BIOLOGICAL RESOURCES

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INTRODUCTION

This section provides the California Energy Commission (Commission) staff's analysis of potential impacts to biological resources from the construction and operation of the Hills Solar Electric Generating System project (HHSEGS or project) as proposed by BrightSource Energy, Inc. (applicant). This analysis addresses potential impacts to special-status plant and animal species, desert washes, common and rare natural communities, groundwater-dependent ecosystems, and other areas of critical biological concern. Information contained in this document includes a detailed description of the existing biotic environment, an analysis of potential impacts to biological resources and, where necessary, specifies mitigation measures (conditions of certification) to reduce potential impacts to less than significant levels. Additionally, this analysis assesses compliance with applicable laws, ordinances, regulations, and standards (LORS).

This analysis is based, in part, on information provided in the HHSEGS Application for Certification (AFC) – Volumes 1 and 2 (HHSG 2011a), two supplements to the AFC (HHSG 2011b and HHSG 2011c) responses to data requests, staff's observations during field visits on November 8, 2011, January 18, 2012, April 6, 2011, April 12, 2012, June 5 and 6, 2012, July 30 to August 3, 2012, and December, 2012. Information was also obtained through discussions with representatives of the U.S. Fish and Wildlife Service (USFWS) from Nevada and California, California Department of Fish and Game (CDFG), representatives from the U.S. Bureau of Land Management (BLM) from both Nevada and California, and staff workshops for the project conducted in October, November, and December of 2011, and January, February, March, April, June, August, and December of 2012.

SUMMARY OF CONCLUSIONS

The Hidden Hills Solar Electric Generating System project (HHSEGS or project) would have significant direct and indirect impacts on biological resources. The proposed project, which is located on private land, features minimal grading onsite; however, mowing of vegetation and fencing of the site would result in the functional loss of Mojave Desert scrub, shadscale scrub, ephemeral desert washes, and habitat for a variety of special-status species that occur within the approximately 3,277- acre site. Without mitigation the project would contribute to cumulatively significant impacts to biological resources within Pahrump Valley, a broader area encompassed by the Northern and Eastern Mojave Desert Planning Area (NEMO)[1], and extending into the Pahrump, Nevada environs. Staff has proposed impact avoidance and minimization measures as well as compensatory mitigation, through habitat acquisition, to offset

[1] The NEMO plan serves as the primary land use control document for the U.S. Bureau of Land Management (BLM), and therefore is solely applicable to public lands. Because this plan encompasses the regional landscape and natural features surrounding the proposed project site, staff believes the NEMO plan to be an appropriate reference document for the project.

direct, indirect, and cumulative impacts to the state-listed threatened desert tortoise and other special-status wildlife species, special status plant species, and desert washes. These measures are necessary to ensure compliance with state and federal laws, as well as other applicable ordinances.

SUMMARY OF IMPACTS TO SPECIAL-STATUS WILDLIFE

Common Wildlife and Nesting Birds: Construction and operation of the HHSEGS project will adversely affect common wildlife and nesting birds from the construction and operation of the facility. Wildlife will also be affected from the installation of permanent exclusion fencing around the perimeter of the site. Species that are not capable of dispersing to surrounding areas would be confined within the project boundaries and subjected to increased risk of road kill and repeated disturbance during construction and operation of the facility. The project exclusion fencing will also exclude species from the site which will result in the loss of foraging and breeding habitat and may disrupt wildlife movement. Implementation of Conditions of Certification **BIO-1** through **BIO-8** would reduce project-related direct and indirect impacts to common wildlife and nesting birds to less than significant levels. These conditions require a project Biologist, and prescribe a variety of minimization measures and best management practices to reduce wildlife mortality, protect nesting birds, control fugitive dust, and reduce the potential for wildfires. Conditions of Certification **BIO-15** (Avian Bat & Golden Eagle Protection Plan) and **BIO-16** (Pre-construction Nesting Bird Surveys, see discussion of impacts to sensitive birds) include conducting pre-construction nesting surveys, and establishing limited disturbance buffers for nesting birds. Condition of Certification **BIO-18** requires the preparation and implementation of a Weed Management Plan to prevent the spread of invasive plants and to protect wildlife from weed management activities. Habitat loss for common wildlife would be mitigated by the implementation of Condition of Certification **BIO-12** (Desert Tortoise Compensatory Mitigation).

Desert Tortoise: Construction and operation of the HHSEGS project will result in direct, indirect, and operational impacts to desert tortoise (federally and State listed as a threatened species). Implementation of the project would also result in the permanent loss of approximately 3,197 acres of occupied desert tortoise habitat. Desert tortoises are present on the project site and their distribution varies based on habitat conditions and proximity to intact desert scrub communities. The project site is expected to support an estimated six to 33 adult/subadult tortoises, three to 34 juvenile tortoises, and 46 to 158 desert tortoise eggs. The estimated numbers of desert tortoise that may occur on the project site were calculated using applicant survey data, formulas recommended by the USFWS, and published scientific literature. These numbers represent a conservative approach and the actual number of desert tortoise detected on the project site may vary. In order to construct the facility desert tortoises would need to be translocated outside of the project site. The translocation of tortoises and other construction related impacts of the proposed project pose substantial effects to this species. At the high end of known mortality rates for translocation (45 percent, see “Impacts to Special-Status Wildlife”) for translocated animals, project construction and translocation may result in the mortality of 46 to 158 eggs and 11 to 65 desert tortoise if mortality rates are reached. If mortality rates are lower or fewer desert tortoise are detected there would be a corresponding reduction in mortality figures. Implementation of Conditions of certification **BIO-1** through **BIO-9** require the protection of desert

tortoise and other biological resources that occur in and near the project area, and Conditions of Certification **BIO-10** through **BIO-12**, which are specific to desert tortoise, would reduce impacts to desert tortoise.

To reduce project effects from the large-scale loss of desert tortoise habitat of the large scale land use conversion, staff has proposed the acquisition of compensatory mitigation lands. This compensatory mitigation is designed to fully mitigate impacts to this species as required under the California Endangered Species Act (CESA). Energy Commission staff proposes compensation at a 3:1 ratio for the loss of desert tortoise habitat that occurs in creosote bush scrub vegetation and a 1:1 ratio for areas dominated by shadscale scrub vegetation. Staff has not required compensatory mitigation for impacts to heavily disturbed lands such as dirt roads, a fallow orchard or graded areas. Currently, the applicant contends that this approach should be further refined to reflect the physical characteristics of the site and provided an alternative approach to determining compensatory mitigation ratios for the site. These ratios varied from a low of 0.5:1 for areas characterized as weed infested to 1.5:1 for areas considered more intact habitat. Staff reviewed the proposal in coordination with the CDFG and determined the approach had merit but failed to accurately characterize habitat conditions at the site. Staff proposed to workshop this issue further to gain resolution, however the applicant declined this offer.

Implementation of the proposed Conditions of Certification, including the acquisition, management, and enhancement of mitigation lands would achieve full mitigation under CESA for habitat loss and other significant impacts to desert tortoises.

Burrowing Owl: Implementation of the proposed HHSEGS project will result in the direct loss of foraging habitat for the burrowing owl (a state species of special concern). Construction of the proposed project may also displace resident wintering or breeding birds. Burrowing owl and their sign (i.e., white wash, pellets, and feathers) was observed on the project site. Depending on the timing of construction and if burrowing owls are present on the project site the applicant will be required to implement passive relocation actions to avoid the direct loss of the birds. With implementation of Conditions of Certification **BIO-1** through **BIO-8**, **BIO-12** (Desert Tortoise Compensatory Mitigation), and **BIO-17**(Burrowing Owl Impact Avoidance and Minimization Measures); the project's impacts to burrowing owls would be mitigated to less-than-significant under CEQA. Condition of Certification **BIO-17** identifies survey requirements, eviction guidelines, and provides for compensatory requirements. Staff considered the recently published 2012 Staff Report on Burrowing Owl Mitigation (CDFG 2012) to provide the most relevant guidance addressing impacts and mitigation development to this species.

Operational impacts would be reduced through Condition of Certification **BIO-15** (Avian, Bat, and Golden Eagle Protection Plans). This requires development of a monitoring and reporting program under the oversight of USFWS, CDFG, and the Energy Commission, that would document and report potential collision and heat flux exposure within the proposed solar fields, and provide compensation if necessary.

Golden Eagle & Migratory Birds: Golden eagle, a California Fully Protected species, are known to nest within the adjacent mountain ranges and have been routinely observed over the project site. Numerous migratory birds are also known to utilize the

site for forage, nesting, and breeding, and are protected by federal laws as well as CDFG code. The large scale land use conversion for the HHSEGS project would result in the loss of approximately 3,277 acres of foraging habitat for golden eagle and migratory birds. The USFWS considers that foraging habitat loss may be interpreted as take under the Bald and Golden Eagle Protection Act (BGEPA) if it causes territory abandonment or reduced productivity. Staff believes that these effects, would be difficult at best to attribute to any given land use. However, staff concludes that the loss of foraging habitat would be significant under CEQA and require compensatory mitigation. Staff does not consider the habitat loss to constitute take under state or federal LORS. To address potential impacts from the loss of foraging habitat, solar flux, and collision concerns (discussed below under operational effects) staff has proposed Condition of Certification **BIO-15** (Avian, Bat, and Golden Eagle Protection Plans). This requires a monitoring and reporting program that would document and report potential collision and flux exposure within the proposed solar fields, and implement conservation measures if deemed necessary. The plan also calls for the implementation of actions that reduce threats to eagles in the region such as placing anti perching devices and reducing existing risks to known nest sites. However, staff believes significant residual impacts to avian species would remain even after the implementation of the proposed conditions of certification.

Nelson's Bighorn Sheep: Nelson's bighorn sheep, a State Fully Protected Species, is known to occur in the Nopah, Kingston, and Clark Mountains which border the Pahrump Valley. Bighorn sheep were not detected during surveys however a partial horn fragment and potential pellets (scat) were identified on the project site. Anecdotal observations of bighorn sheep have also been provided by the public during a workshop for the proposed project. However, the proposed project is not located in a designated movement or linkage corridor for this species and while periodic use of the site may occur; bighorn sheep are not expected to frequent the area. Construction and operation of the proposed project is not expected to result in significant impacts to bighorn sheep foraging habitat or interfere with intermountain movement. Bighorn sheep could be subject to construction disturbance if moving or foraging near the site or attempting to cross existing highways. Implementation of **BIO-8** (General Impact Avoidance & Minimization Measures) would reduce these impacts to less than significant levels.

Potential significant impacts to seasonal watering holes for bighorn sheep would be reduced through the implementation of Condition of Certification **BIO-23** (Groundwater-dependent Vegetation Monitoring) and **WATER SUPPLY-4** which requires groundwater monitoring. Condition of Certification **BIO-23** will protect groundwater-dependent ecosystems (GDEs) within the influence of the project pumping wells from the impacts of project-related groundwater drawdown.

American Badger and Desert Kit Fox: Implementation of the proposed HHSEGS project will result in the direct loss of foraging habitat for American badger and desert kit fox. These species were detected on the HHSEGS project site and are expected to be present during the initial phases of construction. Desert kit fox are a protected furbearing mammal and have been the focus of concern for the CDFG, BLM, and USFWS after outbreaks of canine distemper were documented near existing solar facilities. American badger is a state species of special concern and occurs in low densities throughout the desert. Construction of the proposed project is expected to

result in direct effects to badgers and kit fox. Because of the large size of the project badgers or kit foxes may be confined within the desert tortoise exclusion fence and subject to mortality from road kill, loss or alteration of foraging habitat, overlapping territories or barriers to dispersal. In order to construct the proposed project the applicant will be required to passively relocate badgers and kit foxes form the project site. State regulations (Fish and Game code) currently prohibit trapping of these species.

Staff's proposed Conditions of Certification **BIO-1** through **BIO-8** provide general avoidance and minimization measures for these and other wildlife species. In addition, Condition of Certification **BIO-14** (American Badger and Kit Fox Management Plan) requires that prior to ground disturbance, a qualified biologist perform a preconstruction survey for badger and kit fox dens in the project area, including areas within 250 feet of all project facilities, and access roads. If present, the applicant will flag and avoid occupied badger and kit fox dens during ground-disturbing activities and establish a buffer to avoid loss of maternity dens. Should the applicant need to work in an area with occupied badger dens, the applicant will slowly excavate the den in accordance with Condition of Certification **BIO-14**. The plan also includes an adaptive management approach emphasizing flexibility in the methods employed for passive relocation; the timing of ground-disturbance; monitoring; and the treatment or testing in the event of an outbreak of distemper. Staff's proposed Condition of Certification **BIO-12**, the compensatory mitigation plan for desert tortoise habitat, would also offset the loss of habitat for these species and reduce the impact from habitat loss to less-than-significant levels under CEQA.

SUMMARY OF IMPACTS TO SPECIAL-STATUS PLANTS, COMMON AND SENSITIVE PLANT COMMUNITIES, DESERT WASHES, AND GROUNDWATER-DEPENDENT ECOSYSTEMS

Invasive Weeds: Project-related soil disturbance, increased vehicle traffic, and the movement of equipment and materials onsite and offsite are expected to spread invasive non-native species from the project to uninfested areas, and introduce new species into the vicinity from contaminated vehicles, equipment, and materials during construction and operation. Invasive weeds adversely affect wildlife and sensitive plants by causing destructive changes in ecosystem processes, increasing the flammability of vegetation and altering fire frequency intervals. Some weed species are toxic to wildlife. The project's contribution to the spread of weeds, when combined with similar effects from past, present, and foreseeable future projects, would contribute to a cumulatively considerable effect. These impacts would be minimized to a level less than cumulatively considerable through implementation of Condition of Certification **BIO-18** (Weed Management Plan). **BIO-21** (Qualified Botanist) requires the Weed Management Plan be prepared by a qualified botanist or vegetation ecologist. Prevention measures to address the increased risk of fire from the proliferation of non-native annual grasses onsite and potentially offsite are included in **BIO-8** (General Impact Avoidance and Minimization Measures) and **BIO-18.** Condition of Certification **BIO-6** (Worker Environmental Awareness Program) requires worker training in fire prevention and minimizing the spread of weed. **BIO-18** includes measures for protecting offsite biological resources from collateral or non-target harm from herbicide drift.

Special-status Plants: Twenty-eight occurrences of 11 special-status plant species were found on the project site. Occurrences that are not destroyed directly by grading and construction are expected to decline and perish during operation as a result of vegetation mowing, herbicide spraying, altered surface drainage patterns and geomorphic processes, shading, disrupted dispersal pathways, and other factors.

Two years of *offsite* surveys were conducted to determine if the special-status species were more common than currently understood because the area is generally under-surveyed and some species were only recently added to the California Natural Diversity Database (CNDDB) (2012). Many new occurrences were found for some species; no new occurrences were found for others.

Direct impacts to four of the 11 species are significant because the project would eliminate a substantial portion of their range in California and because the affected species exist in such small numbers in California that all or a significant portion of the species' California distribution may become endangered. For the remaining species, the population or range in California is larger or more stable, the proportion affected by the project less is substantially less, and/or the local population is robust.

Condition of Certification **BIO-20** (Special-status Plant Compensatory Mitigation) requires compensatory mitigation for four species – gravel milk-vetch, Wheeler's skeletonweed, Torrey's joint, and Preuss' milk-vetch – through acquisition and preservation or restoration. Mitigation ratios are based on the degree of extinction risk; three offsite occurrences shall be protected for every S1 ("critically imperiled") species affected and two offsite occurrences protected for every S2 ("imperiled") species affected.

Nine occurrences of special-status plants are located offsite in very close proximity to the project boundary. Potential indirect impacts to these occurrences during operation from fugitive dust, herbicide drift, and the proliferation of invasive plants would be avoided or minimized through measures in **BIO-19** (Special-status Plant Avoidance & Minimization). Potential impacts to plants from the increased risk of fire are addressed in fire prevention measures added to **BIO-8** (General Impact Avoidance & Minimization Measures), **BIO-18** (Weed Management Plan)**,** and **BIO-6** (Worker Environmental Awareness Program). **BIO-21** (Qualified Botanist) was added to ensure a qualified specialist implement tasks requiring the expertise of a botanist or vegetation ecologist. Combined with the compensatory mitigation required in **BIO-20**, these measures would minimize the project's impacts to special-status plants to a level less than significant. Integration of special-status plant compensation lands with desert tortoise or other habitat compensation lands is acceptable only if the mitigation lands meet all selection criteria required in **BIO-20**.

Desert Washes:

A total of 23.21 acres of jurisdictional Waters of the State, including single-thread channel and braided ephemeral streams, were delineated on the project site (CH2 2012mm). Of these 23.21 acres, 0.42 acres are also Waters of the United States. Six of the features are depicted as blue line features on the U.S. Geological Survey (USGS) topographic maps. During an August 2, 2012 field verification of the applicant's state waters delineation (URS 2012b), an additional nine ephemeral streams were identified

within the project boundary. The delineation map was subsequently revised and the total state jurisdictional area adjusted to 23.21 acres (CH2 2012mm).

The applicant will minimize obstructions of the natural surface drainage patterns where possible but staff concluded the biological functions and values of the streams will be lost due to perimeter exclusion fencing, partial grading, road construction and maintenance, vegetation maintenance, herbicide spraying, and human disturbance. These impacts are significant because they would cause a loss of the beneficial functions and values that these state waters provide to wildlife.

Condition of Certification **BIO-22** (State Waters Compensatory Mitigation and Avoidance and Minimization Measures) requires compensatory mitigation for impacts to desert washes by acquiring, preserving, and enhancing ephemeral streams of comparable or better quality within the local watershed, or adjacent watersheds. This mitigation could be integrated with the desert tortoise mitigation requirement for acquisition and enhancement of suitable desert tortoise habitat if the desert tortoise mitigation lands meet the selection criteria described in **BIO-22**. With implementation of this proposed condition of certification, and erosion control measures required in **SOIL-1**, impacts to the project's ephemeral streams would be reduced to less-than-significant levels.

Groundwater-Dependent Ecosystems: Project-related groundwater pumping during construction and operation could result in a drawdown of the water table within the zone of influence of the project pumping wells. Groundwater pumping could have significant indirect and cumulative impacts to biological resources if it lowers the water table in areas where groundwater-dependent ecosystems occur. Approximately 4,000-acres of groundwater-dependent mesquite habitats occur within the cone of depression identified by the applicant in the AFC (**Biological Resources Figure** 1and 2; CH2 2011g, Figure DR48-1), including several seeps, and the Nevada Bureau of Land Management Stump Spring Area of Critical Environmental Concern (ACEC). These resources have exceptional values to wildlife in the project vicinity including special-status species (Crampton et al. 2006; Beedy pers. comm.).The Stump Spring area and mesquite habitats throughout Pahrump Valley are identified as conservation priorities by BLM and the BLM-sponsored Clark County Mesquite-Acacia Conservation Management Strategy adopted by the Multiple Species Habitat Conservation Plan.

Condition of Certification **BIO-23** (Groundwater-dependent Vegetation Monitoring Plan) and groundwater elevation monitoring required in **WATER SUPPLY-6**, would ensure that a significant drawdown would be detected before it resulted in adverse impacts to the groundwater-dependent ecosystems, and will protect groundwater-dependent ecosystems (GDEs) within the influence of the project pumping wells from the impacts of project-related groundwater drawdown. The plans require monitoring to track the impacts of pumping to groundwater levels as they develop during the life of the project, and define triggers for adaptive management to be implemented if data indicate impending adverse effects. With implementation of these mitigation measures, significant impacts to Stump Springs ACEC and the mesquite washes and dunes within the influence of the project pumping wells would be avoided.

The **Water Resources** section of FSA contains an analysis of the project's potential to impact the Amargosa River and local groundwater resources. **Water Resources** staff

concluded the project is not expected to have a measurable impact on the Amargosa River or its tributaries. Condition of Certification **WATER SUPPLY-2** requires compensation for the project's contribution to overdraft conditions in the Pahrump Valley groundwater basin through the acquisition and retiring of local active, senior water rights.

Common and Sensitive Plant Communities: Construction would eliminate the habitat functions and value of 1580.5 acres of shadscale scrub and 1,616.5 acres of Mojave Desert scrub (creosote bush scrub) within the project disturbance area. Although common and widespread plant communities, they nevertheless provide important breeding and foraging habitat for a variety of special-status species, including desert tortoise. To achieve full mitigation under CESA for desert tortoise, and to mitigate to less than significant under CEQA for habitat loss and other significant impacts to desert tortoises, compensation at a 3:1 ratio is proposed for the loss of Mojave Desert scrub habitat and a 1:1 ratio for the loss of shadscale habitat. This compensation would also minimize foraging and breeding habitat losses to other wildlife resulting from the loss of Mojave Desert scrub and shadscale scrub.

Sensitive plant communities indirectly affected by the project include mesquite coppice dunes and mesquite washes. Significant impacts to these groundwater-dependent habitats would be avoided through the monitoring, performance standards, and triggers for adaptive management required in **BIO-23** and **WATER SUPPLY-4**. The project would also impact 1.2 acres of creosote bush/galleta grass association, a rare natural community with a CNDDB state rank of 3. Because the community is more common off the project site, and ranked "S3" (vulnerable but not imperiled), the 1-acre impact is less than significant.

LAWS, ORDINANCES, REGULATIONS, AND STANDARDS

The following laws, ordinances, regulations, and standards (LORS) are applicable to project construction and operation, as listed in **Biological Resources Table 1**.

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

Applicable LORS	Description
Federal	
Endangered Species Act (Title 16, United States Code, section 1531 et seq., and Title 50, Code of Federal Regulations, part 17.1 et seq.)	Designates and protects federally threatened and endangered plants and animals and their critical habitats.
Clean Water Act (Title 33, United States Code, sections 1251 through 1376, and Code of Federal Regulations, part 30,	Requires the permitting and monitoring of all discharges to surface water bodies, including some desert washes. Section 404 requires a permit from the U.S. Army Corps of Engineers (USACE) for a discharge of dredged or fill materials into Waters of the U.S., including wetlands. Section 401 requires a permit from a regional water quality control board (RWQCB) for the discharge of pollutants.

Applicable LORS	Description
section 330.5(a)(26))	By federal law, every applicant for a federal permit or license for an activity that may result in a discharge into a California water body, including wetlands, must request state certification that the proposed activity will not violate state and federal water quality standards.
Eagle Act (Title 50, Code of Federal Regulations, section 22.26)	Would authorize limited take of bald eagles (*Haliaeetus leucocephalus*) and golden eagles (*Aquila chrysaetos*) under the Eagle Act, where the taking is associated with, but not the purpose of activity, and cannot practicably be avoided.
Eagle Act (Title 50, Code of Federal Regulations, section 22.27)	Would provide for the intentional take of eagle nests where necessary to alleviate a safety hazard to people or eagles; necessary to ensure public health and safety; the nest prevents the use of a human – engineered structure, or; the activity, or mitigation for the activity, will provide a net benefit to eagles. Only inactive nests would be allowed to be taken except in the case of safety emergencies.
Bald and Golden Eagle Protection Act (Title 16, United States Code section 668)	This law provides for the protection of the bald eagle and the golden eagle by prohibiting, except under certain specified conditions, the take, possession, and commerce of such birds. The 1972 amendments increased penalties for violating provisions of the Act or regulations issued pursuant thereto and strengthened other enforcement measures. Rewards are provided for information leading to arrest and conviction for violating the Act.
Northern and Eastern Mojave Desert Management Plan (NEMO)	A regional amendment to the CDCA Plan approved in 2002, NEMO protects and conserves natural resources while simultaneously balancing human uses in the northern and eastern portion of the Mojave Desert.
California Desert Protection Act of 1994 (CDPA)	An Act of Congress which established 69 wilderness areas, the Mojave National Preserve, expanded Joshua Tree and Death Valley National Monuments and redefined them as National Parks. Lands transferred to the National Park Service were formerly administered by the BLM and included substantial portions of grazing allotments, wild horse and burro Herd Management Areas, and Herd Areas.
Migratory Bird Treaty (Title 16, United States Code, sections 703 through 711)	Makes it unlawful to take or possess any migratory nongame bird (or any part of such migratory nongame bird) as designated in the Migratory Bird Treaty Act.
Executive Order 11312	Prevent and control invasive species.
California Desert Conservation Area Plan	The California Desert Conservation Area (CDCA) comprises one of two national conservation areas established by Congress at the time of the passage of the Federal Land and Policy Management Act (FLPMA) in 1976. The FLPMA outlines how the BLM will manage public lands. Congress specifically provided guidance for the management of the CDCA and directed the development of the 1980 CDCA Plan.
Desert Tortoise (Mojave Population) Recovery Plan (USFWS 2011)	Describes a strategy for recovery and delisting of the desert tortoise.
Wild and Scenic Rivers Act (Public Law	Created by Congress in 1968, this act designates certain rivers or portions of rivers to be preserved in free-flowing condition, in order to

Applicable LORS	Description
90-542; 16 U.S.C. 1271 et seq.)	conserve scenic, recreational, geologic, fish and wildlife, historic, cultural or other similar values for the public good.
State	
California Endangered Species Act of 1984 (Fish and Game Code, sections 2050 through 2098)	Protects California's rare, threatened, and endangered species.
Definition of "Take" (Fish and Game Code section 86)	Defines take as to hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, catch, capture, or kill.
Protected furbearing mammals (California Code of Regulations, Title 14, section 460)	Fisher, marten, river otter, desert kit fox, and red fox may not be taken at any time.
California Code of Regulations (Title 14, sections 670.2 and 670.5)	Lists the plants and animals of California that are declared rare, threatened, or endangered.
Fully Protected Species (Fish and Game Code, sections 3511, 4700, 5050, and 5515)	Designates certain species as fully protected and prohibits the take of such species or their habitat unless for scientific purposes (see also California Code of Regulations Title 14, section 670.7).
Nelson's bighorn sheep (Fish and Game Code section 4902)	Regulates adoption of sound biological management practices, including sport hunting, of the Nelson's bighorn sheep.
Nest or Eggs (Fish and Game Code section 3503)	Protects California's birds by making it unlawful to take, possess, or needlessly destroy the nest or eggs of any bird, except as otherwise provided by code or regulation.
Birds of Prey (Fish and Game Code section 3503.5	Unlawful to take, possess, or destroy any birds in the orders Falconiformes and Strigiformes or to take, possess, or destroy the nest or eggs of any such bird except as otherwise provided by code or regulation.
Migratory Birds (Fish and Game Code section 3513)	Protects California's migratory birds by making it unlawful to take or possess any migratory nongame bird as designated in the Migratory Bird Treaty Act or any part of such migratory nongame birds except as otherwise provided by code or regulation.
Nongame mammals (Fish and Game Code section 4150)	Makes it unlawful to take or possess any non-game mammal or parts thereof except as provided in the Fish and Game Code or in accordance with regulations adopted by the commission.
Migratory Birds (Fish and Game Code section 355-357)	The commission may, annually, adopt regulations pertaining to migratory birds to conform with or to further restrict the rules and regulations prescribed pursuant to the Migratory Bird Treaty Act except as otherwise provided by code or regulation.
Lake and Streambed Alteration Agreement (Fish and Game Code	Regulates activities that may divert, obstruct, or change the natural flow or the bed, channel, or bank of any river, stream, or lake in California, including desert washes designated by CDFG in which

Applicable LORS	Description
sections 1600 and following)	there is at any time an existing fish or wildlife resource or from which these resources derive benefit. Impacts to vegetation and wildlife resulting from disturbances to waterways are also reviewed and regulated during the permitting process.
California Native Plant Protection Act of 1977 (Fish and Game Code section 1900 and following)	Designates state rare, threatened, and endangered plants.
California Desert Native Plants Act of 1981 (Food and Agricultural Code section 80001 and following and California Fish and Game Code sections 1925-1926)	Protects non-listed California desert native plants from unlawful harvesting on both public and private lands in Imperial, Inyo, Kern, Los Angeles, Mono, Riverside, San Bernardino, and San Diego counties. Unless issued a valid permit, wood receipt, tag, and seal by the commissioner or sheriff, harvesting, transporting, selling, or possessing specific desert plants is prohibited.
Porter-Cologne Water Quality Control Act	Defines waters of the state and regulates discharges of waste and fill material to waters of the state, including "isolated" waters and wetlands.
Local	
Inyo County Renewable Energy Ordinance(Title 21)	Provides comprehensive, long-range plans, policies, and goals to guide the physical development of the county. Specifically, Title 21 requires restoration and revegetation of the site, along with posting financial security to accomplish same.

DESERT RENEWABLE ENERGY CONSERVATION PLAN – INTERIM PLANNING

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

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

The Energy Commission and CDFG are the primary state collaborators in the REAT, operating under a November 18, 2008 MOU between the two agencies to create a "one-

stop process" for permitting renewable energy projects under their joint permitting authority. The BLM and the USFWS also participate in the REAT under a separate MOU signed in November 2008, which outlines the state and federal cooperation of the group. The October 12, 2009 MOU between California and the Department of Interior reiterates several tasks of the REAT provided for in S-14-08 and the Energy Commission-Fish and Game MOU.

The REAT's primary mission is to streamline and expedite the permitting processes for renewable energy projects in the Mojave and Colorado Desert ecoregions within the State of California, while conserving endangered species and natural communities at the ecosystem scale. To accomplish this goal the REAT Agencies are developing a Desert Renewable Energy Conservation Plan (DRECP), a science-based process for reviewing, approving, and permitting renewable energy applications in California. Once the DRECP is complete, anticipated in late 2012, the plan will provide tools to expedite coordination of federal and state endangered species act permitting. The DRECP will also offer a unified framework for state and federal agencies to oversee mitigation actions, including land acquisitions, for listed species.

The REAT Agencies recognize that some renewable energy projects are scheduled to be approved prior to completion of the DRECP. Section 8.9 of the October 2009 Draft Planning Agreement for the DRECP < http://www.energy.ca.gov/2009publications/REAT-1000-2009-034/REAT-1000-2009-034.PDF> directs the REAT Agencies to ensure that permitting for these projects is consistent with the preliminary conservation objectives for the DRECP; would not compromise successful completion and implementation of the DRECP; would facilitate Federal Endangered Species Act, California Endangered Species Act, National Environmental Policy Act, and California Environmental Quality Act compliance; and would not unduly delay permitting during preparation of the DRECP.

SPECIAL CONSIDERATIONS

Special permitting issues arise from the proposed project, and stem from the inter-state nature of the project elements. Electric grid connection (i.e., transmission) and natural gas lines cross into public land in Nevada, and therefore are subject to the review of the BLM, pursuant to the National Environmental Policy Act (NEPA). The Nevada BLM is the federal lead agency and is preparing an Environmental Impact Statement (EIS), which will analyze the whole of the action, including those impacts which occur in California. Pursuant to the Endangered Species Act (ESA), the BLM also has undertaken formal consultation with the USFWS for a Section 7 incidental take statement for the federally listed endangered desert tortoise (*Gopherus agasizzii*). The incidental take statement, if granted by the USFWS, would supplement the analysis and conditions recommended in the FSA proposed to fully mitigate project effects to the desert tortoise in California. The incidental take statement would provide additional language dictating the methods and location for all translocation activities; provide guidance on husbandry topics; and recommend a suite of protective measures that would be implemented from the onset of ground disturbance through project decommissioning and post-project monitoring. See the "Special-Status Plants and Wildlife Species" subsection of this FSA section for more information.

The Energy Commission does not provide CEQA analysis for project features that are located in Nevada such as the electrical transmission and gas lines. These elements will be analyzed by the BLM, and available for public review in the draft EIS. However, effects of the California project to biological resources that may occur in Nevada are considered in the FSA where the project is demonstrated to pose a potential direct, indirect, or cumulative impact. Energy Commission staff have prepared impact assessments for plants, significant natural features, wildlife and other protected biological resources based on the regional factors that contribute to conserving and protecting that feature through applicable LORS. These regional factors were considered in staff's analysis, and extend into Nevada in varying degrees. Further explanation of rationale and geographical extent of analysis is provided in the "Assessment of Impacts and Discussion of Mitigation" subsection of this FSA section. The cumulative impact analysis includes projects in Nevada likely to contribute incrementally to cumulative impacts to biological resources. These cumulative impacts would affect resources in California and Nevada. Refer to the "Cumulative Impacts" subsection of this FSA section for further information and conclusions.

SETTING

PROJECT AREA AND VICINITY DESCRIPTION

The proposed project is located in southeastern Inyo County, immediately adjacent to the Nevada-California border, in the Pahrump Valley. Charleston View, an unincorporated community, is immediately south of the site, and the closest incorporated city is the town of Pahrump, located eight miles to the northwest, in Nevada. The proposed project site is located on privately-owned land, and private land borders the project site to the south and west. The BLM manages public lands to the north and east of the proposed project site, which is bordered to the east by Nye, and Clark counties. The area is sparsely populated and BLM is the major land holder in the county. The California Desert Conservation Area (CDCA) and the Northern and Eastern Mojave Planning Area (NEMO) encompass the BLM lands in the project vicinity.

Proposed Project Facilities

The proposed project would be composed of two solar fields, each one containing approximately 85,000 heliostats and each capable of generating 270 megawatts (MW). Solar plant 1 is 1,483 acres, solar plant 2 is 1,510 acres, and collectively, the solar fields and other project features would occupy approximately 3,277 acres and would produce 500 MW. The proposed project components related to the generation and transmission of electricity are described below. For further information about the elements of the project, please see the **Project Description** and **Soil and Surface Water** sections of this **FSA.**

REGIONAL SETTING

The proposed project is located within the Amargosa Desert-Pahrump Valley ecological subregion of the Mojave Desert (Goudey & Smith 1994). The subregion includes the alluvial plains of the Amargosa Desert, Sarcobatus Flat, Stewart Valley, Pahrump Valley, Sandy (Mesquite) Valley, and California Valley.

The boundary of the Pahrump Valley Wilderness Area is located in the Kingston Range three miles south of the project site. The Nopah Wilderness Area boundary is approximately four miles to the northwest. The BLM Southern Nevada District administers lands to east of the site, including the Stump Spring Area of Critical Environmental Concern (ACEC). The boundary of the ACEC is located approximately two and a half miles east of the project's southeastern corner. BLM lands north and west of the project are in the California BLM Barstow District. The NEMO planning area encompasses BLM lands on the California and Nevada side of the project.

The California portion of the Mojave Desert occupies the northern two-thirds of the California Desert floristic province (Baldwin et al. 2002). It is characterized by hot, dry summers, warm and dry winters, and exhibits greater temperature ranges and topographical relief than the Sonoran Desert region of California in eastern Riverside and Imperial counties. The mean annual precipitation is approximately four to six inches, and in the project vicinity is influenced by two distinct storm patterns: one occurring in winter and the other in summer. Winter precipitation tends to be of low intensity and long duration, and covers greater areas. In contrast, most summer rains, resulting from local convective thunderstorms, are of high intensity and short duration (Belcher & Sweetkind 2010), and frequently patchy but can stimulate late season plant germination and growth. Some native annual plants, including special-status plants, germinate only in response to these warm monsoonal rain events.

The project site is located in the western (California) portion of the bi-state Pahrump Valley and Pahrump watershed. Elevations on the valley floor range from 2,515 feet at the Pahrump Playa to about 2,655 feet in the southwestern part of the basin along Tecopa Road. The project site is located between the middle position and the toe of an alluvial fan complex (bajada) on the western flank of the Spring Mountains (in Nevada) that drain into the Pahrump Playa. The project site is gently sloping with the highest point in the southeast corner, at 2,685 feet elevation, and the lowest along the northwest boundary closest to the playa at 2,590 feet.

The shallow aquifer from which the project and all of Pahrump meets its water needs, and the deeper, more laterally-extensive regional aquifer that underlies the shallow aquifer, occur within the Death Valley Regional Groundwater Flow System (DVRFS). The DVRFS is exceptionally rich in springs and other groundwater-dependent ecological resources. At least 30 groundwater-dependent fish, invertebrate and plant species are found in the region that exist nowhere else in the world, primarily in adjacent basins, such as the Amargosa River and Ash meadows areas. No groundwater-dependent resources occur within the project boundary; however, Pahrump Valley supports a 9,000-acre complex of mesquite washes and coppice dunes arranged linearly along the stateline fault zone where groundwater is forced to or nearer the surface by juxtaposed Pleistocene lake deposits and basin-fill deposits. **Biological Resources Figure 1** shows the distribution of the mesquite east of the project, and **Figure 2a-b** contains photos of groundwater-supported habitats in southern Pahrump Valley.

All surface waters on and adjacent to the project site are ephemeral, i.e., they flow only during storm events, and in the terminal reaches water persisted a day or more following a moderate storm event. All features are presumed to be supported by

precipitation (not groundwater) due to their ephemeral hydrology. The washes enter the site from the east and southeast, and trend northwest towards the playa. A few of the project streams originate as single-thread channels from the more steeply sloped fan terrace to the east but most of the delineated desert washes onsite are characteristic of alluvial fan distributary channel networks, characterized by multiple low-flow meandering and braided channels, nested within a larger but less conspicuous watercourse defined by a frequently shifting channel network. Flow volume decreases due to seepage into the unconsolidated sediments of the fan, and transitions into unconfined sheet flood areas in the western half of the project site. The channels increase in number and density but decrease in size as they flow down the alluvial fan, where the resulting habitat is more diverse and spatially variable than the single-thread portion upstream. **Biological Resources Figure 3a-c** contains photos of characteristic stream forms on the project.

The surface hydrology of the site has been somewhat altered by the network of roads, which diverts and redistributes a portion of the runoff from smaller channels; however, the hydrology of the features delineated as Waters of the State (23.21 ac. total) is intact, based on site visits conducted after small-to-medium size storm events.

Habitat quality in the western portion is highly variable, ranging from small areas of densely weedy, historically disturbed habitat of low native diversity to saltbush scrubs and creosote bush scrubs of moderate-to-high native species diversity but with a moderate-to-high component of non-native annual weeds. Three special-status plant species -- Pahrump Valley buckwheat, Torrey's joint-fir, and Goodding's phacelia occur across the western and eastern portion of the project. A total of 77 acres were mapped as disturbed habitat in the western portion of the project site (areas with a significantly disturbed topography) but topographic disturbance in the remainder of the western portion is limited to unpaved roads and a few areas that appear to have been disked historically and are degraded but in varying stages of recovery. Transitional creosote bush and saltbush scrubs occur near the center of the project site and creosote bush scrubs of good quality and high diversity dominate the eastern third of the project site. **Biological Resources Figure 4a-f** contains photos of the habitats contained on the project site, and **Figure 5** shows the location of the photo points.

SPECIAL-STATUS PLANT AND WILDLIFE SURVEYS

The following description of biological resources presents the results of the applicant's botanical and wildlife surveys of the project site and vicinity, including delineations of desert washes and groundwater-dependent vegetation, summarized from data presented in the Application for Certification (AFC) and responses to staff's data requests. This assessment also represents staff's independent review of the data, including: observations from staff's multiple site visits (representing a minimum of 144 person hours in the field); consultation with recognized experts and resource agencies; and independent research (review of literature and databases).

Resources affected only by the construction of project components in Nevada are not included in this assessment.

NATURAL COMMUNITIES

Natural communities documented within the project area and one-mile buffer surrounding the project are described below, followed by a discussion of desert washes and groundwater-dependent ecosystems found on or near the site. “Natural Communities”, as used here, includes plant communities, desert washes, seeps and springs, and habitats defined by their geology, such as dunes.

Two plant communities were mapped on the project site during the spring 2011 surveys: Mojave Desert scrub (creosote bush scrub) and shadscale scrub. In summer of 2012, staff documented a small (1.2 acre) polygon of a rare natural community along the eastern boundary: creosote bush/big bush galleta grass association. No groundwater-dependent vegetation or springs occur on the project site.

The western half of the project site occurs at the toe of the alluvial fan and edge of the basin sink in silty, fine-textured, Pleistocene lakebed sediments inhabited by a shadscale-dominant saltbush scrub. The eastern half of the project, toward the middle portion of the alluvial fan, on gravelly, well-drained soils, supports a Mojave Desert scrub of creosote bush and white bursage on coarser, gravelly, well-drained soils. The project site also contains approximately 77 acres of topographically disturbed habitat, including dirt roads, a graded area, and a fallow orchard.

Mojave Desert scrub and shadscale scrub also dominate the one-mile buffer surrounding the project site. The groundwater-dependent communities within an approximate five-mile radius of the project are generally restricted to the Nevada side of the state line, and include honey mesquite-dominated coppice dunes and washes. The stabilized mesquite coppice dunes (dunes formed by the entrapment and accumulation of blowing sand at the base of shrubs) are generally confined to the fault zone east of the project site that parallels the California-Nevada stateline, and apparently supported by shallower groundwater forced to the surface by juxtaposed lake and basin-fill deposits (Belcher & Sweetkind 2010).

Plant communities are discussed in more detail below. **Biological Resources Figures 3**, and **4** contain photos of the habitats characteristic of the project site. The total estimated area occupied by each community is provided in **Biological Resources Table 2**.

Biological Resources Table 2
Natural Communities within the HHSEGS Project Site

Natural Community Types within Study Area	Project Site (Acres)
Mojave Desert scrub	1,580.5*
Shadscale scrub	1,616.5*
Disturbed (excluding roads)	77
Total upland, State and federal waters	3,277
Desert Washes/Waters of the US**	0.4
Desert Washes/Waters of the State**	23.21
Creosote bush/big bush galleta grass association	<1 ac.

* Comments on the PSA provided by the applicant included revised estimates of disturbed habitat. This included an additional 61 acres of dirt roads. Estimates did not include revised vegetation estimates; therefore staff decreased the acreages of Mojave Desert Scrub and Shadscale scrub by 30.5 acres each.
** The total acreage of waters is a subset of existing vegetation acreages.

Mojave Desert Scrub

A total of 1,580.5 acres of Mojave Desert scrub occurs within the project site (HHSEGS 2011a). Mojave Desert scrub occurs on well-drained, alluvial soils of slopes, fans, and valleys below 4,000 feet elevation (Holland 1986). In the project area it consists of evergreen and drought-deciduous shrubs one to four feet in height, dominated by creosote bush (*Larrea tridentata*) and white bursage (*Ambrosia dumosa*). Common associated shrubs include rabbit-thorn (*Lycium pallidum var. oligospermum*) and shadscale (*Atriplex confertifolia*). This community also supports a large variety of mostly native herbaceous forbs and bunchgrasses, and provides valuable habitat for a wide variety of common and special-status wildlife. Eleven species of special-status plants were also documented within this community-type.

Creosote bush and white bursage-dominant communities have a CNDDB Element Rank (NatureServe state-rank) of five, meaning they are “demonstrably widespread, abundant, and secure” (Master et al. 2009). Their extinction risk in California is low. Some variations of the creosote-bursage alliance are rare, including the creosote bush/big galleta grass association, described in more detail below under “Sensitive Natural Communities”.

Shadscale Scrub

A total of 1,616.5 acres of shadscale scrub occurs within the project site (HHSEGS 2011a). Shadscale scrub comprises of low-growing, salt-tolerant shrubs that are widely spaced and often have lower overall species diversity; however, shrub species diversity is very good in some areas. Most shrubs are less than two feet in height. This plant community typically occurs on poorly-drained flats with fine-textured, somewhat alkaline soils between 3,000 and 6,000 feet elevation (Holland 1986). Common plant associates include winterfat (Kraschenninikovia lanata), desert allysum (*Lepidium fremontii*), Anderson’s boxthorn (*Lycium andersonii*), rabbit-thorn, Emory’s globemallow (*Sphaeralcea emoryi*), and prince’s plume (*Stanleya pinnata*).

Fewer special-status plant species were found in the shadscale scrub; most of which prefer the more gravelly, better-drained and less alkaline soils farther up the alluvial fan; however, three rare species are nevertheless abundant in the shadscale scrub: (Pahrump Valley buckwheat, Torrey’s joint-fir, and Goodding’s phacelia. Special-status wildlife are also found in lower abundance in this area. The western half of the site is somewhat more disturbed and the invasive weeds halogeton (*H. glomeratus*) and red brome (*Bromus madritensis* ssp. *rubens*) are abundant in many areas (HHSEGS 2011a).

Shadscale-dominant natural communities have a CNDDB Element Rank (Nature Serve state-rank) of 4.2, meaning they are “not rare and apparently secure, but with cause for long-term concern; this rank is clearly lower than G3 but factors exist to cause some concern; i.e., there is some threat, or it has a somewhat narrow habitat” (Master et al. 2009).

Disturbed

A total of 77 acres of disturbed habitat occurs on the project site (HHSEGS 2011a). This includes roads, and sparsely vegetated weedy areas that were previously graded. A

fallow peach orchard is located on the project site at the corner of Silver Street and Old Spanish Trail Highway. Additional disturbed areas were mapped along the Old Spanish Trail Highway on the south side of the project site. Non-native annuals and cultivated species are characteristic of this mapping unit, with few-to-no native shrubs present. Tumbleweed (*Amaranthus albus*) and the invasive weed Russian knapweed *(Acroptilon repens*) are common in the disturbed areas.

SENSITIVE NATURAL COMMUNITIES

Vegetation mapping was conducted in spring 2011 and classified according to Holland (1986) vegetation descriptions (AFC Figure 5.2-3, HHSG 2011a; see also **Biological Resoures Figure 5**). Surveys for rare natural communities, based on the classification system described in *Manual of California Vegetation* (Sawyer et al. 2009), were conducted in spring 2012. The applicant also mapped groundwater-dependent vegetation within an approximate four-mile radius of the project (CH2 2011g, Figure DR48-1). Staff's independent review included a reconnaissance-level survey of the Pahrump Lake playa margins and other mesquite-habitats and springs beyond the four-mile boundary, including the Tecopa area, the stabilized dunes east of the project, and an onsite field verification of the applicant's delineation of state waters and desert tortoise habitat (CH2 2011c; **Biological Resources Figure 6**).

The Mojave Desert scrub and shadscale scrub communities described above are common and widespread habitats; their vulnerability to extinction in California is low at this time. Sensitive natural communities, however, are usually locally and regionally scarce and therefore vulnerable to elimination. Such habitats may be sensitive because they are regulated and protected (such as streams, wetland and riparian habitat, and other state or federal jurisdictional waters), or they are identified in local plan policies or ordinances. Sensitive natural communities often support unique or biologically important plant or wildlife species, or perform important ecological functions (e.g., the bank stabilization or water filtration functions of riparian vegetation). Communities that are not regulated under California Fish and Game Code or the state or federal Clean Water Act or other LORS may still be recognized by agencies and the scientific community as rare and sensitive (CNDDB 2003; Sawyer et al. 2009).

The CDFG Vegetation Program's *Manual of California Vegetation* [2nd ed.](Sawyer et al. 2009) provides a valuable measure of a community's vulnerability through the CNDDB Element Rank (synonymous with the NatureServe state rank). Communities with a state or global rank of 1, 2, or 3 are considered vulnerable to extinction within their range in California. Some of these communities are also globally at-risk. The global and state ranks do not reflect other concerns, *e.g*., whether the habitat is designated critical habitat for a listed species. Some *alliances* (a description of the community based on its dominant species) that are common have rare *associations* (a finer level of classification), such as those with high levels of diversity in the shrub layer, associations of galleta grass or with an important component of stem succulents like Mojave yucca or various cacti (Sawyer et al. 2009).

Sensitive natural communities found onsite include:

- Ephemeral desert washes (Waters of the State)
- Creosote bush/big galleta grass association

The desert washes on the project site are described in the subsection “Desert Washes”, following the discussion of mesquite communities, invasive weeds, special-status plants, and groundwater-dependent ecosystems.

Sensitive natural communities documented or observed *offsite* within the one-mile study area surrounding the project site include:

- Honey mesquite alliance (a groundwater-dependent species)
- Coppice dunes
- Ephemeral desert washes

Mesquite Alliance

Honey mesquite-dominant habitats, their importance to area wildlife, and conservation status are described in more detail under “Groundwater-dependent Ecosystems”. Over 4,000 acres of mesquite-dominant habitats were documented within the five- to six-mile radius of the project study area in the applicant’s mapping of groundwater-dependent vegetation (CH2 2011g, Figure DR48-1; **Biological Resources Figure 1**). With the exception of a small area along lower Stump Spring Wash in the Charleston View area, all mesquite habitats within the study area occur on the Nevada side of the state line. No mesquite habitats occur within the project boundary, with the exception of a few scattered shrubs. This was confirmed by staff during the field verification of the state waters delineation. The nearest mesquite-dominant habitats in California occur 13 to 20 miles west of the project site in the Tecopa area at springs, around playa margins, and along the Amargosa River and its tributaries.

The mesquite-dominated habitats within the study area occur in two forms: 1) coppice dunes of low-growing shrubs, less than six feet tall, on sandy, hummocky stabilized dunes, and 2) as stringers of lush, taller stands along the deeply incised canyons and ephemeral washes that dissect the alluvial fan surface east of the project. In these settings, they occur as very dense stands of taller shrubs and single- or multi-trunked small trees up to approximately eight inches diameter and 15 feet in height. **Biological Resources Figure 1** contains photos of the mesquite habitats characteristic of the incised washes east of the project site. The ephemeral washes do not flow frequently enough to support this obligate phreatophyte (groundwater-dependent) species; the mesquite are presumed to be supported by one or a combination of shallow groundwater forced to the [near] surface along the fault zone, groundwater flow from the Spring Mountains, and in a few small areas by discharging seeps and springs.

Like the dunes (described below), the mesquite associated with the dunes are arranged linearly along the fault zone, between approximately 600 and 2,500 feet east of the project boundary. The mesquite associated with the dunes, spring, and washes at Stump Springs Area of Critical Environmental Concern (ACEC) occur between two and four miles of the project’s southeast corner. The mesquite washes occur as close as one-half mile of the eastern project boundary and extend up to five miles or more east toward the Spring Mountains.

All mesquite-dominant communities are rare in California and Nevada (Crampton et al. 2006; Sawyer et al. 2009). The total mesquite-dominant woodland area in southern Nevada, northwestern Arizona, and southeastern California is 24,669 acres (Crampton et al. 2006). Mesquite-dominant habitats are also rare in California and occurrences are threatened by a variety of factors, predominantly groundwater pumping and urbanization (Sawyer et al. 2009; Crampton et al. 2006).

Classification of the Mesquite Habitats

Staff chose not to include an academic discussion about vegetation classification in the PSA; the issue of the mesquite classification is included here to address concerns expressed by the applicant during workshops and in the PSA comments.

At the applicant's request, the CDFG Vegetation Program was consulted for information on the conservation status and classification of mesquite in California. The Senior Vegetation Ecologist (Keeler-Wolf pers. comm.) affirmed that the mesquite-dominant habitats in California are classified as "Honey Mesquite Alliance"; not "thickets", "bosque" or "woodland". The state and national standard for classification is based on dominant species, not on habitat structure. Under the U.S. National Vegetation Classification system (USNVC), a system still in development, honey mesquite alliances fall under several different "Ecological Systems" including "North American Warm Desert Riparian Low Bosque & Shrubland Group" (Keeler-Wolf pers. comm.). This might explain why BLM uses the term "bosque" to describe the mesquite habitats east of the project.

In the BLM-sponsored Mesquite-Acacia Conservation Management Strategy (CMS) (Crampton et al. 2006), prepared for and adopted by the Clark County Multiple Species Habitat Conservation Plan, the mesquite habitats throughout the study area (that includes southern Nye County) are consistently referred to as "woodlands. The management plan also notes that the southern portion of the Pahrump "Metapatch" (aggregation of smaller patches) known as Stump Spring is "...distinct from the rest of the region in topography, hydrology, soils and mesquite growth form...Many of these woodland patches are comprised of shrubby dune mesquite; however, larger shrubs and trees grow along the deeply eroded wash." (Crampton et al. 2006)

Regardless of the terminology used, the conservation status and ecological importance of Stump Spring ACEC, the mesquite-dominant habitats north of the ACEC and east of the project, and the value of mesquite to wildlife, are undisputed; the ACEC and the entire Pahrump Valley metapatch are identified conservation priorities in the Mesquite-Acacia Conservation Management Strategy (Crampton et al. 2006), and BLM is in the process of developing an additional ACEC that would encompass the mesquite habitats just east of the project (Poff pers. comm.).

The importance of mesquite communities to wildlife are described in more detail under "Groundwater-dependent Ecosystems". **Biological Resources Figure 2** contains photos of the mesquite habitats characteristic of the incised washes east of the project site.

Coppice Dunes

The mesquite coppice dunes are arranged linearly along the fault zone as a discontinuous system of stabilized (inactive) dunes. Most occur within one-half mile of the eastern boundary, occur on BLM lands, and extend southeast of the project to the Stump Spring ACEC, approximately two and one-half miles east of the project's southeast corner

Coppice dunes form as a result of the trapping of aeolian silts and fine sands by shrubs adapted to sand burial. Any shrub (or other obstacle) standing in the airborne stream of sand is an impediment to wind-sand transport, and the resulting turbulence and speed losses cause sand grains to settle out on the downwind side of the shrub and around its base. Only certain kinds of plants are associated with coppice dunes, because only those "edifying" species adapted to sand burial by forming new roots and shoots from buried branches can continue to grow as the sand accumulates around them.

Honey mesquite (*Prosopis glandulosa* var. *torreyana*) is the clear dominant on the coppice dunes. Other shrubs associated with coppice dunes in the project vicinity include creosote bush, Mormon tea (*Ephedra* spp.), and four-wing saltbush (*Atriplex canescens*). The stabilized dunes provide ideal sites for burrowing fauna due to the lack of stones, abundant coarse material, and shade provided by the shrubs (Huang et al. 2011). The vertical structure of the vegetation provides wildlife with nesting and foraging habitat.

Creosote Bush/Big Galleta Grass Association

Some *alliances* (a description of the community based on its dominant species) that are common, such as creosote bush, have rare *associations* (a finer level of classification). The creosote bush/galleta grass *association* found onsite is one example (Sawyer et al. 2009). Only 1.2 acres of this plant community occurs onsite (**Biological Resources Figure 5**). This community extends to the east toward the fault zone coppice and is more abundant off the project site. This association has been observed by staff and others in different locations throughout the eastern Mojave and Colorado Desert regions of California (Sawyer et al. 2009, Evens pers. comm.). This rare natural community has a CNDDB (NatureServe) state rank of 3, meaning it is "vulnerable in the state due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors making it vulnerable to extirpation." (Master et al. 2009)

In the small stand documented in the project area, the big galleta grass (*Pleuraphis rigida*) is the co-dominant in the creosote bush-white bursage alliance. Overall shrub diversity is very good at the site but only the galleta grass and white bursage dominate (31 percent and 38 percent relative cover, respectively).

Blackbrush communities (a habitat of upper bajadas) in southern Nevada that contain a major component of big galleta are heavily utilized by bighorn sheep and are referred to as 'preferred habitat' (Matthews 2000). It also provides fair cover for small mammals and small nongame birds (*ibid.*).

INVASIVE WEEDS

Target lists of invasive non-native plants potentially occurring in the project area were developed from the lists of the California Department of Food & Agriculture (CDFA), California Invasive Plant Council (Cal-IPC), and the Nevada Department of Agriculture (NDA). Because the surveys were floristic, i.e., all plants encountered were identified to at least species level, any new weed species not on the target lists would have been detected, if present. Non-native invasive weed species were mapped in spring 2011, and their abundance was estimated by size classes.

Invasive weeds are species of non-native plants included on the weed lists of the California Department of Food and Agriculture (CDFA 2010), the California Invasive Plant Council (Cal-IPC 2006) and the Mojave Weed Management Area (MWMA 2011). They are of particular concern in wildlands because of their potential to degrade habitat and disrupt the ecological functions of an area (Cal-IPC 2006). Specifically, invasive weeds can alter habitat structure, increase fire frequency and intensity, decrease forage (including for special-status species, such as desert tortoise), exclude native plants, and decrease water availability for both plants and wildlife.

A digest of California's weed laws is available on the CDFA website: http://www.cdfa.ca.gov/plant/ipc/encycloweedia/winfo_weedlaws.htm. The website ("Encycloweedia") also provides fact sheets on weed species management.

Thirteen species of invasive weeds of varying abundance and distribution were mapped in the project area during the 2010/2011 floristic surveys (HHSEGS 2011a). Weeds are most abundant in the western two-thirds of the project area, or the portion of the project most disturbed by grading for the now abandoned residential subdivision (predominantly along roads), areas with an agricultural history, and seasonally moist areas. The species documented onsite are described below, as well as two additional weed species of particular concern to local agricultural commissioner INYO 2012a).

Invasive Weeds on the Project Site

Russian knapweed (Acroptilon repens)

Russian knapweed was found in two locations on the project site; the fallow orchard and along an interior site road. Russian knapweed occurs in the Great Basin, Mojave Desert, and northern California mainly on agricultural lands and roadsides. Russian knapweed is a deep-rooted perennial and established stands are more difficult to control than other knapweeds. Russian knapweed can invade and persist in numerous ecosystems, including rangeland, pastures, agricultural fields, riparian areas, and wildlands. It has been found in saline, alkaline, low lying areas. It most readily invades disturbed areas, forming dense single-species stands. Once established, Russian knapweed uses a combination of adventitious shoots and allelopathic chemicals (toxic to other plants) to spread outward into previously undisturbed areas. On agricultural land, it has caused serious reductions in yields, crop value, and may devalue the land. CDFA recommends avoiding driving vehicles or equipment through mature patches as seed heads can become attached and spread over long distances (CDFA 2012). It is a CDFA A-rated pest; a priority for eradication.

Red brome (Bromus madritensis ssp. rubens)

Red brome is abundant and widespread in the project area, occurring at 218 widely scattered locations. It is an introduced Eurasian grass adapted to microhabitats and was frequently found at the base of desert shrubs and moist places. Red brome is widespread throughout the Mojave Desert and the seeds from this species can disperse readily and across large distances. Cal-IPC has declared this plant highly invasive (Cal-IPC 2006). Because of its widespread distribution, red brome is not considered feasible for general control.

Cheat grass (Bromus tectorum)

Cheat grass was found at 21 scattered locations on the project site. It is among the most widely distributed invasive plant species in the western U.S. Closely related to red brome, it is adapted to colder steppe and woodland habitats. Cal-IPC has declared this plant highly invasive (Cal-IPC 2006). Because of its widespread distribution, cheat grass is not considered feasible for general control.

Purple mustard (Chorispora tenella)

Purple mustard was found in low abundance in two locations in wetter, low-lying areas. This species is uncommon to California and is commonly associated with heavily disturbed agricultural lands. It is primarily a problem in winter annual cereal crops and may cause extensive yield losses at moderate infestations. Densities as low as three plants per square foot have reduced wheat yields by over 50 percent. Purple mustard may also infest roadsides, non-crop areas, and disturbed rangeland. Additionally, dairy animals grazing purple mustard produce milk with a bitter taste and foul odor. It is still somewhat limited in its distribution in California and infestations frequently tend to spread along roads and field edges. Populations should be mapped and aggressively controlled to prevent the continued increase of this weed in cereals (CDFA 2012). It is a B-rated pest plant, meaning it is a known economic or environmental detriment and of currently limited distribution. At the discretion of the individual county agricultural commissioner they are subject to eradication, containment, suppression, control, or other holding actions.

Field bindweed (Convolvulus arvensis)

Field bindweed was found in low abundance at one location in the 250-foot buffer. Field bindweed is considered one of the most noxious weeds of agricultural fields throughout temperate regions of the world. Plants typically develop large patches and are difficult to control. Heavy infestations in grain crops can reduce harvest yields 30-40 percent or more. It can also spread certain plant viruses, and the foliage contains tropane alkaloids and can cause intestinal problems in horses grazing on heavily infested pastures. It is a C-rated by the state, meaning it is a pest of known economic or environmental detriment and, if present in California, it is usually widespread. If found in the state, they are subject to regulations designed to retard spread or to suppress at the discretion of the individual county agricultural commissioner but there is no state enforced action.

Halogeton (Halogeton glomeratus)

Halogeton is abundant and widespread on the western two-thirds of the project site south to the Old Spanish Trail Highway and corresponding 250-foot buffers. Halogeton

often grows in areas of disturbance such as burned-over areas, overgrazed areas, dry lakebeds, abandoned dry farms, along roads, and in places where the soil has been disturbed. It is tolerant of saline soils of colder semiarid regions, especially where native plant cover is thin. Halogeton competes poorly with established perennial vegetation. It is a prolific seed producer and seeds may remain viable in the soil for 10 years or longer. Seeds disperse with wind, water, human activities, seed-gathering ants, animals, and when dry plants break off at ground level and tumble with the wind. It is poisonous to livestock, especially sheep. Though common in Nevada, halogeton is not as widespread in California. CDFA (2012) has assigned it an “A” rating, meaning that eradication is a priority by the state. However, the site is infested over very large areas (at varying densities); containment may be the only realistic management approach.

African mustard (Malcolmia africana)

African mustard is abundant and widespread on the northern two-thirds of the project site, the corresponding 250-foot buffers, and along Old Spanish Trail Highway. It is currently widespread throughout the Southwest and is considered invasive in Nevada and Utah. African mustard can be effectively controlled with herbicide in priority areas. It is not currently rated by the state but because it has been recorded in only a few locations in California, this species should be eradicated if observed.

Mediterranean grass (Schismus arabicus)

Mediterranean grass was observed on the project site and on the 250-foot buffer. Cal-IPC has determined that this plant has a limited invasiveness rating in California (Cal-IPC 2006). BLM and other agencies recognize that because of the widespread distribution of Mediterranean grass, this species is not considered feasible to control.

Russian thistle (Salsola spp.)

Russian thistle, also known as tumbleweed, is more common in the northern half of the project and is abundant along the Old Spanish Trail Highway near the southern boundary of the site. They are strongly competitive in semiarid areas and are heavily favored by disturbance. Tumbleweeds disperse seed over long distances as they are carried along the ground by the wind. Frequently, new infestations appear as a "trail" of tumbleweed seedlings across fields. Skeletons also often collect along fencerows, and subsequent populations can become very dense. One of the keys to preventing spread of Russian thistle is controlling seedlings along both sides of fence rows and along field borders, where tumbleweed skeletons accumulate. Additionally, areas "downwind" of infested areas are most likely to be invaded. In many cases, it is impossible to prevent tumbleweed movement and sensitive areas should be monitored each year for new plants (CDFA 2012). It is a CDFA C-rated pest.

Tumble mustard (Sisymbrium altissimum)

Tumble mustard was mapped mainly in sandy soil in the eastern third of the site and the corresponding 250-foot buffer. Tumble mustard is more common in the Great Basin, but occurs in the Mojave Desert invading roadsides and overgrazed rangelands. It is not currently rated by the state and its impact to wildlands is unknown (CalIPC 2006).

London rocket (Sisymbrium irio)

London rocket is widespread throughout the warm deserts of North America. It was widely scattered throughout the project site and especially abundant along the Old Spanish Trail Highway. It matures earlier in the year than native species, allowing it to out-compete them. It is not currently rated by the state but Cal-IPC has declared this plant moderately invasive in wildlands (Cal-IPC 2006).

Mediterranean tamarisk or saltcedar (Tamarix ramosissima)

Salt cedar was observed near the project site to the south across Tecopa Road within the 250-foot buffer. It appears that the tamarisk has been planted near rural residences. It is a riparian plant and is therefore restricted to habitats where there is perennial saturation such as springs and seeps, or runoff from poorly maintained water pipelines or well pumps. Cal-IPC has declared this plant highly invasive (Cal-IPC 2006).

Filaree or storksbill (Erodium cicutarium)

Filaree is a widespread annual species common in disturbed habitats, and was detected at the project site and in the 250-foot buffer. It can form dense, transient populations when conditions are suitable. It has a limited overall rating by Cal-IPC, generally because the ecological impacts of the species are minor. Because of its widespread distribution, eradication of filaree is not considered feasible.

Other Invasive Weeds of Concern

The Inyo-Mono County Agricultural Commissioner expressed concern about the potential introduction of two additional species, camelthorn and Malta starthistle. Contaminated vehicles and equipment of employees and contractors coming from the Las Vegas area, where there are known infestations may act as a vector for the introduction of these species in the Pahrump Valley (Inyo 2012a). These highly invasive species are not currently documented on the project site.

Camelthorn (*Alhagi pseudalhagi*)

Camelthorn is a highly invasive perennial shrub that invades agricultural lands and riparian areas. Its strongly competitive and rapid aggressive growth allows it to out-compete both native vegetation and cultivated crops. It has been eliminated from all but four California counties due to eradication efforts but large infestations remain in arid parts of Nevada, Arizona, and Washington. In Arizona dense thickets have formed along the Colorado River in the Grand Canyon and along the Little Colorado River. It reproduces by seed and vegetatively by rhizomes that send up shoots and often spreads through contaminated hay, straw, and livestock. CDFA (2010) has assigned it an “A” rating, meaning that eradication is a priority. It was not found on the project but infestations are known from surrounding communities in southern Nevada (Inyo County 2012b).

Malta starthistle (*Centaurea melitensis*)

Malta starthistle was not found on the project but it is another concern and identified priority for eradication by the local agricultural commissioner. Similar to yellow starthistle (*Centaurea solstitialis*), it readily invades disturbed and open areas. Infestations of Malta starthistle displace native plants and animals, threatening natural ecosystems and

nature reserves. It has been documented to significantly reduce seed production in at least one endangered plant (Cal-IPC 2006). It is also toxic to horses. While Malta star-thistle is less invasive than yellow starthistle, it still spreads quickly by producing great quantities of seed that is easily carried on tires and it is often spread by contaminated straw (straw is commonly used on construction sites for erosion and sediment control).

COMMON WILDLIFE

The HHSEGS project is located in the Pahrump Valley within the eastern Mojave Desert. This area consists of a broad open valley supporting a mosaic of desert scrub communities that intergrade depending on the local topography, hydrology, and soil structure. Dry lakebeds, seeps, ephemeral drainages, and complexes of mesquite thickets and woodlands provide a range of conditions that support a complex assemblage of wildlife. The valley is bordered by a series of steep rocky mountain ranges which provide habitat for numerous reptiles, birds, and large mammals.

Habitat on the HHSEGs project site is utilized by a broad suite of common and sensitive wildlife. The distribution of wildlife on the site appears to be a function of the level of historic disturbance, soil type, and existing vegetative cover. Areas characterized by more intact native plant communities such as the northern and eastern portions of the site appear to support higher native species diversity.. More disturbed areas including graded roads, former staging areas along roads, the fallow orchard and other areas heavily colonized by weedy annuals provide lower habitat value and tend to support lower species diversity than otherwise intact native plant communities. Nevertheless, many areas with a moderate to high weed component still had good to excellent diversity in the shrub layer.

Invertebrates

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

Desert fairy shrimp are known from saline lakes in the region and various species of gastropods can be associated with desert seeps and springs. In arid climates, such as that found in the Mojave desert, fairy shrimp inhabit pools that may last from as little as three days to as long as four months, with much more variable levels of dissolved salts than found in pools in more humid climates (Brown and Carpelan 1971). It is possible that during periods of heavy or prolonged rainfall that small depressions, road ruts or gullies may support conditions that allow for the presence of common fairy shrimp. It is also likely that fairy shrimp occur in the dry lake west of the project site and that portions of the project are periodically inoculated with cysts inadvertently carried by mammals or

shorebirds. Therefore it is possible small pooled areas could support fairy shrimp during extremely wet years.

A review of existing literature did not find any comprehensive study describing the species of fairy shrimp expected to occur in the Pahrump Valley. However, approximately 23 species of fairy or brine shrimp are known to occur in California (Bauder et al. 1998) and five species are known from within 100 miles of the project site (Eriksen and Bell, 1999). These include, ranging from farthest to closest, the giant fairy shrimp (*Branchinecta gigas*), Colorado fairy shrimp (*B. coloradensis*), San Francisco brine shrimp (*Artemia franciscana*), versatile fairy shrimp (*B. lindahli*), and the alkali fairy shrimp (*B. mackini*). Tadpole fairy shrimp (*Lepidurus lemmoni*) are also known from Nevada and are common in playas across the great basin. None of these species have California or federal status. Based on the known distribution and habitat requirements of sensitive fairy shrimp; sensitive species are not likely to occur on or near the proposed project site. Native harvester ants (*Pogonomyrmex spp.*) were also detected on the project site and although not detected during surveys, the proximity to rural residents may increase the potential for the introduction of non-native Argentine ants (*Linepithema humile, formerly Iridomyrmex humile*). The introduced Argentine ant is abundant in urban and agricultural lands throughout much of California and invades into relatively mesic natural habitat such as along river courses and in some coastal lowlands (Ward 2005). Desert areas are likely more resilient to invasion due to the low levels of soil moisture that are occur in those locations.

During an August,28, 2012 staff workshop, Intervenor Center for Biological Diversity requested more information on special status butterflies be provided, and provided a reference website (Warren et al 2012). A review of this database indicated that three butterflies are known from the Pahrump Valley: silvery blue (*Glaucopsyche lygdamus deserticola*), small checkered-skipper (*Pyrgus scriptura apertorum*), and Mormon metalmark (*Apodemia mormo autumnalis*). None of these species have special status (CDFG 2011a).

Reptiles and Amphibians

The applicant observed a wide diversity of snakes on the project site. This included three species of rattlesnake; sidewinder (*Crotalus cerastes*), speckled rattlesnake (*C. mitchellii*) and northern Mojave rattlesnake (C*. scutulatus scutulatus*). Great basin gopher snake (*Pituophis catenifer ssp. deserticola*), coachwhip (*Masticophis flagellum ssp. flagellum*), and glossy snake (*Arizona elegans*) were also observed on the HHSEGS site. Although not observed on the project site it is possible that common desert amphibians are also present. Red spotted toad (*Anaxyrus punctatus*) is known from the Kingston Range and may occur in areas supporting ponded water and at Stump Spring. However, investigations of the site conducted by staff following extensive summer storms detected only small pools and road ruts that were often dry within 24 hours.

Mammals

Mammals were well represented on the HHSEGS project site and a variety of species were observed by the applicant. Vegetation on the project site such as the creosote bush scrub, shadscale scrub, and native annuals provide foraging and breeding habitat

for many mammalian species including pocket mouse (*Perognathus longimembris*), white-tailed antelope squirrel (*Ammospermophilus leucurus*), and Merriam's kangaroo rat (*Dipodomys merriami*). Desert cottontail (*Sylvilagus audubonii*) and black tailed jack rabbit (*Lepus californicus*) were observed by staff and the applicant across the project site. In addition, high burrow densities of Botta's gophers (*Thomomys bottae*) were noted along many of the access roads and within portions of the more disturbed vegetation communities. Small carnivores including desert kit fox (*Vulpes macrotis*), coyote (*Canis latrans*), and American badger (*Taxidea taxus*) also appear to commonly use the site. Numerous kit fox complexes were detected on the project site and badger sign was evident in many areas. Wide ranging carnivores such as bobcat (*Felis rufus*) may also use the site. Nelson's big horn sheep (*Ovis Canadensis nelsoni*) are known from the adjacent mountain ranges and likely cross the site during periodic intermountain movement events. The partial fragment of a horn was observed by the applicant during surveys of the project site.

A number of bats are known from desert regions and these species may periodically forage in and near the project area. The presence of stored trailers, vehicles, and other structures on lands east of the site may provide potential roost sites for bats. Standing water does not routinely occur on the project site which reduces the potential for many bats to actively forage in the area. However, due to the proximity of the project site to suitable habitat for foraging and roosting (e.g. Stump Spring ACEC and scattered mesquite thickets along the California-Nevada Stateline), the applicant was requested to install an Anabat station on the HHSEGS site. This technology records bat echolocation calls which are then interpreted by a skilled mammalogist. Data collection began December 21, 2011, and the applicant has committed to providing quarterly reports until December 2012. Preliminary data provided by the applicant indicate the site supports low level use by a variety of common and at least one sensitive bat species. Some of these species include the California myotis (*Myotis californicus*), big brown bat (*Eptesicus fuscus*), western pipistrelle (*Pipistrellus hesperus*), Mexican free-tailed bat (*Tadarida brasiliensis*), and pallid bat (*Antrozous pallidus*). Bat roosts were not detected on the HHSEGS project site but may occur in adjacent off-site areas including old trailers and structures.

Exotic Species

Cattle and sheep grazing are permitted activities within portions of the Pahrump Valley and the project site has been subject to historic grazing. The sign of domestic cattle (*Bos taurus*), sheep (*Ovis aries*), and free ranging burrow (*Equus asinus*) was present on the HHSEGS site. Because of the proximity to residential communities at Charleston View the HHSEGS site also likely experiences periodic use by domestic dogs (*Canis domesticus*).

Avian Species

The Pahrump Valley and Mojave Desert support a wide range of both resident and migratory bird species. The site is located within the Pacific Flyway, a very broad corridor stretching along the Pacific Coast from Mexico north to Alaska and into Siberia, Russia. The states of California and Nevada lie entirely within this large corridor (CDFG, accessed April 19, 2012). Bird use on the site includes resident breeding birds, periodic migrants, and wintering species. For some species of birds, including many large

raptors, the site does not support nesting habitat; however the abundance of small mammals and reptiles provide foraging opportunities for these species. Over 60 species of birds were identified by the applicant in AFC (HHSEGS 2011a).

There are a number of factors that affect the type and the distribution of birds that occur in any given area. Some of these include the type and composition of habitat, the time of year, existing levels of anthropogenic disturbance, and the projects proximity to areas that support high quality or important habitat types including areas mapped as important bird areas (IBAs). IBA's can yield further information on the migrants that would typically be expected to move over the site.

