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May 4, 2012

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Mike Monasmith
Senior Project Manager
Systems Assessment & Facility Siting Division
California Energy Commission
1516 Ninth Street, MS-15
Sacramento, CA 95814

Subject: Data Response, Set 2E
Hidden Hills Solar Electric Generating System (11-AFC-2)

Dear Mr. Monasmith:

On behalf of Hidden Hills Solar I, LLC; and Hidden Hills Solar II, LLC, please find attached an electronic copy of Data Response Set 2E in response to Staff's Data Request Set 2E filed on April 5, 2012.

This data response set is being filed electronically. Please call me if you have any questions.

Sincerely,
CH2M HILL

John L. Carrier, J.D.
Program Manager

Encl.

c: POS List
Project file

Data Response Set 2E

Hidden Hills

Solar Electric Generating System

(11-AFC-2)

Application for Certification

Hidden Hills Solar I, LLC; and Hidden Hills Solar II, LLC

May 2012

With Technical Assistance from

CH2MHILL®

IS061411043744SAC

Hidden Hills Solar Electric Generating System (HHSEGS)

(11-AFC-2)

Data Response, Set 2E
(Response to Data Requests 177 through 188)

Submitted to the

California Energy Commission

Submitted by

Hidden Hills Solar I, LLC; and
Hidden Hills Solar II, LLC

May 4, 2012

With Assistance from

CH2MHILL
2485 Natomas Park Drive
Suite 600
Sacramento, CA 95833

Contents

Introduction

Attached are Hidden Hills Solar I, LLC, and Hidden Hills Solar II, LLC (collectively, "Applicant") responses to the California Energy Commission (CEC) Staff's data requests numbers 177 through 188 for the Hidden Hills Solar Electric Generating System (HHSEGS) Project (11-AFC-2). The CEC Staff served these data requests on April 5, 2012. While these data requests were issued by the CEC after the close of the discovery period (which ended April 2, 2012), without waiving its objections, Applicant is responding to these requests in the interest of aiding the CEC in the timely completion of a Preliminary Staff Assessment.

The responses are grouped by individual discipline or topic area. Within each discipline area, the responses are presented in the same order as provided by CEC Staff and are keyed to the Data Request numbers (177 through 188). New graphics are numbered in reference to the data request number. For example, the first figure used in response to Data Request 177 would be Figure DR177-1, and so on.

Figures (unless imbedded) and Attachments submitted in response to a data request are at the end of this document and are also numbered to match the data request number. The figures and attachments are in numerical order of the data request number.

Biological Resources (177)

BACKGROUND

Staff reviewed applicant's Data Response Set 1B-4 (Hidden Hills SEGS Winter 2012 Burrowing Owl Survey), docketed on March 5, 2012. Applicant provided a response to staff's data request #59, stating that no burrowing owl(s) were observed onsite during either spring or winter surveys. However, this statement requires clarification. The Application for Certification (AFC) section 5.2.6.7.2 states that burrowing owls were observed in the area of the proposed project site boundary, in the northwestern quarter of section 16, and immediately west of the site, but does not quantify the exact number of owls observed. The AFC Table 5.2-7 Biological Resources confirms burrowing owls were observed in 2010 and spring of 2011. Staff needs to know how many owls may be impacted by the project and where they occur within the proposed project site.

DATA REQUEST

177. Submit a revised burrowing owl phase III survey report. Clarify and explain previous burrowing owl survey results. The revised report must be prepared in accordance with the CDFG 2012 Staff Report and include the following:

    a. a discussion of the number of burrowing owls that may be impacted by the project, defined as those onsite plus those within 150 meters of the project boundary;

    b. copies of supporting information, GPS coordinates for observations of burrowing owl and their sign, and dens where sign or burrowing owls were observed, surveyor's field sheets, or other corroborating evidence as well as 2010 burrowing owl survey data, surveyor's resumes, method of survey used; and

Response to a and b: After this data request was filed, CEC staff indicated to Applicant that items a and b were adequately addressed in previous submittals, and further information was not needed. A summary of burrowing owl observations is provided in Attachment DR 177-1. CDFG has indicated that it does not believe further surveys for burrowing owl are necessary at this point.

    c. a proposed burrowing owl mitigation plan, which at a minimum must present applicant's preferred avoidance and minimization measures, a burrowing owl exclusion plan, compensatory mitigation strategy, mitigation monitoring and reporting strategy, and vegetation management goals for land acquired as compensatory mitigation.

Response: A Draft Burrowing Owl Mitigation Plan has been prepared and is provided as Attachment DR177-1. Applicant looks forward to working with staff to discuss mitigation strategies; thus, a compensatory mitigation strategy is not included in the plan at this time but will be appended to the plan at a later date.

Land Use (178-184)

BACKGROUND

The applicant's responses to Land Use Data Request 1B (#74 and #75) and 1C (#93 and #94), stated that the applicant would continue discussions with Inyo County and that a general plan amendment would not be necessary prior to the Energy Commission decision on the proposed project. At the recent Inyo Board of Supervisors' meeting on March 13, 2012, the applicant stated that they would apply for a general plan amendment and zoning amendment. To date, Inyo County staff has indicated that these land use applications have not been filed.

Staff has reviewed Inyo County's Law Ordinances Regulations and Standards (LORS) and has requested input from the county for staff's analysis. As part of this exchange, staff has additional questions regarding the project's compliance with development standards that the county would normally require of projects within their purview. The development standards are related to building heights and colors, parking, setbacks, fencing, and signage.

The site plans shown in AFC Figures 1.2-3 and 2.1-3 show an administration building, gas meter, switchyard and parking lot. The administration building is not listed in the AFC Table 5.13-4 (Visual Resources) and no information is given as to the height, color or material of the building. In addition, several project structures do not have identified colors in the aforementioned table.

Inyo County's requirements for parking in the General Industrial and Extractive zone (M1), which would likely be the applicable development standards according to the county, is one parking space for each full-time employee, plus guest parking and loading space as deemed appropriate.

The Socioeconomics section of the AFC states that the HHSEGS project will have 120 employees during the operation of the plant, with 40 working during the day and 80 working at night. The proposed parking is adequate for the day shift. However, the total number of employees working at night would need 80 spaces and the proposed parking appears to be 73 spaces (eight at each solar plant and 57 at the administration building).

A recent letter from Inyo County (March 20, 2012, Docket Log #: 64221) recommends setbacks of 50 feet for the proposed project due to the adjacent properties and the location along Old Spanish Trail (also known as "Tecopa Road"). The proposed setback for the project as shown on the conceptual landscaping figure (Supplement Response to Data Adequacy Review, Figure 1a – 1c, September 2011) is 20 feet.

In order to address land use related development standards and to provide adequate information to Inyo County for input, staff would like to obtain information on the proposed perimeter fencing or walls. Staff has reviewed the Land Use and Visual Resources sections of the AFC and has not been able to find information about the height of such project features.

Inyo County has development standards for signage in both the M-1 and OS-40 zone districts. Inyo County staff has requested information on what will be proposed for the project in order to determine if the signage meets their local Law Ordinances Regulations and Standards (LORS) requirements. For staff to complete the land use analysis section, additional information is needed as follows.

DATA REQUESTS

178. Please provide information on the height, color and material for the administration building and any other development standards that may apply to the common area structures and buildings.

Response: The approximate dimensions and colors, materials, and finishes of major project features are provided in Table 5.13-4R1 of Applicant's Supplemental Data Response, Set 2 (April 2, 2012). The material for structures and buildings in the common area, including the administration building, will be metal. The color has not been finalized yet. The administration building will be approximately 14 feet high with the warehouse being about 21 feet high.

In accordance with Applicant's agreement with Inyo County, Applicant will be submitting an application to rezone the Project site from OS-40 (Open Space) to the M-1 (General Industrial and Extractive) zoning designation. Assuming the M-1 zone applies to the project, the M-1 zoning designation does not contain any specific standards regarding either the color or material for buildings or structures in the M-1 zone. The M-1 designation provides that buildings and structures may be 40 feet or 2.5 stories in height, although taller buildings and structures may be authorized. However, in lieu of the standards in Title 18 concerning permitted, conditional, or accessory uses related to the facility and its structures, other standards that are either necessary or appropriate may be adopted.

179. Please provide information as to the color of the project features listed in the AFC Table 5.13-4 that were not identified.

Response: Updated information regarding the approximate dimensions and colors, materials, and finishes of major project features is provided in Table 5.13-4R1 of Applicant's Supplemental Data Response, Set 2 (April 2, 2012). However, please note that rather than a flat/ untextured finish, the buildings will have an eggshell-like finish. For project features without a specified color, a color treatment plan to blend project facilities into the existing setting will be developed in consultation with Inyo County and the CEC, as stated in Section 5.13.6 of the AFC.

180. Please provide information related to the proposed parking (number of parking spaces and location) and whether or not there are additional parking spaces located onsite that staff is not aware of.

Response: Information related to proposed parking is provided in Figure 2.1-3 of the AFC and Figure 2.2-1-R1 of Applicant's Supplemental Data Response, Set 2 (April 2, 2012). As shown in AFC Figure 2.1-3, there are 62 proposed parking spaces (58 for non-handicapped, 4 for handicapped) in the common area. As shown in Figure 2.2-1-R1, there are 26 proposed parking spaces at each power block (24 for non-handicapped, 2 for handicapped). Therefore, there are currently 114 proposed parking spaces located on site, which satisfies the requirements of Section 18.57.080 of the Inyo County Zoning Ordinance relating to parking requirements for the M-1 designation.

181. Please provide information as to whether the applicant intends to implement the Inyo County recommended setback of 50 feet.

Response: It is Applicant's understanding that a 50-foot setback is applicable to lands zoned as OS-40 (Inyo County Code § 18.12.050), and that a 25-foot setback is applicable to the M-1 zoning designation (Inyo County Code § 18.57.090). As noted above, Applicant will be

submitting an application to Inyo County for rezoning of the Project site to the M-1 designation.

As shown in Figures VR-1a through VR-1c in Attachment VR-1 (Conceptual Landscaping Plan) to Applicant's Supplemental Response to Data Adequacy Review submitted on September 7, 2011, Applicant has proposed a 20-foot-wide landscaped area along the southern edge of the Project site parallel to Tecopa Road. In addition, an approximately 12-foot-wide unpaved path will be constructed on the inside perimeter of the project boundary fence. The space used by the landscaped area, in conjunction with the unpaved path, satisfies the setback requirements of the M-1 zoning designation.

If, for the sake of argument, this 32-foot buffer did not satisfy the setback requirement, under Title 21, in lieu of the any standards in Title 18 concerning permitted, conditional or accessory uses related to the facility and its structures, including setback requirements, other standards that are either necessary or appropriate may be adopted. In this instance it is both necessary and appropriate to approve the proposed 32-foot buffer.

182. Please provide information related to the height, color and material for the anticipated type of fencing or walls and any security features that may be included.

Response: As stated in Section 2.0 of the AFC, the site perimeter will be fenced with desert tortoise exclusion fencing and perimeter galvanized chain link fencing for security, which will be 8 feet high. While Section 18.78.160 of the Inyo County Zoning Ordinance generally limits fence heights to 6 feet, a greater height is permissible under Section 18.78.170 when specified in connection with the authorization of a conditional use.

If, for the sake of argument, an 8- foot high fence is not in compliance with Title 18, under Title 21, in lieu of the any standards in Title 18 concerning permitted, conditional or accessory uses related to the facility and its structures, including setback requirements, other standards that are either necessary or appropriate may be adopted. In this instance it is both necessary and appropriate to approve a fence height not to exceed 8 feet.

As stated by Applicant at the November 3, 2011 Informational Site Visit, a preliminary plan has been developed to have a landscape buffer along Tecopa Road, which was submitted as Attachment VR-1 to Applicant's Supplemental Response to Data Adequacy Review submitted on September 7, 2011. In this Conceptual Landscaping Plan, Applicant has proposed the use of native shrubs of varying heights in addition to some non-native trees to screen project facilities from residences and along north-south roads within Charleston View. Many of the plant species proposed for the landscape border are species that are now found within the project site, and will require minimal watering once established. Applicant is open to input from Staff, interested stakeholders, and the Charleston View community as to other types of landscaping that might be appropriate.

In addition, at the workshop held on April 26, 2012, Visual Resources Staff asked whether Applicant intended to provide vegetation screening around the entire perimeter of the project site similar to that proposed for the landscape buffer for the southern border of the project site along Tecopa Road. The purpose of the landscape buffer was to mitigate potential visual impacts for viewers driving on Tecopa Road and the residences south of Tecopa Road. Moreover, a landscape buffer is not required under either Title 18 or Title 21 for the M-1 District. Therefore, given the lack of expected viewers along the remaining perimeter of the project, and lack of requirement for such a buffer, the Applicant is not proposing a landscape buffer around the entire border of the project site.

183. Please provide information as to what signs, if any, will be proposed for the project and what development standards will be used with regard to Inyo County LORS.

Response: As stated in Revised Appendix 5.1F [in the materials sent to the Great Basin Unified Air Pollution Control District, which are included in Applicant's Supplemental Data Response, Set 2 (April 2, 2012)], visible speed limit signs (limiting vehicle speed to 15 miles per hour) will be posted near construction area entrances to help control fugitive dust during onsite construction. Speed limit signs will be in compliance with the requirement in Inyo County Zoning Code section 18.75.110 that signs in the M-1 zoning designation not exceed 25-feet in height. Speed limit signs will also comply with the requirements in Sections 18.75.030 and 18.75.040 that signs do not create traffic hazards or deface natural features.

Any additional signs will also conform with the requirements of Chapter 18.75 of the Inyo County Code relating to signage.

BACKGROUND

As indicated in the letter from Inyo County, dated November 29, 2011, the project would be subject to the County Renewable Energy Ordinance (Title 21). Title 21 contains a process for development of renewable energy projects that include land use development standards, health, safety and welfare considerations, and environmental review requirements. As part of the energy impact determination, renewable energy permit or development agreement process there is a provision that requires a reclamation/revegetation plan and financial assurances to ensure that reclamation will proceed in accordance with the reclamation plan.

On April 2, 2012, Inyo County Chief Administrative Officer Kevin Carunchio wrote Energy Commission Staff in regard to an important issue related to conditions the County would place on the applicant but for the exclusive jurisdiction of the Energy Commission. The letter specifically states, "As Energy Commission staff is aware, Title 21 of the Inyo County Code requires a socio economic analysis of the project in order to assure that the County's direct and indirect economic impacts are borne solely by the project applicant and not the citizens of Inyo County. In addition, Title 21 requires that a project applicant restore the project site to pre-project condition and provide financial security to assure that the County and its residents are not required to pay for that restoration should the applicant fail to do so." The County's April 2, 2012 letter asks for specifics from the Applicant related to both the Hidden Hills SEGS' Power Purchase Agreement, as well as the specifics of the 3,277 acre lease agreement between Hidden Hills SEGS and Mary Jane McMonigle, Steven Scow; Nick & Areta Tsiamis, the Mary Willey Trust and Section 20 LLC.

DATA REQUEST

184. Please indicate how the Applicant intends to comply with requirements in the County's Title 21 concerning financial security and decommissioning surety for site rehabilitation for the 3,277 acres of land on which the Hidden Hills SEGS will be constructed and operated.

Response: The Applicant intends to comply with the requirements in the County's Title 21 regarding decommissioning and site restoration by satisfying the decommissioning and site restoration conditions that the Energy Commission has consistently applied to approximately 90 facilities licensed by the Commission.

Applicant understands the interests in ensuring that the permanent closure of a licensed facility is carried out safely and securely and the interest in restoration of the site thereafter, consistent with the then-applicable LORS. Since 1996, the California Energy Commission has

licensed approximately 90 power plants. Of these, 64 power plants are operating or under construction. Another 10 power plants are in pre-construction.

Throughout these past 16 years, the conditions of certification regarding plant closure are virtually the same for all 90 power plants. Each of the 90 Commission decisions "contains measures to ensure that the planned, temporary, or unexpected closure of the project will occur in conformance with applicable laws, ordinances, regulations, and standards."[1] In each of the 90 decisions, these measures include requirements for the submission, review and approval of a Closure Plan, for any planned or unplanned closure. These conditions are generally set forth in the General Conditions in the Commission's final decision, designated as "COM" followed by a number, such as "COM-1".

Not one of the 90 decisions issued over the past 16 years has required the Applicant to post a bond, security or other form of financial guarantee for plant closure costs as a condition of certification.[2] The Commission has elected to not include the requested additional security because, among other reasons, the value of the personal property onsite provides more than enough security. It is well settled that bonds, security or financial guarantees are not required as a condition of certification for power plants licensed by the California Energy Commission. Instead, the Commission relies on preparation, review and approval of closure plans to ensure the orderly closure of power plants without posing a financial burden on public resources.

The Commission has expressly noted in previous proceedings that power plants retain significant economic value even after 40 years of operation. As a result of this evidence, the Commission has not placed the burden on an applicant of identifying, much less sequestering, a specific source of funds for plant closure. The Commission need not single out this facility for the substantial burden of financial sureties, and should instead treat this facility the same as every other project that has been licensed by the Commission.

[1] See, for example Commission Adoption Order, Sunrise Cogeneration Project, 98-AFC-4, December 200, p. 2

[2] Furthermore, while we have not examined every decision prior to 1996, we are not aware of any pre-1996 AFC decision that has required an applicant to post a financial guarantee for plant closure costs. Interestingly, some Commission decisions prior to 1996, did not address the question of plant closure at all.

Public Health (185)

BACKGROUND

The Application for Certification (AFC) and attached Ambient Air Quality Modeling and Screening Health Risk Assessment File (August, 2011) provided some information on how the applicant conducted the health risk assessment. The potential impacts associated with emissions of toxic pollutants to the air from the proposed power plant were addressed in a health risk assessment (Section 5.9 Public Health and Appendix 5.1E). This health risk assessment was prepared using guidelines developed by Office of Environmental Health Hazards Assessment (OEHHA) and California Air Resources Board (CARB), as implemented in the latest version of the HARP (Hotspots Analysis and Reporting Program) model (Version 1.4d). Some files of health risk assessment support data were not included in the Ambient Air Quality Modeling and Screening Health Risk Assessment File, such as receptors, census and map. Staff will need these modeling input data to review and confirm the adequacy of the health risk assessment.

DATA REQUEST

185. Please provide all other related files of input data for HARP which were not included in the August, 2011 Ambient Air Quality Modeling and Screening Health Risk Assessment File (for example, there was no information of receptors, census and map in the provided HARP input files; therefore, staff was not able to locate some of the sensitive receptors).

Response: Sensitive receptors are not identified separately in the modeling files or on maps because there were no sensitive receptors [as defined in the siting regulation at Appendix B (g) (9) (E) (i)] identified within 6 miles of the project site (see Section 5.9.3, Affected Environment, p. 5.9-6 of the AFC: "No daycare, hospital, park, preschool, or school receptors were found within 6 miles of the project site.") Applicant did treat St. Therese Mission, a commercial facility under construction, as a discrete receptor for health risk modeling because the facility is planned to include a visitor's center that will include a children's playground. Applicant also included discrete receptors representing residences. The locations of St. Therese Mission and nearby residences are shown in Figure 5.9-1 of the AFC (called "sensitive receptors" in the figure title, although they do not meet the regulatory definition).

The 48 discrete "sensitive receptors" in AFC Figure 5.9-1 are included in the health risk assessment modeling in the receptor files submitted with the boiler optimization filing: \Refined\HRA\HHRHRA2.ROU and RefinedWMMR\HRA\HHRHRA2.ROU (rows 13995 through 14044), for the Health Risk Assessment for project operation only and project operation plus mirror washing activity, respectively. Among the 48 receptors, 42 (rows 13995 through 14036 of the files) are labeled as "Residence Receptors," 4 are labeled as "St. Therese Mission," and 2 are labeled as "Questionable Residential receptors."[3] These receptors were included in the receptor files in the original modeling submittal also but were not as clearly labeled.

[3] These receptors were labeled "questionable" because those locations are zoned residential but it is not clear whether anyone actually lives in the mobile homes located there.

Census information regarding the project area is in AFC Section 5.10, Socioeconomics. As shown in Table 5.10-4, the total population within 6 miles of the project in California is 638 persons. No cancer burden was calculated for the cancer risk assessment in the AFC because there was no location at which modeled cancer risk equaled or exceeded 1 in one million. The calculated cancer burden for the boiler optimization filing ("Applicant's Supplemental Data Response Set 2, Boiler Optimization Plan and Design Change," submitted April 2, 2012*)* would be zero because the area where modeled cancer risk exceeds 1 in one million is extremely small and does not include any residential receptors.

