness of the US Forest Service's implementation of the Herger-Feinstein Quincy Library Group Act.

For the past two years I have served as a self-employed consultant. I previously served as a Senior Biologist for TSS Consultants and ECORP Consulting. Other positions I have held have included conducting wildlife research for the National Park Service, the Point Reyes Bird Observatory, and the University of California. While in graduate school I served as an instructor of Wildlife Management and as a teaching assistant for a course on ornithology. A summary of my education and professional experience is attached to this testimony.

The testimony contained herein is based on my review of the environmental documents prepared for the Ivanpah Solar Electric Generating System Project ("Project"), and review of scientific literature on the biological resources known to occur in the Project area. In addition, I have conducted my own investigations and analyses on the Project's potential environmental impacts and alternatives. My testimony is based on the activities described above and the knowledge and experience I have acquired during more than 17 years of working in the field of natural resources management.

## STATEMENT

### I. The FSA Omitted a Scientifically-Valid Assessment of the I-15 Project Alternative

The record is clear that the proposed Project would substantially affect many sensitive plant and wildlife species, and it would eliminate a broad expanse of relatively undisturbed Mojave Desert habitat.[1] In addition to direct loss of habitat, the Project would fragment and degrade adjacent habitat, which is also relatively undisturbed.[2] In the FSA, staff discussed the alternative of moving a portion of the Project closer to the I-15 freeway (i.e., slightly east).[3] The "I-15" alternative is advantageous in that it would allow the Project to meet its objectives while remaining in the Ivanpah Valley.[4] As a result, assessment of potential impacts resulting from the I-15 alternative was the focus of my review.

Staff concluded impacts to biological resources at the I-15 alternative site would be comparable to those at proposed project location.[5] Staff's conclusion was based on the presumption that the alternative site would not reduce direct impacts to sensitive plant and wildlife species.[6]

In my opinion, the I-15 alternative location would still result in some impacts to biological resources. Importantly, however, the I-15 alternative would not have the same ecological *system-level* impacts as the proposed Project site, and its impacts to individual plant and animal species would be less severe that the proposed Project. Staff failed to consider this level of analysis in the FSA. Because the I-15 alternative is located adjacent to the freeway and the Primm Valley Golf Club, it would result in less habitat fragmentation and community-level disturbance. Habitat fragmentation and community-level disturbance are known threats to the

[1] [FSA] Final Staff Assessment, p. 6.2-1.
[2] *Id.*
[3] *See* FSA, p. 4-43.
[4] *Id*, p. 4-44.
[5] *Id*, p. 4-45.
[6] *Id.*

long-term viability of many plant and animal species.[7] In my opinion, reducing these threats would benefit the sensitive species known to occur in the Ivanpah Valley.

Reduction of system-level impacts does not subjugate the need to evaluate organism-level impacts or otherwise assess the overall impacts associated with each alternative. As a result, I evaluated the validity of the FSA's conclusions on impacts that would result from implementation of the I-15 alternative.

### A. The FSA Devoted Insufficient Time and Resources to Site Comparisons for the I-15 Alternative

According to the FSA, a "reconnaissance" survey of the proposed project and I-15 alternative sites was conducted on August 15, 2009.[8] During the survey, a biologist examined representative samples of habitat in each of the sites.[9] The survey included examination of habitat for quality and evidence of wildlife activity.[10] In addition, the biologist rated (a) micro-relief; (b) soil texture; (c) vegetation; (d) ground cover; (e) plant diversity; (f) likelihood of desert tortoise occurrence; (g) likelihood of special-status species occurrence; (h) quality of surrounding habitat; (i) special features; and (j) overall quality of habitat for wildlife and desert tortoises.[11] The biologist took field notes, photographed the habitat, and completed evaluation forms.[12] The FSA does not identify the biologist that conducted the survey; nor does it provide the biologist's field notes, photographs, or evaluation forms.

Access to portions of both the proposed Project and I-15 alternative sites is relatively good; however, access to other portions is relatively time consuming. The two sites overlap by approximately 25 percent.[13] Given the Project would occupy approximately 4,073 acres,[14] the FSA implied that a single biologist was able to representatively sample 7,128 acres (i.e., the area occupied by the two sites) in a single day, and that that biologist was able to collect data on approximately 11 variables at each sampling location. In my opinion, adequately completing these tasks in one day is essentially impossible. Because the FSA did not specify the sampling locations or the observed variance, it is impossible to evaluate how representative the samples were. Nonetheless, given the minimal level of effort that was devoted to such a large area, few samples could have been conducted and/or the field data were hastily collected. Under either scenario, the data do not provide a reliable comparison of the two sites.

[7] Meffe GK, CR Carroll. 1997. Principles of Conservation Biology, 2nd edition. Sinauer Associates, Inc., Sunderland, MA.
[8] FSA, p. 4-44.
[9] *Id.*
[10] *Id.*
[11] *Id.*
[12] *Id.*
[13] *Id.*
[14] FSA, p. 6.2-8.

### B. Staff Inadequately Analyzed the Relative Impacts to the Desert Tortoise in the I-15 Alternative Analysis

According to the FSA, the I-15 alternative site is located in high quality, relatively undisturbed habitat for desert tortoises, and it provides no less value to the organism than the proposed Project site.[15] In my opinion, these findings are not supported by the evidence, and the FSA omitted a scientifically valid justification for its conclusions. For example, in presenting the alternatives analysis, the FSA did not quantify or discuss several of the variables that are considered statistically significant predictors of desert tortoise habitat.[16] These include landscape surface roughness, rockiness, soil bulk density, perennial plant cover, and annual plant potential.[17] Other significant predictors (e.g., precipitation) were not properly considered. Research in the Ivanpah Valley has shown micrographic differences in rainfall and primary productivity of annual vegetation can result in significant differences in desert tortoise fecundity and mortality.[18] Information provided in the FSA indicates there are differences in average precipitation among regions of the Project and alternative sites.[19] Surveys for annual plant vegetation were not conducted on the alternative site, and the reconnaissance visit described in the FSA was conducted during the time of year (i.e., late summer) when many annual plants would not have been identifiable.

By focusing solely on habitat "quality", the FSA ignored the critical importance of distinguishing between the *physiological* (fundamental or potential) niche and *ecological* (realized or actual) niche of organisms.[20] A major problem with the FSA's oversimplification of habitat is that features measured can stay the same while use of important resources by an animal within that habitat can change—for example, changes in the species or size of prey taken by a bird foraging on shrubs.[21] The difficulty in, and need to: (a) identify constraints on exploitation of critical resources; and (b) consider critical limiting factors; has been the topic of much of the recent literature on recovery of the desert tortoise population.[22]

### C. Relative Abundance of Desert Tortoises at the Project Site Compared to the I-15 Alternative Site.

Because the FSA omitted a meaningful comparison of the I-15 alternative site's impacts on desert tortoises, I led a field study that was specifically designed to attain information on tortoise resources and occupancy at the proposed Project and I-15 alternative sites. The