The HHSEGS project site is not located in an IBA. The closest IBA is the East Mojave Peak IBA, located approximately five and a half miles south of the project site in the Kingston Mountain range. Joshua tree woodlands and pinyon-juniper vegetation characterize the habitat in this IBA which support s various species such as Bendire's thrasher (*Toxostoma bendirei*), juniper titmouse (*Baeolophus ridgwayi*), and Scott's oriole (*Icterus parisorum*). Only the Bendire's thrasher was reported onsite, however the applicant believes the bird may have been misidentified (HHSEGS 2011a). The Shoshone-Tecopa IBA, associated with the Amargosa River and Grimshaw Lake are located approximately 18 miles from the project site and provides riparian woodlands, wetlands, and alkali marsh habitat. It also is home to a very rare population of endangered yellow-billed cuckoo (*Coccyzus americanus occidentialis*). The East Mojave Springs IBA is approximately 14 miles from the HHSEGS site, and Horsethief Springs, is a major attractant for all wildlife, including migratory birds. A complex of two other above-ground springs, the Piute and Cornfield Springs, provide rare riparian vegetation in what is otherwise arid desert habitat. Bell's vireo (*Vireo bellii*), crissal thrasher (*T. crissale*), least bittern (*Ixobrychus exilis*), northern harrier (*Circus cyaneus*), and snowy plover (*Charadrius nivosus*) use this area for foraging, breeding, and nesting.

The Stump Spring ACEC, other area springs, and the associated greater metapatch of mesquite thickets located in washes and on coppice dunes east of the project provide unique and important habitat to wildlife. The system of mesquite thickets along the state border in Nevada are believed to be crucially important to the greater desert ecosystem and over 30 species of migratory birds are known from these areas. One locally important species, phainopepla (*Phainopepla nitens*), forages on the berries of mistletoe, a hemi-parasitic species common to mesquite and other trees. Recently, phainopepla have been the focus of the Clark County, Nevada, Section 10 Multiple Species Habitat Conservation Plan. This plan contains regional management conservation strategies for a host of special-status plant and wildlife species.

A variety of resident and migratory birds have been detected on and adjacent to the site. Some of these include burrowing owl (*Athene cunicularia*), lesser nighthawk (*Chordeiles acutipennis*), horned lark (*Eremophila alpestris*), western meadowlark (*Sturnella neglecta*), and sage sparrow (*Amphispiza belli canescens*). Possible migrant or wintering Brewer's sparrow (*Spizella breweri*), chipping (*Spizella passerina*), and white crowned sparrows (*Zonotrichia leucophrys*) were also observed. Other species identified on the project site included LeConte's thrasher (*T. lecontei*), black-throated sparrow (*Amphispiza bilineata*), California quail (*Callipepla californica*), cactus wren

(*Campylorhynchus brunneicapillus*), northern mockingbird (*Mimus polyglottos*), Scott's oriole and purple martin. Raptors were well represented and were observed by applicant and staff. Common raptors included red-tailed hawk (*Buteo jamaicensis*), American kestrel (*Falco sparverius*), Cooper's hawk (*Accipiter cooperii*), and ferruginous hawk (*B. regalis*). Golden eagles (*Aquila chrysaetos*) were detected in flight above the site and in adjacent areas. Golden eagles were also noted perching in areas adjacent to the proposed project.

SPECIAL-STATUS PLANT AND WILDLIFE SPECIES

Pre-field research conducted by the applicant to assess the potential presence for special-status plants and animals included a review of literature, databases, and other sources of biological resource information. These include the California Natural Diversity Database (CNDDB 2012), California Native Plant Society (CNPS) *Online Inventory of Rare and Endangered Plants of California* (CNPS 2012), Consortium of California Herbaria (CCH 2012), and the U.C. Riverside Herbarium. Staff independently reviewed the databases and herbarium records, and consulted recognized experts in the rare plant flora of the project vicinity (Silverman pers. comm.; Bagley pers. comm.).

Surveys for special-status plants were consistent with recommended guidelines for botanical surveys of the California Department of Fish and Game (CDFG 2009), the U.S. Fish and Wildlife Service (USFWS 1996), and the California Native Plant Society (CNPS 2001). They were floristic in nature; i.e., all plants encountered were identified to a level necessary for detecting special-status species, if present. Special-status plant surveys of the project site were conducted over a three-year period that included a normal rainfall season and a dry season. Surveys onsite, including a 250-foot buffer around the site, were conducted in spring and fall (spring 2010 and 2011; fall 2010 and 2011). A one-mile buffer surrounding the site was surveyed at a reconnaissance-level in spring 2011.

Because the area is generally under-surveyed, the applicant also conducted extensive offsite surveys to determine if special-status plants were more common than previously understood. Offsite surveys were conducted in several locations in California and Nevada during the spring of 2011 and 2012. Cacti occur in very low numbers in the project area, and no individuals of any species of Yucca are present; thus, cacti and stem succulents were not mapped.

"Special-Status Species" is a universal term used in the scientific community for species that are considered sufficiently rare that they require special consideration and/or protection and should be, or have been, listed as rare, threatened or endangered by the Federal and/or State governments. The applicant has objected to the use of the term, which it dismissed as a "non-legal colloquialism sometimes assigned by other parties".

Special-status Plant Species Definition

In *Protocols for Surveying and Evaluating Impacts to Special-Status Native Plant Populations and Natural Communities* (CDFG 2009), CDFG defines "special-status plant species" to include all plant species that meet one or more of the following criteria:

- Listed or proposed for listing as threatened or endangered under ESA or candidates for possible future listing as threatened or endangered under the ESA (50 CFR §17.12);

- Listed or candidates for listing by the State of California as threatened or endangered under CESA (Fish and Game Code §2050 et seq.). A species, subspecies, or variety of plant is endangered when the prospects of its survival and reproduction in the wild are in immediate jeopardy from one or more causes, including loss of habitat, change in habitat, over-exploitation, predation, competition, disease, or other factors (Fish and Game Code §2062). A plant is threatened when it is likely to become endangered in the foreseeable future in the absence of special protection and management measures (Fish and Game Code §2067);
- Listed as rare under the California Native Plant Protection Act (Fish and Game Code §1900 et seq.). A plant is rare when, although not presently threatened with extinction, the species, subspecies, or variety is found in such small numbers throughout its range that it may be endangered if its environment worsens (Fish and Game Code §1901);
- Meet the definition of rare or endangered under CEQA §15380(b) and (d). Species that may meet the definition of rare or endangered include the following:
    - Species considered by the California Native Plant Society (CNPS) to be "rare, threatened or endangered in California" (Lists 1A, 1B and 2);
    - Species that may warrant consideration on the basis of local significance or recent biological information;
    - Some species included on the California Natural Diversity Database's (CNDDB) Special Plants, Bryophytes, and Lichens List (California Department of Fish and Game 2008);
    - Considered a locally significant species, that is, a species that is not rare from a statewide perspective but is rare or uncommon in a local context such as within a county or region (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 a species occurring on an uncommon soil type.

The term "Special-Status Plants" is also used by BLM in their botanical survey guidelines (BLM 2009b). The BLM guidelines and definitions are also contained in the Energy Commission document Best Management Practices & Guidance Manual: Desert Renewable Energy Projects (CEC 2009).

Biological Resources Table 3 identifies the special-status plant species that were reported to occur, or potentially occur within ten miles of the proposed project area, based on surveys of the proposed project area and vicinity, and searches of the California Natural Diversity Database (CNDDB) and California Native Plant Society's (CNPS) Inventory of Rare and Endangered Plants. The table also includes species identified in public comments as having at least low potential to occur based on the presence of general habitat preferences or known distribution in the region; and species not contained in **Biological Resources Table 3** of the PSA (Basin & Range 2012x).

Biological Resources Table 3
Special-status Plant Species Known to Occur or Potentially Occurring in the HHSEGS Project Area

Common Name	***Scientific Name***	**Status[1]** **State/Fed/CRPR/CNDDB/BLM**
Mormon needle grass	*Achnatherum aridum*	__/__/2.3/S2?
Ivory-spined agave	*Agave utahensis* var. *eborispina*	__/__/1B.3/S2/S
Clark Mountain agave	*Agave utahensis* var. *nevadensis*	__/__/4.2/S3.2
Desert ageratina	*Ageratina herbacea*	__/__/2.3/S2

Smallest aliciella	*Aliciella humillima*	__/__/Proposed/__
Ripley's aliciella	*Aliciella ripleyi*	__/__/2.3/S2
Coyote gilia	*Aliciella triodon*	__/__/2.2/S2
Inyo onion	*Allium atrorubens* var. *cristatum*	__/__/4.3/S2
Nevada onion	*Allium nevadense*	__/__/2.3/S2
Small-flowered androstephium	*Androstephium breviflorum*	__/__/2.2/S2S3
White bear poppy	*Arctomecon merriamii*	__/__/2.2/S2.2
Mojave milkweed	*Asclepias nytaginifolia*	__/__/2.1/S2
Geyer's milk-vetch	*Astragalus geyeri* var. *geyeri*	__/__/2.2/S2
Borrego milk-vetch	*Astragalus lentiginosus* var. *borreganus*	__/__/4.3/S3.3
Curved-pod milk-vetch	*Astragalus mohavensis var. hemigyrus*	__/__/1B.1/S1
Providence Mountain milk-vetch	*Astragalus nutans*	__/__/4.3/S3.3
Nye milk-vetch	*Astragalus nyensis*	__/__/1B.1/S1
Preuss' milk-vetch	*Astragalus preussii* var. *preussii*	__/__/2.3/S1
Gravel milk-vetch	*Astragalus sabulonum*	__/__/2.2/S2
Tidestrom's milk-vetch	*Astragalus tidestromii*	__/__/2.2/S2
Scaly cloak fern	*Astrolepis cochisensis* ssp*. cochisensis*	__/__/2.3/S2.3
Pahrump silverscale	*Atriplex argentea* var. *longirichoma*	__/__/1B.1/S2/S
Three-awned gramma	*Bouteloua trifida*	__/__/2.3/S2?
Pine Creek evening-primrose	*Camissonia boothii* ssp *alyssoides*	__/__/4.3/S3.3
Booth's evening-primrose	*Camissonia boothii* ssp *boothii*	__/__/2.3/S2
Booth's hairy evening-primrose	*Camissonia boothii* ssp. *intermedia*	__/__/2.3/S2.3
Wheeler's skeleton weed	*Chaetadelpha wheeleri*	__/__/2.2/S2
Parry's spurge	*Chamaesyce parryi*	__/__/2.3/S1.3
California sawgrass	*Cladium californicum*	__/__/2.2/S2.2
Small-flowered bird's-beak	*Cordylanthus parviflorus*	__/__/2.3/S1S2
Tecopa bird's-beak	*Cordylanthus tecopensis*	__/__/1B.2/S1.2/S
Desert pincushion	*Coryphantha chlorantha*	__/__/2.1/S2
Hall's meadow hawksbeard	*Crepis runcinata* ssp. *hallii*	__/__/2.1/S1S2
Ribbed cryptantha	*Cryptantha costata*	__/__/4.3/S3.3
Las Vegas cryptantha	*Cryptantha insolita*	__/__/Proposed?
Gilman's cymopterus	*Cymopterus gilmanii*	__/__/2.3/S2.2
Purple-nerve spring parsley	*Cymopterus multinervatus*	__/__/2.2/S2
Panamint daisy	*Enceliopsis covillei*	__/__/1B.2/S2?/S
Ash Meadows daisy	*Enceliopsis nudicaulis* var*. corrugata*	__/**FT**/3.3/S1/S
Torrey's joint-fir	*Ephedra torreyana*	__/__/2.1/S1
Harwood's eriastrum	*Eriastrum harwoodii*	__/__/1B.2/S3/S
White-flowered rabbitbrush	*Ericameria albida*	__/__/4.2/S3.2
Narrow-leaved yerba santa	*Eriodictyon angustifolium*	__/__/2.3/S2?
Pahrump Valley buckwheat	*Eriogonum bifurcatum*	__/__/1B.2/S3/S

Reveal's buckwheat	*Eriogonum contiguum*	__/__/2.3/S2/S
Robust Hoffmann's buckwheat	*Eriogonum hoffmannii* var. *robustius*	__/__/1B.3/S2.3
Juniper sulphur-flowered buckwheat	*Eriogonum umbellatum* var. *juniporinum*	__/__/2.3/S1S2
Hairy erioneuron	*Erioneuron pilosum*	__/__/2.3S2S3
Copperwort	*Euphrosyne acerosa* (syn=*Iva acerosa*)	__/__/4.2/S3.2
Hot springs fimbristylis	*Fimbristylis thermalis*	__/__/2.2/S2.2
Kingston Mountains bedstraw	*Galium hilendiae* ssp. *kingstonense*	__/__/1B.3/S2.3/S
Desert bedstraw	*Galium proliferum*	__/__/2.2/S2
Golden-carpet gilmania	*Gilmania luteola*	__/__/1B.3/S2
Ash Meadows gumplant	*Grindelia fraxinipratensis*	__/**FT**/1B.2/S2/S
Prickle-leaf	*Hecastocleis shockleyi*	__/__/3/S3S4
Kingston Mountains ivesia	*Ivesia patellifera*	__/__/1B.3/S1.3/S
Cooper's rush	*Juncus cooperi*	__/__/4.3/S3.3
Depressed standing-cypress	*Loeseliastrum depressum*	__/__/4.3/S3?
Inyo blazing star	*Mentzelia inyoensis*	__/__/1B.3/S2.3/S
Wing-seed blazing star	*Mentzelia pterosperma*	__/__/2.2/S1.2
Spiny-hair blazing star	*Mentzelia tricuspis*	__/__/2.1/S2
Red four-o'clock	*Mirabilis coccinea*	__/__/2.3/S2
Utah mortonia	*Mortonia utahensis*	__/__/4.3/S3
crowned muilla	*Muilla coronata*	__/__/4.2/S3.2?
Amargosa nitrophila	*Nitrophila mohavensis*	**SE**/**FE**/1B.1/S1/S
Cave evening-primrose	*Oenothera cavernae*	__/__/2.1/S1
Beaver dam breadroot	*Pediomelum castoreum*	__/__/1B.2/S2
Spiny cliff-brake	*Pellaea truncata*	__/__/2.3/S2
Two-color beardtongue	*Penstemon bicolor* ssp. *bicolor*	__/__/Proposed?
Rosy two-toned beardtongue	*Penstemon bicolor* ssp. *roseus*	__/__/1B.1/S1
Armagosa beardtongue	*Penstemon fruticiformis* var. *amargosae*	__/__/1B.3/S2.3/S
Stephen's beardtongue	*Penstemon stephensii*	__/__/1B.3/S2/S
Utah beardtongue	*Penstemon utahensis*	__/__/2.3/S2
Desert rock daisy	*Perityle megalocephala* var. *intricata*	__/__/CBR
Death valley sandpaper plant	*Petalonyx thurberi ssp. gilmanii*	__/__/1B.3/S2.3
Spine-noded milk-vetch	*Peteria thompsoniae*	__/__/2.3/S1.3?
Sky-blue phacelia	*Phacelia coerulea*	__/__/2.3/S1.3
Clarke phacelia	*Phacelia filiae*	__/__/Proposed?
Death Valley round-leaved phacelia	*Phacelia mustelina*	__/__/1B.3/S1.3/S
Parish's phacelia	*Phacelia parishii*	__/__/1B.1/S1/S
Goodding's phacelia	*Phacelia pulchella* var. *gooddingii*	__/__/2.3/S2
Lobed ground-cherry	*Physalis lobata*	__/__/2.3/S1.3?
Desert popcorn-flower	*Plagiobothrys salsus*	__/__/2.2/S1.2?
Notch-beaked milkwort	*Polygala heterorhyncha*	__/__/S1.3?
Death Valley sage	*Salvia funerea*	__/__/4.3/S3.3
Johnson's bee-hive cactus	*Sclerocactus johnsonii*	__/__/2.2/S2.2

Desert wing-fruit	*Selinocarpus nevadensis* *(syn.= Acleisanthes nevadensis)*	__/__/2.3/S1
Desert winged-rockcress	*Sibara deserti*	__/__/4.3/S3.3
Rusby's desert-mallow	*Sphaeralcea rusbyi* var. *eremicola*	__/__/1B.2/S2/S
Small-flowered rice grass	*Stipa divaricata* (syn=*Piptatherum micranthum*)	__/__/2.3/S2S3
Small-flowered sand-verbena	*Tripterocalyx micranthus*	__/__/2.3/S1.3
Plummer's woodsia	*Woodsia plummerae*	__/__/2.3/S1.3?

Status Codes: [1]

Federal: **FE** = Federally listed endangered: species in danger of extinction throughout a significant portion of its range
FT = Federally listed, threatened: species likely to become endangered within the foreseeable future

State **SE** = State listed as endangered: native species or subspecies in serious danger of becoming extinct throughout all, or a significant portion, of its range due to one or more causes, including loss of habitat, change in habitat, over-exploitation, predation, competition, or disease.
ST = State listed as threatened: native species or subspecies that, although not presently threatened with extinction, is likely to become an endangered species in the foreseeable future in the absence of the special protection and management efforts required by this chapter.
SC = State Candidate: that the commission has formally noticed as being under review by the department for addition to either the list of endangered species or the list of threatened species, or a species for which the commission has published a notice of proposed regulation to add the species to either list.
SR = State listed Rare: although not presently threatened with extinction, it is in such small numbers throughout its range that it may become endangered if its present environment worsens.

California Rare Plant Rank (CRPR)(formerly CNPS List)
In March, 2010, DFG changed the name of "CNPS List" or "CNPS Ranks" to "California Rare Plant Rank" (or CRPR). This was done to reduce confusion over the fact that CNPS and DFG jointly manage the Rare Plant Status Review groups (300+ botanical experts from government, academia, NGOs and the private sector) and that the rank assignments are the product of a collaborative effort and not solely a CNPS assignment. The old name gave the false impression that CNPS solely assigned the ranks and had excessive influence on the regulatory process. We did this in consultation and agreement with the CNPS Executive Director and the CNPS Board of Directors. Nothing about the actual process of rare plant review or rank assignment has changed and the same committee of experts from many organizations in addition to DFG and CNPS still review each change and ultimately assign the ranks.

1B = Rare, threatened, or endangered in California and elsewhere
2 = Rare, threatened, or endangered in California but more common elsewhere
3 = Plants which need more information
4 = Limited distribution – a watch list
CBR = Considered But Rejected
0.1 = Seriously threatened in California (high degree/immediacy of threat)
0.2 = Fairly threatened in California (moderate degree/immediacy of threat)
0.3 = Not very threatened in California (low degree/immediacy of threats or no current threats known)

CNDDB Element Rank (NatureServe State Rank)
The state rank (S-rank) is assigned much the same way as the global rank, but state ranks refer to the imperilment status only within California's state boundaries.

S1 = Critically Imperiled—Critically imperiled in the state because of extreme rarity (often 5 or fewer occurrences) or because of some factor(s) such as very steep declines making it especially vulnerable to extirpation from the state/province.
S2 = Imperiled—Imperiled in the state because of rarity due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors making it very vulnerable to extirpation from the nation or state/province.
S3 = Vulnerable—Vulnerable in the state due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors making it vulnerable to extirpation.
S4 = Apparently Secure—Uncommon but not rare; some cause for long-term concern due to declines or other factors.
S5 = Secure—Common, widespread, and abundant in the state.

Bureau of Land Management (BLM)
S = BLM Sensitive; Species requiring special management consideration to promote their conservation and reduce the likelihood and need for future listing under the ESA. BLM Sensitive species also include all Federal Candidate species and Federal Delisted species which were so designated within the last 5 years and CNPS List 1B plant species that occur on BLM lands.

Special-status Wildlife Species Definition

From the CDFG Special Animals List (CNDDB 2011) "*Special Animals"* is defined as a general term that refers to all of the taxa the CNDDB is interested in tracking, regardless of their legal or protection status. This list is also referred to as the list of "species at risk" or "special-status species". The Department of Fish and Game considers the taxa

on this list to be those of greatest conservation need. The species on this list generally fall into one or more of the following categories:

- Officially listed or proposed for listing under the State and/or Federal Endangered Species Acts;
- State or Federal candidate for possible listing;
- Taxa which meet the criteria for listing, even if not currently included on any list, as described in Section 15380 of the California Environmental Quality Act Guidelines. (More information on CEQA is available at http://ceres.ca.gov/topic/env_law/ceqa/guidelines/;
- Taxa considered by the Department to be a Species of Special Concern (SSC);
- Taxa that are biologically rare, very restricted in distribution, declining throughout their range, or have a critical, vulnerable stage in their life cycle that warrants monitoring. There may be taxa that fall into this category but are not included on this list because their status has not been called to our attention;
- Populations in California that may be on the periphery of a taxon's range, but are threatened with extirpation in California;
- Taxa closely associated with a habitat that is declining in California at an alarming rate (e.g., wetlands, riparian, old growth forests, desert aquatic systems, native grasslands, vernal pools, etc.);
- Taxa designated as a special-status, sensitive, or declining species by other state or federal agencies, or non-governmental organization (NGO).

Biological Resources Table 4 identifies the special-status wildlife that were reported to occur, or potentially occur within ten miles of the proposed project area, based on surveys, and searches of the California Natural Diversity Database (CNDDB 2012).

Biological Resources Table 4
Special-status Wildlife Known to Occur
or Potentially Occurring in the HHSEGS Area

Common Name	*Scientific Name*	Status[1] State/Fed/BLM
Insects		
Death Valley Agabus diving Beetle	*Agabus rumppi*	C2/__/__
Death Valley June beetle	*Polyphylla erratica*	SC/__/__
Amargosa naucorid bug	*Pelocoris shoshone*	SC/__/__
Carole's silverspot	*Speyeria zerene carolae*	FE/__/__
Fish		
Amargosa pupfish	*Cyprinodon nevadensis amargosae*	CSC __/ S/__
Pahrump poolfish	*Empetrichthys latos latos*	/_ FE _/__
Amargosa Canyon speckled dace	*Rhinichthys osculus ssp. 1*	__/CSC/__
Reptiles		
Desert tortoise	*Gopherus agassizii*	ST/FT/__
Banded Gila monster	*Heloderma suspectum cinctum*	__/SC/S
Birds		
Purple martin	*Progne subis*	CSC/__/__

Prairie falcon	*Falco mexicanus*	WL/_/CSC
Northern Harrier	*Circus cyaneus*	__/CSC/__
Western Burrowing owl	*Athene cunicularia hypugaea*	CSC/FSC/__
Short-eared owl	*Asio flammeus*	CSC/__/__
Golden eagle	*Aquila chrysaetos*	FP/BCC/__
Northern harrier	*Circus cyaneus*	CSC /__/__
Vaux's swift	*Chaetura vauxi*	CSC/__/__
Western yellow-billed cuckoo	*Coccyzus americanus occidentialis*	FPE/SE/__
Prairie falcon	*Falco mexicanus*	WL//SC
Gray-headed junco	*Junco hyemalis caniceps*	WL/FSC/__
Loggerhead shrike	*Lanius ludovicianus*	CSC/FSC/__
Brown-crested flycatcher	*Myiarchus tyrannulus*	__/CSC/__
Phainopepla	*Phainopepla nitens*	__/__/
Hepatic tanager	*Piranga flava*	WL/__/__
Summer tanager	*Piranga rubra*	CSC/__/__
Vermilion flycatcher	*Pyrocephalus rubinus*	CSC/__/
Brewer's sparrow	*Spizella breweri*	__/BCC/__
Bendire's thrasher	*Toxostoma bendirei*	CSC/BCC/S
Crissal thrasher	*Toxostoma crissale*	CSC/BCC/__
Le Conte's thrasher	*Toxostoma lecontei*	WL/BCC/S
Virginia's warbler	*Vermivora virginiae*	WL/BCC/__
Least Bell's vireo	*Vireo bellii pusillus*	FE**/SE/__
Gray vireo	*Vireo vicinior*	CSC/BCC/S
Mammals		
Townsend's big-eared bat	*Corynorhinus townsendii*	CSC/__/S
Pallid bat	*Antrozous pallidus*	CSC/__/S
Long-legged myotis	*Myotis volans*	CSC/__/__
Mexican free-tailed bat	*Tadarida brasiliensis*	CSC/__/__
California myotis	*Myotis californicus*	__/__/__
Big brown bat	*Eptesicus fuscus*	__/__/__
Western pipistrelle=Parastrelle	*Parastrellus hesperus*	__/__/__
Western small-footed myotis	*Myotis ciliolabrum*	__/__/S
Amargosa vole	*Microtus californicus scirpensis*	FE/SE/_
Kingston Mountain chipmunk	*Neotamias panamintinus acrus*	__/__/S
Nelson's bighorn sheep	*Ovis canadensis nelsoni*	__/__/S
American badger	*Taxidea taxus*	CSC/__/__
Kit fox	*Vulpes macrotis*	FM/__/__

Status Codes:

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

State CSC = California Species of Special Concern. Species of concern to CDFG because of declining population levels, limited ranges, and/or continuing threats have made them vulnerable to extinction.
SE - State listed as endangered
ST = State listed as threatened

WL = State watch list
FM: Protected furbearing mammal

BLM: Sensitive: Bureau of Land Management

BLM Manual §6840 defines sensitive species as"…those species that are (1) under status review by the FWS/NMFS; or (2) whose numbers are declining so rapidly that Federal listing may become necessary, or (3) with typically small and widely dispersed populations; or (4) those inhabiting ecological refugia or other specialized or unique habitats." www.blm.gov/ca/pdfs/pa_pdfs/biology_pdfs/SensitiveAnimals.pdf

Special-status Plants

No state or federally listed plant species occur within the project area, but 11 special-status plant species were found onsite that have a California Rare Plant Rank (CRPR, formerly CNPS List) of 1B or 2. The ranks are assigned under a collaborative effort between CDFG, CNPS, and the Rare Plant Status Review groups.

Plants with a California Rare Plant Rank of 1B are rare throughout their range with the majority of them endemic to California. Most of the plants that are ranked 1B have declined significantly over the last century.

Except for being common beyond the boundaries of California, plants with a California Rare Plant Rank of 2 would have been ranked 1B. From the federal perspective, plants common in other states or countries are not eligible for consideration under the provisions of the Endangered Species Act. Until 1979, a similar policy was followed in California. However, after the passage of the Native Plant Protection Act in 1979, plants were considered for protection without regard to their distribution outside the state.

From the *Inventory of Rare and Endangered Plants of California* (CNPS 2012)

> "With California Rare Plant Rank 2, we recognize the importance of protecting the geographic range of widespread species. In this way we protect the diversity of our own state's flora and help maintain evolutionary processes and genetic diversity within species. All of the plants constituting California Rare Plant Rank 2 meet the definitions of Sec. 1901, Chapter 10 (Native Plant Protection Act) or Secs. 2062 and 2067 (California Endangered Species Act) of the California Department of Fish and Game Code, and are eligible for state listing. It is mandatory that they be fully considered during preparation of environmental documents relating to CEQA."

The applicant conducted extensive offsite surveys to determine if the special-status plants found onsite were more common than previously known; the area is generally under-surveyed and several species had only recently been added to the California Natural Diversity Database (CNDDB 2012) and the California Native Plant Society *Inventory of Rare and Endangered Plants of California* (CNPS 2012). The effort included surveys in the following areas: Pahrump Valley, Stewart Valley, Chicago Valley, California Valley, the Ash Meadows area, Shadow Valley (north and south of I-15), Mesquite Valley, Mesquite Mountains, southern Nopah Range, Kingston Wash, Silurian Valley, Salt Spring Hills, Dumont Dunes area, and the Shoshone- Tecopa area. Many additional previously undocumented occurrences were found of several species, particularly the Pahrump valley buckwheat; however, no or few new occurrences were found for most of the 11 species.

The status, distribution, range and habitat preferences of the special-status plant species found onsite are described below. The CNDDB Element Rank (formerly NatureServe rank) is also provided in the species accounts below. The CNDDB Element Rank is an index of extinction risk within the state based on an internationally recognized methodology (Master et al. 2009). The numeric rank reflects several factors of rarity, threats, and population trend, which are scored and weighted, and include: range & extent; area of occupancy; population size; number of occurrences; number of occurrences or percent area with good viability/ecological integrity; environmental specificity; long- and short-term trend; threats (severity, scope, impact, and timing); intrinsic vulnerability, and other considerations (*ibid.*).

The rank definitions are provided below, as summarized in CDFGs *Special Plants List* (CNDDB 2012b).

> **S1** = *Critically Imperiled* — Critically imperiled in the state because of extreme rarity (often 5 or fewer occurrences) or because of some factor(s) such as very steep declines making it especially vulnerable to extirpation from the state/province;
>
> **S2** = *Imperiled* — Imperiled in the state because of rarity due to very restricted range, very few populations(often 20 or fewer), steep declines, or other factors making it very vulnerable to extirpation from the nation or state/province;
>
> **S3** = *Vulnerable* — Vulnerable in the state due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors making it vulnerable to extirpation;
>
> **S4** = *Apparently Secure* — Uncommon but not rare; some cause for long-term concern due to declines or other factors;
>
> **S5** = *Secure* — Common, widespread, and abundant in the state.

CNDDB re-assessed and updated all the Element Ranks for each of the 11 species to reflect all new occurrence data, including new occurrences found by the applicant during the spring 2012 surveys.

Small-flowered androstephium (*Androstephium breviflorum)*

Small-flowered androstephium is a perennial herb (bulb) with a California distribution represented by over 100 occurrences in Riverside and San Bernardino counties. Due to the project's survey efforts, it is now also documented in Inyo County. It has been on the CNPS Inventory since 1974 and has a CRPR rank of 2, meaning it is rare, threatened, or endangered in California but more common outside California. It has a CNDDB Element Rank of S2S3, meaning the numeric rank is somewhere between an S2 and S3 rank (see definitions above).

Small-flowered androstephium also occurs in Arizona, Nevada, Utah, Wyoming, Colorado, and New Mexico. It blooms March to April in dry, loose sandy to rocky soils and on sand dunes and alluvial fans from about 700 to 4,800 feet elevation.

This species was mapped along the eastern half of the project site and in the 250-foot buffer along the California-Nevada border in Mojave Desert scrub habitat. The applicant

also found new occurrences offsite in southern Pahrump Valley and California Valley. Many new occurrences have been found in recent years and the project area includes only a very small portion of its total distribution in California. Some occurrences are threatened by solar energy development (CNPS 2012).

During the spring 2012 offsite surveys suitable habitat was found and surveyed but no additional occurrences of small-flowered androstephium were found.

Nye milk-vetch (*Astragalus nyensis)*

Nye milk-vetch was not known to occur in California until it was discovered onsite during the project surveys. During the 2011 offsite surveys, additional new occurrences were found offsite in southern and central Pahrump Valley, and a single individual found in Stewart Valley. Four new occurrences were found in Nevada. Larger occurrences were found north and south of the site. A total of 19 occurrences are now documented in California, one of which occurs on the project site.

Nye milk-vetch was added to the CNPS Inventory in December 2011. It has a CNDDB Element Rank of S1 and a CRPR Rank of 1B.1. In Nevada, this annual species occurs in the foothills of desert mountains on calcareous outwash fans and gravelly flats, sometimes in sandy soils or alkaline soils from 1,500 to 5,600 feet elevation. According to the Nevada Natural Heritage Program (NNHP 2010a), there are documented occurrences of Nye milk-vetch in Nye, Clark, and Lincoln counties, Nevada. Nye milk-vetch also occurs in Utah. In the project area, it was mapped in Mojave Desert scrub along the eastern half of the project site in the 250-foot buffer paralleling the California-Nevada border, and at several locations along the transmission line corridor in Nevada that would serve the project.

During spring 2012 offsite surveys, no additional occurrences of Nye milk-vetch were found; however, the applicant noted precipitation was well below normal for the season.

Preuss' milk-vetch (*Astragalus preussii* var. *preussii)*

Preuss' milk-vetch is a perennial herb now known from seven occurrences in Inyo and San Bernardino counties, two of which occur on the project site. There are two additional historic collections, including one in Panamint Valley that has not been observed since 1937. Preuss' milk-vetch is a CRPR List 2.3; it was added to the CNPS Inventory in 1988. Prior to the project surveys, it was known in California from only three locations: the Mesquite Lake and Mesquite Valley areas in San Bernardino County, and northwest of Panamint Valley in Inyo County (CCH 2012).Seven individuals were mapped on the project site during 2011 surveys and two additional localities of Preuss' milk-vetch, each consisting of a few plants, were found onsite near the eastern site boundary during 2012 surveys.

During the 2011 offsite surveys, Preuss' milk-vetch was found in several new locations in Inyo County and along the transmission line corridor in Nevada. In addition, during spring 2012 offsite surveys, one new occurrences of Preuss' milk-vetch was mapped in Mesquite Valley, representing approximately 20,000 plants. A new, but considerably smaller occurrence was mapped in Pahrump Valley. Preuss' milk-vetch also occurs in Arizona and Utah (CNPS 2012).

Preuss' milk-vetch grows in openings in shadscale scrub or Mojave Desert scrub, often in clayey or silty soils, between 2,460 to 2,560 feet elevation. Based on observations of *Astragalus* spp. fruits on the windward side of shrubs, the inflated, papery fruits of some *Astragalus* species may likely be dispersed by wind and also moved in washes when they are flowing.

Gravel milk-vetch (*Astragalus sabulonum)*

Gravel milk-vetch is an annual to short-lived perennial herb that blooms February to June in the eastern Mojave and Sonoran Deserts. Its range in California is restricted to Imperial, Riverside, San Diego, and Inyo counties. No new occurrences were found in Nevada during the surveys of the transmission alignment. In Arizona, Nevada, New Mexico, Utah, and Sonora, Mexico it is reported to also grow as a perennial, and occur in different habitats (Silverman pers. comm. 2012); in California it grows as an annual. It is most often found on sandy sites from 200 to 3,050 feet elevation. Gravel milk-vetch was mapped in Mojave scrub habitat near the center of the project site and along the southeastern portion as well as the 250-foot buffer paralleling the California-Nevada border. Offsite, it was also found in southern Pahrump Valley.

Gravel milk-vetch has a CNDDB Element Rank of S2, and a CRPR Rank of 2.2. It did not have conservation status at the time that the 2011 HHSEGS site survey, the offsite surveys, and the transmission corridor surveys were conducted; consequently, there were no focused surveys for the species in the earlier surveys. It was detected because the surveys were floristic; all species were identified to a level necessary to detect new or rare species, if present. Gravel milk-vetch was added to the CNPS Inventory in October 2011. It is now documented in California from eight recent occurrences, including four on the project site and one extirpated occurrence in the Coachella Valley. There are 11 additional historic occurrences in Calexico, Blythe, the Salton Sea basin, and Coachella Valley that have not been observed within the last 20 years.

No additional occurrences of gravel milk-vetch were found during the spring 2012 offsite surveys.

Tidestrom's milk-vetch (*Astragalus tidestromii)*

Tidestrom's milk-vetch is a perennial herb that blooms April to July on gravelly limestone slopes from 1,968 to 5,200 feet elevation in the San Bernardino, Clark, Kingston, and Ivanpah mountains of San Bernardino County. It has also been found in sandy washes and sandy-silty substrates in valley bottoms in Mojave Desert scrub. Tidestrom's milk-vetch has a CNDDB Element Rank of S2, and a CRPR Rank of 2.2. It also occurs in the Spring Mountains and other locations in Nevada. On the project site, it occurs predominantly in Mojave Desert scrub on the eastern half of the project site and in the adjacent 250-foot buffer paralleling the California-Nevada border.

During the 2011 project surveys, several new occurrences were found in Inyo County and along Tecopa Road in the project's proposed transmission corridor in Nevada. The applicant reports that it can be locally common on roadsides and grows along unpaved, infrequently used roads. Offsite surveys in 2012 mapped approximately 10 new localities of Tidestrom's milk-vetch in Shadow Valley, the Mesquite Mountains, and other locations. It was also found in southern and central Pahrump Valley and California

Valley. It can be misidentified with *Astragalus layneae*; many of the UC Riverside specimens for Layne's milk-vetch were misidentified specimens of Tidestrom's milk-vetch (HHSEGS 2011a, Appendix 5-2G), to which it resembles but differs in several fruit characters. A specimen of *Astragalus layneae* collected in 1991 on Santa Rosa Flat in Inyo County by Mary DeDecker (UCR141695) was recently annotated to *Astragalus tidestromii* by the U.C. Riverside herbarium Director (Andrew Sanders) (Consortium of California Herbaria 2012). This occurrence is distant from others known in Inyo County, and it may constitute an additional new CNDDB occurrence.

It was added to the CNPS Inventory in January 2009 and now has 59 documented occurrences, including two on the project site, and eight historical occurrences that have not been observed in 20 years or more. It is reported to be threatened by solar energy development, mining, road maintenance, and non-native plants (CNPS 2012).

Wheeler's skeletonweed (*Chaetadelpha wheeleri*)

Wheeler's skeletonweed is a perennial herb with a California range represented by 28 documented occurrences in Inyo, Lassen, and Mono Counties, five of which occur on the project site. Seven additional historic collections are documented in Eureka Valley, the foothills of the White Mountains, and Benton and Chalfant valleys in Mono County. Wheeler's skeletonweed has a CRPR Rank of 2.2; it also occurs in Nevada and Oregon. It has a CNDDB Element Rank of S1S2, meaning the numeric rank calculated somewhere between an S1 and S2 rank (see rank definitions in the introduction to this subsection).

Wheeler's skeletonweed occurs in sandy soils on desert dunes, Mojave Desert scrub, and Great Basin scrub from 2,788 to 6,234 feet elevation. Seeds are of Aster family species are ordinarily dispersed intact with the fruiting body (cypsela). Wind dispersal is common (anemochory), assisted by a hairy pappus. Another common dispersal agent is epizoochory, in which the dispersal unit sticks to the fur or plumage of an animal by hooks or barbs.

Wheeler's skeletonweed was added to the CNPS Inventory in January 2001. Prior to the project surveys, it was known in California mainly from the Death Valley region, and the nearest known occurrence to the project site was approximately 50 miles north (CCH 2012).

During 2011 surveys, Wheeler's skeletonweed was found in sandy-gravelly soils in Mojave Desert scrub in the eastern portion of the site, and within the 250-foot buffer. Wheeler's skeletonweed was also found in several locations within the project's proposed offsite transmission line corridor. During offsite surveys conducted in 2011 for this project, Wheeler's skeletonweed was found in several additional new locations in southern Pahrump Valley. During offsite surveys in 2012, one new occurrence (represented by a single plant) was observed in the BLM Pahrump Valley Wilderness.

Purple-nerve spring parsley (*Cymopterus multinervatus)*

Purple-nerve spring-parsley is a perennial herb with 22 documented occurrences in Inyo and San Bernardino Counties, one of which occurs in the southeastern portion of the project site. There are also nine historic collections in and around Joshua Tree National

Park and the Mojave National Preserve. It was added to the CNPS inventory in November 2008. It is has a CRPR Rank of 2.2; this species also occurs in Nevada, Arizona, New Mexico, Utah, Texas, and Baja California. It has a CNDDB Element Rank of S2.

Purple-nerve spring-parsley blooms March to April in sandy or gravelly soils in Mojave Desert scrub and pinyon-juniper woodland from 2,067 to 5,906 feet elevation. Fruits of desert cymopterus are fairly large and do not seem well adapted for dispersal over long distances. Fruits generally seem to fall relatively close to the parent plant. However, the fruits have a marginal wing that may facilitate dispersal by wind (NatureServe 2010). A single individual was mapped in Mojave Desert scrub habitat near the northeastern corner of the proposed southern solar field. Prior to project surveys, the nearest known occurrence was about 25 miles south in the vicinity of Clark Mountain. No individuals of this species were observed within the 250-foot buffer but several additional new offsite occurrences were discovered during 2011 surveys in the Pahrump Valley in Inyo County, California, and in Nye County, Nevada.

During offsite surveys in 2012, reference sites for this species were checked, and no plants were observed. Suitable habitat for this species was surveyed in Shadow Valley and Pahrump Valley but no new occurrences were found.

Pahrump Valley buckwheat (*Eriogonum bifurcatum)*

Pahrump Valley buckwheat is abundant in the southern and western portion of the project site in shadscale scrub. Numerous individuals were found offsite in southern, central, and northern Pahrump Valley, Stewart Valley, and Chicago Valley during the 2011 offsite surveys.

Pahrump Valley buckwheat is a late summer/early fall blooming annual herb found in San Bernardino and Inyo Counties. This species also occurs in Nevada. It occurs in sandy soils in chenopod scrub vegetation from 2,296 to 2,657 feet elevation. The seeds of *Eriogonum* species are dispersed by wind, rain, streams, and animals (Stokes 1936). Due to their high oil content, the seeds float and are readily moved by sheet flow during heavy rains. Stokes (1936) also cites birds and vehicles as likely dispersal vectors, particularly for annual species of *Eriogonum*. Wind is an effective dispersal agent for many species of *Eriogonum*.

Pahrump Valley buckwheat is a BLM Sensitive species and a CRPR Rank 1B.2; it has a global distribution restricted to Pahrump, Stewart, Mesquite and Sandy valleys, but it is also locally abundant, and common near the project site. Population census information from Nevada (NNHP 2010a) report 18 occurrences in Nevada representing approximately 1,609 or more acres (*ibid.*). It has a CNDDB Element Rank of S3, reflecting its narrow range but local abundance (see the description below of new occurrences found during the 2012 surveys).

Pahrump Valley buckwheat was mapped during the October 2010 and October 2011 (late season) surveys and the spring 2011 survey within the site and in the 250-foot buffer. The offsite surveys in California and Nevada confirmed the existence of large populations of Pahrump Valley buckwheat in previously known locations and new locations in Stewart Valley, northern and southern Pahrump Valley, and Chicago Valley.

The Chicago Valley occurrence is on the west side of the Nopah Range and represents an extension of this species into a new watershed west of its previously known range.

During offsite surveys performed in 2012, 20 new occurrences of Pahrump Valley buckwheat, an annual species, representing approximately 7.3 million plants were mapped in Pahrump, Stewart, Chicago, California and Mesquite valleys. Some of the 54 new localities consist of very large populations with millions of individuals. The new occurrences found in California Valley are the first records for Pahrump Valley buckwheat from this valley. Large areas of potentially suitable habitat in the center of California Valley were not surveyed due to access limitations, and this species may also occur there.

During 2012 offsite surveys, one existing population, CNDDB Element Occurrence No. 9 could not be relocated and is believed to be a misidentification of a similar appearing buckwheat (*Eriogonum deflexum* var. *rectum)*.

Goodding's phacelia (*Phacelia pulchella* var. *gooddingii*)

Goodding's phacelia is an annual herb with 16 documented recent occurrences, one of which is on the project site, and three older historic occurrences. It has a CRPR Rank of 2.3 and a CNDDB Element Rank of S2. It occurs in Inyo and San Bernardino counties in California, and in Nevada, Arizona, and Utah. It inhabits clayey, often alkaline soils in Mojave Desert scrub from 2,624 to 3,281 feet elevation. Goodding's phacelia has been on the CNPS inventory since 1994. Prior to the project surveys, it was known in California only from Mesquite Valley and Salsberry Pass in the Amargosa Mountains, south of Death Valley.

Within the study area, Goodding's phacelia is widespread and abundant. It was observed in Mojave Desert scrub and shadscale scrub in silty to sandy-gravelly soil and on gravelly flats onsite and in the 250-foot buffer. Goodding's phacelia was also found in a number of locations along the transmission line corridor in Nevada that would service the project, and at several additional new offsite locations in California in central Pahrump Valley, Stewart Valley, Chicago Valley, and California Valley. No new occurrences were found during the 2012 surveys.

Desert Wing-Fruit (*Acleisanthes nevadensis*)

Desert wing-fruit is a perennial herb that was previously known in California from a single location in Mesquite Valley near the California-Nevada border in Inyo County. Desert wing-fruit has a CRPR Rank of 2.2; it also occurs in Nevada, Arizona, and Utah. It blooms June to September and occurs in typically rocky soils in Mojave Desert scrub and Joshua tree woodland habitats from 3,805 to 4,100 feet elevation. It has been on the CNPS Inventory since 1984. Note that "*Selinocarpus"* (the former name) was recently changed to *Acleisanthes;* the name *Selinocarpus* still appears in some databases.

Seven new occurrences were found in California during the surveys of the project site, one of which occurs in the southwestern portion of the project site in both shadscale scrub and Mojave Desert scrub habitats. No individuals of this species were observed in the 250-foot buffer but several new occurrences were found along the proposed

transmission line corridor in Nevada that would serve the project. During offsite surveys conducted in 2011, desert wing-fruit was found in several new locations in southern and central Pahrump Valley in Inyo County, and along Excelsior Mine Road in San Bernardino County. Five new occurrences were found offsite in 2012.

Torrey's joint-fir (*Ephedra torreyana*)

Torrey's joint-fir is an evergreen shrub that grows from Texas south to Chihuahua, Mexico, and as far west as California's Great Basin Desert (NatureServe 2011). It was not known to occur in California until it was found in Inyo County in the silty soils northwest of the project in May of 2011. It was added to the CNPS inventory on February 8, 2012. It has a CRPR Rank of 2.1, and a CNDDB Element Rank of S1. Torrey's joint-fir is also found in Arizona, Colorado, Nevada, New Mexico, Texas and Utah, and is not ranked in any of those states (NatureServe 2012).

Five occurrences of Torrey's joint-fir were recorded in California on BLM lands along the California-Nevada border during the project surveys in 2011. A total of seven new occurrences of Torrey's joint-fir were mapped in 2012, including occurrences onsite in the southwest quarter of the site, near the eastern boundary, and offsite in Pahrump Valley. Suitable habitat in Stewart Valley, Mesquite Valley, Chicago Valley, California Valley and the Amargosa Valley/Ash Meadows areas were surveyed in spring 2012 but no new occurrences were found.

E*phedra* with dry, winged cone bracts are dispersed by wind (*E. torreyana* and *E. trifurca*); those with small, dry cone bracts and large seeds are dispersed by seed-caching rodents (e.g., *E. viridis* and *E. californica*) (Hollander, Wall & Baguley 2009).

Groundwater-dependent Ecosystems

Groundwater-dependent ecosystems (GDEs) are an important component of biological diversity in a desert region. Because they are rare or limited in distribution, they often support rare or special-status plants and animals. All GDEs depend upon groundwater for all or part of their survival. Characteristic GDEs include playa margin habitats, such as alkali sink scrubs and some saltbush scrubs, seeps and springs, spring pools, mesquite woodlands, riparian or "microphyll" woodlands, desert wash scrubs dominated by phreatophytes, palm oases, alkali meadows, and spring mounds.

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

The use of groundwater may not be year-round by phreatophytes. In these instances, other water sources are used during the rainy season but groundwater is used in the dry season (Froend & Loomes 2004). In the project vicinity, for example, phreatophytes may utilize precipitation, stormwater runoff, or temporary ponding during storm events, but use and depend on groundwater the remainder of the year.

No GDEs occur on the project site, with the exception of a few widely scatted honey mesquite shrubs. The applicant documented approximately 4,000 acres of mesquite-dominant habitats *offsite* within an approximate five-mile radius of the project (CH2 2011g, Figure DR48-1; **Biological Resources Figure 1**). All of these occur in Nevada with the exception of a small area of mesquite and the non-native salt cedar along Stump Springs Wash in California. The nearest mesquite woodlands in California are located approximately 13 to 20 miles west of the project in the Tecopa area.

Other known phreatophytes documented to occur in the project vicinity during the surveys of the one-mile buffer include four-wing saltbush (*Atriplex canescens*), a common associate of the mesquite in the dune areas; allscale (*A. polycarpa*); bush seep-weed (*Suaeda moquinii*); desert baccharis (*Baccharis sergiloides*), and alkali goldenbush (*Isocoma acradenia*). With the exception of the mesquite, these are "facultative" phreatophytes.

Obligate versus Facultative Phreatophytes

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

1) *Obligate phreatophytes* are deep rooted plants that only inhabit areas where they can access groundwater, via the capillary fringe, to satisfy at least some proportion of their environmental water requirement. Access to groundwater is critically important to their presence in a landscape. Mesquite are facultative phreatophytes in regions of higher rainfall (Arizona, New Mexico, etc.) but in California and Nevada they are considered obligate phreatophytes.

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

Characteristics of the Groundwater Basin that Supports the GDEs

The groundwater resources of the project area are located within the Pahrump Valley groundwater basin, one of several smaller basins that overlie the deeper and more laterally extensive regional aquifer known as the Death Valley Regional Flow System (DVRFS). Groundwater flow in the DVRFS is composed of several interconnected, complex groundwater flow systems (Belcher & Sweetkind 2010); groundwater flow occurs in relatively shallow and localized flow paths (herein referred to as the "local aquifer" or "local basin") underlain by the deeper, regional flow paths (the "regional aquifer"). Regional groundwater flow is predominantly through a thick Paleozoic carbonate rock sequence (also referred to as the *carbonate aquifer*). The regional aquifer sustains numerous springs, primarily in adjacent basins, such as the Amargosa Valley to the west, that are home to many threatened and endangered species.

Pahrump Valley is a topographically closed bi-state basin bounded by the Spring Mountains, Nopah ranges, and the Kingston Range). The 650 square mile basin is filled with alluvium to a depth of about 2,000 feet. Groundwater associated with the Pahrump Valley basin-fill aquifer – the aquifer from which the project will pump groundwater -- supports a 9,000-acre system of groundwater-dependent mesquite woodlands, seasonal and permanent seeps and springs.

The aquifers are affected by complex geologic structures from faulting and fracturing that can enhance or impede flow (*ibid.*). The DVRFS regional groundwater flow system includes several large valleys that contain playas that act as catchments for surface water runoff. Some of the playas (former Pleistocene lakes) have been deformed by Quaternary faulting and contain springs where groundwater is forced to the surface by juxtaposed lake and basin-fill deposits (Belcher & Sweetkind 2010).

In the project area, the “Stateline Fault”, also known as the “Pahrump-Stewart Valley Fault Zone” runs parallel to the California-Nevada state line and appears to divide the Pahrump Valley into two groundwater sub-basins (see **WATER SUPPLY Figure 2**). In the northwest, limited water levels measured in basin-fill aquifer wells suggest that the fault zone does not impede groundwater flow through that portion of the valley (Comartin, 2010). In the southwest, where the project site is located, the fault may impede groundwater flow from the Spring Mountains west across the fault into the project area. However, it is likely that the fault represents a partial barrier to flow; not a complete barrier (belcher pers. comm.).

The mesquite woodlands and coppice dunes east of the project are arranged linearly along or within the fault zone; no mesquite habitats are located west of the fault, with the exception of a few small stands around Pahrump Playa and along a few of the dry washes that intercept the dunes and extend west toward or into the project area.

The basin-fill aquifer is the primary groundwater supply and the sole source of water for Pahrump Valley; very few wells tap the deeper, regional aquifer (HHSEGS 2011a, Appendix 5.15D). Approximately 10,000 groundwater wells in Pahrump Valley pump from the basin-fill aquifer (Comartin 2010).

Seeps and Springs

Seven active or recently active springs are documented to occur within five miles of the project area: Brown’s Spring, Monica Spring, Cottonwood Spring, Mound Spring, Hidden Hills Ranch Spring, Stump Spring, and a fifth unnamed spring (USGS 2012; Malmberg 1967; Harrill 1986; Poff pers. comm. 2012). Manse Spring and several other large and small springs occur just beyond the five-mile radius study area. Malmberg (1967), Harrill (1986), and others indicate that most or all of these springs ceased to flow as a result of heavy groundwater pumping during the last century.

BLM reports that Stump Spring is discharging and supports three shallow, seasonal pools that range between 30 and 70 feet long, and one to two feet deep (Poff pers. comm.). BLM Southern Nevada District hydrologist conducted a reconnaissance-level survey in May 2012 to determine if there were any additional active seeps or springs that could potentially be affected by the project pumping. BLM found that three active *seasonal* seeps within an approximate five-mile radius of the project. Two of these

supported healthy wetland-riparian vegetation; the third spring appears to have at least minor intermittent flow that was significantly greater historically. Other sites were suspected to contain seeps or springs, based on aerial photo signatures or documented historic spring sites, but were not ground-truthed or re-visited because they occur on private land (Poff 2012).

Geographic Scope of the Analysis

Groundwater in the local Pahrump Valley basin aquifer is recharged from the Spring Mountains, located 13 miles east in Nevada. Groundwater in Pahrump Valley that is not discharged in the valley (e.g., through springs or playas) is believed to flow southwest through the Nopah Mountains into basins at lower elevations (HHSEGS 2011a, Appendix 5.15D; Belcher & Sweetkind 2010).

The focus of staff's groundwater analysis is the basin-fill aquifer from which the project will pump groundwater for mirror-washing, boiler make-up, and construction needs, and the cone of depression (drawdown zone) surrounding the project wells (see the **Water Supply** section of the FSA). The hydraulic connections and effects of groundwater pumping on flow paths between Pahrump Valley, the Amargosa River, and more distant springs supported by discharge from the deeper, more laterally extensive carbonate aquifer (or regional aquifer) are not well understood. Although the applicant has stated that project pumping will not affect the Amargosa River or the groundwater-dependent resources of area springs (CH2 2011f, DR-82), the applicant's groundwater assessment acknowledges that the hydrogeology of the Pahrump Valley groundwater basin is complex and the project site's connectivity to the larger basin is not fully understood (HHSEGS 2011a). The groundwater assessment adds that the project's use of groundwater may result in offsite impacts on existing domestic pumpers south of the project site and potentially throughout the larger groundwater basin (HHSEGS 2011a, Section 5.15). Therefore, the geographic scope of this analysis also includes a discussion of more distant groundwater-dependent species and habitats connected to or supported by the larger, regional groundwater basin (DVRFS). Water Resources staff analysis of impacts to local groundwater resources, and the Amargosa River, located 20 miles west, is contained in the **Water Supply** section of this FSA.

Local Groundwater-dependent Ecosystems - Stump Spring ACEC, Unnamed Seasonal Springs, and Associated Mesquite Habitats

This subsection describes the groundwater-dependent resources documented to occur within the cone of depression identified by staff in its independent analysis of the project's pump test data (see the Water Supply section of the FSA). Springs, mesquite habitats, and other GDEs associated with the broader or more laterally extensive regional aquifer, or beyond the five to seven mile radius of the project, are discussed under "Regional Groundwater Resources", following this subsection.

The "Pahrump-Stewart Valley Fault Zone, or Stateline Fault zone, which runs along the eastern project boundary at the California-Nevada state line, supports a broad but discontinuous zone of groundwater-dependent habitats that extend north to Pahrump, south toward the Kingston Range, east to the medial position of the Spring Mountains alluvial fan, and west to the California-Nevada state line. Over 4,000 acres of groundwater-dependent mesquite habitats occur within the five mile study area (CH2

2011g, Figure DR48-1; **Biological Resources Figure 1**). These occur in two forms: shrubby mesquite thickets on coppice dunes, and taller, lush and dense mesquite woodlands up to 15 feet in height along the deeply incised washes. The position of the wash thalweg 10 or 20 feet below the base of the dunes, in some examples, may afford these habitats better access to groundwater and account for their taller habit; the ephemeral hydrology of the washes is not adequate to support the mesquite, which require year-round access to either groundwater or soil moisture. The coppice dunes and associated shrubby mesquite habitats occur in very close proximity to the project boundary, as little as 600 feet from the project boundary and less than a mile from the proposed project pumping wells.

Groundwater-dependent vegetation was not found around the playa perimeter with the exception of a few widely scattered, very small stands of mesquite and bush seepweed scrubs located approximately 5 to 7 miles from the project site.

The depth to the groundwater table is unknown except at a few widely scattered well sites across the southern portion of the valley. No previous studies have been conducted in the mesquite habitats east of the project; nor has the applicant provided any direct evidence of the depth to groundwater at these sites. The project pump tests were located in dry desert scrubs on the west side of the fault zone and thus provide no reliable data on groundwater elevations at the GDEs. The Stump Spring monitoring well is located approximately one mile from the site of the spring and may not represent the groundwater elevation at the spring, in the washes, or along the coppice dunes of mesquite associated with the fault zone. Because of the geologic and hydrogeologic complexity of the area and because of the historic groundwater decline in the northern portion of the valley (i.e., near the northern portion of the project), it is likely that the depth the groundwater may be quite variable. Thus, the position of the groundwater table relative to the effective rooting depth of the mesquite can *only* be determined through groundwater monitoring and/or examination of soil cores excavated at the GDEs.

At least four active seeps and springs also occur within five to seven miles of the project (Stump Spring and three unnamed seeps). All occur within the fault zone, or east of the fault zone, in Nevada. Stump Spring, one of the four active springs within the study area, is located south of Tecopa Road approximately two and a half miles east of the project's southeastern corner, and is contained within a BLM Area of Critical Environmental Concern (ACEC) of the same name. Stump Spring is described as having "significant wildlife value" and was designated as a conservation priority in the BLM-Clark County Mesquite-Acacia Conservation Management Strategy (CMS) for the Clark County Multiple Species Habitat Conservation Plan (MSHCP) (Crampton et al. 2006). Stump Spring supports several seasonal pools along the largest wash that provide critical open water habitat during a period that persists from December to July in normal rainfall years.

The proximity of these seeps and springs to the mesquite habitats significantly increases the value of the mesquite to wildlife; however, even in the absence of surface water, mesquite have exceptional value to wildlife (Beedy pers. comm.; Crampton et el. 2006). Many special-status wildlife species have moderate to strong associations with mesquite (Crampton et al. 2006); some of which have been observed in the project

vicinity and others that have potential to use these significant desert resources, at least seasonally. Common and special-status wildlife associated with mesquite habitats in southern Nevada (Crampton et al. 2006) are discussed in detail below.

Mesquite Value to Wildlife

Mesquite woodlands have exceptional ecological importance in an arid region otherwise lacking a tree-dominated habitat, providing nesting opportunities for many bird species and other structural elements of food, cover, nesting and breeding habitat that are quite distinct from the surrounding uplands of sparse, dry desert scrubs. The dense, shrubby mesquite on the dunes just east of the project also provide cover, food sources, and other habitat values that are quite distinct from the surrounding sparse desert scrub, and distinct from the taller mesquite woodlands that occur along the washes.

The stabilized dunes provide ideal sites for burrowing fauna due to the lack of stones, abundant coarse material, and shade provided by the shrubs (Huang et al. 2011). Bioturbation by burrowing animals is extensive at the base of the mesquite on coppice dunes, but the lush, dense, and taller woodlands along the area washes may be more valuable to avian species requiring taller trees of a larger stem diameter.

Mesquite and acacia woodlands occupy less than one percent of the land area in Clark, southern Nye, and southern Lincoln counties, yet these habitats support a disproportionately greater number of wildlife species than the surrounding desert scrub (Crampton et al. 2006). At least 30 common and special-status species of birds have been found breeding in southern Nevada mesquite habitats, including several Clark County MSHCP covered and evaluation species (*ibid.*) and BLM Sensitive species. Among these species, phainopeplas are the most dependent on mesquite; their diet consists almost exclusively of the berries of desert mistletoe which only grows on mesquites and acacias.

The butterflies Western Great Purple Hairstreak(*Atlides halesus*) and Western Palmer's Metalmark (*Apodemia palmeri*)] and several species of bees (*e.g*. *Perdita ashmeadi simulans* and *Perdita dificilis*) are specialists on the nectar of mesquite or its mistletoe and/or use these plants as larval host plants (Crampton et al. 2006). A rare, Inyo County-endemic wasp (*Bembix inyoensis*), known from only two other sites in Death Valley and Panamint Valley, occurs on habitat (stabilized mesquite dune scrubs) identical to that found just off the project's eastern boundary and is "highly likely to occur there" according to the species' author (Kimsey pers. comm.; Kimsey & Kimsey 1981; Kimsey, Kimsey & Toft 1981). Ant abundance and species richness tend to be greater in mesquite-dominated sites, and mesquite dunes also harbor more rare ant species than inter-dune areas. Termites are also more abundant in mesquite dunes (Crampton et al. 2006). These habitats may also support additional species with restricted habitat requirements such as LeConte's thrasher, desert kangaroo rat, and desert pocket mouse (CEC 2011w).

Mesquite habitats also provide important breeding, foraging, and protection for a wide variety of common wildlife species. The fruit of honey mesquite is valuable forage for wildlife; it is quite predictable, even in drought years, providing an abundant and nutritious food source annually for numerous wildlife species such as kangaroo rats,

mice, ground squirrels, quail, black-tailed jackrabbit, mule deer, and others (Steinberg 2001).

More than 40 plant and animal species have been identified as being associated with, or dependent on mesquite and/or acacia habitats in southern Nevada for foraging, breeding, resting, and refuge (Crampton et al. 2006). **Biological Resources Table 5**, below, lists wildlife described in the Mesquite-Acacia Conservation Management Plan as having a moderate to strong affinity to (and in some cases dependence on) mesquite. Systematic surveys of the mesquite habitats for the species listed below were not conducted; however, some species below were incidentally observed during the project surveys for other special-status species (HHSEGS 2011a); others have potential to occur based on the presence of suitable habitat. Desert tortoises have also been observed using the mesquite dune scrub habitat adjacent to the project (Poff pers. comm.).

Biological Resources Table 5
Wildlife Species with a Moderate-to-Strong Association with Mesquite in Southern Nevada (Crampton et al. 2006)[1]

Common Name (Scientific name)	**Species Population Trend[2]**	**Status[3] Fed/State/Other**
Species with Strong Association with Mesquite		
Birds		
Ash-throated flycatcher(*Myiarchus cinerascens*)	Stable in Nevada, Mojave	__/__/NV PIF
Bendire's thrasher(*Toxostoma bendirei*)	Declining in US range	__/__/ CC Evaluation Species.
Black-tailed gnatcatcher (*Polioptila melanura*)	Nearly significant decline in US range	__/__/__
Crissal's thrasher (*Toxostoma crissale*)	Not known; possible decline in western US	__/__/BLM
Phainopepla (*Phainopepla nitens*)	Declining in Mojave, western US	__/__/BLM/ CC Covered Species
Verdin (*Auriparus flaviceps*)	Declining in US range	__/__/__
Abert's towhee (*Pipilo abertii*)	Endemic to the desert southwest	__/__/__
Vermillion flycatcher (*Pyrocephalus rubinus*	US range stable	__/__/__ CC Covered Species
Lucy's warbler (*Vermivora luciae*)	Stable across range but declining locally	__/__/BLM Sensitive/ NV PIF
Insects (Butterflies)		
Western great purple hairstreak (*Atlides halesus*)	Host plant, nectar	__/__/__
Leda hairstreak (*Ministrymon leda*)	Host plant, nectar	__/__/__
Western Palmer's hairstreak (*Apodemia palmeri*)	Host plant, nectar	__/__/__
Insects (Bees)		

Common Name (Scientific name)	Species Population Trend[2]	Status[3] Fed/State/Other
Perdita spp.(12 species)	Pollen specialist	__/__/__
Colletes algarobiae	Pollen specialist	__/__/__
Hyaleus sejunctus	Pollen specialist	__/__/__
Megachile odontostoma	Pollen specialist	__/__/__
Ashmeadiella prospidis	Pollen specialist	__/__/__
Bembix inyoensis	Mesquite dune scrubs	Rare Inyo Co. endemic[4]
Species with Moderately Strong Association with Mesquite		
Arizona Bell's vireo (*Vireo bellii arizonae*)	Declining throughout US range	__/__/__ CC Covered Species
Black-throated sparrow (*Amphispiza bilineata*)	Significant decline in US range	__/__/__
Ladder-backed woodpecker (*Picoides scolaris*)	Declining in US, including the western US	__/__/__
LeConte's thrasher (*Toxostoma lecontei*)	Declining in the Sonora & Mojave Deserts	__/__/BLM Sensitive
Ladder-backed woodpecker (*Picoides scolaris*)	Declining in US, including the western US	__/__/__
Summer tanager (*Piranga rubra*)	Increasing in the US	__/__/__ CC Covered Species
Verdin (*Auriparus flaviceps*)	Declining in US	__/__/__
Long-eared owl (*Asio otus*)	Stable to declining	__/__/BLM Sensitive
Western screech owl (*Otus kennicottii*)	Not known (stable or declining)	__/__/BLM Watch
Western bluebird (*Stalia mexicana*)	Significant decline in western US	__/__/NEV PIF
Pale Townsend's big-eared bat (*Corynorhinus townsendii pallescens*)	Not known	__/__/BLM Sensitive CC Evaluation Species NV Div. Wildlife
California leaf-nosed bat (*Macrotus californicus*)	Not known	__/__/BLM Sensitive NV Div. Wildlife

[1] Cramton, L., Krueger, J. and D. Murphy. 2006. *Conservation Management Strategy for Mesquite and Acacia Woodlands in Clark County, Nevada*. Bureau of Land Management, Las Vegas Field Office. March 2006. Information on rarity of *Bembix inyoensis* provided by Lynn Kimsey, UCD Entomology Department (Kimsey pers. comm. 2012)
[2] Sauer, J. R., J. E. Hines, J. E. Fallon, K. L. Pardieck, D. J. Ziolkowski, Jr., and W. A. Link. 2011. *The North American Breeding Bird Survey, Results and Analysis 1966 - 2010*. Version 12.07.2011 USGS Patuxent Wildlife Research Center, Laurel, MD
[3] BLM = BLM Sensitive; CC = Covered or Evaluation species under Clark County MSHCP; NV PIF = Nevada partners in Flight
[4] Information on rarity of *Bembix inyoensis* provided by Lynn Kimsey, UCD Entomology Department (Kimsey pers. comm. 2012)

Cultural Significance of the Mesquite

Mesquite habitats have significant cultural importance (UMICH 2012). The seeds of all three species were ground by indigenous people into a meal that was baked into cakes, and the honey from nectar produced by the plants was also an important staple. The bark and leaves have a variety of medicinal uses. The wood was used for structures, carving and fuel, and the leaves and seeds are important livestock and wildlife forage. The significance of the Stump Spring cultural resources are discussed in the Cultural Resources section of this FSA and in a May 18, 2012 submittal by the applicant on the area paleobotanical resources (CH2 2012ii).

Potential for Ancient Mesquite Clones

The applicant's paleo botanical consultant speculated that the mesquite associated with the dunes may be clones of great antiquity; as much several thousand years old, assuming the mesquite pre-date the dunes (CH2 2012ii)

The coppice dunes are estimated to have developed along the fault zone as the Pleistocene lake retreated, and the exposed sands, and sands eroded from the sparsely vegetated hill slopes that developed under the new arid climate accumulated around the mesquite associated with the fault-induced springs (Brady pers. comm. 2012). Mesquite are adapted to sand burial by forming new roots and shoots from buried branches that continue to grow as the sand accumulates around them. The development of coppice dunes may have fostered the development of mesquite clones, or off-shoots from a single parent that are genetically identically and connected to the older, original, and now dead parent plant at the base of the dunes, but this has not been established by DNA testing or radiocarbon analysis. Given that mesquite seedlings are very unlikely to germinate in sand dunes (Keeler-Wolf pers. comm. 2012), and layer readily in sand, which allows them to continue vegetatively without successful seedling recruitment, it is possible, or likely, that the mesquite pre-date the dunes (*ibid.*), which are estimated in the paleo resource report to be several thousand years old or older. In similar settings (coppice dunes), creosote clones reach ages of several thousand years (McAuliffe et al. 2007).

Regional Groundwater Resources - Amargosa Wild and Scenic River and the Amargosa Area of Critical Environmental Concern

This section describes, briefly, resources that occur beyond the cone of depression, or potential drawdown area estimated by staff in **Water Supply Figures 19** and **20** but are believed to be supported by the deeper, regional flow paths (the "regional aquifer") that underlie the basin-fill aquifer (shallow aquifer) from which the project will pump groundwater.

The Amargosa Area of Critical Environmental Concern (ACEC) covers approximately 21,552 acres of BLM-managed public lands on the Amargosa River in southeastern Inyo County, and is managed pursuant to an Implementation Plan (BLM 2007) and the BLM's NEMO plan (BLM 2001; BLM 2002). The ACEC is composed of three distinct geographic units. The 15,964 acre Central Amargosa Unit includes the Amargosa Canyon, Grimshaw Lake Natural Areas, and lands in China Ranch Wash and the Tecopa area. The Central Amargosa Unit is located approximately 20 miles west of the project site. A spring-fed tributary to the Amargosa River occurs in California Valley approximately 11 miles southwest of the project site.

Twenty-six miles of the Amargosa River, from Shoshone to State Dumont Dunes, is a federally designated Wild and Scenic River. Designation of a river puts certain constraints on development. These constraints prohibit activities and uses that may adversely affect the potential suitability of the river segment at the recommended level of protection (wild, scenic or recreational).

The Amargosa River is believed to be wholly supported by groundwater discharge in the form of seeps and springs. The tributary to the Amargosa River located in California

Valley 11 miles west of the project is also assumed to be supported by groundwater. The river begins near Beatty, Nevada, and terminates in Death Valley National Park at Bad Water.

The region has exceptional ecological values, as year-round water flow on some spring-supported reaches feeds wetlands and riparian habitat that support wildlife species unable to exist in a typical arid desert setting. The Amargosa is a unique aquatic system; most of its course is underground. Where it surfaces it supports ecologically rich oases such as Ash Meadows and the Oasis Valley in Nevada, and Tecopa, Shoshone and the Amargosa Canyon in California. As a result of their isolation, each oasis contains species and natural communities that exist nowhere else on earth:

- Seven listed species, five species of special concern and three BLM sensitive species reside in habitat created by waters from the Amargosa;
- A lush riparian zone is located along the Amargosa River that supports federally listed species such as the southwestern willow flycatcher (*Empidonax traillii extimus*)and least Bell's vireo(*V. bellii pusillus*), as well as numerous avian species listed by the CDFG as Species of Special Concern;
- The yellow-billed cuckoo, a federal candidate for listing has been found within the riparian areas of Amargosa Canyon;
- Other emergent wetland habitats adjacent to the river in the Tecopa Hot Springs area support the endemic Amargosa vole (*Microtus californicus scirpensis*). Critical habitat for this subspecies of the California vole has been established within the Grimshaw Basin and northern end of the Amargosa Canyon;
- Unique, alkali flats (at lower Carson Slough) located about five miles northeast of Death Valley Junction support populations of the federally endangered Amargosa niterwort (*Nitrophila mohavensis*). This species has also been found on similar habitats in the Tecopa Hot Springs area in Grimshaw Basin. The lower Carson Slough is located in an area that receives surface and subsurface flows from springs in Ash Meadows, Nevada. The slough serves as the point where surface and subsurface flows from Ash Meadows, and flows from the main Amargosa River come together. Wet salt grass meadows located in the lower Carson Slough also support populations of the federally endangered Ash Meadows gumplant (*Grindelia fraxinipratensis*), and possibly populations of the federally threatened spring-loving centaury (*Centaurium namaphilum*);
- Other groundwater-dependent species, listed by the BLM as sensitive, include populations of the Amargosa River speckled dace (*Rhinichthys osculus* ssp. 1) and the Amargosa pupfish (*Cyprinodon nevadensis amargosae*) in the Amargosa Canyon. Populations of Tecopa bird's beak (*Cordylanthus tecopensis*) have been found in the Grimshaw Basin and at Lower Carson Slough;

Additional groundwater-dependent resources are found at China Ranch Spring, Resting Spring, and Willow Spring in the Tecopa area, located between 13 and 20 miles west of the project in California. They support exceptional stands of mesquite and a variety of special-status species.

In California, all mesquite habitats are considered rare and sensitive natural communities (Sawyer et al. 2009; CDFG 2003); they are also rare in Nevada (Crampton et al. 2006).

Desert Washes

The project is located in the Pahrump Hydrologic Unit, a 140,196-acre watershed in Pahrump Valley. Waters on the project site drain the alluvial fan on the western flank of the Spring Mountain in Nevada, approximately 13 miles east of the project site. The watershed is a closed basin (i.e., it has no outlet); the receiving basin for the project waters and all other surface runoff in the watershed is the Pahrump Playa located approximately three miles northwest of the project site. It is a “dry playa” meaning groundwater is not shallow; however, the playa (and the washes that normally terminate before reaching the playa) periodically flood during larger storm events.

Regulatory Setting

The U.S. Army Corps of Engineers (USACE), the CDFG, and the Regional Water Quality Control Board have a shared, and somewhat overlapping, regulatory responsibility for the protection of surface waters. Desert washes have more limited protection under Section 404 of the Federal Clean Water Act, where the lateral limit of jurisdiction under Section 404 of the Clean Water Act ends at the *ordinary high water mark* (OHWM) of the stream. Waters of the State are defined by and regulated under the Porter-Cologne Water Quality Control Act. In addition, some Waters of the State are regulated under California Fish and Game Code (FGC), Sections 1600-1616 and implemented by CDFG through its Lake and Streambed Alteration (LSA) Program.

Porter-Cologne was the authorizing legislation for the Water Quality Control Act (California Water Code Division 7, Water Quality Act). The Porter-Cologne Water Quality Control Act regulates discharges of waste and fill material to Waters of the State including "isolated" waters and wetlands; thus, features delineated as “non-jurisdictional” Waters of the U.S. may be subject to regulation by the Regional Water Quality Control Board (RWQCB) under the Porter-Cologne Water Quality Act. Waters of the State defined in Porter-Cologne (Section 13050(e)) include “any surface water or ground water, including saline waters, within the boundaries of the state.” Water quality issues are addressed in the Clean Water Act Section 401 Water Quality Certification and would apply for placement of fill in any non-federal waters regardless of size or properties of the drainage (see **Water Resources** section of this FSA).

Water quality issues for Waters of the U.S. will be addressed in the Clean Water Act Section 401 Water Quality Certification; the RWQCB will coordinate with the Energy Commission to address placement of fill in any non-federal waters regardless of size or properties of the drainage (see Water Resources section of this FSA).