Traffic & Transportation (186-187)

BACKGROUND

In the applicant's Data Response Set 2C (to Data Request 148), additional data was provided with respect to the Maximum Permitted Exposure (MPE) for retinal damage. Although informative, Data Request 148 was not intended to address the potential for retinal damage from reflected Solar Receiver Steam Generator (SRSG) solar radiation. Rather, the intent was to determine the luminance of the SRSG during operations which can provide the basis for realistic estimations of apparent brightness, glare and visual disruption. The applicant's response states:

"*Flux (W/m^2) is the appropriate measure to use. Luminance measurements calculate light radiant energy that differs from the natural spectrum (limited to the energy in the visual spectrum), while the human eye is affected by the full spectrum*".

This statement is true for the consideration of physiologic damage. However, luminance is absolutely necessary for any determination of perceived brightness. The human photopic luminous efficiency function for the Standard Observer, Vλ, defines the envelope of human visual sensitivity as a function of visible wavelengths. This is shown in **Figure 1** (below) together with a representative solar spectrum (Wehrli) and the visual response/sensitivity profile to the Wehrli spectrum. It is the integrated visual response which defines luminance and contributes to perceived brightness. Staff recognizes that the relationship between luminance and brightness is not straightforward and depends on additional factors such as the observer's state of adaptation, the spatial extent of the SRSG source, and the context/background luminance. Although, as the applicant states in their response, the retinal irradiance (Er) of the SRSG is significantly less than that of the sun, it is still on the order of approximately 30-40 times greater than that of the sky background. Staff considers this potentially significant and desires an understanding of the luminance of the SRSG during operations and its relationship to the luminance of the sky background.

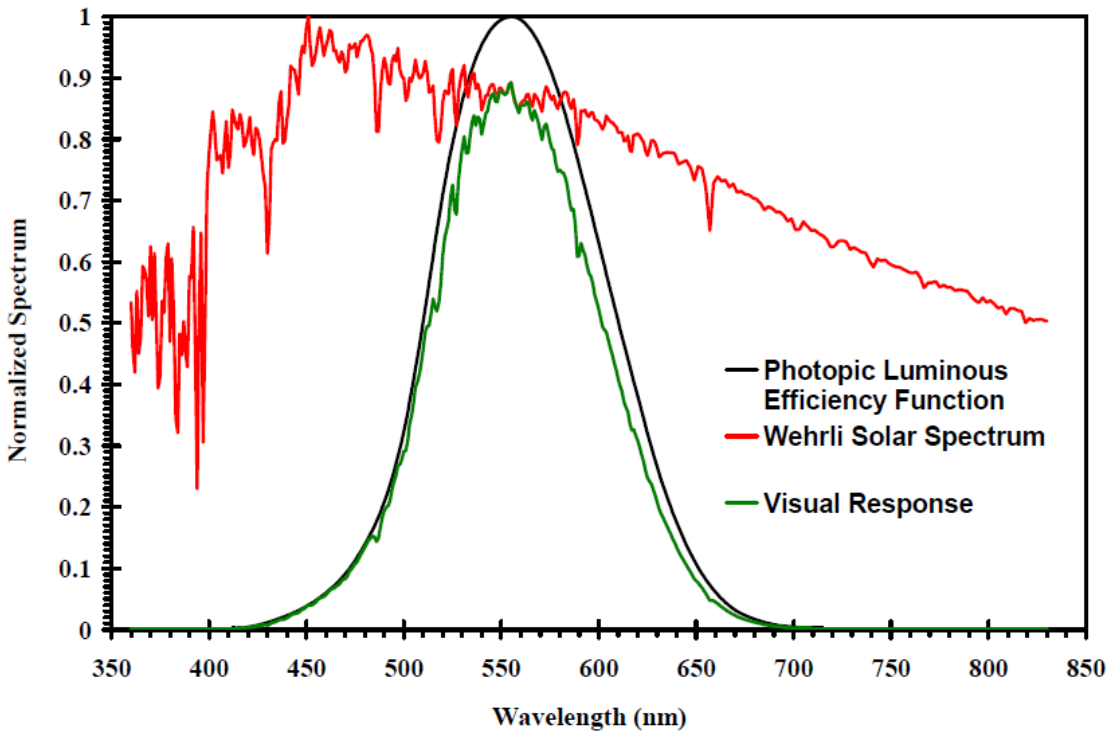

Figure 1 above represents the spectrum of the photopic luminous efficiency function, Vλ (black), and a representative solar spectrum (Wehrli, red). The visual response (green) represents the visual systems sensitivity to the solar spectrum.

DATA REQUEST

186. Please provide estimates of the luminance of the SRSG during operations and the luminance of representative sky background. Please address the impact of these values and their relationship on apparent brightness, glare and visual disruption at nominal viewing distances for workers, the public and motorists.

Response: As the reflectance by the heliostat and receiver have marginal effects on the solar spectrum, the luminous efficiency is Air Mass (AM) 1.5 standard spectrum, which is calculated to be 110 lumens per watt (lm/W). Using the calculated solar flux emanating from the SRSG, as well as the solid angle subtended by the SRSG, the luminance is less than 400 kilocandela per square meter (kcd/m^2). Since the SRSG is a diffusive reflector, this value is essentially for all observers at distances farther than the nominal viewing distance.

Although the luminance of the sky background was not directly measured for the specific site, according to Al-Shareef et al.[4], in a desert environment luminance is typically 2 kcd/m^2 for clear sky. Light dust may increase this to 10 kcd/m^2, while heavy dust may reduce it to 500 cd/m^2. In comparison, the luminance of the sun is 1.6×10^9cd/m^2. Therefore, as the luminance from the SRSG is more than 3 orders of magnitude smaller than that of the sun, we expect no greater visual disruption than that due to the sun.

[4] Al-Shareef, Faisal M.; David Carter, "The use of daylight as a substitute for electric lighting in desert regions", Ingineria Iluminatului (Lighting Engineering), Volume 2, Number 1, March 2000, available at http://journal.florinrpop.ro/2000-04/94.pdf

BACKGROUND

In the applicant's Data Response Set 2C, Data Request 151, additional data is provided with respect to heliostat positioning algorithms, the orientations for sleep, safe, tracking and standby positioning, and safe path transitioning. Further, the applicant states that within the control volume of the site (according to FAA regulations the volume that encompasses the perimeter of the site and a height to 200 feet above the towers) that,

"*In 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 impact on aviation safety*".

Staff recognizes that standby positioning algorithms are planned, such as an annulus of focal points around the tower, to distribute and minimize multiple heliostat focal points above the site control volume.

Staff however, is concerned that direct solar reflections from the heliostats, especially in the standby position, can potentially impact aviation safety. An aircraft in the vicinity of the solar field could certainly experience direct reflections from individual heliostats in standby positions. Further, dependent on the flight path, many successive multiple exposures could occur for a rather extended duration.

DATA REQUEST

187. Please provide the analysis which leads to the applicant's quoted conclusion above. Please provide an assessment of the impact of Glint and Glare, and visual disruption to pilots when directly exposed to a heliostat solar reflection (as in a standby position) and during a succession of such exposures when flying through the field of rays produced by the population of heliostats in standby positions.

Response: The impact a single heliostat will have on a pilot outside of the control of the site (according to FAA regulations the volume that encompasses the perimeter of the site and a height to 500 feet above the towers) is similar in nature to that calculated for a single heliostat in answer to Data Request 149. It is shown there that even using conservative calculations for the relevant distances for a pilot (in excess of 1250 feet or 380 meters), the retinal irradiance is lower than the safe retinal values, and therefore, poses no glint and glare health hazard.

With respect to the visual disruption, one may see in the following plot (Figure DR187-1) the luminance from heliostats with different focal lengths for relevant distances along with the luminance of the sun ($1.6 \times 10^9 \mathrm{cd/m^2}$). The plot is based on ray-tracing calculations of the solar flux incident onto an observation plane facing the heliostat at different distances assuming direct normal incidence of $1\mathrm{kW/m^2}$ from a sun positioned directly normal to the heliostat. To convert the solar flux to luminous flux, a luminous efficiency equal to 110 lm/W was taken based on standard Air Mass 1.5 solar spectrum and the luminance was calculated by dividing the result by the solid angle subtended by the source. The solid angle subtended by the source was calculated using ray-tracing as well, where one finds for distances of the order of the focal length of the heliostat, the solid angle is that of the entire reflective area of the heliostat; for distances much farther or closer than the focal length, the subtended angle is smaller than that of the entire area of the heliostat due to rays from the sides of the heliostat either reflecting at a too large an angle (when the observer is very far) or too small an angle (when the observer is very close) to reach the observer. For an observer just at the mirror surface, the angle subtended is that of the sun.

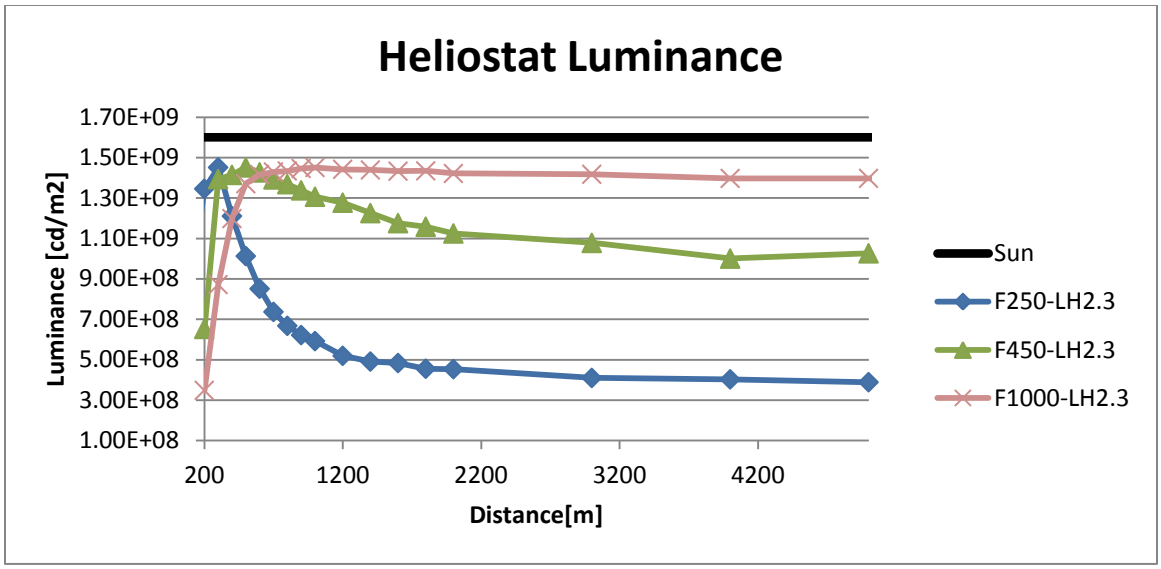

Figure DR187-1. Luminance from Heliostats with Different Focal Lengths

For all the relevant distances larger than 380 meters, the luminance from all heliostats is smaller than the luminance of the sun and therefore does not pose an excessive visual disturbance. Furthermore, typically the reflected flux is expected to be even smaller due to lower mirror reflectance, cosine effect and attenuation of the reflected radiation by the air, and which will further decrease the apparent luminance of the heliostat. Note that since most of the surrounding heliostats will be reflecting the sky back to an observer flying overhead, the relevant background luminance is that of the desert sky, making no greater contrast than that of the sun with the sky background.

A succession of heliostats should not cause any further disturbance than that of a constant observer and heliostat for the duration of the flight over the solar field.

Visual Resources (188)

BACKGROUND

In the applicant's Data Response Set 2C, Data Request 154, the phenomenology and conditions for the production of the so called 'tee pee' effect are discussed. However, the impacts of the prominent visual signature on visual resources are not discussed. The tower and the illuminated Solar Receiver Steam Generator (SRSG) during operations produce a salient visual signature. When combined with the additional visual signature of the 'tee pee' effect produced during conditions of high humidity or elevated levels of suspended airborne particulate, the overall visual signature and its prominence are substantially increased. Staff is concerned that the extent, brightness and prominence of the overall visual signature of the tower area during these conditions will result in significant visual impacts.

DATA REQUEST

188. Please address the potential direct and cumulative impacts on visual resources due to the prominent visual signature of the tower areas during periods of relatively high atmospheric scattering conditions.

Response: Data Response 154 refers to the visual effect created under certain atmospheric conditions when the sunlight reflected from a solar tower project's heliostats creates visible rays of light in the atmosphere that appear to be streaming down from the solar receiver tower, creating a tent-like or "tee pee" effect. While some images of the Abengoa PS-10 and PS-20 solar towers near Seville, Spain depict this effect, the condition occurs only occasionally. For the HHSEGS project, the times at which the tenting effect is likely to be visible are very limited. The tenting effect occurs only at times of high relative humidity or when there are large numbers of dust particles in the air. In addition, it is most likely to occur in the early morning hours when the sun angle is low, and when (because of the lower temperatures) the levels of humidity have the greatest potential to be high enough to permit the visible light streaming to occur.

During the limited times when the tenting effect may be present, this effect will be visually prominent in the view and will attract attention. However, the attention that the streaming will attract will not be negative. As stated in the analysis in the Final Staff Assessment for the Ivanpah project, the tenting effect created by the visible light rays could contribute to a high level of visual unity in the view, which some viewers may find attractive (Ivanpah FSA , p. 6.12-15). The images depicting the Spanish solar towers with streaming rays of light present these solar towers in positive aesthetic terms, as positive elements of energy infrastructure that have an ethereal beauty. These images of the Spanish solar towers suggest that when the tenting effect is present at HHESGS, it will be perceived as a positive visual feature of the view.

Because the times at which the tenting effects may be visible in views of the project will be very limited, and because when the tenting effect is visible it is likely to be perceived as a positive element of the view, the potential tenting effects will not have a significant adverse direct or cumulative impact.

Attachment DR177-1

Draft Burrowing Owl Mitigation and Monitoring Plan

Hidden Hills Solar Electric Generating System

(11-AFC-2)

Submitted to the

California Energy Commission

Submitted by

Hidden Hills Solar I, LLC; and Hidden Hills Solar II, LLC

May 4, 2012

With Assistance from

CH2MHILL
2485 Natomas Park Drive
Suite 600
Sacramento, CA 95833

Contents

1.0 Introduction

This document was prepared for the Hidden Hills Solar Electric Generating System (HHSEGS or project) (11-AFC-2), and provides a conceptual Mitigation and Monitoring Plan (Plan) for western burrowing owl (*Athene cunicularia*). This Plan is provided in response to California Energy Commission (CEC) Staff Data Request 177. A finalized version of this Plan will be incorporated into the HHSEGS Biological Resources Mitigation Implementation and Monitoring Plan (BRMIMP) upon certification and implementation of the project.

Burrowing owls are considered uncommon to rare in the Project area. Published literature on its distribution or seasonal movements in the Mojave Desert is lacking. Garrett and Dunn's (1981) overview of the burrowing owl in southern California deserts states: "It is quite scarce on the northern deserts from the [east] Mojave Desert north through Inyo Co[unty]. . . . While it is largely resident in the region, there is some winter movement of more northerly birds into the southern and coastal parts of the region. . . . The Burrowing Owl reaches peak abundance in agricultural areas in the Imperial Valley; the banks of irrigation ditches provide suitable nesting sites. Open desert scrub is widely but sparsely inhabited." Greger and Hall (2009) found burrow occupancy occurred year-round and was most consistent in the Transition region (the area between Mojave Desert and Great Basin) and tended to be lowest in the Mojave Desert region.

Although one burrowing owl was observed during botanical surveys on the Project site in 2010, and only burrows and sign has been found during subsequent protocol surveys, it is assumed that burrowing owl are present on the HHSEGS project site.

Implementation of this Plan will provide for the protection and monitoring of western burrowing owls should they have the potential to be impacted from project construction. The avoidance, minimization, and monitoring measures being proposed in this Plan are subject to final review and approval by the CEC's CPM, in consultation with the resource agencies including the California Department of Fish and Game (CDFG).

This Plan follows the CDFG burrowing owl guidelines (CDFG, 1995 and CDFG 2012), which document actions to take if owls are observed in the HHSEGS impact area during pre-construction surveys.

2.0 Project Description

HHSEGS will be located 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 18 miles south of Pahrump, Nevada, and approximately 45 miles west of Las Vegas, Nevada (see Figure 1; figures are provided at the end of this section). HHSEGS will be comprised of two solar fields and associated facilities: the northern solar plant (Solar Plant 1) and the southern solar plant (Solar Plant 2). Each solar plant will generate 270 megawatts (MW) gross (250 MW net), for a total net output of 500 MW. Solar Plant 1 will occupy approximately 1,483 acres (or 2.3 square miles), and Solar Plant 2 will occupy approximately 1,510 acres (or 2.4 square miles).

The proposed HHSEGS project is situated in the axial basin of Pahrump Valley about 3.5 miles southeast of the dry lakebed of Pahrump Playa. The nearly flat topography of this site is subject to flash flooding and the project area is generally underlain by a carbonate-rich silt that is friable and possesses little structure and horizonation. The surface lithology of the project area consists of fine-grained material (silt and clay) overlain by a gravel lag in some areas, and by sandy alluvium in the eastern portion of the project site. The habitat on the site is generally described as open desert scrub. Creosote bush (*Larrea tridentata*)-burrobush (*Ambrosia dumosa*) scrub on sandy alluvium on the east transitions into grassland with creosote bush, and into saltbush (*Atriplex confertifolia, A. canescens*) scrub toward the southwest portion of the site. Patches of each type of habitat occur throughout the site, and shrub density is medium to low throughout. Elevation on the site ranges from approximately 2,585 to 2,685 feet, while peaks over 6,000 feet stand within 10-miles to the west, and peaks over 10,000 feet stand within 25 miles to the northeast.

3.0 Regulatory Status and Requirements for Burrowing Owls

Federal and California state laws and resource codes protect burrowing owls and their nesting habitat. Specifically, burrowing owls are protected by the federal Migratory Bird Treaty Act (MBTA) of 1918 (16 U.S.C. 703-711), making it illegal "to pursue, hunt, take, capture, kill, attempt to take, capture, or kill, possess, offer for sale, sell, offer to barter, barter, offer to purchase, purchase, deliver for shipment, ship, export, import…any migratory bird", or any part, nest, or egg of such bird. The burrowing owl is not listed as either threatened or endangered under the federal Endangered Species Act (ESA) or the California Endangered Species Act (CESA). The burrowing owl is identified by the U.S. Fish and Wildlife Service (USFWS) as a "Species of Concern" or "Species at Risk," which are not legal designations formally recognized under the ESA. In California, the CDFG has assigned the burrowing owl the administrative designation of Species of Special Concern.

California Fish and Game Codes §§3503, 3503.5, and 3800 also prohibit the take, possession, or destruction of birds, nests or eggs, except as otherwise provided by law. Take is defined as to "hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, catch, capture, or kill." (Cal. Fish & Game Code § 86) To prevent take, project-related disturbances in owl breeding territories must be minimized or eliminated during the nesting season (typically February 1 to August 31).

4.0 Status of the Burrowing Owl on HHSEGS

Several burrowing owl surveys have been conducted on the project site since 2010, including protocol-level burrowing owl surveys as well as protocol surveys for other species that resulted in incidental observations of burrowing owls; the results of those surveys are summarized below.

During botany surveys conducted in 2010 by GANDA biologists, burrowing owls were incidentally observed on the project site (in the northwest quarter-section of Section 16) using an old kit fox natal den, and immediately west of the project site. This observation was included as an incidental report in the AFC (AFC Section 5.2.6.7.1) for the onsite observation. The general location of the incidental observation was revisited during the 2012 winter burrowing owl surveys.

Burrowing owl surveys were conducted in the spring of 2011 by Sundance Biology, following standard survey protocol found in the Burrowing Owl Survey Protocol and Mitigation Guidelines (CBOC 1993). Surveys were conducted between 13 April 2011 and 18 May 2011 on the 3,277 acre site, and within 150-meter area surrounding the site (650 acres) in the burrowing owl buffer zone survey area. Transect spacing was at 30 feet between transect centerlines. The owl sign that was found on the site was concentrated in the northern portion of the site, and indicates the presence of burrowing owls for wintering and/or nesting purposes. No owls were observed on the HHSEGS site during these surveys (Sundance, 2011).