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[15] *Id*, p. 4-44, 45.
[16] *See* Nussear KE, TC Esque, RD Inman, LL Gass, KA Thomas, CSA Wallace, JB Blainey, DM Miller, RH Webb. 2009. Modeling habitat of the desert tortoise (*Gopherus agassizii*) in the Mojave and parts of the Sonoran Deserts of California, Nevada, Utah, and Arizona: U.S. Geological Survey Open-File Report 2009-1102, 18 p. (Exhibit 601)
[17] *Id.*
[18] Collis S, HW Avery. 2000. Proximate constraints affecting the reproductive output and mortality of desert tortoises [abstract]. Proceedings of the Desert Tortoise Council 2000 Symposium. pp. 12-13. (Exhibit 602)
[19] FSA, Chapter 19b, Soil and Water –Figure 2.
[20] Morrison ML, BG Marcot, and RW Mannan. 2006. Wildlife-Habitat Relationships: Concepts and Applications. 3rd ed. Washington (DC): Island Press. 493 p.
[21] *Id.*
[22] E.g., *See* Tracy CR, R Averill-Murray, W Boarman, D Delehanty, J Heaton, E McCoy, D Morafka, K Nussear, B Hagerty, P Medica. 2004. Desert Tortoise Recovery Plan Assessment. Available at: http://www.fws.gov/nevada/desert_tortoise/dtro_recover_plan_assess.html.

objectives of the study were to:

1. Collect empirical data on tortoise abundance, such that I could test whether there was a significant difference in relative abundance between the two sites.
2. Thoroughly evaluate the two sites, such that I could assess the presence, distribution, and abundance of tortoise resources and threats at the two sites.
3. Evaluate the suite of biological resources present in the region so that I could formulate an educated opinion on whether the I-15 alternative site was appropriately configured to minimize impacts to sensitive biological resources.

### 1. Methodology

Before collecting field data, I reviewed the FSA, Project maps, environmental documents submitted on behalf of the applicant, information provided in the California Natural Diversity Database (CNDDB), and other literature pertaining to the desert tortoise. Jim Cornett and I then developed a plan to meet the study's objectives. Mr. Cornett is the principal of JWC Ecological Consultants, the only ecological consulting firm specializing in biological surveys and impact analyses in the California deserts. Mr. Cornett has provided consulting services since 1974, he is the former Director of Natural Science at the Palm Springs Desert Museum, and he is a recognized authority on desert organisms and environments. Mr. Cornett's qualifications are presented as Exhibit 603.

#### a. Field Techniques

Our field survey methods replicated those performed by the applicant's consultants at the Project site, and those recommended in the U.S. Fish and Wildlife Service's protocol survey guidance for the desert tortoise.[23] Specifically, we used the line-transect method to survey each of the two sites. Before initiating the surveys, Mr. Cornett instructed a survey crew consisting of eight members of American Conservation Experience (ACE) on the techniques for locating burrows, and on the methods for distinguishing (a) tortoise burrows from those created by other species (e.g., American badger, desert kit fox); and (b) winter desert tortoise burrows from summer burrows.

The terms "burrow," "pallet," "form," "winter den," and "summer hole" have been used by other investigators to indicate cover types of both general and specific nature used by terrestrial turtles.[24] For the purpose of our study, we defined any subterranean refuge site that appeared to have been excavated and used by a desert tortoise as a "burrow". We further defined "active winter" burrows as those that showed relatively recent signs of excavation and/or use, and that had a length of at least four feet. We defined "recent summer" burrows as those that appeared to have been excavated and/or used during the 2009 activity period, but that were less than four feet in length. To estimate whether a burrow had been recently excavated and/or used, we examined the burrow to determine whether (a) it contained debris (e.g., leaf litter); (b) the

[23] USFWS. 2009. Preparing for any action that may occur within the range of the Mojave desert tortoise (*Gopherus agassizii*). Available at: http://www.fws.gov/ventura/speciesinfo/protocols_guidelines/.
[24] Burge BL. 1978. Physical characteristics and patterns of utilization of cover sites used by *Gopherus agassizi* in southern Nevada. Proceedings of the Desert Tortoise Council 1978, pp. 80-111.

burrow opening had spider webs or indications of weathering; (c) soil outside the burrow was compacted or showed evidence of precipitation; and (d) the burrow exhibited evidence of use by another organism (e.g., rodent, burrowing owl).

On December 6, 2009, the entire survey team traveled to the Project site so that we could begin fieldwork early the following day. The eight members of ACE were responsible for conducting the line-transect surveys. Surveys began at 0700 each day beginning on December 7, 2009. The surveys concluded on December 10, 2009, and except for the final day (which ended at 1200), surveys were conducted until dark (approximately 1730). Prior to each day of surveys, Mr. Cornett and I provided the survey team with instructions on the regions to survey, and the alignment of the transect lines (expressed in degrees on a compass). The surveyors then searched for desert tortoise burrows along the pre-assigned transect lines, and in the area between transect lines. As they walked, the surveyors used hand-held compasses and GPS units to maintain parallel transect lines and constant spacing between lines. For the first approximately five hours of surveys (conducted on the alternative site), the transect lines were spaced 15 feet apart. During that time, the group convened when anyone located a burrow. At each burrow, the group discussed their interpretation of its characteristics (e.g., organism that created it), and Mr. Cornett answered any questions. Once Mr. Cornett was confident in the groups' ability to identify desert tortoise burrows, the ACE team proceeded with transects that were spaced 30 feet apart.

Because any desert tortoises were hibernating at the time of our surveys, we used the presence of tortoise burrows as an index of relative abundance. Surveyors used GPS units to record the geographic coordinates of each active winter, and recent summer, desert tortoise burrow that was detected. They also recorded the beginning and end points of each transect line such that we had accurate data on the areas that were surveyed. Recent summer burrows were defined as ones that appeared to have been used during the summer of 2009. Surveyors also recorded field notes on each burrow that was detected. Surveyors flagged any burrows that they were unable to (a) positively identify as associated with a desert tortoise; (b) determine whether the burrow was active or inactive; or (c) distinguish whether the burrow was created during the summer or winter. Mr. Cornett and I then inspected these burrows and we made a final determination on burrow classification. We then discussed our interpretation with the group such that we collectively developed a consistent approach to burrow classification.

We walked approximately 87 miles of transect lines within the I-15 alternative site and approximately 64 miles of transect lines within the proposed Project site.[25] The protocol survey guidance suggests transects that are 30 feet apart will provide 100 percent coverage of the survey area. Because detecting tortoises and burrows is relatively more difficult than detecting burrows only, we assume our surveys covered nearly 100 percent of the respective survey areas, and that survey effort was relatively consistent among the various regions that we surveyed. Assuming 100 percent coverage, we surveyed approximately 316 acres within the alternative site and approximately 233 acres within the proposed Project site.

On the afternoon of December 7, and for the entire day on December 8, 2009, Mr. Cornett and I both walked and drove throughout the two sites to assess the tortoise resources that

[25] A map of the areas surveyed is provided as Exhibit 604.

were present. Our assessment included examination of (a) vegetation composition, distribution, and abundance; (b) vegetation community layers (e.g., shrub and sub-shrub) and structure; (c) soil characteristics; (d) different types of disturbance present within the two sites; and (e) other potential threats to the resident desert tortoise population (e.g., fire, garbage, invasive species).

#### b. Analysis

Research indicates desert tortoises may use some "burrows" year-round.[26] Therefore, I calculated the sum of all recent desert tortoise burrows that were detected regardless of whether the surveyor had classified the burrow as "summer" or "winter". This eliminated any error in classification and augmented the sample sizes.