California Fish and Game Code Policy and Practice

Fish and wildlife resources are held in trust for the people of the state by and through the CDFG (Fish and Game Code Section 711.7). CDFG is responsible for conserving, protecting, and managing fish, wildlife, native plants, and the habitat necessary for biologically sustainable populations of these species (Fish and Game Code Section 1802).

Fish and Game Code Chapter 6, Fish and Wildlife Protection and Conservation, Section 1600 *et seq* was enacted to provide for the conservation of fish and wildlife resources associated with stream ecosystems. The Fish and Game Code further defines fish and wildlife to include: "...*all wild animals, birds, plants, fish, amphibians, invertebrates, reptiles, and related ecological communities, including the habitat upon which they depend for continued viability."* (Fish and Game Code Division 5, Chapter 1, section 45, and Division 2, Chapter 1, section 711.2(a), respectively). "*Fish means wild fish, mollusks, crustaceans, invertebrates, or amphibians, including any part, spawn or ova thereof."* (FGC, Division 5, Chapter 1, section 45).

While Fish and Game Code sections 1600 e*t seq*. do not include a definition for "stream", it has been the practice of the Lake and Stream Bed Program to define a stream as: a body of water that flows perennially, intermittently, or ephemerally. Streams include a channel, banks, bed, and floodplains where present (Vyverberg pers. comm.).

Fish and Game Code jurisdiction is not predicated on: the size of a stream; the morphology of a stream or how well-defined the banks area; the cross-sectional area occupied by particular flow events; the time period between flow events; nor the consistency of flow (Vyverberg 2010b). Streams that are afforded protection under FGC Section 1600 et seq are those bodies of water associated with a local biological community, or that contribute to the chemical, physical, or biological integrity of downstream waters or ecosystems. Whether flow is ephemeral, intermittent or perennial, streams, their sources (e.g., swales, springs, ponds, lakes, marshes, wetlands, or other such features), floodplains, and associated ecosystems (i.e., the living flora and fauna, and physical processes that sustain their habitats) are all considered integral parts of a stream system and are extended protection accordingly.

Waters of the U.S. Delineated on the Project Site

Sixty-nine ephemeral streams totaling 13.92 acres were documented in the Jurisdictional Delineation Report for Waters of the U.S. (HHSEGS 2011a, Appendix 5-2E) based on federal delineation guidelines (USACE 2008). A total of six of the 69 features are blue line streams as depicted on the USGS topographic maps of the project area. However, in a December 14, 2011 correspondence from the USACE Ventura Regulatory Field Office, the Corps determined that only two of the 69 features were subject to USACE jurisdiction (URS 2012b). The applicant's delineation estimated 0.42 acres of Waters of the U.S. within the project boundary.

On March 23, 2012, the applicant submitted a Preliminary Delineation of Jurisdictional Waters of the State (URS 2012b) regulated under Fish and Game Code Section 1600 *et seq*. The delineation report concluded that 23.21 acres of state jurisdictional waters are located within the project boundary, including 80 single-thread streams. An additional 5.85 acres of braided streams were delineated. The report also identified other areas as non-jurisdictional features, including "pooled areas" that inundate only during storm events and include depressions in roads or along road edges, the outlet of washes, and the large clay pans (identified on the delineation maps as "problematic alkaline sink areas"), and "relicts from previous hydrological events or manmade disturbance." Representative photos of the delineated features are provided in the Preliminary

Delineation of Jurisdictional Waters of the State (URS 2012b). No features were delineated downstream of the project except for one drainage adjacent to Avenue D.

Staff disagreed with the applicant's delineation of jurisdictional Waters of the State. During a field verification of the delineation conducted by staff and a representative from CDFG Regional Office in Bishop, several additional, previously unmapped streams were documented; features that are functionally and morphologically identical to features that were delineated by the applicant. The delineation map and total acres was accordingly revised by the applicant and is provided as **Biological Resources Figure 7.** The total revised area for the jurisdictional delineation does not include portions of streams located outside the state.

Characteristic hydrology indicators, fluvial indicators and other geomorphic features used in staff's identification of state waters include: channel morphology; inundation or saturation (the site received one-quarter-inch of rain the day before the site visit); recent deposition; ripples; changes in vegetation species composition, structure or density (relative to the adjacent creosote uplands); wrack; mud drapes; changes in sediment texture; sediment sorting; scour or shelving; gravel ramps; and a change in soil color. Photos were taken of many of the indicators and features.

Characteristics of the Project Waters

Desert washes may be ephemeral, intermittent, or perennial, although ephemeral streams are the most common stream type in the desert region of California (Vyverberg 2010a). All features delineated on the project site are ephemeral. Ephemeral streams only flow during and shortly after rainfall events; intermittent streams flow continuously only in places where they receive water from a groundwater source (*ibid.*).

Waters on the project site are characteristic of alluvial fan distributary channel networks, where braided, sometimes discontinuous channels and single-thread channels occur in combinations and in a distinctive pattern reflective of the depositional processes active on alluvial fans. Photos of characteristic stream forms found on the project site are provided in **Biological Resources Figure 3**. The sparse vegetation on alluvial fans, lack of soil, high erosion rates, localized runoff, and downstream decreases in stream flow lead to closely spaced, smaller channels in high drainage density (Bull & Kirkby 2002), unlike the single thread channels found farther upstream. Channel migration, or avulsions are common—a response to channels blocked by sediment accumulations from previous small flows—and produce the divergent channel networks that decrease in density at the headwaters. In general, alluvial fan channels become increasingly less defined as they flow down the fan (Vyverberg 2010), confinement is lost and the channels dissipate. Undefined features (sheetflow) were not included in the delineation of state waters.

Desert washes are important to groundwater recharge; for example, the contribution of alluvial fan stream flow to groundwater from transmission losses in the unconsolidated sediment of the channel bed accounts for 90 percent of the recharge to the groundwater aquifer in the Amargosa River basin above Shoshone (Osterkamp et al. 1994).

During the field verification of state waters, staff and CDFG noted the washes offer habitat functions and values distinct from the surrounding upland. Where there are

concentrations of water, the vegetation is denser, more robust, which in turn provides more shade, escape cover, seed and other food sources, including insects. The washes also have greater plant species diversity; germination of rattlesnake weed (*Chamaesyce albomarginata*), a preferred desert tortoise food, was abundant in the lower reaches of many channels, particularly at the terminus of the streams where soils remain saturated longer. Bunchgrasses (*Sporobolus airoides, Pleuraphis rigida*) are more abundant on some washes. The terminus of these streams held water longer and thus provided sources of temporary pooling and access to water. Staff noted higher mammal density on the streams and their active floodplains, evidenced by greater bioturbation and more abundant coyote scat. These observations are consistent with descriptions of desert washes habitat values in the literature; literature representing decades of observations and surveys (Levick et al. 2008; Baxter 1988; Kirkpatrick et al. 2007; Kubick & Remsen 1977; Tomoff 1977; Daniels & Boyd 1979, and others).

Special-status Wildlife Species

The applicant conducted several focused or protocol based surveys of the project site in 2010, 2011, and 2012. These included protocol surveys for the desert tortoise and burrowing owl; focused surveys for the golden eagle; point counts for migratory birds, and acoustic surveys for bats (electronic and monitoring and acoustic recording). Some of the species detected or that have the potential to occur in the project area are described further below.

Special-status Wildlife Species - Reptiles

Desert Tortoise

Desert tortoises are present on the proposed project site and are known to occur in adjacent habitat. Protocol surveys conducted by the applicant in 2011 detected two desert tortoises within the project footprint and six desert tortoises within 150 meters of the project boundary (HHSEGS 2011a). An additional seven animals were identified along the (Zone of Influence) ZOI transects. The desert tortoise was California state-listed as threatened on August 3, 1989. The Mojave population was federally listed as threatened on April 2 1990. Critical habitat for this species was established February 8, 1994 (55 FR 12178).

The desert tortoise is a large slow growing herbivorous reptile that is well adapted to a variable and often harsh desert environment (USFWS 2011). In the United States the desert tortoise's range includes portions of the Mojave and Sonoran desert regions of southern California, southern Nevada, southwestern Utah, and western Arizona. In Mexico, the species is found throughout most of Sonora and into portions of Sinaloa. Based on genetic differences there are two recognized populations of desert tortoise in the United States; these are the Mojave and Sonoran populations (USFWS 2011). Recently, genetic data suggest these groups are unique species. Although the species often look similar, the differentiation between the Mojave and Sonoran assemblages of the desert tortoise are supported via multiple forms of evidence, including morphology, ecology, and genetics (Weinstein and Berry 1987; Lamb et al. 1989; Lamb and Lydehard 1994; Berry et al. 2002; Van Devender 2002a; 2002b; Murphy et al. 2007). The Mojave population includes those animals living north and west of the Colorado River in the Mojave Desert of California, Nevada, Arizona, southwestern Utah, and in the Colorado Desert in California (a division of the Sonoran Desert).

The Mojave population is further classified by Recovery Units. The USFWS 2011 Recovery Plan identifies five recovery units for the Mojave population of desert tortoise. These include the Upper Virgin River; Northeastern Mojave; Eastern Mojave; Western Mojave; and Colorado Desert. Although the Recovery Unit designation does not provide special legal protection, the USFWS defines recovery units as special units that are geographically identifiable and are essential to the recovery of the entire listed population; that is recovery units are individually necessary to conserve the genetic, behavioral, morphological, and ecological diversity necessary for long-term sustainability of the entire listed population (USFWS 2011a). The proposed project is located in the Eastern Mojave Recovery Unit.

Range wide, desert tortoises occupy a variety of physical locations including alluvial fans, washes, canyon bottoms, rocky hillsides, and bajadas. In the Mojave population desert tortoises are most commonly observed in desert scrub communities dominated by creosote bush, burrobush (*Hymenoclea salsola*), Mojave yucca (*Yucca schidigera*), and blackbrush (*Coleogyne ramosissima*). At higher elevations, Joshua tree (*Yucca brevifolia*) and big galleta grass are common indicators of tortoise habitat (USFWS 1994b). However, the species is also known to occur in a variety of desert scrub communities and microphyll woodlands (USFWS 1994b).

An important functional component that characterizes desert tortoise habitat is the availability of preferred forage particularly annual forbs, native grasses, and succulents (i.e., cactus). While many species of plants are taken forbs are preferred over grasses and green vegetation is preferred over dry (Zeiner et al. 1988). Some of the preferred forage species for desert tortoises in the Mojave Desert include various species of milk-vetch (*Astragalus* spp.) primrose (*Camissonia* spp.), spurges (*Euphorbia* spp.), lotus (*Lotus* spp.) and wishbone (*Mirabilis* sp.) (Jennings 1993). Jennings (1997) noted that about 70 percent of the bites taken by observed tortoises were on annual plants. Friable soils, such as sand and fine gravel, are an important habitat component, particularly for burrow excavation and nesting. The presence of soil suitable for digging burrows is considered a limiting factor to desert tortoise distribution (USFWS 2011a). Burrows provide shelter from predators and thermal stress in areas where ground temperatures may range from below freezing to over 140° F. Depending on the location desert tortoises can construct and maintain a series of single-opening burrows, and may use between seven to 12 burrows at a given time (Barrett 1990; Bulova 1994).

Desert tortoises in the Mojave Desert are generally active between April and June, with a secondary activity period from September through October. Desert tortoises in the Eastern Recovery Unit, which includes the project area, are also active during the late summer months in response to seasonal rainfall. Because up to 40 percent of the annual precipitation falls in response to summer monsoons; the region supports two distinct annual floras on which tortoises can feed (USFWS 2011a).

During inactive periods, tortoises hibernate, aestivate, or rest in subterranean burrows or caliche caves, spending as much as 98 percent of their time underground (Marlow 1979; Nagy and Medica 1986). During active periods, they usually spend nights and the hotter portion of the day in their burrow. However, desert tortoise activity is seasonally variable and peak adult and juvenile activity typically coincides with the greatest annual forage availability during the early spring and summer. Studies conducted at Fort Erwin

in 2010-2011 detected that desert tortoises can also be active during winter months. In this study 9.8 percent (37 of 377) of desert tortoises displayed some winter activity, and 11 were active on more than one occasion. Desert tortoises were identified above ground in small numbers equally between December and January and January and February, typically the coldest months of the year (USGS 2011).

Tortoise activities are primarily concentrated in core areas or home ranges. Although adult males can be aggressive toward each other during the breeding season, there can be a great deal of overlap in individual home ranges (USFWS 2011a). Annual home ranges have been estimated between 10 and 450 acres and are age, sex, seasonal, and resource density dependent (USFWS 2011a). More than 1.5 square miles of habitat may be required to meet the life history needs of a tortoise and individuals have been known to travel more than 7 miles at a time (BLM 2001). In drought years, the ability of tortoises to drink while surface water is available following rains may be crucial for tortoise survival. During droughts, tortoises may be required to forage over larger areas, increasing the likelihood of encounters with sources of injury or mortality including humans and other predators.

The desert tortoise is a long lived species that requires 13-20 years to reach sexual maturity. The species has low reproductive rates during a long period of reproductive potential, and individuals experience relatively high mortality early in life (USFWS 2011a). Copulation typically begins in late March or early April but can occur during the spring, summer, or fall (Black 1976; Rostal et al. 1994). Eggs are laid in late May to July and hatch after approximately three to four months (Stebbins 1985; Zeiner et al. 1988). Multiple clutches (two or rarely three) occur in favorable years (Stebbins 1985). Failure of rainfall and consequent scarcity of plants may result in reproductive failure for desert tortoise (Zeiner et al. 1988).

Desert tortoise have several natural predators including common ravens, desert kit foxes (*Vulpes macrotis*), American badgers (*Taxidea taxus*), roadrunners (*Geococcyx californianus*), and coyotes (*Canis latrans*). Bobcats and mountain lions are also known to prey on this species. A variety of birds prey on desert tortoise including red-tailed hawks, golden eagles, loggerhead shrikes (*Lanius ludovicianus*), American kestrels (*Falco sparvarius*), and burrowing owls (Boarman 1993). Birds typically prey upon two to three-inch long juveniles, which have a thin, delicate shell (USFWS 1994). In addition, non-native species including dogs are a known source of mortality for desert tortoise (USFWS 2011a).

The decline of desert tortoise populations have been attributed to a number of factors including habitat loss or degradation from grazing, housing, mining, infrastructure, energy development, and the conversion of native habitat to agriculture purposes. Off highway vehicle use and the acquisition of lands for military training has also degraded habitat for this species. Also cited as threatening the desert tortoise's continuing existence were illegal collection, upper respiratory tract disease (URTD), and predation on juvenile desert tortoises by common ravens *(Corvus corax)*. Fire is an increasingly important threat to desert tortoise habitat. Over 500,000 acres of desert lands burned in the Mojave Desert in the 1980’s. An additional 404,685 hectares (1,000,000 acres) of Mojave Desert vegetation burned in wildfires in 2005 and 2006, fueled largely by invasive, non-native grasses (USFWS 2011a). Fires in Mojave Desert scrub degrade or

eliminate habitat for desert tortoises (USFWS 1994, Appendix D). Drought and subsidized predation have also been recognized to be sources of mortality for this species.

Critical Habitat

The nearest designated desert tortoise critical habitat for this species is located approximately 20 miles south of the project site within the Shadow Valley Unit.

Banded Gila Monster

The banded Gila monster (*Heloderma suspectum cinctum*) is considered rare in California with only 26 credible records of the species documented within the past 153 years (Lovich and Beaman 2007). This large and distinct lizard is difficult to observe even in areas where they have been recently recorded. As a result, little is known about this species' distribution, population status, and life history in California. Most of the historical observations in California occurred in mountainous areas of moderate elevations with rocky, incised topography, in large and relatively high ranges as well as riparian areas (*ibid.*). Despite the widespread distribution of potential habitat throughout the California desert, the few documented observations suggest the California populations may be confined to the eastern portion of the California desert (*ibid.*), and the current distribution is apparently a function of summer rainfall. As reported by Lovich and Beaman (2007), all California Gila monster observations except one (Mojave River) occurred east of the 116° longitude in areas that received at least 25 percent of their annual precipitation during the summer months. Throughout their range, Gila monsters appear to be most active during or following summer rain events.

The species is known from Nevada in nearby Clark and Nye Counties and from the Kingston Mountain Range in Inyo County (Lovich and Beaman 2007). Banded Gila monsters were not detected onsite during surveys and are expected to have a low potential to occur on the project site.

Mojave Fringe-Toed Lizard

Mojave fringe-toed lizards (*Uma scoparia*) are known almost exclusively from California, primarily in San Bernardino and eastern Riverside Counties, but are also found to the north in southeastern Inyo County and historically to the west in eastern Los Angeles County (Jennings and Hayes 1994). Murphy et al. (2007) identified two maternal lineages of this species; the northern lineage is associated with the Amargosa River drainage system, and the southern with the Mojave River drainage system, Bristol Trough, Clark's Pass (including Palen Lake and Pinto Wash), and the Colorado River sand transport systems.

The Mojave fringe-toed lizard is found in arid, sandy, sparsely vegetated habitats and is associated with creosote scrub throughout much of its range (Norris 1958; Jennings and Hayes 1994). This species is restricted to habitats containing fine, loose, aeolian sand, typically with sand grain size no coarser than 0.375 mm in diameter (Turner et al. 1984; Jennings and Hayes 1994; Stebbins 1944). It burrows in the sand to avoid predators and to thermoregulate (Stebbins 1944), though it will also seek shelter in rodent burrows. Sand dunes provide the primary habitat for this species, although it can also be found in the margins of dry lakebeds and washes and isolated pockets against

hillsides (BLM 2005). The most important factor in this species' habitat is the presence of fine sands.

The Mojave fringe-toed lizard is widespread geographically across the Mojave and northern Colorado deserts, but its distribution is highly fragmented because it is restricted to habitats containing loose sand, which is patchily distributed (Murphy et al. 2007). Many local populations of this species occur on small patches of sand and are quite small. This fragmented pattern of distribution leaves the species vulnerable to local extirpations from additional habitat disturbance and fragmentation as well as stochastic events (*ibid.*). The loose wind-blown sand habitat, upon which the Mojave fringe-toed lizard is dependent, is a fragile ecosystem requiring the protection against both direct and indirect disturbances (Weaver 1981; Beatley 1994; Barrows 1996). Environmental changes that stabilize sand, affect sand sources, or block sand movement corridors will also affect this species (Turner et al. 1984; Jennings and Hayes 1994). Threats to this species include habitat loss or damage from urban development, off-highway vehicles, and agriculture. Aside from the direct loss of land, development can also increase access by predators, such as the common raven. Potential indirect disturbances are associated with the disruption of the dune ecosystem, sand sources, wind transport, and sand transport corridors

Potential habitat for this species has been mapped along portions of the California Nevada border (DRECP 2012). However, habitat for this species does not appear to occur on the project site. The soils associated with the project area are primarily silty sand and generally lack the depth to support this species. Therefore this species is not expected to occur on the project site.

Special-status Wildlife Species - Mammals

American Badger

American badgers were once fairly widespread throughout open grassland habitats of California. They are now uncommon, permanent residents throughout most of the state, with the exception of the northern North Coast area. Known to occur in the Mojave Desert, they are most abundant in the drier open stages of most shrub, forest, and herbaceous habitats that support friable soils. Cultivated lands have been reported to provide little usable habitat for this species however staff has observed badgers along the margins of agricultural fields that border natural lands. They feed mainly on small mammals, especially ground squirrels, pocket gophers, rats, mice, and chipmunks. This species captures some of its prey above ground including birds, eggs, reptiles, invertebrates, and carrion. Its diet will shift seasonally and yearly depending upon prey availability. Badgers are fossorial, digging large burrows in dry, friable soils and will use multiple dens/cover burrows within their home range. They typically use a different den every day, although they can use a den for a few days at a time (Sullivan 1996). Cover burrows are an average of 30 feet in length and are approximately 3 feet in depth. Natal dens are larger and more complex than cover dens. In undisturbed, high-quality habitat, badger dens can average 0.64 dens per acre, but are usually at much lower density in highly disturbed areas (*ibid.*).This species can be somewhat tolerant of human activities that do not disrupt their burrows. The applicant identified approximately 11 badger burrows in fair to good condition on the project site (HHSEGS 2011a). Another burrow was found in the ZOI. There were no live animals observed.

Desert Kit Fox

Desert kit fox is an uncommon to rare permanent resident of arid regions of the southern portion of California. The species occur in annual grasslands, or grassy open, arid stages of vegetation dominated by scattered herbaceous species. Kit fox occur in association with their prey base which is primarily cottontail rabbits, ground squirrels, kangaroo rats and various species of insects, lizards, or birds (Zeiner et al. 1990). Kit foxes are primarily nocturnal and friable soils are necessary for the construction of dens, which are used throughout the year for cover, thermoregulation, water conservation, and rearing pups. Kit foxes typically produce one litter of about four pups per year, with most pups born February through April (Ahlborn 2000). While the desert kit fox is not listed as a special-status species by the State of California or the USFWS, it is protected under Title 14, California Code of Regulations, Section 460. The California Fish and Game Code (§§ 4000 - 4012) defines kit fox as a furbearing mammal and restricts take of this species.

The applicant identified 46 desert kit fox burrow complexes (i.e., numerous burrows within a 3 to 250 square meter area used by a family group) on the project site. Nineteen burrow complexes appeared to be active in the season when the surveys were performed. Two young kit fox were seen at one of the active burrow complexes. Twenty-seven burrow complexes did not appear to be active however kit fox routinely occupy historic burrows. In addition to the kit fox burrow complexes, 30 single canid burrows (isolated and not associated with a burrow complex) were found. Of these, eight were identified as kit fox based on the presence of scat and/or tracks, two of which appeared to be active.

Nelson's Bighorn Sheep

The Nelson's bighorn sheep is a BLM Sensitive species and is considered fully protected by the State of California. The Nelson's bighorn sheep includes bighorns from the Transverse Ranges through most of the desert mountain ranges of California and adjacent Nevada and northern Arizona to Utah. Desert bighorn sheep is a term often used to refer to all the bighorn subspecies inhabiting the arid, sparsely vegetated desert environment of the extreme western and southwestern parts of the U.S. and northern Mexico. Three subspecies of bighorn sheep exist and include the Rocky Mountain, Sierra Nevada, and desert bighorn (National Wildlife Federation, accessed September 14, 2012). This species is widely distributed from the White Mountains in Mono County south to the Chocolate Mountains in Imperial County (CDFG 2012b). Locally, Nelson's bighorn sheep occur in mountain ranges surrounding the project site, including the Kingston Range to the south, Nopah Range to the west, and the Clark and Spring Mountains in Nevada (CDFG 2012b). The CDFG has further stated that genetic connectivity among these sheep populations is well known and supported by a rare, all white form of sheep, that are known to occur in each of those mountain ranges (Bleich pers. comm. 2012).

Bighorn sheep are typically found on open, rocky, steep areas used for escape cover with available water and herbaceous or shrubby vegetation for forage. Bighorn sheep are extremely agile in this type of habitat, allowing them to escape predators such as coyotes, eagles, and cougars (Wehausen 1992). So important is rugged habitat that a commonly used metric for predicting bighorn sheep occupancy is the slope of the

habitat. Habitat with a slope of 15 percent or greater is considered within the range of preferred habitat for this species (Dr. Wehausen, personal communication, August 2012).

Threats to Nelson's bighorn sheep include predation by mountain lions (*Felis concolor*) on bighorn sheep in Kingston, Clark, and Granite Mountains (Jaeger 1994; Wehausen 1996). In some areas, such as Granite Mountains, this has been documented to effect drastic population declines (Wehausen 1996). In fact, over the past 140 years, many bighorn sheep populations have disappeared over much of their California range (Buechner 1960; Wehausen et al. 1987a). While there is no single cause for these losses, pneumonia contracted from domestic sheep probably has been the greatest factor (Wehausen 2005).

Bighorn sheep graze on grasses and browse shrubs, particularly in fall and winter, and seek minerals at natural salt licks. Bighorn sheep have a large rumen, relative to body size, which allows digestion of grasses, even in a dry state (Hanly 1982). This gives them flexibility to select diets that optimize nutrient content from available forage. Consequently, bighorn sheep feed on a large variety of plant species and diet composition varies seasonally and among locations. While diet quality in the Mojave Desert varies greatly among years, it is most predictably high in late winter and spring (Wehausen 1992), and this period coincides with the peak of lambing. Desert bighorn have a long lambing season that can begin in December and end in June in the Mojave Desert, and a small percentage of births commonly occur in summer as well (*ibid.*).

High rainfall and abundant forage are a good time for sheep, usually males, to make long-distance dispersal movements, which are important to maintaining genetic connectivity of metapopulations as well as colonizing new habitat. This intermountain travel can be as important to the long term viability of populations as are the mountain ranges themselves (Schwartz et al. 1986, Bleich et al. 1990). Radio telemetry studies of bighorn sheep in various southwestern deserts, including the Mojave Desert of California, have found considerable movement of sheep between mountain ranges (Bleich et al. 1990). Consequently, intermountain areas of the desert floor that bighorn traverse between mountain ranges can be as important to the long term viability of populations as are the mountain ranges themselves (Schwartz et al. 1986, Bleich et al. 1990). However, this movement is typically constrained by perennial water sources (Turner et al 2004).

Proximity to perennial water has been found to be the best predictor of bighorn sheep presence (Turner et al, 2004), found that 97 percent of sheep observations were within three kilometers of perennial water sources. This study was conducted in the Santa Rosa Mountains, in less arid climate. In the desert region, few perennial water sources exist, and local sources become more important. Interestingly, male and female bighorn sheep inhabiting desert ecosystems can survive without consuming surface water (Krausman et al. 1985), and males appear to drink infrequently in many situations (Jaeger et al., 1991; Bleich et al., 1996); however, there are no known large populations of bighorn sheep in the desert region that lack access to surface water.

Of the locally known populations of bighorn sheep, known perennial water sources are primarily found within mountain ranges and consist of surface flow. Perennial water in

the Nopah Range is known to be limited although water sources in the Kingston ranges are somewhat more plentiful (Glenn Sudemeier, personal communication). The placement of three artificial guzzlers, or watering systems, has been noted to expand occupied sheep habitat in the southern Nopah Range (ibid).

Stump Spring, located eight miles from the Kingston Range is approximately two and a half miles east of the project site and provides surface water from December to July. However, because sheep are known to avoid deeply incised washes where visibility is poor and vulnerability to predation is high, valley floor water sources such as Stump Spring and the mesquites located east of the project within Nevada are not expected to be frequented by bighorn sheep (Dr. Wehausen, personal communication).

Bighorn sheep pellets and a horn fragment were found on the site during late-season plant surveys (HHSEGS 2011a). In addition the Nopah Range to the west and the Kingston Range to the south contain large herds of sheep (Vern Bleich, pers. comm. 2012). During helicopter surveys conducted by the applicant to identify golden eagle nests, biologists noted 11 bighorn sheep at three mountain locations, ranging from seven to ten miles south and southwest of the project site (CH2 2012c). Although bighorn sheep are not expected to be present year round on the project site, the project area is likely periodically used for intermountain movement or foraging. Cover habitat for bighorn sheep is not present on the project site.

Pallid Bat

The pallid bat is a light brown or sandy colored, long-eared, moderate-sized bat that occurs throughout California with the exception of the northwest corner of the state and the high Sierra Nevada (Zeiner et al. 1990b). Pallid bats are most commonly found in oak savannah and in open dry habitats with rocky areas, trees, buildings, or bridges for roosting. These bats are frequently found around rock outcrops and water, but also in areas devoid of these features (O'Farrell and Bradley 1970; Findley et al. 1975). Roosting in rock crevices and man-made structures, males and female pallid bats are gregarious with members of the same sex (Hermanson and O'Shea 1983). Colonies can range from a few individuals to over a hundred (Barbour and Davis 1969) and usually this species occurs in groups larger than 20 individuals (Wilson and Ruff 1999). Although crevices are important for day roosts, night roosts often include open buildings, porches, garages, highway bridges, and mines. Pallid bats may travel up to several miles for water or foraging sites if roosting sites are limited. This bat prefers foraging on terrestrial arthropods in open habitats and regional populations and individuals may show selective prey preferences (Johnston and Fenton 2001). Pallid bat roosts are very susceptible to human disturbance, and urban development has been cited as the most significant factor contributing to their regional decline (Miner and Stokes 2005). Pallid bat is known to occur on the project site; detected using Anabat acoustic technology during monitoring during March, April, July, and September 2012 (CH2 2012nn).

Townsend's Big-eared Bat

The Townsend's big-eared bat is a colonial species that feeds primarily on moths and other soft-bodied insects. Females aggregate in the spring at nursery sites known as maternity colonies. Although the Townsend's big-eared bat is usually a cave-dwelling

species, many colonies are found in anthropogenic structures such as the attics of buildings or old, abandoned mines. Roost sites in California include limestone caves, lava tubes, mine tunnels, buildings, and other structures (Williams 1986). This species is found throughout Nevada, from low desert to high mountain habitats. This species is often concentrated in areas offering caves or mines as roosting sites and preferring caves and mines where the temperature is 54 degrees F. (12 degree C.) or less but usually above freezing Chung-MacCoubrey 1995. Radiotracking studies suggest that movement from a colonial roost during the maternity season is confined to within nine miles of the nursery. Townsend's big-eared bats are very susceptible to human disturbance, and females are known to completely abandon their young when disturbed. The loss of maternity and hibernation roosts has been cited as the most significant factor contributing to their decline throughout their range (Miner and Stokes 2005).

Townsend's big-eared bat was not detected over the project by the applicant during recent acoustic surveys. Roosting habitat does not exist on the project site.

Western Small Footed myotis

In the western United States, these bats are inhabitants of the deserts, semideserts, and desert mountains. Their daytime roosts may be in crevices and cracks in canyon walls, caves, mine tunnels, behind loose tree bark, or in abandoned houses. These bats hibernate in suitable caves or mine tunnels within the range occupied in summer. Bats observed in winter are often found wedged deeply into narrow cracks and crevices in the rock ceilings of old mines. When probed from these crevices they are able to fly, which indicates they do not go into a deep winter sleep. This species was detected on the project site in April and May of 2012, and again in September (CH2 2012nn).

Long-legged myotis

Long-legged myotis prefers to roost in abandoned buildings, cracks in ground, cliff face and other crevices including under the los bark of trees (Chung and Macaoubrey 1995). This species has not been detected on the project site.

Mexican free tailed bat

Mexican free-tailed bats are common in habitat that ranges from pinyon juniper woodlands, to desert grasslands, to arid desert. Preferred roosting for this species includes caves, mines, bridges, and occasionally buildings (Chung and Macaoubrey 1995). This species is uniquely adapted for fast and long distance flight. Hoffmeister (1986) reports these bats travel up to 50 miles to forage in a single night. Other features within grasslands provide additional types of roosting and foraging habitat. This species has been detected on the project site in February through September, and was not detected in December, 2011 or January, 2012.

Special-Status Bird Species

Golden Eagle

Throughout most of the western United States golden eagles are mostly year-round residents, breeding from late January through August with peak activity in March through July (Kochert et al. 2002). Migratory patterns are usually fairly local in California

where adults are relatively sedentary, but dispersing juveniles sometimes migrate south in the fall. This species is generally considered to be more common in southern California than in the northern part of the state (USFWS 2008).

Golden eagles need open terrain for hunting and prefer grasslands, deserts, savanna, and early successional stages of forest and shrub habitats. Golden eagles primarily prey on lagomorphs and rodents but will also take other mammals, birds, reptiles, and some carrion (Kochert et al. 2002). This species prefers to nest in rugged, open habitats with canyons and escarpments, with overhanging ledges and cliffs and large trees used as cover. Golden eagles were detected foraging over the project site; however nesting habitat does not occur near the site.

The applicant's January 2012 Golden Eagle Use Survey Report (CH2 2012g) presented the results of wintering golden eagle surveys, conducted to supplement pedestrian surveys originally performed in 2011. These surveys were conducted from December 20, 2011 to January 11, 2012. Biologists visited eight onsite observational points. A total of 13 eagle observations (12 during avian point counts or mid-day eagle surveys and one incidental observation) were recorded on five separate days. Eagles were mostly noted in flight, foraging over the site, and were observed perching on power poles.

Surveys that rely on single year nest observations may provide inaccurate data on eagle use. Aerial surveys for golden eagles were conducted by the applicant, in coordination with resource agencies between October 3rd to 7th, 2011 and from November 9th to 11th, 2011. Surveys were conducted by a qualified raptor biologist familiar with aerial survey protocol (CH2 2012c). Nineteen confirmed golden eagle nests were observed within 10 miles of the site, along with six unidentified raptor nests. Of these, none were determined by the applicant to be active nests. Nests were described as in poor to excellent condition, or as alternate locations.

Golden eagles are a long lived species and may use from three to 14 nests per territory. However, breeding may not occur every year depending on available forage and nests that appear inactive in a given year may be occupied the following year by breeding birds. This species is present in the region and although the applicant indicated the nests were not active, a single survey cannot be used to make this determination.

Western Burrowing Owl

Western burrowing owls, a California Species of Special Concern, inhabit arid lands throughout much of the western United States and southern interior of western Canada (Haug et al. 1993). In the Mojave Desert this species has declined because of human-induced causes such as loss and/or fragmentation of habitat, diminished prey base, and high populations of species that prey on burrowing owl eggs and young. In this portion of its range, some owls are migratory, while some are year-round residents.

Burrowing owls are unique among the North American owls in that they nest and roost in abandoned burrows, especially those created by California ground squirrels, kit fox, desert tortoise, and other wildlife. Burrowing owls have a strong affinity for previously occupied nesting and wintering habitats. They often return to burrows used in previous years, especially if they were successful at reproducing there in previous years (Gervais

et al. 2008). The breeding season in southern California generally occurs from February to August with peak breeding activity from April through July (Haug et al. 1993).

In the Mojave Desert, burrowing owls generally occur at low densities in scattered populations, but they can be found in much higher densities near agricultural lands where rodent and insect prey tend to be more abundant (Gervais et al. 2008). Burrowing owls tend to be opportunistic feeders. Large arthropods, mainly beetles and grasshoppers, comprise a large portion of their diet, along with small mammals such as mice and voles (*Microtus*, *Peromyscus*, and *Mus* spp.).Larger prey consumed includes reptiles and amphibians, young cottontail rabbits, bats, and birds. Consumption of insects increases during the breeding season (Haug et al. 1993).

Burrowing owl sign was detected during desert tortoise protocol surveys of the project site conducted from March 13, 2011 to May 18, 2011 (HHSEGS 2011a). The applicant detected eight burrows with burrowing owl sign (feathers, whitewash droppings, and/or pellets) on the project site. Section 5.2.6.7.2 of the AFC (HHSEGS 2011a) indicated that burrowing owls were observed in the proposed project site boundary, in the northwestern quarter of Section 16, and immediately west of the site. Burrowing owl sign was also detected adjacent to the project and within the 150 meters survey boundary. The exact number of owls observed was not quantified. The AFC (HHSEGS 2011a, Table 5.2-7) confirms burrowing owls were observed in 2010 and spring of 2011.

Short eared Owl

The short-eared owl is designated as a California Species of Special Concern. This species is a widespread winter migrant, found primarily in the Central Valley, the western Sierra Nevada foothills, and along the coastline. Short-eared owls typically occur as an uncommon winter migrant in southern California. This bird has also been periodically identified in the Pahrump and Amargosa River Valley. Primary habitats for this species include open areas with few trees, including annual and perennial grasslands, prairies, dunes, meadows, irrigated lands, and saline and fresh water emergent wetlands. Short-eared owl numbers have declined over most of the species' range due to destruction and fragmentation of grassland and wetland habitats. Nesting short-eared owls require open country that supports concentrations of microtine rodents and herbaceous cover sufficient to conceal their ground nests from predators (Holt and Leasure 1993). A single short eared owl was observed on the site by staff in April 2012; the bird was likely a migrant.

Loggerhead Shrike

Loggerhead shrikes are uncommon residents throughout most of the southern portion of their range, including southern California. In southern California they are generally much more common in interior desert regions than along the coast (Humpel 2008). In the Mojave Desert this species appears to be most numerous in flat or gently sloping deserts and desert/scrub edges, especially along the eastern slopes of mountainous areas (*ibid.*). Loggerhead shrikes initiate their breeding season in February and may continue with raising a second brood as late as July; they often re-nest if their first nest fails or to raise a second brood (Yosef 1996).

This species can be found within lowland, open habitat types, including creosote scrub and other desert habitats, sage scrub, non-native grasslands, chaparral, riparian, croplands, and areas characterized by open scattered trees and shrubs. Fences, posts, or other potential perches are typically present. In general, loggerhead shrikes prey upon large insects, small birds, amphibians, reptiles, and small rodents over open ground within areas of short vegetation, usually impaling prey on thorns, wire barbs, or sharp twigs to cache for later feeding (Yosef 1996). Loggerhead shrike were observed on the project site in several locations during April and May of 2011 site surveys.

Prairie Falcon

The prairie falcon inhabits dry environments in the North American west from southern Canada to central Mexico. It is They are rare in the arid southeast open habitat from annual grasslands to alpine meadows at all elevations up to 3,350 meters, but is associated primarily with perennial grasslands, savannahs, rangeland, some agricultural fields, and desert scrub areas. They require cliffs or bluffs for nesting though will sometimes nest in trees, on power line structures, on buildings, or inside caves or stone quarries. Ground squirrels and horned larks are the primary food source, but prairie falcon will also prey on lizards, other small birds, and small rodents.

Prairie falcon was observed on the project site and in adjacent areas in 2011. Two birds were observed in December, 2011, and January, 2012(CH2 2012g).

Crissal Thrasher

In California, the crissal thrasher is a year-round resident within very limited regions of the Mojave and Colorado deserts. In the greater vicinity of the project site, the species is known to occupy the New York, and Clark mountains, the Kingston Range, and Mesquite Lake, San Bernardino County; and north to the vicinity of Tecopa and Shoshone, Inyo County (Shuford and Gardali 2008). This species prefers dense, low scrubby vegetation, often riparian scrub or woodland at lower elevations and the low, dense scrub associated with arroyos at higher elevations in the Mojave Desert (Garrett and Dunn 1981, Cody 1999). No crissal thrashers have been observed on site to date (HHSEGS 2011a).

Le Conte’s Thrasher

Le Conte’s Thrasher is a permanent resident of the deserts of the southwestern U.S. and northwestern Mexico. The Le Conte’s thrasher population densities are among the lowest of passerine (perching) birds, estimated at less than five birds per square kilometer in optimal habitats (Fitton 2008). This low population density decreases the probability of their detection during field surveys. An uncommon and hard-to-find bird, it characteristically exists only in low densities; in good habitat for the bird there may be only 10 adults per square kilometer (American Bird Conservancy 2012). This bird prefers a nest site of cholla cactus or dense, thorny desert shrub such as saltbush or shadscale, typically occupying sparsely vegetated habitat such as desert flats, dunes, or gently rolling hills.

An important habit component is accumulated leaf letter, since this species feeds almost entirely on arthropods taking shelter in this substrate. Le Conte's Thrasher also consumes plant seeds, and will take small snakes, lizards, and bird’s eggs. Since this

species inhabits an environment where surface water is rare, all its basic water requirements are met through its diet. This bird was observed onsite during spring of 2011 (HHSEGS 2011a).

Bendire's Thrasher

Bendire's thrashers are known in California from scattered locations in Kern, Inyo, San Bernardino, and Riverside counties, and one documented outlier in San Diego County (Sterling 2008). In the Mojave Desert, this species favors Mojave Desert scrub, primarily in areas that contain large cholla, Joshua tree, Spanish bayonet, Mojave yucca, or other succulents (*ibid.*). The status of populations of this species is poorly understood, but threats are believed to be loss of habitat due to urbanization and agricultural development, harvesting of yuccas and cholla cacti, and off-road vehicle activity (*ibid.*). Bendire's thrasher is migratory to an unknown degree. Given the secretive nature of this species, much remains to be learned about feeding, breeding, and migratory behavior, as well as its range (American Bird Conservancy 2010). This species withdraws from the northern part of its range in the winter, and distribution during breeding is inconsistent. Bendire's Thrasher forages principally on the ground, feeding on arthropods, seeds and berries. This bird was observed onsite in spring of 2010 (HHSEGS 2011a). The applicant has indicated the observation of this species was incorrect and believes it may have been a misidentification. This species is more strongly associated with vegetation communities not present on the project site such as areas supporting large Joshua trees, cholla and other cacti. This species has not been observed on site during subsequent surveys conducted since 2010.

Northern Harrier

In western North America, the northern harrier breeds from northern Alaska south to Baja California, Mexico. This species does not commonly breed in desert regions of California, where suitable habitat is limited, but winters broadly throughout California in areas with suitable habitat. Northern harriers forage in open habitats including deserts, pasturelands, grasslands, and old fields. Because northern harriers rely on hearing to locate prey, they have unusual stiff feathers around the face, making them appear distinctly "owlish" (Cornell Lab of Ornithology 2012). Northern harriers were observed during spring 2011 surveys of the project site, and another 21 were observed during surveys for golden eagle, performed between December 20, 2011 and January 11, 2012 (CH2 2012g).

Phainopepla

This species in not considered rare in California and it is commonly found in southern California deserts and foothills. However, phainopepla is a covered species in the Clark County Multiple Species Habitat Conservation Plan. Phainopepla prefer open woodlands of oaks and other small trees, shrubs and chaparral; it is often associated with mistletoe berries. This species seems to thrive best in palm oasis, desert wash, and desert riparian habitats. In southern deserts, it has been noted that some individuals may leave from early May through September, moving to more western and northern parts of range. It is not known if phainopepla in the vicinity of the project site are year-round residents. Evidence suggests that some individuals may nest first on southern deserts and again in summering area in the same year (Hoffmann 1927; Grinnell and Miller 1944; McCaskie et al. 1979; Garrett and Dunn 1981; Ehrlich et al.

1988). This species has been observed onsite (HHSEGS 2011a), and is also known from the Stump Spring Area of Critical Environmental Concern in Nevada, and the Amargosa River in portions of both Nevada and California.

ASSESSMENT OF IMPACTS AND DISCUSSION OF MITIGATION

METHOD AND THRESHOLD FOR DETERMINING SIGNIFICANCE

The threshold for determining significance is based on the biological resources present or potentially present within the proposed project area in consideration of the proposed project description.

CEQA requires a list of criteria that are used to determine the significance of identified impacts. A significant impact is defined by CEQA as “a substantial, or potentially substantial, adverse change in any of the physical conditions within the area affected by the project” (State CEQA Guidelines Section 15382).

Thresholds for determining CEQA significance in this section are based on Appendix G of the CEQA Guidelines (CCR 2006) and performance standards or thresholds identified by the Energy Commission staff. The determination of whether a project has a significant effect on biological resources is based on the best scientific and factual data that could be reviewed for the project. In this analysis the following impacts to biological resources are considered significant if the project would result in:

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

ASSESSING DIRECT AND INDIRECT IMPACTS AND MITIGATION

Consistent with the requirements of CEQA and relevant regulations, the significance of potential impacts is evaluated through the application of the significance criteria

described above. The objective of the biological resources analysis is to identify potential adverse effects and/or significant impacts on biological resources.

Construction of the HHSEGS project includes the installation of heliostats, two power towers, electrical generation components as well as energy collection systems, access roads, and control buildings. Project construction would also require ancillary facilities including a water and gas pipeline and a 125-acre storm water retention area. The construction and operation of this large-scale solar generation facility includes a number of impacts to biological resources. The nature and type of the impact can depend on a number of factors including species life history characteristics, type of use of the habitat, and hydrology that is present at and near the project site. The following discussion provides an overview of the direct, indirect, and operational impacts that are expected to occur with the development of the proposed HHSEGS facility.

The California Environmental Quality Act (CEQA) Guidelines define “direct” impacts as those impacts that result from the project and occur at the same time and place. These include but are not limited to the removal of vegetation, disturbance to wildlife from construction activities, noise, lighting, dust, or the crushing of burrows. Indirect impacts are caused by the project, but can occur later in time or farther removed in distance while still reasonably foreseeable and related to the project. Indirect impacts can include the disruption of the native seed bank, the spread of invasive plant species, alterations in light regimes (i.e., shade from solar panels), or changes to soil or hydrology that adversely affect native species overtime. Indirect impacts may also include increased traffic and human disturbance. Operational impacts include both direct and indirect impacts that occur during the life of project operation, including maintenance activities.

Significance of impacts is generally determined by compliance with applicable LORS; however, guidelines adopted by resource agencies may also be used. This section analyzes the potential for direct and indirect impacts to biological resources from the construction and operation of the proposed project and provides mitigation, as necessary, in an effort to reduce the severity of potentially adverse impacts. If a significant impact is identified, appropriate mitigation to reduce impacts to below significance is then developed, in conformance with LORS. Within this section, if and where an adverse significant impact is identified appropriate mitigation and concomitant proposed condition of certification immediately follow, including supporting rationale for the effectiveness of the mitigation. The complete mitigation recommendations are found in the subsection entitled Proposed Conditions of Certification (COCs).

APPLICANT PROPOSED MEASURES

In order to reduce or avoid impacts to biological resources the applicant has proposed a series of Applicant Proposed Measures (APMs) that would be implemented during the construction and operation of the proposed project. The APMs are presented in Section 5.2.9 of the AFC and include a range of actions from broad general measures designed to protect biological resources to specific actions regarding survey requirements or plan development. APMs or mitigation strategies designed by the applicant are discussed, and if considered appropriate, are incorporated into the COCs recommended in the FSA. Where necessary, supplementary conditions are also introduced and recommended where APMs do not meet the criteria identified by CEQA as a defensible, enforceable mitigation measure. For example, measures would be considered

inadequate if they lack specificity regarding the timing of an action; do not contain clearly identified performance standards; do not identify the expected goals of a specific plan; or do not identify reporting standards.

SUMMARY OF IMPACTS

Biological Resources Table 6 summarizes the direct, indirect, and cumulative impacts to biological resources resulting from the proposed project, and includes suggested COCs to mitigate these impacts.

BIOLOGICAL RESOURCES Table 6
Overview of Significant Impacts and Conditions of Certification (COCs)

Impact	Conditions of Certification	Determination
Mojave Desert scrub **Direct Impacts:** Permanent loss of 1,580.5 acres, including 3,197 acres desert tortoise habitat, 1,580.5 golden eagle foraging habitat, and habitat for other special-status wildlife; fragmentation of adjacent wildlife habitat and native plant communities. Habitat common and widespread but impacts dependent wildlife, including special-status species. **Indirect Impacts:** Spread of non-native invasive plants; changes in drainage patterns downslope; increased risk of fire; disturbance (noise, lights) to adjacent wildlife; fugitive dust. **Cumulative Impacts:** Contributes to cumulatively considerable loss of habitat, fragmentation, and indirect effects from past, present, and foreseeable future projects in the California Desert region for dependent wildlife.	**BIO-12** requires offsite habitat acquisition and enhancement. **BIO-8** requires implementation of impact avoidance and minimization measures. **BIO-7** BRMIMP ensures implementation of all conditions of certification. **BIO-7** includes measures for dust control and fire prevention. **BIO-18** requires implementation of weed management plan to prevent spread into adjacent habitat. **BIO-21** requires a Designated Botanist to oversee measures for botanical resources for life of project.	Less than significant with conditions of certification
Shadscale Scrub **Direct Impacts:** Permanent loss of 1,616.5 acres, including 3,197 acres desert tortoise habitat, 1,616.5 golden eagle foraging habitat, and habitat for other special-status wildlife; fragmentation of adjacent wildlife habitat and native plant communities. Habitat common and widespread but impacts dependent wildlife, including special-status species. **Indirect Impacts:** Spread of non-native invasive plants; changes in drainage patterns downslope; erosion and sedimentation of disturbed soils; increased risk of fire; disturbance (noise, lights) to adjacent wildlife; fugitive dust. **Cumulative Impacts:** Contributes to cumulatively considerable loss of habitat, fragmentation, and indirect effects from past, present, and foreseeable future projects in the California Desert region for dependent wildlife.	**BIO-12** requires offsite habitat acquisition and enhancement. **BIO-8** requires implementation of impact avoidance and minimization measures, including fugitive dust control. **BIO-6, BIO-8,** and **BIO-18-** include measures for fire prevention. **BIO-18** requires implementation of weed management plan to prevent spread into adjacent habitat. **BIO-7** BRMIMP ensures implementation of all COCs. **BIO-21** requires Designated Botanist to oversee measures for botanical resources for life of project.	Less than significant with conditions of certification
Desert Washes (Waters of the State/Waters of the US) **Direct Impacts:** Permanent loss of habitat function and values for 23.21 acres of state waters (including 0.42 acres Waters of the US). Portion of hydrologic and geomorphic function maintained onsite and reflected in reduced mitigation ratio (from 3:1 to 2:1) **Indirect Impacts:** Onsite, altered surface drainage	**BIO-22** requires acquisition of compensation lands within Pahrump Valley or adjacent valleys at a 2:1 ratio. **BIO-22** also includes measures for minimizing impacts to hydrologic and geomorphic functions onsite and to adjacent offsite streams. **BIO-18** requires implementation of weed	Less than significant with conditions of certification

Impact	Conditions of Certification	Determination
patterns and groundwater recharge; upstream, noise, lighting, glare, human disturbance, potential head-cutting along pipeline trench through washes, diminished habitat value near the project on 0.4 ac. of washes delineated upstream and within California. **Cumulative Impacts:** Contributes to cumulatively considerable loss of desert wash habitat function and values, fragmentation, erosion/sedimentation, altered surface drainage and groundwater recharge patterns, and the spread of invasive weeds into desert washes from past, present, and foreseeable future projects in the Pahrump watershed. .	management plan that would prevent spread of invasive weeds into offsite washes (washes are a common vector for weeds). **BIO-7** BRMIMP ensures enforcement of all COCs. **SOIL-1** includes measures for erosion and sediment control.	
Groundwater-dependent Ecosystems **Direct Impacts:** None. Effects of pumping indirect (may take several-to-many years to propagate to the project boundary), sensitive resources located between one-half and five miles from the project wells. **Indirect Impacts:** Potential for significant indirect impacts to groundwater-dependent ecosystems (GDEs) from project pumping, from habitat loss to impaired habitat function and value for dependent wildlife, including special-status species; reduced cover of mesquite facilitated invasion of weeds and deflation of dunes; loss of a rare plant community; conflicts with BLM ACEC management goals and Clark County conservation management strategy for Stump Spring and Pahrump Valley area mesquite reduced plant cover which increases wind erosion, weedy species, increased risk of area fire from increase in vehicle traffic, etc.; impacts to special-status species inhabiting the GDEs. **Cumulative Impacts:** Even minor impacts cumulatively considerable due to ecological significance of habitat and its importance to BLM.	**WATER SUPPLY-4** requires groundwater elevation monitoring with triggers to stop, reduce, or modify pumping if trigger exceeded. **WATER SUPPLY-1** requires the acquisition and retirement of water rights to offset the project's contribution to the basin imbalance. **BIO-6, BIO-8, and BIO-18** include measures for fire prevention to protect adjacent mesquite washes and coppice dunes. **BIO-7** BRMIMP ensures enforcement of all conditions of certification. Under **BIO-21**, tasks requiring the expertise of a botanist must be conducted or supervised by a qualified botanist or vegetation ecologist. **BIO-23** requires monitoring to track the impacts of pumping to groundwater levels as they develop during the life of the project, and defines triggers for adaptive management to be implemented if data indicate impending adverse effects.	Less than significant with conditions of certification
Special-status Plants **Direct Impacts:** Loss of significant portion of California range of 4 species from project construction and operation. Potential accidental impacts to nine offsite occurrences in close proximity to project boundary during construction**.** **Indirect Impacts:** Potential indirect impacts to nine offsite occurrences in close proximity during operation from introduction and spread of non-native invasive plants; increased risk of fire; altered drainage patterns downstream of site; erosion and sedimentation of disturbed soils; accidental chemical and herbicide drift; disruption of photosynthesis and other metabolic processes from dust, disrupted reproductive process (pollination & dispersal). **Cumulative Impacts:** Contributes to cumulatively considerable direct and indirect effects from past, present, and foreseeable future projects in the California range of species and local population.	**BIO-20** requires compensatory mitigation for impacts to four species (gravel milk-vetch, Wheeler's skeletonweed; Preuss' milk-vetch, and Torrey's joint-fir) through acquisition and preservation offsite. Three offsite occurrences shall be protected for every S1 ("critically imperiled") species affected and two offsite occurrences protected for every S2 ("imperiled") species affected. Includes option to mitigate through restoration of at-risk offsite occurrences. **BIO-19** requires avoidance and minimization measures during life of project to protect nine offsite occurrences located in close proximity to the project boundary. **BIO-21** requires a qualified botanist conduct or supervise specific duties.	Less than significant with conditions of certification

Impact	Conditions of Certification	Determination
	BIO-22 requires compensation of washes in Pahrump Valley or adjacent valleys (washes are important dispersal pathways for rare plants). **BIO-18** requires implementation of weed management plan to prevent spread into offsite occurrences. **BIO-6, BIO-8, and BIO-18** include measures for fire prevention. **BIO-8** includes measures for fugitive dust control. **BIO-7** BRMIMP ensures enforcement of all COCs.	
Common Wildlife and Nesting Birds **Direct Impacts:** Potential mortality or disturbance during construction and operation, loss or fragmentation of habitat, displacement, and disruption of movement, and exposure to concentrated solar flux (nesting birds and flying insects). **Indirect Impacts:** Fragmentation of local population; introduction and spread of non-native invasive plants; increased risk of fire; noise, and light. Disruption of nesting and foraging behaviors. **Cumulative Impacts:** Contributes to cumulatively considerable loss of habitat, fragmentation, and indirect effects from past, present, and foreseeable future projects in the Pahrump Valley.	**BIO-1 through BIO-8** requires avoidance and minimization measures during life of project, construction monitoring, worker training, fugitive dust control, fire prevention and weed management. **BIO-16** requires pre-construction monitoring and avoidance for nesting birds. **BIO-15** the development of Avian, Bat, and Golden Eagle Protection plans.	Less than significant with conditions of certification, but see conclusions for **Migratory/ Special-Status Resident Avian Species** within this table.
Desert Tortoise **Direct Impacts:** Loss of 3,197 acres of desert tortoise habitat, potential mortality or disturbance during construction and operation, loss or fragmentation of habitat, displacement, and disruption of movement. Potential disturbance from translocation including mortality and the spread of disease. **Indirect Impacts:** Fragmentation of local population; introduction and spread of non-native invasive plants; increased risk of fire; noise, and light. Predation by ravens, road kill and fire. **Cumulative Impacts:** Contributes to cumulatively considerable loss of habitat, fragmentation, and indirect effects from past, present, and foreseeable future projects in the Eastern Mojave Recovery Unit.	**BIO-1 through BIO-8** requires avoidance and minimization measures during life of project, construction monitoring, worker training, fugitive dust control, fire prevention and weed management. **BIO-9** requires desert tortoise fencing and preconstruction clearance surveys. **BIO-10** requires the capture and translocation of desert tortoise and the development and implementation of a prescriptive translocation plan. **BIO-12** requires the acquisition of 6,358 acres of compensatory mitigation for the long term management of the species. **BIO-13** requires the development of a Raven Management Plan and the payment of a raven fee. **BIO-25** provides for an in-lieu fee and advanced mitigation option that the applicant may elect to implement as a form of mitigation.	Less than significant with conditions of certification
Kit Fox and American Badger **Direct Impacts:** Loss of 3,277 acres of desert habitat, potential mortality or disturbance during construction and operation, loss or fragmentation of habitat, displacement, and disruption of movement. Potential disturbance from passive relocation including mortality and the spread of disease. **Indirect Impacts:** Fragmentation of local population;	**BIO-1 through BIO-8** requires avoidance and minimization measures during life of project, construction monitoring, worker training, fugitive dust control, fire prevention and weed management. **BIO-9** requires desert tortoise fencing which will exclude badgers and kit fox from the project site.	Less than significant with conditions of certification.

Impact	Conditions of Certification	Determination
introduction and spread of non-native invasive plants; increased risk of fire; noise, and light. **Cumulative Impacts:** Contributes to cumulatively considerable loss of habitat, fragmentation, and direct loss of these species from past, present, and foreseeable future projects in the Pahrump Valley.	**BIO-12** requires the acquisition of 6,358 acres of compensatory mitigation for desert tortoise; however land acquisition and management will reduce impacts to these species. **BIO-14** requires that prior to ground disturbance, a qualified biologist perform a preconstruction survey for badger and kit fox dens in the project area, including areas within 250 feet of all project facilities, utility corridors, and access roads. Requires the development of Management Plan to address concerns related to passive relocation. **BIO-22** requires compensatory mitigation for state waters which will reduce habitat loss to these species. **BIO-18** requires a weed management plan be developed to minimize the spread of invasive plant species. **BIO-23** requires monitoring to track the impacts of pumping to groundwater levels as they develop during the life of the project, and defines triggers for adaptive management to be implemented if data indicate impending adverse effects.	
Nelson's bighorn sheep **Direct Impacts:** No direct loss of important spring foraging habitat. Potential disruption of habitat periodically used for intermountain movement. No direct impacts to known dispersal corridors. **Indirect Impacts:** Fragmentation of local population; introduction and spread of non-native invasive plants; increased risk of fire; and degradation of off-site springs or seeps. **Cumulative Impacts:** Contributes to cumulatively considerable loss of habitat, fragmentation, and direct loss of these species from past, present, and foreseeable future projects in the Pahrump Valley.	**BIO-1** through **BIO-8** requires avoidance and minimization measures during life of project, construction monitoring, worker training, fugitive dust control, fire prevention and weed management. **BIO-12** requires the acquisition of 6,358 acres of compensatory mitigation for desert tortoise; however land acquisition and management may preserve habitat for bighorn sheep. **BIO-22** requires compensatory mitigation for state waters which will reduce habitat loss for this species. **BIO-18** requires a weed management plan be developed to minimize the spread of invasive plant species. **BIO-23** requires monitoring of ground water to ensure impacts to ground water dependent vegetation does not result in habitat degradation for these species.	Less than significant with conditions of certification.
Special Status Bats **Direct Impacts:** No direct loss of maternity, day roosts, or hibernacula. Loss of foraging habitat. Bats that forage near the ground, such as the pallid bat, would also be subject to crushing or disturbance by vehicles driving at dusk, dawn, or during the night. Collision with facility structures. **Indirect Impacts:** the loss of foraging habitat due to type conversion, night time lighting that exposes bats	**BIO-1 through BIO-8** requires avoidance and minimization measures during life of project, construction monitoring, worker training, fugitive dust control, fire prevention and weed management. **BIO-16** the development of an avian and bat plan. **BIO-23** requires monitoring to track the impacts of pumping to groundwater levels	Less than significant with conditions of certification.

Impact	Conditions of Certification	Determination
to predation, and alteration in prey base. Degradation to Stump Spring AEC and associated mesquite thickets in Nevada. **Cumulative Impacts:** Contributes to cumulatively considerable loss of habitat, fragmentation, and direct loss of these species from past, present, and foreseeable future projects in the Pahrump Valley.	as they develop during the life of the project, and defines triggers for adaptive management to be implemented if data indicate impending adverse effects.	
Migratory/Special-Status Resident Avian Species **Direct Impacts:** Loss of 3,277 acres of desert habitat, potential mortality or disturbance during construction and operation, loss or fragmentation of habitat, displacement, and disruption of movement. Collision, electrocution, glare and exposure to solar flux. **Indirect Impacts:** Fragmentation of local population; introduction and spread of non-native invasive plants; increased risk of fire; and degradation of off-site springs or seeps. Weed abatement, mirror washing and maintenance. Glare or heat associated with the heliostats may also adversely affect bird's use of the site. **Cumulative Impacts:** Contributes to cumulatively considerable loss of habitat, fragmentation, and direct loss of these species from past, present, and foreseeable future projects in the Pahrump Valley.	**BIO-1** through **BIO-8** requires avoidance and minimization measures during life of project, construction monitoring, worker training, fugitive dust control, fire prevention and weed management. **BIO-8** also requires transmission lines and all electrical components to be designed, installed, and maintained in accordance with the Avian Power Line Interaction Committee guidelines. **BIO-15** the development of Avian, Bat, and Golden Eagle Protection plans. **BIO-16** requires pre-construction monitoring and avoidance for nesting birds. **BIO-23** requires monitoring to track the impacts of pumping to groundwater levels as they develop during the life of the project, and defines triggers for adaptive management to be implemented if data indicate impending adverse effects.	Potentially significant and unavoidable even with conditions of certification
Golden Eagle **Direct Impacts:** Loss of 3,277 acres of desert habitat, potential mortality or disturbance during construction and operation, loss or fragmentation of habitat, displacement, and disruption of movement. Collision, electrocution, glare and exposure to solar flux. **Indirect Impacts:** Fragmentation of local population; introduction and spread of non-native invasive plants; increased risk of fire; and degradation of off-site springs or seeps. Weed abatement, mirror washing and maintenance. Glare or heat associated with the heliostats may also adversely affect bird's use of the site. **Cumulative Impacts:** Contributes to cumulatively considerable loss of habitat, fragmentation, and direct loss of this species from past, present, and foreseeable future projects in the Pahrump Valley.	**BIO-1** through **BIO-8** requires avoidance and minimization measures during life of project, construction monitoring, worker training, fugitive dust control, fire prevention and weed management. **BIO-8** also requires transmission lines and all electrical components to be designed, installed, and maintained in accordance with the Avian Power Line Interaction Committee guidelines. **BIO-15** the development of an avian, bat, and golden eagle plan. **BIO-16** requires pre-construction monitoring and avoidance for nesting birds. **BIO-23** requires monitoring to track the impacts of pumping to groundwater levels as they develop during the life of the project, and defines triggers for adaptive management to be implemented if data indicate impending adverse effects.	Potentially significant and unavoidable even with conditions of certification
Wildlife Movement **Direct Impacts:** Placement of physical structures such as the solar arrays, buildings, or other facilities that block or impede movement. No direct impacts to	No specific conditions proposed.	Less than significant.

Impact	Conditions of Certification	Determination
known dispersal corridors. **Indirect Impacts:** Fragmentation of local population; introduction and spread of non-native invasive plants; increased risk of fire; and degradation of off-site springs or seeps. **Cumulative Impacts:** Contributes to cumulatively considerable loss of habitat, fragmentation, and direct loss of wildlife movement from past, present, and foreseeable future projects in the Pahrump Valley. Less than significant with COCs.		

SUMMARY OF FINANCIAL SECURITY AND NESTING MITIGATION REQUIREMENTS

Several of the recommended Conditions of Certification require the project owner to mitigate the project's impacts to biological resources by acquiring comparable lands and protecting them in perpetuity under a conservation easement. These conditions are referred to as compensatory mitigation and include:

- **BIO-12** (Desert Tortoise Compensatory Mitigation);
- **BIO-17** (Burrowing Owl Impact Avoidance, Minimization, and Compensatory Measures);
- **BIO-20** (Special-Status Plant Compensatory Mitigation); and
- **BIO-22** (State Waters Compensatory Mitigation and Avoidance & Minimization Measures).

Biological Resources Table 7 provides an estimate of the financial security deposit required prior to the start of ground-disturbing activities, and includes the estimated costs associated with the purchase, transaction, appraisal, escrow, and title insurance including mineral, oil, and gas rights. The estimate also addresses costs of initial enhancement (e.g., signs, fencing, and boundary/property line surveys); or restoration actions (e.g. removal of exotic species, debris, or decommissioning roads), management for ongoing activities (e.g., managing public access and enforcement); and monitoring the implementation, effectiveness, and compliance with the conservation goals and objectives of the mitigation.

For those projects using the Renewable Energy Action Team (REAT) National Fish and Wildlife Foundation (NFWF) Mitigation Account the budget includes the costs of administration of contracts and reporting. For all conditions of certification requiring habitat compensation, the estimated land acquisition costs and amount of the financial security shall be calculated based on the estimated cost per acre for Desert Tortoise mitigation (Condition of Certification **BIO-12**) as a best available proxy.

A number of comments were received from the public regarding the ability of the project owner to nest mitigation requirements. For example, impacts to desert tortoise, burrowing owls, and State waters require the acquisition and management of

compensatory mitigation lands to reduce impacts to less than significant levels. As described in **Biological Resources Table 7,** individually these conditions require the acquisition of lands to minimize project effects to less than significant levels. Although the project owner is required to provide a security deposit for each of the compensatory land requirements, it may be possible to achieve the mitigation for a number of resources through the acquisition of a single parcel (nesting). For the purposes of the FSA, staff considers the nesting of mitigation to be appropriate where the acquisition of lands for one species (i.e., desert tortoise) can be demonstrated to effectively reduce impacts for a different species or resource (i.e., desert washes or burrowing owls). Similar to conditions identified on the proposed project site, the potential compensation lands may support more than one of the affected resources. Therefore the project owner may fulfill the compensatory mitigation obligations for multiple species or resources on all or any portion of the proposed mitigation lands providing they meet all the selection criteria required in each applicable condition of certification. The separate financial security deposit for each compensatory mitigation obligation is required in the event that compensation lands cannot be found that meet the criteria for multiple species or habitats.

Biological Resources Table 7
Biological Resources Compensatory Mitigation
Summary of Compensation Lands Costs[1, 11]

	Desert tortoise compensation	Burrowing owl compensation	State Waters compensation
Number of acres	6,358	600	23.21
Estimated number of parcels to be acquired, at 40 acres per parcel[2]	159	15	1
Land cost at $1000/acre[3]	$6,358,000.00	$600,000.00	$23,210.00
Level 1 Environmental Site Assessment at $3000/parcel	$476,850.00	$45,000.00	$1,740.75
Appraisal at no less than $5,000/parcel	$794,750.00	$75,000.00	$2,901.25
Initial site clean-up, restoration or enhancement, at $250/acre[4]	$1,589,500.00	$150,000.00	$5,802.50
Closing and Escrow Cost at $5000/parcel[5]	$794,750.00	$75,000.00	$2,901.25
Biological survey for determining mitigation value of land (habitat based with species specific augmentation) at $5000/parcel	$794,750.00	$75,000.00	$2,901.25
3rd Party Administrative Costs (Land Cost x 10%)[6]	$635,800.00	$60,000.00	$2,321.00
Agency cost to accept land[7] [(Land Cost x 15%) x 1.17] (17% of the 15% for overhead)	$1,115,829.00	$105,300.00	$4,073.36
Subtotal - Acquisition and Initial Site Work	$12,560,229.00	$1,185,300.00	$45,851.36
Long-term Management and Maintenance Fund (LTMM) fee at $1450/acre[8]	$9,219,100.00	$870,000.00	$33,654.50
Financial Security Requirement Subtotal if the application-directed compensatory	**$21,779,329.00**	**$2,055,300.00**	**$79,505.85**

	Desert tortoise compensation	Burrowing owl compensation	State Waters compensation
mitigation option			
NFWF Fees			
Establish Project Specific Account[9]	$12,000.00	$12,000	$12,000.00
Call for and Process Pre-Proposal Modified RFP or RPF[10]	$30,000.00	$30,000.00	$30,000.00
NFWF Management fee For Acquisition and Enhancement Actions (Subtotal x 3%)	$376,806.87	$35,559.00	$1,375.54
NWFW Management Fee for LTMM account (LTMM x 1%)	$92,191.00	$8,700.00	$336.55
Subtotal of NFWF Fees if NFWF option selected	$510,997.87	$86,259.00	$47,712.09
TOTAL Estimated cost for deposit in project specific REAT-NFWF Account	**$22,290,326.87**	**$2,141,559.00**	**$123,217.94**

1. All costs are best estimates as of summer 2010. Actual costs will be determined at the time of the transactions and may change the funding needed to implement the required mitigation obligation. Note: regardless of the estimates, the developer is responsible for providing adequate funding to implement the required mitigation.
2. For the purposes of determining costs, a parcel is defined at 160 acres, recognizing that some will be larger and some will be smaller, but that 160 acres provides a good estimate for the number of transactions anticipated (based on input from CDD).
3. Generalized estimate taking into consideration a likely jump in land costs due to demand, and an 18-24 month window to acquire the land after agency decisions are made. If the agencies, developer, or 3rd party has better information on land costs in the specific area where project-specific mitigation lands are likely to be purchased, that data overrides this general estimate. Note: regardless of the estimates, the developer is responsible for providing adequate funding to implement the required mitigation.
4. Based on information from CDFG.
5. Two transactions at $2500 each: landowner to 3rd party; 3rd party to agency. The transactions will likely be separated in time.
6. Includes staff time to work with agencies and landowners; develop management plan; oversee land transaction; organizational reporting and due diligence; review of acquisition documents; and assembling acres to acquire.
7. Includes agency costs to accept the land into the public management system and costs associated with tracking/managing the costs associated with the donation acceptance, including 2 physical inspections; review and approval of the Level 1 ESA assessment; review of all title documents; drafting deed and deed restrictions; issue escrow instructions; and parcel mapping.
8. Estimate for purposes of calculating general costs. The actual long term management costs will be determined using a Property Assessment Report (PAR) tailored to the specific acquisition. Includes land management; enforcement and defense of easement or title [short and long term]; monitoring.
9. Each renewable energy project will be a separate sub-account within the REAT-NFWF account, regardless of the number of required mitigation actions per project.
10. If determined necessary by the REAT agencies if multiple 3rd parties have expressed interest; for transparency and objective selection of 3rd party to carryout acquisition.
11. Compensatory mitigation for special-status plants, as described in **BIO-20**, is based on the number of occurrences affected, to be replaced on an occurrence-for-occurrence basis--not acres of 'habitat' affected--mitigation lands must be occupied by the affected species. For example, under a 3:1 mitigation ratio for CNDDB S1-ranked species, three occurrences must be acquired and. CNDDB S2-ranked species are mitigated at a 2:1 ratio, that is, two occurrences must be acquired and protected for S2-ranked species affected.

Project Impacts to Common Wildlife and Wildlife Habitat

Construction of the HHSEGS facility would result in large scale direct, indirect and operational impacts to common wildlife and would result in the permanent or long-term land use conversion of primarily native vegetation and wildlife habitat.

TEMPORARY AND LONG-TERM IMPACTS

Impact analyses typically characterize effects to vegetation and wildlife habitat as either temporary or permanent. Permanent impacts are generally considered disturbances or land use conversion that would preclude most natural wildlife habitat function throughout the life of a project or longer. Temporary disturbance is generally understood as construction disturbance occurring on a site that may return to a more natural condition or may be actively revegetated or enhanced, returning to natural conditions within approximately five years. In desert ecosystems, the interpretation of permanent and temporary impacts needs to reflect the slow recovery rates of native plant communities and the subsequent loss of value to native wildlife. Natural recovery rates from disturbance in desert ecosystems depend on the nature and severity of the impact. Temporary habitat impacts such as vegetation removal and soil disturbance can take from 50 to 300 years for partial recovery and complete ecosystem recovery may require over 3,000 years (Lovich and Bainbridge, 1999). During this time the value of the habitat to wildlife is reduced and in some cases can no longer supports species that existed in those areas preceding the disturbance. In this analysis, an impact that might be considered temporary in other parts of California will be considered long-term or permanent due to these very slow natural recovery rates.

Permanent and long-term habitat loss, as defined by staff, includes any impacts that would not recover within five years. Staff considers that project impacts to habitat persisting throughout the life of the project and beyond are, for purposes of this analysis, permanent. In addition, staff considers that temporary project impacts to habitats that persist longer than five years are long-term. Construction and operation of the HHSEGS would have permanent impacts throughout the solar generator site and on any permanent new or widened access routes. In addition, the project would have long-term impacts where habitat is disturbed for temporary construction areas.

DIRECT IMPACTS TO WILDLIFE HABITAT

The term “habitat” refers to the environmental and ecological conditions where a species is found. Wildlife habitat is generally described in terms of vegetation, though a complete explanation often must encompass further detail, such as availability or proximity to water; suitable nesting or denning sites; shade; foraging perches; cover sites to escape from predators; soils that are suitable for burrowing or hiding; limited noise and disturbance; and many other factors that are unique to each species. Vegetation itself provides many aspects of habitat, physical structure, and biological productivity and food resources for many wildlife species. Further, vegetation often reflects other habitat components such as regional climate, soil productivity and texture, elevation, and topography. Thus, vegetation is a useful overarching descriptor for habitat and it is the primary factor in this analysis of impacts to wildlife habitat.

Native vegetation would be cleared and grubbed (i.e., shrubs and roots removed) for construction of permanent access roads, heliostat support installation, construction of solar towers, and other project facilities throughout much of the proposed solar generator site. Outside of access roads and maintenance tracks, vegetation would be cut to 12-18 inches to provide clearance for heliostat function, but would leave the root structure intact (HHSEGS 2011a). Similarly, grading plans have been designed to promote sheet flow and maintain natural features, with one notable exception, the 125-acre retention area which would impound water for approximately 24 hours following

large storm events. Specific details addressing the proposed retention pond is discussed further below under the subsection entitled Retention Pond.

Although the project proposes to utilize a “low impact design” which substitutes mowing for grading wherever possible, and maintains natural drainage features as much as possible; functional habitat values on the project site for most species of wildlife will be lost. Outside of access roads and maintenance tracks, vegetation may be cut to ground level as needed for construction but roots would be left intact, allowing for some regrowth. During project operations, vegetation would be cut or removed as needed to provide clearance for heliostat function and manage potential fire hazard. Native shrubs undergoing repeated mowing would be weakened and diminished in size, degrading or eliminating their value as wildlife habitat. Overall impacts of these construction, operation, and maintenance procedures would cause substantial degradation to native vegetation and wildlife habitat. However, to the extent that native shrubs persist on the site, they may have some benefit to soils and hydrology, by reducing likely soil erosion throughout the heliostat fields.