During the 2012 winter burrowing owl survey, burrowing owl burrows previously documented by Sundance (2011) and the area reported by GANDA were visited and checked for sign of recent use. No burrow was found to be occupied and no fresh sign of burrow use (e.g., fresh white wash, pellets, feathers, prey remains) was present at any of the previously identified burrowing owl burrows within the project site or the 150-meter buffer. In addition, at least one of the previously reported burrowing owl burrows from the spring surveys was found to be collapsed, and no burrowing owl sign was observed at this burrow. Visual surveys of the project area and buffer also did not yield any burrowing owl sightings (CH2M HILL, 2012a).

An incidental observation of a burrowing owl was recorded along Tecopa Road in Nevada during winter avian point count surveys conducted by CH2M HILL biologists in December 2011 and January 2012 (CH2M HILL, 2012b).

Burrowing owl sign was observed on the project site, but there was no conclusive evidence that burrowing owl nesting occurred on the HHSEGS site during the 2011 surveys. It is likely that owls use the project site, but burrows on the western side of the project site are temporary and short-term due to the fine silt and clay soils and the impacts that rain events have on it. Soil horizons, including caliche ledges, are absent from most areas of the project site. Where carbonate horizons have been seen, near the southwestern corner of the site, they are not exhumed by erosion, and therefore, are not available to serve as “roofs” for burrows. These fine-grained sediments easily collapse and are not conducive to the preservation of burrows. On the east side of the site, where tortoise habitat is better, the fine-grained valley fill is overridden by younger sandy alluvium that also possesses little structure, is poorly indurated (quite loose), and therefore, collapses easily (CH2M HILL, 2012a). However, the east side of the site provides more potentially suitable habitat for burrowing owl.

Although there were no burrowing owls observed on the project site during protocol surveys (there was

one incidental observation of a burrowing owl in the northwest corner during botany surveys in 2010); based on the burrows that have been detected, their locations, the conditions of the burrows and sign associated with each burrow, the amount of suitable habitat in the project site and the 150-foot buffer, and the size of a burrowing owl territory, it is estimated that up to 3 and no more than 5 burrowing owls or owl pairs may use the project site and the 150-foot buffer. Because burrowing owls forage within 600 meters of their nests (within approximately 300 acres) during the breeding season (CDFG, 2012), where clusters of burrows occur on the project site they would likely support one owl territory rather than several.

The burrow groupings with the most potential to support one burrowing owl territory are located in the northern portion, and in the western portion of the site near the temporary construction area. The burrow groupings that may support one-half to one burrowing owl territory are found in the southeastern portion of the site near the common area, and in the central-eastern portion of the project (Figure 2). It is also likely that burrowing owl territories may occur within the 150-foot buffer that overlap with the project site in the southeastern and northeastern portions; these areas were included in the estimate of no more than 5 territories on the project site.

5.0 Proposed Mitigation Measures

Construction of HHSEGS will entail ground-disturbing activities that could directly or indirectly impact burrowing owls. This section presents proposed mitigation measures to minimize or eliminate impacts to burrowing owls if they are found on or using the project site.

Avoidance and Minimization Measures

Prior to installation of the desert tortoise exclusion and/or security fencing biologists will survey the fence line corridor, 500 feet on each side of the centerline, for burrowing owls. Burrowing owl surveys will be conducted no more than 14 days prior to the start of the fence installation. Once the site is fenced, a pre-construction pedestrian survey of suitable habitat for burrowing owls within the interior will be conducted. Pedestrian surveys will occur along transects spaced approximately every 7 to 20 feet to allow for 100 percent visual coverage of the ground surface. If ground-disturbing activities are delayed or suspended for more than 30 days after the pre-construction survey, the suitable habitat within the site will be resurveyed for burrowing owls.

HHSEGS will implement approximately 500-foot (150-meter) no-work setbacks from active burrowing owl burrows during project construction activities during the nesting season (February 1 to August 31) and during the non-nesting season as well. At the no-work setback area, additional noise/visual barriers such as haystacks or plywood fencing will be constructed to shield the active burrow from construction activities. Signs will be posted designating the presence of a biologically sensitive area.

The Applicant will also work with a qualified biologist to site the least damaging temporary access routes and locations for temporary work areas during construction. These work areas will be positioned in a manner that avoids or minimizes impacts to active burrowing owl burrows.

Burrowing Owl Exclusion Plan

If occupied burrows are identified onsite during the pre-construction survey and cannot be avoided, the owls will be passively relocated using CDFG protocol (CDFG, 1995 and CDFG, 2012) only with prior approval by the CEC Compliance Project Manager (CPM) in consultation with CDFG. At least one or more weeks may be necessary to accomplish this and allow the owls to acclimate to alternate burrows. Passive relocation will implement the following take avoidance measures:

- Occupied burrows will not be disturbed during the nesting season (February 1 to August 31) unless a qualified biologist can verify through non-invasive methods that egg laying/incubation has not begun or juveniles are foraging independently and able to fly. A 500-foot no-work setback will be established from active burrowing owl burrows. Additional noise/visual barriers such as haystacks or plywood fencing will be constructed to shield the active burrow from construction activities. Signs will be posted designating the presence of a biologically sensitive area.
- Prior to any ground-disturbing activities, the Applicant will install up to five artificial burrows within the proposed relocation area for each identified owl burrow in the Project Area that would be destroyed by Project construction or impacted by Project operations.

- A qualified biologist will passively relocate owls, confirm that owls have left burrows prior to ground-disturbing activities, and monitor the burrows to observe if owls return.
- One-way doors should be left in place for 48 hours to ensure burrowing owls have left the burrow before excavation, visited twice daily and monitored for evidence that owls are inside and can't escape (i.e., sign should be searched for immediately inside the door).
- Once evacuation is confirmed, the biologist will collapse burrows to prevent reoccupation. Potentially suitable, burrowing owl burrows will be hand-excavated by a qualified biologist and then filled to ensure that burrowing owls are not occupying burrows within the disturbance footprint at the time of construction.
- A qualified biologist will identify any potential owl burrow surrogates or refugia on site and monitor removal.
- A qualified biologist will demonstrate success and sufficiency by photographing the excavation and closure of the burrow.
- Monitoring of the site will evaluate success.
- The owner will implement remedial measures to prevent subsequent owl use to avoid take.
- The owner will continually make the impacted site inhospitable to burrowing owls and fossorial mammals (for example, by allowing vegetation to grow tall, by heavy disking, or immediate and continuous grading) until development is complete.
- When destruction of occupied burrows is unavoidable, suitable unoccupied replacement burrows will be identified, and if none are present, any existing unsuitable burrows will be enhanced (enlarged or cleared of debris).

In general, the project is located in a region of the Pahrump Valley within undeveloped suitable desert habitat, within the range of burrowing owl. Suitable offsite habitat that could support any passively relocated burrowing owl is available adjacent to the project site in the northeast corner and along the eastern edge. Burrowing owls would be allowed to relocate themselves to that area if they are found on the project site prior to project construction. Because of the suitable nesting habitat in the project vicinity, construction of artificial burrows for passively relocated owls will not be included as a mitigation measure for this Plan.

Compensatory Mitigation Plan

Offsite mitigation at a CEC-approved mitigation site will occur only if burrowing owls are found during preconstruction surveys and must be relocated from an occupied burrow. During the non-breeding season, any owls that need to be relocated will be passively relocated from an occupied burrow to a nearby offsite mitigation area. Passive relocation is the preferred option to trapping (CBOC, 1993), and is described in the burrowing owl exclusion plan above. During the non-breeding season, owls should be given a minimum of 3 weeks to become familiar with the new artificial burrows, after which eviction of owls within the project site can begin.

Because burrowing owls and desert tortoise use the same habitat in the Mojave Desert, the burrowing owl offsite habitat mitigation would also likely occur at the project's—still to be determined—desert tortoise mitigation site. Based on the habitat in the vicinity of the project site that may be purchased for mitigation, it is expected that the desert tortoise mitigation site will be located contiguous to occupied

burrowing owl habitat. The Burrowing Owl Survey Protocol and Mitigation Guidelines (BOC, 1993), the 1995 Staff Burrowing Owl Mitigation Report (CDFG, 1995), and the 2012 Staff Burrowing Owl Mitigation Report (CDFG, 2012) recommend that projects replace 6.5 acres of occupied owl habitat per owl (or pair of owls) that are impacted; and that mitigation sites within contiguous habitat would require a mitigation ratio of 2:1. Thus, at a 2:1 ratio, 13 acres of occupied habitat will be conserved for each single owl or pair of burrowing owls detected during the pre-construction surveys.

- If land acquisition is used, a qualified biologist will conduct a burrowing owl habitat assessment to determine suitability of the proposed mitigation site for burrowing owl use and to determine the current use of the potential mitigation site. The biologist will also identify any issues on the site and any necessary rehabilitation or other restorative measures (such as construction of artificial burrows or enhancement of existing burrows), or habitat improvement(s) to make the site more acceptable for owl mitigation. The habitat assessment and any recommendations will be provided to CDFG for review and comment and to the CPM for review and approval no later than 90 days after site acquisition. Potential habitat improvement methods are discussed below.
- As an alternative to offsite mitigation for desert tortoise and burrowing owl, under the 2010 Senate Bill SB 34 X8 and the 2011 Assembly Bill AB 13 X1, the Applicant also has the option to pay an in-lieu fee to mitigate impacts to burrowing owl and desert tortoise, as well as other listed species impacted by the project. This fee is determined by the CEC in consultation with CDFG, and is in lieu of mitigation activities the Applicant would otherwise undertake directly.
- The method of compensatory mitigation will be determined by the Applicant and the final burrowing owl mitigation plan will summarize the chosen approach.

Mitigation Land Vegetation Management Goals

Burrowing owl habitat in California has been described as “open, dry, nearly or nearly level grassland, prairie, or desert floor” (Grinnell and Miller 1994), and shrubland is generally considered potential habitat if the shrub cover is below 30 percent (CBOC 1993). If feasible, mitigation land will be selected that naturally supports vegetation meeting the habitat requirements of burrowing owl. The goal is to provide shrub coverage of less than 30 percent and to minimize the occurrence of weeds.

6.0 Mitigation Monitoring and Reporting Strategy

The mitigation measures presented in this Plan are designed to minimize or avoid the potential adverse impacts of the project on burrowing owl. To assess the effectiveness of the proposed mitigation measures, monitoring is included as part of this Plan. If burrowing owls are identified onsite during the pre-construction survey, the following burrowing owl monitoring measures will be implemented if approved by the CPM in coordination with the CDFG:

Monitor burrowing owl pairs identified during the pre-construction survey within 500 feet of any work activities that exceed ambient noise and/or vibration levels for signs of stress or changes in behavior caused by the work activity that could cause nest abandonment. If, in the opinion of the Designated Biologist or biological monitor assisting the Designated Biologist, the 500-foot buffer is inadequate to protect burrowing owl, the following will occur:

- The no-work buffer will be extended until the offset distance is adequate to protect owls, as determined by the Designated Biologist;
- Additional and/or more effective noise and visual barriers will be installed; or
- If the above actions are inadequate to protect owls, the CPM and CDFG will be consulted for further direction.

Impacts to burrowing owls during project construction will be recorded and these findings will be reported to the CPM in the monthly compliance reports written by the Designated Biologist.

The Designated Biologist or biological monitor assisting the Designated Biologist will conduct as-needed monitoring visits following the pre-construction survey until the completion of both project sites to determine status and effectiveness of owl passive relocation. The Designated Biologist will provide the results of the monitoring surveys and any recommendations to improve the effectiveness of passive relocation to the CEC in the monthly compliance report. Any agency-approved remedial actions will be implemented immediately and monitored for their success by the Designated Biologist or biological monitor assisting the Designated Biologist.

The Designated Biologist, biological monitor assisting the Designated Biologist, or other approved qualified biologist will conduct monitoring visits during the spring and winter at the owl mitigation site for 2 years following project construction to document the current owl population using standard survey techniques (CBOC, 1993 and CDFG, 1995) and the effectiveness of any habitat improvement measures that had occurred at the site. The Designated Biologist will present the results of the survey and any recommended remedial actions to the CPM in a written report within 90 days following each seasonal survey. Any approved remedial actions will be implemented as soon as feasible by the Applicant.

7.0 Reporting

Any injuries, mortality, or other unforeseen circumstances regarding burrowing owls will be reported to the CPM within 24 hours. If deemed necessary by the regulatory agencies, construction monitoring of onsite owls would be reported on a monthly basis by the Designated Biologist, and copies of the monitoring report distributed to CDFG, USFWS, and the CPM.

A construction termination report written by the Designated Biologist will be provided to the CPM within 90 days of completion of owl relocation. The construction termination report will identify when surveys were completed, survey observations, how mitigation measures were implemented, remedial actions taken, how the measures were completed, and the results of the mitigation.

Monitoring will occur at the burrowing owl mitigation site and will be described in monitoring reports to be submitted annually to the CEC by the Designated Biologist. If, at the end of 2 full reporting cycles success criteria have been met, the project owner will make a request to terminate the monitoring effort (see Section 8.0).

All monitoring reports will generally include the following information:

- Date and time of visits, including weather and visibility conditions and survey methodology;
- Description of the site including location, amount of suitable habitat, topography, vegetation communities and animals observed during visits;
- A spring and winter census of the burrowing owls, as applicable;
- Assessment of habitat suitability for burrowing owls and any known predators or humans visiting or disturbing the site, as applicable;
- Photographs of the site from set locations for valid comparison over time;
- Map showing the location of all burrows (natural or artificial) and owls, including the numbers at each burrow if present, and tracks, feathers, pellets, or other items (prey remains, animal scat) observed at the burrows;
- Description of burrow preference and use, condition of artificial burrows (if any), and date and description of any maintenance performed on artificial burrows;
- Behavior of owls during the surveys
- Assessment of the extent to which the success criteria have been met;
- Identification of trends by comparison to pre-action conditions and those of previous monitoring reports;
- Identification of factors that delay or prevent meeting the success criteria, if any are identified; and
- Names of biologists conducting the survey

8.0 Success Criteria

With respect to avoidance or passive relocation, success of this Plan is defined as: 1) no active burrowing owl burrows marked for avoidance were impacted; and 2) no owls were directly killed or harmed during construction. These criteria apply to both solar plants, during the entire construction period.

The mitigation site would be considered successful if it is occupied by burrowing owl and is contiguous with habitat occupied by at least a single adult owl or breeding pair and the population appears to be stable. The site would be monitored annually. With approval of the CPM, in consultation with CDFG, the Applicant would discontinue monitoring of the mitigation site 2 years after ground-disturbing activities are complete, if it can be shown that the Plan has met the applicable success criteria. Otherwise, the site would be monitored annually for up to 5 years.

If mitigation is provided through an in-lieu fee process, success would be based on the Applicant's payment of the required fees into the mitigation account. The fee schedule would be phased to coincide with the commencement of each phase of the HHSEGS project.

9.0 Adaptive Management

To manage any unforeseen conditions that may arise, adaptive management may be required to ensure that the success criteria are met. Adaptations may include implementing new mitigation measures as appropriate based on the actual effects of the HHSEGS project on owls, and, as feasible, implementing any new owl mitigation measures developed by burrowing owl experts.

During construction, the Applicant will work collaboratively with the CPM and CDFG to ensure that the most effective and reliable mitigation measures are implemented for the protection of active burrows and individual burrowing owls. Adaptive management measures may include more stringent no-work offsets, constant construction monitoring of active burrows, and/or the use of more effective noise/visual barriers if the avoidance/relocation success criteria are in jeopardy of not being met.

If the HHSEGS offsite mitigation site owl population does not meet the success criteria described above, the following additional measures may be implemented:

- Installation of artificial burrows to encourage owl inhabitation followed by monitoring of the new burrows to track their success as reviewed and approved by the CPM, in consultation with CDFG
- As-needed maintenance and repairs to keep the site secured from illegal disturbance (e.g., off-highway vehicles). Habitat restoration may be deemed necessary in response to disturbance to the site
- Extend the 2-year monitoring effort on a year-by-year basis not to exceed 5 years to evaluate the effectiveness of new management actions to meet success criteria

If after 5 years the success criteria have not been met, the Applicant will discontinue monitoring and discuss with the CPM, in consultation with CDFG, the issues that are contributable to the Plan's failure. All parties will mutually agree on appropriate remedial actions such as provisions for additional offsite compensation or selection of an alternative mitigation site. The remedial action(s) may also include additional mitigation monitoring, as appropriate.

10.0 References

California Burrowing Owl Consortium (CBOC). 1993. Burrowing Owl Survey Protocols and Mitigation Guidelines. Sacramento, California.

California Department of Fish and Game (CDFG). 1995. *Staff report on burrowing owl mitigation*. Unpublished report.

California Department of Fish and Game (CDFG). 2012. *Staff report on burrowing owl mitigation*. March 7.

CH2M HILL. 2012a. Attachment DR59-1, Hidden Hills SEGS Wintering Burrowing Owl Survey. February 13. 6 pages. Submitted in Data Response Set 1B-4.

CH2M HILL. 2012b. Data Response Set 1B-5, Hidden Hills Solar Electric Generating System (HHSEGS). Data Response 54. March 15.

Greger, P.D, and D.B. Hall. 2009. Burrow Occupancy Patterns of the Western Burrowing Owl in Southern Nevada. Western North American Naturalist. 69(3): 285-294. February.

Grinnell, J., and A. H. Miller. 1944. The Distribution of the Birds of California. Pacific Coast Avifauna 27.

Sundance Biology, Inc. 2011. Attachment DR58-1, Resource Summary for Phase I and Phase II Burrowing Owl (*Athene cunicularia*) Surveys on the Proposed Hidden Hills SEGS Project, Inyo County, California. November 30. 17 pages. Submitted in Data Response Set 1B.

Figures

LEGEND

- Major Freeways
- Major Road
- State Boundary
- County Boundary
- Major Railroad Lines
- National Parks/ Forests
- Military Installation
- Dry Lake
- Urban Areas
- Wilderness Area
- HHSEGS Boundary

N

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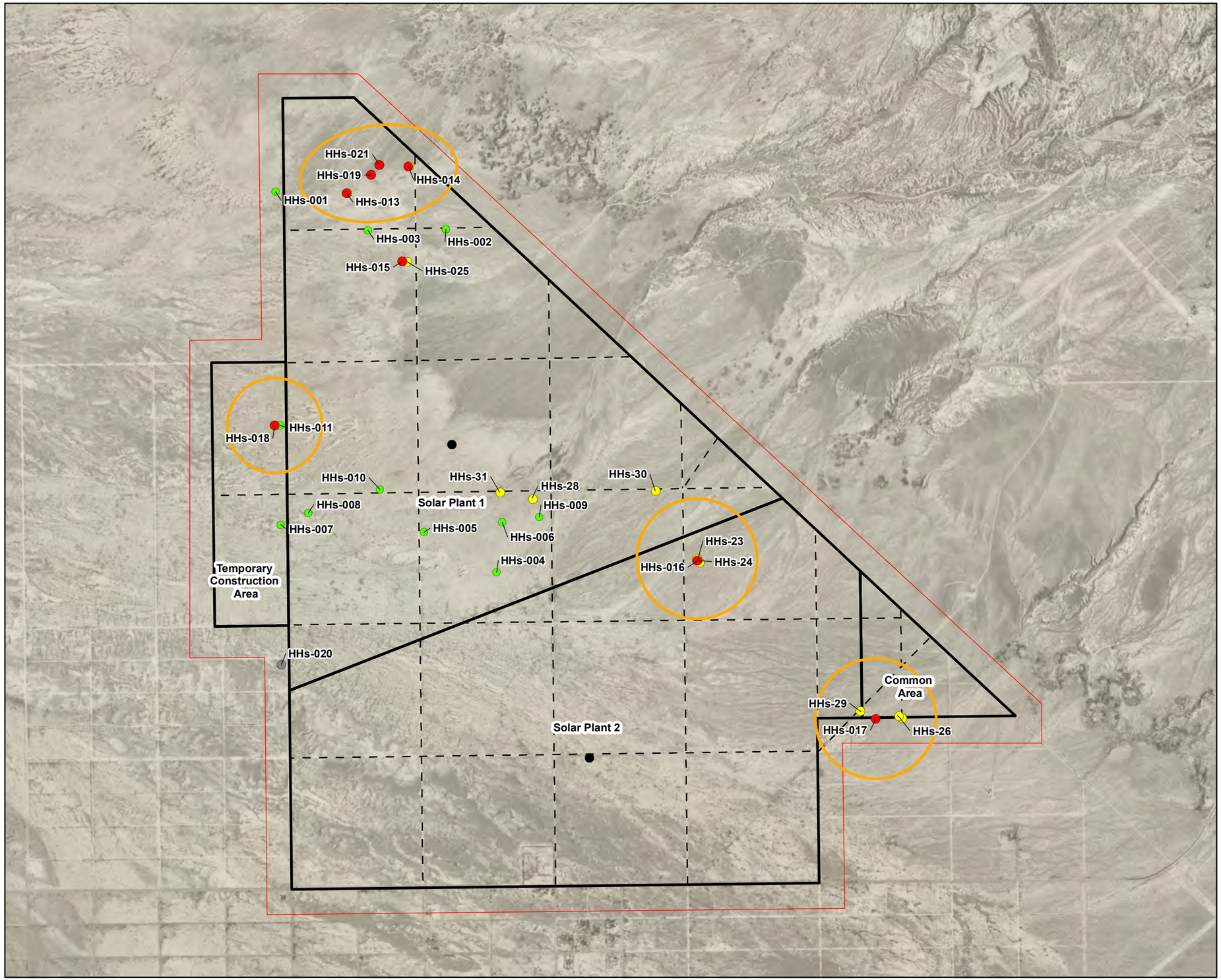
FIGURE 1
Vicinity Map
Hidden Hills Solar Electric Generating System



VICINITY MAP

LEGEND

- Solar Power Tower
- Potentially Suitable Burrowing Owl Burrow (Jan/Feb 2012)
- Burrowing Owl Burrow (Sundance)
- Potentially Suitable Burrowing Owl Burrow (July 2011)
- Collapsed Burrow
- Site Road
- HHSEGS Boundary
- Burrowing Owl 150-ft Buffer Zone
- Potential Burrowing Owl Territories

Source: Sundance Biology, Inc.