I calculated the total length of transects walked at each site through use of the GPS data we collected in the field. I then conducted a Fisher exact test to determine if there was a statistically significant difference between the number of desert tortoise burrows between the two sites.

#### c. Results

We detected significantly more burrows on the Project site than on the I-15 site ($P < 0.01$). Forty-three recent desert tortoise burrows were detected on the Project site compared to 26 recent desert tortoise burrows on the I-15 site. **We encountered desert tortoise burrows at a frequency of 0.67 burrows/mile on the Project site, and 0.30 burrows/mile on the I-15 site.**

### D. Discussion and Management Implications for Desert Tortoise

#### 1. Other Survey Data

In the Mojave Desert, desert tortoise habitat has been characterized as having a high diversity of perennial plant species (among other variables).[27] As a result, the applicant conducted vegetation surveys to determine if the lands proposed for desert tortoise translocation (some of which are now the I-15 Alternative site) had the same shrub and succulent species composition, diversity, and richness as the Project area.[28] Results of those surveys indicated that species richness at approximately half the sampling locations that now coincide with the I-15 Alternative did not meet the California Department of Fish and Game's (CDFG) criteria that the translocation areas have comparable ecological make up as the habitat where the tortoises currently reside.[29] Both of these sampling locations are within the I-15 alternative site.[30]

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[26] Burge BL. 1978. Physical characteristics and patterns of utilization of cover sites used by *Gopherus agassizi* in southern Nevada. Proceedings of the Desert Tortoise Council 1978, pp. 80-111.
[27] Luckenbush (1982) and others cited *in* CH2MHILL. 2009 Aug 12. Supplemental Data Response, Set 2I, Ivanpah Solar Electric Generating System (07-AFC-5). Letter from John Carrier, Program Manager to John Kessler, Project Manager, California Energy Commission.
[28] CH2MHILL. 2009 Aug 10. Supplemental Data Response, Set 2I, Ivanpah Solar Electric Generating System (07-AFC-5). Letter from John Carrier, Program Manager to John Kessler, Project Manager, California Energy Commission.
[29] *Id*. p. 8.
[30] *See* Figure BR5.2A-1 of *Id.*

Therefore, there are empirical data that the I-15 alternative site has a lower abundance of both desert tortoises and plant resources than does the Project site. These empirical data are considerably more reliable than the unsubstantiated opinion presented in the FSA's I-15 alternative analysis. The FSA did not provide any data to support the conclusion that the I-15 alternative is of equal value to the desert tortoise. The only evaluation techniques described in the FSA are those that were conducted by a single biologist during a 1-day trip to the alternative and Project sites. In my opinion, such an evaluation does not comport with recognized standards.

### 2. Adverse Effects of Roads on Desert Tortoise Populations

The significantly lower number of desert tortoise burrows we detected at the I-15 alternative site may be a result of the site's proximity to the highway. Negative impacts to desert tortoises from roads and highways have been well documented.[31] [32] Road kills are considered a significant source of mortality to desert tortoises. Boarman and Sazaki (1996) reported a conservative estimate of one tortoise killed per 3.3 km (2 mi) of road surveyed per year.[33] A common mitigation for the impacts of roads and highways is a barrier fence, which has been shown to be highly effective at reducing mortality in tortoises and other vertebrates in the west Mojave.[34] However, fences only increase the fragmenting effects of roads.[35] Preliminary results of an eight-year long study indicate that culverts are used by tortoises to cross highways,[36] but it is unknown whether their use is sufficient to ameliorate the fragmenting effects of fenced highways.[37]

In addition to direct mortality, roads and highways are believed to have several indirect effects on tortoise populations. Habitat fragmentation by satellite urbanization and high-density highways (e.g., I-15) may be preventing essential desert tortoise metapopulation processes and, ultimately, species recovery.[38] The presence of roads and highways may lead to increased predation on desert tortoises (and other species) by providing a travel corridor and reliable food

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[31] LaRue EL, Jr. 1992. Distribution of desert tortoise sign adjacent to Highway 395, San Bernardino County, California. Proceedings of the Desert Tortoise Council 1992 Symposium. pp. 190-204. (Exhibit 605)

[32] Nicholson L. 1978. The effects of roads on desert tortoise populations. Proceedings of the Desert Tortoise Council 1978 Symposium. pp. 127-129. (Exhibit 606)

[33] Boarman WI, M Sazaki. 1996. Highway mortality in desert tortoises and small vertebrates: success of barrier fences and culverts. Pages 169 - 173 in Transportation and wildlife: reducing wildlife mortality and improving wildlife passageways across transportation corridors. G Evink, D Zeigler, P Garrett, J Berry, editors. U.S. Department of Transportation, Federal Highway Administration, Washington, DC.

[34] *Id.*

[35] Boarman WI. 2002. Threats to Desert Tortoise Populations: A Critical Review of the Literature. U.S. Geological Survey, Western Ecological Research Center. Sacramento (CA): 86 p. (Exhibit 607)

[36] Boarman WI, T Goodlett, GC Goodlett. 1998. Review of radio transmitter attachment techniques for chelonian research and recommendations for improvement. Herpet. Rev. 29:26-33.

[37] Boarman WI, M Sazaki. 1996. Highway mortality in desert tortoises and small vertebrates: success of barrier fences and culverts. Pages 169 - 173 in Transportation and wildlife: reducing wildlife mortality and improving wildlife passageways across transportation corridors. G Evink, D Zeigler, P Garrett, J Berry, editors. U.S. Department of Transportation, Federal Highway Administration, Washington, DC.

[38] Tracy CR, R Averill-Murray, W Boarman, D Delehanty, J Heaton, E McCoy, D Morafka, K Nussear, B Hagerty, P Medica. 2004. Desert Tortoise Recovery Plan Assessment. Available at: http://www.fws.gov/nevada/desert_tortoise/dtro_recover_plan_assess.html.

source.[39] For example, common ravens, which are predators on juvenile tortoises, are known for cruising road edges.[40]

Roads and highways are a vector for introduced plant and animal species, which may affect desert tortoises and other native species in adjacent areas.[41] Other potentially harmful activities that likely occur in greater numbers near roads include: mineral exploration, illegal dumping of garbage and toxic wastes, release of ill tortoises, vandalism, handling and harassing of tortoises, illegal collection of tortoises, and anthropogenic fire.[42]

The numerous direct and indirect adverse effects of roads and highways may drain desert tortoise populations two miles or more away.[43] Research studies conducted by Boarman and Sazaki (2006); Nicholson (1978); Von Seckendorff Hoff and Marlow (1997); and other researchers have detected a statistically significant relationship between road distance and presence of desert tortoise sign.[44] Our results are consistent with these studies.

In sum, numerous studies have demonstrated roads and highways have several adverse impacts on desert tortoise populations. Many of these impacts result in habitat degradation, which may significantly reduce habitat quality for tortoises.[45] The cumulative effects of habitat loss and degradation have been implicated as causes in the extirpation and drastic reductions in tortoise populations in several locations.[46]

The results of several research studies, and our site-specific data, suggest I-15 has adverse effects on the local tortoise population. The proposed Project location would contribute to the cumulative effects of these adverse effects; it conflicts with principles of conservation biology; and it is in direct opposition to the Desert Tortoise Recovery Plan.[47] Therefore, it is my professional opinion that there is ample evidence suggesting locating the Project adjacent to the freeway would cause less impacts to the desert tortoise (and other sensitive wildlife) than the currently proposed location.