Construction of the proposed project would result in the direct loss of foraging habitat for a variety of wildlife from construction and operation of the facility and the permanent conversion of open space. How the project would affect individual species depends on many factors including how a species tolerates disturbance and the ability of a species to adapt to features such as the heliostat arrays, access roads, noise from electrical transformers and human presence. For some common species including small reptiles, mice, rabbits, ground squirrels, and some disturbance tolerant birds, the project would not lead to a substantial loss of foraging habitat and may in fact provide additional perches, refugia, and increased access to some prey. However, for other species, the project would likely eliminate foraging opportunities due to the presence of the project facilities. These species include animals excluded by the perimeter fencing such as coyotes, deer, desert kit fox, or badgers. Large aerial foragers such as golden eagles and various raptors are also expected to have reduced foraging opportunities on the project site both during construction and operation of the facility.

INDIRECT IMPACTS TO WILDLIFE HABITAT

Indirect impacts to foraging habitat could include alterations to existing topographical and hydrological conditions, increased erosion and sedimentation, and the establishment of noxious weed colonies. Indirect impacts may also result in the alteration of soils, such as compaction that could reduce burrowing opportunities for small mammals and degrade existing habitat. The placement of perimeter fencing will also degrade existing habitat value for some wildlife by providing roosting opportunities for some disturbance tolerant birds such as ravens which can result increased predation risk in adjacent lands. Trash left on the project site could also attract predators such as the common raven and coyote (Boarman, 2002).

Conclusions and Discussion of Mitigation for Wildlife Habitat

Construction of the proposed project would occur over a period of approximately 29 months and result in the disturbance to approximately 3,277 acres of wildlife habitat (including dirt roads and disturbed areas). This vegetation and habitat provides cover, denning or nesting sites, foraging areas, and other habitat functions for wildlife species, including special-status species, throughout the area. In some cases, habitat use is

seasonal (e.g., for migratory birds) or is limited to foraging but not nesting (e.g., for golden eagles or other wide-ranging cliff-nesting raptors). Remnant vegetation and habitat that remain post construction and throughout the operational life of the facility may be suitable for some common species, such as side-blotched lizard, house finch, and desert cottontail. However, during construction and operations, the remnant or recovering vegetation and habitat would be unsuitable for most species, particularly species with specific habitat requirements, including most special-status wildlife. The project's direct impacts to native vegetation and wildlife habitat would be significant and require compensatory mitigation. Staff recommends measures below to reduce, minimize, or offset these impacts. Implementation of Condition of Certification **BIO-12** (Desert Tortoise Compensatory Mitigation), described below under Impacts to Special-Status Species, requires the acquisition, protection and enhancement of desert tortoise habitat. Implementation if this condition would reduce impacts to wildlife habitat to less than significant levels.

DIRECT IMPACTS TO WILDLIFE

Project level effects to wildlife depend on many factors that include but are not limited to the species use of the site (i.e. home range); behavioral factors that result in wildlife seeking refuge rather than dispersing (i.e., site fidelity, behavior); a given species dispersal ability; ecological characteristics (i.e., fossorial, aerial dispersal, highly mobile); and the ability of the species to evade or disperse from the construction activity. Project level effects to wildlife are further influenced by factors such as the seasonal use of the site. For example some species including small mammals and many reptiles are year round residents with small or restricted home ranges while other species including foxes, badgers, and some birds may be periodic visitors or have large or overlapping home ranges. Other species such as large raptors limit their activity on the site to foraging. Likewise, many species of birds may be semi-permanent dwellers or seasonal residents (i.e., migratory birds) that are present either as breeding pairs or rely on the site for winter foraging.

Direct impacts to wildlife could include mortality from trampling or crushing; increased noise levels due to heavy equipment use; light impacts from construction during low-light periods; increased vehicular and human presence along existing access roads; displacement due to habitat modifications, including vegetation removal, alterations of existing soil conditions; fugitive dust; and increased erosion and sediment transport. Wildlife could also become entombed in burrows or be subject to increased risk of predation when flushed from cover by equipment or construction workers. Fires that occur as a result of construction activities can quickly spread to vegetation and displace or kill native wildlife.

Noise from clearing, grading and construction activities could also affect wildlife in adjacent habitats by interfering with breeding or foraging activities and movement patterns, causing animals to temporarily avoid areas adjacent to the construction zone. Refer to the **Noise** section of the FSA for more information. Nocturnal wildlife would be affected less by construction than diurnal species since construction would occur primarily during daylight hours. However, construction may also occur during dusk and dawn when many species are highly active. More mobile species such as birds and larger mammals would likely disperse into adjacent habitat areas during the land

clearing and grading phases of solar array and road construction. However, smaller animals would be less able to disperse. Additional information regarding project effects from noise and lighting is presented under the section entitled Project Operation Impacts and Mitigation, below. **Biological Resources Table 8** summarizes direct impacts to wildlife from construction activities.

Biological Resources Table 8
Examples of Direct Effects to Wildlife

Construction Activity	Type of Effect
Direct	
Grading, excavation, mowing, vegetation removal	Loss of foraging, sheltering, or breeding habitat Direct mortality to small and/or less mobile species Entombment or entrapment in pipes or excavations Increased risk of predation when flushed from cover Loss of small nests or young
Noise and Vibration	Interference with breeding, foraging and movement Avoidance of areas adjacent to the construction zone Temporary threshold shifts in hearing sensitivity and related loss of hearing resulting increased subjection to predation. Abandonment of burrows
Man-made sources of light	Increased risk of predation Avoidance of light areas Disturbance to nests and young
Vehicle Traffic	Direct mortality from road kill Avoidance of areas adjacent to traffic routes Disruption of breeding, foraging, and movement of bird species resulting in nest, roost, or territory abandonment and subsequent reproductive failure (during breeding season)
Fire	Habitat loss, degradation or vegetation type conversion Direct mortality Abandonment of habitat
Fugitive Dust	Adverse physiological effects, stress, reduced fitness Avoidance of project area
Perimeter Fence Construction	Restrict wildlife movement Disrupt home ranges or territories Trap wildlife within the enclosure

INDIRECT IMPACTS TO WILDLIFE

Indirect impacts can include the disruption of the native seed bank, the spread of invasive plant species, alterations in light regimes (i.e., shade from solar panels), or changes to soil or hydrology that adversely affect native species overtime. Indirect

impacts may also include increased traffic and human disturbance and the disruption of prey base or increased predation through alterations of the physical landscape from project features (i.e., fencing, heliostats, or power poles) that provide perch sites or shelter for predators.

Conclusions and Discussion of Mitigation for Wildlife

Construction-related effects to common wildlife are typically not considered significant under the CEQA. However, staff concludes that the scale and duration of construction (i.e., over 3,277 acres of land conversion over a period of 29 months); the variety of wildlife present at the project site; and the use of perimeter fencing, which will prevent many species from dispersing, would result in significant effects to common wildlife without implementation of mitigation measures.

By design, the project facility would include perimeter fencing to prevent desert tortoise and other species from entering the work area. Prior to construction, tortoises and other species (i.e. desert kit fox, American badger, and burrowing owl) inhabiting the project site would be relocated/translocated to suitable receptor sites (See impacts to desert tortoise below for a detailed discussion of desert tortoise relocation). With the exception of birds, this barrier would exclude or entrap wildlife at the project site. Therefore, during construction, terrestrial wildlife trapped within the perimeter fence would have limited dispersal ability. This would subject any trapped wildlife to repeated disturbance from construction and the use of roads to support maintenance activities. While many species of wildlife can tolerate human disturbance to some degree; implementation of the proposed project would result in an ongoing loss of wildlife from mowing, vehicle traffic, nest failure, and alteration of foraging habitat. The most likely long term effect of the project on wildlife trapped within the project by perimeter fencing is mortality from road traffic and the loss of habitat functions and value due to vegetation management.

The applicant has recommended general impact avoidance and minimization measures to reduce construction related impacts to common wildlife. These recommendations have been incorporated into conditions of certification, and enhanced where deemed necessary to reduce effects to common wildlife. These conditions of certification are designed to educate workers of the presence and sensitivity of wildlife that may occur in the project area; provide limitations on the work that may occur during the breeding season; require inspection for wildlife under vehicles; reducing or controlling fugitive and vehicle speeds; monitoring construction to reduce direct wildlife mortality; and the control of noxious weeds. The conditions also reduce impacts to common wildlife from the effects of noise and lighting.

The following conditions of certification would avoid or reduce impacts to general wildlife to less-than-significant levels: **BIO-1** (Designated Biologist Selection) which requires the designation of a lead project biologist ; **BIO-2** (Designated Biologist Duties) which outlines the duties performed during any site mobilization, ground disturbance, grading, construction, operation, closure, and restoration activities; **BIO-3** (Biological Monitor Qualifications); **BIO-4** (Biological Monitor Duties) in which the Biological Monitor assists the Designated Biologist during any site mobilization, ground disturbance, grading, construction, operation, closure, and restoration activities; **BIO-5** (Designated Biologist and Biological Monitor Authority) in which the Designated Biologist and Biological Monitor can call a halt to any activities that would be an adverse impact to biological

resources; **BIO-6** (Worker Environmental Awareness Program) in which workers on the project site or any related facilities are informed about sensitive biological resources; **BIO-7** (Biological Resources Mitigation Implementation and Monitoring Plan) which identifies all biological resources mitigation, monitoring, compliance measures, conditions of certification, and permits; **BIO-8** (Impact Avoidance and Minimization Measures) in which all feasible measures which avoid or minimize impacts to the local biological resources are incorporated in any modification or finalization of project design; **BIO-9** (Desert Tortoise Clearance Surveys and Fencing).

Potential impacts from the spread of invasive plant species and effects to locally important ground water dependent vegetation and seeps including the mesquite bosque located east of the project site and Stump Spring ACEC would be reduced to less than significant levels through the implementation of Conditions of Certification **BIO-18** (Weed Management Plan) and **BIO-23** (Ground Water-Dependent Vegetation Monitoring Plan. Implementation of these measures would reduce impacts of the proposed project to less-than-significant levels under CEQA.

Lighting may also be required to facilitate nighttime construction activities, which might disrupt the activities and affect behavior of nocturnal wildlife. As discussed in the Visual Resources section, construction lighting must be consistent with worker safety codes, directed toward the center of the construction site, shielded to prevent light from straying offsite, and task-specific. Condition of Certification **VIS-2** requires temporary lighting measures during construction activity and on the laydown area. See the Visual Resources analysis in this FSA for more details about proposed Condition of Certification **VIS-2**. With implementation of this measure, impacts to wildlife from construction lighting at the HHSEGS project would be reduced to less-than-significant levels under CEQA.

IMPACTS TO NESTING AND MIGRATORY BIRDS

The project site provides foraging, cover, and/or breeding habitat for a variety of resident and migratory birds. Localized water sources such as Stump Spring and other seasonal seeps and springs, private residences south of the site, and mesquite thickets east of the site also provide resources used by many species of birds. Bird species potentially affected include ground nesting species such as quail, night hawks and horned larks. Songbirds and several species of raptor are also known to forage at or near the project site. During surveys of the project site the applicant identified approximately 60 species of birds in the project area including a number of special-status bird species. Some of the known or expected species that may be impacted by the project include ground nesting species such as night hawks, poorwills, roadrunners, and horned lark, and various shrub nesters. The project's impacts to special-status birds are discussed under Special-Status Wildlife, below.

DIRECT IMPACTS TO NESTING AND MIGRATORY BIRDS

Direct impacts to nesting birds or raptors would be similar to those described for common wildlife and are identified in **Biological Resources Table 8**. This includes the loss of foraging and nesting habitat and disturbance from construction activities. Construction during the breeding season could also result in the displacement of breeding birds and the abandonment of active nests. Small well hidden nests could also

be subject to loss during construction of the proposed project. Similarly, increased noise levels from heavy equipment, increased human presence, and exposure to fugitive dust could displace native birds. Habitat fragmentation, degradation and shifts in vegetative structure will also directly affect nesting birds. In addition, noise and lighting effects have been demonstrated to adversely affect behavior, reproduction, and increase the risk of predation.

INDIRECT IMPACTS TO NESTING AND MIGRATORY BIRDS

Indirect impacts to nesting birds could include the loss of habitat due to the colonization of invasive plants and a disruption of breeding or foraging activity due to facility maintenance. Weed abatement, mirror washing (which occurs at night), and maintenance activities would likely limit the use of some areas as foraging or nesting habitat. Indirect impacts to nesting birds may also occur from the drawdown of surface and subsurface water in adjacent lands such as the mesquite thickets and Stump Spring ACEC.

Another indirect risk to birds during project construction is entrapment. Birds may become entrapped within vertical pipes used to support the heliostats. It appears that birds may descend into pipes either in search of nest cavities or food and become trapped within the pipes. Once inside the cavity, the birds cannot climb the slick interior or spread their wings to fly (Brean 2011). Animals that become entrapped in these pipes die from starvation and dehydration (American Bird Conservancy 2011). Vertical pipes have been found to be a significant threat to bird mortality in Nevada, where the wide-spread use of vertical PVC pipes for mining claims markers has led to the widespread mortality of thousands of birds that had become entrapped in them (American Bird Conservancy 2011). Some of the cavity-nesting birds protected under the Migratory Bird Treaty Act (MBTA) and California Fish and Game Code Sections 3503 and 3513 that have been found dead in these pipes include Say's Phoebes, owls, woodpeckers, kestrels, and ash-throated flycatchers (Brean 2011). To date, the Nevada Department of Wildlife (NDOW) has found over 3,000 fatalities in 10,000 removed pipes (Brean 2011). California Audubon also indicated that open pipes kill birds indiscriminately and that both common birds and protected species have been found among the layers of dead birds in open pipes (http://ca.audubon.org/workinglands-pipes.php). A single pipe on a preserve in Kern County contained the remains of numerous birds (http://kern.audubon.org/Audubon_Kern_River_Preserve_death_pipes.pdf).

Habitat Loss for Nesting and Migratory Birds

Implementation of the proposed project would result in the direct loss of approximately 3,277 acres of habitat that supports foraging for a variety of resident and migratory birds. Because of the large size of the project, direct effects would include the loss of foraging habitat. Construction of the project facility would require large scale land disturbance within the project site. Although the applicant has proposed to mow vegetation and allow some vegetation to persist within the heliostat field, the habitat remaining would be degraded and have the potential to type convert to more disturbance tolerant species. In addition, construction of the power towers, power plant, roadway, and various facilities would result in the removal of potential nesting habitat for most species of birds. The loss of habitat from the proposed project would be significant

absent mitigation. Conditions of certification required to reduce impacts to sensitive birds are described below.

Conclusions and Discussion of Mitigation for Nesting and Migratory Birds

The Point Reyes Bird Observatory (PRBO) has prepared a landscape analysis within the Desert Renewable Energy Conservation Plan (DRECP) planning area. This analysis identifies areas of high and low value to nearly 70 species. This review included common and special-status species that collectively utilize a range of habitat features. The PRBO ranked the Calvada Springs area of the Pahrump Valley near the project site in the lowest priority group. The study concluded that these low priority areas should be considered first for siting solar and other renewable energy installations to minimize impacts on breeding birds (Howell and Veloz 2011). However, at the project level, the existing mosaic of scrub communities, small washes, and adjacent mesquite habitat and mesquite dune scrubs are utilized by a wide range of species.

There is a growing body of evidence suggesting that populations of desert birds are at risk from invasive plants, wildfires, growing populations, and development. The Partners in Flight (PIF) North American Land Bird Conservation Plan characterizes species of the Southwestern Avifaunal Biome to have generally low population sizes, narrow distributions, high threats, and, when trend data exist, generally declining populations (Rich et al. 2004). Due to remoteness and difficult research conditions, bird populations found in Mojave and Colorado Desert habitats have poor or no trend data (Rich et al. 2004). Yet two of the top three fastest-growing metropolitan areas in the United States from 1990- 2000 (Las Vegas, NV and Yuma, AZ) are found within the area covered by this plan. In the western Mojave Desert, the population has tripled in the last twenty years (CalPIF, 2009). These pressures have been found to negatively impact desert bird populations (Latta et al. 1999). Bird species of the southwestern United States tend to have smaller populations and smaller breeding ranges, rendering these species more vulnerable to ecological stresses (Rich et al. 2004). Black-tailed gnatcatchers and black-throated sparrows have been found to be particularly sensitive to urbanization and the replacement of native desert scrub with exotic vegetation (Germaine et al. 1998 and Emlen 1974).

With the exception of a few non-native birds such as European starling, the loss of active bird nests or young is regulated by the federal Migratory Bird Treaty Act (MBTA) and Fish and Game Code Section 3503, though most native birds have no other special conservation status. The project's impacts to special-status birds are discussed under Special-Status Wildlife, below.

Implementation of the proposed project would result in direct, indirect and operational effects to nesting birds. During construction it is expected that most birds would disperse to adjacent habitat during the initial vegetation clearance for the proposed project. However, if site grading, brush removal, or construction were to occur during the nesting season, then it likely would destroy bird nests, including eggs or nestling birds.

Noise during construction may be loud enough to adversely affect bird nesting success. For most common species, staff concludes that this impact would be less than significant, but staff believes that it could significantly affect breeding habitat suitability for native birds, including special-status species. Construction activities would primarily

occur between 7:00 AM and 6:00 PM and would result in a short-term, temporary increase in the ambient noise level. Construction noises are anticipated to range from 43 decibels to 74 decibels at 1500 feet from the noise source (piece of construction equipment) (HHSG 2011a, Table 5-7-7).

Open pipes left over the weekend or for extended periods of time pose a documented mortality risk to birds and possibly some species of bats. It appears that construction of the heliostat field requires the placement of many cylindrical pipes to support the solar reflectors.

To reduce the potential for direct impacts to nesting birds the applicant has proposed mitigation measures to avoid and minimize project related effects. This includes conducting pre-construction nesting surveys, and the establishment of limited disturbance buffers, ranging from 250 to 500 feet around active nests depending upon the species. The approach proposed by the applicant is valid, but may be difficult to achieve due to the extended (i.e., 29 month) construction schedule, scale of the project (i.e., 3,277 acres), and the numerous common birds expected to nest within the area prior to and during construction. Staff considers it highly unlikely that nesting birds could be completely avoided if clearing and grubbing occur during the nesting season.

As described above, the construction and maintenance activities associated with the project are expected to exclude some species of birds that are less tolerant of anthropogenic disturbance. However, some species of birds will likely nest in the project area both during construction and operation of the facility. These include common ravens, horned larks, various raptors, and other birds. Depending on the species, birds may actively nest on the ground close to equipment, within the open metal framework of the heliostats, or on idle construction equipment. For example, staff has observed recent nesting activity at several solar and transmission line developments in the Mojave and Colorado Desert and within the Carrizo Plain. In these locations birds nested on the ground near solar panels, vehicles, foundations, construction trailers, and other equipment left overnight or during a long weekend. In areas where construction was phased (i.e., footings, or tower structures) birds quickly utilized these features as nest sites. Low-nesting species are susceptible to population suppressants such as alteration of predation pressures and increased anthropogenic disturbance/traffic (Emlen 1974). Ground-nesting gambel's quail, greater roadrunners, and black-throated sparrows, all species detected on the site, have been found to be especially sensitive to these urban predation and disturbance threats (Emlen 1974).

While many of the birds consisted of common ravens, house finches, and doves, these species are protected by the MBTA and relevant Fish and Game codes. The likelihood of encountering nesting birds either within the 250-500-foot disturbance buffer proposed by the applicant or on vehicles and equipment is considered high.

Birds have demonstrated a varying degree of tolerance to human disturbance. Where some species such as house finches display a tolerance for human activities and have been documented nesting on a variety of manmade structures (Hill 1993); other birds including some raptors are often displaced by construction and may have reduced nesting success. Emlen (1974) identified two factors key to the decline of native desert avifauna in urban habitats: changes in the nature and quality of vital resources, and changes in the nature and magnitude of population suppressants. A study of bird

buffers in the United Kingdom indicated that animals commonly move away from an approaching human or encroaching human activities such as recreation and this response can have adverse influences on, for instance, their feeding success (Burger & Gochfeld 1998, Fernández-Juricic & Tellería 2000), range use (Andersen et al. 1997), reproduction (Giese 1996, Miller et al. 1998), survival (Wauters et al. 1997, West et al. 2002) and abundance (Miller et al. 1998, Fernández-Juricic 2000, 2002). Studies near Tucson have shown that black-throated sparrows and black-tailed gnatcatchers in particular require undisturbed, native vegetation (Germaine et al. 1998). Post development, undisturbed native habitat is not expected to remain; however remnant strips of native vegetation may persist.

Urbanization also results in the alteration of vegetation structure important to desert avifauna (Germaine et al. 1998, Emlen 1974). Urbanization results in the rapid increase of foraging and watering opportunities, but these opportunities are generally skewed toward ground-foraging, seed-eating guilds (Beissinger and Osborne 1982, Emlen 1974). While this study focuses on more urban development such as residential housing; mowing, weed abatement, and human disturbance are expected to result in shifts in vegetation at the project site. This is, coupled with the expected level of disturbance at the site is expected to result in a transition to more disturbance tolerant species.

Project impacts to native birds can be reduced or offset through implementation of Conditions of Certification **BIO-1** through **BIO-8** (see Common Wildlife, above). These measures would require biological monitoring during construction activities, worker environmental awareness training, minimization of impact areas, and protection measures to prevent wildlife entrapment in trenches, pipes, or other facilities or supplies. In addition, some birds are capable of successfully nesting in close proximity to some forms of localized disturbance. Therefore staff has incorporated the applicant proposed measures into the recommended Conditions of Certification **BIO-15** (Avian Bat & Golden Eagle Protection Plan) and **BIO-16** (Pre-construction Nesting Bird Surveys), see discussion of impacts to sensitive birds. Condition of Certification **BIO-16** includes conducting pre-construction nesting surveys, and the establishment of limited disturbance buffers. The condition would require the applicant to survey the project area for nesting birds prior to construction, and to prepare and implement a nest management plan to ensure the protection of native birds and their nests. The Nest Management Plan would specify buffer areas for impact avoidance to nesting birds, dependent on the bird species or family, conservation status, and nature of disturbance. The Plan also would specify procedures for situations where it may be necessary to reduce buffer areas for certain low intensity construction activities.

Implementation of these conditions of certification would avoid direct impacts to nests, eggs, or young of migratory birds and would reduce the impacts of construction disturbance to nesting birds to less than significant levels under CEQA.

Species that utilize the project site for foraging but not nesting, such as coopers hawks or red-tailed hawks and wintering birds such as merlins, sharp-shinned hawks, and ferruginous hawks would not be directly affected; however, the loss of foraging habitat would be considered significant absent mitigation. Loss of nesting and foraging habitat for these special-status bird species would adversely affect populations of these species within the Pahrump Valley. As discussed in the cumulative impact subsection, the

project would be a contributor to the cumulative loss of biological resources, including these special-status bird species. Implementation of Condition of Certification **BIO-12** (Desert Tortoise Compensatory Mitigation) would reduce this habitat loss by the preservation of similar foraging areas. Implementation of this condition of certification would reduce impacts from the loss of habitat to less than significant levels under CEQA.

Indirect impacts to habitat from the drawdown of surface and subsurface water in adjacent lands such as the mesquite thickets and Stump Spring ACEC would be reduced to less than significant levels with the implementation of conditions of certification, **BIO-23** (Groundwater-dependent Vegetation Monitoring Plan) and **WATER SUPPLY-4** (groundwater monitoring.

Project Operation Impacts and Mitigation

The operation of the HHSEGS project would result in long term persistent impacts to biological resources both within the existing perimeter fence and in adjacent habitats. Operational impacts include both direct and indirect impacts to biological resources that occur during the life of project operation, including maintenance activities. Because many maintenance activities occur at night (i.e., heliostat washing) human activities may disrupt native species in adjacent habitat. These impacts would remain an ongoing source of disturbance for many wildlife species that occur within the fenced facility perimeter and in adjacent habitat.

Operational impacts to biological resources include disturbance to common and sensitive wildlife (discussed below) from vehicle traffic; maintenance and washing (i.e., each heliostat would be washed with a pressure washing unit approximately every 14 days [ca. 6,071 heliostats washed every night based on 85,000 heliostats/14 days]); mowing and herbicide application; night time lighting and maintenance activities (i.e., washing and maintenance); noise; collisions with structures; and exposure to solar flux. These impacts are discussed further below.

Roads

The proposed project would require construction of ring roads in the heliostat field and access by facility staff and maintenance personnel would increase existing traffic levels along Tecopa Road. Increased traffic and use of these roads during operation of the facility will result in the ongoing loss of common and sensitive wildlife.

The ecological effects of roads have been widely studied (Hoff and Marlow 2002; Trombulak & Frissell 2000; Findlay & Bourdages 2000; Jones et al. 2000; Parendes & Jones 2000; Haskell 2000; Vistnes & Nellemann 2001). These studies have identified seven general effects from roads that include: mortality from road construction and vehicle collisions; modification of animal behavior; changes to the physical and chemical environment; the spread of invasive species, and increased human access and use (Trombulak & Frissell 2000). The large size of the project (i.e., approximately 3,277 acres) coupled with the activities required to support the operation of the facility such as mowing, bi-weekly washing, and routine maintenance, would result in ongoing disturbance and mortality to wildlife that remain within the project perimeter. Given the multi-year phased implementation of the project there would also be substantial use of

access roads outside of the fenced project site. Staff considers impacts from operational traffic to be a significant impact to wildlife.

To minimize the risks of increased traffic fatality and other hazards associated with roads at the project site, the applicant has proposed a variety of general minimization measures which staff has incorporated into Condition of Certification **BIO-8**. These measures include confining vehicular traffic to and from the project site to existing routes of travel, prohibiting cross-country vehicle and equipment use outside designated work areas, and imposing a speed limit of 25 miles per hour within the project area, on maintenance roads for linear facilities, and on dirt access roads to the project site.

Noise

Operational noise from the HHSEGS is predicted to range from 90 dBA near certain equipment to roughly 65 dBA in areas more distant from any major noise source and would not exceed 54 dBA at the closest residence or 52 dBA at the St. Therese Mission (HHSG 2011a). Based on this data staff assumes both the facility site and surrounding area will be subject to ongoing noise greater than 65 dBA. No significant ground or air vibrations are expected to occur, nor are tonal noises, such as noise from motors and fans (*ibid.*). Noise from operation of the facility could discourage wildlife from foraging and nesting adjacent to the proposed project.

Noise may affect birds in several ways, including annoyance which causes birds to abandon nests that are otherwise suitable; raise the level of stress hormones, interfering with sleep and other activities; cause permanent injury to the auditory system; and interfere with acoustic communication by masking important sounds or sound components (Dooling 2006). Many bird species rely on vocalizations during the breeding season to attract a mate within their territory, and noise from construction could disturb nesting birds and other wildlife and adversely affect nesting and other activities. Reijnen et al. (1995) demonstrated that for two species of European warbler *(Phylloscopus* spp.), sound levels between 26 dB(A) and 40 dB(A) reduced breeding density by up to 60 percent compared to areas without disturbance. Studies have also shown that noise levels over 60 A-weighted decibels (dBA) can result in nest abandonment and intense, long-lasting noise can mask bird calls which can reduce reproductive success (Dooling and Popper 2007; Hunsaker 2001). In addition, 60 dBA has been used by the wildlife agencies and the Energy Commission as a reference point for evaluating noise impacts on wildlife. Staff considers noise impacts to most nesting birds above 60 dBA to be a significant impact.

Noise from daytime operation and nighttime washing and maintenance activities could affect wildlife in adjacent habitats by interfering with breeding or foraging activities and movement patterns, causing animals to avoid areas adjacent to the project. This could disrupt foraging, breeding, sheltering, and other activities. Nocturnal (i.e., active at night) wildlife would be affected less because the maintenance activates would occur in different locations each night. However, lighting and noise from the pressure washers would disrupt nocturnal animals in adjacent habitat and those that remain within the project fence line. Staff considers noise effects to be of a concern for wildlife located in and adjacent to the project site. Noise may result in significant impacts to wildlife or nesting birds along the perimeter of the project primarily along sensitive wash and mesquite habitat (located in Nevada).

Lighting

Bright lighting at night could disturb the nesting, foraging, or mating activities of wildlife and make wildlife more visible to predators. Night lighting could be especially disruptive to nocturnal animals, including desert kit fox and owls, which were observed onsite. Lighting may also increase the risk of predation of wildlife because they may be more detectable to nocturnal predators (USACE and CDFG 2009). Many insects are drawn to lights, and bats or other insectivores may be attracted to lighted construction areas which would increase the potential for disturbance and mortality. However, many small species, such as rodents, rabbits, snakes, and bats, are less active in bright lighting (Longcore and Rich 2004), which may be a biological adaptation to avoid predation during bright moonlight.

Night lighting could be disorienting to migratory birds and, if placed on tall structures, may increase the likelihood of collision, as discussed in the “Avian Collision and Electrocution” subsection of this section. Switched lighting would be provided for areas where continuous lighting is not required for normal operation, safety, or security; this would allow these areas to remain un-illuminated (dark) most of the time, thereby minimizing the amount of lighting potentially visible off site. These measures are described in Condition of Certification **VIS-2** (see the **Visual Resources** section). With implementation of this measure lighting impacts to wildlife would be minimized. Although facility lighting would be shielded it is expected that the project would be operated seven days per week. Maintenance activities would also occur seven days a week, including nighttime hours when mirror washing would be conducted. Light from these activities is expected to result in ongoing disturbance to wildlife both within the perimeter fencing and in adjacent habitat.

Impacts to Wildlife from Weed Management Activities

The applicant proposed weed management as an ongoing activity on the project site. This may consist of both mechanical weed removal and the application of herbicides. The use of herbicides to control weeds can be effective; however herbicides that are indiscriminately applied or that have residual toxicity could adversely impact native plants and wildlife, or negatively affect water quality. Some herbicides, such as pre-emergent herbicides designed to deter germination, have a residual toxicity that may be harmful to wildlife.

Wildlife could be exposed to herbicides in several ways, including direct spray; indirect contact through grooming or contact with affected vegetation; and ingestion of contaminated vegetation, prey species, and water. Small animals will generally receive a higher dose, in terms of body weight, than large animals for a given type of exposure (Durkin 2007). **Biological Resources Table 9** identifies the general effects of herbicides on wildlife.

Biological Resources Table 9
General effects of herbicides on wildlife

Herbicide	Effects on Vegetation	Effects on Wildlife
Chlorsulfuron	Rate and extent of uptake following foliar application varies by species Inhibits an enzyme that is essential for plant growth	Causes weight loss and decreased body weight gain in experimental mammals Appears to have low toxicity in mammals, birds, fish, and invertebrates
Clopyralid	Highly selective toxicity to terrestrial plants (primarily broadleaf species) Relatively non-toxic to aquatic plants and grasses Regulates plant growth by acting as a synthetic auxin, thus altering plant's metabolism and growth characteristics	Appears to be relatively non-toxic to terrestrial or aquatic wildlife May adversely affect liver and kidney weights and gastric epithelial tissue Appears to show no effect on viability of bird eggs and chick immune systems
*Dicamba**	Mimics plant hormone indole 3 acetic acid Mechanism appears to involve a stimulation of ethylene production leading to accumulation of abscisic acid and/or cyanide resulting in abnormal growth	Displays an apparent pattern of interspecies scaling, with smaller animals being less sensitive than larger animals Relatively non-toxic to mammals, fish, and amphibians Acute toxicity to birds appears to be generally low May reduce growth and stunt eye development in pre- and post-hatch birds
Glyphosate	Inhibits shikimic acid pathway, effectively blocking synthesis of certain phenolic compounds and aromatic amino acids Inhibits photosynthesis, respiration, and nucleic acid synthesis	May reduce food conversion efficiency leading to loss of body weight in mammals and birds Certain surfactants used with glyphosate are much more toxic to fish that others May cause histological changes in gills, kidneys, and liver of some fish
Imazapyr	Inhibits an enzyme that is essential for plant growth Practically non-toxic to conifers	Appears to be relatively non-toxic to terrestrial and aquatic animals
Picloram	More toxic to broadleaf plants than grasses Mimics naturally occurring auxins leading to uncontrollable and abnormal growth	Appears relatively non-toxic to terrestrial animals Moderately toxic to aquatic animals, particularly some fish May affect fry survival and growth in some fish
Triclopyr	Mimics indole auxin plant growth hormones causing uncontrollable growth At sufficiently high levels of exposure, abnormal growth is so severe that vital functions cannot be maintained and plants die	May cause developmental effects at levels that cause maternal toxicity in mammals May have adverse effect on mammalian kidney functions Higher concentrations may cause mortality or immobility in frog tadpoles

Herbicide	Effects on Vegetation	Effects on Wildlife
		Larger doses may cause a decrease in body length and smaller doses may lead to lethargic behavior in some fish Relatively non-toxic to birds

The functional value of the entire 3,277-acre project site would be lost for most species of wildlife. However, some disturbance-tolerant species, and the many small species trapped within the perimeter, including birds, small mammals, and reptiles, may be harmed by ongoing weed management activities, including the use of herbicides. Plants and wildlife that occur in close proximity to the project, or downstream of the project could also be directly or indirectly affected by herbicide use, including desert tortoise and other special-status species protected under a variety of LORS.

The known toxic effects of some herbicides on wildlife are summarized in **Biological Resources Table 9**. Staff considers potential impacts to wildlife from herbicide use to be significant, absent mitigation. To avoid potentially significant impacts, Condition of Certification **BIO-18** (Weed Management Plan)would require the project follow guidelines for protecting native species from herbicides recommended by The Nature Conservancy. These may include restricting herbicide use on windy days, controlling drift, prohibiting the use of pre-emergents and other herbicides with residual soil toxicity, prohibiting spraying or mechanical weed management near special-status species, and limiting weed management around the perimeter to isolated occurrences of highly invasive species. The use of herbicides in the project area would also be required to comply with regulations set forth by the U.S. Environmental Protection Agency (EPA) and California Department of Pesticide Regulation (CDPR).

Retention Area

Operation of the project would require the development of a 125-acre storm water retention area to manage stormwater runoff and protect downstream private lands from erosion and sedimentation. The retention area will occur on the western side of the project (CH2 2012ii) and would control peak flows that would occur from elevating the western perimeter roadway above the existing grade. The accumulated water would drain through an 18-inch culvert or infiltrate into the soil. Information in the AFC indicates that a 5 year storm could result in standing water over one foot deep, and water almost four feet deep could result from a 100-year storm. The applicant indicates that the retention area would drain completely within 24 hours with the installation of three 18-inch drain pipes (CH2 2012ii).

Water impounded in the retention area will adversely affect both native vegetation and wildlife. Small fossorial (i.e., burrowing animals), or species with limited dispersal abilities that remain within this area will be periodically lost during large storm events. This may include ground nesting birds. In addition, given the scarcity of water in the desert, many species of wildlife can be attracted to areas supporting large areas of standing water. Retention basins that hold water for extended periods of time would provide a potential water source in an otherwise arid region and could act as a subsidy to ravens. Since the retention area coincides with placement of heliostats, the location will be fenced from routine animal use; however, the retention basin may still attract

predators and other species, including waterfowl. In addition, small mammals, waterfowl, shorebirds, and other resident or migratory birds may attempt to access areas supporting ponded water despite the perimeter fencing. The project site is located in an area where ephemeral drainages from the surrounding mountains terminate, and localized flooding would be expected, and has been previously documented at the site (KCET 2012).

Successful eviction of kit fox, burrowing owl, and badger has been a continuing concern on large solar projects. At the Ivanpah Electric Generating System project, kit fox have been observed climbing eight foot chain link fence (Douglas Davis pers. comm. 2012). Burrowing owls have also entered pens where tortoises are held onsite, and where human presence is a daily factor. On the Genesis Solar Electric Generating Project (GSEP), the use of electrified fencing added to project perimeter fencing has also failed to deter kit fox from entering and exiting the site on a daily basis (GSEP Monthly Compliance Report 2012). While it is uncertain if the desert kit foxes are trying to return to previous occupied territories or seeking ponded water these areas remain an ongoing concern for staff. Another concern is the location of the retention pond along the western border of the project site where attraction to the ponds by birds would increase the possibility of collision with facility structures. Staff considers large areas of standing water, even for relatively short durations of time, to pose a potential risk to desert tortoise and other wildlife because of the potential subsidy these pools provide to ravens.

Implementation of **BIO-8** (Impact Avoidance and Minimization Measures) would minimize the potential for the project to provide further subsidies to ravens and other predators. This condition includes the requirement that standing water does not persist on the project site for more than 24 hours after a precipitation event. With implementation of this condition, impacts to wildlife from the retention basin would be considered less than significant.

Avian and Bat Issues

The project would introduce several factors which could cause injuries or even mortality to birds. Potential operational impacts include collision with the power tower or heliostats, risk of burns to birds that fly into the reflected sunlight between the heliostats and the power towers, electrocution, and disturbance from lighting. These are discussed further below.

Collisions, Lighting, and Glare

The project would include two power towers, heliostat fields, and ancillary equipment including boilers and control facilities. Onsite facilities range from a height of 750 feet (power towers), to 120 feet for boilers and the air-cooled condenser unit. Each of the heliostats is approximately 12 feet high. The remaining facilities are generally less than 80 feet in height (HHSG 2011a). All of these features would pose a potential collision risk for birds. Birds are known to collide with communications towers, transmission lines, and other elevated structures including buildings. Estimates of the number of bird fatalities specifically attributable to interactions with utility structures vary considerably. Nationwide, it is estimated that hundreds of thousands to as many as 175 million birds are lost annually to fatal collisions with transmission and distribution lines (Erickson et

al., 2001). Numerous studies have also documented extensive avian collision mortality associated with buildings and similar structures such as smokestacks or monuments (*ibid*). In California, even general estimates are unavailable, although it is plausible that such collisions result in the deaths of hundreds of thousands of birds each year (Hunting, 2002).

Collisions typically result when the structures are invisible (e.g., bare power lines or guy wires at night), deceptive (e.g., glazing and reflective glare), or confusing (e.g., light refraction or reflection from mist) (Jaroslow 1979). Collision rates generally increase in low light conditions, during strong winds, and during panic flushes when birds are startled by a disturbance or are fleeing from danger. The Avian Power Line Interaction Committee (APLIC) has determined that collisions are more probable near wetlands, within valleys that are bisected by power lines, and within narrow passes where power lines run perpendicular to flight paths (APLIC 1996). Collisions are more probable near wetlands, valleys that are bisected by power lines, and within narrow passes where power lines run perpendicular to flight paths. Passerines (e.g., songbirds) and waterfowl (e.g., ducks) are known to collide with wires (APLIC 2006), particularly during nocturnal migrations or poor weather conditions (Avery et al. 1978).

Diurnal birds, or those active during daylight hours, could also collide with tall structures. Staff has concluded that the risk of such impacts is low. Most diurnal bird collisions with tall structures are associated with guyed towers in poor visibility conditions such as fog or inclement weather (Manville 2001). The HHSEGS project does not include guyed structures. While the project would not have evaporation ponds that could attract birds to the site, it would contain a 155 acre stormwater retention basin that would hold water for up to 24 hours after seasonal rainfall. In addition, dust storms and or windy days may increase particles in the air, which in turn reflect the solar energy and could increase the collision risk for birds.

To date little is known regarding the avian response to glare from solar technology. However, it is likely that glare will affect birds to some degree. In the same way that large mirrored buildings may be confused by birds as open sky; the mirrors will reflect light and take on the color of the image being reflected. This may result in birds confusing the heliostats as either open sky or water and increase the collision risk. Bird response to glare is not well understood. Staff has reviewed research by McCrary et al. (1986) which quantified bird mortality, including collisions, at a 10 MW pilot SRSG pilot facility (Solar One) near Daggett, California. The Solar One facility consisted of a 79-acre heliostat field and 282-foot solar receiver tower. Staff is not aware of any other scientific study of bird mortality at any other comparable generator.

McCrary et al. documented 70 bird fatalities during the course of a 40-week study, and estimated that approximately 10 to 30 percent of bird carcasses went undocumented because animal scavengers removed the carcasses before they were detected by the researchers. Adjusting for the estimated number of undocumented birds, the total average mortality rate was 1.9 to 2.3 birds per week. The bulk of bird mortality (more than 80 percent) resulted from collisions. The average weekly mortality rate for collisions was 1.5 to 1.8 birds. Most of these mortalities were from collisions with the heliostat mirrors, and one known mortality resulted from collision with the solar receiver tower. The authors partially attributed these collisions to high numbers of birds attracted to the adjacent evaporation ponds and agricultural fields. The applicant has undertaken

monitoring bird mortalities due to solar flux exposure at its six MW SEDC project in Israel (BS 2012x, BS 2012v, BS 2012w), a site that is significantly smaller than the proposed HHSEGS site. To date, no mortalities due to collision or lethal exposure to concentrated solar flux have been reported (Ibid.); however, staff concluded survey methodology was inadequate to detect carcasses presence. The proposed project would be substantially larger than both Solar One, SEDC, or GEMASolar (BrightSource Energy, Inc 2012x). **Biological Resources Table 10** compares physical characteristics of Solar One, GEMASolar, and SEDC to the proposed project**.**

Biological Resources Table 10
Avian Mortality Hazard: Comparison of SRSG Projects

Project Component	Solar One (San Bernardino Co., CA)	SEDC (Israel)	GEMASolar (Andalusia, Spain)	Hidden Hills SEGS (Inyo Co., CA)
Acreage / MW	79 acres / 10 MW	80 / 6 MW	457 acre/19.9 MW	3,277 acres / 500 MW
Mirrors	1,818 heliostats, each one 430 ft^2); Total = 781,740 ft^2	1,610 heliostats, 75-150 ft^2 each. Total = 120,000 – 240,000 ft^2	2,650 heliostats = to 1,075 ft^2	2 generators x 85,000 heliostats each (170,000 total); 2 mirrors per heliostat; each mirror 8.5 x 12 ft (102 ft^2 each, 205 ft^2 per heliostat); Total = 34.8 million ft^2
Tower(s)	One; 282 ft. tall	One; 256 ft tall	One; 420 ft tall	Two; each one 750 ft tall
Adjacent land use/ habitat	Desert shrubland; adjacent agriculture & evaporation ponds	No agriculture or wetlands; adjacent evaporation ponds; within major migratory flyway	Unknown	Adjacent to desert shrubland, near mesquite thickets in Nevada, and Important Bird Areas
Bird Mortality	70 mortalities documented during 40 weeks of surveys 19 were waterfowl & shorebirds; 51 (incl. all burns) were other species	Applicant commenced bird monitoring at this location in spring 2012. No mortality or injuries reported	No mortality or injuries noted after two days of carcass searches.	

Source: URS 2012a.

McCrary et al. (1986) also inventoried bird carcasses on the Solar One project site and estimated the number of birds in the surrounding approximately 370-acre area, including the solar facility, evaporation ponds, and adjacent agricultural fields. They estimated total bird mortality as 1.9 to 2.2 birds per week (including collisions and

“burns”, from exposure to concentrated solar flux); and that collisions account for 1.5 to 1.8 of the weekly mortalities). Based on the total number of birds observed in the area, weekly, mortalities (collisions and burns) accounted for a 0.6 to 0.7 percent weekly mortality rate in the survey area. Much of the bird mortality consisted predominantly of collisions with mirrors, according to McCrary. These collisions were partially attributed to an increased numbers of birds attracted to the adjacent evaporation ponds and agricultural fields (McCrary 1986). However, it is important to note that the Solar 1 facility was completely graded, with heavy industry development adjacent to the facility. The proposed project enlists use of a low impact design, with the majority of habitat remaining intact onsite, albeit mowed.

The applicant has indicated that heliostat mirrors at the proposed project would be shorter than those at the Solar One site, and that this design difference would reduce collision hazard for birds. However staff has been unable to find documentation of relative collision hazards of taller or shorter mirrors. Staff believes that collision hazard is more likely to be a function of the total area of mirror surface than the height of the individual mirrors, and how birds appear to interact with reflective surfaces. The HHSEGS project would have 37 times more surface area of mirrors. Based on those factors, the Solar One collision mortality rates extrapolate linearly as 56 to 67 (rounded) bird mortalities per week at the larger HHSEGGS project site. The low value (56 birds per week) is based on the estimate for Solar One collision mortalities (1.5 birds per week) multiplied by 37 (mirror surface ratio). The higher value (67 birds per week) is based on the higher estimate for Solar One collision mortalities (1.8 per week) multiplied by 37(the mirror surface ratio). Annually, this results in a range of mortalities from 2,912 to 3,484 birds. These estimates do not account for morbidity that occurs as a result of collision and exposure to concentrated solar flux.

These extrapolations are intended as projections of the anticipated scale of bird collision mortality, using the best data available. Staff cautions, however, that this is not an estimated or predicted mortality rate. McCrary et al. (1986) noted that “The greater magnitude of these [larger commercial-scale] facilities may produce non-linear increases in the rate of avian mortality when compared to Solar One and extrapolations from this study should be made with caution.” Due to the many factors contributing to bird collision risk and bird behavior in a concentrated solar flux zone, staff cannot quantify expected bird mortalities from the project facilities. Nevertheless, staff believes that the risk is significant. See **Appendix BIO1** for a discussion of the nonlinear scaling of effects from concentrating solar power projects.

Lighting also plays a substantial role in collision risk because lights can attract nocturnal migrant songbirds, and major bird kill events have been reported at lighted communications towers (Manville 2001), with most kills from towers higher than 300 to 500 feet (Kerlinger 2004). Radar data from the Mojave Desert indicate that less than 15 percent of birds that migrate at night fly below 984 feet (Felix et al. 2008), therefore more migratory flight is likely to occur over the 750-foot power tower. Disruption of birds’ migratory path, such as happens during storm events can cause birds to fly at lower heights, and be at risk of collision with the tower or other project facilities. Many of the avian fatalities at communications towers and other tall structures have been associated with steady-burning, red incandescent L-810 lights, which seem to attract birds (Gehring et al. 2009). Longcore et al. (2008) concluded that use of strobe or flashing lights on

towers resulted in less bird aggregation, and, by extension, lower bird mortality, than use of steady burning lights. Bright night lighting close to the ground at the project site could also attract bats and disturb wildlife that occurs adjacent to the project site (e.g., nesting birds, foraging mammals, and flying insects).

The project's transmission lines are not expected to pose a collision risk to bats. Although many studies have quantified bird strikes with transmission lines, analogous information on bats is very limited (Manville 2001). Collisions with distribution, collector or feeder lines will likely occur to some degree however collision risk is not thought to pose a significant risk to bats in the project area. The most likely collision risk for bats is associated with vehicle or equipment as bats forage near roads or work areas.

Given that most bat species can use echolocation to discriminate objects as small as 0.4 to 0.004 inches in size (Vaughan and Vaughan 1986), and the size of transmission lines are typically equal to or greater than 0.5 inches in diameter, the frequency of strikes with facility structures is expected to be extremely low.

Installation of heliostats could also cause an increase in Polarized Light Pollution (PLP) which occurs from light reflecting off of dark colored anthropogenic structures, and been demonstrated to be generated from even low-reflectance photovoltaic panels (Horvath et al. 2009). According to Horvath et al., PLP caused by anthropogenic structures can alter the ability of wildlife to seek out suitable habitat and elude or detect the presence of predators (Horvath et al. 2010). It has also been documented that for a variety of birds and other species PLP can affect their ability to detect natural polarized light patterns in the sky which can negatively affect navigation ability and ultimately affect dispersal and reproduction (Horvath et al. 2009). Although the proposed heliostats are not expected to result in PLP the effects of large reflective surfaces are poorly understood. Polarizing surfaces are also known to disrupt insect behavior, causing some insects to react as though the surface is water, and depositing eggs on polarizing surfaces ((Horvath et al. 2009)., Horvath et al (2009) determined that minimization of polarizing effects was possible by adding white grids onto solar panels, or otherwise minimizing the solar active area. The extent to which heliostats could serve as an attractant is not known.

There is uncertainty regarding how many birds may be killed by collisions with project features, but bird mortality is predictable. The significance of such mortality, in a CEQA context, is also uncertain, and would vary depending on the species involved, and the number of birds involved.

To minimize this risk of collision and disturbance to wildlife from lights, Condition of Certification **BIO-8** specifies that the lighting atop the towers be flashing strobe lights rather than steady burning lights, and that lighting be shielded, directed downward, and turned off when not needed. The project owner has proposed use of FAA lighting systems on the HHSEGS project, using only red lights at night with the longest permissible interval between flashes and the shortest flash duration permissible, which would further reduce the potential for nocturnal strikes. Staff has incorporated these measures into proposed Condition of Certification **VIS-3**, which directs the use, placement, and minimization of all lighting. Condition of Certification **BIO-15**, which requires development of an Avian, Bat, and Golden Eagle Protection Plan, would

require the project owner to monitor, record, and report dead or injured birds found within the project footprint. The plan would also require the implementation of remedial actions including the placement of aerial markers, ribbons, or other devices to reduce bird mortality. Monitoring of operational impacts for seasonal factors, and species of birds affected, and types of injuries or mortalities has also been requested by the USFWS, is considered crucial in understanding operational impacts, bird behavior and responses to stresses, and identifying and implementing measures to avoid, minimize, or mitigate impacts. However, staff believes residual impacts to avian species will exist after implementation of the conditions of certification.

Staff also recommends Condition of Certification **BIO-15** (Avian, Bat, and Golden Eagle Protection Plan) to monitor bird mortality due to glare. Staff concludes that the Avian and Bat Protection Plan and mortality monitoring as recommended in Condition of Certification **BIO-15** would effectively determine rates of bird and bat mortality from collisions with structures. It may not be feasible to accurately determine the rate of latent mortality, when mortality occurs at a time and place removed from the project site. There is no feasible means of minimizing or avoiding this impact.

Solar Energy Flux

Implementation of the proposed project would have the potential to expose birds to potentially dangerous levels of solar energy. Solar energy from the field will strike the bird as it is reflected from the heliostat field to the solar receiver. Solar energy would be expected to strike the bird in the heliostat field, and the intensity of the exposure will vary, based on a number of factors including the angle of the bird (see **Appendix BIO1 and Appendix BIO2, Figures 1 -7**).

Thresholds for solar flux exposure have been established for humans, and range from 1.42kW/m^2 (24CFR, Section 51.204 Appendix II) to 5kW/m^2 (49CFR Part 193). No published threshold for avian exposure has previously been identified. Exposure to solar flux has the potential to result in direct and indirect effects to birds by damaging their eyes, including the loss of sight; burning or singeing feathers; compromising the molecular structure of feathers (i.e., non-visible damage); and secondary, non-visible physiological changes including elevated body temperatures or thermal stress. In some circumstances exposure to solar energy flux will result in the death of the bird either immediately or within a short period of time following exposure. The potential for injury depends on a variety of factors including the size and type of bird; length of exposure; and the level of solar energy flux (see **Appendix BIO1**). **Biological Resources Table 11** provides an example of the effects of solar energy flux on various organic materials including applicant's preliminary, unpublished anecdotal information on bird carcasses.

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Biological Resources Table 11

Effects of Thermal Radiation*

Radiant Heat Flux (kW/m^2)	Observed Effect
0.67	Summer sunshine in UK [a]
1	Maximum for indefinite skin exposure
6.4	Pain after 8 second skin exposure[b]
10.4	Pain after 3 second exposure[a]

12.5	Volatiles from wood may be ignited by pilot after prolonged exposure
16	Blistering of skin after 5 seconds[b]
29	Wood ignites spontaneously after prolonged exposure[a]
50	Singed or burned feathers; tissue discoloration and drying of a bird carcass after 20-30 seconds (BS 2012v)
52	Fibreboard ignites spontaneously in 5 seconds[a]

[a]D. I. Lawson (1954) [b]S.H. Tan (1967)
The data quoted for human exposure are essentially in agreement with information given by Purser (1995) and Mudan and Croce (1995)
Table source: Drysdale 1998, An Introduction to Fire Dynamics, 2nd Ed., by Dougal Drysdale, Publ: John Wiley and Sons, 1998, Table 2.8, P. 61

McCrary et al. (1986) found that 13 of the bird carcasses (19 percent) at the Solar One facility had been burned, reporting that the "heavily singed flight and contour feathers indicated that the birds burned to death," see Appendix BIO2, Figure 7. The authors interpreted these mortalities as the result of birds flying through that facility's standby points, though they did not observe the incidents, and the mortalities also may have been caused by flying within elevated flux levels surrounding the SRSG during normal operation. Risk of burning was evidently higher for aerial foragers (swifts and swallows) because of their feeding behavior. The McCrary study was based on systematic searches of the 32 hectare (79 acre) Solar One site but not beyond the site boundaries. Thus, if any birds were injured but were able to fly beyond the site's boundaries (about 1,200 ft from the receiver tower), they would not have been found by the field biologists and could have been scavenged before being observed. For this reason, staff believes that actual mortality from burning may have been higher than reported. It is also possible that birds considered collision victims had suffered damage to flight feathers such that birds were unable to fly, or had experienced damage to the eyes and became disoriented, resulting in collision with the heliostats. However, the authors did not perform microscopic examination of feather structure or eyes that would make this determination possible.

The HHSEGS's reflective surface area would be 37 times greater than Solar One's. Mortality ascribed to solar flux exposure at the Solar One site ranged from 0.3 to 0.4 birds per week. Based on those factors, the Solar One radiant energy flux mortality rate extrapolates linearly as 11 to 15 bird mortalities per week at the larger HHSEGS project site, or 572 to 780 bird mortalities per year. This extrapolation is intended as a rough projection of the anticipated scale of radiant energy flux mortality, but that it may be inaccurate for a variety of reasons. Even with site mortality monitoring it will be very difficult to discern the full impact of solar flux on birds. A detailed discussion of non-linear scaling effects has been included in **Appendix BIO1**. Due to the many factors contributing to bird collision risk, staff cannot quantify expected bird mortalities from radiant energy flux. Nevertheless, staff believes that the risk is significant. Interestingly, the authors concluded that power tower projects should be located away from water sources and rare, threatened, or endangered species (Ibid).

Elevated levels of solar flux would occur within some airspace over the solar field. This field would expose a variety of birds, bats, and insects to potentially damaging levels of solar energy. The applicant has stated that the HHSEGS would begin to operate at the moment the sun appears over the horizon; there is limited potential for bats to be active at that time. Birds that fly at lower elevations over the heliostat field may, intentionally or unintentionally, fly below zones of concentrated solar flux, and therefore not suffer damage from exposure to high levels of solar energy (see **Appendix BIO1**).

There is no information available to staff on the safe levels of solar energy flux that bats or insects may tolerate; however, because of body size and the absence of feathers, these species would be subject to adverse effects from lower intensities of solar energy flux than most birds. The risk to bats from the exposure of concentrated levels of solar energy is likely to be low. Bats are crepuscular, that is, primarily active during dawn and dusk, and at night when the facility would not be fully operational. Therefore this risk is not expected to be significant.

Staff has evaluated the formulation of a risk assessment model for the HHSEGS project, and the possibility of adapting existing risk models commonly used for the wind industry to power tower technology. Staff and the resource agencies have agreed that there is insufficient background data on expected bird use at the site to perform a risk assessment, and that a “retooled” wind project model is likewise not yet available to create a risk assessment model for this technology. Therefore, further quantification of mortalities is not currently possible. **Appendix BIO1** provides a “Characterization of Risk” and “Analysis of Uncertainty for the HHSEGS project and provides describes staffs best estimates for evaluating risks associated with this technology.

As described above staff believes that exposures to elevated levels of solar energy would be likely to kill living birds. In addition, staff believes that shorter exposures would be likely to cause other tissue or feather damage that could impair flight or vision or cause physiological effects and ultimately cause or contribute to mortality from other causes (e.g., reduce ability to forage, escape from predators, or thermoregulate). Staff also believes that longer exposures to lower energy flux levels are likely to cause feather damage or physiological effects. The following discussion is intended to illustrate the role of feathers to birds, and the types of behavioral or physiological functions that may be impaired or destroyed following exposure to concentrated solar flux in excess of safe thresholds, estimated to be no more than one minute’s exposure at $4kW/m^2$.

Damage to Plumage and Flight Feathers

A birds’ plumage is well adapted to its environment, and serves a variety of roles, such as: flight, thermoregulation, protection from impact, defense, incubating eggs and young, tactile hunting, seasonal displays such as breeding plumage in male birds, and camouflage from predators (Raptor Research Foundation, 2012). When exposed to elevated levels of solar radiation; it is the plumage that is expected to show the first signs of damage. Eye exposure is also expected be a sensitive endpoint, and is discussed further below in the section entitled Irradiance.

Surface feathers, or contour feathers, cover and streamline the remainder of the body and also contribute to aerodynamics. Insulating feathers are found beneath the contour

feathers. Damage to insulating feathers may affect the bird's thermoregulation (body temperature control). A bird's plumage is critical to insulating the bird from the environment, and is influenced by color and structure of the plumage (Wolf and Walsberg 2000).

Bird feathers grow from lines, or tracts, pterylae (Raptor Research Foundation 2012) with bare patches of skin in between, called apteria (Ibid.) There are several types of feathers, including fluffy down insulating feathers (which are used in the manufacture of pillows); semi-plumes, which shape and insulate the bird, bristles, usually around the face and used in feeding; filoplumes, used to feel and sense vibrations, and contour feathers, which add shape to a bird. A diagram of a feather is depicted in Appendix BIO2, Figure 6. Feathers are comprised of a central shaft, or rachis, and barbs come off the rachis at an approximately 45 degree angle (45°). Between barbs are two sets of barbules, microscopic filaments that connect each barb (Doctors Foster and Smith 2012, Muller and Patone 1998). Barbules have even smaller microstructures, called barbicels, which hooks the barbules together. These barbules act like a zipper, connecting the barbs and making them airtight and able to withstand air resistance during flight (Ibid., see also Muller and Patone 1998). This microstructure of a feather, consisting of barbules and barbicels, comprises the majority of the feather, and is not visible to the naked eye. These components, so critical to flight, are used in establishing a safe avian exposure criteria (see **Appendix BIO1**)

Flight feathers may be one of the most important feathers at risk from exposure to high levels of solar energy. The long relatively rigid feathers of the wings and tail (flight feathers) are the bird's aerodynamic flight surfaces. These feathers provide lift and are adapted to the body style of the bird, that is, raptors have long wings and long pointed flight feathers that allow for catching air current and generating great speed, while other birds have wing lengths and flight feather construction that allow for various flight patterns and behaviors. The feathers used for flight include primary, secondary, and tertiary feathers which are located along the arm of the bird, while the large tail feathers are called retrices. Feathers are "instrumental in flying [and] they play a critical role in temperature regulation" (Sibley 2002), and are considered the most valuable asset a bird has (Raptor Research Foundation 2012).

Feathers damaged by concentrated solar flux would only be replaced during a molt. Birds have no physiological means to replace damaged feathers other than seasonal molting. Molting generally occurs during or after the breeding season (Raptor Research Foundation 2012), and birds are known to time molting to optimize fitness such as after migration, or in concert with breeding. During a molt, the bird replaces all of the feathers over a period of four to 16 weeks. Typically the molt is staggered to allow the bird to fly and maintain thermal protection. Depending on the stage of molt, the existing plumage would provide varying degrees of protection from solar energy. A bird in the middle of molt, that may have areas of exposed skin, would be expected to have an increased risk from exposure to elevated levels of solar energy flux and may experience immediate tissue damage to tissue; having no thermal protection from plumage.

Birds replace lost feathers slowly and even minimal damage to flight feathers can significantly affect flight performance. Large birds, such as eagles and vultures may take up to two years to molt (Raptor Research Foundation 2012); although a few

species will molt all flight feathers at once (Ibid.). When a feather is actively growing, blood is supplied to the shaft of the feather. When fully grown and formed the vessels that supply blood to the feather constrict and the feather is considered dead tissue, without feeling, similar to human hair. A feather broken while in the blood feather stage remains damaged until molt (Chubb 2003). Birds exposed to elevated levels of solar energy flux while in the blood feather stage may be subject to increased risk of feather damage. Additionally, it is unknown if a feather heated by flux could conduct heat through the feather shaft and into the follicle or skin of a bird.

Molting requires additional energy to create the feather components and synthesize them (Murphy 1999). A bird that has experienced damage from elevated levels of solar energy flux may have diminished abilities to meet existing energy requirements. Damaged plumage may require the use of additional energy to fly, forage, and perform normal behaviors lowering the survivability of the bird. Hawks and eagles have been demonstrated to manage the nutritional cost of molting by shedding just two feathers on each wing at a time, and typically having around 24 flight feathers total to be molted (Chubb 2003). Feathers produced during periods of poor nutrition can be faulty, showing ridges and other abnormalities (German Assn. for the Prot. Of Common Swifts 2012), therefore, one or more molts may be necessary to repair the damage, and a bird would be energetically challenged to do so if damaged feathers reduced the birds success at foraging.

Exposure to elevated levels of solar flux would be expected to damage feathers such that insulating and flight capacities are lost, impaired or even destroyed. Birds exposed to damaging levels of solar energy flux either during or after a recent molt may also have an increased the risk of mortality or decreased fitness. In a desert environment, staff expects that a bird exposed to high temperatures and with limited access to water would have low survivability, either succumbing to heat, or extreme cold during cold desert nights, or from being more susceptible to predation. Birds with exposed skin are considered “greatly disadvantaged” (Chubb 2003). As with most species, older and younger individuals would be considered more susceptible to injury or mortality from elevated levels of solar flux. For example, juvenile birds have feathers that are much softer, and are not as adept at maintaining feathers as adults (The Modern Apprentice 2012); and may be more susceptible to injury or mortality than older birds.

Flight Performance

Fight performance is critical to foraging, evading predators, conducting seasonal migration and breeding displays, and performing other life history characteristics. In pet birds, incorrect feeding or caging can cause damage and weakness in feathers such that swifts cannot thermoregulate or fly (German Assn. for the Prot. of Common Swifts 2012). Seemingly minor damage to flight feathers may affect a bird’s flight speed or its ability to maneuver; more significant damage to flight feathers would prevent flight altogether. Length of flight feathers, and asymmetry in flight feathers were noted to reduce take-off speed in birds, when impaired by damage, or during molt (Swaddle et al 1996). In rehabilitating wild birds, the condition of plumage is critical to determining if the bird can be released. If plumage conditions allow the bird to fly, thermoregulate, and waterproof themselves, the survival rate is much greater (Wildlife Rehabber 2012). Additionally, damage to flight feathers may impact a birds’ capability to migrate. Passerines with impaired flight feathers have been demonstrated to avoid long-distance

flights (Hedenstrom 2003). Birds prevented from seasonal migrations due to the inability to effectively fly may experience mortality from the lack of food or exposure. Birds damaged by exposure to elevated solar energy flux would likely have limited abilities to complete these actives, and may suffer mortality at a later time or after leaving the site (i.e. off the project site). See **Appendix BIO1** for further discussion of flight mechanics.

Flight performance is also important in raising young. Adult birds make numerous trips back and forth from foraging grounds to the nest, carrying food items to young. A bird attempting to feed young with damaged flight feathers would have impaired flight capabilities that reduce the bird's ability to forage or hunt. Raptors in particular carry large prey to young, and have feathers adapted to these heavy loads. Bald eagles are capable of carrying up to half of their weight (Nye 2005), and damaged flight feathers would be detrimental to successful fledging of chicks.

Flight speeds and patterns will affect the length of time a bird is exposed to solar flux while moving across the project site. Flight speeds are reported to be typically within 10 20 to 50 miles per hour (mph) (USGS 1998), and vary dramatically on the upper end of the range. Appendix BIO1 provides estimates of the time required to traverse the solar field at various flight speeds, and also provides data for select flight paths and concentrated solar flux dose at the Solar 1 site. For reference purposes, horned larks and ravens are known to occur on the project site, and fly from 22 to 28 miles per hour, (mph) (USGS 2006), whereas mourning doves, which could also occur onsite, are faster flying, around 35 mph. Even faster are the swifts, whose speeds may possibly exceed 180 mph (Cooke 1933). It is unclear how flight speed may affect the likelihood of exposure to elevated levels of solar flux. Flight patterns would also affect the dose of solar flux a bird receives. Depending on species and behavior, birds exhibit various flight patterns such as continuous flapping, as well as non-continuous flapping such as soaring or gliding, flap-bounding and flap-gliding. Furthermore, flap speed varies depending upon energetics, weather conditions and speed needed, with swallows having a very low flap speed for birds of comparable size (Park et al 2001).

While it is unknown what the behavioral response of a bird will be from exposure to elevated levels of solar energy flux, passage through an area of high energy intensity could result in injury to the birds. Bird behavior will likely act in conjunction with flight speed to influence the probability of the exposure risk. Birds that fly at low elevations below elevated levels of solar energy flux are not expected to experience an exposure risk. However, aerial foraging birds, such as swifts and swallows, have been documented to be more likely to experience exposure to this risk (McCrary 1986).

The type and color of the plumage will also influence the potential risk to the bird. Plumage will absorb various amounts of solar radiation, depending on many factors. Plumage color, position of bird, density and structure of feathers, and flight speed, will all affect a birds' tolerance to this heat (Walshburg 1992). Other factors such as behavioral response to elevated flux levels, age of the bird, ambient temperature and humidity level will also affect how exposure to elevated solar energy levels will impact a bird. Birds will not be able to see the solar energy flux over the heliostat field, and therefore would not be expected to avoid the airspace where solar energy is concentrated. Birds may also become confused or disoriented and depending on

behavioral response, such as flying lower, higher, or making evasive maneuvers will affect duration of exposure.

It is unknown what protection plumage will afford the different species of birds that may move into solar fields and experience elevated levels of solar energy flux. At low levels and short durations the birds may suffer little permanent damage and be able to survive post exposure. However, at exposure to high levels of solar energy flux even short durations may be lethal even if the bird is able to fly out of the flux field. For a large powerful bird, such as golden eagle, lethal damage to plumage, skin, or eyes from exposure to high levels of solar energy flux may occur, yet the bird may be able to fly away from the site. Documenting incidences of latent mortality that occur off the project site is likely not feasible nor is it possible to accurately predict what percentage of birds would be subject to this effect.

Irradiance

When the project is operating, the heliostats will reflect the sun's rays onto the SRSG, which occupy the top 130 feet of each solar power tower. During these times, the boilers absorb approximately 95 percent of the light that reaches them. Light that is not absorbed will be visible reflecting off of the surfaces of the solar boilers.

The perceived brightness of objects is measured in terms of retinal irradiance, which is a measure of the intensity of the light reaching the retina. Retinal irradiance also has the potential to cause adverse impacts. The avian eye is comparatively larger than the human eye (Brooke et al 1999), and raptors have even larger size eyes than non-predatory birds of the same weight (*Ibid*). Birds eyes are typically fixed in the socket and unable to turn (Project Beak 2012), although some species such as raptors have limited ability to turn their eyes (White et al 2007) (O'Rourke et al 2007), and have very wide fields of view (O'Rourke et al 2007). Some birds may be unable to look away or avoid exposure, given their physiological attributes (Dr. Gregg Irvin, personal communication). This lack of response would be considered similar to a "deer in the headlights". In humans, the sensation of pain is not linked to retinal damage, nor does it seem to be linked in animal species (*Ibid*).

It has been suggested that the presence of specially-adapted oils in the cones of avian eyes may provide some protection against solar irradiance (Vorobyev 2003). Staff has no data on how much, if any, protection is gained by the presence of these oils. However, it is assumed that wildlife have evolved and adapted protective physiological traits specific to their environment, and would not have innate protections against irradiance of the magnitude created by the project.

Staff has no further data regarding the impacts of irradiance exposure on wildlife. It should be noted that the possibility exists for wildlife to experience damage, yet still be able to fly off the site. For the purposes of evaluating significance thresholds, staff believes irradiance has the potential to cause injury or lethality to avian species that fly within an un-quantified area of the solar field. Estimates of species most susceptible, or numbers of individuals exposed to damage from irradiance is not currently available. Injury or death from exposure to irradiance would be in conflict with LORS. It should be noted that the monitoring and mitigation protocol outlined in Condition of Certification

BIO-15 would not detect eye damage, as necropsy of a live or freshly killed specimen would be needed to quantify damages. Staff has accounted for the lack of data by incorporating a safety margin (see Appendix BIO1) for flux exposure on feathers, and therefore will rely on damage to keratin (feathers) as the lowest endpoint of toxicity.

Applicant's Data

Staff has reviewed all information provided by the applicant with respect to solar flux. The applicant initiated a pilot study commissioned by the applicant at the SEDC site in Israel in April, 2012 (CH2 2012pp). The SEDC site uses similar technology, albeit is a much smaller project, with a 75-meter power tower. After 41 days of monitoring, only 3 bird carcasses were found at the SEDC site, with no signs of singeing or effects of collisions noted on the carcass. However, it is possible that flight capability was impaired by flux exposure, but not detected during examination of the carcasses.

Further information regarding the study was provided on November 1, 2012 (CH2 2012pp) and during a workshop held December 5, 2012, including information regarding study design at the site, and presenting the results of spring 2012 survey data. The study includes carcass searches within the heliostat field, as well as observation of bird behavior in the airspace over the project site. During 41 days of surveys a total of 62 species have been observed at the project site, with the majority of the birds flying above 100m. Fall surveys of the SEDC site will be performed from August 15 to October 15, 2012 (CH2 2012pp); no results were available to staff at time of publication of this analysis.
The applicant also provided results of the preliminary investigation on the effects of concentrated solar energy on bird carcasses to staff during a workshop on August 28, 2012, and December 5, 2012 (BS 2012uBS 2012v, BS 2012w, BW2012x). Carcasses of three species (chickens, doves, and quail) were exposed to various energy flux level for periods of 10 to 30 seconds. Burned or singed feathers and discolored or dried muscle tissue were observed in the carcasses exposed for 20 to 30 seconds to flux levels above 50 kW/m^2. These effects were not observed in carcasses exposed to lower flux levels for the same intervals. No data on longer exposures were available.

The levels of feather and tissue damage reported for these exposures at 50 kW/m^2 or above would be likely to kill living birds. In addition, shorter exposures at these energy flux levels would be likely to cause other tissue or feather damage that could impair flight or vision or cause physiological effects and ultimately cause or contribute to mortality from other causes (e.g., reduce ability to forage, escape from predators, or thermoregulate). Longer exposures to solar flux levels below 50 kW/m^2 are likely to cause feather damage or physiological effects. Staff has reviewed these studies, disagrees with conclusions presented, and notes that applicant's results are in stark contrast with other published literature. For example, a whole house is known to ignite after 15 to 20 minute exposure to flux density of 31.53 kW/m^2 (24CFR, Section 51.204, Appendix II); it seems unreasonable to believe that a bird might withstand even higher flux densities for any amount of time.

Conclusions and Discussion of Mitigation

Based on staff's understanding of solar energy flux intensity and exposure times, staff believes that birds flying for through energy flux in excess of safe thresholds will likely

suffer significant damage to flight feathers, eyes, or skin so that they will be unable to survive longer than a few days. In some cases, where they fly through higher flux levels, these birds will fall to the ground with evidence of severe burning as reported by McCreary et al. (1986). Staff believes that many birds may continue flying for a few seconds or minutes, perhaps long enough to escape the hazard, but will be unable to fly effectively, find food, or escape predators and will die a short time after the exposure.

Staff also believes that birds exposed to concentrated solar flux will be at risk of suffering (1) feather damage and consequent flight impediment, or (2) hyperthermia, hypothermia, or other damaging physiological or anatomical effects. These effects of exposure are influenced by both the dose level and exposure time. These effects are considered significant and immitigable.

The project applicant has offered no mitigation for impacts stemming from exposure to solar flux, and has stated that the size and configuration of the project itself serves to minimize effects. Staff disagrees with this position; yet no feasible onsite mitigation and minimization measures to avoid the impact have been identified. Implementation of Condition of Certification **BIO-15 (**Avian, Bat, and Golden Eagle Protection Plan) will be required to monitor and potentially reduce the onsite loss of some birds and golden eagles. Opportunities for offsite mitigation may also be possible by enhancing, creating, or restoring offsite habitat demonstrated to be of value to the avian species occurring on the HHSEGS site. Other offsite mitigation may be available through a partnership between the project owner and the USFWS JointVenture Program (discussed further below). However, just as it is difficult to discern the full actual impact of the project on avian species, it is also difficult to identify feasible mitigation that is matched proportionally to such an impact.

In developing Condition of Certification **BIO-15** with respect to golden eagles, staff has considered the USFWS Draft Environmental Assessment for the West Butte Wind Project golden eagle take permit (2011c). The USFWS concludes (in its Draft) that the applicant's conservation measures would meet USFWS's purpose and need. The relevant conservation measure is 11 power pole upgrades for each eagle mortality. However the take of golden eagle is not permitable under state law, and such take cannot be "fully mitigated" under state law. Thus, even with mitigation for potential golden eagle take, the impact to golden eagles would be viewed as significant.

Staff has also considered the USFWS's recommended survey protocol for bird mortality at the Rice Solar Energy project (Rice project). The Rice project is a 150 MW concentrating solar power project, similar to the HHSEGS project in creating a concentrated solar flux field over the heliostats. The Rice Project (09-AFC-10) was certified by the Energy Commission in 2010, and pursuant to conditions of certification, a monitoring plan was developed for the Rice Project (Nicolai et al 2010).

Implementation of **BIO-15** (Avian, Bat, and Golden Eagle Protection Plan) would require the project owner to monitor, record, and report bird deaths and injuries from project construction and operation. Monitoring the project's operational impacts for seasonal factors, the species of birds affected, and the types of injuries or mortalities that occur have also been requested by the USFWS. This type of monitoring is considered crucial in documenting bird behavior, noting responses to stress, quantifying impacts, and

subsequently identifying and implementing any available measures to avoid, minimize, or mitigate these impacts. If take occurs, it will be reported to the US Fish and Wildlife Service (USFWS) for further action. Additionally, Condition of Certification **BIO-15** has been developed to meet USFWS requirements for addressing the ESA, MBTA, and BGEPA. Feasible mitigation to reduce impacts below the level of significance are not currently known.