N

0 1,000 2,000
Feet

Figure 2
Potential Burrowing Owl Territories
Hidden Hills Solar Electric Generating System

Appendix A
1995 California Department of Fish and Game Staff Report on Burrowing Owl Mitigation

State of California

Memorandum

To : "Div. Chiefs - IFD, BDD, NED, & WMD
Reg. Mgrs. - Regions 1, 2, 3, 4, & 5

Date : October 17, 1995

From : Department of Fish and Game

Subject :
Staff Report on Burrowing Owl Mitigation

I am hereby transmitting the Staff Report on Burrowing Owl Mitigation for your use in reviewing projects (California Environmental Quality Act [CEQA] and others) which may affect burrowing owl habitat. The Staff Report has been developed during the last several months by the Environmental Services Division (ESD) in cooperation with the Wildlife Management Division (WMD) and regions 1, 2, and 4. It has been sent out for public review and redrafted as appropriate.

Either the mitigation measures in the staff report may be used or project specific measures may be developed. Alterative project specific measures proposed by the Department divisions/regions or by project sponsors will also be considered. However, such mitigation measures must be submitted to ESD for review. The review process will focus on the consistency of the proposed measure with Department, Fish and Game Commission, and legislative policy and with laws regarding raptor species. ESD wiIl coordinate project specific mitigation measure review with WMD.

If you have any questions regarding the report, please contact Mr. Ron Rempel, Supervising Biologist, Environmental Services Division, telephone (916) 654-9980.

COPY Original signed by C.F Raysbrook

C. F. Raysbrook
Interim Director

Attachment

cc: Mr. Ron Rempel
Department of Fish and Game
Sacramento

STAFF REPORT ON BURROWING OWL MITIGATION

Introduction

The Legislature and the Fish and Game Commission have developed the policies, standards and regulatory mandates to protect native species of fish and wildlife. In order to determine how the Department of Fish and Game (Department) could judge the adequacy of mitigation measures designed to offset impacts to burrowing owls *(Speotyto cunicularia;* A.O.U. 1991) staff (WMD, ESD, and Regions) has prepared this report. To ensure compliance with legislative and commission policy, mitigation requirements which are consistent with this report should be incorporated into: (1) Department comments to Lead Agencies and project sponsors pursuant to the California Environmental Quality Act (CEQA); and (2) other authorizations the Department gives to project proponents for projects impacting burrowing owls.

This report is designed to provide the Department (including regional offices and divisions), CEQA Lead Agencies and project proponents the context in which the Environmental Services Division (ESD) will review proposed project specific mitigation measures. This report also includes preapproved mitigation measures which have been judged to be consistent with policies, standards and legal mandates of the Legislature,. the Fish and Game Commission and the Department's public trust responsibilities. Implementation of mitigation measures consistent with this report are intended to help achieve the conservation of burrowing owls and should compliment multi-species habitat conservation planning efforts currently underway. The *Burrowing Owl Survey Protocol and Mitigation Guidelines* developed by The California Burrowing Owl Consortium (CBOC 1993) were taken into consideration in the preparation of this staff report as were comments from other interested parties.

A range-wide conservation strategy for this species is needed. Any range-wide conservation strategy should establish criteria for avoiding the need to list the species pursuant to either the California or federal Endangered Species Acts through preservation of existing habitat, population expansion into former habitat, recruitment of young into the population, and other specific efforts.

California's burrowing owl population is clearly declining and, if declines continue, the species may qualify for listing. Because of the intense pressure for urban development within suitable burrowing owl nesting and foraging habitat (open, flat and gently rolling grasslands and grass/shrub lands) in California, conflicts between owls and development projects often occur. Owl survival can be adversely affected by disturbance and foraging habitat loss even when impacts to individual birds and nests/burrows are avoided. Adequate information about the presence of owls is often unavailable prior to project approval. Following project approval there is no legal mechanism through which to seek mitigation other than avoidance of occupied burrows or nests. The absence of standardized survey methods often impedes consistent impact assessment.

Burrowing Owl Habitat Description

Burrowing owl habitat can be found in annual and perennial grasslands, deserts, and arid scrublands characterized by low-growing vegetation (Zarn 1974). Suitable owl habitat may also include trees and shrubs if the canopy covers less than 30 percent of the ground surface. Burrows are the essential component of burrowing owl habitat. Both natural and artificial burrows provide protection, shelter, and nests for burrowing owls (Henny and Blus 1981). Burrowing owls typically use burrows made by fossorial mammals, such as ground squirrels or badgers, but also may use man-made structures such as cement culverts; cement, asphalt, or wood debris piles; or openings beneath cement or asphalt pavement.

Occupied Burrowing Owl Habitat

Burrowing owls may use a site for breeding, wintering, foraging, and/or migration stopovers. Occupancy of suitable burrowing owl habitat can be verified at a site by detecting a burrowing owl, its molted feathers, cast pellets, prey remains, eggshell fragments, or excrement at or near a burrow entrance. Burrowing owls exhibit high site fidelity, reusing burrows year after year (Rich 1984, Feeney 1992). A site should be assumed occupied if at least one burrowing owl has been observed occupying a burrow there within the last three years (Rich 1984).

CEQA Project Review

The measures included in this report are intended to provide a decision-making process that should be implemented whenever-there is potential for-an action or project to adversely affect burrowing owls. For projects subject to the California Environmental Quality Act (CEQA), the process begins by conducting surveys to determine if burrowing owls are foraging or nesting on or adjacent to the project site. If surveys confirm that the site is occupied habitat, mitigation measures to minimize impacts to burrowing owls, their burrows and foraging habitat should be incorporated into the CEQA document as enforceable conditions. The measures in this document are intended to conserve the species by protecting and maintaining viable' populations of the species throughout their range in California. This may often result in protecting and managing habitat for the species at sites away from rapidly urbanizing/developing areas. Projects and situations vary and mitigation measures should be adapted to fit specific circumstances.

Projects not subject to CEQA review may have to be handled separately since the legal authority the Department has with respect to burrowing owls in this type of situation is often limited. The burrowing owl is protected from "take" (Section 3503.5 of the Fish and Game Code) but unoccupied habitat is likely to be lost for activities not subject to CEQA.

Legal Status

The burrowing owl is a migratory species protected by international treaty under the Migratory Bird Treaty Act (MBTA) of 1918 (16 U.S.C. 703-711). The MBTA makes it unlawful to take, possess, buy, sell, purchase, or barter any migratory bird listed in 50 C.F.R. Part 10, including feathers or other parts, nests, eggs, or products, except as allowed by implementing regulations (50 C.F.R. 21). Sections 3505, 3503.5, and 3800 of the California Department of Fish and Game Code prohibit the take, possession, or destruction of birds, their nests or eggs. To avoid violation of the take provisions of these laws generally requires that project-related disturbance at active nesting territories be reduced or eliminated during the nesting cycle (February 1 to August 31). Disturbance that causes nest abandonment and/or loss of reproductive effort (e.g., killing or abandonment of eggs or young) may be considered "take"' and is potentially punishable by fines and/or imprisonment.

The burrowing owl is a Species of Special Concern to California because of declines of suitable habitat and both localized and statewide population declines. Guidelines for the Implementation of the California Environmental Quality Act (CEQA) provide that a species be considered as endangered or "rare" regardless of appearance on a formal list for the purposes of the CEQA (Guidelines, Section 15380, subsections b and d). The CEQA requires a mandatory findings of significance if impacts to threatened or endangered species are likely to occur (Sections 21001 (c), 2103; Guidelines 15380, 15064, 15065). To be legally adequate, mitigation measures must be capable of "avoiding the impact altogether by not taking a certain action or parts of an action"; "minimizing impacts by limiting the degree or magnitude of the action and its implementation"; "rectifying the impact by repairing, rehabilitating or restoring the impacted environment"; "or reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action" (Guidelines, Section 15370). Avoidance or mitigation to reduce impacts to less than significant levels must be included in a project or the CEQA lead agency must make and justify findings of overriding considerations.

Impact Assessment

Habitat Assessment

The project site and a 150 meter (approximately 500 ft.) buffer (where possible and appropriate based on habitat) should be surveyed to assess the presence of burrowing owls and their habitat (Thomsen 1971, Martin 1973). If occupied habitat is detected on or adjacent to the site, measures to avoid, minimize, or mitigate the project's impacts to the species should be incorporated into the project, including burrow preconstruction surveys to ensure avoidance of direct take. It is also recommended that preconstruction surveys be conducted if the species was not detected but is likely to occur on the project site.

Burrowing Owl and Burrow Surveys

Burrowing owl and burrow surveys should be conducted during both the wintering and nesting seasons, unless the species is detected on the first survey. If possible, the winter survey should be conducted between December 1 and January 31 (when wintering owls are most likely to be present) and the nesting season survey should be conducted between April 15 and July 15 (the peak of the breeding season). Surveys conducted from two hours before sunset to one hour after, or from one hour before to two hours after sunrise, are also preferable.

Surveys should be conducted by walking suitable habitat on the entire project site and (where possible) in areas within 150 meters (approx. 500 ft.) of the project impact zone. The 150-meter buffer zone is surveyed to identify burrows and owls outside of the project area which may be impacted by factors -such as noise and vibration (heavy equipment, etc.) during project construction. Pedestrian survey transects should be spaced to allow 100 percent visual coverage of the ground surface. The distance between transect center lines should be no more than 30 meters (approx. 100 ft.) and should be reduced to account for differences in terrain, vegetation density, and ground surface visibility. To effectively survey large projects (100 acres or larger), two or more surveyors should be used to walk adjacent transects. To avoid impacts to owls from surveyors, owls and/or occupied burrows should be avoided by a minimum of 50 meters (approx. 160 ft.) wherever practical. Disturbance to occupied burrows should be avoided during all seasons.

Definition of Impacts

The following should be considered impacts to the species:

- Disturbance within 50 meters (approx. 160 ft.) Which may result in harassment of owls at occupied burrows;
- Destruction of natural and artificial burrows (culverts, concrete slabs and debris piles that provide shelter to burrowing owls); and
- Destruction and/or degradation of foraging habitat adjacent (within 100 m) of an occupied burrow(s).

Written Report

A report for the project should be prepared for the Department and copies should be submitted to the Regional contact and to the Wildlife Management Division Bird and Mammal Conservation Program. The report should include the following information:

- Date and time of visit(s) including name of the qualified biologist conducting surveys, weather and visibility conditions, and survey methodology;

- Description of the site including location, size, topography, vegetation communities, and animals observed during visit(s);

- Assessment of habitat suitability for burrowing owls;

- Map and photographs of the site;

- Results of transect surveys including a map showing the location of all burrow(s) (natural or artificial) and owl(s), including the numbers at each burrow if present and tracks, feathers, pellets, or other items (prey remains, animal scat);

- Behavior of owls during the surveys;

- Summary of both winter and nesting season surveys including any productivity information and a map showing territorial boundaries and home ranges; and

- Any historical information (Natural Diversity Database, Department regional files? Breeding Bird Survey data, American Birds records, Audubon Society, local bird club, other biologists, etc.) regarding the presence of burrowing owls on the site.

Mitigation

The objective of these measures is to avoid and minimize impacts to burrowing owls at a project site and preserve habitat that will support viable owls populations. If burrowing owls are detected using the project area, mitigation measures to minimize and offset the potential impacts should be included as enforceable measures during the CEQA process.

Mitigation actions should be carried out from September 1 to January 31 which is prior to the nesting season (Thomsen 1971, Zam 1974). Since the timing of nesting activity may vary with latitude and climatic conditions, this time frame should be adjusted accordingly. Preconstruction surveys of suitable habitat at the project site(s) and buffer zone(s) should be conducted within the 30 days prior to construction to ensure no additional, burrowing owls have established territories since the initial surveys. If ground disturbing activities are delayed or suspended for more than 30 days after the preconstruction survey, the site should be resurveyed.

Although the mitigation measures may be included as enforceable project conditions in the CEQA process, it may also be desirable to formalize them in a Memorandum of Understanding (MOU) between the Department and the project sponsor. An MOU is needed when lands (fee title or conservation easement) are being transferred to the Department.

Specific Mitigation Measures

1. Occupied burrows should not be disturbed during the nesting season (February 1 through August 3 1) unless a qualified biologist approved by the Department verifies through non-invasive methods that either: (1) the birds have not begun egg-laying and incubation; or (2) that juveniles from the occupied burrows are foraging independently and are capable of independent survival.

2. To offset the loss of foraging and burrow habitat on the project site, a minimum of 6.5 acres of foraging habitat (calculated on a 100 m {approx. 300 ft.} foraging radius around the burrow) per pair or unpaired resident bird, should be acquired and permanently protected. The protected lands should be adjacent to occupied burrowing owl habitat and at a location acceptable to the Department. *Protection of additional habitat acreage per pair or unpaired resident bird may be applicable in some instances.* The CBOC has also developed mitigation guidelines (CBOC 1993) that can be incorporated by CEQA lead agencies and which are consistent with this staff report.

3. When destruction of occupied burrows is unavoidable, existing unsuitable burrows should be enhanced (enlarged or cleared of debris) or new burrows created (by installing artificial burrows) at a ratio of 2:1 on the protected lands site. One example of an artificial burrow design is provided in Attachment A.

4. If owls must be moved away from the disturbance area, passive relocation techniques (as described below) should be used rather than trapping. At least one or more weeks will be necessary to accomplish this and allow the owls to acclimate to alternate burrows.

5. The project sponsor should provide funding for long-term management and monitoring of the protected lands. The monitoring plan should include success criteria, remedial measures, and an annual report to the Department.

Impact Avoidance

If avoidance is the preferred method of dealing with potential project impacts, then no disturbance should occur within 50 meters (approx. 160 ft.) of occupied burrows during the nonbreeding season of September 1 through January 31 or within 75 meters (approx. 250 ft.) during the breeding season of February 1 through August 31. Avoidance also requires that a minimum of 6.5 acres of foraging habitat be *permanently* preserved contiguous with occupied burrow sites for each pair of breeding burrowing owls (with or without dependent young) or single unpaired resident bird. The configuration of the protected habitat should be approved by the Department.

Passive Relocation - With One-Way Doors

Owls should be excluded from burrows in the immediate impact zone and within a 50 meter (approx. 160 ft.) buffer zone by installing one-way doors in burrow entrances. One-way doors (e.g., modified dryer vents) should be left in place 48 hours to insure owls have left the burrow before excavation. Two natural or artificial burrows should be provided for each burrow in the project area that will be rendered biologically unsuitable. The project area should be *monitored daily for one* week to confirm owl use of burrows before excavating burrows in the immediate impact zone. Whenever possible, burrows should be excavated using hand tools and refilled to prevent reoccupation. Sections of flexible plastic pipe should be inserted into the tunnels during excavation to maintain an escape route for any animals inside the burrow.

Passive Relocation - Without One-Way Doors

Two natural or artificial burrows should be provided for each burrow in the project area that will be rendered biologically unsuitable. The project area should be *monitored daily until the owls have relocated to the new burrows.* The formerly occupied burrows may then. be excavated. Whenever possible, burrows should be excavated using hand tools and refilled to prevent reoccupation. Sections of flexible plastic pipe should be inserted into burrows during excavation to maintain an escape route for any animals inside the burrow.

Projects Not Subject to CEQA

The Department is often contacted regarding the presence of burrowing owls on construction sites, parking lots and other areas for which there is no CEQA action or for which the CEQA process has been completed. In these situations, the Department should seek to reach agreement with the project sponsor to implement the specific mitigation measures described above. If they are unwilling to do so, passive relocation without the aid of one-way doors is their only option based upon Fish and Game Code 3503.5.

Literature Cited

American Ornithologists Union (AOU). 1991. Thirty-eighth supplement to the AOU checklist of North American birds. *Auk* 108:750-754.

Feeney, L. 1992. Site fidelity in burrowing owls. Unpublished paper presented to Raptor Research Annual Meeting, November 1992. Seattle, Washington.

Haug, E. A. and L. W. Oliphant. 1990, Movements, activity patterns, and habitat use of burrowing owls in Saskatchewan. *J. Wildlife Management* 54:27-35.

Henny, C. J. and L. J. Blus. 1981. Artificial burrows provide new insight into burrowing owl nesting biology. *Raptor Research* 15:82-85.

Martin, D. J. 1973. Selected aspects of burrowing owl ecology and behavior. *Condor* 75:446-456.

Rich, T. 1984. Monitoring burrowing owl populations: Implications of burrow re-use. *Wildlife Society Bulletin* 12:178-180.

The California Burrowing Owl Consortium (CBOC). 1993. Burrowing owl survey protocol and mitigation guidelines. Tech. Rep. Burrowing Owl Consortium, Alviso, California.

Thomsen, L. 1971. Behavior and ecology of burrowing owls on the Oakland Municipal Airport. *Condor* 73:177-192.

Zarn, M. 1974. Burrowing owl. U. S. Department of Interior, Bureau of Land Management. Technical Note T-N 250. Denver, Colorado. 25 pp.

Reproductive Success of Burrowing Owls Using Artificial Nest Burrows in Southeastern Idaho

by Bruce Olenick

Artificial nest burrows were implanted in southeastern Idaho f'or burrowing owls in the spring of 1986. These artificial burrows consisted of a 12" x 12" x 8" wood nesting chamber with rernovable top and a 6 foot corrugated and perforated plastic drainage pipe 6 inches in diameter (Fig. 1). Earlier investigators claimed that artificial burrows must provide a natural dirt floor to allow burrowing owls to modify the nesting tunnel and chamber. Contrary to this, the artificial burrow introduced here does not allow owls to modify the entrance or tunnel. The inability to change the physical dimensions of the burrow tunnel does not seem to reflect the owls' breeding success or deter them from using this burrow design.

In 1936, 22 artificial burrows were inhabited. Thirteen nesting attempts yielded an average clutch size of 8.3 eggs per breeding pair. Eight nests successfully hatched at least 1 nestling. In these nests, *67 of 75* eggs hatched (59.3%) and an estimated 61 nestlings (91.0%) fledged. An analysis of the egg laying and incubation periods showed that incubation commenced well after egg laying bega. Average clutch size at the start of incubation was 5.6 eggs. Most eggs tended to hatch synchronously in all successful nests.

Although the initial cost of constructing this burrow design may be slightly higher than a burrow consisting entirely of wood, the plastic pipe burrow offers the following advantages: (1) it lasts several field seasons without rotting or collapsing; (2) it may prevent or retard predation; (3) construction time is minimal; (4) it is easy to transport, especially over long distances; and (5) the flexible tunnel simplifies installation. The use of this artificial nest burrow design was highly successful and may prove to be a great resource technique for future management of this species.

For additional information on constructing this artificial nest burrow, contact Bruce Olenick, Department of Biology, Idaho State University, Pocatello, ID 83209.