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[39] Boarman WI, M. Sazaki. 2006. A highway's road-effect zone for desert tortoises (*Gopherus agassizii*). Journal of Arid Environments 65:94-101. (Exhibit 608)
[40] Boarman WI. 2002. Threats to Desert Tortoise Populations: A Critical Review of the Literature. U.S. Geological Survey, Western Ecological Research Center. Sacramento (CA): 86 p. (Exhibit 607)
[41] Boarman WI, M. Sazaki. 2006. A highway's road-effect zone for desert tortoises (*Gopherus agassizii*). Journal of Arid Environments 65:94-101. (Exhibit 608)
[42] Boarman WI. 2002. Threats to Desert Tortoise Populations: A Critical Review of the Literature. U.S. Geological Survey, Western Ecological Research Center. Sacramento (CA): 86 p. (Exhibit 607)
[43] *Id.*
[44] *See* Boarman WI, M. Sazaki. 2006. A highway's road-effect zone for desert tortoises (*Gopherus agassizii*). Journal of Arid Environments 65:94-101. (Exhibit 608)
[45] Boarman WI. 2002. Threats to Desert Tortoise Populations: A Critical Review of the Literature. U.S. Geological Survey, Western Ecological Research Center. Sacramento (CA): 86 p. (Exhibit 607)
[46] *Id.*
[47] U.S. Fish and Wildlife Service. 1994. Desert Tortoise (Mojave Population) Recovery Plan. U.S. Fish and Wildlife Service, Portland, Oregon.

### 3. My Findings are Consistent with the Recommendation of Expert Agency, California Department of Fish And Game.

In response to the Preliminary Staff Assessment (PSA), the California Department of Fish and Game (CDFG) requested that the FSA's conclusions be supported by "the best available data for impacts to desert tortoise and plant species of concern that clearly indicate a comparable or at least higher level of impact to those resources than they are being impacted by the Project."[48] The CDFG further recommended that the FSA present a "full analysis of alternate siting locations and scenarios…given the fact the current Project area is excellent tortoise habitat [and]…lower quality habitat is clearly within the range to potentially reduce the overall Project impacts to endangered and sensitive species."[49] The FSA did not heed CDFG's recommendations. Below are examples of how the FSA was inconsistent with CDFG's recommendations.

1. As shown in this testimony, the best available data indicate highways have a significant adverse impact on desert tortoises, and that locating the Project adjacent to the highway would likely have considerably less of an impact on the species than the proposed location.
2. The FSA concluded the I-15 alternative site "is all high quality tortoise habitat"; "there is very little difference in value for desert tortoise [over the proposed site]; and "it is difficult to value one [site] higher than the other."[50] These conclusions are not supported by the best available data, and they do not incorporate "full analysis." The FSA failed to report that no desert tortoises were reported within the action area during the development of the Primm Valley Golf Club.[51] The Primm Valley Golf Club is located immediately adjacent to the I-15 alternative site; it occupies a similar range of elevations as the I-15 site; and similar to the I-15 site, it is at least partially within the zone characterized as a "sink" for tortoises because of its proximity to the highway. Furthermore, a research study conducted in the Ivanpah Valley demonstrated that availability of desert tortoise food resources increased with higher elevation; tortoise reproductive output was greater; and mortality was lower, at the higher elevation along a short elevational and rainfall gradient.[52]
3. The FSA erroneously stated: "surveys conducted in 2007 identified 20 individual desert tortoise within the area that would be eliminated from the project under this [I-15] alternative."[53] Surveys conducted for the Project detected five tortoises within the "Ivanpah 1" project area and an additional tortoise 1,200 feet east of the "Ivanpah 1"

[48] CDFG. 2009 Oct 27. Comments on the Preliminary Staff Assessment and Recommendations for the Final Staff Assessment for the Ivanpah Solar Electric Generating System (CEC Docket # 07-AFC-5). Letter from Kevin Hunting, Deputy Director, Ecosystem Conservation Division to John Kessler, Program Manager, Siting, Transmission & Environmental Protection Division, California Energy Commission. (Exhibit 609)
[49] *Id.*
[50] FSA, p. 4-45.
[51] CH2MHILL. 2008 Sep 12. Data Response, Set 2D, Ivanpah Solar Electric Generating System (07-AFC-5). Letter from John Carrier, Program Manager to Che McFarlin, Project Manager, California Energy Commission.
[52] Collis S, HW Avery. 2000. Proximate constraints affecting the reproductive output and mortality of desert tortoises [abstract]. Proceedings of the Desert Tortoise Council 2000 Symposium. pp. 12-13. (Exhibit 602)
[53] FSA, p. 4-44.

boundary.[54] Assuming the I-15 alternative site encompasses the Ivanpah 1 site and all land to the east (to I-15), survey data have only demonstrated the presence of six tortoises within the alternative project area.

## II. The Proposed Project's Impacts on Sensitive Plant Species

The FSA provided very little evidence to support its conclusion that the I-15 alternative would have comparable impacts to sensitive plant species. Specifically, staff concluded that "[t]he I-15 alternative would not reduce the impact to special-status plant species that would be directly impacted by construction of the proposed ISEGS project. A good diversity of plants exists at both sites."[55] Staff supports its conclusion by stating "[t]he plant associations, associated soils, hydrology and microtopography associated with the rare plants at ISEGS site are all present in the I-15 alternative, particularly the portion of the alternative above the 2,750-foot elevation contour, at which point the diversity and microtopography improves and the vegetation reflects the same species composition and structure associated with the ISEGS site rare plant occurrences."[56]

In my opinion, the FSA's conclusion on impacts to sensitive plant species is not valid for the following reasons:

1. Staff made no effort to identifying the composition, distribution, and abundance of sensitive botanical resources on the I-15 alternative site. In fact, the FSA supports the presumption that a valid conclusion cannot be made in stating: "[w]ithout protocol rare plant surveys, it is not possible to compare in detail the alternative to the proposed project."[57]
2. According to the FSA, "[o]ver approximately 60% or more of the I-15 alternative offers good to excellent habitat for the same suite of rare plants found at ISEGS and many or all of the same rare plant taxa found at the ISEGS site are expected to occur on I-15 Alt as well."[58] If this is true, it still suggests that approximately 40% of the I-15 alternative site does not offer the same level of quality habitat as the Project (ISEGS) site. The FSA supported this conclusion by stating "[b]elow that point [2,750 feet in elevation], nearer to the Primm Valley Golf Course, the topography [of the I-15 alternative] flattens out, the habitat lacks the microtography and soil textures upon which many of the rare plants depend, and the overall plant diversity is reduced, and important indicators such as the cacti and succulent component drop out of the species composition."[59] The FSA has demonstrated the I-15 alternative is feasible, and that approximately 40% of the alternative site is likely to posses fewer sensitive biological resources than the proposed Project site. Importantly, further modifications to the alternative's footprint could result in an even greater percentage of lands with fewer sensitive biological resources.
3. The FSA's statement that 60% of the I-15 site has the same plant species composition

[54] PSA, Figure 5.2-9.
[55] FSA, p. 4-45.
[56] *Id.*
[57] *Id.*
[58] *Id.*
[59] *Id.*

and structure associated with the ISEGS' site rare plant occurrences is not sufficient scientific evidence to support a conclusion that impacts to sensitive plant species would be the same. In the Mojave Desert, vegetation composition can change dramatically over short distances as a function of terrain position.[60] Furthermore, the microenvironment conditions along edges (e.g., the boundary between I-15 and native habitat) are known to be different than in the interior (e.g., Project site). These include temperature, humidity, light, chemical inputs, and other variables.[61] Each of these variables, as well as their synergistic effects, may have a strong influence on the presence and distribution of individual plant species.[62] Therefore, even if the elevations, soils, climate, and hydrology (among other variables) of the I-15 alternative site were identical to the proposed Project site, plant composition would likely differ due to the site's location adjacent to the highway (a sharp edge).