Condition **BIO-15** requires development of Avian, Bat, and Golden Eagle Protection Plans. These plans require development of project monitoring methodology and implementation of compensatory mitigation, should monitoring reveal significant impacts to avian species. This mitigation shall be implemented as needed based on levels of take revealed by monitoring, and would detail all appropriate minimization and compensatory actions, as determined in consultation with USFWS, CDFG, and the Energy Commission. These actions would vary from restoration of avian habitat that supports the species impacted by the project, power line retrofits or other means of minimizing take and enhancing habitat, and will allow for flexibility in measures imposed, based on effectiveness monitoring. These avian protection plans will also incorporate a means of accounting for individuals that may suffer damage from irradiance exposure, yet still be capable of flying off the site. These animals would not be detected during onsite carcass searches, yet would be adversely impacted by the project.

While data collection is important, and could potentially inform new mitigation or adaptive management strategies, feasible mitigation to reduce impacts to avian species from exposure to elevated levels of solar energy flux or irradiance to below the level of significance does not exist. This is because mitigation cannot avoid bird mortality, nor can it adequately replace birds in the local population that are killed by solar flux exposure. Further, if golden eagles are adversely affected, impacts to this species would be considered unmitigable because golden eagle is a fully protected state species. While habitat restoration actions may benefit by some measure the species impacted by improving survivability and reproduction of the species, staff is unaware of any means of directly correlating such restoration measures to the impact of solar flux on various bird, bat, and insect species. Staff concludes significant residual effects could exist after implementation of **BIO-15**.

Conservation Opportunities

Condition of Certification **BIO-15** would, among other things, require the development and implementation of conservation opportunities. Staff has accordingly conferred with various agencies to determine where these conservation opportunities may exist. While the final determination of specific conservation actions would be made during development of the Avian, Bat, and Golden Eagle Protection Plans, and are not limited to those opportunities presented here, the following are viable examples of conservation actions that may be taken by the project owner.

The USFWS Joint Venture is a collaborative, regional partnership of government agencies, non-profit organizations, corporations, tribes, and individuals that conserves habitat for priority bird species, other wildlife, and people. Joint Ventures bring these diverse partners together under the guidance of national and international bird

conservation plans to design and implement landscape-scale conservation efforts. Joint Ventures have been widely accepted as the model for collaborative conservation in the 21st century. They use state of the art science to ensure that a diversity of habitats is available to sustain migratory bird populations for the benefit of those species, other wildlife, and the public. JointVenture actions include: biological planning, conservation design, and prioritization; project development and implementation; monitoring, evaluation, and research; communications, education, and outreach; and funding support for projects and activities.

Within California, several JointVentures exist: the Central Valley, Intermountain, and Sonoran. Based on personal conversations with USFWS and the Sonoran JointVenture Coordinator, means of compensation benefitting desert avian species are in place (Robert Mesta, personal communication), and further, the Sonoran JointVenture program also has the capability of designing conservation plans responsive to certain bird species or specific geographic locales. It is possible that conservation measures, as determined in the Avian, Bat, and Golden Eagle Protection Plans may entail cooperative effort with a JointVenture Program.

Staff has also conferred with the BLM (Chris Otahal, personal communication) regarding conservation opportunities at the Amargosa River Natural Area, which is comprised of three ACECs: the Upper Amargosa Mesquite Bosque Unit, Central Amargosa Unit, which includes the previous Amargosa Canyon and Grimshaw Lake Natural Areas plus additional lands in China Ranch Wash and the Tecopa area, and the Lower Carson Slough Unit. Within these ACECs restoration and enhancement of the Amargosa River and adjacent environs are ongoing, including tasks such as tamarisk removal and control of brown-headed cowbirds (*Molothrus ater*), a bird known to parasitize the nests of songbirds. The BLM has indicated that if conservation actions are deemed necessary through project operations monitoring, the possibility exists for the project owner to participate in these conservation opportunities through various means such as funding or supply of personnel.

Electrocution

Egrets, herons, raptors, and other large aerial perching birds, including those accorded state and/or federal protection, are susceptible to transmission line electrocution if they simultaneously contact two energized phase conductors or an energized conductor and grounded hardware. The design characteristics of transmission towers/poles are a major factor in raptor electrocutions. Electrocution occurs when a perching bird simultaneously contacts two energized phase conductors or an energized conductor and grounded hardware. This happens most frequently when a bird attempts to perch on a transmission tower/pole with insufficient clearance between these elements. Electrocution can occur when horizontal separation is less than the wrist-to-wrist (flesh-to-flesh) distance of a bird’s wingspan or where vertical separation is less than a bird’s length from head-to-foot. Electrocution can also occur when birds perched side-by-side span the distance between these elements (APLIC 2006).

The majority of bird electrocutions are caused by lines that are energized at voltage levels between 1-kV and 60-kV, and “the likelihood of electrocutions occurring at voltages greater than 60-kV is low” because phase-to-phase and phase-to-ground

clearances for lines greater than 60-kV are typically sufficient to prevent bird electrocution (APLIC 2006). The proposed transmission lines on the project site are currently under review and the applicant has proposed burying transmissions lines on the project site. Therefore, the project will not afford new perching opportunities from these facilities; however, substation structures do provide perching opportunities for birds. To reduce potential effects of the project the applicant has indicated that construction and operations crews will use BMPs, and that transmission facilities will be designed to be raptor-safe in accordance with the Suggested Practices for Raptor Protection on Power Lines: The State of the Art in 2006 (APLIC 2006). This includes placing perch deterrents on small structures to reduce the potential for birds to perch on the poles. Condition of Certification **BIO-8** requires above-ground transmission lines and all electrical components to be designed, installed, and maintained in accordance with APLIC guidelines to reduce the likelihood of large bird electrocutions and collisions. With the Implementation of proposed Condition of Certification **BIO-8**, the project transmission lines would not pose a significant electrocution threat to birds.

Impacts to Special-Status Wildlife

Habitat in the project area has the potential to support a variety of special-status wildlife. Some of the sensitive species observed in the project area include desert tortoise, burrowing owl, Le Conte's thrasher, golden eagle, American badger, and Nelson's bighorn sheep. **Biological Resource Table 4** lists the special-status wildlife species that have the potential to occur in the project area. Impacts to special-status or listed species would occur in the same way as described for common wildlife and could be caused by a variety of direct and indirect factors. Impacts to special-status species are described below.

Special-Status Reptiles

Desert Tortoise

The desert tortoise is listed as threatened under CESA, and the Mojave population (i.e., all animals located west of the Colorado River) is listed as threatened under the federal ESA. The proposed project would be required to obtain both state (Incidental Take Permit via Section 2081 of Fish and Game Code) and federal permits (USFWS Biological Opinion via Section 7 of the ESA). As part of its authority granted by the Warren-Alquist Act, the Energy Commission has in-lieu permitting authority for local and state agencies; therefore the state Incidental Take Permit (2081) for desert tortoise would subsumed in the Commission Final Decision.

Protocol-level surveys were conducted between March 13, 2011, and May 18, 2011 (HHSEGS 2011a). Desert tortoise and their sign were detected on the project site and in adjacent habitat to the east and south. Two live desert tortoises, the remains of a skeleton and shell, 58 burrows, 12 desert tortoise scats, and six sets of desert tortoise tracks were detected on the project site (See Figure 5.2 -7 Desert Tortoise and Sign in the AFC). Six live desert tortoise, 15 burrows, one desert tortoise scat, and three sets of tracks were detected within 150 meters of the project site. Surveys within the broader "zone of influence" (ZOI), which extends 1,600 meters from the project boundary, detected seven live tortoise, 21 burrows, and 5 desert tortoise scats. **Biological Resources Table 12** provides a summary of the applicant's data representing desert tortoise observations, burrows, and their sign within the project area, the 150 meter

buffer, and the ZOI transects (HHSEGS 2011a). **Biological Resources Figure 5** identifies burrows detected by the applicant and staff during surveys of the project site conducted in August 2012.

Biological Resources Table 12
2011 Desert Tortoise Survey Results

Location	Tortoise	Carcass	Burrows	Scat	Tracks
Project Site	2	1	58	12	5
150 M Buffer*	6	0	15	1	4
Zone of Influence**	7	0	21	5	0
Total Sign	**15**	**1**	**94**	**18**	**9**

**Denotes sign identified within 150 meters of the project boundary*
*** Zone of Influence surveys were conducted in suitable tortoise habitat along all sides of the main project site at 200 meters, 400 meters, 600 meters, 1200 meters, and 1600 meters from the survey area perimeter. No ZOI transects were conducted south of the site due to the presence of private residences.*

Although only a small number of desert tortoises were detected on the project site it is likely that the project area supports a larger number of tortoises than were observed by the surveyors. Desert tortoises are frequently unavailable to be sampled by field crews because they make extensive use of underground shelters (Nussear 2004). Similarly, desert tortoises spend much of the year in burrows even during the active season (Woodbury and Hardy 1948; Marlow 1979; Nagy and Medica 1986; Bulova 1994), and only the proportion of the tortoise population that is above ground is usually sampled (Nussear 2004). Even when desert tortoise are active and above ground during the surveys only a subset of these animals are usually detected. This can lead to a violation of a critical assumption of the line distance sampling technique, namely, that all animals on the line are found (Anderson et al. 2001; Buckland et al. 2001).

In order to account for observer bias, weather conditions, and desert tortoise behavior the USFWS developed a predictive model (USFWS 2010) for estimating the expected range of desert tortoise that may present based on the limited ability to detect animals during the surveys. The USFWS 2010 survey protocol takes into account the probability that tortoises would be present above ground based on the previous winter's rainfall and the fact that not all tortoises within the survey area are seen by surveyors. The model then provides a mathematical formula that is used to estimate the number of adult and subadult tortoises that are actually present. Statistical techniques can provide further estimates of minimum and maximum numbers of tortoises expected, within a 95 percent confidence interval. In addition, most juvenile tortoises and tortoise eggs are not detected during field surveys.

The applicant has indicated that although most tortoises were found off the proposed project site, the abundance of burrows, recent scat, and tracks on site, and the close proximity (within 150 meters) of desert tortoise and their sign indicate an active population is using the site (HHSEGS 2011a, Appendix 5.2F). Based on the USFWS predictive formulas completed by the applicant between 6 and 33 adult and subadult desert tortoises are expected to occur on the project site (USFWS 2010a). In addition to adult and subadult desert tortoises, the proposed project site is expected to support a population of juvenile tortoises that are not considered in the USFWS formula.

Juvenile tortoises are extremely difficult to detect because of their small size and their cryptic nature. In many instances these species are overlooked during surveys. However, estimates of juvenile tortoise populations can be extrapolated using information based on a four-year study of tortoise population ecology conducted by Turner et al. (1987). This study determined that juveniles accounted for approximately 31.1 to 51.1 percent of the overall tortoise population. Using this range and the estimate of between six and 33 adult and subadult desert tortoises (i.e., lower and upper 95 percent confidence value), the project site may support between three to 34 juvenile tortoises (i.e., a total population range between nine and 67 adults, subadults, and juveniles).

The project site may also support areas containing the eggs of desert tortoise. The number of tortoise eggs that could be present on the project site was estimated based on the assumption of a 1:1 sex ratio and that all females present would lay eggs (clutch) in a given year. Applying the 1:1 sex ratio to the lower and upper 95 percent confidence values (i.e., five out of the nine adult desert tortoises and 17 out of the 33 adult desert tortoises) the project site could theoretically support between five and 17 reproductive females. Using the average clutches per reproductive female in a given year (i.e., 1.6, see Turner et al. 1984), multiplied by the average number of eggs found in a clutch (i.e., 5.8; see USFWS 1994b); approximately 46 to 158 eggs would be expected on the site in a given year. However, fewer eggs are likely to be onsite at any given time because it is likely that not all females are of reproductive age or elected to produce eggs during any given year. The estimated number of desert tortoise, their range class, and the number of eggs that have the potential to occur on the project site are presented in **Biological Resources Table 13.**

Biological Resources Table 13
Estimated Number of Desert Tortoise on the Project Site and Within the 150 meter Buffer (95 percent confidence values)

Adult and Sub-adults*		**Juvenile Estimates****		**Eggs*****	**Total Adult/Sub-adult and Juvenile**	
Lower	Upper	Lower	Upper	(Min-Max)	Lower	Upper
6	33	3	34	46-158	**9**	**67**

*Value based on formula recommended by the USFWS. Numbers reflect the 95 percent confidence interval.
** Values based on the equations of Turner et al 1987. Equation assumes that juveniles account for approximately 31.1 to 51.1 percent of the overall tortoise population. If P = Percentage of juveniles in population, A = Number of adults, and J = Number of juveniles then P = J / (J + A). Therefore J = PA/ (1 – P).
*** Assumes a 1:1 sex ratio and that all females present would clutch in a given year. Assumes average clutches per reproductive female in a given year (i.e., 1.6, see Turner et al. 1984), multiplied by the average number of eggs found in a clutch (i.e., 5.8; see Service 1994).

Impacts to Desert Tortoise

Construction of the proposed project would result in direct, indirect, and operational effects to desert tortoise and their habitat. These effects are similar to those described for common wildlife and would occur during the initial stages of mobilization, construction, and from operation and maintenance of the proposed facility. In addition, the implementation of the proposed project would require the translocation of all desert tortoises that occur in the development footprint prior to construction. The translocation of desert tortoise from the project site has the potential to adversely affect desert

tortoises that may occur on the project site and at designated recipient areas (See translocation effects below).

Direct Impacts to Desert Tortoise

During construction of the proposed project desert tortoises could be harmed during clearing, grading, and trenching activities or may become entrapped within open trenches and pipes. Construction activities could also result in direct mortality, injury, or harassment of individuals and eggs from encounters with vehicles or heavy equipment. Desert tortoises are known to shelter under parked vehicles and be killed, injured, or harassed when the vehicle is moved. Other direct effects could include individual tortoises or eggs being entombed in their burrows, collection or vandalism, disruption of tortoise behavior during construction and disturbance due to noise or vibrations from heavy equipment. Human disturbance, lighting and noise may disrupt desert tortoise in adjacent lands. Desert tortoise may also be injured or suffer mortality from encounters with workers' or visitors' pets. Windblown dust can also adversely affect desert tortoise by degrading habitat and decreasing the value of available forage. Desert tortoises may also be attracted to the construction area by the application of water to control dust, placing them at higher risk of injury or mortality by vehicle traffic.

Construction of the proposed project would occur over a period of 29 months and access the site through Tecopa Road. Section 5.12.4.2 (Summary of Construction Phase Impacts) of the AFC indicate that during the peak construction month, the project is projected to add 2,744 daily trips, with 907 trips occurring during the morning peak hour and 907 trips occurring during the afternoon peak hour. Use of paved roads and the small dirt access roads could result in mortality of desert tortoises by vehicle strikes. The potential for increased traffic-related tortoise mortality is greatest along paved roads where vehicle frequency and speed is greatest. Desert tortoises on dirt roads may also be affected depending on vehicle frequency and speed. Data indicate that desert tortoise numbers decline as vehicle use increases (Bury et al. 1977) and that tortoise sign increases with increased distance from roads (Nicholson 1978; Karl 1989; von Seckendorf & Marlow 1997, 2002).

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

Indirect Impacts to Desert Tortoise

Indirect effects to desert tortoises could include soil compaction, fugitive dust, the introduction of non-native and invasive plant species, and increased human presence along access roads. Indirect effects may also include habitat fragmentation, the disruption of existing home ranges, and barriers to dispersal. Increased human presence from new access roads or interest in the facility could lead to increased road

kill, illegal collecting and the spread of disease due to abandonment of captive tortoises infected with upper respiratory tract disease.

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

Operational Impacts to Desert Tortoise

Operational impacts to desert tortoise include both direct and indirect effects including those described above. Typically, these effects are similar in type but smaller in magnitude when compared to construction related effects. These effects may include the risk of mortality from vehicle traffic, crushing of burrows by routine maintenance activities on access roads or if any desert tortoises remain in the facility area post construction, vegetation management activities, and washing of the heliostats. Other operational effects include fires, habitat degradation, and the spread of invasive plant species. Increased road traffic on Tecopa Road either from facility staff or sightseers increases the risk of road kill to both tortoises and common wildlife. This not only results in the loss of desert tortoise but increases the risk for subsidized predators such as ravens and coyotes.

Construction and operation of the project has the potential to increase raven and coyote presence in the project area. Ravens depend on human encroachment to expand into areas where they were previously absent or in low abundance. Ravens habituate to human activities and are subsidized by the food and water, as well as roosting and nesting resources that are introduced or augmented by human encroachment. Ravens were observed by the applicant and staff on the project site and are likely to increase during construction of the project.

The proximity to the community of Charleston View may provide subsidies to known predators of desert tortoise. For example, common raven populations in some areas of the Mojave Desert increased 1,500 percent from 1968 to 1988 in response to expanding human use of the desert (Boarman 2002). Since ravens were scarce in this area prior to 1940, the current level of raven predation on juvenile desert tortoises is considered to be an unnatural occurrence (BLM 1990; USFWS 2008a). In addition to ravens, feral dogs have emerged as major predators of the tortoise. Dogs may range several miles

into the desert and have been found digging up and killing desert tortoises (USFWS 2011; Evans 2001).

Ravens may also use the perimeter fence as potential perch sites and new transmission line structures as nest and perch sites increasing the potential for loss of tortoises from raven predation. Several raven subsidies occur in the region including the city of Pahrump, Nevada, a trash dumpster placed along the road in Charleston View, and a small pond that occurs at a local firearms training institute located north east of the project. Small mammal, fox, coyote, rabbit, lizard, snake, and tortoise road kill along Tecopa Springs Road also provides an additional attractant and subsidy for opportunistic predators/scavengers such as ravens. In addition, bird collisions with facility structures or transmission lines may also attract ravens. As the project area is already subject to elevated raven predation pressure and any loss of juvenile tortoise due to the further addition of raven subsidies could have a long-term effect on the tortoise population by reducing the recruitment of juvenile tortoises into the adult life stages (Boarman 2003). The effects of reduced recruitment may not be apparent for years because tortoises do not typically reach sexual maturity until approximately 15 to 20 years of age, and are therefore considered indirect impacts of project operation.

Conclusions and Discussion of Mitigation for Direct, Indirect and Operational Impacts to Desert Tortoise

Implementation of the proposed project would result in significant direct, indirect, and operational impacts to desert tortoise. Section 5.2.9.2.1 (Mitigation Measure 2 – Desert Tortoise) of the AFC identified a series of actions that would be employed during construction to minimize project effects to this species. These actions include but are not limited to worker training; the installation of exclusion fencing to prevent desert tortoises from entering construction areas; conducting pre-construction clearance sweeps; translocating desert tortoises; construction monitoring; trash collection; and providing compensatory mitigation for lost habitat. The applicant has also proposed to implement dust control measures; inspect beneath vehicles; restrict construction traffic to designated routes; and require reduced vehicle speed limits to minimize the risk of collision with vehicles or equipment. These actions were reviewed and incorporated into staffs recommended Conditions of Certification **BIO-1** through **BIO-13**, which apply to the protection of desert tortoise and other biological resources.

The most effective mechanism for reducing impacts to desert tortoise is to avoid or minimize on-site disturbance. However, because of the distribution of this species on the project site it will not be possible to avoid all occupied habitat. Desert tortoise are cryptic species that are often overlooked during surveys, and can be difficult detect unless weather conditions are favorable. The primary strategy to reducing direct impacts from construction related effects is educating workers as to the natural history of desert tortoise through Condition of Certification **BIO-6** (Worker Environmental Awareness Program); **BIO-7 (**Biological Resources Mitigation and Monitoring Plan) identifying sensitive species locations and permit requirements; **BIO-8** (Impact Avoidance and Minimization Measures); conducting pre-construction surveys and relocating desert tortoise to pre-selected off-site locations required by **BIO-9** (Desert Tortoise Clearance Surveys and Exclusion Fencing and **BIO-10** (Desert Tortoise Translocation Plan). **BIO-10** would require that the applicant prepare and implement a

desert tortoise translocation plan to move the tortoises from the project site prior to ground disturbance. Direct impacts would also be reduced through Condition of Certification **BIO-12** (Desert Tortoise Compensatory Mitigation), which requires the acquisition of compensatory mitigation lands to off-set habitat loss (Impacts to Desert Tortoise Habitat are discussed further below).

Even with the implementation of the Desert Tortoise Translocation Plan it is likely that some juvenile tortoises and eggs would be overlooked and subject to mortality from project activities within the enclosed fence line both during construction and operation of the facility. Likewise, the ongoing translocation experience associated with the Ivanpah Solar Energy Project has illuminated the need to revise the translocation strategy to increase the number of clearance surveys in order to detect tortoises. While impacts to desert tortoise would be minimized through the implementation of proposed Conditions of Certification **BIO-8** (Impact Avoidance and Minimization Measures)**, BIO-9** (Desert Tortoise Clearance Surveys and Exclusion Fencing), and **BIO-10** (Desert Tortoise Translocation Plan) some onsite mortality would likely occur because of the cryptic nature of juvenile tortoises and from recent hatchlings not detected during the pre-construction clearance surveys. It is also likely that desert tortoise will continue to be found within the project fence line during the multi-year development of the project. Similarly, maintaining the integrity of the tortoise fence after storms and in locations where burrowing mammals such as coyote, badger and kit fox have breached the fence line will be an ongoing challenge. In addition, conditions of certification **BIO-9** (Desert Tortoise Clearance Surveys and Exclusion Fencing) and **BIO-10** (Desert Tortoise Translocation Plan) have inherent risks and could themselves result in direct and indirect effects to tortoises on the proposed project, translocation, and control sites. These could include direct effects such as mortality, injury, or harassment of desert tortoises due to equipment operation, fence installation activities, removal of tortoise burrows, and tortoise translocation. Indirect effects could include but are not limited to intraspecific competition for burrows or forage, increased stress, and the spread of disease. These impacts are described in more detail below.

Indirect effects to desert tortoise would also be reduced through the implementation of the conditions identified for direct effects. Implementation of the worker environmental awareness training (Condition of Certification **BIO-6**) would reduce the potential for wildfires to occur. Condition of Certification **BIO-8** would minimize the risks of increased traffic fatalities. These measures include confining vehicular traffic to the project site and existing routes of travel, prohibiting cross country vehicle and equipment use outside designated work areas, and imposing reduced speed limits on the dirt access roads. Condition of Certification **BIO-8** will also prohibit the use of the existing desert trail network to access the site and require vehicles to access the project via Tecopa Road and Highway 160. Potential impacts from the spread of invasive plant species would be reduced to less than significant levels through the implementation of conditions of certification **BIO-18** (Weed Management Plan). Condition of Certification **BIO-23** (Ground Water-Dependent Vegetation Monitoring Plan) would prevent significant adverse impacts to the mesquite dune scrub and Stump Spring ACEC, which are also used by desert tortoise (Poff pers. comm. 2012, HHSEGS 2011a). Implementation of these measures would reduce impacts of the proposed project to less-than-significant levels under CEQA.

The AFC did not identify specific mitigation to reduce the impacts of increased raven presence at the project site. However, measures proposed by the applicant including the removal of trash, management of standing water, and the removal of road kill would reduce raven subsidies. However, because of the responsibility to fully mitigate impacts to desert tortoise staff has proposed Conditions of Certification **BIO-8** (Impact Avoidance and Minimization Measures) and **BIO-13** (Raven Management Control Plan and Fee). These conditions would minimize the project's potential to cause increased predation on desert tortoise by ravens and other species in the project area by requiring a variety of impact avoidance and minimization measures to collect road kill; control trash and minimize other human activities that tend to increase raven activity; and implement on-site raven management and control. The project owner would also be required to provide a one-time per-acre contribution to support the USFWS Regional Raven Management Program.

Regional Approach to Raven Control

The USFWS, in cooperation with CDFG and BLM, has developed a comprehensive regional raven management and monitoring program in the California Desert Conservation Area to address the regional, significant cumulative threat that increased numbers of common ravens pose to desert tortoise recovery efforts (USFWS 2010b). The Regional Raven Management Program will implement recommendations in the USFWS E*nvironmental Assessment to Implement a Desert Tortoise Recovery Plan Task: Reduce Common Raven Predation on the Desert Tortoise* (USFWS 2008). To mitigate the projects contribution to cumulative and indirect impacts on desert tortoise from raven predation, staff proposes that the applicant contribute toward implementation of the Regional Raven Management Program (USFWS 2010b), as described in Condition of Certification **BIO-13**. To mitigate for the regional effects of ravens on desert tortoise, the applicant shall provide a onetime fee in the amount of $105.00 per acre and a two percent fund management fee to the REAT Account held by NFWF for 3,197 acres of desert tortoise habitat disturbed by the project. This payment of $342,399 would support the regional raven management plan activities focused within the Mojave Desert Recovery. The fees contributed by the applicant would fund staff to implement raven removal actions, provide education and outreach efforts, and survey and monitor the activities identified in the federal Environmental Assessment (USFWS 2008b).

Staff has concluded that that implementation of these actions would be an effective means of reducing the project's cumulative contributions to desert tortoise predation from increased raven numbers. Implementation of these conditions would reduce direct, indirect and operational impacts to desert tortoise to less-than-significant levels under CEQA and would also satisfy the CESA requirements to fully mitigate impacts to desert tortoise under Fish and Game Code Section 2081.

Translocation

As discussed above, desert tortoises are a listed species under both the State and federal ESA. Projects like HHSEGS that result in "take" of desert tortoise require a authorization from the USFWS. This authorization may be provided in the form of an "incidental take statement" in compliance with Section 7 of the ESA. For many large scale projects the USFWS requires that all living desert tortoises are removed from the development site and placed in areas where the tortoise have a possibility to survive.

This relocation is called “translocation” when desert tortoises are move more than a certain distance from their current habitat (i.e., typically greater than 500 meters/1642 feet). For the HHSEGS project it is likely that translocation will be required and the USFWS will require a “translocation plan” as part of the Biological Opinion that accompanies its permit for incidental take.

Large scale land acquisition to support military training, residential and commercial development, and the construction of industrial level solar infrastructure projects has necessitated the use of translocation as a tool to minimize direct losses to desert tortoise and other sensitive wildlife. Construction of the proposed project would require the translocation or removal of all desert tortoises, including adults, subadults, and any juveniles that are found on the site during clearance surveys. An important consideration in assessing potential impacts from the translocation effort is establishing the proposed translocation sites. Translocation and control sites should occur on lands that can be managed for the protection of this species. The translocation of animals to privately held lands is not recommended by USFWS and CDFG, given the threat of future development and other inherent risks to desert tortoise associated with private land.

Most of the desert tortoise sign that occurs on the HHSEGS project is located near the eastern border of the project site; however, desert tortoise sign was observed in scattered locations across large portions of the site. Animals that are identified in the eastern area will likely be translocated to lands located immediately east of the proposed project site. These lands consist of suitable habitat that may include portions of the animals existing home range. The lands in this area are managed by the BLM and primarily occur within the State of Nevada. In order to comply with CDFG legal requirements all desert tortoises translocated to this area will be placed on lands located adjacent to the project that occur in California. Although the land in California is limited to a narrow strip of habitat; the land is contiguous with suitable habitat that occurs in Nevada. Animals found near the western border of the project site or in areas greater than 500 meters from a proposed translocation site will be held and tested prior to release in conformance with the proposed Translocation Plan.

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

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

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

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

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

Translocation may be a useful tool in the conservation of some species, yet well designed studies are necessary to properly evaluate its efficacy (Field et al 2007). As of 2012 there are a number of ongoing translocation actions that are currently underway. Most of these translocation events are related to military land expansion and solar energy development. Definitions of success are variable and determining ultimate success can require lengthy studies (Fischer and Lindenmayer 2000, Seigel and Dodd 2002). For the HHSEGS project translocation should be considered a mechanism to salvage existing animals and place them in an area where they have the potential to survive post construction.

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

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

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

tortoises being monitored (*ibid.*). **Biological Resource 14** provides a summary of the data as taken from 2011 USGS study at Fort Irwin California.

Biological Resource Table 14
Desert tortoise mortality from 2008-2011 at the Ft. Irwin Study Site.*

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

*Drake et al 2011.

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

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

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

The applicant provided a Preliminary Draft Desert Tortoise Translocation Plan in Data Response, Set 1B in December 2011. The plan provides a general outline only and the applicant has indicated a revised plan is forthcoming. However, the complete plan will be required by the USFWS, CDFG, and Energy Commission prior to implementing any tortoise clearance activities. The plan will be required to identify the proposed translocation and control areas, identify the number of tortoises that can be translocated into these areas, and provide a detailed methodology to describe the proposed translocation procedures, disease testing, and long term monitoring.

Biological Resources Table 15 (Desert Tortoise Density Estimates and Impact Summary) estimates of the numbers of tortoises that could be translocated from the project site; numbers of tortoises that would be handled at the translocation and control sites; and numbers of undetected juveniles and eggs that may occur at the project site. These estimates were derived through surveys and mathematical formulations. The number of desert tortoises that may actually occur on the project site is expected to fall somewhere between the upper and lower statistical 95 percent confidence level identified in the USFWS formula. Nonetheless, for the purposes of this analysis, the FSA presents the largest probability estimates of desert tortoise that has the potential to occur on the project site.

Biological Resources Table 15
Desert Tortoise Density Estimates and Impact Summary

	Estimated Number of Tortoises Subject to Direct Project Effects						
Project Feature	**Adult and Sub-adults***		**Juvenile Estimates****		**Eggs*****	**Total Adult/Sub-adult and Juvenile******	
	Lower	Upper	Lower	Upper	(Min-Max)	Lower	Upper
Project Site	6	33	3	34	46-158	9	67
Translocation Area[2]	6	33	3	34	N/A	9	67
Control Area[3]	6	33	3	34	N/A	9	67
Subtotal	18	99	9	102	N/A	27	201

*Value based on formula recommended by the USFWS. Table assumes all tortoise are detected and translocated.
** Values based on the equations of Turner et al 1987. Equation assumes that juveniles account for approximately 31.1 to 51.1 percent of the overall tortoise population. If P = Percentage of juveniles in population, A = Number of adults, and J = Number of juveniles then P = J / (J + A). Therefore J = PA/ (1 – P). For translocation purposes it is highly likely that most of the juvenile tortoise will not be detected during the clearance surveys. However they are included here for documentation purposes.
*** Assumes a 1:1 sex ratio and that all females present would clutch in a given year. Assumes average clutches per reproductive female in a given year (i.e., 1.6, see Turner et al. 1984), multiplied by the average number of eggs found in a clutch (i.e., 5.8; see Service 1994).
****Table assumes all tortoises are detected and translocated. The actual number of tortoises that may be subject to translocation is expected to be a subset of this value based on the assumption that only 15 percent of juvenile desert tortoise are likely to be detected.

Comments on the PSA provided by the applicant suggested the number of desert tortoises estimated in the PSA is too high, and recommended a reduced estimate. This information was reviewed and considered by staff. However, the PSA estimates are derived from the applicant's AFC (Appendix 5.2 F, Desert Tortoise Survey Report). The derived numbers are based on the USFWS predictive model and include desert tortoises that were found within 150 meters of the proposed project site. Staff utilized these numbers as a basis for extrapolating the expected levels of adult, sub-adult, and juvenile desert tortoises and their eggs based on the calculations of Turner et al (1985). The PSA used applicant data that between six and 33 adult and subadult desert

tortoises may occur on the project site and within a 150 meter buffer. The AFC assessment correctly suggested that desert tortoise found within 150 meters of the project boundary may include portions of the project site as part of their home range. Staff has used these assumptions and the USFWS model to calculate the number of desert tortoise affected by the project. Applicant in its comments proposes to exclude from the estimate animals immediately adjacent to the site. Staff and CDFG believe that this approach would severely underestimate project impacts, as the project is removing part of the home range of these desert tortoises, and the level of disturbance from construction may force temporary abandonment of the remaining portion.

As described in **Biological Resources Table 15** (Desert Tortoise Density Estimates and Impact Summary) approximately six to 33 adult tortoises (lower and upper USFWS 95 percent confidence level), three to 34 juvenile tortoises (based on 31.1 to 51.1 percent of the total population identified by Turner), and 46 and 158 eggs are expected to occur on the proposed project site. The actual number of animals that may be subject to translocation is expected to be a subset of this value. It is estimated that only 15 percent of juvenile tortoises (0.15 multiplied by the number of juveniles) on the site would be located during clearance surveys.

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

For this project translocation mortality rates are assumed to range up to 45 percent. This value represents the high end of documented translocation mortality for desert tortoise at this time. Using the five percent mortality rate for the control population (adult and juvenile tortoises multiplied by 0.05) and the 45 percent mortality rate for the translocated and host populations (adults and juveniles multiplied by 0.45) this would result in the potential loss of between eight and 36 tortoises from translocation mortality. In addition, given the likelihood that all of the eggs will be lost and assuming approximately 85 percent of the juveniles will be overlooked, it is reasonable to estimate that between three and 29 juvenile desert tortoises (i.e., 85 percent of 3-34), and all of the 46 to 158 eggs would be lost.

In total, translocation could result in the estimated loss of between 46 to 158 eggs and between 11 and 65 desert tortoise if mortality rates are 45 percent for the translocated animals. If mortality rates are lower there would be a corresponding reduction in desert tortoise deaths from translocation activities.

Condition of Certification **BIO-10** requires development of a Desert Tortoise Translocation Plan in consultation with CDFG and USFWS. The Desert Tortoise Translocation Plan will include the identification and prioritization of potentially suitable locations for translocation; desert tortoise handling and transport considerations (including temperature); animal health considerations; a description of translocation

scheduling, site preparation, and management; and specification of monitoring and reporting activities for evaluating success of translocation. With implementation of proposed Condition of Certification **BIO-10**, adverse impacts associated with desert tortoise translocation would be minimized.

Direct Impacts to Desert Tortoise Habitat

The project would result in "take" of desert tortoise as that term is defined under both State and federal law. Under the CESA, impacts for take of listed species must be "fully mitigated," such that the project does not result in the net loss of the species. CDFG, were it issuing the take permit, would require "compensatory mitigation" to meet the requirement that the project be "fully mitigated." Since the Energy Commission is issuing a permit that subsumes the CDFG "take" permit, staff has consulted with CDFG to determine the compensatory mitigation appropriate for the project.

Implementation of the proposed project would result in the direct loss of approximately 3,197 acres of occupied desert tortoise habitat. These impacts are significant and require compensatory mitigation. This includes approximately 1,580.5 acres of Mojave Desert scrub and 1,616.5 acres of shadscale scrub. The project area also includes 77 acres of disturbed lands including a fallow orchard (HHSEGS 2011a, Figure 5.2-3). In addition, the site includes a grid of unpaved roads; disturbed ruderal habitat, and a large bermed area primarily devoid of native vegetation. The loss of this habitat would reduce access to foraging, denning, and dispersal areas. Compensatory mitigation is not requested for the 77 acres of disturbed habitat on the project site.

The U.S. Geological Surveys (USGS) has developed a model which appraises the habitat value of various regions inhabited by the desert tortoise. The Desert Tortoise Habitat Model (Nussear et al. 2009) ranks tortoise habitat based on sixteen environmental data layers including soils, landscape, climate, and biotic factors that were merged with desert tortoise presence data region wide. This model provides an output of the statistical probability of habitat potential that can be used to map potential areas of desert tortoise habitat (*ibid.*). The habitat quality is given a numeric value ranging from zero to one. Areas within the designated mapping unit of one square kilometer given a rank of zero are not considered suitable habitat for desert tortoise; areas given the value of 1.0 represent high quality habitat for this species. Model values for the proposed project site range from of a high of 1.0 in the southeastern tip of the project site to 0.7; with the majority of the site ranked as 0.8 or 0.9. In other words, the model suggests that the majority of the project site either is, or potentially could be, excellent tortoise habitat.

Desert tortoise and their sign are concentrated within the northeastern third of the project site. This location abuts the California Nevada State line and is contiguous with open desert. Desert tortoise sign also occurs to a limited degree on most of the project; this included several burrows and a single scat. Desert tortoise or their sign were not detected on the southwestern corner of the site which consists of an approximately 640-acre parcel. Habitat on the project site consists of three primary vegetation community types. This includes Mojave Desert scrub, shadscale scrub, and disturbed communities that consist of disturbed areas and a fallow orchard. In addition, a network of unpaved roads excavated for a proposed residential subdivision, particularly in the western two-thirds of the site.

The highest concentration of desert tortoise or their sign was associated with the creosote bush scrub communities that dominate the eastern portion of the site. Creosote bush scrub in this area is largely unaffected and is considered to be of moderate-to-high quality (in terms of structure and species diversity). In addition, a total of 11 special-status plant species were documented in the eastern portion of the project site (HHSEGS 2011a) which suggests the site retains native habitat functions. **Biological Resources Figure 4** provides photos of representative habitat in the project area. The presence of tortoise in this area may be associated with a variety of factors including the more intact creosote bush scrub communities that occur in this area, soil composition, increased grass and herb layers, and proximity to adjacent natural lands supporting similar vegetation types. Although burrow density and sign was concentrated in this area; burrows were present to some degree in most of the project area. Although portions of the site have been degraded by roads, the majority of habitat is largely undisturbed in the eastern portion of the project site. Similarly, while noxious weeds and other invasive non-native plants were mapped across the entire project site (as were special-status plants); the eastern portion of the site is much less affected by non-native species.

Desert tortoise sign was also detected in vegetation supporting shadscale scrub. Shadscale or saltbush scrub dominates the western half of the project which is common on the finer textured and more saline or alkaline soils that occur between playas and the gravelly alluvial fans. Although desert tortoise are found in shadscale communities across their range desert tortoise density and sign was lower in areas dominated by this community. Habitat quality in the western portion is highly variable, ranging from densely weedy, highly degraded habitat of low native diversity to areas dominated by shadscale scrubs of moderate-to-high native species diversity. Some areas appear to have an agricultural history and most of this community type supports a moderate-to-high component of non-native annual weeds. However, although portions of this community type have been degraded two special-status plant species, Pahrump Valley buckwheat and Goodding's phacelia, were documented in scattered locations in the western and eastern portions of the project site.

Many invasive non-native species are adapted to and promoted by soil disturbance (Lathrop & Archibald 1980). Once introduced, they can out-compete native species because of minimal water requirements, high germination potential and high seed production (Beatley 1996). Weeds can outcompete native annuals where nitrogen deposition (near highways such as Tecopa Road) and precipitation rates are higher, leading to higher risk of wildfire (Allen et al. 2010), and can become locally dominant, representing a serious threat to native desert ecosystems (Abella et al. 2008). Lower desert tortoise densities on the southern and western portion of the project site may also be associated with the proximity to Tecopa Road and the residential communities that occur in this area. Dogs may range several miles into the desert and have been found digging up and killing desert tortoises (USFWS 2011, Evans 2001).

Although the USGS tortoise map identifies most of the project area as high quality desert tortoise habitat, portions of the project site are degraded and likely provide a reduced forage base for desert tortoise. As with any model of this nature, the regional scores reflect a hypothesized habitat potential given the range of environmental conditions where tortoise occurrence was documented (Nussear et al. 2009). As such,

the model may underrate some areas and overrate others compared to their actual habitat potential (*Ibid.*)

Nussear et al. (2009) also states that the map of desert tortoise potential habitat does not account either for anthropogenic effects, such as urban development, habitat destruction, or fragmentation, or for natural disturbances, such as fire, which might have compromised habitat potential. While portions of the site are mapped as good quality habitat some of these areas do not appear to routinely support desert tortoise or their sign. In addition, only limited desert tortoise or their sign was detected within most of the vegetation characterized as shadscale scrub. While the presence of desert tortoise is not strictly limited to vegetative structure alone, the degraded habitat, presence of weeds and proximity to residential properties likely limits the use of this area by this species.

Impacts to Critical Habitat

There is no federally designated critical habitat for desert tortoise within the proposed development footprint and no direct or indirect impacts to critical habitat are expected to occur from the project. The nearest designated critical habitat for this species is located approximately 20 miles south of the project site within the Shadow Valley Unit (USFWS 2011a). Until the proposed translocation areas have been provided by the applicant it is unknown whether any critical habitat units would be subject to effects from translocation activities.

Habitat Loss and Compensatory Mitigation

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

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

mitigation, the project's impacts would result in a net loss of desert tortoises and their habitat.

To fully mitigate the loss of desert tortoise habitat under CESA, the CDFG usually requires a mitigation ratio greater than 1:1 for compensation lands (i.e., acquisition of more than one acre of compensation lands for every acre lost), and typically uses a 3:1 ratio or higher for good quality habitat such as that found in portions (i.e., northeastern portions) of the project site. The higher ratio reflects value of the existing habitat and the limits to increases in carrying capacity that can be achieved on the acquired lands, even with implementation of all possible protection and enhancement measures. Depending on the quality of habitat that is lost and the habitat conditions of the land that is acquired, it is difficult to sufficiently increase the carrying capacity of the acquisition lands to completely offset habitat loss without relying on additional acreage to increase the numbers of desert tortoise that can be supported on the mitigation lands.

The applicant proposed a 1:1 ratio to mitigate permanent impacts to desert tortoise habitat in the AFC. The PSA recommended adopting the applicant's proposed 1:1 ratio for (1,616.5 acres) of the project site that supports shadscale scrub communities because some of these areas were more disturbed, are proximal to other disturbed areas, and have less evidence of use by desert tortoise. However, based on an analysis of site conditions and the expected use of the site by desert tortoise the PSA suggested that for areas supporting creosote bush scrub (1,580.5 acres) a 3:1 ratio was appropriate. The highest desert tortoise densities and most suitable habitat were observed in the north and eastern portions of the project site; in areas primarily supporting creosote bush scrub. These areas support relatively intact vegetation and provide more complex topography and soil development.

Applicant comments on the PSA state that the habitat quality on the site is relatively low value compared to many areas of the desert and that the PSA mitigation was excessive and not warranted for this site. The applicant identified a number of factors that reduce the habitat value at the site, including but not limited to the presence of silty soil types, the surficial geology, the relatively flat topography, existing vegetation patterns, and the presence of weeds. In addition, the applicant stated that the number of desert tortoises estimated by staff in the PSA is too high and provided an alternative estimate. In summary, the applicant suggests that the site has a low value to desert tortoise and recommends that mitigation ratios should range from between 0.5:1 to 1.5:1 for the proposed project site.

In response to applicant's comments, staff conducted supplemental field investigations to further evaluate the site. These investigations were conducted by a wildlife biologist and botanist and included two biologists from the CDFG. The site visit confirmed staff's (and CDFG's) earlier estimate of habitat value, an appraisal consistent with other factors previously considered. Despite the presence of weeds which are acknowledged as locally abundant in some areas, most of the lands present on the project site are relatively intact and are characterized by areas supporting biotic soil crusts, native shrub cover, and a diverse assemblage of annual plant life. Most of the heavily disturbed areas are located along the roads that form a grid pattern across much of the site; however, lands within the existing road system continue to support large areas of native vegetation. For example, Section 5.2.6.3.1 of the AFC indicates that for creosote bush

scrub communities “the understory consists of a large variety of mainly annual forbs, a few species of native grasses, and a few species of non-native grasses”. Staff confirmed this during biological surveys of the project site and a review of the annual plant species detected during botanical surveys conducted by the applicant. In addition, based on a review of information provided in the AFC approximately 131 native annuals and shrubs occur on the project site. This includes approximately ten plants considered rare by the California Department of Fish and Game and California Native Plant Society. Similarly, approximately 63 species of birds, 18 reptiles, and nine mammals were detected or expected to occur on the project site. Notwithstanding the presence of invasive weeds, and some heavily disturbed areas the presence and distribution of native plants and animals indicates the site supports a fairly diverse assemblage of wildlife which are not associated with more heavily disturbed areas.

Staff’s conclusion regarding appropriate mitigation ratios are based on a wide range of biotic and abiotic factors. These included but were not limited to the existing vegetation communities; annual plant composition; percentage and distribution of weeds; presence of soil crusts; level of site disturbance; soil composition; proximity to adjacent lands supporting desert tortoise populations; and proximity to developed lands. Staff also took into consideration the number and distribution of desert tortoise on the project site; the landscape level scale of the project; the projects location; the sites’ importance for connectivity and regional movement and gene flow; and the cumulative effects of other projects. The mixed compensation ratio reflects the variability of site habitat quality.

Desert Tortoise Mitigation Requirements

To satisfy CDFG’s full mitigation standard the proposed mitigation must meet criteria described in Title 14 CCR, Sections 783.4(a) and (b). These criteria include requirements that the proposed mitigation would be capable of successful implementation, and that adequate funding is provided to implement the required mitigation measures and to monitor compliance effectiveness of the measures. As described above, the CDFG has recommended the following mitigation strategies that fulfill the state’s full mitigation standard for desert tortoise. CDFG would require a 3:1 ratio (1,616.5 acres) for areas supporting creosote bush scrub and a 1:1 (1,580.5 acres) ratio for areas of the project site that supports shadscale scrub communities. In total this would require the acquisition of 6,358 acres of compensatory mitigation for desert tortoise. This results in several conditions of certification: **BIO-12** (Desert Tortoise Compensatory Mitigation) requires acquisition, protection and enhancement of desert tortoise habitat, in combination with the requirements for a Designated Biologist and Designated Monitor (**BIO-1** through **BIO-5**), worker training (**BIO-6**), mitigation monitoring (**BIO-7**), general avoidance and minimization measures (**BIO-8**), clearance surveys and fencing (**BIO-9**), relocation/translocation plan (**BIO-10**), and **BIO-13** (Raven Management). These conditions of certification, if adopted by the Commission, would fully mitigate project impacts to desert tortoise. Acquisition of appropriate mitigation lands as described in **BIO-12** would secure lands that would promote protection of high quality desert tortoise habitat and facilitate biological connectivity in the region.

Potential indirect impacts to desert tortoise habitat from the spread of invasive plant species would be reduced to less than significant levels through the implementation of Conditions of Certification **BIO-18** (Weed Management Plan), and **-(**Ground Water-Dependent Vegetation Monitoring Plan would minimize and potentially avoid impacts to

locally important groundwater-dependent vegetation used by desert tortoise. Implementation of these measures would reduce these indirect impacts of the proposed project to less-than-significant levels under CEQA.

Calculation of Financial Security for Desert Tortoise Compensatory Mitigation

CDFG, were it the permitting agency, would require the applicant to provide financial assurances to guarantee that an adequate level of funding is available to implement all impact avoidance, minimization, and compensation measures described in the desert tortoise conditions of certification that are not carried out before project impacts occur. CDFG's approach has been adopted by the Commission in previous siting cases. The required financial assurances are generally provided in the form of an irrevocable letter of credit, an escrow account, a pledged savings account, or another form of financial security prior to initiating ground-disturbing project activities. The proposed conditions of certification typically specify the dollar amount of the security, and include a provision for adjusting that financial security amount when parcel-specific information is available. This financial security amount is calculated by multiplying the acreage of the impact area by the total per-acre costs, a figure which represents the sum of the costs required for: (1) land acquisition, (2) initial habitat improvements, and (3) a fund to support long-term management of the acquired lands. The latter cost for the long-term management fund is typically the largest component of the mitigation fee. Interest from the fund provides enough income to cover annual stewardship costs on the acquired lands and includes a buffer to offset inflation.

The amount for the fund is established by a Property Analysis Record (PAR), a computerized database methodology developed by the Center for Natural Lands Management (<www.cnlm.org/cms>) which calculates the costs of land management activities for a particular parcel. These activities include preparation of a desert tortoise management plan tailored for each parcel of mitigation land to assess habitat status, identify desired conditions, and develop plans to achieve conditions that would best support desert tortoise. Once the management plan is prepared and approved by the appropriate resource agencies, implementation of enhancement actions such as fencing, road closure, invasive plant control, habitat restoration, and monitoring can begin. The goal of these activities is to increase the carrying capacity of the acquired lands for desert tortoise and increase their population numbers by enhancing survivorship and reproduction.

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

Condition of Certification **BIO-12**, Desert Tortoise Compensatory Mitigation, specifies financial security for acquisition of 6,358 acres and provides an estimate of associated costs. These costs include an acquisition fee of $1,000 per acre, initial habitat improvement costs at $250 per acre, long-term management fund is estimated at $1,450 per acre, and other administrative and acquisition costs (see **Biological**

Resources Table 16). The estimated composite mitigation cost for establishing the financial security would be $3,506 per acre. This security amount may change with updated appraisals and when a Property Analysis Record is prepared for the parcels selected for acquisition. It is important to note that these are estimates based on current costs; the requirement is defined in terms of acres, not dollars per acre, and actual costs may vary.

The applicant may elect to purchase and permanently protect compensation lands itself; to fund the acquisition and initial improvement of compensation lands through National Fish and Wildlife Foundation (NFWF) by depositing funds for that purpose into NFWF's Renewable Energy Action Team (REAT) Account; or to fund the acquisition of compensation lands through a third party other than NFWF, as outlined in **BIO-12**. REAT options are described below. Further, **BIO-12** would require that the project owner provide financial assurances to guarantee an adequate level of funding to implement the compensation measures described above. Because there are several suitable options available to the applicant to satisfy the compensation requirement, and because mitigation requirements must satisfy the requirements of both state and federal Endangered Species acts, the calculation of the security amount includes estimates of all transaction and management fees described above. These calculations are presented in **Biological Resources Table 16**.

Biological Resources Table 16
Desert Tortoise Compensation Cost Estimate[1]

	Task	**Cost**
1.	Land Acquisition	$1000 per acre[2]
2.	Level 1 Environmental Site Assessment	$3000 per parcel[4]
3.	Appraisal	$5000 per parcel[4]
4.	Initial site work - clean-up, enhancement , restoration	$250 per acre[4]
5.	Closing and Escrow Costs – 1 transaction includes landowner to 3rd party and 3rd party to agency	$5000 per transaction
6.	Biological survey for determining mitigation value of land (habitat based with species specific augmentation)	$5000 per parcel
7.	3rd party administrative costs - includes staff time to work with agencies and landowners; develop management plan; oversee land transaction; organizational reporting and due diligence; review of acquisition documents; assembling acres to acquire….	10% of land acquisition cost (#1)
8.	Agency costs to review and determine accepting land donation - includes 2 physical inspections ; review and approval of the Level 1 ESA assessment; review of all title documents; drafting deed and deed restrictions; issue escrow instructions; mapping the parcels….	15% of land acquisition costs (#1) × 1.17 (17% of the 15% for overhead)
	SUBTOTAL - Acquisition & Initial Site Work	**$12,560,229.00**

9.	Long-term Management and Maintenance (LTMM) Fund - includes land management; enforcement and defense of easement or title [short and long term]; monitoring….	$1450 per acre[5]
	SUBTOTAL - Acquisition, Initial Site Work, & LTMM	**$9,219,100.00**
	SECURITY SUBTOTAL -	**$21,779,329.00**
	NFWF Fees	
10.	Establish the project specific account	$12,000.00
11.	Pre-proposal Modified RFP or RFP processing[9]	$30,000
12.	NFWF management fee for acquisition & initial site work	3% of SUBTOTAL
13.	NFWF Management fee for LTMM Fund	1% of LTMM Fund
	TOTAL for deposit in REAT-NFWF Project Specific Account	**$22,290,326.87**

1. All costs are best estimates as of summer 2010. Actual costs will be determined at the time of the transactions and may change the funding needed to implement the required mitigation obligation. Note: regardless of the estimates, the developer is responsible for providing adequate funding to implement the required mitigation.
2. For the purposes of determining costs, a parcel is defined at 40 acres, recognizing that some will be larger and some will be smaller, but that 40 acres provides a good estimate for the number of transactions anticipated (based on input from CDD).
3. Generalized estimate taking into consideration a likely jump in land costs due to demand, and an 18-24 month window to acquire the land after agency decisions are made. If the agencies, developer, or 3rd party has better information on land costs in the specific area where project-specific mitigation lands are likely to be purchased, that data overrides this general estimate. Note: regardless of the estimates, the developer is responsible for providing adequate funding to implement the required mitigation.
4. Based on information from CDFG.
5. Two transactions at $2500 each: landowner to 3rd party; 3rd party to agency. The transactions will likely be separated in time.
6. Includes staff time to work with agencies and landowners; develop management plan; oversee land transaction; organizational reporting and due diligence; review of acquisition documents; assembling acres to acquire.
7. Includes agency costs to accept the land into the public management system and costs associated with tracking/managing the costs associated with the donation acceptance, including 2 physical inspections; review and approval of the Level 1 ESA assessment; review of all title documents; drafting deed and deed restrictions; issue escrow instructions; and parcel mapping .
8. Estimate for purposes of calculating general costs. The actual long term management costs will be determined using a Property Assessment Report (PAR) tailored to the specific acquisition. Includes land management; enforcement and defense of easement or title [short and long term]; monitoring.
9. Each renewable energy project will be a separate sub-account within the REAT-NFWF account, regardless of the number of required mitigation actions per project.
10. If determined necessary by the REAT agencies if multiple 3rd parties have expressed interest; for transparency and objective selection of 3rd party to carryout acquisition.

The compensatory mitigation described in Condition of Certification **BIO-12**, in addition to other conditions of certification that reduce impacts to desert tortoise, would meet CESA's full mitigation standard and would mitigate CEQA impacts to desert tortoise to less-than-significant levels. CDFG is currently reviewing this calculation of financial security costs (acquisition costs, initial habitat improvement, and long-term management endowment). However, the calculations for security are consistent with past CDFG guidance on Energy Commission projects that included an Incidental Take Permit, and staff believes believe that CDFG would find this approach acceptable.

“In Perpetuity” Protection for Acquired Mitigation Lands

The Energy Commission and CDFG do not accept land acquisition as adequate mitigation for impacts to endangered species unless the lands can be maintained and protected in perpetuity for the benefit of those species. CDFG or an appropriate land conservation organization would be required to own, protect, and manage the mitigation lands to ensure permanent protection.

Location of Acquired Mitigation Lands

Coordination with CDFG is ongoing in conjunction with Nevada BLM and the USFWS to define an appropriate geographic boundary for compensatory acquisitions. Consideration has been given to the preferences of the County of Inyo, which has expressed concerns regarding the siting of mitigation lands. With less than three percent of the county in private holdings, the county requests that private lands not be used for mitigation purposes. While biological factors suggest that the proposed mitigation land should be as close to the project site as possible, ideally in the Pahrump Valley, a broader region, such as the NEMO planning area, or eastern Mojave Recovery Unit could also be beneficial to the species. The State Lands Commission is another entity with substantial land available for sale and use as compensatory mitigation. Revenue from the sale of “school lands” held across California is intended to benefit the State Teachers’ retirement fund (Barker, 2011).Together the Departments of General Services, Corrections and Rehabilitation, Transportation (Caltrans), Water Resources, Fish and Game, the University of California, and the State Lands Commission adopted a memorandum of understanding between the Energy Commission to facilitate the development of renewable energy projects on state buildings, properties, and rights-of-way.

Summary – Impacts and Mitigation for Desert Tortoise

The impact analysis and translocation requirements for desert tortoise have been based on the applicant’s survey data, USFWS probability calculations for determining desert tortoise number on a project site, and available published literature. Based on this data the project site supports approximately six to 33 adult tortoises, three to 34 juvenile tortoises, and 46 to 158 eggs.

Based on the existing data the applicant will be required to translocate between an estimated low of six desert tortoises (six adults and subadults, and no juveniles) to an estimated high of 38 desert tortoises (33 adults and subadults, and five juveniles). If all of these tortoise are translocated to areas greater than 500 meters from the project site, an estimated 18 (six adults + no juveniles multiplied by three) to 114 tortoises (33 adults + five juveniles multiplied by three) would require handling, radio tagging, and long term monitoring.

Total mortality estimates for the proposed project range from a low of eight desert tortoises and approximately 46 eggs to a high or 65 desert tortoise and approximately 158 eggs. These figures represent estimates only and reflect a conservative approach to quantifying project impacts to desert tortoise. Should lower numbers of desert tortoise be detected on the project site the associated impacts to this species would be correspondingly lower as well. However, should the number of tortoises detected on the project site during the translocation events exceed the 38 identified for translocation, the

applicant would be required to cease the translocation efforts and coordinate with the CPM, USFWS, and CDFG to determine if translocation efforts should be stopped to consider if new mitigation measures or translocation sites are needed.

Conditions of Certification **BIO-1** through **BIO-9** describe measures that would avoid and minimize direct impacts to sensitive biological resources, including desert tortoise. Conditions of Certification **BIO-10** and **BIO-12** would require additional measures specific to desert tortoise, including installation of tortoise exclusion fencing; pre-construction clearance surveys; monitoring; verification that all desert tortoise impact avoidance, minimization, and compensation measures to replace lost habitat are implemented; translocation of tortoises from the project area; and acquisition of compensation lands. Condition of Certification **BIO-13** would require the preparation and implementation of a Raven Monitoring, Management, and Control Plan which would minimize impacts to desert tortoise resulting from increases in raven populations.

Staff concludes that implementation of these conditions would reduce impacts to desert tortoise to less-than-significant levels under CEQA and would also satisfy the CESA requirements to fully mitigate impacts to desert tortoise under Fish and Game Code Section 2081.

Mojave Fringe-Toed Lizard and Gila Monster

Mojave fringe-toes lizard habitat has been mapped along portions of the California Nevada border (DRECP 2011). However, this species has not been detected on the project site during multiple surveys and the preferred habitat for this species (i.e., sand ramps, partially stabilized dunes, and sand fields) is not present on or adjacent to the project site. While it is likely that populations of this species exist in the region they are likely restricted to locations in and near areas supporting large areas of friable sands. Direct and indirect impacts to this species are not expected to occur.

Gila monsters were not observed during biological surveys conducted by the applicant. This species is often associated with rocky outcrops, sandy soils and desert riparian areas which are largely absent from the project site. Based on the current distribution of this species and preferred habitat associations impacts to Gila monster are not expected to occur.

Impacts – Special-Status Mammals

American Badger and Desert Kit Fox

American badger burrows and desert kit fox complexes were found on the project site. In addition, the project site supports suitable foraging and denning habitat for these species. The desert kit fox is designated as a furbearer and, under Title 14 Section 460 of the California Code of Regulations, “may not be taken at any time.” The California Fish and Game Code defines “take” as to “hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, catch, capture, or kill” (§ 1-89.1). The CDFG does not issue Incidental Take Permits or Memoranda of Understanding to permit the capture or handling of desert kit fox. American badger is considered a species of special concern, which affords this species special consideration and protection under CEQA.

Direct Impacts to American Badger and Desert Kit Fox

Direct impacts to American badger and desert kit fox include mechanical crushing of individuals or burrows by vehicles and construction equipment, noise, dust, and loss of habitat. Construction activities could also result in the disturbance of badger maternity dens during the pup-rearing season (15 February to 1 July). Because of the large size of the project, numerous badgers or kit foxes may be affected. For example, depending on prey densities, home ranges of badgers can vary from 338 to 1,549 acres (Zeiner et al. 1990). Their distribution in a landscape coincides with the availability of prey, burrowing sites, and mates, with males ranging wider than females during the breeding and summer months (Minta 1983). While home ranges are expected to be larger and badger densities lower in more arid regions, construction of the project could result in the loss of as many as nine home ranges if home ranges are small (3,277 acres divided by a 338-acre home range) to as few as two home ranges if home ranges are large (3,277 acres divided by a 1,549-acre home range). Based on the number of pocket gopher burrows and small rodent burrows observed by staff, prey densities appear high on the project site, primarily along disturbed access roads. While badgers near the perimeter of the project may be able to effectively disperse to other areas, the placement of the tortoise exclusion fence is expected to trap badgers in the project footprint.

Estimates of kit fox home range size vary widely, and population densities fluctuate drastically depending on the availability of food, predation pressures, and rainfall (Zoellick and Smith 1992; White and Garrott 1999; Arjo et al. 2003). In addition, many kit fox home ranges overlap considerably, often by 20 percent or more (Zoellick and Smith 1992). Therefore, it is difficult to estimate the actual number of desert kit fox that currently occupy the project site. However, the applicant identified numerous active kit fox complexes on the project site during surveys conducted in 2011. Desert kit fox could be trapped within the site by the exclusion fence, as described above for badgers. Construction activities could also result in disturbance or harassment to these species on lands adjacent to the proposed project.

Indirect Impacts to American Badger and Desert Kit Fox

Indirect impacts to badgers and kit foxes include alteration of soils, such as compaction that could preclude burrowing, alteration in prey base, and the spread of invasive plants. Forcing kit foxes into adjacent habitat may also increase the risk and spread of diseases. Operational impacts include risk of mortality by vehicle strikes on access roads by maintenance personnel, the spread of invasive plants, and disturbance due to increased human presence.

Forcing animals out of active territories can result in increased stress which can lead to disease and possibly death. Forcing diseased animals to adjacent territories can threaten the local populations. Several of the recent kit fox deaths (preliminary estimates of eight deaths) have been caused by canine distemper, a disease that had not been documented in desert kit fox until construction of the Genesis project.

Habitat Loss for American Badger and Desert Kit Fox

Implementation of the proposed project would result in the direct loss of approximately 3,277 acres of habitat for American badger and desert kit fox. Staff considers these

impacts to be significant and require compensatory mitigation. The loss of this habitat would reduce access to foraging, denning, and dispersal areas.

Conclusions and Discussion of Mitigation for American Badger and Desert Kit Fox

Prior to construction of the project the applicant would be required to evict all American badger and kit fox from the project site. This is often accomplished through passive mechanisms, designed to discourage animals from remaining onsite. During this "passive relocation," or hazing, dens of these species are typically blocked, and fitted with one-way doors. Once the animals have abandoned the burrow the den is excavated to ensure no animals remain then collapsed to prevent re-occupation of the den. Displaced animals are then forced to disperse to adjacent habitat. On the project site, construction of the project would occur in phases. Depending on the fencing plan animals would be required to disperse up to a mile in any given direction to find habitat outside the fenced area. Displaced animals would attempt to locate suitable new burrows in territory not already occupied by residents of the species. Passive relocation on a large site has proven problematic and may lead to increased predation risk, overcrowding of remaining suitable habitat, competition for food, mates, and territory in adjacent lands. Currently private lands surround the project to the south and west which extends at least 1,600 meters beyond the boundaries of the project site. Publically-held land is located east of the project.

Staff considers eviction of resident kit fox or badgers into adjacent private lands unsuitable for kit fox and badgers, as the land cannot be managed for the benefit of the species. For kit fox, access to safe burrows reduces predation by eagles and coyotes and provides thermal refugia. Staff is concerned that unless supplemental burrows can be provided on adjacent lands, forcing kit fox from the project area will likely result in mortality. To minimize this risk staff recommends that the applicant attempt to evict animals onto adjacent public lands that are afforded some protection by the BLM.

Staff is also concerned regarding the viability of displacing the animals. Typically, procedures used to evict kit fox from the site include passive hazing or grading the site such that safe, vegetated "escape corridors" to undisturbed land are maintained. While effective to a degree on smaller sites, the use of the method on large solar sites has proven challenging. Additional scrutiny of kit fox impacts has resulted from the deaths of kit fox on or adjacent to the Genesis Solar Energy Project. Staff is aware of difficulties in fully evicting kit fox from active solar projects where construction is underway. Rather than establish new permanent offsite territories, some kit fox attempt to remain onsite, digging new burrows overnight, or possibly moving briefly offsite, only to return to the following day. This results in increased stress to kit fox, as the animals are forced to repeatedly search out and/or create new dens, avoid humans and equipment, and find prey. Successful eviction is also important because kit fox may not be disturbed during the pupping season (February 15 through May 31), and must be protected with construction buffers during this time.

Potential direct and indirect impacts to American badgers and desert kit fox are significant, and considering the landscape level scale of the project, some level of mortality is expected even with staff's proposed conditions of certification. The implementation of Condition of Certification **BIO-8** (Impact Avoidance and Minimization

Measures) and Condition of Certification **BIO-14** (American Badger and Kit Fox Management Plan) would reduce impacts to American badgers and desert kit fox. These conditions require the project owner to perform preconstruction surveys for badger and kit fox dens in the project area, including areas within 250 feet of all project facilities, utility corridors, and access roads prior to ground disturbance. If these species are present, the applicant will flag and avoid occupied badger and kit fox dens during ground-disturbing activities and establish a buffer to avoid loss of natal dens. The applicant would also be required to map all kit fox dens and badger dens and document the type of the burrow/den (i.e., natal, single den, complex). Condition of Certification **BIO-14** would also require the applicant, in consultation with CDFG, to prepare a management plan for kit fox and American badger. Staff expects implementation of an adaptive management approach emphasizing flexibility in passive relocation methods, ground-disturbance schedule, placement of escape dens on facility property, and treatment of possible disease outbreak.

Condition of Certification **BIO-12** (Desert Tortoise Compensatory Mitigation) would mitigate habitat loss for these species. **BIO-22** (Compensatory Mitigation for State Waters), **BIO-18** (Weed Management Plan), and **BIO-23** (Groundwater-dependent Vegetation Monitoring Plan), would further reduce direct and indirect impacts of the project to less than significant levels under CEQA.

Nelson's Bighorn Sheep

The Nelson's bighorn sheep is a BLM sensitive species and is classified as fully protected by the State of California. Nelson's Bighorn sheep are known from the local mountain ranges and the applicant detected the horn of a bighorn sheep on the project site. At a staff workshop conducted in Bishop, California, residents from the Charleston View and other local communities stated that a herd of sheep had been sighted on the project site in May of 2012. The CDFG confirmed that herds of this species are present in the Nopah Range to the west, the Kingston Range to the south (CNDDB 2012), and that they occupy, or have occupied in the past, the north portions of the Nopah Range.

Direct Impacts to Nelsons Bighorn Sheep

Direct effects to bighorn sheep could include disturbance from construction activities, noise, and lighting. Construction of the facility may also pose a partial barrier to movement for this species.

Indirect Impacts to Nelsons Bighorn Sheep

Indirect impacts include the degradation of habitat in the region from invasive weeds, human disturbance, and lighting. Additional indirect effects include avoidance of areas near manmade structures, increased traffic on desert roads by the public, and risk of wildfires. Degradation of seeps or springs from groundwater pumping may also occur. Loss of surface water sources within existing and historic bighorn sheep ranges may diminish the viability of existing populations or the potential for successful reintroduction or natural colonization where this species is absent. The influence to bighorn sheep from the loss of any particular water source will depend on the number of water sources available to bighorn sheep in the region (Wehausen 2005). Water sources can be lost to bighorn sheep due to various causes, including domestic and feral stock use, vandalism, or natural disasters.

Operational impacts include the degradation of habitat in adjacent areas due to increased human presence associated with use of new facility, noise, nighttime maintenance activities and mirror washing. Public interest in the new facility may also result in increased road traffic along roads in the region.

Habitat Loss for Nelsons Bighorn Sheep

Implementation of the proposed project would result in the direct loss of approximately 3,277 acres of habitat that likely supports only periodic use for foraging and movement. Staff considers the loss of habitat from the proposed project to be adverse but less than significant.

Conclusions and Discussion of Mitigation for Nelsons Bighorn Sheep

The Society for Conservation of Bighorn Sheep has recommended a minimum buffer of one mile from the upper edge of any solar development to the base of rugged terrain to protect spring foraging habitat. The proposed project is located several miles from the base of either the Nopah or Spring mountains. However, in years of high rainfall, animals may move further out from rugged terrain to take advantage of available forage resources and, thereby, temporarily occupy new habitat that has the potential to facilitate gene flow, and enhance reproductive success (Bleich pers comm. 2012).

While sheep will range far from mountainous areas, especially during intermountain movement, the implementation of the proposed project is not expected to result in the loss of annual spring forage for this species or act as a barrier to movement. Because of the distance to known herds the project is also not expected to result in direct impacts from noise, dust, or human activity unless sheep are undergoing seasonal movement at the time of construction. The most likely risk to bighorn sheep would be increased road traffic during spring lambing or during periods of intermountain movement. Sheep have been known to acclimate to human habitual noise and human presence to a certain degree, whereas being exposed to sudden noises or human presence elicited a stronger startle response (Papouchis et al 2001).

Ensuring availability of intermountain areas used for movement by bighorn sheep is fundamental to colonization of vacant habitat and to metapopulation processes, in general. Colonization allows the species to maintain adequate metapopulations to thrive. Colonization by ewes is the slow link in this process, but has recently been documented in several Mojave Desert ranges in California (Bleich et al. 1996; Torres et al. 1996). Consequently, intermountain areas of the desert floor that bighorn traverse between mountain ranges are as important to the long term viability of populations as are the mountain ranges themselves (Schwartz et al. 1986; Bleich et al. 1990b, 1996). CDFG has informed staff that the project site likely has some import in facilitating movement by bighorn sheep between the Nopah Range and other, nearby, mountain ranges.

Several intervenors and members of the public have commented that the site is or may be more frequently used by bighorn sheep. However, staff notes that significant portions of Pahrump Valley remain undeveloped and the project would not preclude intermountain movement. Although intermountain movement may periodically occur consultations with experts in bighorn sheep ecology (Dr. Wehausen, personal

communication) have stated that the Pahrump Valley may be too wide for bighorn sheep to cross and the movement of bighorn sheep between mountain ranges does not depend upon inter-valley movements in this area. Rather, these movements are expected to occur across rugged mountain habitat. In addition, the project site does not provide the rugged terrain more suitable for bighorn sheep, and is located over three miles from the preferred escape habitat for this species (i.e., slopes greater than 15 percent, see **Biological Resource Figure 7, Bighorn Sheep Habitat**). Because sheep are only expected to visit the site infrequently and the project will not preclude movement significant impacts to foraging habitat or movement corridors are not expected to result from implementation of the proposed project.

Implementation of the following conditions would minimize potential impacts, if any, to this species. These include Conditions of Certification **BIO-5** (Designated Biologist and Biological Monitor Authority) in which the Designated Biologist and Biological Monitor can halt any activities that would be an adverse impact to biological resources including bighorn sheep; **BIO-6** (Worker Environmental Awareness Program); **BIO-7** (Biological Resources Mitigation Implementation and Monitoring Plan); and **BIO-8** (Impact Avoidance and Minimization Measures). Implementation of these measures would reduce impacts on bighorn sheep to less-than-significant levels under CEQA.

Compensatory mitigation for the loss of land associated with the project is being provided for both desert washes and to reduce impacts to desert tortoise. While not required to reduce potential impacts to bighorn sheep, Condition of Certification **BIO-12** (Desert Tortoise Compensatory Mitigation), **BIO-22** (Compensatory Mitigation for State Waters), and **BIO-18** (Weed Management Plan) may benefit bighorn sheep should these lands occur in areas used by the species either as spring forage or for intermountain movement.

Direct and indirect impacts from groundwater pumping are not expected to occur on water sources located within mountain ranges utilized on a permanent basis by Nelson's bighorn sheep; see the **Soils** section of this FSA for staff's analysis of impacts to groundwater resources. However, project groundwater pumping could potentially impact the seasonal spring pools at Stump Spring ACEC, which provides water from December to July, by lowering the water table in the vicinity of the springs. Cumulative and incremental impacts to mountain block streams in the Clark Mountains have also been identified, including at Manse Springs to the north of the project site. The connection of mountain block streams to the groundwater supply is not known for this region. However, without mitigation, these impacts to water sources could be significant. Condition of Certification **WATER SUPPLY-4** (groundwater monitoring) would require the applicant to stop pumping groundwater if declines in groundwater levels reach the project boundary. **WATER SUPPLY-2** would offset the project's contribution to the Pahrump Valley groundwater basin overdraft.

Potential indirect impacts associated with the degradation of habitat in adjacent lands or by reducing access to surface water at Stump Spring would be reduced to less than significant levels with the implementation of conditions of certification **BIO-23** (Groundwater-dependent Vegetation Monitoring Plan) and **WATER SUPPLY-4** (Groundwater Monitoring).

Special-status Bats

The AFC indicated that there was a low to moderate potential for sensitive bat species to occur in the project area. However, due to proximity of the project site to suitable habitat for foraging and roosting (e.g. Stump Spring ACEC, scattered mesquite thickets along the Stateline, etc.), staff requested that the applicant install an Anabat station. Three special-status bats have been detected onsite, the pallid bat, Yuma myotis, and the Western small-footed myotis. These species have the potential to forage within the project site and adjacent areas and some bat species utilize large areas for foraging. For example, the pallid bat is capable of flying more than 18 miles, although most foraging occurs within about two miles of the diurnal roost (Hermanson and O'Shea 1983). Western mastiff bats have been heard in open desert, at least 15 miles from the nearest possible roosting site (Vaughan1959).

Direct Impacts to Special-status Bats

Direct impacts to bats could include mortality of individuals during construction activities should bats elect to day or night roost in equipment or the power towers. The placement of large open structures may be an attractant to bats which are known to periodically day roost on open structures such as the eves of buildings. Bats could also be directly impacted by the loss of foraging habitat due to construction of permanent structures or other construction activities, and temporary disturbance during construction (noise, air turbulence, dust, and ground vibrations from construction equipment). Bats that forage near the ground, such as the pallid bat, would also be subject to crushing or disturbance by vehicles driving at dusk, dawn, or during the night.

In general, bats are highly mobile and it is unlikely that construction activities would result in mortality of bats in the project area. Although bats forage periodically in the project area, most activities will occur during daylight hours when the potential for bat interactions is limited. The applicant has not proposed specific avoidance measures for bats and staff considers the likelihood of roosting bats to be low. However, because potential roost sites may be constructed on the project area (i.e., power towers, stacks of pallets or constriction materials) and sensitive bats are known to occur at the site, staff considers potential impacts to these species significant absent mitigation. In order to reduce these impacts staff has developed pre-construction monitoring and impact avoidance measures for bats to reduce impacts to potential day roosts. Conditions of certification required to reduce impacts to sensitive bats are described below.