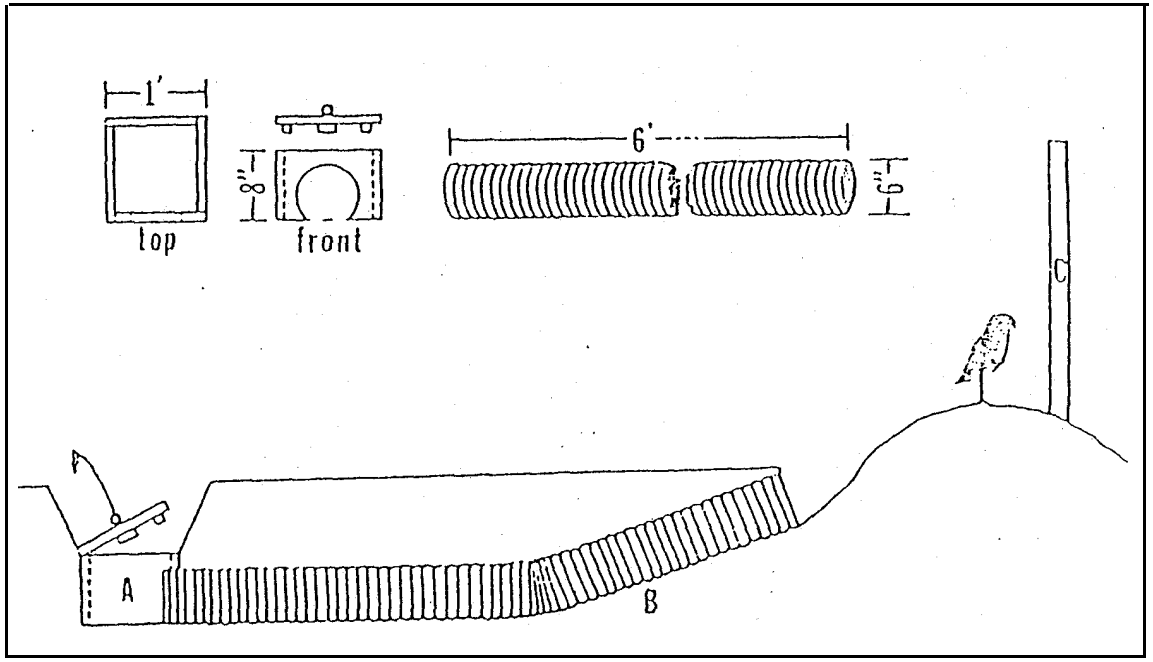


fig. 1 Artificial nest burrow design for burrowing owls Entire unit (including nest chamber) is buried 12" -- 18" below ground for maintaining thermal stability of the nest chamber. A= nest chamber, B = plastic pipe. C = perch.

ATTACHMENT A

Appendix B
2012 California Department of Fish and Game Staff Report on Burrowing Owl Mitigation

Staff Report on Burrowing Owl Mitigation

State of California

Natural Resources Agency

Department of Fish and Game

March 7, 2012[1]

[1] This document replaces the Department of Fish and Game 1995 Staff Report On Burrowing Owl Mitigation.

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INTRODUCTION AND PURPOSE

Maintaining California's rich biological diversity is dependent on the conservation of species and their habitats. The California Department of Fish and Game (Department) has designated certain species as "species of special concern" when their population viability and survival is adversely affected by risk factors such as precipitous declines or other vulnerability factors (Shuford and Gardali 2008). Preliminary analyses of regional patterns for breeding populations of burrowing owls (*Athene cunicularia*) have detected declines both locally in their central and southern coastal breeding areas, and statewide where the species has experienced modest breeding range retraction (Gervais et al. 2008). In California, threat factors affecting burrowing owl populations include habitat loss, degradation and modification, and eradication of ground squirrels resulting in a loss of suitable burrows required by burrowing owls for nesting, protection from predators, and shelter (See Appendix A).

The Department recognized the need for a comprehensive conservation and mitigation strategy for burrowing owls, and in 1995 directed staff to prepare a report describing mitigation and survey recommendations. This report, "1995 Staff Report on Burrowing Owl Mitigation," (Staff Report) (CDFG 1995), contained Department-recommended burrowing owl and burrow survey techniques and mitigation measures intended to offset the loss of habitat and slow or reverse further decline of this species. Notwithstanding these measures, over the past 15+ years, burrowing owls have continued to decline in portions of their range (DeSante et al. 2007, Wilkerson and Siegel, 2010). The Department has determined that reversing declining population and range trends for burrowing owls will require implementation of more effective conservation actions, and evaluating the efficacy of the Department's existing recommended avoidance, minimization and mitigation approaches for burrowing owls.

The Department has identified three main actions that together will facilitate a more viable, coordinated, and concerted approach to conservation and mitigation for burrowing owls in California. These include:

1. Incorporating burrowing owl comprehensive conservation strategies into landscape-based planning efforts such as Natural Community Conservation Plans (NCCPs) and multi-species Habitat Conservation Plans (HCPs) that specifically address burrowing owls.
2. Developing and implementing a statewide conservation strategy (Burkett and Johnson, 2007) and local or regional conservation strategies for burrowing owls, including the development and implementation of a statewide burrowing owl survey and monitoring plan.
3. Developing more rigorous burrowing owl survey methods, working to improve the adequacy of impacts assessments; developing clear and effective avoidance and minimization measures; and developing mitigation measures to ensure impacts to the species are effectively addressed at the project, local, and/or regional level (the focus of this document).

This Report sets forth the Department's recommendations for implementing the third approach identified above by revising the 1995 Staff Report, drawing from the most relevant and current knowledge and expertise, and incorporating the best scientific information

available pertaining to the species. It is designed to provide a compilation of the best available science for Department staff, biologists, planners, land managers, California Environmental Quality Act (CEQA) lead agencies, and the public to consider when assessing impacts of projects or other activities on burrowing owls.

This revised Staff Report takes into account the California Burrowing Owl Consortium's Survey Protocol and Mitigation Guidelines (CBOC 1993, 1997) and supersedes the survey, avoidance, minimization and mitigation recommendations in the 1995 Staff Report. Based on experiences gained from implementing the 1995 Staff Report, the Department believes revising that report is warranted. This document also includes general conservation goals and principles for developing mitigation measures for burrowing owls.

DEPARTMENT ROLE AND LEGAL AUTHORITIES

The mission of the Department is to manage California's diverse fish, wildlife and plant resources, and the habitats upon which they depend, for their ecological values and for their use and enjoyment by the public. The Department has jurisdiction over the conservation, protection, and management of fish, wildlife, native plants, and habitats necessary to maintain biologically sustainable populations of those species (Fish and Game Code (FGC) §1802). The Department, as trustee agency pursuant to CEQA (See CEQA Guidelines, §15386), has jurisdiction by law over natural resources, including fish and wildlife, affected by a project, as that term is defined in Section 21065 of the Public Resources Code. The Department exercises this authority by reviewing and commenting on environmental documents and making recommendations to avoid, minimize, and mitigate potential negative impacts to those resources held in trust for the people of California.

Field surveys designed to detect the presence of a particular species, habitat element, or natural community are one of the tools that can assist biologists in determining whether a species or habitat may be significantly impacted by land use changes or disturbance. The Department reviews field survey data as well as site-specific and regional information to evaluate whether a project's impacts may be significant. This document compiles the best available science for conducting habitat assessments and surveys, and includes considerations for developing measures to avoid impacts or mitigate unavoidable impacts.

CEQA

CEQA requires public agencies in California to analyze and disclose potential environmental impacts associated with a project that the agency will carry out, fund, or approve. Any potentially significant impact must be mitigated to the extent feasible. Project-specific CEQA mitigation is important for burrowing owls because most populations exist on privately owned parcels that, when proposed for development or other types of modification, may be subject to the environmental review requirements of CEQA.

Take

Take of individual burrowing owls and their nests is defined by FGC section 86, and prohibited by sections 3503, 3503.5 and 3513. Take is defined in FGC Section 86 as "hunt, pursue, catch, capture or kill, or attempt to hunt, pursue, catch, capture or kill."

Migratory Bird Treaty Act

The Migratory Bird Treaty Act (MBTA) implements various treaties and conventions between the United States and Canada, Japan, Mexico, and Russia for the protection of migratory birds, including the burrowing owl (50 C.F.R. § 10). The MBTA protects migratory bird nests from possession, sale, purchase, barter, transport, import and export, and collection. The other prohibitions of the MBTA - capture, pursue, hunt, and kill - are inapplicable to nests. The regulatory definition of take, as defined in Title 50 C.F.R. part 10.12, means to pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to hunt, shoot, wound, kill, trap, capture, or collect. Only the verb "collect" applies to nests. It is illegal to collect, possess, and by any means transfer possession of any migratory bird nest. The MBTA prohibits the destruction of a nest when it contains birds or eggs, and no possession shall occur during the destruction (see Fish and Wildlife Service, Migratory Bird Permit Memorandum, April 15, 2003). Certain exceptions to this prohibition are included in 50 C.F.R. section 21. Pursuant to Fish & Game Code section 3513, the Department enforces the Migratory Bird Treaty Act consistent with rules and regulations adopted by the Secretary of the Interior under provisions of the Migratory Treaty Act.

Regional Conservation Plans

Regional multiple species conservation plans offer long-term assurances for conservation of covered species at a landscape scale, in exchange for biologically appropriate levels of incidental take and/or habitat loss as defined in the approved plan. California's NCCP Act (FGC §2800 et seq.) governs such plans at the state level, and was designed to conserve species, natural communities, ecosystems, and ecological processes across a jurisdiction or a collection of jurisdictions. Complementary federal HCPs are governed by the Endangered Species Act (7 U.S.C. § 136, 16 U.S.C.§ 1531 et seq.) (ESA). Regional conservation plans (and certain other landscape-level conservation and management plans), may provide conservation for unlisted as well as listed species. Because the geographic scope of NCCPs and HCPs may span many hundreds of thousands of acres, these planning tools have the potential to play a significant role in conservation of burrowing owls, and grasslands and other habitats.

Fish and Game Commission Policies

There are a number of Fish and Game Commission policies (see FGC §2008) that can be applied to burrowing owl conservation. These include policies on: Raptors, Cooperation, Endangered and Threatened Species, Land Use Planning, Management and Utilization of Fish and Wildlife on Federal Lands, Management and Utilization of Fish and Wildlife on Private Lands, and Research.

GUIDING PRINCIPLES FOR CONSERVATION

Unless otherwise provided in a statewide, local, or regional conservation strategy, surveying and evaluating impacts to burrowing owls, as well as developing and implementing avoidance, minimization, and mitigation and conservation measures incorporate the following principles. These principles are a summary of Department staff expert opinion and were used to guide the preparation of this document.

1. Use the Precautionary Principle (Noss et al.1997), by which the alternative of increased conservation is deliberately chosen in order to buffer against incomplete knowledge of burrowing owl ecology and uncertainty about the consequences to burrowing owls of potential impacts, including those that are cumulative.
2. Employ basic conservation biology tenets and population-level approaches when determining what constitutes appropriate avoidance, minimization, and mitigation for impacts. Include mitigation effectiveness monitoring and reporting, and use an adaptive management loop to modify measures based on results.
3. Protect and conserve owls in wild, semi-natural, and agricultural habitats (conserve is defined at FGC §1802).
4. Protect and conserve natural nest burrows (or burrow surrogates) previously used by burrowing owls and sufficient foraging habitat and protect auxiliary "satellite" burrows that contribute to burrowing owl survivorship and natural behavior of owls.

CONSERVATION GOALS FOR THE BURROWING OWL IN CALIFORNIA

It is Department staff expert opinion that the following goals guide and contribute to the short and long-term conservation of burrowing owls in California:

1. Maintain size and distribution of extant burrowing owl populations (allowing for natural population fluctuations).
2. Increase geographic distribution of burrowing owls into formerly occupied historical range where burrowing owl habitat still exists, or where it can be created or enhanced, and where the reason for its local disappearance is no longer of concern.
3. Increase size of existing populations where possible and appropriate (for example, considering basic ecological principles such as carrying capacity, predator-prey relationships, and inter-specific relationships with other species at risk).
4. Protect and restore self-sustaining ecosystems or natural communities which can support burrowing owls at a landscape scale, and which will require minimal long-term management.
5. Minimize or prevent unnatural causes of burrowing owl population declines (e.g., nest burrow destruction, chemical control of rodent hosts and prey).
6. Augment/restore natural dynamics of burrowing owl populations including movement and genetic exchange among populations, such that the species does not require future listing and protection under the California Endangered Species Act (CESA) and/or the federal Endangered Species Act (ESA).
7. Engage stakeholders, including ranchers; farmers; military; tribes; local, state, and federal agencies; non-governmental organizations; and scientific research and education communities involved in burrowing owl protection and habitat management.

ACTIVITIES WITH THE POTENTIAL TO TAKE OR IMPACT BURROWING OWLS

The following activities are examples of activities that have the potential to take burrowing owls, their nests or eggs, or destroy or degrade burrowing owl habitat: grading, disking, cultivation, earthmoving, burrow blockage, heavy equipment compacting and crushing burrow tunnels, levee maintenance, flooding, burning and mowing (if burrows are impacted), and operating wind turbine collisions (collectively hereafter referred to as "projects" or "activities"

whether carried out pursuant to CEQA or not). In addition, the following activities may have impacts to burrowing owl populations: eradication of host burrowers; changes in vegetation management (i.e. grazing); use of pesticides and rodenticides; destruction, conversion or degradation of nesting, foraging, over-wintering or other habitats; destruction of natural burrows and burrow surrogates; and disturbance which may result in harassment of owls at occupied burrows.

PROJECT IMPACT EVALUATIONS

The following three progressive steps are effective in evaluating whether projects will result in impacts to burrowing owls. The information gained from these steps will inform any subsequent avoidance, minimization and mitigation measures. The steps for project impact evaluations are: 1) habitat assessment, 2) surveys, and 3) impact assessment. Habitat assessments are conducted to evaluate the likelihood that a site supports burrowing owl. Burrowing owl surveys provide information needed to determine the potential effects of proposed projects and activities on burrowing owls, and to avoid take in accordance with FGC sections 86, 3503, and 3503.5. Impact assessments evaluate the extent to which burrowing owls and their habitat may be impacted, directly or indirectly, on and within a reasonable distance of a proposed CEQA project activity or non-CEQA project. These three site evaluation steps are discussed in detail below.

Biologist Qualifications

The current scientific literature indicates that only individuals meeting the following minimum qualifications should perform burrowing owl habitat assessments, surveys, and impact assessments:

1. Familiarity with the species and its local ecology;
2. Experience conducting habitat assessments and non-breeding and breeding season surveys, or experience with these surveys conducted under the direction of an experienced surveyor;
3. Familiarity with the appropriate state and federal statutes related to burrowing owls, scientific research, and conservation;
4. Experience with analyzing impacts of development on burrowing owls and their habitat.

Habitat Assessment Data Collection and Reporting

A habitat assessment is the first step in the evaluation process and will assist investigators in determining whether or not occupancy surveys are needed. Refer to Appendix B for a definition of burrowing owl habitat. Compile the detailed information described in Appendix C when conducting project scoping, conducting a habitat assessment site visit and preparing a habitat assessment report.

Surveys

Burrowing owl surveys are the second step of the evaluation process and the best available scientific literature recommends that they be conducted whenever burrowing owl habitat or sign (see Appendix B) is encountered on or adjacent to (within 150 meters) a project site

(Thomsen 1971, Martin 1973). Occupancy of burrowing owl habitat is confirmed at a site when at least one burrowing owl, or its sign at or near a burrow entrance, is observed within the last three years (Rich 1984). Burrowing owls are more detectable during the breeding season with detection probabilities being highest during the nestling stage (Conway et al. 2008). In California, the burrowing owl breeding season extends from 1 February to 31 August (Haug et al. 1993, Thompsen 1971) with some variances by geographic location and climatic conditions. Several researchers suggest three or more survey visits during daylight hours (Haug and Diduik 1993, CBOC 1997, Conway and Simon 2003) and recommend each visit occur at least three weeks apart during the peak of the breeding season, commonly accepted in California as between 15 April and 15 July (CBOC 1997). Conway and Simon (2003) and Conway et al. (2008) recommended conducting surveys during the day when most burrowing owls in a local area are in the laying and incubation period (so as not to miss early breeding attempts), during the nesting period, and in the late nestling period when most owls are spending time above ground.

Non-breeding season (1 September to 31 January) surveys may provide information on burrowing owl occupancy, but do not substitute for breeding season surveys because results are typically inconclusive. Burrowing owls are more difficult to detect during the non-breeding season and their seasonal residency status is difficult to ascertain. Burrowing owls detected during non-breeding season surveys may be year-round residents, young from the previous breeding season, pre-breeding territorial adults, winter residents, dispersing juveniles, migrants, transients or new colonizers. In addition, the numbers of owls and their pattern of distribution may differ during winter and breeding seasons. However, on rare occasions, non-breeding season surveys may be warranted (i.e., if the site is believed to be a wintering site only based on negative breeding season results). Refer to Appendix D for information on breeding season and non-breeding season survey methodologies.

Survey Reports

Adequate information about burrowing owls present in and adjacent to an area that will be disturbed by a project or activity will enable the Department, reviewing agencies and the public to effectively assess potential impacts and will guide the development of avoidance, minimization, and mitigation measures. The survey report includes but is not limited to a description of the proposed project or proposed activity, including the proposed project start and end dates, as well as a description of disturbances or other activities occurring on-site or nearby. Refer to Appendix D for details included in a survey report.

Impact Assessment

The third step in the evaluation process is the impact assessment. When surveys confirm occupied burrowing owl habitat in or adjoining the project area, there are a number of ways to assess a project's potential significant impacts to burrowing owls and their habitat. Richardson and Miller (1997) recommended monitoring raptor behavior prior to developing management recommendations and buffers to determine the extent to which individuals have been sensitized to human disturbance. Monitoring results will also provide detail necessary for developing site-specific measures. Postovit and Postovit (1987) recommended an analytical approach to mitigation planning: define the problem (impact), set goals (to guide mitigation development), evaluate and select mitigation methods, and monitor the results.

Define the problem. The impact assessment evaluates all factors that could affect burrowing owls. Postovit and Postovit (1987) recommend evaluating the following in assessing impacts to raptors and planning mitigation: type and extent of disturbance, duration and timing of disturbance, visibility of disturbance, sensitivity and ability to habituate, and influence of environmental factors. They suggest identifying and addressing all potential direct and indirect impacts to burrowing owls, regardless of whether or not the impacts will occur during the breeding season. Several examples are given for each impact category below; however, examples are not intended to be used exclusively.

Type and extent of the disturbance. The impact assessment describes the nature (source) and extent (scale) of potential project impacts on occupied, satellite and unoccupied burrows including acreage to be lost (temporary or permanent), fragmentation/edge being created, increased distance to other nesting and foraging habitat, and habitat degradation. Discuss any project activities that impact either breeding and/or non-breeding habitat which could affect owl home range size and spatial configuration, negatively affect onsite and offsite burrowing owl presence, increase energetic costs, lower reproductive success, increase vulnerability to predation, and/or decrease the chance of procuring a mate.

Duration and timing of the impact. The impact assessment describes the amount of time the burrowing owl habitat will be unavailable to burrowing owls (temporary or permanent) on the site and the effect of that loss on essential behaviors or life history requirements of burrowing owls, the overlap of project activities with breeding and/or non-breeding seasons (timing of nesting and/or non-breeding activities may vary with latitude and climatic conditions, which should be considered with the timeline of the project or activity), and any variance of the project activities in intensity, scale and proximity relative to burrowing owl occurrences.

Visibility and sensitivity. Some individual burrowing owls or pairs are more sensitive than others to specific stimuli and may habituate to ongoing visual or audible disturbance. Site-specific monitoring may provide clues to the burrowing owl's sensitivities. This type of assessment addresses the sensitivity of burrowing owls within their nesting area to humans on foot, and vehicular traffic. Other variables are whether the site is primarily in a rural versus urban setting, and whether any prior disturbance (e.g., human development or recreation) is known at the site.

Environmental factors. The impact assessment discusses any environmental factors that could be influenced or changed by the proposed activities including nest site availability, predators, prey availability, burrowing mammal presence and abundance, and threats from other extrinsic factors such as human disturbance, urban interface, feral animals, invasive species, disease or pesticides.

Significance of impacts. The impact assessment evaluates the potential loss of nesting burrows, satellite burrows, foraging habitat, dispersal and migration habitat, wintering habitat, and habitat linkages, including habitat supporting prey and host burrowers and other essential habitat attributes. This assessment determines if impacts to the species will result in significant impacts to the species locally, regionally and range-wide per CEQA Guidelines §15382 and Appendix G. The significance of the impact to habitat depends on the extent of habitat disturbed and length of time the habitat is unavailable (for example: minor – several days, medium – several weeks to months, high - breeding season affecting juvenile survival,

or over winter affecting adult survival).