4. Of the five sensitive plant species occurring on the Project site, and for which staff has concluded impacts would be significant, the applicant's consultant has reported two (nine-awned pappus grass and Mojave milkweed) occupy distinctive microhabitats.[63] The FSA did not demonstrate that these microhabitats are present (or as equally abundant) within the I-15 alternative site. Conversely, there is scientific evidence that suggests the I-15 alternative site does not contain suitable habitat for several of the sensitive plant species known to occur on the Project site. I provide this evidence in the subsequent section.

### A. Habitat Suitability for Sensitive Plant Species at the I-15 Alternative Site

This section provides a review of literature describing the habitat requirements (or associations) of several of the sensitive plant species known to occur on the Project site. Eight special-status plant species would be directly impacted by construction of the Project at the proposed location.[64] Of these, the FSA concludes impacts to five species would be significant according to CEQA guidelines because the Project would eliminate a substantial portion of their documented occurrences in the state.[65] Staff further concluded impacts to at least two of the species would remain significant even after the FSA's proposed impact avoidance and minimization measures.[66]

Topographic position (elevation, slope angle, slope aspect) exerts a strong influence on plant distributions at a finer spatial scale than bioclimatic gradients. This is important in the

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[60] Thomas KA, T Keeler-Wolf , J Franklin, P Stine. 2004. Mojave Desert Ecosystem Program: Central Mojave Vegetation Mapping Database. Western Regional Center, US Geological Survey. Technical Report [Online] Available at: http://www.dfg.ca.gov/biogeodata/vegcamp/pdfs/VegMappingRpt_Central_Mojave_Vegetation_Database.pdf. (Exhibit 610).

[61] Boarman WI. 2002. Threats to Desert Tortoise Populations: A Critical Review of the Literature. U.S. Geological Survey, Western Ecological Research Center. Sacramento (CA): 86 p. (Exhibit 607)

[62] *Id.*

[63] Garcia and Associates. 2008. Technical Report: Botanical Resources of the Ivanpah Solar Electric Generating System.

[64] FSA, p. 6.2-1.

[65] *Id.*

[66] *Id.*

Mojave, where vegetation composition can change dramatically over short distances as a function of terrain position.[67] The FSA discussed the correlation between elevation and the occurrence of sensitive plant species at the Project and alternative site.[68] However, the FSA provided erroneous information on the elevations within the proposed Project area. The FSA's conclusion on the similarity of impacts to sensitive plant species between the two sites may have been based on this erroneous elevation data. Elevations in the Project area range from approximately 3,500 feet[69] [70] in the northwest corner (not 3,150 feet as reported in the FSA)[71] to approximately 2,850 feet in the southeast corner. The FSA did not provide the elevations of the I-15 alternative site, although it indicates approximately 40 percent of the alternative site is below 2,750 feet in elevation.[72] Using topographic maps, I estimated approximately 85 percent of the alternative site is located below 3,000 feet in elevation.

### 1. Plant Species for which the FSA Concluded Significant Impacts

#### a. Mojave Milkweed

Mojave milkweed occurs in Mojavean desert scrub and pinyon and juniper woodland communities.[73] Within these communities, it occurs in washes and on dry slopes from about 3,000 to 5,100 feet in elevation.[74] The FSA did not provide a detailed map of the I-15 alternative. However, it appears that most of the I-15 alternative is located below 3,000 feet in elevation.[75] Furthermore, the FSA listed *Atriplex* scrub as one of the two dominant habitat types present on the I-15 alternative site.[76] Mojave milkweed is not reported to be associated with *Atriplex* scrub.[77] Given this information, the I-15 alternative is likely to have considerably less of an impact on Mojave milkweed.

#### b. Nine-awned Pappus Grass

Nine-awned pappus grass occurs on rocky slopes, crevices, and calcareous soils in desert

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[67] Thomas KA, T Keeler-Wolf , J Franklin, P Stine. 2004. Mojave Desert Ecosystem Program: Central Mojave Vegetation Mapping Database. Western Regional Center, US Geological Survey. Technical Report [Online] Available at: http://www.dfg.ca.gov/biogeodata/vegcamp/pdfs/VegMappingRpt_Central_Mojave_Vegetation_Database.pdf. (Exhibit 610)

[68] *See* FSA, p. 4-45.

[69] *See* US Geological Survey. 1985. Ivanpah Lake [7.5 minute topographic map quadrangle]. Denver: US Dept of Interior Geological Survey.

[70] *See* Garcia and Associates. 2008. Technical Report: Botanical Resources of the Ivanpah Solar Electric Generating System.

[71] FSA, p. 6.2-9.

[72] FSA, p. 4-45.

[73] CNPS. 2008. Cited *in* Garcia and Associates. 2008. Technical Report: Botanical Resources of the Ivanpah Solar Electric Generating System.

[74] Baldwin et al. 2002. Cited *in* Garcia and Associates. 2008. Technical Report: Botanical Resources of the Ivanpah Solar Electric Generating System.

[75] US Geological Survey. Ivanpah Lake and Mineral Hill [7.5 minute topographic map quadrangles]. Denver: US Dept of Interior Geological Survey.

[76] FSA, p. 4-44.

[77] California Natural Diversity Database. 2009. Rarefind [computer program]. Version 3.1.0. Nov 1, 2009. Sacramento (CA): Wildlife & Habitat Data Analysis Branch. California Department of Fish and Game.

woodlands.[78] In Ivanpah Valley, it occurs within Mojave Creosote Bush Scrub plant community located on the Ivanpah Valley alluvial fan, at 2,900 to 3,400 feet elevation.[79] Much of the I-15 alternative site is outside of the known elevation range for this species. Additionally, nine-awned pappus grass is not reported to be associated with the *Atriplex* scrub plant community that occurs on the alternative site.[80] Given this information, the I-15 alternative is likely to have considerably less of an impact on nine-awned pappus grass.

### c. Desert Pincushion

Details on the distribution of desert pincushion in California are imperfectly understood.[81] The *Jepson Desert Manual* describes its habitat as limestone soils from approximately 3,000 to 7,000 feet elevation.[82] However, the California Native Plant Society (CNPS) *Online Inventory* describes its habitat as Joshua tree woodland, Mojavean desert scrub, and pinyon-juniper woodland at elevations from 150 to 4,500 feet.[83] The applicant's consultant concluded the lower elevation limit of 150 feet is probably an error.[84] Because the distribution of desert pincushion in California is imperfectly understood, the FSA had no justification for its conclusion that the I-15 alternative would have similar impacts as the proposed project location. However, assuming the lower elevation limit provided by the CNPS is an error, much of the I-15 alternative site is outside of the currently known elevation range for the species.