Indirect Impacts to Special-status Bats

Indirect effects include the loss of foraging habitat due to type conversion, night time lighting that exposes bats to predation, and alteration in prey bases. Because crews will work at night to wash mirrors it is likely that bats will be attracted to the night lighting associated with the project area. Bats may also be attracted to project features such as night lighting, mirror washing, and the retention basin (when filled), as these features may attract prey items such as insects. Indirect impacts to the Stump Spring ACEC and associated mesquite thickets in Nevada, as well as to the Amargosa River in California, may also occur (see also the **Water Supply** section for more information).

Habitat Loss for Special-status Bats

Implementation of the proposed project would result in the direct loss of approximately 3,277 acres of habitat for several species of bats. The most likely bat to forage on the ground would be the pallid bat. Other bats may periodically forage over the project site post development or be attracted to night lighting. Staff considers the loss of habitat from the proposed project to be significant absent mitigation. Conditions of certification required to reduce impacts to sensitive bats are described below.

Conclusions and Discussion of Mitigation for Special-status Bats

Implementation of the proposed project has the potential to result in the direct loss of special status bats. The project is not expected to result in the loss of maternity roosts, day roosts, or hibernacula for sensitive bats. These features are not known to occur on the project site, and while bats will utilize large trees for day roosts, the habitat on the project site (primarily Mojave Desert scrub and windrows of dead Arizona cypress trees surrounding the abandoned orchard) is generally exposed and may not be well suited for this behavior. Roosting opportunities for bats are available in habitats offsite, such as the Nopah and Kingston ranges, potentially within buildings in Pahrump Valley, and other habitat that provides rock outcrops, tree hollows, and such sheltered roosts. Bats may also be associated with the large trees that occur immediately south of the site in the community of Charleston View or in the many stored trailers and vehicles that occurs on private lands east of the project site. It is possible that bats may roost within some of the dense mesquite that occurs near the California/Arizona Stateline. Staff recommends the implementation of Condition of Certification **BIO-8.** This condition includes specific language regarding the avoidance of roosting bats or maternity colonies should they occur. Implementation of this condition would reduce project impacts to a level that is less-than-significant.

Potential indirect impacts associated with the degradation of habitat in adjacent lands or by drawdown of the spring-fed surface water at Stump Spring, other smaller seasonal springs, and other areas known to support a variety of foraging bats, would be reduced to less than significant levels with the implementation of Condition of Certification **BIO-23** (Groundwater-dependent Vegetation Monitoring Plan). With the implementation of these conditions of certification, impacts from the project to special-status bats would be considered less-than-significant under CEQA.

Operation of the project may also have the potential to alter the abundance of insect prey for both bats and birds. The presence of insect prey on the project site, and the hazard to bats from collision with and thermal exposure is also poorly understood. Presumably, bats will be able to avoid striking the heliostats and support facility through the use of echolocation. Similarly, while bats are active at dawn and dusk, when the facility is just commencing or ending daily operation, it is likely the solar flux levels will be at sub- lethal levels. Studies by Horvath et al. (2010) have suggested that some solar panels could cause an increase in Polarized Light Pollution (PLP) which occurs from light reflecting off of dark colored anthropogenic structures; the authors also demonstrated that some insects are attracted to photovoltaic solar panels and mistake these structures for the surface of water, depositing eggs on the solar panels. According to Horvath et al. (2009), PLP caused by anthropogenic structures can alter the ability of wildlife to seek out suitable habitat and elude or detect the presence of predators.

Because the heliostats onsite would also be expected to polarize light, they may also serve as an attractant. In general, many species of insects are attracted to light or heat.

Staff recommends the implementation of **BIO-15** (Avian, Bat, and Golden Eagle Protection Plans), to assist with monitoring operational impacts and formulate adaptive management strategies if significant project effects upon bats are demonstrated through project operations monitoring.

Impacts - Special-Status Bird Species

Special-Status Bird Species

The desert scrub communities present on the project site support a broad range of food items for resident and wintering birds, including seeds from annual grasses and forbs, various insects, small mammals, and a variety of small resident birds. Species expected to use the site include golden eagle, burrowing owl, loggerhead shrike, Leconte's thrasher, northern harrier, and prairie falcon. **Biological Resources Table 4** identifies the special-status birds either observed during surveys conducted by the applicant or species that have the potential to occur on or near the project site.

Direct Impacts to Special-status Birds

Direct impacts to special-status nesting birds or raptors would be similar to impacts described above (see subsections entitled Overview of Impacts to Wildlife, and Nesting Birds). This includes the impacts of mortality from solar flux, collision with power tower, heliostats, or other project features, removal or disturbance of vegetation that supports nesting birds, increased noise levels from heavy equipment, increased human presence, and exposure to fugitive dust.

Indirect Impacts to Special-status Birds

Indirect impacts to special-status nesting birds or raptors would be similar to impacts described above (see subsections entitled Overview of Impacts to Wildlife, and Nesting Birds). This includes the loss of habitat due to the colonization of invasive plants and a disruption of breeding or foraging activity due to facility maintenance. The drawdown of surface and subsurface water in adjacent lands such as the mesquite thickets and Stump Spring ACEC could result in significant impacts to bird habitat.

Birds may also become trapped within vertical pipes used to support the heliostats. In addition, noise and lighting effects have been demonstrated to adversely affect behavior, reproduction, and increase the risk of predation. The project's collision hazards and concentrated solar energy hazards have the potential to result in the loss of special-status bird species, and staff concludes that these hazards present a significant and unavoidable impact (see Operational Impacts, above).

Habitat Loss for Special-status Birds

Implementation of the proposed project would result in the direct loss of approximately 3,277 acres of habitat that supports foraging for a variety of resident and migratory birds. As with most common bird's, species that rely on the site for year round cover, foraging and nesting would be subject to more intense effects of the proposed project when compared to species that utilize the project site for foraging alone. Other special-

status species may use the site during winter or migration season, but would not nest on the site. The effects of foraging, migration stopover, and wintering habitat loss for these species would be comparable to other habitat loss effects (see Overview of Wildlife Habitat Impacts, above). All native birds, including special-status species, are protected under the federal Migratory Bird Treaty Act (MBTA) and California Fish and Game Code. The loss of habitat from the proposed project would be significant absent mitigation. Conditions of certification required to reduce impacts to sensitive birds are described below.

Conclusions and Discussion of Mitigation for Special-status Birds

Implementation of the proposed project would result in the direct loss of habitat supporting special-status birds. Declines in verdin, pyrrhuloxia (*Cardinalis sinuatus*), northern flicker, cactus wren, Leconte's thrasher, crissal thrasher, Bendire's thrasher, loggerhead shrike, and greater roadrunner populations have all been correlated to urbanization, though verdin and cactus wrens have also been found to be unaffected by urban development if nest-site alternatives are present in the urban matrix (Corman and Wise-Gervais 2005, Germaine et al. 1998, Emlen 1974). It is expected that construction of the HHSEGS facility will result in the displacement of these and other sensitive birds. Staff considers these effects to be significant absent mitigation.

Direct impacts to sensitive birds can be reduced or offset through implementation of staff's recommended Conditions of Certification **BIO-1** through **BIO-8** (see Common Wildlife, above). Staff also recommends Conditions of Certification **BIO-15** (Avian Bat & Golden Eagle Protection Plan) and **BIO-16** (Pre-construction Nesting Bird Surveys), see discussion of impacts to common birds. Condition of Certification **BIO-16** includes conducting pre-construction nesting surveys, and the establishment of limited disturbance buffers. The condition would require the applicant to implement a nest management plan to ensure the protection of sensitive birds or their nests. Implementation of these conditions of certification would avoid direct impacts to nests, eggs, or young of migratory birds and would reduce the impacts of construction disturbance to nesting birds to less than significant levels under CEQA.

The loss of foraging habitat would be considered significant absent mitigation. Loss of nesting and foraging habitat for these special-status bird species would adversely affect populations of these species within the Pahrump Valley. As discussed in the cumulative impact subsection, the project would be a contributor to the cumulative loss of biological resources, including these special-status bird species. Implementation of Condition of Certification **BIO-12** (Desert Tortoise Compensatory Mitigation) would reduce this habitat loss by the preservation of similar foraging areas. Implementation of this condition of certification would reduce impacts from the loss of habitat to less than significant levels under CEQA.

Indirect impacts to habitat from the drawdown of surface and subsurface water in adjacent lands such as the mesquite thickets and Stump Spring ACEC would be avoided or reduced to less than significant levels with the implementation of conditions of certification, **BIO-23** (Groundwater-dependent Vegetation Monitoring Plan) and **WATER SUPPLY-4** (groundwater monitoring). With the implementation of these conditions impacts to sensitive birds from the proposed project would be considered less-than-significant under CEQA.

Golden Eagle

Golden eagles are known to occur in the region and have been observed foraging over and/or near the project site during bird surveys by staff and the applicant. Surveys conducted by the applicant identified 19 nests in the region, and this species has been observed in proximity to Charleston View. Golden eagles can have extremely large home ranges and would be expected to prey on many of the species that occur on the project site.

Direct Impacts to Golden Eagles

Direct impacts to golden eagles include the loss of foraging habitat and disturbance from construction activities such as clearing and grading. Increased human presence and vehicle traffic could also adversely affect golden eagles. Noise from these activities will likely exclude or greatly reduce foraging in and adjacent to the Proposed Project. Construction noises are anticipated to range from 43 decibels to 74 decibels at 1500 feet from the noise source (piece of construction equipment) (HHSG 2011a, Table 5-7-7). During project operation, direct impacts could occur from exposure to concentrated solar flux.

Indirect Impacts to Golden Eagles

Indirect impacts could include the loss of habitat due to the colonization of invasive plants and a disruption of breeding or foraging activity due to facility maintenance. Weed abatement, mirror washing (which occurs at night), and maintenance activities would likely limit the use of some areas as foraging or nesting habitat. Glare or heat associated with the heliostats may also adversely affect the use of the site by this species. In addition, noise and lighting effects have been demonstrated to adversely affect behavior, reproduction, and increase the risk of predation. Post development, golden eagles could collide with facility structures or be subject to mortality from exposure to solar energy flux (see Operational Impacts, above).

Habitat Loss for Golden Eagles

Golden eagle, are known to forage within the proposed project site. While golden eagles do not nest onsite, the site provides important foraging habitat. Project construction would result in the loss of 3,277 acres of suitable foraging habitat for these species. Staff considers this loss of foraging habitat a significant impact. Conditions of certification required to reduce impacts to sensitive birds is described below.

State and Federal Guidelines Protecting Golden Eagles

The Bald and Golden Eagle Protection Act (BGEPA) prohibits the take of bald and golden eagles without a permit. A federal permit is required for take. Under state law, golden eagles are fully protected and no take is allowed for this species, in contrast with federal law.

On November 10, 2009, the USFWS introduced new rules (74 FR 46835) requiring a permit for all activities that might result in take of golden or bald eagles, including activities that might cause decreased productivity or nest abandonment. This was supported through the preparation of an Environmental Assessment (EA) and Implementation Guidance for take permits were issued under the Bald Eagle and

Golden Eagle Protection Act (USFWS 2010d). The USFWS concluded that all activities that may disturb or incidentally take an eagle or its nest as a result of an otherwise legal activity must be permitted by the USFWS under this act. Under (72 FR 31132) the USFWS defines disturb as any activity interfering with normal breeding, feeding, or sheltering behavior to the degree that it causes or is likely to cause decreased productivity or nest abandonment. Because large-scale solar projects would result in the loss of large amounts of golden eagle foraging habitat, there are concerns regarding the cumulative impacts to golden eagles from the loss of foraging habitat.

Given the nature of the potential impacts and loss of foraging habitat, coupled with potential injury or mortality from concentrated solar flux (see Operational Impacts, above), the USFWS has recommended that the project applicant apply for a federal Eagle Act Permit, and has also indicated that two-to three years of eagle survey data are necessary to apply for the permit. The project owner is not required to apply for a permit, and an Eagle Act Permit is not being considered as part of this analysis.

Conclusions and Discussion of Mitigation for Golden Eagles

The proposed project site does not provide nesting habitat for golden eagles; however, scrub communities present on the project site provide suitable foraging habitat for this species. Golden eagles are extremely susceptible to disturbance during the breeding season and have been documented to abandon nests when disturbed. However, the nearest nest is located over four miles to the west of the project site, Figure 8, Golden Eagles at Hidden Hills Project Site. Similarly, all of the 19 nests located within 10 miles of the project site were unoccupied in 2011. While it is possible that these nests may become occupied at any time the distance from the project site greatly reduces the potential of the proposed project to result in direct effects to golden eagles or their nests from construction or operation activities.

Golden eagles are expected to actively forage on and near the proposed project site. This includes year round residents and seasonal migrants. The development of the 3,277-acre project site would result in substantial loss of foraging habitat for this species. Accelerated commercial and urban development was attributed to golden eagle nesting declines along the Colorado Front Range (Boeker 1974). Post development, staff considers it likely that golden eagles will be effectively excluded from foraging on the project site. While it is possible that this species may forage near the border of the site; the large numbers of structures within the heliostat field, coupled with glare would likely preclude foraging within the solar field. If foraging did occur within the heliostat field, it could lead to collision, electrocution, or lethal exposure to solar flux (see Operational Impacts, above).

The USFWS considers that foraging habitat loss may be interpreted as take under the BGEPA if it causes territory abandonment or reduced productivity. Staff believes that these effects, would be difficult at best to attribute to any given land use. However, staff concludes that the loss of foraging habitat would be significant under CEQA and require compensatory mitigation. Staff does not consider the habitat loss to constitute take under state or federal LORS.

The USFWS has also raised concerns regarding potential collision threats associated with solar and renewable technologies. To address potential collision concerns (see

Operational Impacts, above) staff has proposed Condition of Certification **BIO-15** (Avian, Bat, and Golden Eagle Protection Plan). This requires a monitoring and reporting program that would document and report potential collision mortality from the proposed solar fields. The plan would specify the project owner's anticipated take of golden eagles and provide specific measures proposed to compensate for that take (e.g., retrofitting of existing off-site electrical distribution lines to reduce electrocution risk, or removal of existing disturbance in nesting habitat, or the control of ravens). The Plan would also specify the project owner's proposed measures to remediate any further take of eagles that may exceed the estimated.

Staff concludes that even with the implementation of the proposed Conditions of Certification it is possible that golden eagles will be subject to mortality. Staff considers these impacts to be significant and unavoidable. Staff notes that any take of bald or golden eagles even if mitigated as required under CEQA, would violate the state Fish and Game Code due to the species' status a fully protected species. Staff believes that if golden eagle became a covered species under the Desert Renewable Energy Habitat Conservation Plan (in preparation) or another plan meeting state requirements as a Natural Community Conservation Plan, such take could be authorized under state law.

To offset other project related effects and the loss of foraging habitat staff recommends the implementation of conditions of certification **BIO-1** through **BIO-9**, **BIO-15**, and **BIO-12**, which include worker training, implementation of Best Management Practices, pre-construction surveys, biological monitoring, the avian protection plan, and acquisition and preservation of compensatory mitigation lands. Conditions of Certification **BIO-22** (Compensatory Mitigation for State Waters), **BIO-18** (Weed Management Plan), **BIO-23** (Groundwater-dependent Vegetation Monitoring Plan), and **WATER SUPPLY-4** would reduce direct loss of golden eagle habitat.

Burrowing Owl

The burrowing owl is a CDFG Species of Special Concern. Construction and operation of the project would result in impacts to burrowing owls and their habitat. Burrowing owl sign (feathers, whitewash, and/or pellets) was detected at on the project site during protocol surveys for desert tortoise conducted from March 13, 2011 to May 18, 2011 (HHSEGS 2011a). The AFC (HHSEGS 2011a, Table 5.2-7) notes that incidental sightings of burrowing owls were observed in 2010 and the spring of 2011. Supplemental information provided by the applicant including a Draft Burrowing Owl Mitigation and Monitoring Plan, suggests that there is no conclusive evidence that burrowing owl nesting occurred on the site during 2011 and that burrowing owls likely use the project site, but burrows on the western portion of the project site are temporary and short-term due to the fine silt and clay soils and impacts that rain events have on it (CH2 2012y). Further the applicant contends that winter surveys, conducted by the applicant January 30, 2012 and February 2, 2012 to a previously reported burrow, was found to be collapsed and no burrowing owl sign was observed at the burrow. No burrowing owls or fresh sign was found at any of the nine previously identified burrowing owl burrows within the project site or the 150 meter buffer. Furthermore, visual surveys of the project area and buffer, conducted by the applicant, did not detect any burrowing owl sign.

The applicant may be correct in concluding that use of the site by burrowing owl is limited; however there is no reliable data to draw this conclusion. A review of Table 2 (Sensitive Species and Sign Locations) of Appendix 5.2 F(Desert Tortoise Survey Report) indicate that of the eight potential burrowing owl burrows detected, two contained pellets, white wash and feathers. However, there is no indication that focused burrow surveys consistent with burrowing owl monitoring guidelines were implemented. These surveys, which consist of repeated burrow surveys, are required to assess if owls are physically present and breeding at a given location. A single breeding season survey alone is not effective to determine if burrowing owls are breeding at a location. However, staff recognizes that the applicant did not conduct these surveys based on direction from the CDFG once burrowing owls were detected.

Direct Impacts to Burrowing Owls

Direct impacts to burrowing owls would be similar to those described for nesting birds. This includes the crushing of burrows, removal or disturbance of vegetation, increased noise levels from heavy equipment and the, increased human presence, and exposure to fugitive dust. Because burrowing owls are cavity dwellers that are primarily active during crepuscular periods (i.e., dawn and dusk) or at night, birds flushed from burrows during the day are exposed to elevated predation risk from various raptors. Burrowing owls also exhibit site fidelity and owls displaced during construction or from passive relocation activities increase the risk of mortality for this species if they lack access to adequate burrows.

Indirect Impacts to Burrowing Owls

Indirect impacts would be similar to those described for nesting birds and could include the loss of habitat due to the colonization of noxious weeds, plant community shifts associated with the maintenance, long term human presence associated with the 29 month construction schedule, mowing of existing vegetation and the degradation of foraging habitat. Operational impacts include increased human presence from maintenance personnel that would flush or otherwise disturb burrowing owls, invasive plant control activities, weeding, and vehicular use of access roads. Burrowing owls may also be at risk from collision or electrocution with facility structures and exposure to solar flux (see Operational Impacts, above).

Habitat Loss for Burrowing Owls

Project construction would result in the loss of 3,277 acres of suitable foraging habitat for burrowing owls. Staff considers this loss of foraging habitat a significant impact. Conditions of certification required to reduce impacts to burrowing owls are described below.

Conclusions and Discussion of Mitigation for Burrowing Owls

Burrowing owls are rare in the undisturbed desert areas of the eastern and southeastern portion of California (Small 1994). By the 1940s', burrowing owls had become scarce in many portions of the desert southwest as a result of shooting and elimination of ground squirrel burrows (Grinnell and Miller 1944). Limited data suggest that they are decreasing in some areas, but may be stable or increasing in others (Klute et al. 2003). Surveys in California in 1986-91 found population decreases of 23-52% in

the number of breeding groups and 12-27% in the number of breeding pairs of owls (DeSante et al. 1997). In addition, in a 2003 report by the U.S. Fish and Wildlife Service, breeding burrowing owls were thought to be largely extirpated during the last 10-15 years from multiple areas in California, including Napa, Marin, San Francisco, Santa Cruz, and Ventura counties, coastal San Luis Obispo county and the Coachella Valley (http://burrowingowlconservation.org/PR12-09-2010.html).

Notwithstanding the current conservation designation assigned to this species by the CDFG and BLM habitat for burrowing owls continues to be lost through development. A ranking of the most important threats to the species included loss of habitat, reduced burrow availability due to rodent control, and pesticides (James and Espie 1997).

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

The applicant has proposed mitigation based on the current guidelines recommended by the CDFG Staff Report on Burrowing Owl Mitigation (CDFG, 1995) and the revised 2012 CDFG Staff Report on Burrowing Owl Mitigation (CDFG 2012). Staff has included these recommendations into proposed Condition of Certification **BIO-17** (Burrowing Owl Impact Avoidance and Minimization Measures). Staff is considering the recently published 2012 revision to those guidelines (CDFG 2012) to provide the most relevant guidance addressing impacts and mitigation development to this species.

To avoid potential impacts to burrowing owls that might be nesting or residing within burrows in the project impact area, the proposed conditions of certification include the completion of pre-construction surveys of the site using established protocols. If present, the applicant would establish a buffer and avoid active nests during the breeding season. If owls are detected using a burrow outside the breeding season the owls may be passively displaced pending the establishment of artificial burrows and the acquisition of adequate mitigation lands. As described above the strategy for displacing owls depends greatly on how burrowing owls use the site, their number, and the timing of construction activities. Because project construction would occur for up to 29 months and result in the land use conversion of approximately 3,277 acres of habitat; passive relocation may result in the repeated harassment of resident owls should they try to re-establish territories within the projects footprint. While construction of replacement burrows in off-site areas and the acquisition of mitigation lands would reduce impacts to the species, it is likely that owls would attempt to occupy areas close to known territories. This could require multiple passive relocation events for the same owls. Each of these events stresses the bird and exposes the owls to predation, lost breeding opportunities, thermal stress, and potential territorial disputes.

There is much debate among state, federal, local, and private entities over the most practicable and successful relocation/translocation methods for burrowing owl. When only passive relocation is used as an impact avoidance measure, it is generally only effective when burrowing owl nesting territories are directly adjacent to permanently protected lands (i.e., military reservation, airport, wildlife reserve, agricultural reserve with appropriate crop type such as alfalfa). Conversely active translocation of owls involves trapping owls, temporarily holding them in enclosures with supplemental feeding, and releasing at a suitable off-site location with existing or artificial burrows prior to breeding.

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

The applicant has indicated that no more than five owl territories occur on the project site (CH2 2012y). Territories are typically defined as an area used by a species for foraging and reproduction. In addition, at least eight burrows with sign have been discovered onsite. However, given the occasional migratory nature of burrowing owl, staff cannot predict how many burrowing owls or physical burrows might be detected onsite during pre-project surveys. In some circumstances burrows that occur adjacent to project activities are blocked to minimize conflicts with breeding birds. Staff would consider the closure of burrows in adjacent lands to constitute a significant impact that requires compensatory mitigation.

In order to reduce impacts to burrowing owls from the loss of burrows and foraging habitat the acquisition of off-site habitat for burrowing owl should take into consideration the foraging distance and average home range of breeding and non-breeding owls. Diurnal home range for owls can be 150 feet on both sides of burrow. Nocturnal home range is much larger, one square mile per owl pair, and several owls can overlap in that one square mile. The mean home range for 11 male burrowing owls in 1998 and 22 males in 1999 was 177 hectares (437 acres) and 189 hectares (467 acres), respectively, at Naval Air Station in Lemoore, California which is located south of Fresno (*ibid.*). Male burrowing owls often move greater than 1,000 meters when foraging in the breeding season and home ranges often overlap (*ibid.*). Due to the wide variation of home range size used by burrowing owls and lack of known occurrences of burrowing owls surrounding the project site, staff believes that owls identified during surveys would be impacted by project development. Suitable, off-site (preferably occupied) burrowing owl habitat would need to be acquired to offset the loss of these habitat resources on the project site. Acknowledging that owl territories can overlap staff is considering the site to support between two to four burrowing owls and at least two territories.

For the purposes of establishing compensatory mitigation requirements staff is assuming that each territory encompasses approximately 300 acres. The use of the 300 acre territory size takes into consideration the wide variation of territory size and that some territories likely overlap. Provided that adequate conditions exist on the proposed desert tortoise mitigation lands staff believes the mitigation lands for burrowing owls may be nested within the lands acquired for desert tortoise.

Implementation of Conditions of Certification **BIO-1** through **BIO-8, BIO-12** (Desert Tortoise Compensatory Mitigation), and **BIO-17,** which outlines survey requirements, eviction guidelines, and compensatory requirements; the project's impacts to burrowing owls would be mitigated to less-than-significant under CEQA.

Impacts to Wildlife Movement Corridors

Recent studies indicate that habitat fragmentation and isolation of natural areas ultimately results in the loss of native species within those communities (Soulé et al. 1988). Populations of animals that are isolated from other populations are higher risk of extirpation both from sources such as drought, disease, or wildlife. In the Mojave Desert large areas have been subject to habitat fragmentation from residential development, agricultural practices, military land uses (including Fort Irwin, Marine Corps Logistic Base Yermo, and Twentynine Palms); and off highway vehicle use. On a local scale, the city of Pahrump is one of the fastest growing cities in Nevada. The amount and distribution of suitable habitat is an essential element to consider for the management of wildlife. For example, some species require, and are often limited to, unique vegetation or terrain features for breeding or foraging such as bighorn sheep and desert tortoise.

Direct impacts of the project include the placement of physical structures such as the solar arrays, buildings, or other facilities that block or impede wildlife movement. Ground-disturbing activity, including heliostat and power tower installation and construction, grading of new access roads, and use or improvement of existing access roads would also be expected to interfere with terrestrial wildlife movement during construction. Construction could also affect wildlife in adjacent habitats by interfering with movement patterns or causing animals to temporarily avoid areas adjacent to the construction zone. More mobile species such as birds and larger mammals would be evicted from the project site and prevented access by perimeter fencing. Because construction would occur for up to 29 months it is likely that wildlife use of the area would be adversely affected.

Indirect impacts include human disturbance, shade, altered vertical structure (i.e., heliostat arrays) that reduce the sites' openness (a key element associated with use of an area by some species), the proliferation and spread of invasive weeds, and potential for increased predation risk from the addition of perch sites.

Operational impacts include night time lighting that increases predation risk, and collisions with vehicles (see Operational Impacts, above).

Wildlife corridors provide a variety of functions and can include habitat linkages between natural areas; provide greenbelts and refuge systems; and divert wildlife across permanent physical barriers to dispersal such as highways and dams by roadway underpasses and ramps (Haas 2000, Simberloff et al. 1992). Generally, the accepted

definition describes a wildlife corridor as a linear habitat, embedded in a dissimilar matrix that connects two or more larger blocks of habitat (Beier and Noss 1998). Noss (1987) also suggests several potential advantages to corridors, including increased species richness and diversity, decreased probability of extinction, maintenance of genetic variation, a greater mix of habitat and successional stages, and alternative refugia from large disturbances.

Even within relatively open expanses of the Mojave Desert many species move through the landscape utilizing various physical and biotic features. Some species including Nelson's bighorn are strongly associated with steep mountainous regions and tend to move between these features quickly often utilizing local water sources where available. Likewise, many birds and some mammals seasonally utilize patches of microphyll woodlands, mesquite thickets, and riparian areas during summer and winter migratory passages. An important consideration of any wildlife corridor analysis is evaluating what target species occur in the project area and determining how these species use and move through the landscape affected by the proposed project. For example, desert tortoise while capable of long distance dispersal, are essentially corridor dwellers that complete their entire life history cycle within a relatively small area. In many instances home ranges for desert tortoise may run between 200 and 640 acres. Nelson's bighorn sheep are wide ranging species that may use portions of the project site only for episodic foraging and during periods of intermountain movement. Species may also use an area as true movement or dispersal corridor, on a seasonal basis, where the time spent within a given block of land is limited.

The HHSEGS project would be located in the Pahrump Valley, a broad alluvial plain, located between the Nopah Range, Kingston Range, and the Clark Mountains. Although this area remains largely undeveloped the valley is confined by the steep mountain ranges which affect the dispersal and distribution of some species in the region. Ongoing development in the region including the city of Pahrump, local airfields, and rural residents has led to various forms of habitat fragmentation in the region. Although the project is adjacent to Tecopa Road and bordered by rural residences to the south, the entire project site to provide habitat used by resident and dispersing animals. Habitat suitability and permeability (i.e., ease of movement for the species in the defined habitat) on the project site appears to be high for east-west movement with no existing barriers to dispersal or movement. North-south movement on the project site is hindered by both Tecopa Road and the community of Charleston View.

Construction of the proposed HHSEGS facility would result in the land use conversion of approximately 3,197 acres of natural lands. This would likely disrupt movement on a local scale and would fragment existing home ranges for many small species including desert tortoise, kit fox, and badger. Based on the vegetation, topography and connectivity to other open areas, these impacts are locally significant but the project would not be expected to result in the genetic isolation of the species in the project area.

The project would also have the potential to restrict some areas used by big horn sheep. Bighorn sheep are known from the region and likely use the project site for periodic intermountain movement. Bighorn sheep are known to move between the Nopah Range, the Spring Mountain Range, and the Kingston and Clark ranges. This

species is known to forage in the bajadas near the foothills of the mountains and may move across the flatlands associated with the project. While not located in a designated wildlife corridor for this species the project area and adjacent desert flatlands would be expected to support this species. Wehausen (2005) and others (Schwartz et al. 1986; Bleich et al. 1990, 1996) consider intermountain areas of the desert floor that bighorn traverse between mountain ranges as important to the long term viability of populations as the mountain ranges themselves. Construction of the project may obstruct or hinder some of this movement. For other wide ranging mammals including coyotes, badgers, bighorn sheep, and desert kit fox the project will also pose an obstacle but will not completely prevent movement.

For other less motile species such as desert tortoise, construction of the project will hinder north-south and east-west movement. To reduce potential operational effects to desert tortoise the project will be constructed with fencing that prohibits tortoises and other non-avian wildlife from entering the site. This fencing will result in permanent barriers to east-west and north-south movement for the entire 3,277 acre site. East-west movement will remain available along the northern boundary of the project. Movement along the southern border of the project may occur however this small area would abut Tecopa Road.

Impacts to wildlife movement from the construction and operation of the project power plant site and transmission line in California would be adverse but not significant. The presence of adjacent large areas of open habitat and adjacent natural lands will not preclude movement in the area, rather, movement would be expected to reroute around the project site. The proposed project's construction impacts to wildlife movement would be less than significant.

Impacts to Special-status Plants

Summary of Impacts to Special-status Plants

Construction and operation of the project would directly and indirectly impact 28 occurrences of 11 special-status plant species located within the project boundary. None of the affected species are state or federally listed Threatened, Endangered, Rare, or Candidate species but nine of the 11 species have a highly restricted range in California. This is depicted in **Biological Resources Figure 9**.

All 11 species have a California Rare Plant Rank (CRPR) of 1B or 2, meaning they are "rare, threatened, or endangered in California". All 11 species have distribution outside California (a CRPR 2 rank) but 2 species are also rare outside California (CRPR 1B). The CRPR rank is assigned by the Rare Plant Status Review groups, representing over 300 botanical experts, and jointly managed by the California Department of Fish and Game (CDFG) and the California Native Plant Society (CNPS).

The difference between a CRPR Rank 1B and 2 is not reflection of the degree of rarity within California, or the risk of extinction within California; it simply distinguishes plants that are rare in California and elsewhere from plants that are rare or endangered in California but more common outside the state.

CDFGs Natural Diversity Database (CNDDB) Element Rank is, however, an *index of extinction risk* within California*.* Consequently, staff utilizes both measures in its analyses of special-status plant impacts. The CNDDB Element Rank, formerly known as the NatureServe rank, is based on a methodology (Master et al. 2009) used by natural heritage programs and conservation data centers throughout North America, and has been used by CNDDB since the mid-1980s. Species' conservation status is summarized as a series of ranks from "critically imperiled" to "secure and widespread" that are assessed at the state level, and at a global level. All but two of the 11 special-status plant species in the project area have a state extinction index, or "state rank" of "S1" or "S2":

> **S1 = "Critically imperiled** because of extreme rarity (often 6 or fewer occurrences statewide) or because of some factor(s) making it especially vulnerable to extinction from the state/province."
>
> **S2 = "Imperiled** in the state because of rarity due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors making it very vulnerable to extirpation from the state/province."

Two of the 11 species (Pahrump Valley buckwheat and pink-flowered androstephium) have a CNDDB Element Rank of S3:

> **S3 = "Vulnerable** in the state due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors making it vulnerable to extirpation."

The following is a list of the special-status plant species that occur within the project footprint and would be directly affected by the project. Their CRPR Rank and CNDDB Element rank is also provided:

- **desert wing-fruit** (*Acleisanthes nevadadensis*) (syn=*Selinocarpus nevadensis)*) – CRPR 2; CNDDB S1
- **pink-flowered androstephium** (*Androstephium breviflorum*) – CRPR 2; CNDDB S3
- **Nye milk-vetch** (*Astragalus nyensis*) – CRPR 1B; CNDDB S1
- **Preuss' milk-vetch** (*Astragalus preussii* var*. preusii*) – CRPR 2; CNDDB S1
- **gravel milk-vetch** (*Astragalus sabulonum*) – CRPR 2; CNDDB S2
- **Tidestrom's milk-vetch** (*Astragalus tidestromii*) – CRPR 2; CNDDB S2
- **Wheeler's skeletonweed** (*Chaetadelpha wheeleri*) – CRPR 2; CNDDB S1/S2
- **purple-nerve spring parsley** (*Cymopterus multinervatus*) – CRPR 2; CNDDB S2
- **Torrey's joint-fir** (*Ephedra torreyana*) – CRPR 2; CNDDB S1
- **Pahrump Valley buckwheat** (*Eriogonum bifurcatum*) – CRPR 1B; CNDDB S3
- **Goodding's phacelia** (*Phacelia pulchella* var*. gooddingii*) – CRPR 2; CNDDB S2

Construction and operation of the project would *eliminate a substantial portion* of the California range, or total documented occurrences in California, of four special-status plant species, thus increasing their risk of extinction in California. The proportion of the total documented occurrences, including occurrences found by the applicant over two years of offsite surveys, is shown in parenthesis:

- **gravel milk-vetch** (50% of total documented occurrences in state eliminated);
- **Wheeler's skeletonweed** (25%);
- **Torrey's joint-fir** (45%);
- **Preuss' milk-vetch** (18%).

Condition of Certification **BIO-20** (Special-status Plant Compensatory Mitigation) requires offsite mitigation, in the form of preservation. Three offsite occurrences shall be protected for every S1 ("critically imperiled") species affected and two offsite occurrences protected for every S2 ("imperiled") species affected. Range ranks (e.g., an S1S2 rank) shall defer to the more imperiled rank. Condition of Certification **BIO-20** includes the option of mitigating in the form of restoration of offsite populations in immediate threat or risk from off-road vehicles, noxious weeds, herbivores, or other factors. The project can elect to implement the restoration on private lands or fund a participating agency to conduct restoration of at-risk occurrences on public lands. Selection criteria for projects and performance standards are included in **BIO-20** and restoration proposals are subject to review and approval by the Compliance Manager and participating agency.

Avoidance and minimization measures (**BIO-19**) – standard Best Management Practices (BMPs) – are required for protecting the nine special-status plant occurrences located in close proximity to the project boundary from indirect effects during operation or accidental impacts during construction. Potential indirect impacts from the introduction and spread of invasive weeds, and from accidental herbicide drift, will be minimized through Condition of Certification **BIO-18** (Weed Management Plan). The risk of fire, and indirect impacts to plants resulting from fires, will be minimized through fire prevention measures contained in **BIO-8** (General Impact Avoidance & Minimization Measures).

The conservation status, range, local distribution, general and microhabitat preferences of the 11 affected species are discussed in the "Setting" subsection of this Biological Resources section, and in the applicant's botanical survey reports (HHSEGS 2011a, Appendix 5-2G; CH2 2011h; CH2 2012c; Hiss pers. comm.).

California Laws Protecting Native Plants

From the CDFG webpage *California Laws Protecting Native Plants: California Environmental Quality Act* (2012x):

> "CEQA provides protection not only for State-listed or Federally-listed species, but "also for any species that can be shown to meet the criteria for listing (CEQA Guidelines Section 15380)."

CEQA requires a "*mandatory finding of significance*" for special-status species that meet CEQA's definition of "rare" or "endangered," regardless of their formal listing status under the Native Plant Protection Act (NPPA), California Endangered Species Act (CESA) or any other law:

> "When any of the following conditions occur the lead agency shall find that a project may have a significant effect on the environment which will require a Mandatory Finding of Significance...When a project has the potential to substantially degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, *reduce the number or restrict the range of an* e*ndangered, rare or threatened species*." [emphasis added]
>
> "[CDFG] encourages public agencies to ensure that actions they approve do not significantly impact such species." "As the trustee agency for the wildlife of California, which includes plants, ecological communities and the habitat upon which they depend, [CDFG] advises public agencies during the CEQA process to help ensure that the actions they approve do not significantly impact such resources."

Special-status species defined in CDFGs *Special Plants List* (2012a) and *Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Natural Communities* (CDFG 2009), and monitored by CNDDB include:

> ""Taxa which meet the criteria for listing, even if not currently included on any list, as described in Section 15380 of the California Environmental Quality Act (CEQA) Guidelines; these taxa may indicate "None" under listing status, but note that *all CNPS 1 and 2* and some List 3 and 4 (now known as California Rare Plant Ranks 1A, 1B, 2, 3, and 4) plants may fall under Section 15380 of CEQA." [emphasis added]

Spring 2012 Survey Results

This impact assessment includes an analysis of the results of offsite surveys conducted by the applicant in spring and summer of 2012 (CH2 2012oo). Because several of the special-status plant species affected by the project were only recently added to the CNDDB (2012a) and California Native Plant Society *Inventory or Rare and Endangered Plants of California* (CNPS 2012), and because the area is generally under-surveyed, the applicant elected to conduct extensive offsite surveys in Pahrump and surrounding valleys over a two-year period, to determine whether any of the affected species may be more common than previously understood. As expected, many new occurrences were found for a few species, and no new occurrences were detected for others.

Reconnaissance level offsite surveys were conducted in several locations during the spring of 2011 and 2012, with a focus on species most substantially affected by the project in terms of the number of total documented occurrences affected. Estimated population sizes are included (in parentheses) in the summary of new offsite occurrences detected during the 2012 surveys, below. Note that populations of most

desert annuals (such as Pahrump Valley buckwheat) can fluctuate wildly in response to variable annual precipitation, and the timing of storms. In particularly dry years, even perennials can remain dormant and undetectable. New occurrences found in spring 2012 include:

- 2 occurrences of **Preuss' milk-vetch** (est. 20,000 plants)
- 8 occurrences of **Tidestrom's milk-vetch** (252 plants)
- 1 occurrence of **Wheeler's skeletonweed** (1 plant)
- 7 occurrences of **Torrey's joint-fir** (126 plants)
- 20 occurrences of **Pahrump Valley buckwheat** (est. 7.3 million plants)
- 5 occurrences of **desert wing fruit** (10 plants)

The offsite surveys conducted in spring 2011 (a normal rainfall year) yielded many new occurrences for some – but not all – of the affected species. New occurrences were found in Pahrump Valley, Stewart Valley, Chicago Valley, and California Valley. The applicant also documented some new occurrences east of the California-Nevada border that bisects Pahrump Valley, and in the Ash Meadows area of Nevada (the Nevada occurrences are not included in the CNDDB).

Staff requested CNDDB to update the Element Rank upon receipt of the applicant's 2012 survey data to ensure the ranks used in the analysis were current and reflect all new occurrences. Predictably, the Element Rank for Pahrump Valley buckwheat was downgraded to an S3 ("vulnerable" but not "imperiled"). Tidestrom's milk-vetch was also downgraded from an S1 to an S2, and Goodding's phacelia was downgraded from an S1 to an S2 as a result of new occurrences detected in 2011.

In May 2012, a focused survey for Torrey's joint-fir was conducted onsite and in a 250-foot buffer surrounding the project site. The applicant intends to continue surveying for Torrey's joint-fir offsite because it was not added to the CNDDB (2012) and CNPS *Inventory* (2012) until January 2012. Nor is it included in the old or new editions of the flora of California (Hickman 1993; Baldwin et al. 2012); in such a case it is reasonable to conclude that the species may be more common because it would have been overlooked, and not considered, during any rare plant surveys of the region.

Proportion of State Distribution Affected and Other Factors Considered

This assessment employed a combination of qualitative and simple quantitative analyses. Occurrence data from CNDDB and the various herbaria were compared spatially in GIS to prevent duplication and to view current and historical occurrences with landform datasets on aerials and topographic base maps to better understand: 1) species' threats and vulnerabilities relative to probable future development; 2) peripheral status; 3) potential for fragmentation and indirect effects from nearby development and other cumulative concerns, and 4) examination of the ownership of lands containing or adjacent to occurrences to assess potential for mitigation offsite through acquisition or restoration.

Information sources consulted to determine the total number of documented occurrences in California include:

- California Natural Diversity Database (CNDDB 2012)
- California Native Plant Society Online Inventory [v8] (CNPS 2012)
- Consortium of California Herbaria (CCH 2012)
- Calflora (Calflora 2012)
- University of California Riverside herbarium records (UNR 2012)

In all cases, occurrences or collections that were greater than 20 years old (referred to as “historical” occurrences in the CNPS Inventory) were not included in the analysis of total state distribution because the data is unreliable for a variety of reasons -- ambiguous location descriptions, occurrences subsequently eliminated by development or agriculture, etc.

All of the project survey data, to date, has been incorporated into the CNDDB, including the spring 2012 survey results. The number of occurrences described in this analysis and shown in the CNDDB reflects CNDDBs prompt processing of the applicant’s new GPS data in order to compare the applicant’s survey results to the CNDDB database occurrences by a common metric. An “occurrence” is defined by CNDDB as individuals of a particular species occurring within one-quarter mile of each other that are not separated by significant habitat discontinuities. Consequently, aggregations of rare plant locations depicted in the applicant’s special-status plant maps were lumped by CNDDB into a single occurrence if they fell within one-quarter mile of each other. In general, numbers of occurrences are used to evaluate rarity rather than population size because population size data is incomplete for most species, and the populations of desert annuals fluctuate wildly in response to a variable and unpredictable climate.

Staff’s analysis of the significance of impacts considered the following additional factors:

- Size and integrity of the local (Pahrump Valley) population;
- Proportion of the local population that would be affected;
- The peripheral status of the local population (whether isolated or in close proximity to other sub-populations);
- Species’ patterns of rarity and (where known) dispersal mechanisms;
- Site quality and vigor of the offsite occurrences;
- Consideration of whether the local populations have characteristics that would assign them local or regional significance;
- Potential indirect impacts such as introduction or spread of invasive plants, operation impacts (dust, chemical drift, fire risk, erosion and sedimentation), fragmentation of the local population; and downstream impacts to hydrologic and geomorphic processes that may be necessary to sustain the habitat;
- Integrity and quality of habitat and occurrences onsite;
- Potential cumulative threats to remaining occurrences, and
- Ownership and management threats and opportunities

Direct Impacts to Special-status Plants

Partial site grading and construction, trenching, road construction, vehicle and equipment traffic, and initial vegetation mowing and herbicide spraying are expected to eliminate many of the occurrences within the project footprint. The remainder are expected to be destroyed over time or significantly compromised through a variety of indirect effects, discussed later. Cumulative impacts are discussed in a separate chapter later in the Biological Resources section. Potential direct impacts to special-status plants on the proposed transmission line in Nevada (Hidden Hills Valley Electric Transmission Line (HHVETL) are not included in this analysis.

Construction of the project would eliminate a substantial portion of the total documented occurrences in California of four of the 11 special-status plant species: gravel milk-vetch; Wheeler's skeletonweed; Torrey's joint-fir, and Preuss' milk-vetch. **Biological Resources Table 17**, below, summarizes the direct impacts based on occurrence data that incorporates the results of the spring 2012 surveys and the most current CNDDB version (September 2012). The calculation of the proportion of total statewide occurrences affected by the project is made after subtracting the "historical" occurrences (shown in brackets) not observed in the past 20 years.

Biological Resources Table 17
Proportion of Special-status Plant Species Affected by Project

Common name (*Scientific name*)	**Status Codes[3] CNDDB Element Rank (Global/State)** **CRPR List**	**Total Documented Occurrences in California (including project onsite & offsite occurrences[1])** (historical >20 yrs not included)[2]	**Total Number of Occurrences on Project Site and Affected by the Project**	***Proportion of Total Statewide Distribution Affected by Project[4]***
desert wing fruit (*Acleisanthes nevadensis syn=Selinocarpus nevadensis*)	G5 / **S1** CRPR List 2.3	**13** <1>	**1**	**8%**
Goodding's phacelia (*Phacelia pulchella* var. *gooddingii*)	G4T2T3 /**S2** CRPR List 2.3	**19** <3>	**1**	**6%**
gravel milk-vetch (*Astragalus sabulonum*)	G5 /**S2** CRPR List 2.2	**19** <11>	**4**	**50.0%**
Nye milk-vetch (*Astragalus nyensis*)	G3 /**S1** CRPR List 1B.1	**19** <0>	**1**	**5%**
Pahrump Valley buckwheat (*Eriogoum bifurcatum*)	G2 / **S3** CRPR 1B.2 BLM Sensitive	**40** <1>	**3**	**8%**

Common name (*Scientific name*)	**Status Codes[3] CNDDB Element Rank (Global/State)** **CRPR List**	**Total Documented Occurrences in California (including project onsite & offsite occurrences[1])** (historical >20 yrs not included)[2]	**Total Number of Occurrences on Project Site and Affected by the Project**	***Proportion of Total Statewide Distribution Affected by Project[4]***
pink-flowered androstephium (*Androstephium breviflorum*)	CRPR List 1B.2 G5 /**S2S3** CRPR List 2.2	**93** <8>	**1**	**1%**
Preuss' milk-vetch (*Astragalus preussii* var. *preussii*)	G4T4 /**S1.2** CRPR List 2.3	**22** <0>	**4**	**18%**
purple-nerve spring parsley (*Cymopterus multinervatus*)	G5? /**S2** CRPR List 2.2	**31** <9>	**1**	**4.5%**
Tidestrom's milk-vetch (*Astragalus tidestromii*)	G4G5 /**S2** CRPR List 2.2	**59** <8>	**2**	**4%**
Torrey's Mormon-tea (*Ephedra torreyana*)	G5? / **S1** CRPR List 2.1	**11** <0>	**5**	**45%**
Wheeler's skeletonweed (*Chaetadelpha wheeleri*)	G4 /**S1S2** CRPR List 2.2	**25** <5>	**5**	**25%**

[1] The total number of occurrences includes spring 2012 data and September 2012 version of CNDDB. [2] Herbarium collections >20 ys old and CNDDB occurrences not seen >20 ys not included in this analysis because they are unreliable; location descriptions are often ambiguous, misidentified, or the site has been developed or converted.

[3] Status Codes

CNDDB Element Rank (NatureServe)

Global rank (G-rank) and **State rank (S-rank)** is a reflection of the overall condition of an element throughout its global (or **State)** range. Subspecies are denoted by a T-Rank; multiple rankings indicate a range of values. **State rank (S-rank)** is assigned much the same way as the global rank, except state ranks in California often also contain a threat designation attached to the S-rank. An H-rank indicates that all sites are historic.

G1 or S1 = Critically imperiled; Less than 6 viable element occurrences (EOs) OR less than 1,000 individuals
G2 or S2 = Imperiled; 6-20 EOs OR 1,000-3,000 individuals
G3 or S3 = Rare, uncommon or threatened, but not immediately imperiled; 21-100 EOs OR 3,000-10,000 individuals
G4 or S4 = Not rare and apparently secure, but with cause for long-term concern; this rank is clearly lower than G3 but factors exist to cause some concern; i.e., there is some threat, or somewhat narrow habitat.
G5 or S5 = Demonstrably widespread, abundant, and secure.

California Rare Plant Rank (former California Native Plant Society List)

List 1B = Rare, threatened, or endangered in California and elsewhere
List 2 = Rare, threatened, or endangered in California but more common elsewhere
List 3 = Plants which need more information
List 4 = Limited distribution – a watch list
0.1 = Seriously threatened in California (high degree/immediacy of threat)
0.2 = Fairly threatened in California (moderate degree/immediacy of threat)
0.3 = Not very threatened in California (low degree/immediacy of threats or no current threats known)

Bureau of Land Management

BLM Sensitive = Species requiring special management consideration to promote their conservation and reduce the likelihood and need for future listing under the ESA. BLM Sensitive species also include all Federal Candidate species and Federal Delisted

species which were so designated within the last 5 years and CNPS List 1B plant species that occur on BLM lands. http://www.blm.gov/style/medialib/blm/wo/Information_Resources_Management/policy/blm_manual.Par.43545.File.dat/6840.pdf.
[4] The percentage of the total statewide distribution affected is calculated *after* subtracting historical occurrences (occurrences that have not been observed in over 20 years; shown in brackets in column 3) from the number of total documented occurrences in California.

Indirect Impacts to Special-status Plants

Potential indirect impacts to special-status plants located on or adjacent to the project site include: introduction and spread of invasive plants; alteration of the surface hydrology or geomorphic processes that maintain habitat for rare plants; fragmentation of the local population; increased risk of fire; erosion and sedimentation of disturbed soils; disturbance of the structure and functioning of biological soil crusts; impacts of herbicide spraying and other chemical drift on plants and their pollinators; shading; potential disease from mist during mirror-washing; and fugitive dust during construction and operation, which disrupts photosynthesis and other metabolic processes. Plants and other sessile organisms are particularly vulnerable to the effects of habitat fragmentation. Small fragments of habitat can only support small populations and are more vulnerable to extinction.

Status as Peripheral Populations

California occupies an important biogeographic location and zone of ecological transition on the Pacific coast of North America, and so its floristic diversity includes many widespread taxa on the edge of their range. This includes many of the CRPR Rank 2 plants in the project area, which represent the western limit of those species' ranges—geographically marginal, peripheral populations on the frontiers of their ranges. Peripheral populations can be completely isolated from their core populations, or they can occur in closer proximity to other marginal populations.

Peripheral plant populations are at greater risk of extirpation because they occur on the edge of a species' range. Relative to core populations, peripheral populations tend to be smaller, more isolated, and more genetically and ecologically divergent than central populations, they have more variable densities, and are ecologically distinctive and/or occur in marginal habitats (Leppig & White 2006).

The biological and intrinsic values of these peripheral populations are well documented; maintenance of genetic variation contributes to long-term species survival and preservation of local genetic diversity (Channel and Lomolino 2000). Interestingly, when species undergo catastrophic range contractions, populations on the edge of the range have significantly greater survival than core populations (*Ibid.*). Thus, the maintenance of genetic variation in the form of small, isolated populations contributes to long-term species survival and preservation of local genetic diversity (Leppig & White 2006). The degree of spatial isolation and ecological distinctiveness are the best criteria for assessing a population's conservation significance, especially in the absence of population genetics data (*ibid.*).

CNDDB Element Rank (NatureServe Rank) – an Index of Extinction Risk in California

The case for rarity and extinction risk in California of the affected species is demonstrated, in part, through the California Natural Diversity Database (CNDDB) Element Rank. The rank evaluates several factors of rarity, threats, and population

trend, which are scored and weighted, and include: range & extent; area of occupancy; population size; number of occurrences; number of occurrences or percent area with good viability/ecological integrity; environmental specificity; long- and short-term trend; threats (severity, scope, impact, and timing); intrinsic vulnerability, and other considerations (Master et al. 2009). The CNDDB Element Rank definitions are summarized in the introduction to this analysis, and on page iii-iv of the state's special-status plant list, published by the *California Department of Fish and Game Natural Diversity Database Special Vascular Plants, Bryophytes, and Lichens List* (CNDDB 2012b), also known as the "*Special Plants List*". The rarity of the affected species is demonstrated spatially in **Biological Resources Figure 9,** which also demonstrates the highly restricted range of many of the affected species in California.

CRPR Rank 1 and 2 Plants Widely Recognized as Rare and Endangered In California

CDFG recognizes the California Native Plant Society (CNPS) as an authority on rare, threatened, and endangered plants in California. CDFG works collaboratively with the nationally recognized organization in the management of the Rare Plant Status Review groups that assign the "CRPR rank" (formerly CNPS List). The Rare Plant Status Review groups represent over 300 botanical experts from government, academia, NGOs and the private sector. From CDFG *Special Plants List* (CNDDB 2012x)

> "In March 2010, DFG changed the name of "CNPS List" or "CNPS Ranks" to "California Rare Plant Rank" (or CRPR). This was done to reduce confusion over the fact that CNPS and DFG jointly manage the Rare Plant Status Review groups and that the rank assignments are the product of a collaborative effort and not solely a CNPS assignment. The old name gave the false impression that CNPS solely assigned the ranks and had excessive influence on the regulatory process."

The CNPS website <<http://www.cnps.org/cnps/rareplants/>, a site familiar to botanical consultants and accessible to the general public, provides over 18 pages of details on the Rare Plant Program and Rare Plant Status Review Groups, including: the rare plant status review process; the relationship between CNPS and CDFG in establishing the lists, or ranks; staff and leadership; the Rare Plant Program Committee; contact information; a flow chart of the process; instructions for recommending an addition, list change, deletion, or name change; a description of the regional plant status review groups; a description of the rare plant status review public forum; and sample forms for proposed additions and proposed status changes.

CRPR Rank 1B plants are California endemics, i.e., their entire global distribution is limited to California, or they are also rare outside California. The CRPR Rank 2 is defined in CDFGs *Special Plants List* (CNDDB 2012x):

> "CRPR Rank 2 = **Plants Rare, Threatened, or Endangered in California, but More Common Elsewhere**: Except for being common beyond the boundaries of California, plants with a California Rare Plant Rank of 2 would have been ranked 1B. From the federal perspective, plants common in other states or countries are not eligible for consideration under the provisions of the Endangered Species

Act. Until 1979, a similar policy was followed in California. However, after the passage of the Native Plant Protection Act in 1979, *plants were considered for protection without regard to their distribution outside the state.*"[emphasis added]

Applicant, in its comments, questions CDFG's interpretation that "range" pertains to distribution within the state, and not outside of it. This interpretation of the significance of the California range of a species that also occurs outside California – more specifically the interpretation of the term "range" in "...all or a significant portion of its range...." was upheld in *California Forestry Association v. California Fish and Game Commission* [3], in which the court upheld a trial court's ruling that that the term "range" in the CESA[4] refers to a species' California range only, thereby entitling a species to protection if it is threatened with extinction throughout all, or a significant portion, of its California range (as opposed to its worldwide range).

Indeed, at least five CESA listed plant species are also CRPR Rank 2 species (species that have distribution outside California), and many more CESA-listed wildlife species also have distribution outside California

The language in question in that case, i.e., the term "range" in "...all or a significant portion of its range...." is the same language, verbatim, used in Section 15380 of CEQA to define species that are endangered, rare, or threatened. The California courts have concluded that CEQA and CESA are complimentary statutes whose provisions must be given concurrent effect where possible. For example, in *Mountain Lion Foundation v. Fish and Game Commission*, the California Supreme Court held that California's Courts "are obligated to harmonize the objectives common to both [CEQA and CESA] to the fullest extent the language of the statutes fairly permits."

In *California Forestry Association v. California Fish and Game Commission*[10] the court concludes by noting that species listed under CESA for which the same species are listed under the FESA are justified, because a listing regulation under the CESA ensures that a species remains protected in California if the same species is delisted under the FESA. Further, the decision considered a scenario in which a species is delisted under the FESA because it is flourishing in areas outside of California but is still declining in California. Already having in place a CESA listing of the same species would ensure continued protection of the species in California without having to endure the lengthy wait for a species to move from petition status to listing status[5]. If the species were not already listed under the CESA, it could suffer a dramatic decline in population during the time it takes for the Commission to amend the existing regulations to list the species, undermining the purpose of the CESA."

CDFG's interpretation of the law is thus consistent with the case law, and is reflected in the analysis in this document.

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[3] *California Forestry Association v. California Fish and Game Commission* (2007) 156 Cal.App4th 1535.

[4] *Mountain Lion Foundation v. Fish and Game Commission* (16 Cal.4th at p. 122)

[5] In that case, it took approximately four years for the two coho salmon units at issue to be listed as endangered and threatened under the CESA.

California Native Plant Society is a Recognized Authority

The applicant has questioned whether the CNPS rare plant “Lists” (now CRPR Rank), or the ranking process itself, provides sufficient evidence of the rarity of a species, and in this and other proceedings has questioned whether CNPS can be relied upon as an authority for assessing the rarity of plants in California.

Recognizing that formal listings under federal and state law only account for a fraction of California’s native plants that are, as a matter of empirical fact, threatened with extinction, CNPS began publishing an inventory of California’s rare and endangered plants, beginning 1974 (CNPS 2001; CNPS 2012). For over 30 years, the CNPS Inventory has served as a forum for regular review of the status of rare plants by a broad body of scientists and field botanists, and as a means of bringing that critical information to the attention of regulatory agencies and the concerned public.

Indeed, as illustrated by resource agencies’ recognition of the CNPS Inventory in agency guidelines for rare plant surveys and assessing impacts to rare plants (CDFG 2009; BLM 2009; CNDDB 2012; and others), and in the courts, the CNPS Inventory is considered by CDFG and other agencies as a primary source of information for determining whether non-listed plants meet CEQA’s independent definitions of “rare” and “endangered,” thus triggering a mandatory finding of significance, environmental review, and the implementation of all feasible mitigation measure to reduce or avoid impacts to such special-status, non-listed plants.

CRPR Rank 1 and 2 Plants Meet CEQA Definition of Rare and Endangered

Applicant in its comments questions whether the plants listed above should be considered rare or endangered. This is presumably because of the legal implications: CEQA Guidelines section 15065 lists certain project impacts that require *mandatory* findings of significance. One such condition is if the project has the potential to substantially degrade the quality of the environment, or *substantially reduce the number or restrict the range of an endangered, rare, or threatened species*. The special-status plant species that would be directly affected by the project are not listed under the California Endangered Species Act, but that does not diminish the significance of their loss. Indeed, there are many plant species without CESA listing whose entire statewide distribution is limited to a small number of occurrences, threatened by one or more factors, and thus their vulnerability to extinction in California is very high. The Commission has acknowledged the rare and endangered status of CRPR Rank 1 and 2 species (formerly termed “CNPS List 1" and "List 2") in its siting decisions, including the Ivanpah Solar Electric Generating System project, Palen Solar Power Project, Blythe Solar Power Project, and Genesis Solar Electric Project.

Plants not CESA-listed must nevertheless be considered “rare” or “endangered” where such plants meet the definitions of these terms in CEQA Guidelines section 15380. Section 15380 provides that a plant or animal species must be treated as “rare” even if not on one of the official lists if “A) although not presently threatened with extinction, the species is existing in such small numbers throughout all or a significant portion of its range that it may become endangered if its environment worsens; or B) the species is likely to become endangered within the foreseeable future throughout all or a significant

portion of its range." Plants on CNPS List 1A, 1B, and 2 meet these criteria, and are thus considered to be "rare" by CDFG.

Case for Rarity

"Rare" and "rarity" are generic, commonly used terms in the scientific literature used to describe scarcity, a statement about the geographic distribution and population sizes of a particular species. The terms "threatened" and "endangered" typically refer to human activities and other processes that are increasing a species' vulnerability to extinction, and the degree of endangerment.

Rarity is based upon pattern of *distribution* and *abundance.* There are three basic kinds of rarity based on these two factors:

1) Restricted in distribution, but locally abundant (e.g., Pahrump Valley buckwheat);

2) More widespread, but never abundant; and

3) Localized and not abundant

The affected species' rarity and endangerment is clearly demonstrated in **Biological Resources Table 17**, and in the spatial representation of these species' highly restricted range in California (**Biological Resources Figure 9**). Combined with the species' CNDDB Element Rank and additional factors considered in this analysis, it is clear that *the affected species exist in such small numbers in California that all or a significant portion of the species' California distribution may become endangered.* **Biological Resources Table 17** underscores the degree of endangerment for four species, represented by the total documented occurrences in California, including the applicant's two years of focused surveys, and in the proportion of those occurrences that would be eliminated by the project. Additional cumulative threats to remaining occurrences in California are discussed in the "Cumulative Impacts" subsection. The case for rarity and concern is also reflected in the CNDDB Element Rank, an index of extinction risk within the state.

Conclusions and Discussion of Special-status Plant Mitigation

As shown in **Biological Resources Table 17**, direct impacts to four of the 11 species are *significant because the project would eliminate a substantial portion of their range in California* and because the affected species *exist in such small numbers in California that all or a significant portion of the species' California distribution may become endangered*:

- **gravel milk-vetch** – CNDDB S2 (50% of total documented occurrences in California eliminated);
- **Wheeler's skeletonweed** – CNDDB S1S2 (25%);
- **Torrey's joint-fir** – CNDDB S1 (45%), and
- **Preuss' milk-vetch** – CNDDB S1 (18%).

For the remaining species, the population or range in California is larger and more stable, the proportion of the total statewide distribution and range affected by the project and/or extinction risk is substantially less, and/or the local population is robust.
Two years of offsite surveys were conducted to determine if these species were more common than previously understood, but the direct impacts still affect a substantial portion of their state distribution and thus increase their vulnerability to extinction within the state. This is aggravated by potential indirect threats and cumulative impacts from other past, present and foreseeable future actions within their already highly restricted range in California (see “Cumulative Impacts” subsection). For all four species, the total documented occurrences is less than 20, a threshold at which a species assigned extinction risk increases from “vulnerable” to “imperiled” under the methodology used by CNDDB and Natural Heritage programs around the world to establish extinction risk (Master et al. 2009), and “making it very vulnerable to extirpation from the state/province.” Combined with the threats from indirect and cumulative impacts, the extinction risk could increase to “critically imperiled” and “especially vulnerable to extinction in the state” as the total documented occurrences is reduced to approximately 6 viable occurrences or fewer, and/or those occurrences are threatened by one or more factors (Master et al. 2009).

Staff reviewed the ownership and management threats and opportunities for these species to determine if offsite mitigation was feasible. All four species have multiple occurrences on undeveloped private lands and/or occurrences threatened by invasive non-native plants, off-road vehicles, and other factors on private and public lands that could benefit from dedicated restoration efforts to reduce or eliminate the threats.

Avoidance along the eastern boundary could minimize the project’s direct impacts to special-status plants. However, staff considered the possibility that because of the position of the project on the California-Nevada border, the constraints to dispersal and limitations in connectivity due to the location of a different habitat type to the east (coppice dunes) and the obstructions of the project to the west, avoidance along a strip on the eastern side of the project (where most occurrences are located) may not be sustainable over the long term and thus may do little to protect the California range of the affected species. Because washes and wind are important seed dispersal pathways (O’Leary pers. comm.), disruption of the natural surface drainage patterns from east to west (into California) by the project, and because the direction of the prevailing winds is from California into Nevada (northwest to southeast), any avoided occurrences along the eastern edge may have limited connectivity, which affects their long-term sustainability or viability, and dispersal pathways into California may be affected over the long term. Staff concluded that mitigation that protects occurrences better situated in California is preferable to avoiding a strip along the eastern boundary with Nevada that may or may not be sustainable.

Condition of Certification **BIO-20** (Special-status Plant Compensatory Mitigation) provides guidelines and performance standards for offsite mitigation through acquisition, with an option for mitigation through restoration of at-risk occurrences. **BIO-20** would require the project owner to place a conservation easement on the mitigation site to ensure protection in perpetuity from future development, and provide stewardship fees necessary for basic protection (e.g., fencing and/or signage if needed). Three offsite occurrences shall be protected for every S1 (“critically imperiled”) species affected and

two offsite occurrences protected for every S2 ("imperiled") species affected. Range ranks (e.g., an S1S2 rank) shall defer to the more imperiled rank. Species that are currently assigned an S1 CNDDB Rank ("critically imperiled") warrant a higher mitigation ratio in order to protect the species from immediate endangerment.

Under the terms of **BIO-20**, this can be accomplished through acquisition alone or a combination of acquisition and restoration if the restoration can be demonstrated to save an occurrence at moderate to high risk from threats. These may include threats from: noxious weeds or other invasive plants; unauthorized off-road vehicles; alteration of the drainage patterns and/or geomorphic processes essential to maintain the habitat, or herbivores. Because connectivity and maintenance of the ecological processes essential for maintaining the habitat are essential for the long-term sustainability of an occurrence, **BIO-20** requires the mitigation proposal to demonstrate that the acquired or restored occurrence can be protected from the edge effects of adjacent land uses.

The same mitigation strategy, mitigation ratios, and a similar condition of certification was adopted to minimize special-status plant impacts on at least three other Energy Commission-licensed projects (Blythe, Genesis, and Palen projects). As an example of mitigation ratios required by other agencies, in CDFG practice, compensatory mitigation for streams and riparian vegetation is typically mitigated at a minimum mitigation-to-effect ratio of 3:1 for permanent effects and 1:1 for temporary effects (Vyverberg pers. comm.).

There is also potential for impacts to special-status plant occurrences in close proximity to the project boundary during operation. These potential impacts include: the spread of weeds into currently uninfested areas; chemical drift from weed management and dust control; fugitive dust from grading, mowing and road maintenance; increased risk of wildfire from project operation and increased traffic on area roads; and sedimentation of washes offsite from erosion of channels onsite and upstream. Although these indirect project effects are individually minor, they are cumulatively considerable when considered in combination with past, present, and foreseeable future projects in the region (see "Cumulative Impacts" subsection).

Nine occurrences of eight rare species were mapped within a 250-foot buffer surrounding the project. In most cases, the occurrences extend to or near the project boundary. These include: Nye Valley milk-vetch (1 occurrence); Preuss' milk-vetch (1); pink funnel lily (1); Tidestrom's milk-vetch (1); Wheeler's skeletonweed (1); Torrey's joint-fir (1); Pahrump Valley buckwheat (1), and Goodding's phacelia (1).

Condition of Certification **BIO-19** includes avoidance and minimization measures for protecting against accidental impacts during construction and indirect impacts following construction. The Best Management Practices (BMPs) described in **BIO-19** are standard BMPs employed on development projects for protecting adjacent oaks, streams, wetlands, etc., and are consistent with avoidance measures described in the Energy Commission's BMP Manual (CEC 2010). **BIO-19** *does not require the project owner to implement BMPs offsite* avoidance and minimization measures are only required onsite, i.e., at or near the project boundary, to prevent impacts to adjacent sensitive resources. Examples of BMPs include silt-fencing, temporary construction fencing and signage, and guidelines for preventing or minimizing herbicide drift.

Condition of Certification, **BIO-21** (Qualified Botanist) would ensure that specific measures for protecting special-status plants are carried out by a qualified botanist or vegetation ecologist.

Measures for control of fugitive dust, herbicide and other chemical drift, and erosion control measures are incorporated into **BIO-8** (General Impact Avoidance and Minimization Measures). Because washes facilitate the dispersal of special-status plants as well as act as conduits for the spread of some invasive weeds, **BIO-22** (State Waters Compensatory Mitigation and Avoidance & Minimization Measures) and **SOIL-1** contain measures for preventing erosion and sedimentation of washes onsite and downstream. Measures for avoiding and minimizing indirect impacts to offsite occurrences from the spread of invasive weeds are contained in **BIO-18** (Weed Management Plan).

It is reasonable to conclude that one of the four significantly affected species – Torrey's joint-fir – could potentially be more common than currently understood because: 1) it was just added to the CNDDB and CNPS *Inventory* (CNPS 2012) in January 2012; and 2) the species was not known to occur in California before it was discovered on the project site, and it is not included in the state flora (Baldwin et al. 2011). This means, in this unique case, there is a high potential that it may have been overlooked by other surveyors, an opinion shared by at least one other recognized local expert (Silverman pers. comm.). Currently, only one round of surveys has been conducted to assess the size of the species' population in California. **BIO-20** includes a provision that if many new occurrences are found in fall 2012 or spring 2013 that results in a downgrading of the CNDDB Element Rank from an S1 to an S3 ("vulnerable but not under immediate threat of extinction"), and the proportion of the statewide distribution affected by the project is less than 10 percent, the mitigation requirement for that species would be dismissed.

Operation Impacts to Groundwater-Dependent Ecosystems

Local Groundwater-Dependent Ecosystems

Groundwater levels near the proposed project's water supply wells will decline during the project pumping (HHSEGS 2011a, Appendix 5.15D; **Water Supply Figures 19** and **20**). Groundwater pumping could have significant indirect and cumulative impacts to biological resources if it lowers the water table in areas where groundwater-dependent ecosystems occur. Approximately 4,000-acres of mesquite habitats occur within one-half mile and five miles of the project wells (**Biological Resources Figure 1 and 2**; CH2 2011g, Figure DR48-1).

WATER SUPPLY Figure 18 summarizes staff's estimate of the potential drawdown at the distance of the Stump Springs monitoring well and the latent effects on water levels after pumping ends. The range of drawdown estimated at the distance of the Stump Springs monitoring well ranges from no drawdown (based on minimum transmissivity and maximum storativity) to a 19-foot drawdown (minimum transmissivity and storativity); all other aquifer parameter combinations fall between these two limits. These results are considered maximum potential impacts because they ignore the potential (undemonstrated) buffering effects of the state line fault zone, which may – to some degree -- limit the hydraulic connection between project pumping and

groundwater northeast of the fault zone associated with Stump Springs. More often, such faults provide a partial barrier to groundwater flow, but not a complete barrier (Belcher pers. comm.; Comartin 2010).

These estimates of drawdown do not include the cumulative effect of other foreseeable future projects in the vicinity, the most significant of which would come from the BrightSource Energy project ("Sandy Valley Project") located near the opposite side of Stump Spring ACEC that would pump 170 acre feet per year. **WATER SUPPLY Figure 22** also shows that the potential cumulative water level decline at both Stump Springs could be greater than 60 feet. Similarly, this estimate does not consider the potential buffering effects of the fault, i.e., the spread of drawdown from the project wells to Stump Springs could be limited on the northeast of the fault. Staff is concerned about the close proximity of the project wells to sensitive groundwater-dependent ecosystems, which are extensive and occur as close as 600 feet to the project boundary.

Many public and agency comments expressing similar concerns about the impacts of groundwater pumping on dependent habitats and wildlife of the project were received. These include comments from:

- BLM California State Director and Nevada State Director of BLM (BLM 2012a; BLM 2012b; CEC 2011v);
- Inyo County (INYO 2012a; INYO 2012b)
- Nevada Department of Wildlife (NDW 2011a)
- Amargosa Conservancy (ARM 2011a; ARM 2011b; Wright 2011a);
- The Nature Conservancy (TNC2012a);
- Center for Biological Diversity (CBD 2012b);
- Big Pine Paiute Tribe of Owens Valley (PINE 2012a);
- Pahrump Paiute Tribe (PAIU 2012a)

The comments from BLM (BLM 2012a; 2012b), Inyo County (INYO 2012a; 2012b), and The Nature Conservancy (TNC 2012x) contain specific and detailed recommendations for mitigation in the form of long-term monitoring and provisions to stop, reduce, or modify pumping if adverse impacts are detected.

The record of conversation with The Nature Conservancy (CEC 2012g) contains links to presentations made by the BLM California Desert District and USGS. These agencies expressed concern about the potential for cumulative impacts to the Amargosa Wild and Scenic River and other resources of the Lower Amargosa Valley.

There was considerable discussion about the proposed project and other energy projects in the region at the December 12-13, 2011 meeting on the Amargosa Basin, hosted by the Desert Manager's Group (CEC 2012g).

Differences between the applicant's and staff's assessments of this issue center on: 1) the ability of the groundwater-dependent ecosystems to withstand a sustained, project-related decline in the water table; 2) the reliability of limited area well data and the pre-

project pump tests to accurately predict the lateral or vertical extent of the project's effects in a complex hydrogeologic setting; 3) the applicant's assertion that the fault zone represents a complete barrier to groundwater flow and buffer between the project and sensitive resources (rather than a partial barrier), or that its highly unlikely that project pumping would affect resources on the other side of the fault; and 4) the conservation values of the area mesquite washes and mesquite dunes. Many public and agency comments also expressed concern about whether information currently available is adequate to conclude there is no long-term cumulative risk to the Amargosa Wild and Scenic River and other regional groundwater-dependent resources. Some of these differences are addressed below, followed by staff's analysis of significance of potential impacts to groundwater-dependent biological resources. A detailed analysis of the applicant's groundwater assessment and **Water Resources** staff's independent analysis of the applicant's recent pump test data is contained in the **Water Supply** section of the FSA.

Historic Decline of Springs Due to Groundwater Pumping

Many local springs experienced precipitous water table declines and ultimately stopped flowing as a result of groundwater depletion in the middle of the last century (Harrill 1986; Malmberg 1967; Buqo 2004; Comartin 2010). Before extensive agricultural development, the Pahrump Valley playa area (northwest of the project) supported some phreatophytic vegetation, which is largely absent now. Groundwater pumping in the Pahrump Valley for agriculture (predominantly alfalfa and cotton) peaked in 1968 and there was a significant downward trend in static water levels between the years 1953 and 1996, based on an analysis of 651 wells within one mile of a mesquite woodland (Crampton et al. 2006). Groundwater withdrawals accompanying large-scale agricultural development caused some major springs in the area to stop flowing during this period of groundwater withdrawal. Some springs eventually recovered after some the pumping stopped (Moreo et al. 2003). Historically, Manse and Bennetts Springs discharged along the base of the broad alluvial fans at the foot of the Spring Mountains. Groundwater withdrawal in the valley caused these springs to cease flowing in the 1970s. In the late 1990s, after the heavy agricultural pumping stopped, Manse Spring began to flow again. Other springs have not recovered.

Pumping has declined since the heavy agricultural pumping of the last century but with the population expansion that followed, agricultural groundwater uses were replaced by domestic, and the basin is still considered in an overdraft condition (Comartin 2010).