Cumulative effects. The cumulative effects assessment evaluates two consequences: 1) the project's proportional share of reasonably foreseeable impacts on burrowing owls and habitat caused by the project or in combination with other projects and local influences having impacts on burrowing owls and habitat, and 2) the effects on the regional owl population resulting from the project's impacts to burrowing owls and habitat.

Mitigation goals. Establishing goals will assist in planning mitigation and selecting measures that function at a desired level. Goals also provide a standard by which to measure mitigation success. Unless specifically provided for through other FGC Sections or through specific regulations, take, possession or destruction of individual burrowing owls, their nests and eggs is prohibited under FGC sections 3503, 3503.5 and 3513. Therefore, a required goal for all project activities is to avoid take of burrowing owls. Under CEQA, goals would consist of measures that would avoid, minimize and mitigate impacts to a less than significant level. For individual projects, mitigation must be roughly proportional to the level of impacts, including cumulative impacts, in accordance with the provisions of CEQA (CEQA Guidelines, §§ 15126.4(a)(4)(B), 15064, 15065, and 16355). In order for mitigation measures to be effective, they must be specific, enforceable, and feasible actions that will improve environmental conditions. As set forth in more detail in Appendix A, the current scientific literature supports the conclusion that mitigation for permanent habitat loss necessitates replacement with an equivalent or greater habitat area for breeding, foraging, wintering, dispersal, presence of burrows, burrow surrogates, presence of fossorial mammal dens, well drained soils, and abundant and available prey within close proximity to the burrow.

MITIGATION METHODS

The current scientific literature indicates that any site-specific avoidance or mitigation measures developed should incorporate the best practices presented below or other practices confirmed by experts and the Department. The Department is available to assist in the development of site-specific avoidance and mitigation measures.

Avoiding. A primary goal is to design and implement projects to seasonally and spatially avoid negative impacts and disturbances that could result in take of burrowing owls, nests, or eggs. Other avoidance measures may include but not be limited to:

- Avoid disturbing occupied burrows during the nesting period, from 1 February through 31 August.
- Avoid impacting burrows occupied during the non-breeding season by migratory or non-migratory resident burrowing owls.
- Avoid direct destruction of burrows through chaining (dragging a heavy chain over an area to remove shrubs), disking, cultivation, and urban, industrial, or agricultural development.
- Develop and implement a worker awareness program to increase the on-site worker's recognition of and commitment to burrowing owl protection.
- Place visible markers near burrows to ensure that farm equipment and other machinery does not collapse burrows.
- Do not fumigate, use treated bait or other means of poisoning nuisance animals in areas where burrowing owls are known or suspected to occur (e.g., sites observed with nesting

- Restrict the use of treated grain to poison mammals to the months of January and February.

Take avoidance (pre-construction) surveys. Take avoidance surveys are intended to detect the presence of burrowing owls on a project site at a fixed period in time and inform necessary take avoidance actions. Take avoidance surveys may detect changes in owl presence such as colonizing owls that have recently moved onto the site, migrating owls, resident burrowing owls changing burrow use, or young of the year that are still present and have not dispersed. Refer to Appendix D for take avoidance survey methodology.

Site surveillance. Burrowing owls may attempt to colonize or re-colonize an area that will be impacted; thus, the current scientific literature indicates a need for ongoing surveillance at the project site during project activities is recommended. The surveillance frequency/effort should be sufficient to detect burrowing owls if they return. Subsequent to their new occupancy or return to the site, take avoidance measures should assure with a high degree of certainty that take of owls will not occur.

Minimizing. If burrowing owls and their habitat can be protected in place on or adjacent to a project site, the use of buffer zones, visual screens or other measures while project activities are occurring can minimize disturbance impacts. Conduct site-specific monitoring to inform development of buffers (see Visibility and sensitivity above). The following general guidelines for implementing buffers should be adjusted to address site-specific conditions using the impact assessment approach described above. The CEQA lead agency and/or project proponent is encouraged to consult with the Department and other burrowing owl experts for assistance in developing site-specific buffer zones and visual screens.

Buffers. Holroyd et al. (2001) identified a need to standardize management and disturbance mitigation guidelines. For instance, guidelines for mitigating impacts by petroleum industries on burrowing owls and other prairie species (Scobie and Faminow, 2000) may be used as a template for future mitigation guidelines (Holroyd et al. 2001). Scobie and Faminow (2000) developed guidelines for activities around occupied burrowing owl nests recommending buffers around low, medium, and high disturbance activities, respectively (see below).

Recommended restricted activity dates and setback distances by level of disturbance for burrowing owls (Scobie and Faminow 2000).

Location	Time of Year	Level of Disturbance		
		Low	Med	High
Nesting sites	April 1-Aug 15	200 m*	500 m	500 m
Nesting sites	Aug 16-Oct 15	200 m	200 m	500 m
Nesting sites	Oct 16-Mar 31	50 m	100 m	500 m

* meters (m)

Based on existing vegetation, human development, and land uses in an area, resource managers may decide to allow human development or resource extraction closer to these area/sites than recommended above. However, if it is decided to allow activities closer than

the setback distances recommended, a broad-scale, long-term, scientifically-rigorous monitoring program ensures that burrowing owls are not detrimentally affected by alternative approaches.

Other minimization measures include eliminating actions that reduce burrowing owl forage and burrowing surrogates (e.g. ground squirrel), or introduce/facilitate burrowing owl predators. Actions that could influence these factors include reducing livestock grazing rates and/or changing the timing or duration of grazing or vegetation management that could result in less suitable habitat.

Burrow exclusion and closure. Burrow exclusion is a technique of installing one-way doors in burrow openings during the non-breeding season to temporarily exclude burrowing owls, or permanently exclude burrowing owls and close burrows after verifying burrows are empty by site monitoring and scoping. Exclusion in and of itself is not a take avoidance, minimization or mitigation method. Eviction of burrowing owls is a potentially significant impact under CEQA.

The long-term demographic consequences of these techniques have not been thoroughly evaluated, and the fate of evicted or excluded burrowing owls has not been systematically studied. Because burrowing owls are dependent on burrows at all times of the year for survival and/or reproduction, evicting them from nesting, roosting, and satellite burrows may lead to indirect impacts or take. Temporary or permanent closure of burrows may result in significant loss of burrows and habitat for reproduction and other life history requirements. Depending on the proximity and availability of alternate habitat, loss of access to burrows will likely result in varying levels of increased stress on burrowing owls and could depress reproduction, increase predation, increase energetic costs, and introduce risks posed by having to find and compete for available burrows. Therefore, exclusion and burrow closure are not recommended where they can be avoided. The current scientific literature indicates consideration of all possible avoidance and minimization measures before temporary or permanent exclusion and closure of burrows is implemented, in order to avoid take.

The results of a study by Trulio (1995) in California showed that burrowing owls passively displaced from their burrows were quickly attracted to adjacent artificial burrows at five of six passive relocation sites. The successful sites were all within 75 meters (m) of the destroyed burrow, a distance generally within a pair's territory. This researcher discouraged using passive relocation to artificial burrows as a mitigation measure for lost burrows without protection of adjacent foraging habitat. The study results indicated artificial burrows were used by evicted burrowing owls when they were approximately 50-100 m from the natural burrow (Thomsen 1971, Haug and Oliphant 1990). Locating artificial or natural burrows more than 100 m from the eviction burrow may greatly reduce the chances that new burrows will be used. Ideally, exclusion and burrow closure is employed only where there are adjacent natural burrows and non-impacted, sufficient habitat for burrowing owls to occupy with permanent protection mechanisms in place. Any new burrowing owl colonizing the project site after the CEQA document has been adopted may constitute changed circumstances that should be addressed in a re-circulated CEQA document.

The current scientific literature indicates that burrow exclusion should only be conducted by qualified biologists (meeting the Biologist's Qualifications above) during the non-breeding

season, before breeding behavior is exhibited and after the burrow is confirmed empty by site surveillance and/or scoping. The literature also indicates that when temporary or permanent burrow exclusion and/or burrow closure is implemented, burrowing owls should not be excluded from burrows unless or until:

- A Burrowing Owl Exclusion Plan (see Appendix E) is developed and approved by the applicable local DFG office;
- Permanent loss of occupied burrow(s) and habitat is mitigated in accordance with the Mitigating Impacts sections below. Temporary exclusion is mitigated in accordance with the item #1 under Mitigating Impacts below.
- Site monitoring is conducted prior to, during, and after exclusion of burrowing owls from their burrows sufficient to ensure take is avoided. Conduct daily monitoring for one week to confirm young of the year have fledged if the exclusion will occur immediately after the end of the breeding season.
- Excluded burrowing owls are documented using artificial or natural burrows on an adjoining mitigation site (if able to confirm by band re-sight).

Translocation (Active relocation offsite >100 meters). At this time, there is little published information regarding the efficacy of translocating burrowing owls, and additional research is needed to determine subsequent survival and breeding success (Klute et al. 2003, Holroyd et al. 2001). Study results for translocation in Florida implied that hatching success may be decreased for populations of burrowing owls that undergo translocation (Nixon 2006). At this time, the Department is unable to authorize the capture and relocation of burrowing owls except within the context of scientific research (FGC §1002) or a NCCP conservation strategy.

Mitigating impacts. Habitat loss and degradation from rapid urbanization of farmland in the core areas of the Central and Imperial valleys is the greatest of many threats to burrowing owls in California (Shuford and Gardali, 2008). At a minimum, if burrowing owls have been documented to occupy burrows (see Definitions, Appendix B) at the project site in recent years, the current scientific literature supports the conclusion that the site should be considered occupied and mitigation should be required by the CEQA lead agency to address project-specific significant and cumulative impacts. Other site-specific and regionally significant and cumulative impacts may warrant mitigation. The current scientific literature indicates the following to be best practices. If these best practices cannot be implemented, the lead agency or lead investigator may consult with the Department to develop effective mitigation alternatives. The Department is also available to assist in the identification of suitable mitigation lands.

1. Where habitat will be temporarily disturbed, restore the disturbed area to pre-project condition including decompacting soil and revegetating. Permanent habitat protection may be warranted if there is the potential that the temporary impacts may render a nesting site (nesting burrow and satellite burrows) unsustainable or unavailable depending on the time frame, resulting in reduced survival or abandonment. For the latter potential impact, see the permanent impact measures below.
2. Mitigate for permanent impacts to nesting, occupied and satellite burrows and/or burrowing owl habitat such that the habitat acreage, number of burrows and burrowing owls impacted are replaced based on the information provided in Appendix A. Note: A

3. Mitigate for permanent impacts to nesting, occupied and satellite burrows and burrowing owl habitat with (a) permanent conservation of similar vegetation communities (grassland, scrublands, desert, urban, and agriculture) to provide for burrowing owl nesting, foraging, wintering, and dispersal (i.e., during breeding and non-breeding seasons) comparable to or better than that of the impact area, and (b) sufficiently large acreage, and presence of fossorial mammals. The mitigation lands may require habitat enhancements including enhancement or expansion of burrows for breeding, shelter and dispersal opportunity, and removal or control of population stressors. If the mitigation lands are located adjacent to the impacted burrow site, ensure the nearest neighbor artificial or natural burrow clusters are at least within 210 meters (Fisher et al. 2007).
4. Permanently protect mitigation land through a conservation easement deeded to a non-profit conservation organization or public agency with a conservation mission, for the purpose of conserving burrowing owl habitat and prohibiting activities incompatible with burrowing owl use. If the project is located within the service area of a Department-approved burrowing owl conservation bank, the project proponent may purchase available burrowing owl conservation bank credits.
5. Develop and implement a mitigation land management plan to address long-term ecological sustainability and maintenance of the site for burrowing owls (see Management Plan and Artificial Burrow sections below, if applicable).
6. Fund the maintenance and management of mitigation land through the establishment of a long-term funding mechanism such as an endowment.
7. Habitat should not be altered or destroyed, and burrowing owls should not be excluded from burrows, until mitigation lands have been legally secured, are managed for the benefit of burrowing owls according to Department-approved management, monitoring and reporting plans, and the endowment or other long-term funding mechanism is in place or security is provided until these measures are completed.
8. Mitigation lands should be on, adjacent or proximate to the impact site where possible and where habitat is sufficient to support burrowing owls present.
9. Where there is insufficient habitat on, adjacent to, or near project sites where burrowing owls will be excluded, acquire mitigation lands with burrowing owl habitat away from the project site. The selection of mitigation lands should then focus on consolidating and enlarging conservation areas located outside of urban and planned growth areas, within foraging distance of other conserved lands. If mitigation lands are not available adjacent to other conserved lands, increase the mitigation land acreage requirement to ensure a selected site is of sufficient size. Offsite mitigation may not adequately offset the biological and habitat values impacted on a one to one basis. Consult with the Department when determining offsite mitigation acreages.
10. Evaluate and select suitable mitigation lands based on a comparison of the habitat attributes of the impacted and conserved lands, including but not limited to: type and structure of habitat being impacted or conserved; density of burrowing owls in impacted and conserved habitat; and significance of impacted or conserved habitat to the species range-wide. Mitigate for the highest quality burrowing owl habitat impacted first and foremost when identifying mitigation lands, even if a mitigation site is located outside of

11. Select mitigation lands taking into account the potential human and wildlife conflicts or incompatibility, including but not limited to, human foot and vehicle traffic, and predation by cats, loose dogs and urban-adapted wildlife, and incompatible species management (i.e., snowy plover).
12. Where a burrowing owl population appears to be highly adapted to heavily altered habitats such as golf courses, airports, athletic fields, and business complexes, permanently protecting the land, augmenting the site with artificial burrows, and enhancing and maintaining those areas may enhance sustainability of the burrowing owl population onsite. Maintenance includes keeping lands grazed or mowed with weed-eaters or push mowers, free from trees and shrubs, and preventing excessive human and human-related disturbance (e.g., walking, jogging, off-road activity, dog-walking) and loose and feral pets (chasing and, presumably, preying upon owls) that make the environment uninhabitable for burrowing owls (Wesemann and Rowe 1985, Millsap and Bear 2000, Lincer and Bloom 2007). Items 4, 5 and 6 also still apply to this mitigation approach.
13. If there are no other feasible mitigation options available and a lead agency is willing to establish and oversee a Burrowing Owl Mitigation and Conservation Fund that funds on a competitive basis acquisition and permanent habitat conservation, the project proponent may participate in the lead agency's program.

Artificial burrows. Artificial burrows have been used to replace natural burrows either temporarily or long-term and their long-term success is unclear. Artificial burrows may be an effective addition to in-perpetuity habitat mitigation if they are augmenting natural burrows, the burrows are regularly maintained (i.e., no less than annual, with biennial maintenance recommended), and surrounding habitat patches are carefully maintained. There may be some circumstances, for example at airports, where squirrels will not be allowed to persist and create a dynamic burrow system, where artificial burrows may provide some support to an owl population.

Many variables may contribute to the successful use of artificial burrows by burrowing owls, including pre-existence of burrowing owls in the area, availability of food, predators, surrounding vegetation and proximity, number of natural burrows in proximity, type of materials used to build the burrow, size of the burrow and entrance, direction in which the burrow entrance is facing, slope of the entrance, number of burrow entrances per burrow, depth of the burrow, type and height of perches, and annual maintenance needs (Belthoff and King 2002, Smith et al. 2005, Barclay et al. 2011). Refer to Barclay (2008) and (2011) and to Johnson et al. 2010 (unpublished report) for guidance on installing artificial burrows including recommendations for placement, installation and maintenance.

Any long-term reliance on artificial burrows as natural burrow replacements must include semi-annual to annual cleaning and maintenance and/or replacement (Barclay et al. 2011, Smith and Conway 2005, Alexander et al. 2005) as an ongoing management practice. Alexander et al. (2005), in a study of the use of artificial burrows found that all of 20 artificial burrows needed some annual cleaning and maintenance. Burrows were either excavated by predators, blocked by soil or vegetation, or experienced substrate erosion forming a space beneath the tubing that prevented nestlings from re-entering the burrow.

Mitigation lands management plan. Develop a Mitigation Lands Management Plan for projects that require off-site or on-site mitigation habitat protection to ensure compliance with and effectiveness of identified management actions for the mitigation lands. A suggested outline and related vegetation management goals and monitoring success criteria can be found in Appendix E.

Mitigation Monitoring and Reporting

Verify the compliance with required mitigation measures, the accuracy of predictions, and ensure the effectiveness of all mitigation measures for burrowing owls by conducting follow-up monitoring, and implementing midcourse corrections, if necessary, to protect burrowing owls. Refer to CEQA Guidelines Section 15097 and the CEQA Guidelines for additional guidance on mitigation, monitoring and reporting. Monitoring is qualitatively different from site surveillance; monitoring normally has a specific purpose and its outputs and outcomes will usually allow a comparison with some baseline condition of the site before the mitigation (including avoidance and minimization) was undertaken. Ideally, monitoring should be based on the Before-After Control-Impact (BACI) principle (McDonald et al. 2000) that requires knowledge of the pre-mitigation state to provide a reference point for the state and change in state after the project and mitigation have been implemented.

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REFERENCES

Alexander, A. K., M. R. Sackschewsky, and C. A. Duberstein. 2005. Use of artificial burrows by burrowing owls (athene cunicularia) at the HAMMER Facility on the U.S. Department of Energy Hanford Site. Pacific Northwest National Lab-15414. U.S. Department of Energy, DE-AC05-76RL01830, Richland, Washington, USA.

BIOS. California Department of Fish and Game. The Biogeographic Information Observation System (http://bios.dfg.ca.gov/)

Barclay, J. H. 2008. A simple artificial burrow design for burrowing owls. Journal of Raptor Research. 42: 53-57.

Barclay, J. H. 2012. Albion Environmental, Inc, personal communication.

Barclay, J. H., K. W. Hunting, J. L. Lincer, J. Linthicum, and T. A. Roberts, editors. 2007. Proceedings of the California Burrowing Owl Symposium, 11-12 November 2003, Sacramento, California, USA. Bird Populations Monographs No. 1. The Institute for Bird Populations and Albion Environmental, Inc., Point Reyes Station, CA.

Barclay, J. H., N. Korfanta, and M. Kauffman. 2011. Long-term population dynamics of a managed burrowing owl colony. Journal of Wildlife Management 75: 1295–1306.

Belthoff, J R., R. A. King. 2002. Nest-site characteristics of burrowing owls (athene cunicularia) in the Snake River Birds of Prey National Conservation Area, Idaho, and applications to artificial burrow installation. Western North American Naturalist 62: 112-119.

Botelho, E. S. 1996. Behavioral ecology and parental care of breeding western burrowing owls (Speotyto cunicularia hupugaea) in southern New Mexico, USA. Dissertation, New Mexico State University, Las Cruces, New Mexico, USA.

Burkett, E. E., and B. S. Johnson. 2007. Development of a conservation strategy for burrowing owls in California. Pages 165-168 *in* J. H. Barclay, K. W. Hunting, J. L. Lincer, J. Linthicum, and T. A. Roberts, editors. Proceedings of the California Burrowing Owl Symposium, 11-12 November 2003, Sacramento, California, USA. Bird Populations Monographs No. 1. The Institute for Bird Populations and Albion Environmental, Inc., Point Reyes Station, CA.

CBOC (California Burrowing Owl Consortium). 1997. Burrowing owl survey protocol and mitigation guidelines. Pages 171-177 *in* Lincer, J. L. and K. Steenhof (editors). 1997. The burrowing owl, its biology and management. Raptor Research Report Number 9.

CDFG (California Department of Fish and Game). 1995. Staff report on burrowing owl mitigation. Unpublished report. Sacramento, California, USA.

CNDDB. California Department of Fish and Game. The California Natural Diversity Database (CNDDB) (http://www.dfg.ca.gov/biogeodata/cnddb/), Sacramento, California, USA.

Catlin, D. H. 2004. Factors affecting within-season and between-season breeding dispersal of Burrowing Owls in California. Thesis, Oregon State University, Corvallis, Oregon, USA

Catlin, D. H., and D. K. Rosenberg. 2006. Nest destruction increases mortality and dispersal of Burrowing Owls in the Imperial Valley, California. Southwest Naturalist 51: 406–409.

Catlin, D. H., D. K. Rosenberg, and K. L. Haley. 2005. The effects of nesting success and mate fidelity on breeding dispersal in burrowing owls. Canadian Journal of Zoology 83:1574–1580.

Conway, C. J., and J. Simon. 2003. Comparison of detection probability associated with burrowing owl survey methods. Journal of Wildlife Management 67: 501-511.

Conway, C. J., V. Garcia, M. D., and K. Hughes. 2008. Factors affecting detection of burrowing owl nests during standardized surveys. Journal of Wildlife Management 72: 688-696.