### d. Parish's Club-cholla

There is conflicting information on habitat associated with occurrences of Parish's club-cholla. The *Jepson Desert Manual* describes its habitat as sandy flats from 2,950 to 3,935 feet elevation.[85] However, the CNPS *Online Inventory* indicates it occurs in sandy areas within Mojavean desert scrub, Sonoran desert scrub, and Joshua tree woodland communities. The CNPS reports the species has an elevation range of 985 to 5,000 feet.[86] The lowest known occurrence reported in the CNDDB is 2,950 feet (which would be consistent with the *Jepson Desert Manual*).[87] Assuming the lower elevation limit provided by the CNPS is an error, much

[78] Baldwin et al. 2002. Cited *in* Garcia and Associates. 2008. Technical Report: Botanical Resources of the Ivanpah Solar Electric Generating System.
[79] Garcia and Associates. 2008. Technical Report: Botanical Resources of the Ivanpah Solar Electric Generating System.
[80] California Natural Diversity Database. 2009. Rarefind [computer program]. Version 3.1.0. Nov 1, 2009. Sacramento (CA): Wildlife & Habitat Data Analysis Branch. California Department of Fish and Game.
[81] Garcia and Associates. 2008. Technical Report: Botanical Resources of the Ivanpah Solar Electric Generating System.
[82] Baldwin et al. 2002. Cited *in* Garcia and Associates. 2008. Technical Report: Botanical Resources of the Ivanpah Solar Electric Generating System.
[83] CNPS. 2008. Cited *in* Garcia and Associates. 2008. Technical Report: Botanical Resources of the Ivanpah Solar Electric Generating System.
[84] Garcia and Associates. 2008. Technical Report: Botanical Resources of the Ivanpah Solar Electric Generating System.
[85] Baldwin et al. 2002. Cited *in* Garcia and Associates. 2008. Technical Report: Botanical Resources of the Ivanpah Solar Electric Generating System.
[86] CNPS. 2008. Cited *in* Garcia and Associates. 2008. Technical Report: Botanical Resources of the Ivanpah Solar Electric Generating System.
[87] California Natural Diversity Database. 2009. Rarefind [computer program]. Version 3.1.0. Nov 1, 2009. Sacramento (CA): Wildlife & Habitat Data Analysis Branch. California Department of Fish and Game.

of the I-15 alternative site is outside of the currently known elevation range for the species.

#### e. Rusby's Desert Mallow

There is conflicting information on habitat associated with occurrences of Rusby's desert mallow. The *Jepson Desert Manual* describes its habitat as desert scrub from 3,900 to 4,500 feet in elevation.[88] However, the CNPS *Online Inventory* indicates it occurs on Mojavean desert scrub and Joshua tree woodland from 2,925 to 4,500 feet.[89] Under either scenario, much of the I-15 alternative site is outside of the currently known elevation range for the species.

### 2. Species for which the FSA Concluded Less than Significant Impacts

#### a. Small-flowered Androstephium

The FSA concluded that Project impacts to small-flowed androstephium would be less than significant. According to the FSA, numerous new occurrences of small-flowered androstephium have been found in recent years during surveys conducted for other development projects.[90] For this reason (combined with a larger total number of documented occurrences), staff considers the Project effects to this species not significant under CEQA.[91]

The FSA provided a discussion of cumulative impacts analysis and its context in the regulatory environment:

> "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 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))."[92]

The FSA did not consider the cumulative impacts of the Project on the continued viability of small-flowered androstephium in California. Of the 82 known occurrences reported in the CNDDB, 70 (85%) are threatened by proposed development projects.[93] These include nearly all of the "[m]any new occurrences …found in recent years" used in staff's justification. [94] [95]

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[88] Baldwin et al. 2002. Cited *in* Garcia and Associates. 2008. Technical Report: Botanical Resources of the Ivanpah Solar Electric Generating System.
[89] CNPS. 2008. Cited *in* Garcia and Associates. 2008. Technical Report: Botanical Resources of the Ivanpah Solar Electric Generating System.
[90] FSA, p. 6.2-37.
[91] *Id.*
[92] FSA, p. 6.2-66,67.
[93] California Natural Diversity Database. 2009. Rarefind [computer program]. Version 3.1.0. Nov 1, 2009. Sacramento (CA): Wildlife & Habitat Data Analysis Branch. California Department of Fish and Game.
[94] *Id.*

The FSA further justified the conclusion that the Project will result in less-than-significant impacts to small-flowered androstephium with the assertion that the Project area includes only a very small portion of the species' total distribution in California.[96] The FSA's conclusion appears to contradict CEQA guidelines, which advise lead agencies to address impacts to locally unique botanical resources regardless of their status elsewhere in the state.[97] Outside of the Project area, the next closest occurrence of small-flowered androstephium is approximately 31 miles away.[98] Therefore, the potential elimination of all known occurrences of small-flowered androstephium within the Ivanpah Valley should be considered a significant impact under CEQA.

## III. Conclusion

Based on my review of the literature, Project-related documents, and the FSA, I have concluded that impacts to the state and federally threatened desert tortoise would be reduced by selection of the I-15 alternative site. My conclusion is supported by the results of my site-specific field study, which identified a statistically significant greater number of desert tortoise burrows on the Project site than on the I-15 alternative site. Although the timing of my study prevented scientific study of other taxa (e.g., birds, plants), my qualitative field observations have led me to conclude selection of the I-15 alternative site would reduce impacts to other sensitive species known to occur in the Project region. This conclusion was based on (a) the lower diversity (structural and species) of plant resources; and (b) the greater number of anthropogenic disturbances within the I-15 alternative site.

Through my review, I also have concluded the I-15 alternative site is unlikely to have the same magnitude of impacts to sensitive botanical resources as the currently proposed Project area. My conclusion is based on a thorough literature review, and many of the same reasons provided above.

The FSA did not define the precise boundaries of the I-15 alternative site. As a result, the site assessment that Jim Cornett and I conducted encompassed areas that we believed extended beyond the alternative site's boundaries. Our assessment led us to two conclusions that I believe are important to convey to the Commission:

1. The southern portion of the alternative site (i.e., near Nipton Road) posses an extremely high diversity and abundance of plant and animal resources that should be avoided by the Project.
2. There are opportunities to reconfigure the alternative site's footprint so that impacts to sensitive biological resources are further reduced. I encourage staff to explore additional site configurations that may further minimize (or eliminate) impacts to sensitive biological resources. For example, staff should explore the possibility of

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[95] FSA, p. 6.2-19.
[96] *Id.*
[97] CEQA §15125 (c)
[98] California Natural Diversity Database. 2009. Rarefind [computer program]. Version 3.1.0. Nov 1, 2009. Sacramento (CA): Wildlife & Habitat Data Analysis Branch. California Department of Fish and Game.

extending the alternative site slightly west and/or north in order to eliminate impacts to resources in the vicinity of the Clark Mountain Range.

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In his 17 years in the profession, Scott Cashen has consulted on projects pertaining to wildlife and fisheries ecology, avian biology, wetland restoration, and forest management. Because of his varied experience, Mr. Cashen is knowledgeable of the link between the various disciplines of natural resource management, and he is a versatile scientist.

Mr. Cashen's employment experience includes work as an expert witness, wildlife biologist, consulting forester, and instructor of Wildlife Management. He has worked throughout California, and he is knowledgeable of the different terrestrial and aquatic species and habitats present in the state.