Currently, groundwater at the Stump Spring monitoring well is 28 feet below ground surface (bgs); however, the well is not located at or close to the actively discharging spring, and may not reflect the hydrograph or groundwater levels at the spring. Stump Spring supports three seasonal pools that provide exceptionally valuable open water habitat over a period that extends from approximately December to July (Poff pers. comm. 2012). BLM recently discovered that three additional unnamed seeps within 5 miles of the project boundary have above-ground spring discharge (Poff 2012). Two of these support healthy wetland-riparian vegetation; the third spring appears to have at least minor intermittent flow that was significantly greater historically. The proximity of these water sources to the adjacent mesquite habitats and desert scrubs significantly

increases the value of the habitat for many wildlife species, including some special-status species.

There is inadequate well data in the area to conclude the project will have no effect on the area seeps and springs. However, despite such uncertainty, the documented corresponding decline of the basin's springs during the last century's agricultural pumping is cause for concern.

Significance of the Resources At-risk

The mesquite woodlands and coppice dunes in the southern Nevada region have significant biological importance, providing habitat to many wildlife species in the region, including several species covered under the Clark County Multiple Species Habitat Conservation Plan (MSHCP). The extent and condition of these important resources, however, has been severely impacted by the diverse activities of a growing population (Crampton et al. 2006). In response, the development of a Mesquite-Acacia Conservation Management Strategy (CMS) was adopted in the MSCHP (*ibid.*).

Stump Spring, in addition to its status as an ACEC, is identified as a conservation management priority in the CMS and describes Stump Spring as having "significant wildlife values". Stump Spring also provides a critical seasonal water source in an otherwise extremely arid landscape.

The entire Pahrump Valley "metapatch" (a collection of smaller patches), including the groundwater-dependent mesquite habitats and seeps east of the project and north of the ACEC, is also an identified conservation priority in the CMS, which recommends "coordination with Nye County to protect the woodlands that occur in Nye County". Mesquite habitats were also a proposed conservation priority in the scoping for the Southern Nye County MSHCP (USFWS undated).

In a landscape dominated by desert scrub, the contrastingly dense cover and shade provided by the mesquite serve as important breeding, foraging, and resting places for many avian species (Crampton et al. 2006). They offer protection from weather and predators, and provide refuges where birds may experience more favorable energy budgets. Although mesquite comprise a small percentage of the total vegetation in the desert, they support disproportionately greater densities of birds than surrounding desert habitats. They add structural complexity to the landscape, providing nesting sites and food resources for breeding birds.

Many special-status wildlife species are dependent on or strongly associated with mesquite in the region. These are discussed in detail in the "Setting" subsection of this FSA, and summarized in **Biological Resources Table 5**; (Crampton et al. 2006; NDW 2011a). A decline in the habitat functions and value of the mesquite habitats from groundwater pumping could adversely affect special-status species, including Clark County MSHCP covered species.

The applicant has argued that there is no evidence of the habitat values of the mesquite habitats near the project. The importance of mesquite to wildlife is a matter of empirical fact, an exhaustive review of which is contained in BLMs Mesquite-Acacia Conservation Management Strategy (Crampton et al. 2006), and endorsed in comment letters from

BLM, the Nevada Department of Wildlife, The Nature Conservancy, Amargosa Conservancy, and in conversations with USFWS and CDFG. Staff and CDFG observations of wildlife use of mesquite habitats east of the project are consistent with the habitat values and wildlife associations described in literature. The applicant has provided no evidence for their implausible assertion that the extensive mesquite resources east of the project have no significant value to wildlife.

The applicant has taken issue with a reference to the mesquite as “woodlands” because of a concern that it implies the resources have the habitat values of a tree-dominant community. The Mesquite-Acacia Conservation Management Strategy (Crampton et al. 2006) and BLM use the terms “woodland”, “dune scrub” and “bosque” to describe the mesquite-dominant habitats in the project vicinity, which vary from shrubby forms to low trees up to 15 ft with trunks to eight inches diameter or larger. Whatever description is used, it does not diminish their value to wildlife in the Stump Spring area, which BLM describes as “significant”; an opinion reflected in the multi-agency recognition of the area mesquite as a conservation priority. Nevertheless, a detailed and academic discussion of the classification of mesquite, based on consultation with the CDFG Senior Vegetation Ecologist, is provided in the “Setting” section of this FSA to address the applicant’s comments.

Tolerance of Mesquite to Declining Groundwater Elevations

In Data Response Set 1A (CH2 2011g), the applicant states that “...mesquite, rooted in shallow groundwater as they are, must be adapted to appreciable inter-annual fluctuations in groundwater level. They would need to survive lowered groundwater conditions, potentially for years when there are a number of drought years in a row—not an infrequent occurrence in the desert. Observation suggests an inter-annual variability in groundwater depth of greater than 6 feet in the vicinity of Corn Creek Springs in the Upper Las Vegas Valley.” The applicant also noted that while some area wells declined as much as 40 feet during the second half of the last century, the mesquite persisted. Given this evidence, they speculate that “draw-downs of less than 10 feet must be within the tolerance of the groundwater-dependent vegetation that has survived to the current time.”

By contrast, applicant’s data response also states that “....while mesquite are adapted to some variability, including declines, in water table elevation, it also seems that historic die back of groundwater-dependent vegetation is likely due to long-term and persistent draw-down of the water table and decline of shallow groundwater influenced by artesian flow” (CH2 2011c). Staff concurs; the potential cumulative effect of the project pumping and other past, present, and future projects, including another BrightSource Energy project near Stump Spring is likely to be significant, particularly when combined with the effect of future droughts. This is particularly worrisome given the overdraft condition of the valley basin and adverse effects already apparent in the mesquite stands near the northern end of the project.

Figure DR49-2, from the same submittal (CH2 2011g), provides a photographic example of the die-back apparent on the stands closest to Pahrump. On the previous page the applicant states “No appreciable die-back of mesquite coppice vegetation was noted on the dunes southeast of the Tecopa Highway (CH2 2011g, Figure DR49-1).

Die-back of groundwater-dependent vegetation was found north and northwest of the Tecopa Highway, both on the dunes closer to the project area (*ibid*.) and in arroyos farther north and east...” Staff confirmed this in several site visits. The applicant argues this could be caused by mistletoe and not attributable to basin drawdown (cite comment letter).

On the subject of mesquite mistletoe competition with its host, the BLM-sponsored Mesquite-Acacia Conservation Management Strategy (CMS) (Crampton et al. 2006), states

> “Hemiparasites are seldom the primary cause of death to their hosts.... The most common damage is death of the branch distal to the infection (Boyce 1961), although this is less likely as distal branch size increases (Reid and Stafford Smith 2000).”

This is consistent with staff’s on-the-ground observations, and both staff and the CMS noted an overall low mistletoe infection rate. Regarding the primary cause of decline of mesquite (Crampton et al. 2006):

> “The primary natural factor influencing leguminous [mesquite] tree survival appears to be water supply...Honey mesquite mortality increases with increasing distance from the water table (Stromberg et al. 1992). Although mesquite roots have been excavated at depths as great as 60 meters (Phillips 1963), this is the exception rather than the rule. In general, it becomes increasingly difficult for mesquite to survive once the water table falls below 15 meters (Judd et al. 1971).”

Groundwater pumping and water level declines are documented to have caused the decline or death of mesquite in many areas of the southwest (Sawyer et al. 2009; Judd et al. 1971; Webb & Leake 2006; Stromberg pers. comm.; Keeler-Wolf pers. comm.). “Similar effects are seen throughout the species range in California and Nevada” (Keeler-Wolf pers. comm. 2010). Keeler-Wolf (*ibid.*) has “observed mesquite and the effects of water drawdown [and noted] observation of dead and dying mesquite in several places in California, Nevada, and elsewhere....up and down the Mojave River from Hinkley to Camp Cady to Cronese Lakes.” Groundwater pumping is a serious threat in many locations and has led to the decline of numerous stands (Sawyer et al. 2009).” Stromberg (pers. comm.), Arizona State University, described documented examples of mesquite that died as a result of groundwater-pumping on the Gila River and Santa Cruz River.

The applicant cites a case study from literature of a mesquite that rooted to a depth of 190 feet, and implied that, based on this single case, that the mesquite roots would chase the decline of the water. Staff consulted a researcher from Arizona State University, and recognized expert in the impacts of groundwater pumping on phreatophytes (Stromberg pers. comm.):

> “The ability of mesquite roots to ‘track’ a declining water table unfortunately is not well studied. As the water table declines, the plant will have to invest more energy into root production and root maintenance and it is likely that its

> aboveground biomass will decrease. In general, there is a relationship between root to shoot ratios and plant water stress. For mesquite, specifically, there is a documented relationship between the degree of water stress a mesquite tree experiences and its above ground biomass (see Martinez and Lopez-Portillo 2003). Also note that increased drought stress can decrease the ability of a mesquite tree to survive other ecological stressors, such as damage by herbivores (see Martinez et al. 2009)."

The County of Inyo Water Department (INYO 2012b) recommended staff establish a typical rooting depth for mesquite on which to base its analysis and mitigation recommendations. Staff conducted an exhaustive literature review of the subject prior to publication of the PSA, and consulted recognized experts (Stromberg pers. comm.; Keeler-Wolf pers. comm.). In fact, there is no way to establish a typical rooting depth for mesquite on which to base critical groundwater management decisions, as, for example, Inyo County has been able to establish for groundwater-dependent meadows in the Owens Valley area.

There are many environmental factors affecting rooting depths: soil porosity and texture, temperature, soil water and oxygen content, and soil chemistry. Soil salinity is also an important factor in these settings. Examples in literature of mesquite rooting to great depths are exceptions (Stromberg pers. comm.). Honey mesquite's taproot commonly reaches depths of 40 feet (12 m) when subsurface water is available (Fisher et al. 1973). The example of a mesquite rooting to over 50 meters (160 ft) was a case study in which the roots of a mesquite followed a mine shaft. In areas where the soil is shallow, or where a distinct calcium carbonate layer is present, the taproot seldom extends more than 3 to 6 feet (1-2 m) (Heitschmidt et al 1988; Ansley et al. 1989; Steinberg 2001). From Stromberg (pers. comm.):

> "There is the one documented case of mesquite (*Prosopis juliflora*) rooting to a depth of 53 meters depth; this appears to be an atypically deep value, and is for a plant in a Sonoran desert upland setting (Phillips, 1963). Roots of [mesquite] generally are strongly dimorphic, with shallow lateral roots near the surface and deep tap roots (Virginia et al., 1976; Bleby et al., 2010). Along incised rivers in southern Arizona and New Mexico, roots of [velvet mesquite] have been observed at cutbanks at depths of at least 8 meters (Cannon, 1911), 9 meters (Zimmerman, 1969), and 12 m (Havard, 1894). Maximum rooting depths for [honey mesquite] include 9 meters and 15 meters for plants growing along an arroyo and playa lake edge, respectively (Silva et al., 1989) and 20 meters in a karst landscape (Bleby et al., 2010)."

The maximum tolerable water table decline is difficult to predict and variable depending on many environmental factors; however, the warning signs of impending changes in ecosystem processes may already be present in the stands most affected by the basin overdraft (i.e., stands closest to Pahrump). As described above, die-off is already occurring in the northernmost mesquite stand and there is a well-documented decline in water tables throughout the valley that parallels the drying of springs. Given the strong above-ground evidence that groundwater levels in the area may have already declined to levels low enough to cause die-back, combined with a documented decline in

groundwater levels, the stands near the northern end of the project may well be at or near the limits of their tolerance.

Staff agrees that mesquite can withstand inter-annual fluctuations in groundwater level. The question is whether the stands can take an additional and sustained lowering of the water table through all seasons (not just the dry season) that extends 30 years or more.

Fault Zones as Hydraulic Barriers

The applicant posits that the position of the project west of the fault zone, "combined with studies conducted by Buqo in 2006 indicate that the hydraulic gradient in the Pahrump Valley Fault Zone [state line fault zone] was found to be lower relative to the overall gradient of the valley. This indicates that the fault zone may act as a hydraulic flow barrier, which could isolate impacts to the greater Pahrump Valley aquifer from onsite pumping. If the groundwater basin in the project area is indeed disconnected from the larger basin, then impacts from site pumping may not extend out to areas of greater groundwater production to the north." The applicant adds "Because the discontinuity cannot be demonstrated, however, this analysis assumes that local drawdown may have regional impacts."

Staff concurs; faults have hydraulic properties that result in decreased cross-fault flow and enhanced flow parallel to the fault by juxtaposing geologic strata of contrasting permeability, resulting in an impediment to groundwater flow (Belcher pers. comm. 2012; Belcher & Sweetkind 2010). However, because this fault juxtaposes carbonate basement rock against carbonate rock, it may present only a partial barrier (*ibid.*). More importantly, no studies have been conducted to confirm the assertion that a barrier is present and protective. A synoptic set of monitoring wells on both sides of the fault would be required to assess the hydraulic connection across the fault (Comartin 2010; Belcher pers. comm.).

Ecological Consequences

When groundwater is maintained within the root zone, management decisions can be made that do not result in loss of cover or adverse impacts to dependent vegetation. However, lowering the local water table from groundwater pumping has been demonstrated to cause die-off and habitat conversions where pumping causes water levels to drop below the effective rooting depth (Manning 2006, 2007, 2009, and others). Stromberg (1996) noted that "groundwater declines equal to or less than one meter have resulted in loss of canopy vigor, declines in radial growth and shoot increment, and tree death" in cottonwood-willow forests. "Velvet mesquite, for example, is a deep-rooted species that grows over a wide range of groundwater depths, but that varies in height, foliage area, leaf size, and xylem [stem] water potential as groundwater declines." Stromberg also describes documented examples of loss of biodiversity, increases in invasive weeds, decreases in cover, and other ecosystem impacts. Other organisms dependent on or associated with these groundwater-dependent plant species would also be affected. The complex below-ground systems of bacteria, algae, and fungi, which provide many valuable ecosystems services (e.g. breakdown of organic matter, nitrogen fixation, carbon storage, and recycling of nutrients are also destroyed or adversely affected when water tables are lowered (Kimsey pers. comm. 2012; Manning 2009).

Impacts to these important biological resources are potentially significant even if the mesquite habitats do not ultimately die as a result of the project. Ultimately, if pumping causes a sustained lowering of the water table below the effective rooting depth of the predominant species, it could set off a cascade of impacts to other shallower-rooted species, as well as dependent wildlife.

Impacts observed in the northernmost mesquite stands presumed (based on documented groundwater declines) to be declining as a result of groundwater drawdown, include a reduction in mesquite cover combined with an increase in cover by weedy annual grasses. As an example, in mesquite stands near an agricultural well in Chuckwalla Valley, staff observed a near complete die-off of the shallower-rooted facultative phreatophyte four-wing saltbush and an increase in cover of Russian thistle in stands, even where the deeper-rooted mesquite was not affected.

Loss of the mesquite associated with the coppice dunes could leave dunes vulnerable to deflation (USACE 2012; Brady pers. comm.) if the plants that anchor or stabilize the dunes die.

Animals, including mammals, reptiles, birds, and invertebrates that require certain plant species or a certain vegetation structure may no longer find suitable food, cover, or nesting habitat if the habitat structure of the mesquite habitats is affected or there are die-offs. For example, ladderback woodpeckers, Lucy's warblers and ash-throated flycatchers can only nest in tree trunks sufficiently large to hold nest cavities, (Crampton et al 2006); drought-induced stunting or loss of the taller mesquite along the washes east of the site and at springs would diminish or eliminate the value of the mesquite for some avian species. Decreases in fruit production can affect many common and special-status species. Local extirpations, if they occur, are compounded if the displaced animal or affected plant species is an important food source for another animal.

Cumulative Concerns

The total dependence of the community of Pahrump on the basin’s groundwater resources, and the potential for significant cumulative effects from another solar thermal project near Stump Spring (the BrightSource Energy Sandy Valley project), is another serious concern. A detailed analysis of the potential cumulative groundwater drawdown is provided in the “Water Supply” section of the FSA, and in the “Cumulative Impacts” subsection of this Biological Resources section.

Over 10,000 pumping wells are located in the basin. Groundwater pumping in this already significantly over-appropriated basin has placed these valuable habitats in direct competition for scarce water supplies. Compounding the effects of groundwater pumping, the indirect impacts of salt cedar invasion, fragmentation, and fire from urban and agricultural development have also taken their toll on the ecological health of the basin’s mesquite woodlands, mesquite dune scrubs, and area springs. Additional demands on groundwater resources from renewable energy projects and urban expansion may threaten the continued survival of mesquite in much of their range in southern Nevada (Crampton et al. 2006) and California (Sawyer et al. 2009). Water-stressed mesquite may also be a more common scenario under climate change,

accentuated by the higher water demands of a growing population (Crampton et al. 2006).

Discussion of Impacts and Mitigation

Project-related groundwater pumping may impact sensitive and biologically significant groundwater-dependent ecosystems located within the cone of depression identified by staff in their analysis of recent pump test data (see **Water Supply Figures 19** and **20**), including mesquite habitats , seasonal seeps and springs, and an Area of Critical Environmental Concern (ACEC). If project-related groundwater pumping in the vicinity of the groundwater-dependent ecosystems described above causes the water table to decline below the level of effective rooting, the impacts would be significant, and could occur at an ecosystem scale. The potential ecosystem-scale consequences of these impacts are discussed above.

The applicant argues that the project will have no offsite groundwater drawdown, based on the results of its pump test. Water Resources staff has argued the applicant has misinterpreted the pump test results and presents a worst case scenario. Several parties, including BLM California, BLM Nevada, Inyo County Water Department, and The Nature Conservancy agree with staff's conclusion that the applicant has misinterpreted the pump test data. The Inyo County Water Department hydrologist commented on the inadequacy of the necessarily simple hydrologic analytical models used by the applicant and staff

> "...do not provide a single, uniquely correct interpretation of the aquifer system...." and "...extrapolating the results from a test that spanned a few days into an assessment of impacts over the life of the project is inherently uncertain." (INYO 2012b) "Additional testing for a week or month will not eliminate this uncertainty, so the CEC is faced with developing its final staff assessment based on inconclusive data. A high level of hydrogeologic uncertainty is not unique to this project; rather, it is typical when making hydrogeologic predictions...." (*ibid*.)

The Inyo County Water Department supports staff's argument that long-term monitoring and adaptive management are necessary and reasonable:

> "For HHSEGS, because the assessment of impacts is inconclusive, the most viable way for the project to proceed is to require monitoring that will allow tracking of impacts to the groundwater system before they develop during the life of the project, so that mitigation can be implemented if it becomes apparent that groundwater dependent resources will be impacted. This approach is reasonable and feasible for HHSEGS."

Inyo County Water Department proposes -- with consensus from all other interested parties -- that observations of water level change can be used to anticipate adverse impacts and manage pumping to avoid them, and supports staff's recommendation that if a conservative threshold is exceeded, that pumping cease until the project can demonstrate the drawdown is not the result of project-related pumping.
The exceptional ecological values of Stump Spring, and the habitat values of other nearby desert springs and mesquite habitats, are discussed under the Existing

Conditions subsection of this analysis. These resources have been identified as conservation priorities in the BLM document *Mesquite-Acacia Conservation Management Strategy*, and adopted by the Clark County Multiple Species Habitat Conservation Plan (BLM 2012a, Crampton et al. 2006).

Given the ecological significance of the resources at-risk, and evidence that some stands may already be at or near the limits of their tolerance, even seemingly minor drawdowns could have significant impacts. Even if stands persisted, their habitat function and value could be seriously affected. Their ability to support special-status species may be diminished, and in a worse-case scenario there could be local extirpations.

Although there is potential for the state line fault zone to buffer the effects of project pumping, the data is inconclusive, and cannot be demonstrated without hydraulic evidence obtained from wells placed on either side of the fault, and across the fault. Given the cumulative concerns described above, combined with the limited quantity and reliability of the data, and the ecological significance and sensitivity of the resources at risk, a greater factor of safety must be applied. Without the safety net of a long-term (30 year), well-designed and peer-reviewed monitoring plan, protection of the resources cannot be assured. Without monitoring, and a plan for remedial action to restore groundwater levels, the impacts would be significant and immitigable.

Unanimous Support for Long-term Monitoring and Adaptive Measures to Protect Groundwater-dependent Ecosystems

There was unanimous concern among the commenting resource agencies and land managers about the impacts of project-related groundwater pumping to these important resources, support for long-term groundwater monitoring, and for a provision to “stop, reduce, or modify” project pumping if monitoring detects a drawdown in the vicinity of the resources (BLM 2012a; BLM 2012b; INYO 2012a; INYO 2012b; TNC 2012a; ARM 2012b; Custis pers. comm.).

Staff consulted 16 agency hydrologists and biologists and recognized experts in the development of the groundwater-dependent vegetation monitoring conditions. Experts in vegetation ecology, environmental statistics and the development of long-term vegetation monitoring plans, impacts of groundwater pumping on dependent ecosystems were consulted, as well as staff’s own hydrologists and geologists. A complete list is provided under “Personal Communications” following the list of references at the end of this FSA section. Similar conditions were adopted for another Energy Commission-licensed project (Palen Solar Power Project).

Patten, Rouse & Stromberg (2007) suggest that on-site monitoring is critical for detecting impacts, and long-term vegetation data are capable of providing early warning signs of impending changes in ecosystem processes (Patten et al. 2007). Combined with the data on groundwater and climate, sampling of plant communities can provide sensitive metrics for assessing ecological changes over time.

Condition of Certification **BIO-23** provides detailed specifications and performance standards for the development of a peer-reviewed vegetation monitoring plan. The vegetation monitoring plan would be used in conjunction with the groundwater

monitoring plan proposed by **Water Resources** staff in **WATER SUPPLY-4.**To ensure that the selection of adaptive measures was not deferred until a later time, Condition of Certification **BIO-23** outlines the remedial action that would be taken once a project-related adverse effect is detected. If water levels in either of the Power Block 1 or Power Block 2 onsite monitoring wells identify a projected 0.5 foot or greater water level decline at the property boundary due to project pumping during construction or operation, the project owner is required to stop pumping until or unless the project owner can provide evidence that demonstrates, subject to review and approval by the Compliance Manager and interested agencies, that: 1) the pumping can be reduced or modified to maintain groundwater levels above the 0.5 ft. drawdown threshold at the project boundary; or 2) the drawdown trigger was exceeded due to factors other than the project pumping and the project did not contribute to the drawdown; or 3) through vegetation monitoring and soil coring described in **BIO-23** and predictive water level trend analysis **WATER SUPPLY-4**, that a greater groundwater drawdown will not result in significant adverse impacts to the groundwater-dependent vegetation.

Agency and Others' Concern about Sensitivity of Vegetation Triggers and Multi-Parameter Approach for Adaptive Action and Revisions to the Vegetation Monitoring Condition of Certification

BLM, Inyo County, The Nature Conservancy, and Amargosa Conservancy expressed concern in their PSA comments about the sensitivity of the "vegetation triggers" or field indicators prescribed in **BIO-23** to provide adequately early warning of impending ecosystem changes (BLM 2012b; INYO 2012b; TNC 2012a; ARM 2012b). Specifically, there were objections to the ambiguity and/or adequacy of the "20 percent decline in vigor" of the mesquite for triggering adaptive action.

Staff agrees it was not clear that the 20 percent threshold was a measure of individual plant vigor, rather than tree mortality. Characteristic measures of plant vigor, or response to drought stress, include decreases in biomass, crown density, and twig die-back. The 20 percent threshold was developed in consultation with vegetation monitoring specialist Willoughby (pers. comm.) as the "minimum detectable change" in crown density or biomass. Stromberg (pers. comm.) agreed that a 20 percent decline in biomass or crown density is a good threshold, and a decline in vigor from which the mesquite could easily recover, *assuming* immediate action was taken to halt pumping and restore the groundwater levels. It is possible or even likely that groundwater elevations would not recover immediately, and may take as long to recover as it did to drawdown to the threshold level, based on consultation with Water Resources staff, and other hydrogeologists (Custis pers. comm.; INYO 2012b). For this reason, and to address BLM and others concerns about the sensitivity of the trigger, staff conducted a literature review and consulted Stromberg (pers. comm.) and other vegetation ecologists with The Nature Conservancy (Parker pers. comm.) and BLM (Edwards pers. comm.) to determine if more sensitive measures were available that could provide accurate, reliable, and efficient field measures of mesquite drought stress. Regarding the earliest warning signs of drought stress in mesquite, Stromberg (pers. comm.) responded

> "There will be declines in stem water potential, transpiration rate, and amount of carbon fixed (via photosynthesis) in the early stages....Objective techniques for

measuring drought stress include measurements of 1) stem water potential (technically xylem water potential); 2) gas exchange rate; 3) transpiration rate."

Stromberg (pers. comm.) and Edwards (pers. comm.) agree that eco-physiological parameters could be developed for these measurements of drought stress that could be used to develop thresholds for adaptive action after baseline measurements were taken at the site to establish the seasonal variations, and variability between stands, or plots.

Condition of Certification **BIO-23** (Groundwater-dependent Vegetation Monitoring Plan) has been revised to base adaptive action on these more sensitive and earlier warning signs of stress. **BIO-23** requires the development of field-calibrated thresholds from baseline data to establish the range of seasonal and stand variability, and to factor the variability into the thresholds. Although the numeric thresholds are not specified at this time, **BIO-23** provides performance standards for the thresholds. It also provides detailed guidelines for the content of the monitoring plan, and requires approval of the plan by the Compliance Manager in consultation with the BLM Nevada and BLM California state leads for Soil, Water, Air and Riparian Programs, the BLM Southern Nevada District and BLM Barstow District hydrologists and botanists, and the Inyo County Water Department.

Hydrologists and vegetation ecologists representing BLM, The Nature Conservancy, Inyo County Water Department, and Amargosa Conservancy commented on Condition of Certification **BIO-24**, which was originally presented in the PSA, and has since been incorporated into **BIO-23** in this FSA. The above groups expressed concern that under the three-parameter threshold in **BIO-23** and **BIO-24** of the PSA (PSA pp. 4.2-235-242), adaptive action cannot be taken until all three parameters are met ("groundwater drawdown and vegetation decline that cannot be correlated solely to regional drought condition"). BLM and The Nature Conservancy commented that this places an unfairly high burden of proof on the resource that could "result in adverse and irreversible impacts to the vegetation" (BLM 2012b), and a "difficult test that, if it were required to invoked pumping limitations, protracted litigation would almost certainly ensue." (TNC 2012a). These entities recommended a more rigorous and protective threshold that requires pumping be curtailed or stopped if groundwater levels decline more than 0.5 feet at the project boundary. Pumping would not resume unless the project can demonstrate through vegetation monitoring data –based on the more sensitive and field-calibrated measures described above and/or soil coring to establish rooting depths—that the project pumping is not causing an adverse effect on the groundwater-dependent resources. Given that the specific numeric thresholds for the more sensitive (and reliable and objective) measurements of drought stress require field calibration from baseline data, staff agrees with this simpler, single-parameter approach to the threshold, and has revised **BIO-23** and **BIO-24** accordingly, blending the two conditions into one final condition, **BIO-23**. The field measurements of drought-stress would—in combination with corresponding drawdown – be used to establish whether or not pumping could resume, and at what level; however, the requirement to "stop, reduce, or modify pumping" would be triggered solely by the 0.5 foot drawdown at the project boundary.

The County of Inyo Water Department has a long history of requiring long-term groundwater monitoring for pumping project in Owens Valley, and considerable

experience in the development of related groundwater monitoring plans and conditions of approval. Staff accepted many of the Inyo County Water Department's recommended changes to **BIO-23** and **BIO-24,** resulting in one condition, **BIO-23**.

The 0.5-foot Drawdown Trigger Can be Detected with a High Level of Confidence

The applicant has argued that the groundwater monitoring conditions require "...a precision that is not possible...in an area where the water table can vary by several feet annually due to normal variations in seasonal rainfall." Water Resources staff responded to the same comment at the June 14, 2012, public workshop, and in the Water Supply sections of the PSA and FSA. Water Resources staff noted that water levels on the project side of the state line fault are very stable, and concluded that because water levels on the project site are stable (unlike offsite wells in other parts of the basin), the 0.5 foot drawdown threshold can be detected with nearly 100 percent confidence.

Groundwater Monitoring is Not Unprecedented

Applicant's comments argue that groundwater monitoring of the kind proposed by staff (as well as many of the commenting agencies and entities) is unprecedented. But this is incorrect. In fact, a similar condition was imposed on another Energy Commission-licensed project (Palen Solar Power Project). Moreover, it is now common practice to require monitoring, management, and mitigation plans for groundwater impacts; so common that the term "3M plans" is used by practitioners (Harrington pers. comm.; Custis pers. comm.). As an example, the monitoring plan for the Coso Hay Ranch Water Extraction Project in Inyo County requires monthly monitoring at 10 well locations for the life of the 30-year project, identifies triggers at each well, some as low as 0.2 feet, and specifies that pumping must *stop, change, or reduce pumping*:

> "Requiring that observed drawdown values [at intervening monitoring wells],over time be kept below these defined trigger levels would provide an early warning system, allowing for the system operations to *change, to reduce or stop pumping* before maximum acceptable drawdown levels propagated down the valley to Little Lake [emphasis added]."

Inyo County's agreement with the Los Angeles Department of Water and Power has provisions for monitoring, management and control of pumping, mitigation of impacts from pumping for water management and export activities in Owens Valley (Harrington pers. comm.). The primary goals of the agreement are to avoid causing significant decreases in the live cover of groundwater-dependent vegetation, significant changes in vegetation type, groundwater mining and other significant adverse effects. Extensive monitoring began in 1983 to determine the relationship between groundwater pumping and its impact on native vegetation, including the responses of managing pumping to minimize impacts. In contrast, the monitoring for the HHSEGS project requires relatively simple vegetation monitoring that is required only twice annually, at an appropriately small number of plots, and can be conducted by the Designated Biologist (under the supervision or training of a qualified botanist).

The projects described above use considerably more water, but it is the project's *very close proximity* to sensitive and ecologically significant resources that are at the crux of

staff's concern. The 1) close proximity (and thus potential for impacts), combined with: 2) significant cumulative concerns from the proposed Sandy Valley project; 3) limited quantity and reliability of the data; 4) hydrogeologic complexity of the area; and 5) the identification of these resources as conservation priorities justify staff's concern. A conservative approach must be applied that combines long-term groundwater elevation monitoring and monitoring the health of the mesquite, with triggers for adaptive action if impending impacts are detected. This approach has been generally supported by Inyo County (Inyo 2012b) and BLM Nevada and California (BLM 2012a; BLM 2012b), and finds support in many additional scoping comments and PSA comments.

The applicant has argued that the monitoring condition would make the project "un-financeable and un-buildable". However, an almost identical condition was imposed on another Energy Commission-licensed project (Palen Solar Power Project) – a project that was approved for purchase by BrightSource Energy, Inc., in June 2012 (BrightSource Energy, Inc 2012). Note that the remedial action described in **WATER SUPPLY-4** (Groundwater Monitoring) and **BIO-23** allows the project the option of *reducing* water consumption to sustainable levels, for example through water conservation measures. The conditions also provide the project with an option to *modify* pumping, for example, through the installation of new wells located farther from the sensitive resources, or through timing and rotation if monitoring shows that resources adjacent to one of the wells can sustain a greater drawdown than resources affected by the second or third pumping wells (Froend pers. comm.). Staff consulted researchers and manufacturers of waterless mirror-washing technologies, some of which are already available for photovoltaic projects and solar trough projects (Hofman, Baldini, Schik, Hemadrasa, and Mishra pers. comm.).

With the options described above, and examples of other projects requiring a similar conditions that were licensed and built, staff believes the adaptive action described in **WATER SUPPLY-4** and **BIO-23**) is *reasonable and feasible*, an opinion shared by hydrologists representing Inyo County, CDFG, and BLM.

Alternatives to Vegetation Monitoring

Staff considered eliminating the vegetation monitoring component (**BIO-23**) and basing the adaptive action solely on the 0.5 ft. groundwater drawdown threshold at the project boundary (**WATER SUPPLY-4**). Staff concluded that the vegetation monitoring was necessary to determine the drawdown level at which the mesquite begin to exhibit signs of drought stress, a level staff expects to vary from one area to the next due to geologic and hydrogeologic complexity of the area, and variations in the amount of background decline (present or historical groundwater drawdown). If the requirement to "stop, reduce, or modify pumping" is triggered by the 0.5 ft drawdown at the project boundary, the project could not resume pumping unless it can establish evidence of a sustainable level of pumping.

Condition of Certification **BIO-23** includes a provision for using soil coring to establish the maximum effective rooting depths of the groundwater-dependent plant species in the project vicinity (mesquite and four-wing saltbush). Stromberg (pers. comm.) agreed that a soil core would "provide valuable information on the distribution of the root system." The BLM Southern Nevada District hydrologist indicated that a proposal to

collect soil cores on BLM land for establishing thresholds for protecting resources may qualify for a categorical exemption (Poff pers. comm.). The amount of drawdown, relative to the maximum rooting depth, that the plants can sustain before manifesting signs of stress is unknown, however, and would require corresponding measurements of drought stress to establish a safe drawdown threshold.

Mitigation Considered But Rejected

A full range of mitigation options was considered. Mitigation in the form of offsite plantings and transplantation was considered but rejected. This type of mitigation has a long, documented history of failure. A study by CDFG (Fiedler 1991) found that, even under optimum conditions, ex-situ mitigation plantings were not effective in 85 percent of cases studied. Recent studies are even more discouraging. Mitigation with a high potential for failure would not be further considered. Where the hydrology is intact, riparian and wetland plantings have a higher potential for success than upland habitats in an arid region; however, groundwater elevations are declining throughout this basin and plantings may not be self-sustaining over the long-term. Mitigation through offsite restoration is risky for many of the same reasons, and large-scale salt cedar removal projects come with their own set of biological impacts (Shafroth et al. 2010) that must be analyzed and are likely to be significant, largely due to potential impacts to special-status bird species and other nesting birds.

Nor does offsite mitigation replace the complexity of plants and animals, including special-status species that make up the mesquite dune or mesquite woodland ecosystem, or replace the ecological processes essential to maintain these complex systems.

Compensatory mitigation through acquisition and preservation of offsite mesquite habitats was considered but rejected for a number of reasons:

1. Mesquite habitats are rare natural communities (Sawyer et al. 2009; Crampton et al. 2006; NNHP 2010b), and may have additional significance if mesquite clones are of ancient origin; acquisition and preservation would still result in a significant net loss and a residual cumulative effect not alleviated by putting a conservation easement on another stand;

2. Desert springs may be one of the rarest and most endangered habitats. Many have already stopped flowing and those that remain may be threatened by the basin imbalance. Desert springs have exceptional significance and importance to wildlife; they are the only natural source of water for wildlife in the desert, they often support rare and endemic species, and they are disappearing region-wide at an alarming rate due to groundwater pumping;

3. Other mesquite habitats in the basin are also threatened or degraded, and may not be sustainable. Staff considered the value of placing easements on mesquite stands with a higher value (at least to avian species) such as Stewart valley; however, few other stands of high quality occur in the basin, and they are already affected or by past and present groundwater declines, firewood cutting, the edge effects of urbanization, and expected continuing groundwater declines in this over-appropriated basin; thus they may not be sustainable over the long-term;

4. Stump Spring and the habitat surrounding the ACEC offer exceptional habitat values due in part to the presence of seasonal open water habitat. The presence of other active seeps and springs east of the project (Poff 2012) significantly increases the value of the habitats outside the ACEC to wildlife;

5. BLM is currently designing a new Area of Critical Environmental Concern (ACEC) to protect the mesquite and other resources just east of the project boundary and north of the existing Stump Spring ACEC (Poff, pers. comm);

6. Placing an easement on another mesquite stand does not mitigate for impacts to special-status species likely to use Stump Spring and other seeps and springs in the area, such as special-status bats, migratory birds, and special-status birds;

7. Allowing a net loss of mesquite habitat is in conflict with the goals and objectives for mesquite in Clark County MSHCP Mesquite Conservation Management Strategy (CMS), particularly for identified high priority conservation sites, which include Stump Springs and the Pahrump Valley metapatch (Crampton et al. 2006). The management goals include “maintaining woodlands at their current extent and restoring and enhancing remaining stands at year 2000 and higher levels”. The CMS objectives include “sustaining surface and groundwater levels at current or higher levels”. The CMS concludes “either all woodlands existing in 2000, including those on private lands, must be protected and restored, or the area and/or quality of remaining woodlands must be enhanced to compensate for a loss of woodlands in a way that allows the same numbers of individual plants and animals to exist with the same probabilities of persistence [in fewer but enhanced woodlands].” The CMS adds “it is not clear whether the latter option [enhancement] is feasible. Thus, the CMS emphasizes preserving all current woodlands, including private ones.”

Impacts to Regional Groundwater-Dependent Resources

BLM, The Nature Conservancy, Amargosa Conservancy, and others have expressed concern that pumping from the Pahrump Valley groundwater basin, combined with the cumulative effects of other past, present, and foreseeable future pumping, may cause impacts to the Amargosa Wild and Scenic River system, the Amargosa River ACEC, other mesquite woodlands in Pahrump Valley, Stump Springs ACEC, and other ecologically significant groundwater-dependent resources, including state and federal listed species. BLM and others have stressed the “outstanding remarkable values” of the federally-designated Amargosa Wild and Scenic River, which is wholly supported by groundwater in the form of seeps and springs. The project would pump from the Pahrump Valley basin-fill aquifer, which is included within and hydrologically connected to the Death Valley Regional Groundwater Flow System (DVRFS))Belcher & Sweetkind 2010).

Approximately 35 state and/or federal-listed species and other species exist in the Amargosa River and Ash Meadows regions that are found nowhere else globally. The Ash Meadows National Wildlife Refuge, one of several areas of exceptional biological importance also sustained by the regional groundwater basin, has the greatest concentration of rare and endemic species in the United States and the second

greatest in all of North America (USFWS 2012)[6] including several endemic pupfish species. Deacon (2007) demonstrated that some pupfish species may be highly sensitive to even minor changes in the groundwater.

In addition to the 35 state or federal-listed species, 22 other special-status species are known to depend on the areas groundwater system through seeps and springs, spring pools, the Amargosa River and its tributaries, and areas of shallow groundwater. The list does not include the abundance of unique, rare and sensitive groundwater-dependent natural communities.

BLM and others have expressed concern that there is insufficient information on the complex hydrogeology of the basin for the applicant to conclude no indirect or cumulative effect to the Amargosa Wild and Scenic River and other groundwater-dependent resources from project pumping. The applicant proposes that the project pumping would not affect these resources indirectly or cumulatively because of evidence they believe demonstrates that there is no hydraulic communication between the shallow aquifer (from which they will pump 140 afy) and the deeper carbonate aquifer.

The Water Supply analysis concluded that given the lack of evidence for a hydraulic connection, the relatively large intervening distance (about 20 miles), and uncertainty in potential flow barriers and permeability contrasts within the subsurface it would be speculative to conclude that project, pumping would adversely affect the Amargosa River. In the analysis, staff states there is no available data that identifies groundwater flow paths or confirms a hydraulic connection between the local basin-fill aquifer (the Pahrump Valley Groundwater Basin) and the Amargosa River, so the water consumed by project pumping may or may not be a source of inflow to the Amargosa River. Although staff concludes that a significant impact due to project pumping is unlikely, **WATER SUPPLY-1**, which requires an offset of project water use in the local basin-fill aquifer, would ensure there is likely no net overall change in subsurface outflow from the local aquifer that might affect the Amargosa River (See the “Water Supply” analysis of this FSA).

Impacts to Mesquite Dunes

The potential for impacts to dunes downwind of the project from obstruction of the wind-sand transport corridor by the project was considered because prevailing winds are from the northwest, and mesquite dune scrubs occur east and southeast of the project. Staff consulted two independent geologists with local expertise during a recent site visit (Brady & Vyverberg pers. comm. 2012). Their informal opinion (no report was prepared) is that the dunes developed along the Stateline Fault Zone as the Pleistocene lake retreated, and the exposed sands, or sands eroded from the sparsely vegetated hill slopes that developed under the new arid climate accumulated around mesquite associated with the fault-induced springs (Brady pers. comm. 2012). Indicators that the dunes are no longer active (accreting) include: 1) there is no apparent source area (dunes or other sand source) upwind of the dunes; 2) the leeward sides of the dunes are completely stabilized; 3) there is no loose sand in the stream channels around the

[6] USFWS. 2012. *Ash Meadows National Wildlife Refuge*. U.S. Fish and Wildlife Service.

dunes, and 4) the windward side is wind scoured and not accreting. The lee sides are also eroded but well-vegetated, and there is no sand there which, in an active system, would supply the next dune down wind. The conclusion was that the dunes would not occur where they are under the present climate; there is no source for the sand and no transport corridor to supply sand to the dunes. For these reasons, the mesquite dune scrub downwind of the project would not be affected by any obstructions upwind. Impacts to the dunes could occur if project-related groundwater pumping caused groundwater levels to drop below the level of effective rooting and the mesquite died, leaving dunes vulnerable to deflation (USACE 2012a; Brady pers. comm.); impacts to the coppice dunes and other groundwater-dependent ecosystems are described in the previous subsection of this FSA section.

Construction Impacts to Desert Washes

Jurisdictional Waters of the State and Waters of the U.S.

A total of 23.82 acres of jurisdictional Waters of the State, including single-thread channel and braided ephemeral streams, were delineated by the applicant on the proposed project site (URS 2012b). Of these 23.21 acres, 0.42 acres are also Waters of the United States. Six of the features are also depicted as blue line features on the U.S. Geological Survey (USGS) topographic maps. During an August 2012 field verification of the applicant's state waters delineation (URS 2012b), an additional nine ephemeral streams were identified within the project boundary. Features mapped as "nonjurisdictional waters" in the preliminary State waters delineation report (i.e., pooling areas, moist pooling areas, alkaline soils areas, sheet flow areas) were confirmed by the Energy Commission and CDFG as not constituting waters of the State. The CEC and CDFG conducted a site visit to verify the state waters delineation in August 2012. The CEC provided the applicant with data representing 9 additional drainages, adding an additional 3.13 acres of jurisdictional waters of the state within the project boundary. With the addition of the 3.13 acres by the CEC, the areal extent of State jurisdictional waters within the HHSEGS project boundary totals 23.21 acres (CH2 2012mm**)**.

Impacts to Ephemeral Streams

The applicant proposes to minimize impacts to desert washes by allowing them to pass through the site, rather than diverting them around the site in artificially constructed channels. This analysis recognizes that at least a portion of the hydrologic and geomorphic functions would be maintained, and mitigation ratios were reduced accordingly. However, staff and the CDFG maintain that the wildlife habitat functions and values of the streams would be eliminated or significantly diminished by a combination of partial site grading, road construction and maintenance, perimeter exclusion fencing, dust and weed control, vegetation mowing, mirror-washing, glare and lighting, human disturbance, and potential erosion and sedimentation of streams during storm events as the storm flows navigate around the mirror pylons and other obstructions. The functions and values of the 0.4 acres of streams delineated just upstream of the project's eastern boundary, within California, could be indirectly impacted from construction of the underground and overhead transmission line. Indirect effects to the upstream portion of the state waters include: human disturbance, glare, lighting, road maintenance, and potential headcutting (erosion) from trenching through the washes.

Importance of Ephemeral Desert Washes to Wildlife

The importance of ephemeral streams to wildlife in the desert is undisputed; it is well-documented in the literature, the sum of which represents decades of observations and surveys (Levick et al. 2008; Baxter 1988; Kirkpatrick et al. 2007; Kubick & Remsen 1977; Tomoff 1977; Daniels & Boyd 1979, and others). Loss of the habitat function and values of all or a significant portion of all streams across a 3,277-acre site is a substantial adverse effect on state jurisdictional waters. It conflicts with state LORS, and it is a significant impact.

Ephemeral and intermittent streams in the arid west provide important habitat for wildlife and are responsible for much of the biotic diversity (Levick et al. 2008). They have higher moisture content, and the topographic relief provides shade and cooler temperatures within the channel. In cases where the habitat is distinct in species composition, structure, or density, wash communities provide habitat values not available in the adjacent uplands. They provide movement corridors and seasonal access to water or moisture. Baxter (1988) noted that washes, because of their higher diversity plant communities, are probably important foraging locations for desert tortoise; in smaller washes, there is greater cover and diversity of spring annuals, providing important food sources. Researchers have noted the high diversity of herpetofauna in desert washes and many snakes and lizards preferentially use xeroriparian habitat because of its denser cover (*ibid.*). Kirkpatrick et al. (2007) noted that even dry, ephemeral washes have greater avian abundance and species richness than adjacent uplands. In a study of 66 plots on BLM lands in California, dry washes support 1.5 times more breeding species and twice as many wintering species as the more common desert scrub (Kubick & Remsen 1977; Tomoff 1977; Daniels & Boyd 1979, and others).

Staff's observations of the habitat functions and values provided by the washes on the project site, and observations of wildlife use of the features are consistent with the literature. During the state waters delineation field verification and other site visits, biologists from CDFG and staff noted the washes offer habitat functions and values distinct from the surrounding upland. For example, anywhere there are concentrations of water, the vegetation is denser and more robust, which in turn provides more shade, escape cover, more seed and other food sources, including more insects, which would in turn support more reptiles, etc. The washes also have greater plant species diversity; for example, germination of rattlesnake weed (*Chamaesyce albomarginata*), a preferred desert tortoise food, was abundant in the lower reaches of many channels, particularly at the terminus of the streams where soils remain saturated longer. Bunchgrasses (*Sporobolus airoides, Pleuraphis rigida*) are more abundant on some features. The terminus of these streams held water longer and thus provided sources of temporary pooling. Staff noted higher mammal density on the streams and their active floodplains, evidenced by greater bioturbation and more abundant coyote scat.

The applicant argues that CDFG's interpretation of Fish and Game Code (PSA pp. 4.2-44-45) is not consistent with the California Code of Regulations definition of "stream." The definition of a stream in Title 14, Section 1.72 of the California Code of Regulations (CCR) is not the definition used by Fish and Game Code (Section 1600 *et seq*.). The Section 1.72 definition was developed to address a specific sports fish issue that came before the Fish & Game Commission; while the definition does speak to periodic and

intermittent flow, Section 1.72 is limited to fish-bearing or aquatic life-bearing streams (Vyverberg pers. comm.).

Fish and Game Code Chapter 6, Fish and Wildlife Protection and Conservation, Section 1600 *et seq.* was enacted to provide for the conservation of fish *and* wildlife resources associated with stream ecosystems. The Fish and Game Code further defines fish and wildlife to include: "...*all wild animals, birds, plants, fish, amphibians, invertebrates, reptiles, and related ecological communities, including the habitat upon which they depend for continued viability."* (FGC Division 5, Chapter 1, section 45, and Division 2, Chapter 1, section 711.2(a), respectively)

Ephemeral Streams Not Excluded Under Fish and Game Code

The applicant's PSA comments assert that the washes on the project site have no value to wildlife because they are *narrow* or *ephemeral*. This assertion is not supported by the relevant literature. Moreover, it finds no support in law or the policies and practice of CDFG. For the purposes of implementing sections 1601 and 1603 of the Fish and Game Code, California Code of Regulations Title 14, section 720, requires submission to CDFG of general plans sufficient to indicate the nature of a project for construction by or on behalf of any person, governmental agency, state or local, and any public utility, of any project which will divert, obstruct or change the natural flow or bed of *any* river, stream or lake designated by the department, or will use material from the streambeds designated by the department, all rivers, streams, lakes, and streambeds in the State of California, including *all rivers, streams and streambeds which may have intermittent flows of water*, are hereby designated for such purpose. The term "*...intermittent flows...*" has long been interpreted by the courts and the Attorney General's office to include ephemeral flow (Vyverberg pers. comm.).

While Fish and Game Code sections 1600 *et seq.* do not include a definition for "stream", it has been the practice of the Lake and Streambed Alteration Program (LSA) to define a stream as: A body of water that flows perennially, intermittently, or ephemerally. Streams include a channel, banks, bed, and floodplains where present.

During the field verification of state waters, conducted after a 0.20-inch storm event, the smaller washes onsite contained water and/or evidence of recent inundation, and were expressed by a number of fresh fluvial indicators reflective of stream processes. Characteristic hydrology indicators, fluvial indicators and other geomorphic features used in staff's identification of state waters include: channel morphology; inundation or saturation; fresh deposition; ripples; changes in vegetation species composition, structure or density (relative to the adjacent creosote uplands); wrack; mud drapes; changes in sediment texture; sediment sorting; scour or shelving; and gravel ramps. The use of these indicators to delineate desert streams is well-documented in literature and agency guidance (USACE 2005; Lichvar & McColley 2008; Lichvar & Wakely 2004). Photos of a sampling of the stream features and indicators are provided in **Biological Resources Figure 3**.

All Desert Wash Vegetation Protected Under Fish and Game Code

Fish and wildlife resources are held in trust for the people of the State by and through the California Department of Fish and Game (FGC § 711.7). CDFG is responsible for

conserving, protecting, and managing fish, wildlife, native plants, and the habitat necessary for biologically sustainable populations of these species (Fish and Game Code Section 1802).

The importance of vegetation along streams to the function and values of the stream habitat is a matter of undisputed fact, supported by the body of scientific literature, and presumed by CDFG (Vyverberg pers. comm.). The applicant's argument that the vegetation is not linked to ecosystem function and the vegetation along the washes is not an integral part of the stream system is erroneous. Fish and Game Code links stream protection with the presence of fish, wildlife, *and their habitat.* Fish and Game Code Chapter 6, Fish and Wildlife Protection and Conservation, Section 1600 *et seq.* was enacted to provide for the conservation of fish *and* wildlife resources associated with stream ecosystems. The Fish and Game Code further defines fish and wildlife to include: "...*all wild animals, birds, plants, fish, amphibians, invertebrates, reptiles, and related ecological communities, including the habitat upon which they depend for continued viability."* (FGC Division 5, Chapter 1, section 45, and Division 2, Chapter 1, section 711.2(a), respectively).

The applicant also argues that the washes are "devoid of any plant life"; a statement with no basis in fact. The applicant's own delineation report discusses the vegetation along the washes and notes the distinctions in the species composition of the wash vegetation (URS 2012b). This is consistent with staff and CDFG's observations of the washes during numerous site visits, including the verification of the applicant's delineation of state waters, conducted approximately 7-10 days following a large storm event, and one day following a smaller (0.2 inch) storm event. As described above, staff found an abundance of germination of native annuals in the lower reaches of many washes, including the smallest washes; germination that was not apparent in the adjacent uplands. There were differences in the species composition of the wash vegetation on some (not all) washes; however, the vegetation is typically larger, more robust, and denser along the washes than in the adjacent uplands.

The regulations do not limit CDFG's protection or conservation authority to one specific type of vegetation community (e.g., woody riparian vegetation but not other wash communities). It has been the practice of the LSA Program to define "riparian" to mean: *areas adjacent to perennial, intermittent, and ephemeral streams, lakes, and estuarine-marine shorelines that are transitional between terrestrial and aquatic ecosystems and that are distinguished by gradients in biophysical conditions, ecological processes, and biota, areas through which surface and subsurface hydrology connect waterbodies with their adjacent uplands. Riparian areas include those portions of terrestrial ecosystems that significantly influence exchanges of energy and matter with aquatic ecosystems (i.e., a zone of influence)* (Vyverberg pers. comm.).

Conclusions and Discussion of Mitigation Regarding State Waters

It has been CDFG policy and practice to collect notification fees for Section 1600 *et seq.* jurisdictional "projects" in conjunction with Energy Commission (CEQA) projects (Condon pers. comm.). Applicants provide information regarding planned stream encroachments, water diversions (activities subject to Section 1600 *et seq.*) in a completed 1600 notification form, including fees, which facilitates the Energy Commission's and CDFG's review of the information. CDFG consults with the Energy

Commission with recommendations for minimization and mitigation measures. The Energy Commission includes those measures under the conditions of certification.

On October 10, 2012, the applicant submitted a
Notification of Lake or Streambed Alteration form and required fees, based on the revised delineation of state waters (CH2 2012mm). Fish and Game Code Section 1605 assumes implicitly that some form of mitigation will likely be part of any Lake and Streambed Alteration Agreement issued for a project. CDFGs no net loss policy for riparian/riverine habitat means that if a project results in a loss of one acre of stream then a minimum of two acres of compensatory stream mitigation are required to satisfy the no net loss goal (Vyverberg pers. comm.). In practice, compensatory mitigation is typically mitigated at a minimum mitigation-to-effect ratio of 3:1 for permanent effects and 1:1 for temporary effects.

The 2:1 mitigation ratio for impacts to desert washes proposed in Condition of Certification **BIO-22** (State Waters Compensatory Mitigation) is supported by CDFG (Branston pers. comm.). Although CDFG has received mitigation at a 3:1 ratio for impacts to desert washes, the regional office has agreed to a 2:1 ratio in recognition that at least some portion of the hydrologic and geomorphic function would be maintained (*Ibid.*). Staff and CDFG are united in their assessment that the impacts to habitat functions and values from perimeter exclusion fencing, partial site grading, road construction and maintenance, vegetation maintenance, spraying, noise, glare, and human disturbance are significant.

No compensatory mitigation is required for indirect impacts to streams in Nevada; however, there is a small (0.4 ac.) portion of the washes just east of the project that are located in California. The match of pre-and post-project flows will protect the soil and water resources downstream of the project but will not protect the upstream portion of the streams immediately adjacent to the project at the east boundary. Unless the trench fill and surface is fundamentally transparent to the stream, sediment can be expected to be removed preferentially from the trench area. Once a pipeline is exposed, the erosion will first be greatest on the downstream edge, eventually undermining the pipe, at which point headcutting is commonly initiated (Vyverberg pers. comm.). Headcutting and other erosion can be avoided or minimized through recommended erosion control measures.

With implementation of **BIO-22,** which includes the compensatory mitigation discussed above, impacts to state waters would be reduced to less-than-significant levels.

Introduction and Spread of Noxious Weeds and Other Invasive Plants

Noxious Weeds and Other Invasive Plants in the Project Area

Thirteen species of invasive weeds were documented in the project area, including two California Department of Food and Agriculture A-rated pests (Russian knapweed and halogeton). Project-related construction activities, vehicle and equipment use during operation and closure, mirror-washing, and sedimentation of streams from adjacent weedy areas are all expected to increase the spread of weeds into adjacent public and private lands from contaminated vehicle and equipment tires and undercarriages. Naturally disturbed habitats such as dunes and washes are particularly vulnerable to colonization by weeds. Many invasive non-native species are adapted to and promoted

by soil disturbance, and seeds are commonly transported on vehicles and by wind and water.

Vegetation management on the project site is expected to promote the proliferation of invasives, particularly cheat grass and red brome. Suppressing the surrounding taller native vegetation by mowing can give lower-growing weeds a competitive edge. The native perennial shrubs would be weakened and diminished in size, utilizing less moisture and nutrients, and increasing sunlight available to the weeds between shrubs. These in turn could spread into adjacent lands by contamination of vehicles and equipment, and along washes that pass through the site and drain into lower-lying areas. They can be spread along area roads and transmission corridors, which are common vectors for the spread of weeds.

New species not currently found in the project vicinity can be inadvertently introduced on the tires and undercarriages of workers vehicles commuting from southern Nevada (Inyo County 2012b).

County agricultural commissioners and have expressed concern about the spread of weeds, particularly the introduction of highly invasive species common in southern Nevada from which employees and contractors are likely to commute (Inyo County 2012b).

Ecological Consequences

About 42 percent of federally threatened or endangered species are listed because, among other factors, threats from invasive species (Brooks & Pyke 2002). They can directly affect wildlife and sensitive plants, or indirectly affect them by causing destructive changes in ecosystem processes. Accordingly, the management of invasive plants is now a top priority for land managers.

Invasive species out-compete native species for moisture and nutrients because of minimal water requirements, high germination potential and high seed production (Beatley 1966) and can become locally dominant, representing a serious threat to native desert ecosystems (Abella et al. 2008). In some areas of the western Mojave Desert, weeds now comprise 50 to 97 percent of the herbaceous plant material produced each spring. Showy wildflowers and special-status plants are swamped by monocultures of red brome and other annual weeds that contribute little or nothing to the food web (Pavlik 2008). Invasives have decreased the quality and quantity of plant foods available to desert tortoises and other herbivores and thereby affected their nutritional intake (Hazard et al. 2002; Nagy et al.1998).

Without consumption by wildlife, the dead material from the previous year accumulates to form a continuous, flammable canopy over thousands of acres in areas where fire was once infrequent for lack of fuel; areas that now burn frequently and with catastrophic consequences. Burned creosote and other native shrubs are typically replaced by short-lived perennials and non-native grasses (Brown & Minnich 1986), resulting in large-scale habitat conversions.

Weeds and the Increased Risk of Fire

Fire in desert ecosystems is well documented to cause catastrophic, landscape-scale ecosystem changes and impacts to the local species (Allen et al. 2011; Abella 2009; Belnap et al. 2005; Brooks & Esque 2002; Brooks et al. 2004; Brooks & Matchett 2006; Pavlik 2008; and others). The proliferation of non-native annual grasses and other weeds has dramatically increased the fuel load and frequency of fire in many desert ecosystems (Lovich & Bainbridge 1999). Unlike other ecosystems in California, fire was not an important part of the Mojave Desert ecosystems and most perennials are poorly adapted to even low-intensity fires; the animals that coevolved are not likely to respond favorably to fire either. Instead of occurring every 30 to 100 years as fires did historically in the region, wildfires are now recorded about every five years (*Ibid.*). Between 1980 and 1990 and average of 38 square miles was burned every year in the Mojave Desert. Because of the proliferation of annual grasses and other weeds, the fires sweep across the desert scrubs, incinerating the native species with no tolerance for the new form of disturbance. High temperatures also sterilize the soil of its beneficial fungi and kill desert tortoise and other wildlife. The effect is then magnified by the opportunistic colonization of newly burned areas by non-native annual grasses that in turn significantly delays or inhibits natural regeneration. This in turn results in permanent habitat conversations from diverse desert scrubs to weedy, flammable grasslands, or weed-infested scrubs that choke out special-status plants, offer little habitat value for wildlife and increase their risk of mortality under a new regime of frequent, catastrophic fires. Thus a relatively few invasive, productive, and unchecked non-native plants from other arid regions can create a cascade of habitat degradation (*ibid.*).

Wildfires are rare in the desert but the sharp increase in daily vehicle use would correspondingly increase the risk of ignition, particularly at pullouts and on partially vegetated unpaved roads where the exhaust system comes into contact with dry grass or other vegetation. Sparks generated by mowers, welders, grinders, and other equipment are also common ignition sources; fires caused by converter equipped vehicles can occur instantaneously once the vehicle has come to a stop on dry grass. The weeds that typically recolonize disturbed soils along roads and transmission corridors tend to increase the flammability of the roadside vegetation. The impacts to these poor-adapted desert communities and special-status wildlife, including desert tortoise, would be severe.

Conclusions and Discussion of Mitigation

Indirect effects from the introduction and spread of invasive weeds, and the concomitant increase in vegetation flammability and disruption of ecosystem processes are The applicant conducted thorough weed surveys and mapping as part of the pre-application studies. The applicant acknowledges the potential of the project to introduce and spread invasive weeds, and proposes to prepare a weed management plan (HHSEGS 2011a). Condition of Certification **BIO-18** provides guidelines and performance standards for the development of a weed plan. **BIO-18** requires the project owner to manage or contain weeds onsite for the life of the project to prevent their spread into adjacent offsite habitat, or to nearby communities via employees and contractors contaminated vehicles and equipment. **BIO-18** also includes measures for minimizing the accidental introduction or spread of weeds from contaminated vehicles and equipment entering the site during construction, operation, and closure. **BIO-18** requires the establishment of a washing station where construction vehicles and equipment would be inspected and

washed within an approved area or commercial facility prior to entry or exit to prevent the introduction and spread of invasive weeds.

Herbicides can help protect native vegetation from invasive weeds, but they can also have detrimental environmental impacts (CNPS 2008). Wildlife within and adjacent to the project can be directly or indirectly harmed by herbicide drift from sprayers, or residual soil toxicity from the use of some pre-emergent herbicides. Because of this, it is best to select a contact herbicide that has low toxicity and no residual toxicity (as many pre-emergent herbicides and soil fumigants have. The application method should be designed to minimize drift in or near sensitive species or native habitat offsite. Not all herbicides or application methods are equally appropriate, effective, or safe, given different site conditions and weed species. To avoid accidental harm to biological resources from weed management activities, **BIO-18** includes specifications for environmentally safe weed management, including: employing only manual methods of weed management within 100 feet of offsite biological resources; spraying only on windless days; using sprayer adapters that confine the width of the spray pattern and eliminate drift; and using rollers or brushes to apply herbicides rather than sprayers, and prohibiting the use of herbicides with residual soil toxicity.

BIO-8 and **BIO-18** contain additional measures for fire prevention to address the concomitant increased risk of fire from an increase in abundance and distribution of weeds, especially annual grasses such as red brome, cheat grass, and Mediterranean grass and potential ignition from mowing, welding, grinding, and increased vehicle

CUMULATIVE IMPACTS

“Cumulative” impacts refer to a proposed project’s incremental effect viewed over time together with other closely related past and present projects and projects in the reasonably foreseeable future whose impacts may compound or increase the incremental effect of the proposed project (Public Resources Code Section 21083; California Code of Regulations, Title 14, Sections 15064[h], 15065[c], 15130, and 15355). The following sections present a definition of the geographic extent within which cumulative impacts are analyzed and an analysis of the project’s potential incremental effects when combined with other past, present, and future projects.

The standard for a cumulative impacts analysis is defined by the use of the term "collectively significant" in the CEQA Guidelines section 15355; the analysis must assess the collective or combined effect of development. Cumulative impact assessments cannot conclude that contributions to cumulative impacts are not significant because the contributions represent a small percentage of the overall problem. Doing so could improperly omit facts relevant to an analysis of the collective effect that the project and other related projects would have upon biological resources. The result could be approval of projects based on an analysis that avoided evaluating the severity of impacts which, when taken in isolation appear insignificant, but when viewed together appear significant.

GEOGRAPHIC EXTENT

The geographic scope of staff's preliminary analysis of cumulative effects to special-status wildlife encompasses Pahrump Valley and makes a broad, regional evaluation of the impacts of reasonably foreseeable future projects that threaten special-status wildlife in the southern Amargosa Desert region, from the Las Vegas environs to Pahrump and Ash Meadows, and south to Sandy Valley. For some biological resources, a different geographic scope was warranted, such as the use of watershed boundaries to analyze cumulative effects to desert washes. The analysis of impacts from the inadvertent introduction and spread of invasive weeds considered species known to infest the communities from which most equipment and employee vehicle traffic will originate in southern Nevada. The analysis of the project's cumulative impacts to groundwater-dependent ecosystems makes a broader, regional evaluation of biological resources within the context or geographic scope of the Death Valley Regional Groundwater Flow System (DVRFS), which includes Pahrump Valley.

Because many species found in Pahrump Valley also extends into the state of Nevada, staff considered the potential for cumulative impacts from the Nevada side of the valley, or further, depending on the habitat needs and movement capability of each species, and the scope of the hydrological and vegetative cumulative impacts. Impacts to the Nevada portion of local population could indirectly affect the viability of the species' range in California; fragmentation of formerly large contiguous populations into smaller, isolated occurrences is generally believed to increase extinction risk, and reproduction needs depends on proximity to neighboring metapopulations. Ensuring connectivity between patches of suitable habitat and metapopulations helps to ensure species vigor and persistence.

EXISTING CUMULATIVE CONDITIONS

Over the past two hundred years, California's southern deserts have been subject to major human-induced changes that have threatened native plant and animal communities by habitat loss, fragmentation, and degradation. Some of the most conspicuous threats are those activities that have resulted in large scale habitat loss due to urbanization, agricultural uses, landfills, military operations, mining activities, as well as activities that fragment and degrade habitats such as roads, off-highway vehicle activity, recreational use, and grazing (Berry et al. 1996; Boarman and Sazaki 2006; Avery 1997; Jennings 1997). In addition, these development pressures facilitated the introduction of non-native plant species and increases in predators such as ravens, which contribute to population declines and range contractions for many special-status plant and animal species (Boarman 2002).

PROJECTS CONTRIBUTING TO CUMULATIVE EFFECTS TO BIOLOGICAL RESOURCES

Past and present projects in Pahrump Valley and adjacent areas in the northeastern Mojave Desert that have contributed to cumulative impacts to special-status species found in the project study area include:

- Conversion of natural communities for agriculture and groundwater pumping for irrigated agriculture (mostly cotton and alfalfa) during the last century, fragmenting and isolating populations; altering surface drainage patterns (dispersal pathways),

surface and groundwater hydrology, introducing agricultural weeds into the local ecosystem;

- Development of military reservations and military training activities;
- Past and present residential, commercial, and industrial development in the Pahrump environs, fragmenting populations, increasing the risk of fire, off road vehicles, and the spread of invasive plants;
- Construction of highways and other roads, modifying surface runoff patterns and acting as vectors for the spread of invasive plants;
- Transmission corridors, another common vector for weed spread; and
- BLM grazing allotments (sheep and cattle grazing), which also contributed to the spread of invasive weeds, particularly red brome and cheat grass.

Reasonably foreseeable future actions that are expected to contribute to cumulative impacts include:

- Pahrump Valley General Aviation Airport (650 acres on BLM lands);
- Element Power Solar project (2,560 acres on BLM lands);
- PSI Amargosa (Pacific Solar) (PV project on 1,700 acres of BLM lands);
- Amargosa Farm (4,350 acres of BLM lands);
- Silver State Solar Project (600 acres on BLM lands);
- Sandy Valley Solar Project (a 15,190-acre BrightSource Energy project on BLM lands);
- Table Mountain (8,549 acres on BLM lands);
- South Solar Ridge (8,549 acres on BLM lands);
- Southern Owens Valley Solar Ranch (3,100 acres on private lands);
- Lathrop Wells Solar (5,336 acres on BLM lands);
- Solar Express Transmission (122 miles on undetermined right of ways);
- St. Therese Mission (17.5 acres on private lands);
- Urban expansion in the Pahrump Valley and Sandy Valley areas;
- HHSEGS Hidden Hills Valley Electric Transmission Project (10 acres on BLM lands);
- Searchlight Wind Energy (18,949 acres on BLM and public lands);
- Stateline Solar Farm (2,114 acres on BLM lands in San Bernardino County); and
- Infrastructure development associated with urban expansion and renewable energy development

Approximately two percent of Inyo County is in private ownership. Large tracts of land are in public trust, held by the BLM. The BLM manages land for multiple uses. While maintenance of habitat features and functions is a priority, the BLM must allow uses that stand in direct conflict with many conservation goals. Mining claims, grazing leases,

renewable energy and other project development, and recreational uses may all be permittable under certain circumstances.

ANALYSIS OF CUMULATIVE EFFECTS TO BIOLOGICAL RESOURCES

This qualitative assessment of cumulative effects was based on a review of the project's onsite and offsite survey data, databases, literature, and consultation with regional experts. In addition to the combined effects of habitat loss and direct mortality, staff identified a range of indirect effects that combine with similar effects from other past, present, and foreseeable future project that must be factored into the cumulative analysis. This suite of indirect impacts to which the project would contribute includes: increase in ravens, coyotes, and other predators; introduction and spread of invasive weeds; the effects of groundwater pumping on springs and other dependent ecosystems; altered surface drainage patterns; fragmentation; increased risk of fire; erosion and sedimentation of streams; potential for the introduction and or spread of wildlife diseases; diminished habitat values from increased noise and lighting; exotic wildlife invasions; dust and air pollution; road kills; human disturbance; and other factors contributing to a significant cumulative effect.

Cumulative Impacts – Special-status Wildlife

Desert Tortoise

The geographic extent of the analysis of cumulative impacts to desert tortoise is the range of the Mojave Desert portion of the population with special emphasis on the Eastern Mojave Recovery Unit, as recognized by the USFWS (USFWS 2011a). The Mojave population's range encompasses the area north and west of the Colorado River in the Mojave and Sonoran/Colorado deserts in California, southern Nevada, southwestern Utah, and extreme northwestern Arizona (USFWS 2011a).

The proposed project is located in the Pahrump Valley which occurs in the south-central portion of the Eastern Recovery Unit. The Pahrump Valley has direct connectivity to adjacent valleys within the Amargosa Desert region in California and Nevada. However, the USFWS 2011 Recovery Plan noted that genetic differentiation occurred for desert tortoises at the Amargosa Desert and Pahrump Valley sites. This area is more confined than other units and movement has been more confined by the adjacent mountains and Death Valley. For this region a lack of desert tortoise habitat dedicated to conservation to the west of the Spring Mountains and in Las Vegas Valley highlights the need for careful management in these areas to maintain connectivity among populations and the genetic variation within this recovery unit (USGS 2011). Corridors north and south of the Spring Mountains warrant particular management attention to prevent genetic isolation of populations on either side of this mountain range. Ongoing development in these areas, including in and near Pahrump Valley contributes to the decline in habitat and may further isolate populations of desert tortoise.

To promote substantial populations for desert tortoise recovery in the Mojave population's range, the 1994 Recovery Plan (USFWS) designated six Recovery Units traversing all four abovementioned states. In 2011 the Recovery Units were revised to better reflect genetic and geographic boundaries and were reduced to five units. The establishment of the Recovery Units is intended to protect the species and its habitat

requirements so that desert tortoises can maintain self-sustaining within each recovery unit into the future. However, desert tortoises are slow-growing animals that do not reach sexual maturity until age 15 to 20 years and have a low reproductive rate over a long period of reproductive potential; these life history characteristics hinder recovery since tortoises experience high mortality rates prior to reaching sexual maturity (USFWS 2011a).

Urbanization/loss of habitat, deteriorating habitat quality from off-highway vehicles, invasion of non-native grasses and weeds, predation by ravens, collection, livestock grazing, and spread of an upper respiratory tract disease have all contributed to the decline of desert tortoise populations. In response to this decline, large expanses of desert tortoise critical habitat and numerous ACEC/DWMA areas have been identified or established within the NEMO southern recovery unit planning area. Cumulatively, the impacts of these projects to desert tortoises in the Mojave population would be significant.

The proposed project's incremental contribution to cumulative impacts to desert tortoise would be similar to the impacts of other solar developments in the range of the Mojave population, and would include loss of habitat, interference with regional movement, stress and potentially illness or mortality from translocation, and indirect impacts from an increase in predators such as the common raven. The current USGS Desert Tortoise Habitat Model (Nussear et al. 2009) maps the project area and portions of the Pahrump Valley as "Medium Quality" desert tortoise habitat, with scores of 0.7 to 0.9 on a scale of 0 to 1.0 (0 being the lowest quality and 1.0 being the highest quality). The model is a predictive model for mapping the potential distribution of desert tortoise habitat and is useful tool for evaluating different land-use issues that tortoises face at a landscape scale. It is not intended to be used, or viewed, as a substitute for ground-based and site-specific field surveys. Model scores reflect a hypothesized habitat potential given the range of environmental conditions where tortoise occurrence was documented. The report (Nussear et al. 2009) specifically states:

> "*. . . there are likely areas of potential habitat for which habitat potential was not predicted to be high, and likewise, areas of low potential for which the model predicted higher potential. Finally, the map of desert tortoise potential habitat that we present does not account either for anthropogenic effects, such as urban development, habitat destruction, or fragmentation, or for natural disturbances, such as fire, which might have rendered potential habitat into habitat with much lower potential in recent years*".

Based on staff's field observations, surveys conducted by the applicant, and historic land uses in portions of the project site, desert tortoise habitat quality on the project site ranges from good to somewhat degraded. Even so, the site is occupied habitat and the observations of desert tortoises of different age class, numerous burrows, and their sign suggest the site remains actively populated. Construction of the proposed project would have permanent and long-term impacts to approximately 3,258 acres of habitat at the solar field site. The project would also disturb habitat in occupied habitat in Nevada to support linear facilities including a natural gas pipeline and transmission line. The NEMO indicates there are approximately 172,000 acres of Class III desert tortoise in the Pahrump Valley. This area is defined by the NEMO as "the Pahrump Valley is bounded

by the Nopah Range on the west and northwest, the Nevada State line on the east, the town of Pahrump on the northeast, and the Inyo/San Bernardino county line on the south". Construction of the proposed project would result in a 0.02 percent loss of this existing habitat solely within the Pahrump Valley. Region wide the loss of habitat would be extremely low.

Mitigation measures to reduce project-level impacts to desert tortoise include: construction minimization measures (**BIO-8**); clearance surveys and exclusion fencing (**BIO-9**); preparation and implementation of a translocation plan (**BIO-10**); acquisition and conservation of compensation lands (**BIO-12**); and preparation and implementation of a plan to control ravens (**BIO-13**). Together these measures would reduce project-level impacts of the solar generator, generator tie-line, and interconnector substation to less than significant under CEQA and would fully mitigate those impacts under CESA. After implementation of these measures, the project's contribution to significant cumulative effects to desert tortoises would not be cumulatively considerable.

Nelson's Bighorn Sheep

The proposed project would not impact any identified connectivity corridors as identified by CDFG, or wildlife habitat management areas (WHMA) designated by BLM as protective of bighorn sheep habitat. Large-scale renewable energy development could significantly impact gene flow between sheep populations through significant cumulative impacts to connectivity corridors, potentially decreasing the viability of the metapopulation of bighorn sheep. The project itself, however, would have no direct contribution to the loss of habitat within the identified connectivity corridors or the WHMAs.

Proposed future projects could also cumulatively and significantly affect bighorn sheep through the loss of spring foraging habitat on the upper bajadas adjacent to occupied range. The impact of development within a 1-mile buffer from the base of occupied ranges (or potentially restored populations in unoccupied ranges) was assessed for potential impacts to bighorn sheep foraging habitat. No significant direct impacts to bighorn sheep WHMAs, connectivity corridors, or spring foraging habitat would result from the proposed project; therefore, no mitigation measures relating to bighorn sheep are proposed by staff.