Coulombe, H. N. 1971. Behavior and population ecology of the burrowing owl, Speotyto cunicularia, in the Imperial Valley of California. Condor 73: 162–176.

Dechant, J. A., M. L. Sondreal, D. H. Johnson, L. D. Igl, C. M. Goldade, P. A. Rabie, and B. R. Euliss. 2003. Effects of management practices on grassland birds: burrowing owl. Northern Prairie Wildlife Research Center, Jamestown, North Dakota. Northern Prairie Wildlife Research Center Online. <http://www.npwrc.usgs.gov/resource/literatr/grasbird/buow/buow.htm>.

DeSante, D. F., E. D Ruhlen, and R. Scalf. 2007. The distribution and relative abundance of burrowing owls in California during 1991–1993: Evidence for a declining population and thoughts on its conservation. Pages 1-41 *in* J. H. Barclay, K. W. Hunting, J. L. Lincer, J. Linthicum, and T. A. Roberts, editors. Proceedings of the California Burrowing Owl Symposium, 11-12 November 2003 Sacramento, California, USA. Bird Populations Monographs No. 1. The Institute for Bird Populations and Albion Environmental, Inc., Point Reyes Station, CA.

Desmond, M. J., and J. A. Savidge. 1998. Burrowing Owl conservation in the Great Plains. Proceedings of the Second International Burrowing Owl Symposium, 29-30 September 1999, Ogden, Utah, USA.

Desmond, M. J., and J. A. Savidge. 1999. Satellite burrow use by burrowing owl chicks and its influence on nest fate. Pages 128-130 *in* P. D. Vickery and J. R. Herkert, editors. Ecology and conservation of grassland birds of the western hemisphere. Studies in Avian Biology 19.

Emlen, J. T. 1977. Estimating breeding season bird densities from transects counts. Auk 94: 455-468.

Fisher, J. B., L. A. Trulio, G. S. Biging, and D. Chromczack. 2007. An analysis of spatial clustering and implications for wildlife management: a burrowing owl example. Environmental Management 39: 403-11.

Gervais, J. A., D. K. Rosenberg, and L. A. Comrack. Burrowing Owl (Athene cunicularia) *in* Shuford, W.D. and T. Gardali, editors. 2008. California Bird Species of Special Concern: A ranked assessment of species, subspecies, and distinct populations of birds of immediate conservation concern in California. Studies of Western Birds 1. Western Field Ornithologists, Camarillo, California, and California Department of Fish and Game, Sacramento, California, USA.

Gervais, J. A., D. K. Rosenberg, R. G. Anthony. 2003. Space use and pesticide exposure risk of male burrowing owls in an agricultural landscape. Journal of Wildlife Management 67: 155-164.

Green, G.A.; Anthony, R.G. 1989. Nesting success and habitat relationships of burrowing owls in the Columbia Basin, Oregon. The Condor 91: 347-354.

Haug, E. A. 1985. Observations on the breeding ecology of burrowing owls in Saskatchewan.

Thesis, University of Saskatchewan, Saskatoon, Saskatchewan, Canada.
Haug, E. A., B. A. Millsap, and M. S. Martell. 1993. Burrowing owl (Speotyto cunicularia), *in* A. Poole and F. Gill, editors, The Birds of North America, The Academy of Natural Sciences, Philadelphia, Pennsylvania, and The American Ornithologists' Union, Washington, D.C., USA.
Haug, E. A., and L. W. Oliphant. 1990. Movements, activity patterns, and habitat use of burrowing owls in Saskatchewan. Journal of Wildlife Management 54: 27-35.
Holroyd, G. L., R. Rodriguez-Estrella, and S. R. Sheffield. 2001. Conservation of the burrowing owl in western North America: issues, challenges, and recommendations. Journal of Raptor Research 35: 399-407.
James, P. C., T. J. Ethier, and M. K. Toutloff. 1997. Parameters of a declining burrowing owl population in Saskatchewan. Pages 34-37. *in* J. L. Lincer, and K. Steenhof, editors. The burrowing owl, its biology and management: including the proceedings of the first international symposium. 13-14 November 1992, Bellevue, WA, USA. Raptor Research Report Number 9.
Johnson, D. H., D. C. Gillis, M. A. Gregg, J. L.Rebholz, J. L. Lincer, and J. R. Belthoff. 2010. Users guide to installation of artificial burrows for burrowing owls. Unpublished report. Tree Top Inc., Selah, Washington, USA.
Klute, D. S., A. W. Ayers, M. T. Green, W. H. Howe, S. L Jones, J. A. Shaffer, S. R. Sheffield, and T. S. Zimmerman. 2003. Status assessment and conservation plan for the western burrowing owl in the United States. U.S. Department of the Interior, Fish and Wildlife Service, Biological Technical Publication FWS/BTP-R6001-2003, Washington, D.C, USA.
Koenig, W. D., D. D. Van Vuren, and P. N. Hooge. 1996. Detectability, philopatry, and the distribution of dispersal distances in vertebrates. Trends in Ecology and Evolution 11: 514–517.
LaFever, D. H., K. E. LaFever, D. H. Catlin, and D. K. Rosenberg. 2008. Diurnal time budget of burrowing owls in a resident population during the non-breeding season. Southwestern Naturalist 53: 29-33.
Lincer, J. L., and P. W. Bloom. 2007. The status of the burrowing owl (Athene cunicularia) in San Diego County, CA. Pages 90-102 *in* Proceedings of the California Burrowing Owl Symposium, 11-12 November 2003, Sacramento, California, USA. Bird Populations Monographs No. 1. The Institute for Bird Populations and Albion Environmental, Inc., Point Reyes Station, CA.
Lutz, R. S. and D. L. Plumpton. 1999. Philopatry and nest site reuse by burrowing owls: implications for management. Journal of Raptor Research 33: 149-153.
MacCracken, J. G., D. W. Uresk, and R. M. Hansen. 1985a. Vegetation and soils of burrowing owl nest sites in Conata Basin, South Dakota. Condor 87: 152-154.
Manning, J. A., and R. S. A. Kaler. 2011. Effects of survey methods on burrowing owl behaviors. Journal of Wildlife Management 75: 525-30.
McDonald, T. L., W. P. Erickson, and L. L. McDonald. 2000. Analysis of count data from before-after control-impact studies. Journal of Agricultural, Biological and Environmental Statistics 5: 262-279.
Millsap, B. A., and C. Bear. 2000. Density and reproduction of burrowing owls along an urban development gradient. Journal of Wildlife Management 64:33-41.
Nixon, P A. 2006. Effects of translocation on the Florida burrowing owl (Athene cunicularia floridana). Thesis. University of South Florida, Tampa, Florida, USA.
Noss, R. F., M. A. O'Connell, and D. D. Murphy. 1997. The science of conservation planning:

habitat conservation under the Endangered Species Act. Island Press, Washington D.C., USA.
Postovit, H. R., and B. C. Postovit. 1987. Impacts and mitigation techniques. Pages 183-213 in Raptor management techniques manual scientific technical series number 10, National Wildlife Federation, Washington, D. C., USA
Remsen, J. V., Jr. 1978. Bird species of special concern in California: An annotated list of declining or vulnerable bird species. California Department of Fish and Game, Nongame Wildlife. Investigations, Wildlife Management Branch Administrative Report 78-1, Sacramento, California, USA.
Rich, T. 1984. Monitoring burrowing owl populations: implications of burrow re-use. Wildlife Society Bulletin 12: 178-189.
Richardson, C. T. and C. K. Miller. 1997. Recommendations for protecting raptors from human disturbance: a review. Wildlife Society Bulletin 25: 634-38.
Ronan, N. A. 2002. Habitat selection, reproductive success, and site fidelity of burrowing owls in a grassland ecosystem. Thesis, Oregon State University, Corvallis, Oregon, USA.
Rosenberg, D., 2009 Oregon State University, Corvallis, personal communication.
Rosenberg, D. K., J. A. Gervais, D. F. DeSante, and H. Ober. 2009. An updated adaptive management plan for the burrowing owl population at NAS Lemoore. The Oregon Wildlife Institute, Corvallis, OR and The Institute for Bird Populations, Point Reyes Station, CA. OWI Contribution No. 201 and IBP Contribution No. 375.
Rosenberg, D. K., J. A. Gervais, H. Ober, and D. F. DeSante. 1998. An adaptive management plan for the burrowing owl population at Naval Air Station Lemoore, California, USA. Publication 95, Institute for Bird Populations, P.O. Box 1346, Pt. Reyes Station, CA 94956.
Rosenberg, D. K., and K. L. Haley. 2004. The ecology of burrowing owls in the agroecosystem of the Imperial Valley, California. Studies in Avian Biology 27:120-135.
Rosenberg, D. K., L. A. Trulio, D. H. Catlin, D. Chromczack, J. A. Gervais, N. Ronan, and K. A. Haley. 2007. The ecology of the burrowing owl in California, unpublished report to Bureau of Land Management.
Rosier, J. R., N. A., Ronan, and D. K. Rosenberg. 2006. Post-breeding dispersal of burrowing owls in an extensive California grassland. American Midland Naturalist 155: 162–167.
Sawyer, J. O., T. Keeler-Wolf, and J. M. Evens. 2009. A manual of California vegetation, Second edition. California Native Plant Society, Sacramento, California, USA.
Scobie, D., and C. Faminow. 2000. Development of standardized guidelines for petroleum industry activities that affect COSEWIC Prairie and Northern Region vertebrate species at risk. Environment Canada, Prairie and Northern Region, Edmonton, Alberta, Canada.
Shuford, W. D. and T. Gardali, editors. 2008. California Bird Species of Special Concern: a ranked assessment of species, subspecies, and distinct populations of birds of immediate conservation concern in California. Studies of Western Birds 1. Western Field Ornithologists, Camarillo, California, and California Department of Fish and Game, Sacramento. Gervais, J. A., D. K. Rosenberg, and L. Comrack. 2008. Burrowing Owl (Athene cunicularia).
Smith, M. D., C. J. Conway, and L. A. Ellis. 2005. Burrowing owl nesting productivity: a comparison between artificial and natural burrows on and off golf courses. Wildlife Society Bulletin 33: 454-462.
Thelander, C. G., K. S. Smallwood, and L. Rugge. 2003. Bird risk behaviors and fatalities at the Altamont Pass Wind Resource Area, period of performance: March 1998–

December 2000. U.S. Department of Energy, National Renewable Energy Laboratory, Golden, Colorado, USA.
Thomsen, L. 1971. Behavior and ecology of burrowing owls on the Oakland Municipal Airport. Condor 73: 177-192.
Thompson, C. D. 1984. Selected aspects of burrowing owl ecology in central Wyoming. Thesis, University of Wyoming, Laramie, Wyoming, USA.
Trulio, L. 1995. Passive relocation: A method to preserve burrowing owls on disturbed sites. Journal of Field Ornithology 66: 99–106.
U.S. Fish and Wildlife Service (USFWS). 2002. Birds of conservation concern 2002. U.S. Department of Interior, Division of Migratory Bird Management, Arlington, Virginia, USA.
U.S. Fish and Wildlife Service (USFWS). 2008. Birds of Conservation Concern 2008. U.S. Department of Interior, Division of Migratory Bird Management, Arlington, Virginia, USA.
Wesemann, T. and M. Rowe. 1985. Factors influencing the distribution and abundance of burrowing owls in Cape Coral, Florida. Pages 129-137 *in* L. W. Adams and D. L. Leedy, editors. Integrating Man and Nature in the Metropolitan Environment. Proceedings National Symposium. on Urban Wildlife, 4-7 November 1986, Chevy Chase, Maryland, USA.
Wilkerson, R. L. and R. B. Siegel. 2010. Assessing changes in the distribution and abundance of burrowing owls in California, 1993-2007. Bird Populations 10: 1-36.
Zarn, M. 1974. Burrowing owl. U.S. Department of the Interior, Bureau of Land Management. Technical Note T-N-250, Denver, Colorado, USA.

Appendix A. Burrowing Owl Natural History and Threats

Diet

Burrowing owl diet includes arthropods, small rodents, birds, amphibians, reptiles, and carrion (Haug et al. 1993).

Breeding

In California, the breeding season for the burrowing owl typically occurs between 1 February and 31 August although breeding in December has been documented (Thompson 1971, Gervais et al. 2008); breeding behavior includes nest site selection by the male, pair formation, copulation, egg laying, hatching, fledging, and post-fledging care of young by the parents. The peak of the breeding season occurs between 15 April and 15 July and is the period when most burrowing owls have active nests (eggs or young). The incubation period lasts 29 days (Coulombe 1971) and young fledge after 44 days (Haug et al. 1993). Note that the timing of nesting activities may vary with latitude and climatic conditions. Burrowing owls may change burrows several times during the breeding season, starting when nestlings are about three weeks old (Haug et al. 1993).

Dispersal

The following discussion is an excerpt from Gervais et al (2008):

> "The burrowing owl is often considered a sedentary species (e.g., Thomsen 1971). A large proportion of adults show strong fidelity to their nest site from year to year, especially where resident, as in Florida (74% for females, 83% for males; Millsap and Bear 1997). In California, nest-site fidelity rates were 32%–50% in a large grassland and 57% in an agricultural environment (Ronan 2002, Catlin 2004, Catlin et al. 2005). Differences in these rates among sites may reflect differences in nest predation rates (Catlin 2004, Catlin et al. 2005). Despite the high nest fidelity rates, dispersal distances may be considerable for both juveniles (natal dispersal) and adults (postbreeding dispersal), but this also varied with location (Catlin 2004, Rosier et al. 2006). Distances of 53 km to roughly 150 km have been observed in California for adult and natal dispersal, respectively (D. K. Rosenberg and J. A. Gervais, unpublished data), despite the difficulty in detecting movements beyond the immediate study area (Koenig et al. 1996)."

Habitat

The burrowing owl is a small, long-legged, ground-dwelling bird species, well-adapted to open, relatively flat expanses. In California, preferred habitat is generally typified by short, sparse vegetation with few shrubs, level to gentle topography and well-drained soils (Haug et al. 1993). Grassland, shrub steppe, and desert are naturally occurring habitat types used by the species. In addition, burrowing owls may occur in some agricultural areas, ruderal grassy fields, vacant lots and pastures if the vegetation structure is suitable and there are useable burrows and foraging habitat in proximity (Gervais et al 2008). Unique amongst North

American raptors, the burrowing owl requires underground burrows or other cavities for nesting during the breeding season and for roosting and cover, year round. Burrows used by the owls are usually dug by other species termed host burrowers. In California, California ground squirrel (*Spermophilus beecheyi*) and round-tailed ground squirrel (*Citellus tereticaudus*) burrows are frequently used by burrowing owls but they may use dens or holes dug by other fossorial species including badger (*Taxidea taxus*), coyote (*Canis latrans*), and fox (e.g., San Joaquin kit fox, *Vulpes macrotis mutica*; Ronan 2002). In some instances, owls have been known to excavate their own burrows (Thompson 1971, Barclay 2007). Natural rock cavities, debris piles, culverts, and pipes also are used for nesting and roosting (Rosenberg et al. 1998). Burrowing owls have been documented using artificial burrows for nesting and cover (Smith and Belthoff, 2003).

Foraging habitat. Foraging habitat is essential to burrowing owls. The following discussion is an excerpt from Gervais et al. (2008):

> "Useful as a rough guide to evaluating project impacts and appropriate mitigation for burrowing owls, adult male burrowing owls home ranges have been documented (calculated by minimum convex polygon) to comprise anywhere from 280 acres in intensively irrigated agroecosystems in Imperial Valley (Rosenberg and Haley 2004) to 450 acres in mixed agricultural lands at Lemoore Naval Air Station, CA (Gervais et al. 2003), to 600 acres in pasture in Saskatchewan, Canada (Haug and Oliphant 1990). But owl home ranges may be much larger, perhaps by an order of magnitude, in non-irrigated grasslands such as at Carrizo Plain, California (Gervais et al. 2008), based on telemetry studies and distribution of nests. Foraging occurs primarily within 600 m of their nests (within approximately 300 acres, based on a circle with a 600 m radius) during the breeding season."

Importance of burrows and adjacent habitat. Burrows and the associated surrounding habitat are essential ecological requisites for burrowing owls throughout the year and especially during the breeding season. During the non-breeding season, burrowing owls remain closely associated with burrows, as they continue to use them as refuge from predators, shelter from weather and roost sites. Resident populations will remain near the previous season's nest burrow at least some of the time (Coulombe 1971, Thomsen 1971, Botelho 1996, LaFever et al. 2008).

In a study by Lutz and Plumpton (1999) adult males and females nested in formerly used sites at similar rates (75% and 63%, respectively) (Lutz and Plumpton 1999). Burrow fidelity has been reported in some areas; however, more frequently, burrowing owls reuse traditional nesting areas without necessarily using the same burrow (Haug et al. 1993, Dechant et al. 1999). Burrow and nest sites are re-used at a higher rate if the burrowing owl has reproduced successfully during the previous year (Haug et al. 1993) and if the number of burrows isn't limiting nesting opportunity.

Burrowing owls may use "satellite" or non-nesting burrows, moving young at 10-14 days, presumably to reduce risk of predation (Desmond and Savidge 1998) and possibly to avoid nest parasites (Dechant et al. 1999). Successful nests in Nebraska had more active satellite burrows within 75 m of the nest burrow than unsuccessful nests (Desmond and Savidge

1999). Several studies have documented the number of satellite burrows used by young and adult burrowing owls during the breeding season as between one and 11 burrows with an average use of approximately five burrows (Thompsen 1984, Haug 1985, Haug and Oliphant 1990). Supporting the notion of selecting for nest sites near potential satellite burrows, Ronan (2002) found burrowing owl families would move away from a nest site if their satellite burrows were experimentally removed through blocking their entrance.

Habitat adjacent to burrows has been documented to be important to burrowing owls. Gervais et al. (2003) found that home range sizes of male burrowing owls during the nesting season were highly variable within but not between years. Their results also suggested that owls concentrate foraging efforts within 600 meters of the nest burrow, as was observed in Canada (Haug and Oliphant 1990) and southern California (Rosenberg and Haley 2004). James et al. (1997), reported habitat modification factors causing local burrowing owl declines included habitat fragmentation and loss of connectivity.

In conclusion, the best available science indicates that essential habitat for the burrowing owl in California must include suitable year-round habitat, primarily for breeding, foraging, wintering and dispersal habitat consisting of short or sparse vegetation (at least at some time of year), presence of burrows, burrow surrogates or presence of fossorial mammal dens, well-drained soils, and abundant and available prey within close proximity to the burrow.

Threats to Burrowing Owls in California

Habitat loss. Habitat loss, degradation, and fragmentation are the greatest threats to burrowing owls in California. According to DeSante et al. (2007), "the vast majority of burrowing owls [now] occur in the wide, flat lowland valleys and basins of the Imperial Valley and Great Central Valley [where] for the most part,...the highest rates of residential and commercial development in California are occurring." Habitat loss from the State's long history of urbanization in coastal counties has already resulted in either extirpation or drastic reduction of burrowing owl populations there (Gervais et al. 2008). Further, loss of agricultural and other open lands (such as grazed landscapes) also negatively affect owl populations. Because of their need for open habitat with low vegetation, burrowing owls are unlikely to persist in agricultural lands dominated by vineyards and orchards (Gervais et al. 2008).

Control of burrowing rodents. According to Klute et al. (2003), the elimination of burrowing rodents through control programs is a primary factor in the recent and historical decline of burrowing owl populations nationwide. In California, ground squirrel burrows are most often used by burrowing owls for nesting and cover; thus, ground squirrel control programs may affect owl numbers in local areas by eliminating a necessary resource.

Direct mortality. Burrowing owls suffer direct losses from a number of sources. Vehicle collisions are a significant source of mortality especially in the urban interface and where owls nest alongside roads (Haug et al. 1993, Gervais et al. 2008). Road and ditch maintenance, modification of water conveyance structures (Imperial Valley) and discing to control weeds in fallow fields may destroy burrows (Rosenberg and Haley 2004, Catlin and Rosenberg 2006) which may trap or crush owls. Wind turbines at Altamont Pass Wind Resource Area are known to cause direct burrowing owl mortality (Thelander et al. 2003). Exposure to

pesticides may pose a threat to the species but is poorly understood (Klute et al. 2003, Gervais et al. 2008).

Appendix B. Definitions

Some key terms that appear in this document are defined below.

Adjacent habitat means burrowing owl habitat that abuts the area where habitat and burrows will be impacted and rendered non-suitable for occupancy.