Mr. Cashen is an accomplished birder and is able to identify bird species by sight and sound. His knowledge has enabled him to survey birds throughout the United States and instruct others on avian identification. Mr. Cashen's research on avian use of restored wetlands is currently being used by the United States Fish and Wildlife Service to design wetlands for specific "target" species, and as a model for other restored wildlife habitat monitoring projects in Pennsylvania. In addition to his bird experience, Mr. Cashen has surveyed for carnivores, bighorn sheep, and other mammals; special-status amphibian species; and various fish species.

**PROFESSIONAL EXPERIENCE**

**Litigation Support / Expert Witness**

Mr. Cashen serves as the biological resources expert for the San Francisco law firm of Adams Broadwell Joseph & Cardozo. He is responsible for reviewing CEQA/NEPA documents, assessing biological resource issues, preparing written comments, providing public testimony, and interfacing with public resource agencies.

REPRESENTATIVE EXPERIENCE

- Victorville 2 Solar-Gas Hybrid Power Project: Victorville, CA (338-acre natural gas and solar energy facility) – Review of CEQA equivalent documents and preparation of written documents.
- Avenal Energy Power Plant: Avenal, CA (148-acre natural gas facility) – Review of CEQA equivalent documents and preparation of written documents.
- Ivanpah Solar Electric Generating System: Ivanpah, CA (3700-acre solar facility) – Review of CEQA equivalent documents and preparation of written documents.
- Carrizo Energy Solar Farm: San Luis Obispo County, CA (640-acre solar energy facility) – Review of CEQA equivalent documents. Preparation of data requests, comments on Preliminary Staff Assessment, comments on wildlife corridor model (CEQA equivalent

documents).

- Live Oak Master Plan: Hanford, CA (390-acre housing development) – Review of CEQA documents and preparation of comment letter.
- Rollingwood: Vallejo, CA (214-unit housing development) – Review of CEQA documents and preparation of comment letter.
- Columbus Salame: Fairfield, CA (430,000 $ft^2$ food processing plant) – Review of CEQA documents and preparation of comment letter.
- Concord Naval Weapons Station: Concord, CA (5028-acre redevelopment) – Review of CEQA documents, preparation of comment letters, and provision of public testimony at County hearings.
- Chula Vista Bayfront Master Plan: Chula Vista, CA (556-acre development) – Review of CEQA documents and preparation of comment letter.
- Beacon Solar Energy Project: California City, CA (2012-acre solar facility) – Review of CEQA equivalent and NEPA documents. Preparation of data requests, comments on Preliminary Staff Assessment, comments on Incidental Take Permit Application. Expert witness providing testimony at California Energy Commission hearings.
- Solar One Power Project: San Bernardino County, CA (8230-acre solar facility) – Review of CEQA equivalent and NEPA documents and preparation of data requests. Expert witness providing testimony at California Energy Commission hearings.
- Solar Two Power Project: Imperial County, CA (6500-acre solar facility) – Review of CEQA equivalent and NEPA documents. Preparation of data requests and other documents for case record. Expert witness providing testimony at California Energy Commission hearings.
- Alves Ranch: Pittsburgh, CA (320-acre housing development) – Review of CEQA documents.
- Roddy Ranch: Antioch, CA (640-acre housing and hotel development) – Review of CEQA documents and preparation of comment letter.
- Aviano: Antioch, CA (320-acre housing development) – Review of CEQA documents.
- Western GeoPower Power Plant and Steamfield: Geyserville, CA (887-acre geothermal facility) – Review of CEQA documents and preparation of comment letter.
- San Joaquin Solar I & II: Fresno County, CA (640-acre hybrid power plant) – Review of CEQA equivalent documents and preparation of data requests.
- Sprint-Nextel Tower: Walnut Creek, CA (communications tower in open space preserve) - Review of project documents and preparation of comment letter.

**Project Management**

Mr. Cashen has managed several large-scale and high profile natural resources investigations. High profile projects involving multiple resources often require consideration of differing

viewpoints on how resources should be managed, and they are usually subject to intense scrutiny. Mr. Cashen is accustomed to these challenges, and he is experienced in facilitating the collaborative process to meet project objectives. In addition, the perception of high profile projects can be easily undermined if inexcusable mistakes are made. To prevent this, Mr. Cashen bases his work on solid scientific principles and proven sampling designs. He also solicits input from all project stakeholders, and provides project stakeholders with regular feedback on project progress. Mr. Cashen's educational and project background in several different natural resource disciplines enable him to consult on multiple natural resources simultaneously and address the many facets of contemporary land management in a cost-effective manner.

REPRESENTATIVE EXPERIENCE

- Forest health improvement projects – Biological Resources *(CDF: San Diego and Riverside Counties)*
- San Diego Bark Beetle Tree Removal Project – Biological Resources, Forestry, and Cultural Resources *(San Diego Gas & Electric: San Diego Co.)*
- San Diego Bark Beetle Tree Removal Project - Forestry *(San Diego County/NRCS)*
- Mather Lake Resource Management Study and Plan – Biological Resources, Hydrology, Soils, Recreation, Public Access, CEQA compliance, Historic Use *(Sacramento County: Sacramento)*
- "KV" Spotted Owl and Northern Goshawk Inventory *(USFS: Plumas NF)*
- Amphibian Inventory Project *(USFS: Plumas NF)*
- San Mateo Creek Steelhead Restoration Project – TES species, Habitat Mapping, Hydrology, Invasive Species Eradication, Statistical Analysis *(Trout Unlimited and CA Coastal Conservancy: Orange County)*
- Hillslope Monitoring Project – Forest Practice Research *(CDF: throughout California)*
- Placer County Vernal Pool Study – Plant and Animal Inventory, Statistical Analysis *(Placer County: throughout Placer County)*
- Weidemann Ranch Mitigation Project – Mitigation Monitoring and Environmental Compliance *(Toll Brothers, Inc.: San Ramon)*
- Delta Meadows State Park Special-status Species Inventory – Plant and Animal Species Inventory, Special-status Species *(CA State Parks: Locke)*
- Ion Communities Biological Resource Assessments – Biological Resource Assessments *(Ion Communities: Riverside and San Bernardino Counties)*
- Del Rio Hills Biological Resource Assessment – Biological Resource Assessments *(The Wyro Company: Rio Vista)*

**Biological Resources**

Mr. Cashen has a diverse background in biology. His experience includes studies of a variety of fish and wildlife species, and work in many of California's ecosystems. Mr. Cashen's specialties include conducting comprehensive biological resource assessments, habitat restoration, species inventories, and scientific investigations. Mr. Cashen has led investigations on several special-status species, including ones focusing on the foothill yellow-legged frog, mountain yellow-legged frog, steelhead, burrowing owl, California spotted owl, northern goshawk, willow flycatcher, and forest carnivores. Mr. Cashen was responsible for the special-status species inventory of Delta Meadows State Park, and for conducting a research study for Placer County's Natural Community Conservation Plan.

REPRESENTATIVE EXPERIENCE

*Avian*

- Study design and Lead Investigator - Delta Meadows State Park Special-status Species Inventory *(CA State Parks: Locke)*
- Study design and lead bird surveyor - Placer County Vernal Pool Study *(Placer County: throughout Placer County)*
- Surveyor - Willow flycatcher habitat mapping *(USFS: Plumas NF)*
- Independent surveyor - Tolay Creek, Cullinan Ranch, and Guadacanal Village restoration projects *(Ducks Unlimited/USGS: San Pablo Bay)*
- Study design and Lead Investigator - Bird use of restored wetlands research *(Pennsylvania Game Commission: throughout Pennsylvania)*
- Study design and surveyor - Baseline inventory of bird species at a 400-acre site in Napa County *(HCV Associates: Napa)*
- Surveyor - Baseline inventory of bird abundance following diesel spill *(LFR Levine-Fricke: Suisun Bay)*
- Study design and lead bird surveyor - Green Valley Creek Riparian Restoration Site *(City of Fairfield: Fairfield, CA)*
- Surveyor - Burrowing owl relocation and monitoring of artificial habitat *(US Navy: Dixon, CA)*
- Surveyor - Pre-construction raptor and burrowing owl surveys *(various clients and locations)*
- Surveyor - Backcountry bird inventory *(National Park Service: Eagle, Alaska)*
- Lead surveyor - Tidal salt marsh bird surveys (*Point Reyes Bird Observatory: throughout Bay Area*)

*Amphibian*

- Crew Leader - Red-legged frog, foothill yellow-legged frog, and mountain yellow-legged frog surveys *(USFS: Plumas NF)*
- Surveyor - Foothill yellow-legged frog surveys *(PG&E: North Fork Feather River)*
- Surveyor - Mountain yellow-legged frog surveys *(El Dorado Irrigation District: Desolation Wilderness)*
- Crew Leader - Bullfrog eradication *(Trout Unlimited: Cleveland NF)*

*Fish and Aquatic Resources*

- Surveyor - Hardhead minnow and other fish surveys *(USFS: Plumas NF)*
- Surveyor - Weber Creek aquatic habitat mapping (*El Dorado Irrigation District: Placerville, CA*)
- Surveyor - Green Valley Creek aquatic habitat mapping *(City of Fairfield: Fairfield, CA)*
- GPS Specialist - Salmonid spawning habitat mapping *(CDFG: Sacramento River)*
- Surveyor - Fish composition and abundance study (*PG&E: Upper North Fork Feather River and Lake Almanor*)
- Crew Leader - Surveys of steelhead abundance and habitat use *(CA Coastal Conservancy: Gualala River estuary)*
- Crew Leader - Exotic species identification and eradication *(Trout Unlimited: Cleveland NF)*

*Mammals*

- Principal Investigator – Peninsular bighorn sheep resource use and behavior study (*California State Parks: Freeman Properties*)
- Scientific Advisor – Red Panda survey and monitoring methods. Study on red panda occupancy and abundance in eastern Nepal *(The Red Panda Network: CA and Nepal)*
- Surveyor - Forest carnivore surveys *(University of CA: Tahoe NF)*
- Surveyor - Relocation and monitoring of salt marsh harvest mice and other small mammals *(US Navy: Skagg's Island, CA)*

*Natural Resource Investigations / Multiple Species Studies*

- Scientific Review Team Member – Member of the science review team assessing the effectiveness of the US Forest Service's implementation of the Herger-Feinstein Quincy Library Group Act.
- Lead Consultant - Baseline biological resource assessments and habitat mapping for CDF management units *(CDF: San Diego, San Bernardino, and Riverside Counties)*
- Biological Resources Expert – Peer review of CEQA/NEPA documents (*Adams Broadwell Joseph & Cardoza: California)*

- Lead Consultant - Pre- and post harvest biological resource assessments of tree removal sites *(SDG&E: San Diego County)*
- Crew Leader - T&E species habitat evaluation for BA in support of a steelhead restoration plan *(Trout Unlimited: Cleveland NF)*
- Lead Investigator - Resource Management Study and Plan for Mather Lake Regional Park *(County of Sacramento: Sacramento, CA)*
- Lead Investigator - Wrote Biological Resources Assessment for 1,070-acre Alfaro Ranch property *(Yuba County, CA)*
- Lead Investigator - Wildlife Strike Hazard Management Plan *(HCV Associates: Napa)*
- Lead Investigator - Del Rio Hills Biological Resource Assessment *(The Wyro Company: Rio Vista, CA)*
- Lead Investigator – Ion Communities project sites (*Ion Communities: Riverside and San Bernardino Counties*)
- Surveyor – Tahoe Pilot Project: CWHR validation *(University of California: Tahoe NF)*

**Forestry**

Mr. Cashen has five years of experience working as a consulting forester on projects throughout California. During that time, Mr. Cashen has consulted with landowners and timber harvesters on best forest management practices; and he has worked on a variety of forestry tasks including selective tree marking, forest inventory, harvest layout, erosion control, and supervision of logging operations. Mr. Cashen's experience with many different natural resources enable him to provide a holistic approach to forest management, rather than just management of timber resources.

REPRESENTATIVE EXPERIENCE

- Lead Consultant - CDF fuels treatment projects *(CDF: San Diego, Riverside, and San Bernardino Counties)*
- Lead Consultant and supervisor of harvest activities – San Diego Gas and Electric Bark Beetle Tree Removal Project *(SDG&E: San Diego)*
- Crew Leader - Hillslope Monitoring Program *(CDF: throughout California)*
- Consulting Forester – Inventory and selective harvest projects *(various clients throughout California)*

**EDUCATION / SPECIAL TRAINING**

M.S. Wildlife and Fisheries Science, The Pennsylvania State University (1998)

B.S. Resource Management, The University of California-Berkeley (1992)
Forestry Field Program, Meadow Valley, California, Summer (1991)

**PERMITS**

U.S. Fish and Wildlife Service Section 10(a)(1)(A) Recovery Permit for the Peninsular bighorn sheep

CA Department of Fish and Game Scientific Collecting Permit

**PROFESSIONAL ORGANIZATIONS / ASSOCIATIONS**

The Wildlife Society

Society of American Foresters

Mt. Diablo Audubon Society

**OTHER AFFILIATIONS**

Scientific Advisor and Grant Writer – *The Red Panda Network*

Scientific Advisor – *Mt. Diablo Audubon Society*

Grant Writer – *American Conservation Experience*

Land Committee Member – *Save Mt. Diablo*

**TEACHING EXPERIENCE**

Instructor: Wildlife Management, The Pennsylvania State University, 1998

Teaching Assistant: Ornithology, The Pennsylvania State University, 1996-1997

**Declaration of Scott Cashen**
**Ivanpah Solar Electric Generating System Project**

**Docket 07-AFC-5**

I, Scott Cashen, declare as follows:

1) I am an independent biological resources consultant. I have been self-employed for the past two years. Prior to starting my own business I was the Senior Biologist for TSS Consultants.

2) I hold a Master's degree in Wildlife and Fisheries Science. My relevant professional qualifications and experience are set forth in the attached testimony and are incorporated herein by reference.

3) I prepared the testimony attached hereto and incorporated herein by reference, relating to the biological resource impacts of the Ivanpah Solar Electric Generating System Project.

4) I prepared the testimony and map attached hereto and incorporated herein by reference relating to the distribution of solar energy generation infrastructure in San Bernardino County.

5) It is my professional opinion that the attached testimony and map are true and accurate with respect to the issues that they address.

6) I am personally familiar with the facts and conclusions described within the attached testimony and map, and if called as a witness, I 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: 12/18/09 Signed: Scott Cashen

At: Walnut Creek, CA