Breeding (nesting) season begins as early as 1 February and continues through 31 August (Thomsen 1971, Zarn 1974). The timing of breeding activities may vary with latitude and climatic conditions. The breeding season includes pairing, egg-laying and incubation, and nestling and fledging stages.

Burrow exclusion is a technique of installing one-way doors in burrow openings during the non-breeding season to temporarily exclude burrowing owls or permanently exclude burrowing owls and excavate and close burrows after confirming burrows are empty.

Burrowing owl habitat generally includes, but is not limited to, short or sparse vegetation (at least at some time of year), presence of burrows, burrow surrogates or presence of fossorial mammal dens, well-drained soils, and abundant and available prey.

Burrow surrogates include culverts, piles of concrete rubble, piles of soil, burrows created along soft banks of ditches and canals, pipes, and similar structures.

Civil twilight - Morning civil twilight begins when the geometric center of the sun is 6 degrees below the horizon (civil dawn) and ends at sunrise. Evening civil twilight begins at sunset and ends when the geometric center of the sun reaches 6 degrees below the horizon (civil dusk). During this period there is enough light from the sun that artificial sources of light may not be needed to carry on outdoor activities. This concept is sometimes enshrined in laws, for example, when drivers of automobiles must turn on their headlights (called lighting-up time in the UK); when pilots may exercise the rights to fly aircraft. Civil twilight can also be described as the limit at which twilight illumination is sufficient, under clear weather conditions, for terrestrial objects to be clearly distinguished; at the beginning of morning civil twilight, or end of evening civil twilight, the horizon is clearly defined and the brightest stars are visible under clear atmospheric conditions.

Conservation for burrowing owls may include but may not be limited to protecting remaining breeding pairs or providing for population expansion, protecting and enhancing breeding and essential habitat, and amending or augmenting land use plans to stabilize populations and other specific actions to avoid the need to list the species pursuant to California or federal Endangered Species Acts.

Contiguous means connected together so as to form an uninterrupted expanse in space.

Essential habitat includes nesting, foraging, wintering, and dispersal habitat.

Foraging habitat is habitat within the estimated home range of an occupied burrow, supports suitable prey base, and allows for effective hunting.

Host burrowers include ground squirrels, badgers, foxes, coyotes, gophers etc.

Locally significant species 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 (CEQA §15125 (c)) or is so designated in local or regional plans, policies, or ordinances (CEQA Guidelines, Appendix G). Examples include a species at the outer limits of its known range or occurring in a unique habitat type.

Non-breeding season is the period of time when nesting activity is not occurring, generally September 1 through January 31, but may vary with latitude and climatic conditions.

Occupied site or occupancy means a site that is assumed occupied if at least one burrowing owl has been observed occupying a burrow within the last three years (Rich 1984). Occupancy of suitable burrowing owl habitat may also be indicated by owl sign including its molted feathers, cast pellets, prey remains, eggshell fragments, or excrement at or near a burrow entrance or perch site.

Other impacting activities may include but may not be limited to agricultural practices, vegetation management and fire control, pest management, conversion of habitat from rangeland or natural lands to more intensive agricultural uses that could result in “take”. These impacting activities may not meet the definition of a project under CEQA.

Passive relocation is a technique of installing one-way doors in burrow openings to temporarily or permanently evict burrowing owls and prevent burrow re-occupation.

Peak of the breeding season is between 15 April and 15 July.

Sign includes its tracks, molted feathers, cast pellets (defined as 1-2” long brown to black regurgitated pellets consisting of non-digestible portions of the owls’ diet, such as fur, bones, claws, beetle elytra, or feathers), prey remains, egg shell fragments, owl white wash, nest burrow decoration materials (e.g., paper, foil, plastic items, livestock or other animal manure, etc.), possible owl perches, or other items.

Appendix C. Habitat Assessment and Reporting Details

Habitat Assessment Data Collection and Reporting

Current scientific literature indicates that it would be most effective to gather the data in the manner described below when conducting project scoping, conducting a habitat assessment site visit and preparing a habitat assessment report:

1. Conduct at least one visit covering the entire potential project/activity area including areas that will be directly or indirectly impacted by the project. Survey adjoining areas within 150 m (Thomsen 1971, Martin 1973), or more where direct or indirect effects could potentially extend offsite. If lawful access cannot be achieved to adjacent areas, surveys can be performed with a spotting scope or other methods.
2. Prior to the site visit, compile relevant biological information for the site and surrounding area to provide a local and regional context.
3. Check all available sources for burrowing owl occurrence information regionally prior to a field inspection. The CNDDB and BIOS (see References cited) may be consulted for known occurrences of burrowing owls. Other sources of information include, but are not limited to, the Proceedings of the California Burrowing Owl Symposium (Barclay et al. 2007), county bird atlas projects, Breeding Bird Survey records, eBIRD (http://ebird.org), Gervais et al. (2008), local reports or experts, museum records, and other site-specific relevant information.
4. Identify vegetation and habitat types potentially supporting burrowing owls in the project area and vicinity.
5. Record and report on the following information:
    a. A full description of the proposed project, including but not limited to, expected work periods, daily work schedules, equipment used, activities performed (such as drilling, construction, excavation, etc.) and whether the expected activities will vary in location or intensity over the project's timeline;
    b. A regional setting map, showing the general project location relative to major roads and other recognizable features;
    c. A detailed map (preferably a USGS topo 7.5' quad base map) of the site and proposed project, including the footprint of proposed land and/or vegetation-altering activities, base map source, identifying topography, landscape features, a north arrow, bar scale, and legend;
    d. A written description of the biological setting, including location (Section, Township, Range, baseline and meridian), acreage, topography, soils, geographic and hydrologic characteristics, land use and management history on and adjoining the site (i.e., whether it is urban, semi-urban or rural; whether there is any evidence of past or current livestock grazing, mowing, disking, or other vegetation management activities);
    e. An analysis of any relevant, historical information concerning burrowing owl use or occupancy (breeding, foraging, over-wintering) on site or in the assessment area;
    f. Vegetation type and structure (using Sawyer et al. 2009), vegetation height, habitat types and features in the surrounding area plus a reasonably sized (as supported with logical justification) assessment area; (Note: use caution in discounting habitat based on grass height as it can be a temporary condition variable by season and conditions (such as current grazing regime) or may be distributed as a mosaic).

g. The presence of burrowing owl individuals or pairs or sign (see Appendix B);
h. The presence of suitable burrows and/or burrow surrogates (>11 cm in diameter (height and width) and >150 cm in depth) (Johnson et al. 2010), regardless of a lack of any burrowing owl sign and/or burrow surrogates; and burrowing owls and/or their sign that have recently or historically (within the last 3 years) been identified on or adjacent to the site.

Appendix D. Breeding and Non-breeding Season Surveys and Reports

Current scientific literature indicates that it is most effective to conduct breeding and non-breeding season surveys and report in the manner that follows:

Breeding Season Surveys

Number of visits and timing. Conduct 4 survey visits: 1) at least one site visit between 15 February and 15 April, and 2) a minimum of three survey visits, at least three weeks apart, between 15 April and 15 July, with at least one visit after 15 June. Note: many burrowing owl migrants are still present in southwestern California during mid-March, therefore, exercise caution in assuming breeding occupancy early in the breeding season.

Survey method. Rosenberg et al. (2007) confirmed walking line transects were most effective in smaller habitat patches. Conduct surveys in all portions of the project site that were identified in the Habitat Assessment and fit the description of habitat in Appendix A. Conduct surveys by walking straight-line transects spaced 7 m to 20 m apart, adjusting for vegetation height and density (Rosenberg et al. 2007). At the start of each transect and, at least, every 100 m, scan the entire visible project area for burrowing owls using binoculars. During walking surveys, record all potential burrows used by burrowing owls as determined by the presence of one or more burrowing owls, pellets, prey remains, whitewash, or decoration. Some burrowing owls may be detected by their calls, so observers should also listen for burrowing owls while conducting the survey.

Care should be taken to minimize disturbance near occupied burrows during all seasons and not to "flush" burrowing owls especially if predators are present to reduce any potential for needless energy expenditure or burrowing owl mortality. Burrowing owls may flush if approached by pedestrians within 50 m (Conway et al. 2003). If raptors or other predators are present that may suppress burrowing owl activity, return at another time or later date for a follow-up survey.

Check all burrowing owls detected for bands and/or color bands and report band combinations to the Bird Banding Laboratory (BBL). Some site-specific variations to survey methods discussed below may be developed in coordination with species experts and Department staff.

Weather conditions. Poor weather may affect the surveyor's ability to detect burrowing owls, therefore, avoid conducting surveys when wind speed is >20 km/hr, and there is precipitation or dense fog. Surveys have greater detection probability if conducted when ambient temperatures are >20º C, <12 km/hr winds, and cloud cover is <75% (Conway et al. 2008).

Time of day. Daily timing of surveys varies according to the literature, latitude, and survey method. However, surveys between morning civil twilight and 10:00 AM and two hours before sunset until evening civil twilight provide the highest detection probabilities (Barclay pers. comm. 2012, Conway et al. 2008).

Alternate methods. If the project site is large enough to warrant an alternate method, consult current literature for generally accepted survey methods and consult with the Department on the proposed survey approach.

Additional breeding season site visits. Additional breeding season site visits may be necessary, especially if non-breeding season exclusion methods are contemplated. Detailed information, such as approximate home ranges of each individual or of family units, as well as foraging areas as related to the proposed project, will be important to document for evaluating impacts, planning avoidance measure implementation and for mitigation measure performance monitoring.

Adverse conditions may prevent investigators from determining presence or occupancy. Disease, predation, drought, high rainfall or site disturbance may preclude presence of burrowing owls in any given year. Any such conditions should be identified and discussed in the survey report. Visits to the site in more than one year may increase the likelihood of detection. Also, visits to adjacent known occupied habitat may help determine appropriate survey timing.

Given the high site fidelity shown by burrowing owls (see Appendix A, Importance of burrows), conducting surveys over several years may be necessary when project activities are ongoing, occur annually, or start and stop seasonally. (See Negative surveys).

Non-breeding Season Surveys

If conducting non-breeding season surveys, follow the methods described above for breeding season surveys, but conduct at least four (4) visits, spread evenly, throughout the non-breeding season. Burrowing owl experts and local Department staff are available to assist with interpreting results.

Negative Surveys

Adverse conditions may prevent investigators from documenting presence or occupancy. Disease, predation, drought, high rainfall or site disturbance may preclude presence of burrowing owl in any given year. Discuss such conditions in the Survey Report. Visits to the site in more than one year increase the likelihood of detection and failure to locate burrowing owls during one field season does not constitute evidence that the site is no longer occupied, particularly if adverse conditions influenced the survey results. Visits to other nearby known occupied sites can affirm whether the survey timing is appropriate.

Take Avoidance Surveys

Field experience from 1995 to present supports the conclusion that it would be effective to complete an initial take avoidance survey no less than 14 days prior to initiating ground disturbance activities using the recommended methods described in the Detection Surveys section above. Implementation of avoidance and minimization measures would be triggered by positive owl presence on the site where project activities will occur. The development of avoidance and minimization approaches would be informed by monitoring the burrowing owls.

Burrowing owls may re-colonize a site after only a few days. Time lapses between project activities trigger subsequent take avoidance surveys including but not limited to a final survey conducted within 24 hours prior to ground disturbance.

Survey Reports

Report on the survey methods used and results including the information described in the Summary Report and include the reports within the CEQA documentation:

1. Date, start and end time of surveys including weather conditions (ambient temperature, wind speed, percent cloud cover, precipitation and visibility);
2. Name(s) of surveyor(s) and qualifications;
3. A discussion of how the timing of the survey affected the comprehensiveness and detection probability;
4. A description of survey methods used including transect spacing, point count dispersal and duration, and any calls used;
5. A description and justification of the area surveyed relative to the project area;
6. A description that includes: number of owls or nesting pairs at each location (by nestlings, juveniles, adults, and those of an unknown age), number of burrows being used by owls, and burrowing owl sign at burrows. Include a description of individual markers, such as bands (numbers and colors), transmitters, or unique natural identifying features. If any owls are banded, request documentation from the BBL and bander to report on the details regarding the known history of the banded burrowing owl(s) (age, sex, origins, whether it was previously relocated) and provide with the report if available;
7. A description of the behavior of burrowing owls during the surveys, including feeding, resting, courtship, alarm, territorial defense, and those indicative of parents or juveniles;
8. A list of possible burrowing owl predators present and documentation of any evidence of predation of owls;
9. A detailed map (1:24,000 or closer to show details) showing locations of all burrowing owls, potential burrows, occupied burrows, areas of concentrated burrows, and burrowing owl sign. Locations documented by use of global positioning system (GPS) coordinates must include the datum in which they were collected. The map should include a title, north arrow, bar scale and legend;
10. Signed field forms, photos, etc., as appendices to the field survey report;
11. Recent color photographs of the proposed project or activity site; and
12. Original CNDDB Field Survey Forms should be sent directly to the Department's CNDDB office, and copies should be included in the environmental document as an appendix. (http://www.dfg.ca.gov/bdb/html/cnddb.html).

Appendix E. Example Components for Burrowing Owl Artificial Burrow and Exclusion Plans

Whereas the Department does not recommend exclusion and burrow closure, current scientific literature and experience from 1995 to present, indicate that the following example components for burrowing owl artificial burrow and exclusion plans, combined with consultation with the Department to further develop these plans, would be effective.

Artificial Burrow Location

If a burrow is confirmed occupied on-site, artificial burrow locations should be appropriately located and their use should be documented taking into consideration:

1. A brief description of the project and project site pre-construction;
2. The mitigation measures that will be implemented;
3. Potential conflicting site uses or encumbrances;
4. A comparison of the occupied burrow site(s) and the artificial burrow site(s) (e.g., vegetation, habitat types, fossorial species use in the area, and other features);
5. Artificial burrow(s) proximity to the project activities, roads and drainages;
6. Artificial burrow(s) proximity to other burrows and entrance exposure;
7. Photographs of the site of the occupied burrow(s) and the artificial burrows;
8. Map of the project area that identifies the burrow(s) to be excluded as well as the proposed sites for the artificial burrows;
9. A brief description of the artificial burrow design;
10. Description of the monitoring that will take place during and after project implementation including information that will be provided in a monitoring report.
11. A description of the frequency and type of burrow maintenance.

Exclusion Plan

An Exclusion Plan addresses the following including but not limited to:

1. Confirm by site surveillance that the burrow(s) is empty of burrowing owls and other species preceding burrow scoping;
2. Type of scope and appropriate timing of scoping to avoid impacts;
3. Occupancy factors to look for and what will guide determination of vacancy and excavation timing (one-way doors should be left in place 48 hours to ensure burrowing owls have left the burrow before excavation, visited twice daily and monitored for evidence that owls are inside and can't escape i.e., look for sign immediately inside the door).
4. How the burrow(s) will be excavated. Excavation using hand tools with refilling to prevent reoccupation is preferable whenever possible (may include using piping to stabilize the burrow to prevent collapsing until the entire burrow has been excavated and it can be determined that no owls reside inside the burrow);
5. Removal of other potential owl burrow surrogates or refugia on site;
6. Photographing the excavation and closure of the burrow to demonstrate success and sufficiency;

7. Monitoring of the site to evaluate success and, if needed, to implement remedial measures to prevent subsequent owl use to avoid take;
8. How the impacted site will continually be made inhospitable to burrowing owls and fossorial mammals (e.g., by allowing vegetation to grow tall, heavy disking, or immediate and continuous grading) until development is complete.

Appendix F. Mitigation Management Plan and Vegetation Management Goals

Mitigation Management Plan

A mitigation site management plan will help ensure the appropriate implementation and maintenance for the mitigation site and persistence of the burrowing owls on the site. For an example to review, refer to Rosenberg et al. (2009). The current scientific literature and field experience from 1995 to present indicate that an effective management plan includes the following:

1. Mitigation objectives;
2. Site selection factors (including a comparison of the attributes of the impacted and conserved lands) and baseline assessment;
3. Enhancement of the conserved lands (enhancement of reproductive capacity, enhancement of breeding areas and dispersal opportunities, and removal or control of population stressors);
4. Site protection method and prohibited uses;
5. Site manager roles and responsibilities;
6. Habitat management goals and objectives:
    a. Vegetation management goals,
        i. Vegetation management tools:
            1. Grazing
            2. Mowing
            3. Burning
            4. Other
    b. Management of ground squirrels and other fossorial mammals,
    c. Semi-annual and annual artificial burrow cleaning and maintenance,
    d. Non-natives control – weeds and wildlife,
    e. Trash removal;
7. Financial assurances:
    a. Property analysis record or other financial analysis to determine long-term management funding,
    b. Funding schedule;
8. Performance standards and success criteria;
9. Monitoring, surveys and adaptive management;
10. Maps;
11. Annual reports.

Vegetation Management Goals

- Manage vegetation height and density (especially in immediate proximity to burrows). Suitable vegetation structure varies across sites and vegetation types, but should generally be at the average effective vegetation height of 4.7 cm (Green and Anthony 1989) and <13 cm average effective vegetation height (MacCracken et al. 1985*a)*.
- Employ experimental prescribed fires (controlled, at a small scale) to manage vegetation structure;

- Vegetation reduction or ground disturbance timing, extent, and configuration should avoid take. While local ordinances may require fire prevention through vegetation management, activities like disking, mowing, and grading during the breeding season can result in take of burrowing owls and collapse of burrows, causing nest destruction. Consult the take avoidance surveys section above for pre-management avoidance survey recommendations;
- Promote natural prey distribution and abundance, especially in proximity to occupied burrows; and
- Promote self-sustaining populations of host burrowers by limiting or prohibiting lethal rodent control measures and by ensuring food availability for host burrowers through vegetation management.

Refer to Rosenberg et al. (2009) for a good discussion of managing grasslands for burrowing owls.

Mitigation Site Success Criteria

In order to evaluate the success of mitigation and management strategies for burrowing owls, monitoring is required that is specific to the burrowing owl management plan. Given limited resources, Barclay et al. (2011) suggests managers focus on accurately estimating annual adult owl populations rather than devoting time to estimating reproduction, which shows high annual variation and is difficult to accurately estimate. Therefore, the key objective will be to determine accurately the number of adult burrowing owls and pairs, and if the numbers are maintained. A frequency of 5-10 years for surveys to estimate population size may suffice if there are no changes in the management of the nesting and foraging habitat of the owls.

Effective monitoring and evaluation of off-site and on-site mitigation management success for burrowing owls includes (Barclay, pers. comm.):

- Site tenacity;
- Number of adult owls present and reproducing;
- Colonization by burrowing owls from elsewhere (by band re-sight);
- Evidence and causes of mortality;
- Changes in distribution; and
- Trends in stressors.

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APPLICATION FOR CERTIFICATION
FOR THE *HIDDEN HILLS SOLAR ELECTRIC GENERATING SYSTEM*

DOCKET NO. 11-AFC-02

PROOF OF SERVICE
(Revised 5/1/2012)

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DECLARATION OF SERVICE

I, Mary Finn, declare that on May 4, 2012, I served and filed copies of the attached Hidden Hills Data Response, Set 2E, dated May 4, 2012. This document is accompanied by the most recent Proof of Service list, located on the web page for this project at: www.energy.ca.gov/sitingcases/hiddenhills/index.html.

The document has been sent to the other parties in this proceeding (as shown on the Proof of Service list) and to the Commission's Docket Unit or Chief Counsel, as appropriate, in the following manner:

(*Check all that Apply*)

For service to all other parties:

_x_ Served electronically to all e-mail addresses on the Proof of Service list;

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AND

For filing with the Docket Unit at the Energy Commission:

_x_ by sending an electronic copy to the e-mail address below (preferred method); *OR*

___ by depositing an original and 12 paper copies in the mail with the U.S. Postal Service with first class postage thereon fully prepaid, as follows:

CALIFORNIA ENERGY COMMISSION – DOCKET UNIT
Attn: Docket No. 11-AFC-2
1516 Ninth Street, MS-4
Sacramento, CA 95814-5512
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OR, if filing a Petition for Reconsideration of Decision or Order pursuant to Title 20, § 1720:

____ Served by delivering on this date one electronic copy by e-mail, and an original paper copy to the Chief Counsel at the following address, either personally, or for mailing with the U.S. Postal Service with first class postage thereon fully prepaid:

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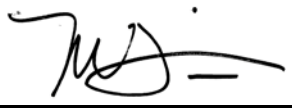
I declare under penalty of perjury under the laws of the State of California that the foregoing is true and correct, that I am employed in the county where this mailing occurred, and that I am over the age of 18 years and not a party to the proceeding.



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