The project's contribution to the loss of habitat, increased noise and lighting, road kills, fragmentation, and the spread of invasive pest plants is cumulatively considerable. However, the project's contribution to these effects would be reduced to a level less than cumulatively considerable through implementation of several conditions of certification designed to address indirect effects as well as habitat loss. These include completion of badger and kit fox specific pre-construction surveys, as well as impact avoidance and minimization measures in **BIO-14**; **BIO-8** (General Impact Avoidance and Minimization Measures) contains specific measures to minimize noise and lighting impacts; **BIO-18** (Weed Management Plan); **BIO-12** to acquire 6,358 acres of desert tortoise habitat, which is expected to contain suitable habitat for badger and kit fox; and **BIO-22**, which requires acquisition and protection of desert washes and adjacent habitat within the local watersheds, which will minimize future fragmentation in the vicinity of the project area by protecting lands from future development.

Although the project would be expected to affect wildlife movement and connectivity across the Pahrump Valley, the project is not expected to significantly affect—directly, indirectly, or cumulatively—bighorn sheep movement.

American Badger and Desert Kit Fox

Reasonably anticipated cumulative effects considered by staff in a qualitative manner include habitat fragmentation and the diminished habitat values of remaining habitat from increased noise, lighting, exotic plant invasions including their ability to fuel wildfires and alter fire regimes, exotic wildlife invasions, dust and air pollution, increase in predators, agriculture, urban development and the consequences of human intrusion into previously undisturbed habitats: hunting, use of rodenticides and other poisons, road kills, trapping, and human disturbance.

Approximately 63,000 acres of habitat, of which a large portion may be suitable for American badger and desert kit fox foraging or denning habitat, would be displaced by proposed future projects within the greater region of the project. This cumulative effect, when combined with the anticipated indirect effects to remaining habitat and populations described above, is cumulatively considerable. The project's contribution to the loss of habitat, increased noise and lighting, road kills, fragmentation, and the spread of invasive pest plants is cumulatively considerable. However, the project's contribution to these effects would be reduced to a level less than cumulatively considerable through implementation of several conditions of certification designed to address indirect effects as well as habitat loss. These include completion of badger and kit fox specific pre-construction surveys, as well as impact avoidance and minimization measures in **BIO-14**; **BIO-8** (General Impact Avoidance and Minimization Measures) contains specific measures to minimize noise and lighting impacts; **BIO-18** (Weed Management Plan); **BIO-12** to acquire 6,358 acres of desert tortoise habitat, which is expected to contain suitable habitat for badger and kit fox; and **BIO-22**, which requires acquisition and protection of desert washes and adjacent habitat within the local watersheds, which will minimize future fragmentation in the vicinity of the project area by protecting lands from future development.

Eagles and Passerine Birds

An estimated 63,000 acres of habitat for terrestrial and avian species will be lost if the projects listed for the cumulative analysis are constructed. This effect, when combined with the anticipated indirect effects to remaining habitat and populations described above, is cumulatively considerable. The project's contribution to the loss of habitat, increased noise and lighting, road kills, habitat fragmentation, potential to spread of invasive species, and hydrological impacts would be cumulatively considerable. At this time, staff is unable to make determinations of cumulative effects stemming from loss of golden eagle and migratory birds due to operation of the project. Project operation could result in injury or mortality (take) of golden eagle due to exposure to solar flux and or irradiance, and injury or mortality to migratory birds. Staff is expecting further data from the applicant regarding project impacts and feasible mitigation.

The project's contribution to these effects would be reduced through implementation of several conditions of certification designed to address direct and indirect effects as well as habitat loss; however staff observes that residual impacts of project operation are still

expected. These conditions of certification include **BIO-1** through **BIO-8** which requires avoidance and minimization measures during the life of the project, construction monitoring, worker training, fugitive dust control, fire prevention, weed management, and the presence of the designated biologist and/or biological monitors on the project site at all times during ground disturbance or any other construction activity. **BIO-8** also requires transmission lines and all electrical components to be designed, installed, and maintained in accordance with the Avian Power Line Interaction Committee guidelines. **BIO-15** the development of an avian and bat plan. **BIO-16** requires pre-construction monitoring and avoidance for nesting birds. **BIO-23** requires monitoring of ground water to ensure impacts to groundwater-dependent vegetation does not result in habitat degradation for these species. **BIO-23** also requires remedial action if monitoring detects impending ecosystem changes. **BIO-12** directs the acquisition of 6,358 acres of desert tortoise habitat, which is expected to contain suitable habitat for eagles and passerines; and **BIO-22**, which requires acquisition and protection of desert washes and adjacent habitat within the local watersheds, which will minimize future fragmentation in the vicinity of the project area by protecting lands from future development, and also provide high quality habitat for eagles and passerines.

Western Burrowing Owl

The project's contribution to the cumulative loss of burrowing owl habitat is comparable to the cumulative loss of badger and kit fox habitat, described above. The potential loss of habitat from all proposed future projects is significant, and the project's contribution to that effect is cumulatively considerable. The project will also contribute to a cumulatively considerable impact from habitat fragmentation, degradation of groundwater-dependent vegetation, edge effects, noise and lighting, increased road kills, increased risk of fire from weed invasion and increased ignition sources (vehicles), and an increase in avian predators, all of which ultimately degrade the function and values of the remaining habitat. The project's contribution to these indirect effects and loss of habitat would be mitigated to a level less than cumulatively considerable through implementation of **BIO-17** preconstruction surveys, avoidance and minimization measures, and compensatory mitigation; measures for addressing impacts from noise, lighting, and traffic (road kills) through a variety of measures in **BIO-8**; **BIO-18** (Weed Management Plan) to address the project's contribution to the spread of invasive weeds; **BIO-12** for acquisition of 6,358 acres of desert tortoise habitat, which is likely to contain suitable habitat burrowing owls; and **BIO-22** which requires acquisition and protection of desert washes and adjacent habitat within the local watersheds, which will minimize future fragmentation in the greater vicinity of the project by protecting the acquired desert wash habitat from future development.

Special-Status Bats

Approximately 63,000 acres of habitat could be lost to future development, of which portions may be suitable for bat roosting or foraging habitat. The project would not impact any bat roosts, so the project's contribution to the cumulative loss of special-status bat roosting habitat is not considered an issue. However, staff considers the loss of foraging habitat to be cumulatively significant. The project could contribute to a cumulatively considerable impact within the aquifer system underlying the Pahrump Valley. This effect is cumulatively considerable when combined with the anticipated indirect effects to remaining foraging habitat and bat populations. These indirect effects

include fragment habitat, degrade groundwater-dependent vegetation, increase competition for remaining food and roost sources, promote weeds and habitat degradation, and change in insect abundance. Operational impacts of the proposed project may also be cumulatively significant when considered with solar and wind development.

The project's contribution to these impacts and loss of habitat would be mitigated to a level less than cumulatively considerable through **WATER SUPPLY-4** (Groundwater Elevation Monitoring) and **BIO-23** (Groundwater-dependent Vegetation Monitoring Plan), which ensure groundwater pumping would minimize potential impacts to groundwater-dependent ecosystems, including springs; **BIO-18** (Weed Management Plan) which will address the project's contribution to the spread of invasive weeds; and **BIO-22** which requires acquisition and protection of desert washes and adjacent habitat within the local watersheds, which could preserve important foraging and roosting habitat.

Cumulative Impacts – Special-status Plants

The geographic scope of the analysis of cumulative effects to special-status plants encompasses the range of the affected species in California, and portions of the local population that extend into Nevada. The qualitative assessment was based on a review of the project's offsite survey data, databases, literature, and consultation with regional experts.

In addition to the project's contribution to the reduction and fragmentation of local populations from construction, the project also contributes to the cumulative, interactive, and synergistic impacts of multiple indirect threats from a variety of sources, including past, present, and future urban development, agriculture (crop lands), grazing, roads and other infrastructure development.

Past and present projects in Pahrump Valley and adjacent valleys that may have contributed to cumulative impacts to special-status plants found in the project study area include:

- Conversion of natural communities for agriculture and groundwater pumping for irrigated agriculture (mostly cotton and alfalfa) during the last century, fragmenting and isolating populations; altering surface drainage patterns (dispersal pathways), surface and groundwater hydrology, introducing agricultural weeds into the local ecosystem;
- Past and present residential, commercial, and industrial development in the Pahrump environs, including the Charleston View subdivision, fragmenting populations, increasing the risk of fire, ORV, and the spread of invasive plants;
- Construction of highways and other roads, modifying surface runoff patterns and acting as vectors for the spread of invasive plants;
- Transmission corridors, another common vector for weed spread; and
- BLM grazing allotments (sheep and cattle grazing), which also contributed to the spread of invasive weeds, particularly red brome and cheat grass.

Reasonably foreseeable future actions that are expected to contribute to cumulative impacts to special-status plants:

- Pahrump Valley General Aviation Airport
- Element Power Solar project
- PSI Amargosa (Pacific Solar) PV project
- Sandy Valley Solar project (a BrightSource Energy project)
- St. Therese Mission (a commercial facility)
- Urban expansion in the Pahrump Valley and Sandy Valley areas;
- HHSEGS Hidden Hills Valley Electric Transmission Project;
- Infrastructure development associated with urban expansion and renewable energy development

These future projects are expected to combine with the project's effects of fragmentation and isolation of populations, introduction and spread of invasive weeds, increased risk of fire, altered surface drainage patterns, and the interruption of dispersal pathways. The BLM Nevada botanist confirmed the projects listed above would have a cumulatively significant impact of the Nevada rare species Pahrump Valley buckwheat and Nye milk-vetch (Edwards pers. comm. 2012).

Large reserves of BLM or National Park Service wilderness lands in the project vicinity are not expected to contain occurrences of the special-status plants found in the project area, or to buffer or minimize cumulative effects. The wilderness areas are drawn around local mountain ranges and do not include the basin habitats known to support these species.

Where BLM lands in Pahrump and adjacent valleys do contain suitable habitat for the affected species, the lands outside ACECs have a multiple use management designation that limits the ability of the agency to protect the occurrences, in perpetuity, from renewable energy development or other authorized mixed uses.

Any quantitative analyses of the extent of a species known macro-habitat should not be misconstrued to conclude that the habitat is potentially occupied by special-status; plants are sessile organisms with very specific microhabitat requirements that are not well understood. The failure to find many new occurrences of most of the affected species after two years of focused offsite surveys is a testament to their rarity. The actual distribution of rare plants within their general habitat preferences is typically confined to small, scattered and infrequent occurrences within an already restricted range. Alternately, rare plants can also sometimes be locally abundant, but highly restricted in their range, such as Pahrump Valley buckwheat.

The most significant of cumulative effects to special-status plants in the region include: fragmentation and isolation of populations; introduction and spread of weeds; increased risk of fire; and fires of greater intensity and ecological damage from the increase and spread of annual grasses.

Staff considered the mitigated effect of the project after implementation of conditions of certification **BIO-19** (Special-status Plant Avoidance & Minimization Measures) and **BIO-20** (Special-status Plant Compensatory Mitigation). No monitoring or management of adjacent offsite special-status plant occurrences is proposed because adjacent lands are not owned or accessible to the project. Nor can the project manage any weeds that may have spread to offsite occurrences or been introduced into the vicinity on the contaminated vehicles and equipment of employees and contractors. Avoidance and minimization measures included in **BIO-19** will minimize the project's impacts to occurrences immediately adjacent to the project boundary. However, without monitoring and adaptive management of project-related weed occurrences offsite, fire prevention measures, and compensatory mitigation at ratios adequate to address the net loss of occurrences the project effects – although individually minor – are cumulatively considerable, when viewed in connection with the similar effects of past, present, and foreseeable future projects in the Pahrump Valley environs. These residual effects would be addressed with the addition of the following fire prevention measures:

- **BIO-20** (Special-status Plant Compensatory Mitigation) - requires mitigation at ratios greater than 1:1 to address the net loss of occurrences and the project's contribution to fragmentation of affected species;

- **BIO-6** (Worker Environmental Awareness Program) – measures added to ensure worker awareness of special-status plants, weeds, and fire;

- **BIO-18** (Weed Management Plan) – fire prevention measures added, including prohibiting the use of mowers and other mechanical methods of weed control during periods of high fire risk, requiring mowing be conducted during the early morning (low risk) hours, prohibiting disking (which increases weeds and thus the flammability of vegetation), and requiring basic fire prevention measures during mowing (contact information for fire personnel, a live water supply, shovels and extinguishers);

- **BIO-8** (Avoidance and Minimization Measures) – measures added for minimizing weed vectors and fire ignition sources.

  - Because washes are important dispersal pathways for rare plants, additional measures were added to **BIO-22** (State Waters Compensatory Mitigation and Avoidance & Minimization Measures) for minimizing the effects of erosion and sedimentation downstream or offsite and minimizing alteration of geomorphic and hydrologic functions downstream.

  - Conditions of certification **BIO-7** (BRMIMP) and a new condition, **BIO-21** (Qualified Botanist) will ensure the full and timely implementation of the measures described above under the supervision of a qualified botanist or vegetation ecologist.

Cumulative Impacts – Introduction and Spread of Invasive weeds

Nearly all of the past and present urban and agricultural development has occurred in northern Pahrump Valley; however, past grazing and other smaller residential and agricultural operations have impacted the southern Pahrump Valley. Transmission

corridors, railroads, paved and unpaved roads, and off-road vehicle routes are particularly effective as conduits for the spread of weeds, and these features have in the past and continue to spread weeds throughout the region.

Past and present projects or actions in the area between Pahrump Valley, Las Vegas, the project site, and Death Valley National Park that have contributed to the cumulative spread of invasive weeds include:

- Livestock grazing in Pahrump and adjacent valleys during the last and prior centuries, which introduced weeds on contaminated feed and animals, and established by overgrazing and poorly timed grazing, which favors weeds over native species;
- Construction and operation of highways 160, 178, 127, and 190 and associated local and interstate travel between Death Valley National Park, Pahrump, and Las Vegas; transportation routes are major vectors for long-distance dispersal of invasive plants;
- Tecopa Railroad and other area railroads from the late 19th and early 20th century fostered invasions for many weedy species, such as cheat grass and Russian thistle (Brooks & Pyke 2002);
- Residential development in Pahrump and Charleston View has caused a general increase in vehicle traffic, which facilitates the spread of weeds. Area residential development also promotes increased off-road vehicle use, which in turn introduces weeds into previously uninfested areas. The increase in weeds, particularly annual grasses, increases the frequency of fire, which in turn promotes further habitat conversions to weed-dominated habitats;
- Construction and maintenance of gas and electric transmission corridors are major vectors for the past, present and continued spread of invasive plants;
- Excessive groundwater pumping in Pahrump Valley for irrigated agriculture (mostly cotton and alfalfa) during the last century significantly lowered the basin groundwater table, and lowering groundwater favors the establishment of salt cedar over native mesquite in riparian areas.

Reasonably foreseeable future actions that are expected to contribute to cumulative spread of invasive weeds:

- Pahrump Valley General Aviation Airport, and the associated soil disturbance and increase in vehicle traffic;
- Element Power Solar project and its concomitant construction-related soil disturbance, particularly along linears, and increase in vehicle traffic;
- Pacific Solar project, construction-related soil disturbance, construction and maintenance of linears, and increase in vehicle traffic;
- Sandy Valley Solar project, construction-related soil disturbance, construction and maintenance of linears, and a corresponding increase in vehicle traffic;
- St. Therese Mission (a commercial facility), associated soil disturbance and increase in vehicle traffic;

- Urban expansion in the Pahrump Valley and Sandy Valley areas, associated soil disturbance, ORV, increased risk of fire and construction-related soil disturbance, and significant increase in vehicle traffic, which facilitates the spread of weeds on infected tires and undercarriage;
- Hidden Hills Valley Electric Transmission Project; and
- Infrastructure development and improvements associated with urban expansion and other renewable energy development; transmission and other corridors are major vectors.

The past, present, and foreseeable future projects listed above combine with the project's contribution to the spread of weeds and contribute to a cumulatively considerable effect. The effects of weeds are insidious and synergistic, and affect not only biological resources but also recreational and agricultural resources, and public safety. Invasive species rank second only to habitat destruction in causing species endangerment across the United States (Brooks & Pyke 2002).

Staff considered the mitigated effect of the project after implementation of **BIO-18** (Weed Management Plan). The Inyo-Mono County Agricultural Commissioner expressed particular concern – in comment letters and public workshops -- about the high potential for the employee commuter traffic and contractors to introduce new and virulent weed species into the area from the communities of Pahrump and Las Vegas. Because the project cannot monitor project-related increases in weeds along roads off the project site**, BIO-18** includes a requirement to pay a fee, as requested by Agricultural Commissioner, for increased monitoring and abatement costs.

Under Section 5421 of the California Food and Agriculture Code, the State, through its agricultural commissioner's, has the authority to require eradication or control. Under Section 5430 "…the amount which is incurred or expended by the county in the abatement is a lien on the land against which the expense is chargeable."

Other indirect effects that are individually minor but cumulatively considerable include an increased risk of fire from the proliferation of weeds onsite and along area roads from the increased traffic and increase in ignition sources. These effects would be addressed with the addition of fire prevention measures in **BIO-8** (General Avoidance and Minimization Measures), **BIO-6** (Worker Environmental Awareness Program), and **BIO-18. BIO-21** (Qualified Botanist) requires the weed plan be prepared by a qualified botanist or vegetation ecologist. With implementation of these additional measures, the project's contribution to these cumulative effects would be less than cumulatively considerable.

Cumulative Impacts – Groundwater-dependent Ecosystems

Prior to agricultural and urban development in southern Nevada, the distribution of mesquite and acacia woodlands was much greater; the Las Vegas Valley was a 3 mile by 12 mile expanse of mesquite and acacia woodlands when the first Europeans settled here (Paher 1971). The Virgin, Muddy, and Colorado rivers are also believed to have supported more extensive and denser stands of mesquite (Crampton et al. 2006).

The *Manual of California Vegetation* (Sawyer et al. 2009) reports that groundwater pumping in California is “a serious threat in many locations and has led to the decline of numerous stands.” Sawyer et al. (2009) also report that the invasive salt cedar has invaded stands along much of the Colorado River, and other rivers and desert wetlands in California; salt cedar invasion is a common sight along hydrologically altered streams.

Firewood cutting has decimated many stands of mesquite in its range in California and Nevada (Sawyer et al. 2009; Crampton et al. 2006). Most firewood cutting has occurred near urban areas. In the California Mojave Desert region, the most extensive stands of mesquite remaining today are reported at Tecopa (Sawyer et al. 2006), approximately 20 miles west of the Nopah Range.

The most severe future threats to mesquite habitats are urbanization and water development/management, and, to a lesser degree, exotic plants, fire, and conversion to agriculture (Crampton et al. 2006).

As Nevada’s most heavily allocated groundwater basin, Pahrump Valley has seen its population increase exponentially over the past 30 years. Data obtained from the Nevada Division of Water Resources (NVDWR) by Comartin (2010) demonstrate that annual pumping has continuously exceeded this sustainable basin yield estimate for over 50 years resulting in considerable water level declines.

The vast majority of the population growth has been in the Nye County, Nevada portion of the valley; the California portion remains sparsely populated. Until recently, there has been relatively little pumping in the southern portion of the valley near Stump Spring, but the recent push for renewable energy development has placed these important resources at risk. Declining groundwater elevations today are seen as far south as Stump Spring; however, the decline is greatest in the northern part of the valley. Mesquite stands closest to Pahrump are in obvious decline from lowering water tables but the well at Stump Spring has shown a steady background decline of approximately 0.3 feet per year.

Pahrump Valley currently has the highest density of domestic wells (approximately 11,000) in Nevada, and consequently is the most over-allocated groundwater basin in the state. The majority of domestic wells are drilled at an interval between 140 and 160 feet below land surface (Buqo 2006) and are vulnerable to substantial water table declines (Comartin 2010). Although extraction rates have steadily decreased since the late 1960s, current pumping rates of approximately 24,000 ac-ft/yr still significantly exceed the sustainable basin yield estimate of 19,000 ac-ft/yr estimated by Harrill (1986). If the population increases to the projected 50,000 residents by 2050 (Buqo 2006), the depletion of Pahrump Valley groundwater resources will continue.

The cumulative effect of urban growth in Pahrump, Nevada, where water rights are dangerously over-appropriated, and in California, where they are essentially unregulated; appropriated rights in Pahrump are 5 times greater than the basins’ perennial groundwater yield. Compounding the impacts of over-appropriation, there is no single, coordinated groundwater management entity to ensure that future development on both sides of the bi-state basin will be sensitive to the groundwater

needs of the mesquite habitats and other groundwater-dependent plant and wildlife resources.

The strain placed on the Pahrump Valley groundwater system through unsustainable extraction rates throughout the valley threatens the future viability of the entire Pahrump Valley Metapatch of mesquite woodlands and coppice dunes.

Past and present impacts in Pahrump Valley groundwater basin that have already contributed to water table declines and impacts to area springs and mesquite habitats include:

- Groundwater pumping for irrigated agricultural operations during the last century (mostly cotton and alfalfa);
- Past and present groundwater pumping for residential, commercial, and industrial development in the Pahrump environs; and
- Construction of highways and other roads that modify the hydrologic balance of an area through increases in impermeable surfaces and modifications of surface runoff patterns.

The southern portion of the basin, where the project is located, has experienced very little of the past and present groundwater pumping for agricultural and urban uses. Declines in the northern portion of the basin are significantly greater than declines experienced in the southern portion, to date. Nevertheless, declines in water levels at the springs east of the project parallel the declines throughout the northern portion of the basin.

Reasonably foreseeable future actions in the southern portion of the Pahrump groundwater basin that were are expected to combine with the project's effects on area springs and mesquite habitats, or considered in the analysis, include:

- Pahrump Valley General Aviation Airport – acre feet/year (afy) groundwater use unknown
- PSI Amargosa PV Project – 0 afy
- Sandy Valley (BrightSource Energy Solar Partners) – 170 afy
- Element Power PV Solar Project – 5-7 afy
- St. Therese Mission (a commercial facility)– afy groundwater use unknown
- Climate change is expected to exacerbate already declining water levels and increase the demand for groundwater in the local basin.

The past, present, and foreseeable future projects listed above would combine with the project's contribution to the loss or degradation of remaining mesquite woodland ecosystems and their dependent common and special-status species – and contribute to a significant cumulative effect.

Although there is potential that the impact at Stump Spring ACEC could be individually minor, even seemingly minor impacts can be cumulatively considerable if they affect an extremely rare or ecologically significant resource.

WATER SUPPLY Figure 22 shows that the potential cumulative water level decline at Stump Springs could be greater than 60 feet. Although the sandy valley project is the primary contributor, the project nevertheless contributes to a cumulatively significant impact. The potential for the fault zone to buffer the project impacts to Stump Springs is speculative; monitoring wells across the fault zone would be required to assess the project's contribution to this effect. Fault zones more typically provide a partial – not complete – barrier to groundwater flow (Belcher pers. comm.; Comartin 2010).

Regarding a drawdown impact from cumulative pumping on the Amargosa River, the Water Supply analysis concluded there is inadequate information available to quantify the hydraulic connection between the basin and river. Given the lack of evidence for a hydraulic connection, the relatively large intervening distance (about 20 miles), uncertainty in potential flow barriers, permeability contrasts within the subsurface, and the presence of the fault zone which would isolate pumping effects from the Sandy Valley site, staff concluded that a significant cumulative impact at the Amargosa River due to project pumping is unlikely. However, **WATER SUPPLY-1** which requires an offset of project water use in the local groundwater basin would ensure there is likely no net cumulative overall change in subsurface outflow from the PVGB that might affect the Amargosa River.

Although there is potential that the impact at Stump Spring ACEC could be individually minor, even seemingly minor impacts can be cumulatively considerable if they affect an extremely rare or ecologically significant resource.

Given the cumulative concerns described above, combined with the limited quantity and reliability of the data, and the ecological significance and sensitivity of the resources at risk, a conservative approach must be applied that combines long-term groundwater elevation monitoring and monitoring the health of the mesquite, with clear and detailed triggers for adaptive action if impending impacts are detected.

Long-term vegetation monitoring data are capable of providing early warning signs of impending changes in ecosystem processes (Patten et al. 2007). Combined with the data on groundwater and climate, sampling of vegetation responses can provide sensitive metrics for assessing ecological changes over time. However, to ensure that the information is appropriate for management, it is important that monitoring and analysis be designed to test for magnitudes of changes rather than just existence of change, a phenomenon that can occur under disturbance or non-disturbance conditions.

Staff consulted local and regional experts in groundwater hydrology, the impacts of groundwater pumping on dependent resources, and sampling and monitoring plant populations and prepared a peer-reviewed condition of certification (**BIO-23**) that would ensure the project's effects are rendered less than cumulatively considerable.

Conditions of certification **BIO-23** (Groundwater-dependent Vegetation Monitoring) and **WATER SUPPLY-4** (Groundwater Level Monitoring) would minimize the project's contribution to cumulative impacts to Stump Springs and other groundwater-dependent resources in the local basin.

Under **BIO-23**, if water level monitoring, as described in WATER SUPPLY-4, identifies a 0.5 foot or greater water level decline at the property boundary due to project pumping, the project owner shall cease pumping. Pumping cannot resume unless the project provides evidence, subject to review and approval by the CPM and interested agencies, that either: 1) the pumping can be reduced or modified to maintain groundwater levels above the 0.5 ft. drawdown threshold at the project boundary; 2) the drawdown trigger was exceeded due to factors other than the project pumping and the project did not contribute to the drawdown; or 3) through vegetation monitoring and soil coring described in the condition, and predictive hydrologic trend analysis described in **WATER SUPPLY-4**, a greater groundwater drawdown will not result in adverse impacts to the groundwater-dependent vegetation from which it cannot recover fully in one season.

A full range of mitigation options was considered; these are discussed in detail under "Impacts to Groundwater-dependent Ecosystems" subsection of this FSA section, including the rationale for the proposed and the rejected mitigation options.

Cumulative Impacts – Desert Washes

The geographic scope for the analysis of cumulative impacts to desert washes encompassed the Pahrump Valley watershed. Pahrump Valley Playa, located 3 miles northwest of the project, is the receiving basin for the desert washes that drain the watershed. The desert washes that cross the project site are alluvial fan distributary channels that drain the western flank of the Spring Mountains in Nevada.

Although the project would attempt to maintain existing surface drainage, rather than divert the runoff around the project perimeter, staff considers the perimeter exclusion fencing, and regular vegetation mowing and spraying and road construction and maintenance, and human activity to be a significant impact to the habitat functions and value of the streams.

Past and present projects in Pahrump Valley and adjacent valleys that have contributed to cumulative impacts to desert washes include:

- Conversion of basin and alluvial fan habitats for agriculture during the last century, which lowered groundwater tables and dried springs and spring channels and affected the base flows of spring-fed streams, and spread the highly invasive salt cedar into riparian areas and degraded habitat quality;
- Past and present residential, commercial, and industrial development in the Pahrump Valley watershed, which fragmented stream habitat, diverted flows and altered surface and groundwater hydrology, increased the risk of fire in riparian areas, increased ORV and the spread of invasive plants along washes, and increased erosion and sedimentation; and

- Construction of highways and other roads, modifying surface runoff patterns and acting as vectors for the spread of invasive plants;

Reasonably foreseeable future actions that are expected to contribute to cumulative impacts to desert washes:

- Pahrump Valley General Aviation Airport
- Element Power Solar project
- Pacific Solar project
- Sandy Valley Solar project
- St. Therese Mission (a commercial facility)
- Urban expansion in the Pahrump Valley and Sandy Valley areas
- Infrastructure development associated with urban expansion and renewable energy development (paved and unpaved maintenance roads, transmission lines (gas and electric, underground and overhead)

The effects of these past, present, and foreseeable future projects combine with the project's effects and contribute to a significant cumulative effect on desert washes in the local watershed, particularly on the habitat functions and value of the washes. Desert washes are also important dispersal pathways for the seed of common and special-status plants, and where the habitat is distinct from the adjacent uplands in composition, density, or structure, they may provide important habitat values that are not present in the adjacent uplands.

Staff considered the mitigated effect of the project after implementation of **BIO-22** (compensatory mitigation for state waters) and added additional avoidance and minimization measures for protecting adjacent offsite washes near construction, and design guidelines for road crossings and discharge points to minimize erosion and sedimentation, and included measures in **BIO-18** (Weed Management Plan) to prohibit the use of herbicides that could be harmful to wildlife using adjacent washes. Further loss and/or fragmentation of remaining washes in the basin would be minimized through acquisition and preservation of washes within the local watershed and at a ratio of 2:1, and restoration of degraded washes as described in **BIO-22** (compensatory mitigation and avoidance and minimization measures for state waters), **BIO-7** (monitoring and reporting requirements), **BIO-8** (Impact Avoidance and Minimization Measures), **BIO-21** (Designated Botanist), **BIO-2** (Designated Biologist), and **BIO-4** (Designated Biological Monitor) will ensure that these mitigation measures are fully implemented.

CUMULATIVE IMPACTS - SUMMARY OF CONCLUSIONS

Construction and operation of the proposed project will have effects on a number of biological resources that are individually limited but cumulatively considerable. "Cumulatively considerable" means that the incremental effects of an individual project are significant when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects. However, cumulative impact assessments cannot conclude that contributions to cumulative impacts are not

significant merely because the contributions represent a small percentage of the overall problem.

The project's contribution to significant cumulative effects to listed species and sensitive wildlife such as the desert tortoise are not cumulatively considerable after the implementation of conditions of certification intended to minimize or fully mitigate those impacts. For desert tortoise these include construction and minimization measures (**BIO-8**), clearance surveys and exclusion fencing (**BIO-9**), preparation and implementation of a translocation plan (**BIO-10**), acquisition and conservation of compensation lands (**BIO-12**), and preparation and implementation of a plan to control ravens (**BIO-13**).

The project's contribution to desert kit fox, American badger, bats, and Nelsons bighorn sheep are cumulatively considerable but mitigated by the implementation of conditions of certification **BIO-8** (General Impact Avoidance and Minimization Measures), **BIO-14** which requires the development of a management plan for kit fox and American badger, **BIO-18** (Weed Management Plan); **BIO-12** for acquisition of 6,358 acres of desert tortoise habitat, which is expected to contain suitable habitat for badger and kit fox and dispersal habitat for bighorn sheep; and **BIO-22**, which requires acquisition and protection of desert washes and adjacent habitat within the local watersheds.

The HHSEGS project's contribution to significant cumulative effects to migratory birds and golden eagles is cumulatively considerable when combined with the anticipated indirect effects to remaining habitat and populations. The project's contribution to the loss of habitat, increased noise and lighting, road kills, habitat fragmentation, potential to spread of invasive species, and hydrological impacts is cumulatively considerable. Staff considers the cumulative effects stemming from the loss of golden eagle and migratory birds that may occur due to operation of the project to be cumulatively considerable even with the implementation of proposed Conditions of Certification. The following impact avoidance, minimization, and mitigation Conditions would address the project's contribution to many of the significant cumulative impacts described above: **BIO-16**, a nesting bird management plan, **BIO-8** (Impact Avoidance and Best Management Practices), and **BIO-16** (Pre-construction Nest Surveys).

The project's incremental contribution to cumulatively significant impacts to other wildlife, desert washes, and groundwater-dependent ecosystems is cumulatively considerable. Conditions of certification **BIO-1** through **BIO-26** contain measures for avoiding, minimizing, and compensating for direct and indirect impacts. Funding mechanisms, worker environmental compliance training, mitigation monitoring and reporting, and requirements for designated biologists, monitors, and a designated botanist will ensure accountability and full implementation of conditions. Staff assessed the mitigated effect and considered whether new mitigation measures were needed to address any residual effects. New conditions of certification were added, and other conditions strengthened to ensure that the project's contributions to these significant cumulative impacts are less than cumulatively considerable.

COMPLIANCE WITH LORS

The proposed project must comply with state and federal LORS that address state and federally listed species, as well as other sensitive species and their habitats. Applicable LORS are presented in **BIOLOGICAL RESOURCES Table 1**.

STATE LORS

Under the Warren-Alquist Act (Pub. Resources Code § 25500) the Energy Commission's certificate for thermal power plants 50 MW and more is "in lieu of" other state, local, and regional permits (*ibid*.). All required terms and conditions that might otherwise be included in state permits are incorporated into the Energy Commission's certificate or license. When conditions of certification are finalized in the FSA, staff expects the proposed mitigation measures would satisfy the following state LORS and take the place of terms and conditions that, but for the Commission's exclusive authority, would be addressed for the following LORS and state permits:

Incidental Take Permit: California Endangered Species Act (Fish and Game Code §§ 2050 et seq.). The California Endangered Species Act (CESA) prohibits the "take" (defined as "to hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, catch, capture, or kill"") of state-listed species except as otherwise provided in state law. Construction and operation of the proposed project would result in the take of desert tortoise, listed as threatened under CESA. No other state-listed species would be affected by the project. Condition of Certification **BIO-12** specifies compensatory mitigation for desert tortoise habitat loss. Ratios proposed by staff include 1:1 for areas dominated by shadscale scrub and 3:1 for areas dominated by Mojave Desert scrub. In total compensatory mitigation would require the acquisition and preservation of approximately 6,358 acres of desert tortoise habitat. Avoidance and minimization measures described in conditions of certification **BIO-6** through **BIO-10**, **BIO-12**, and **BIO-13 (**Raven Management Plan) would also mitigate for potential impacts to desert tortoise. **BIO-9** and **BIO-10** require the applicant to fence the project site and translocate tortoise from the project site prior to construction. Conditions of certification **BIO-1** through **BIO-5** for a Designated Biologist and Biological Monitor, **BIO-6** (Worker Environmental Awareness Program) and **BIO-7** (Biological Resources Mitigation Implementation and Monitoring Plan) would ensure timely and thorough compliance under the supervision of qualified biologists. Implementation of these conditions of certification would ensure compliance with CESA.

Streambed Alteration Agreement: California Fish and Game Code §§ 1600-1607. Pursuant to these sections, CDFG typically regulates all changes to the natural flow, bed, or bank, of any river, stream, or lake that supports fish or wildlife resources. Construction and operation of the project would result in direct impacts to approximately 23.21 acres of jurisdictional state waters, and indirect impacts to 4.51 acres, according to the applicant's delineation. Condition of Certification **BIO-22** specifies compensatory mitigation for the loss of state waters at a ratio of 2:1. The compensatory mitigation requirements and avoidance and minimization measures in **BIO-22** would minimize and offset direct and indirect impacts to state waters, and would assure compliance with California Fish and Game Code that provides protection to these waters and their associated riparian vegetation.

Protected furbearing mammals (California Code of Regulations, Title 14, Section 460). This regulation specifies that fisher, marten, river otter, desert kit fox and red fox may not be taken at any time. Condition of Certification **BIO-14** (American Badger and Kit Fox Management Plan) requires the development of a management plan to safely exclude animals from the project site and ensure compliance with the California Fish and Game Code that provides protection to these species. The California Department of Fish and Game (CDFG) does not issue Incidental Take Permits or Memoranda of Understanding to permit the capture or handling of desert kit fox.

Fully Protected Species (Fish and Game Code, sections 3511, 4700, 5050, and 5515). Designates certain species as fully protected and prohibits the take of such species or their habitat unless for scientific purposes (see also California Code of Regulations Title 14, section 670.7). Golden eagle and bighorn sheep are fully protected species that occur in the project area. Condition of Certification **BIO-15** requires the completion of Avian, Bat, and Golden Eagle Protection Plans, and **BIO-16** (Pre-construction Nesting Bird Surveys) will avoid direct take of golden eagles during construction. Staff notes that these conditions will not ensure full protection of golden eagles during project operations. Condition **BIO-15** requires mitigation should a golden eagle be taken by the project, however, any take of golden eagles even if mitigated as required under CEQA, could violate the state Fish and Game Code due to the both species' status as migratory birds and fully protected species. To mitigate for lost habitat, **BIO-12** (Desert Tortoise Compensatory Mitigation) will ensure the preservation and management of large areas of natural lands. Bighorn sheep are not expected to be taken during project construction and impacts to this species would be mitigated through the implementation of avoidance and minimization measures identified in conditions of certification **BIO-1** through **BIO-8**.

Nelson's bighorn sheep (Fish and Game Code section 4902). Regulates adoption of sound biological management practices, included sport hunting, of the Nelson's bighorn sheep. Bighorn sheep are not expected to be taken during project construction and impacts to this species would be mitigated and compliance achieved through the implementation of avoidance and minimization measures identified in conditions of certification **BIO-1** through **BIO-8**.

Nest or Eggs (Fish and Game Code section 3503). This regulation protects California's birds by making it unlawful to take, possess, or needlessly destroy the nest or eggs of any bird. Implementation of conditions of certification **BIO-8** (Impact Avoidance and Best Management Practices) and **BIO-16** (Pre-construction Nest Surveys) would ensure the project complies with regulations that protect nesting birds and their nests.

Birds of Prey (Fish and Game Code section 3503.5.) This regulation identifies that it is unlawful to take, possess, or destroy any birds in the orders Falconiformes and Strigiformes or to take, possess, or destroy the nest or eggs of any such bird. Implementation of conditions of certification **BIO-8** (Impact Avoidance and Best Management Practices) and **BIO-16** (Pre-construction Nest Surveys) would ensure the project complies with regulations that protect nesting birds and their nests.

Migratory Birds (Fish and Game Code section 3513). This regulation protects California's migratory birds by making it unlawful to take or possess any migratory nongame bird as designated in the Migratory Bird Treaty Act or any part of such migratory nongame birds. Implementation of conditions of certification **BIO-8** (Impact Avoidance and Best Management Practices) and **BIO-16** (Pre-construction Nest Surveys) would ensure the project complies with regulations that protect nesting birds and their nests. Condition of Certification **BIO-15** requires development of Avian, Bat, and Golden Eagle Protection Plans, however, no feasible mitigation to avoid operational impacts of the project is available. **Nongame mammals (Fish and Game Code section 4150).** This regulation makes it unlawful to take or possess any non-game mammal or parts thereof except as provided in the Fish and Game Code or in accordance with regulations adopted by the California Fish and Game Commission. Implementation of conditions of certification **BIO-8** (Impact Avoidance and Best Management Practices) would ensure the project complies with regulations that protect nongame animals.

Migratory Birds (Fish and Game Code section 355-357). The Fish and Game Commission may, annually, adopt regulations pertaining to migratory birds to conform with or to further restrict the rules and regulations prescribed pursuant to the Migratory Bird Treaty Act. Implementation of conditions of certification **BIO-8** (Impact Avoidance and Best Management Practices) and **BIO-16** (Pre-construction Nest Surveys) would ensure the project complies with regulations that protect migratory birds.

California Native Plant Protection Act of 1977 (Fish and Game Code section 1900 and following) designates state rare, threatened, and endangered plants. No state listed Rare, Threatened, or Endangered plant species occur on the project site or would be indirectly affected by the project construction or operation. Implementation of conditions of certification **BIO-8** (Impact Avoidance and Best Management Practices), **BIO-18** (Weed management Plan), **BIO-19** (Special-Status Plant Impact Avoidance and Minimization), and **BIO-20** (Special-Status Plant Compensatory Mitigation) would ensure the project complies with regulations that protect native plants.

California Desert Native Plants Act of 1981 (Food and Agricultural Code section 80001 and following and California Fish and Game Code sections 1925-1926) protects non-listed California desert native plants from unlawful harvesting on both public and private lands in Imperial, Inyo, Kern, Los Angeles, Mono, Riverside, San Bernardino, and San Diego counties. Unless issued a valid permit, wood receipt, tag, and seal by the commissioner or sheriff, harvesting, transporting, selling, or possessing specific desert plants is prohibited. The Inyo-Mono Counties Agricultural Commissioner would issue a permit to the project owner for the removal of three common cactus species that occur within the project boundaries. Condition of Certification **BIO-7** (Biological Resources Mitigation Implementation & Monitoring Plan) requires the applicant provide a copy of all state and federal permits.

Porter-Cologne Water Quality Control Act. This act is administered by the state regional water quality control boards (RWQCB), which regulates discharges of waste and fill material to waters of the State, including "isolated" waters and wetlands. For

projects under the jurisdiction of the Energy Commission, applicants file a waste discharge report to the RWQCB, who then issues waste discharge requirements (WDRs) for inclusion in the Energy Commission's license. For HHSEGS, the Lahontan RWQCB will issue the WDRs, which will be incorporated into the Condition of Certification **BIO-7** (Biological Resources Mitigation Implementation & Monitoring Plan), which requires the project owner provide a copy of all state and federal permits and implement all provisions of those permits ensure compliance with the Porter-Cologne Water Quality Control Act. These WDRs have yet to be issued. The Lahontan RWQCB will separately issue a Clean Water Act Section 401 Water Quality certification for the project.

FEDERAL LORS

The project is located on private lands and is therefore not subject to the provisions of BLM's California Desert Conservation Area (CDCA) Plan or the Northern and Eastern Mojave Desert Management Plan (NEMO). Staff considered the following federal LORS and the management direction of the designations described below:

Areas of Critical Environmental Concern (ACEC) are specific, legally defined, BLM designations where special management is needed to protect and prevent irreparable damage to important historical, cultural, scenic values, fish and wildlife, and natural resources or to protect life and safety from natural hazards. The project is not included within any designated ACEC; the potential for indirect impacts to biological resources and groundwater resources of the Stump Spring ACEC from project groundwater pumping were assessed.

To avoid adverse impacts to the ACEC, conditions of certification **WATER SUPPLY-4** and **BIO-23** require monitoring of the response of groundwater and dependent vegetation to project pumping for the life of the project. If water level monitoring, as described in **WATER SUPPLY-4**, identifies a 0.5 foot or greater water level decline at the property boundary due to project pumping, the project owner shall cease pumping. Pumping cannot resume unless the project provides evidence, subject to review and approval by the CPM, in consultation with BLM and Inyo County water Department, that either: 1) the pumping can be reduced or modified to maintain groundwater levels above the 0.5 ft. drawdown threshold at the project boundary; 2) the drawdown trigger was exceeded due to factors other than the project pumping and the project did not contribute to the drawdown; or 3) through vegetation monitoring and soil coring described in this condition, and predictive hydrologic trend analysis described in **WATER SUPPLY-4**, a greater groundwater drawdown will not result in impacts to the mesquite.

Critical Habitat consists of specific areas defined by the USFWS as areas essential for the conservation of the listed species, which support physical and biological features essential for survival and that may require special management considerations or protection. The project would not result in direct or indirect impacts to critical habitat for any federal listed species.

Endangered Species Act (ESA; 16 USC Section 1531 et seq.). Potential take of the desert tortoise or its habitat, listed as threatened by the USFWS, requires compliance with the federal Endangered Species Act (ESA) (16 USC §§ 1531 et

seq.). No other federal-listed species would be affected by the project. “Take” of a federally listed species is prohibited without an Incidental Take Permit, which would be obtained through a Section 7 consultation between BLM and the USFWS. The applicant will submit a Draft Biological Assessment (BA) for the project to BLM, and when BLM has reviewed and made appropriate revisions to the draft BA it will be submitted to the USFWS so that the formal Section 7 consultation process can be initiated. A draft BA is not yet available for review. Implementation of the conditions of certification **BIO-1** through **BIO-10**, **BIO-12**, and **BIO-13**, summarized above, would ensure compliance with the federal ESA. When available, a copy of the BO would be required (**BIO-7**).

Bald and Golden Eagle Protection Act (Title 16, United States Code, Sections 668-668c) A recently issued Final Rule (September 2009) provides for a regulatory mechanism under the Bald and Golden Eagle Protection Act (Eagle Act) to permit take of bald or golden eagles comparable to incidental take permits under the ESA. This rule adds a new section at 50 CFR 22.26 to authorize the issuance of permits to take bald eagles and golden eagles on a limited basis. The proposed project could potentially result in “take” of the golden eagle from the loss of foraging habitat or collision with facility structures. Proposed conditions of certification **BIO-15**, which requires the completion of Avian, Bat, and Golden Eagle Protection Plans and **BIO-16** (Pre-construction Nesting Bird Surveys) will avoid direct take of this species during construction. To mitigate for lost habitat **BIO-12** (Desert Tortoise Compensatory Mitigation) will ensure the preservation and management of large areas of natural lands that would also provide suitable eagle foraging habitat. While acquisition does not address the net loss of foraging habitat in the immediate future, it would reduce future losses of habitat by placing a permanent conservation easement and deed restrictions on private lands. Condition of Certification **BIO-15** will facilitate data collection and advance understanding of project impacts, and requires mitigation for take of golden eagle. The USFWS has encouraged the project owner to apply for an Eagle Conservation Permit, which would permit take of golden eagle.

Migratory Bird Treaty Act (16 U.S.C. §§ 703 et seq.) This law makes it illegal to “pursue, hunt, take capture, or kill” any migratory bird or nest or egg of such bird, except as allowed by permit or regulations. While the project would kill birds, such kill is incidental to a legal commercial activity, and would not likely be considered a violation of the Act if unintentional and consistent with all agency mitigation requirements and recommendations.

Clean Water Act (Title 33, United States Code, sections 1251 through 1376, and Code of Federal Regulations, part 30, section 330.5(a)(26)) Section 404 of the federal Clean Water Act (CWA) requires permitting and monitoring of all discharges to surface water bodies. On March 19, 2012, a new Nationwide Permit (NWP 51) was issued for "Land-Based Renewable Energy Generation Facilities" affecting 1/2 acre or less of non-tidal Waters of the U.S., or 300 linear feet of streambed. In a December 14, 2011 correspondence to the applicant, the Corps verified the applicant’s delineation of Waters of the U.S and determined that only two streams, totaling 0.42 acre, were subject to USACE jurisdiction. Condition of Certification **BIO-22** requires 2:1 compensatory mitigation for the loss of 23.21acres of state

waters, which includes compensation for impacts to 0.42 acres of federal jurisdictional waters. **BIO-22** and issuance of a permit by the Corps will ensure compliance with these provisions of the Clean Water Act. Condition of Certification **BIO-7** (Biological Resources Mitigation Implementation & Monitoring Plan) requires the project owner provide a copy of all state and federal permits and implement all provisions of those permits. In addition, the preservation of lands to mitigate desert tortoise as required by **BIO-12** (Desert Tortoise Compensatory Mitigation) will also preserve desert habitat that may potentially have Waters of the U.S. or influence Waters of the U.S.

LOCAL LORS

Inyo County Renewable Energy Ordinance (Title 21). Title 21 is intended to support, encourage and regulate the development of the County's solar and wind resources while protecting the health, safety and welfare of its citizens and its environment. Specific to biology, Title 21 requires restoration and revegetation of a renewable energy project site once the facility is decommissioned or otherwise ceases to be operational. To ensure the project complies with this local ordinance, staff has recommended **BIO-26** (Facility Closure, Revegetation, and Reclamation Plan).

NOTEWORTHY PUBLIC BENEFITS

The HHSEGS project would result in significant impacts to sensitive biological resources, and would permanently diminish the extent and habitat value of native plant and animal communities in the region. Staff has therefore concluded that the HHSEGS project would not provide any noteworthy public benefits related to biological resources.

FACILITY CLOSURE

When facility closure occurs, whether planned or unexpected, it must be done in such a way as to protect the environment and public health and safety. Inyo County requires that applicants for renewable energy projects prepare a plan for closure, reclamation and revegetation of the site in the event the facility is decommissioned, or ceases to be operational (County Ordinance 1158 § 3, 2010.). Reclamation plans must be site-specific, based upon the character of the surrounding area, characteristics of the property as type of native vegetation, soil type, habitat, climate, water resources, and the existence of public trust resources.

Based on applicant's data response Set 2E (CH2 2012y), applicant acknowledges this local ordinance and confirms its intent to comply with these regulations. Condition of Certification **BIO-26** (Closure, Revegetation, and Reclamation Plan) would ensure the project complies with Inyo County's Title 21. This plan will present the goals and objectives of reclamation of the site, methods of revegetation, success criteria and monitoring to insure all standards are met, and other activities, project owner responsibilities, or and closure requirements of Inyo County Title 21. The **Land Use** section presents further information, including description of funding sufficient for these activities, as required by **LAND-2**. Facility closure mitigation measures would also be included in the BRMIMP prepared by the project owner as required in Condition of Certification **BIO-7.** Staff also notes that per Title 21 (Section 21.20.030), a draft

reclamation plan is required at the time an applicant applies for a renewable energy permit from the County.

RESPONSE TO AGENCY AND PUBLIC COMMENTS

Staff received comments on the Biological Resources section of the Preliminary Staff Assessment (**PSA**) from the following parties.

- Inyo County (INYO 2012j)
- Bureau of Land Management (BLM 2012b)
- National Park Service (NPS 2012a)
- The Nature Conservancy (TNC 2012a)
- Amargosa Conservancy (ARM 2012a)
- Basin and Range Watch (BRW 2012b)
- Pahrump Paiute Tribe (PAIU 2012a)
- Richard Arnold, Pahrump Paiute Tribe (PAIU 2012b)
- Big Pine Tribe of Owens Valley (PINE 2012a)
- Intervenor Cindy MacDonald (MAC 2012b)
- Intervenor Center for Biological Diversity (CBD 2012b)
- Intervenor, Old Spanish Trail Association (OSTA 2012c)
- Applicant, BrightSource Energy, Inc. (CH2 2012ee)

Energy Commission staff has summarized these comments and provided responses in **Appendix 1** -- PSA Response to Comments, Biology.

CONCLUSIONS REGARDING LORS COMPLIANCE

With implementation of proposed conditions of certification, the project may comply with most laws, ordinances, regulations, and standards (LORS), and most direct, indirect, and cumulative impacts would be avoided, minimized, or mitigated to less than significant levels. However, even with the implementation of the proposed conditions of certification the project would kill or injure a large number of birds from either collisions with structures (including mirrors) or from solar flux damage. Birds at risk include golden eagles, a species often seen at the site. Should take of golden eagle occur, a federal permit for such would be required pursuant to federal law. Since state law does not allow take of golden eagle, such take could not be in compliance with state law.

STAFF'S PROPOSED FINDINGS OF FACT

1. Construction and operation of HHSEGS will disturb approximately 3,277 acres of desert habitat, of which approximately 77 acres has previously been developed or significantly disturbed.

2. Invasive non-native weeds occur across much of the eastern two-thirds of the project site but the density and ecological threat or impact varies from low to high.

3. The plant communities and landscape features in and around the HHSEGS site provide suitable foraging breeding for a variety of wildlife including nesting birds, and/or facilitate wildlife movement throughout the greater region.

4. A total of 23.21 acres of jurisdictional Waters of the State, a CDFG-designated sensitive habitat, occur on the project site. A total of 0.42 acres are also Waters of the United States, and six of the washes are also depicted as blue line features on the U.S. Geological Survey (USGS) topographic maps.

5. The project would maintain a portion of the hydrologic and geomorphic processes of many of the affected washes by allowing them to pass through the site, rather than diverting them around the site in artificially constructed channels; however these processes would be altered by the berm constructed across the downstream boundary of the project to control stormwater, partial site grading, and the obstruction of flow paths by mirror pylons and roads.

6. The perimeter exclusion fencing, required to exclude desert tortoise, in conjunction with ongoing operational activities would eliminate the habitat function and values for most wildlife. These activities include: regular human disturbance, lighting and glare, noise, regular vegetation mowing, mirror washing, dust and weed control, and other operational activities.

7. Ephemeral desert washes comprise the majority of streams in the desert and CDFG recognizes the habitat function and values to wildlife provided by ephemeral desert, including: seasonal or temporary sources of water higher biotic diversity; higher moisture content, topographic and habitat complexity; denser and more robust vegetation; shade and cooler temperatures; greater food sources; greater abundance of native annuals.

8. Wildlife habitat functions and values were observed and documented by Energy Commission and CDFG staff during multiple site visits, and habitat along most washes was observed to be distinct from the adjacent uplands.

9. Condition of Certification **BIO-22** (State Waters Compensatory Mitigation) would offset impacts to state waters through acquisition and preservation of comparable habitat offsite. To address a no net loss policy for riparian and riverine (stream) habitat, **BIO-22** would require compensation at a ratio of 2:1, or two acres of washes protected for every acre affected, and would fully mitigate loss of state waters.

10. Condition of Certification **BIO-8** requires that a copy of the Army Corps of Engineers permit or official communication confirming no permit is necessary be provided to the Energy Commission, and all requirements implemented on the project site, to mitigate for waters of the U.S.

11. One state and federally listed threatened species, the desert tortoise, occurs on the HHSEGS site.

12. Portions of the project site support relatively intact habitat for desert tortoise, but the habitat value is not uniform.

13. Desert tortoise sign (i.e., live animals, tracks, burrows, or scat) is present across most of the site but is concentrated near the eastern border of the project.

14. Tortoise present near the boundary of the project site will be affected by the project, and should be considered for determining project impacts and mitigation.

15. Impacts to desert tortoise can be fully mitigated by requiring compensatory mitigation at a 3:1 ratio for creosote bush scrub habitat and a 1:1 ratio for shadscale habitat.

16. One state fully protected species, the golden eagle, forages on the HHSEGS site, and nests within ten miles of HHSEGS project site.

17. Structures that are part of the HHSEGS project, including the heliostats, ancillary facilities, and the power tower, could cause bird deaths from collisions. The actual frequency of collisions is unknown, and collisions may be secondary to flux exposure.

18. The impact of avian collisions with project features generally is significant, and is significant, although adaptive measures may reduce the number of such collisions

19. Operation of the HHSEGS project will concentrate solar flux. This is expected to result in bird injury and death from exposure in excess of avian tolerance. Birds may also die from exposure to repeated low levels doses of solar flux, or die from exposure after leaving the project site.

20. The impact of solar flux on bird species is potentially significant inasmuch as morbidity and mortality is likely for golden eagle and migratory birds, for which no incidental take is permitted under state law.

21. The project site supports a variety of common and special status wildlife including the American Badger and burrowing owl; species considered by the California Department of Fish and Game as species of special concern. The site also supports desert kit fox. The desert kit fox is designated as a protected furbearer, which may not be trapped or taken.

22. American badger, kit fox, and burrowing owl would be displaced by HHSEGS project construction.

23. Impacts to American badger, kit fox, and burrowing owl are adverse but are less than significant with the adoption of feasible mitigation measures required by the Commission.

24. The HHSEGS site provides occasional forage and dispersal pathways for the fully protected Nelson’s bighorn sheep. This species would still be able to complete intermountain travel.

25. Implementation of conditions of certification **BIO-9**, **BIO-12**, **BIO-18** through **BIO-20**, and **BIO-1** through **BIO-22** would reduce impacts to Nelson's bighorn sheep and their habitat. The project is not expected to pose significant impacts to movement for this species.

26. The project impacts to Nelson's bighorn sheep are adverse but less than significant with the adoption of feasible mitigation measures required by the Commission.

27. Implementation of conditions of certification **BIO-1** through **BIO-10**, **BIO-12**, and **BIO-13** will reduce significant impacts to the desert tortoise, considered "take" under CESA.

28. Implementation of conditions of certification **BIO-14**, **BIO-1** through **BIO-9**, **BIO-14**, and **BIO-18** through **BIO-23** will reduce impacts to American badger and kit fox to a level that is less than significant.

29. Implementation of conditions of certification **BIO-1** though **BIO-8**, **BIO-12, BIO-17** will reduce impacts to burrowing owl to a level that is less than significant.

30. Construction noise is not expected to have a substantial impact on nearby wildlife with the implementation of Conditions **NOISE-1** through **NOISE-7, BIO-15, and BIO-16**.Implementation of Conditions of certification **BIO-1** through **BIO-8**, **BIO-14, BIO-18 and BIO-12, BIO-15, BIO-16, and BIO-25 will re**duce impa**cts to nesting birds and sp**ecial-status bat species to less than significa**nt.**

31. Construction and operation of the project would directly and indirectly impact 28 occurrences of 11 special-status plant species located within the project boundary.

32. None of the affected species are state or federally listed Threatened, Endangered, Rare, or Candidate species but nine of the 11 species have a highly restricted range in California.

33. All 11 species onsite have distribution outside California but are rare in California (CRPR Rank 2; formerly CNPS List 2), and meet the criteria in Section 15380 of the CEQA Guidelines for designation as "rare".

34. Nine additional occurrences of eight special-status (CRPR rank 1B and 2) species were documented offsite in very close proximity to the project boundary, and thus in close proximity to construction and operation.

35. Conditions of certification **BIO-19, BIO-18**, and **BIO-8** specify Best Management Practices and other measures for avoiding and minimizing indirect impacts to these occurrences in close proximity from fugitive dust, herbicide and other chemical drift, the introduction and spread of weeds, and increased risk of fire.

36. Condition of Certification **BIO-20** (Special-status Plant Compensatory Mitigation) offers two options for offsite mitigation to offset impacts to occurrences onsite: 1) preservation, and 2) restoration of at-risk occurrences, and includes performance standards for each option. Mitigation ratios for preservation are based on the degree of rarity and extinction risk.

37. The HHSEGS project will lower groundwater levels within an area proximate to the site's pumps, as well as in the water basin generally.

38. How far and fast project pumping cone of depression will propagate cannot be determined with certainty given certain geological complexities in the area.

39. Large concentrations of groundwater-dependent mesquite habitats occur in close proximity to the project in Nevada, some within a half-mile or less of the project.

40. The mesquite habitats located near the project include the Stump Springs Area of Critical Environmental Concern (ACEC), an area designated for protection of its biological and cultural resources by the Bureau of Land Management. Stump Springs ACEC also contains an active seasonal spring.

41. The applicant mapped 4,040 acres of groundwater-dependent habitats within an approximate 5 to 6-mile radius of the project; most of these occur on lands administered by the Nevada Bureau of Land Management.

42. One of the largest concentrations of mesquite patches in southern Nevada occurs in Pahrump Valley; the 9,047-acre Pahrump Valley metapatch; no mesquite or other groundwater-dependent communities occur within the project boundary.

43. At least three active seasonal seeps and springs occur within a 5-mile radius of the project, and several additional inactive springs that stopped flowing during the period of heavy agricultural pumping in the last century.

44. The Nevada Bureau of Land Management Mesquite-Acacia Conservation Management Strategy states mesquite have significant biological and cultural importance in southern Nevada, and identified the mesquite habitats in Pahrump Valley and Stump Springs areas as conservation priorities.

45. The Conservation Management Strategy states that the Stump Springs area has significant wildlife habitat values, and that in a landscape dominated by desert scrub, mesquite patches serve as important breeding and foraging areas for wildlife, including many special-status species.

46. The Bureau of Land Management Southern Nevada District is currently considering establishing a new ACEC to protect the mesquite and other resources north of Stump Springs and east of the project boundary.

47. Project groundwater pumping could have significant direct and cumulative impacts on the mesquite habitats east of the project and the Stump Springs ACEC if project pumping should result in water levels being lowered below the effective rooting depth of the mesquite and other groundwater-dependent species.

48. If mesquite habitats are adversely affected, dependent wildlife would also be affected, including some special-status species.

49. Mesquite rooting depths are highly variable and the ability of mesquite to track a declining water table is not well documented.

50. Groundwater levels across the entire Pahrump Valley have already declined as a result of basin groundwater pumping, particularly in the northern valley or areas closest to Pahrump.

51. There has been a severe over-allocation of water rights in the Pahrump Valley groundwater basin.

52. There is a fault zone between the project site and Stump Springs ACEC and other mesquite habitats that may buffer the effects of project pumping but the protective properties of this fault zone are not presently known or established.

53. The hydrogeology of this portion of the Death Valley Regional Flow System is complex and not well understood.

54. Groundwater monitoring is necessary to determine whether there will be drawdown that will negatively affect Stump Springs ACEC and other mesquite habitats and area seeps and springs.

55. Vegetation monitoring and/or soil cores to examine rooting depths are necessary to determine the tolerance of mesquite to declining water tables and to determine whether project water use is negatively affecting Stump Springs ACEC and the area mesquite habitats.

56. There is significant public interest on the groundwater issues of the project, and the potential for project pumping to negatively impact area mesquite habitats, dependent wildlife, and springs.

57. Several local, state, and federal agencies submitted scoping comments and/or PSA comments expressing concern about groundwater pumping impacts to biological (and cultural) resources.

58. The Bureau of Land Management submitted scoping comments and PSA comments urging the Energy Commission to adopt conditions of certification requiring groundwater monitoring and groundwater-dependent vegetation monitoring to protect these resources on adjacent BLM lands, and require the project stop, reduce or modify pumping if monitoring detects a groundwater drawdown beyond the project boundary.

59. Implementation of conditions of certification **BIO-23**, **WATER SUPPLY-2**, **and** WATER **SUPPLY-4** will avoid or minimize indirect impacts from project pumping to less than significant levels.

60. Thirteen species of invasive weeds were documented in the project area, including two California Department of Food and Agriculture (CDFA) A-rated pests (Russian knapweed and halogeton) subject to state-enforced actions including eradication.

61. Increased vehicle and equipment use during construction and operation could increase the spread of weeds into adjacent public and private lands from contaminated vehicle and equipment tires and undercarriages.

62. Mowing and mirror-washing and soil disturbance could also increase the spread of weeds by making the habitat more vulnerable to invasion by weeds.

63. The spread of invasive plants is a major threat to biological resources in the Mojave Desert, causing destructive changes in ecosystem processes and increasing the risk of catastrophic fire and fire frequency.

64. Condition of Certification **BIO-18** (Weed Management Plan) requires the project owner to manage or contain weeds onsite for the life of the project to prevent their spread into adjacent offsite habitat, or to nearby communities via employees and contractors contaminated vehicles and equipment.

65. **BIO-18** includes specifications for environmentally safe weed management to avoid accidental harm to biological resources from weed management activities.

66. Construction and operation of the project will have effects on a number of biological resources that are individually limited but cumulatively considerable when viewed in connection with the effects of past, current, and probable future projects.

67. The project's contribution to significant cumulative effects to desert tortoise are not cumulatively considerable after implementation of conditions of certification **BIO-8, BIO-9, BIO-10, BIO-12 and BIO-13** to minimize or fully mitigate those impacts.

68. The project's contribution to significant cumulative effects to desert kit fox, American badger, special-status bat species, and Nelson's bighorn sheep are not cumulatively considerable after implementation of Conditions of Certification **BIO-8, BIO-12, BIO-14, BIO-18, and BIO-22**.

69. The project's contribution to significant cumulative effects to migratory birds and golden eagles is cumulatively considerable when combined with the anticipated indirect effects to remaining habitat and populations.

70. The significant cumulative effect from the loss of migratory birds and golden eagles that may occur during project operation would be cumulatively considerable even with the implementation of conditions of certification **BIO-8**, **BIO-15**, and **BIO-16** which address impact avoidance and minimization measures would address the project's contribution to this significant cumulative impact.

71. The project's contribution to significant cumulative effects to other wildlife, desert washes, and groundwater-dependent communities are not cumulatively considerable after implementation of Conditions of Certification **BIO-1** through **BIO-26**.

PROPOSED CONDITIONS OF CERTIFICATION

Staff proposes the following conditions of certification:

DESIGNATED BIOLOGIST SELECTION AND QUALIFICATIONS[7]

BIO-1 The project owner shall submit the resume of the proposed Designated Biologist, with at least three references and contact information, to the Energy Commission Compliance Project Manager (CPM) for approval. The Designated Biologist must meet all qualifications as stated within the U.S. Fish and Wildlife Service's (USFWS's) Biological Opinion (BO) for the HHSEGS project. Those qualifications at a minimum shall include at least three references and contact information.

The Designated Biologist must meet the following minimum qualifications:

1. Bachelor's degree in biological sciences, zoology, botany, ecology, or a closely related field;

2. Three years of experience in field biology or current certification of a nationally recognized biological society, such as The Ecological Society of America or The Wildlife Society;

3. Have at least one year of field experience with biological resources found in or near the project area;

4. Meet the current USFWS Authorized Biologist qualifications criteria (USFWS 2008), demonstrate familiarity with protocols and guidelines for the desert tortoise, and be approved by the USFWS; and

5. Possess a California ESA Memorandum of Understanding pursuant to Section 2081(a) for desert tortoise.

Verification: No less than 90 days prior to the start of any project-related ground disturbing activity, the project owner shall provide the CPM and CDFG a copy of the Commission Designated Biologist (= USFWS Authorized Biologist(s)) selection for the HHSEGS project and a copy of the above specified qualifications or the qualifications as required by the federal Biological Opinion. The project owner shall submit the specified information to the CPM and CDFG within 1 (one) week of receipt from the USFWS. No site or related ground disturbing activities shall commence until the appropriate number of approved Designated Biologist(s) is/are available to be on site.

If a Designated Biologist needs to be replaced, copies of the above specified information of the proposed replacement, as well as the USFWS new designated Authorized Biologists (= Commission title of Designated Biologist) for the HHSEGS project must be submitted to the CPM and CDFG within 48 hours of receipt of USFWS's authorization of a new Designated Biologist for the HHSEGS project site. In an emergency, the project owner shall immediately notify the CPM, CDFG, and USFWS to discuss the qualifications and approval of a short-term replacement, and/or enact any

[7] USFWS <www.fws.gov/ventura/speciesinfo/protocols_guidelines/docs/dt> designates biologists who are approved to handle tortoises as "Authorized Biologists." Such biologists have demonstrated to USFWS that they possess sufficient desert tortoise knowledge and experience to handle and move tortoises appropriately, and have received USFWS approval. Authorized Biologists are permitted to then approve specific monitors to handle tortoises, at their discretion. The California Department of Fish and Game (CDFG) must also approve such biologists, potentially including individual approvals for monitors approved by the Authorized Biologist. Designated Biologists are the equivalent of Authorized Biologists. Only Designated Biologists and certain Biological Monitors who have been approved by the Designated Biologist would be allowed to handle desert tortoises.

emergency provisions as specified in the USFWS Biological Opinion for the HHSEGS project.

DESIGNATED BIOLOGIST DUTIES

BIO-2 The project owner shall ensure that the Designated Biologist performs the following during any site (or related facilities) mobilization, ground disturbance, grading, construction, operation, or other activities as otherwise directed by the CPM. The Designated Biologist may be assisted by the approved Biological Monitor(s) but remains the contact for the project owner and the CPM. The Designated Biologist Duties shall include the following:

1. Advise the project owner's Construction and Operation Managers on the implementation of the biological resources conditions of certification;

2. Approve and submit the Biological Resources Mitigation Implementation and Monitoring Plan (BRMIMP) to the CPM;

3. Be available to supervise, conduct and coordinate mitigation, monitoring, and other biological resources compliance efforts, particularly in areas requiring avoidance or containing sensitive biological resources, such as special-status species or their habitat;

4. Clearly mark sensitive biological resource areas and inspect these areas at appropriate intervals for compliance with regulatory terms and conditions;

5. Inspect active construction areas where animals may have become trapped prior to construction commencing each day. At the end of the day, inspect for the installation of structures that prevent entrapment or allow escape during periods of construction inactivity. Periodically inspect areas with high vehicle activity (e.g., parking lots) for animals in harm’s way;

6. Inspect heliostat fields after rain events for presence of standing water in planned retention area and document the intensity and duration of the rain event via rain collectors. At least two collectors shall be placed within the project boundaries, one in each solar field, and marked on all project planning maps. The perimeter of the ponded area shall be mapped with GPS, and all above information, including readings of rain collectors and photographic documentation must be included within Monthly Compliance Reports;

7. Determine and oversee implementation of remedial actions any time water has been observed standing onsite for 24 hours. The Designated Biologist shall initiate remedial methods no later than 24 hours after standing water has been observed on the project site. Remedial methods may include grading, pumping spraying, tilling, or any other means to disperse or ensure evaporation and/or absorption of standing water. Other remedial efforts may be determined in conjunction with CPM review and approval. Descriptions of remedial efforts, including photo documentation, and

discussion of results of remedial efforts must be included in the Monthly Compliance Report;

8. Notify the project owner and the CPM of any non-compliance with any biological resources condition of certification;

9. Respond directly to inquiries of the CPM and Biological Resources Staff regarding biological resource issues;

10. Respond immediately to reports of onsite kit fox mortality or injury, and to the extent possible, reports of dead or injured kit fox offsite and immediately adjacent the project boundaries or on access roads, notify the CDFG and CPM within 24 hours, and undertake restorative and/or disease prevention actions as specified within the American Badger and Kit Fox Management Plan, or as directed by the CDFG, with copies of all CDFG guidance provided to the CPM within 24 hours of receipt;

11. Maintain compliance with the provisions of the Avian, Bat, and Golden Eagle Protection Plans, USFWS Golden Eagle Conservation Permit (if issued), and/or any other directions from the USFWS, CDFG, or CPM with respect to golden eagle, and special-status birds and bats.

12. Maintain written records of the tasks specified above and those included in the BRMIMP. Summaries of these records shall be submitted in the Monthly Compliance Report and the Annual Compliance Report;

13. Train the Biological Monitors as appropriate, and ensure their familiarity with the BRMIMP, Worker Environmental Awareness Program (WEAP) training, and USFWS guidelines on desert tortoise surveys and handling procedures <www.fws.gov/ventura/speciesinfo/protocols_guidelines>, and; and

14. Maintain the ability to be in regular, direct communication with the CPM and representatives of CDFG and USFWS including notifying these agencies of dead or injured listed species and reporting special-status species observations to the California Natural Diversity Data Base.

Verification: The Designated Biologist shall submit in the Monthly Compliance Report to the CPM and copies of all written reports and summaries that document biological resources compliance activities. If actions may affect biological resources during operation a Designated Biologist shall be available for monitoring and reporting. During project operation, the Designated Biologist shall submit record summaries in the Annual Compliance Report unless his/her duties cease, as approved by the CPM.

BIOLOGICAL MONITOR(S) SELECTION AND QUALIFICATIONS

BIO-3 The project owner's approved Designated Biologist shall submit the resume, at least three references, and contact information of the proposed Biological Monitor(s) to the CPM. The resume shall demonstrate, to the satisfaction of the CPM the appropriate education and experience to accomplish the

assigned biological resource tasks. The Biological Monitor is the equivalent of the USFWS designated Desert Tortoise Monitor (USFWS 2008).

Biological Monitor(s) training by the Designated Biologist shall include familiarity with the conditions of certification, BRMIMP, WEAP, and USFWS guidelines on desert tortoise surveys and handling procedures <www.fws.gov/ventura/speciesinfo/protocols_guidelines>.

Verification: The project owner shall submit the specified information to the CPM for approval at least 30 days prior to the start of any project-related site disturbance activities. The Designated Biologist shall submit a written statement to the CPM confirming that individual Biological Monitor(s) has been trained including the date when training was completed. If additional biological monitors are needed during construction the specified information shall be submitted to the CPM and for approval at least 10 days prior to their first day of monitoring activities, or within 24 hours of receipt of USFWS decision approving acceptability as tortoise monitors, whichever comes sooner.

BIOLOGICAL MONITOR DUTIES

BIO-4 The Biological Monitors shall assist the Designated Biologist in conducting surveys and in monitoring of mobilization, ground disturbance, grading, construction, operation, and closure activities. The Designated Biologist shall remain the contact for the project owner and the CPM.

Verification: The Designated Biologist shall submit in the Monthly Compliance Report to the CPM copies of all written reports and summaries that document biological resources compliance activities, including those conducted by Biological Monitors. If actions may affect biological resources during operation of the project, a Biological Monitor, under the supervision of the Designated Biologist, shall be available for monitoring and reporting. During project operation, the Designated Biologist shall submit record summaries in the Annual Compliance Report unless their duties cease, as approved by the CPM after receiving verification from the USFWS that their services are not required for compliance with federal permits, with a copy of the USFWS decision document provided to the CPM.

DESIGNATED BIOLOGIST AND BIOLOGICAL MONITOR AUTHORITY

BIO-5 The project owner's construction/operation manager shall act on the advice of the Designated Biologist and Biological Monitor(s) to ensure conformance with the biological resources conditions of certification.

The Designated Biologist shall have the authority to immediately stop any activity that is not in compliance with these conditions and/or order any reasonable measure to avoid take of an individual of a listed species. If required by the Designated Biologist and Biological Monitor(s) the project owner's construction/operation manager shall halt all site mobilization, ground disturbance, grading, construction, and operation activities in areas specified by the Designated Biologist. The Designated Biologist shall:

1. Require a halt to all activities in any area when determined that there would be an unauthorized adverse impact to biological resources if the activities continued;

2. Inform the project owner and the construction/operation manager when to resume activities; and

3. Notify the CPM and CDFG within 24 hours if there is a halt of any activities and advise them of any corrective actions that have been taken or will be instituted as a result of the work stoppage.

If the Designated Biologist is unavailable for direct consultation, the Biological Monitor shall act on behalf of the Designated Biologist.

Verification: The project owner shall ensure that the Designated Biologist or Biological Monitor notifies the CPM immediately (and no later than the morning following the incident, or Monday morning in the case of a weekend) of any non-compliance or a halt of any site mobilization, ground disturbance, grading, construction, and operation activities. The project owner shall notify the CPM of the circumstances and actions being taken to resolve the problem.

Whenever corrective action is taken by the project owner, a determination of success or failure will be made by the CPM within five working days after receipt of notice that corrective action is completed, or the project owner will be notified by the CPM that coordination with other agencies will require additional time before a determination can be made.

WORKER ENVIRONMENTAL AWARENESS PROGRAM (WEAP)

BIO-6 The Designated Biologist shall develop and implement project-site-specific Worker Environmental Awareness Program (WEAP). The WEAP shall be administered to all onsite personnel including surveyors, construction engineers, employees, contractors, contractor's employees, supervisors, inspectors, subcontractors, and delivery personnel. The WEAP shall be implemented during site mobilization, ground disturbance, grading, construction, operation, and closure. The WEAP shall:

1. Be developed by or in consultation with the Designated Biologist, be responsive of CPM, and/or input CDFG, and consist of an on-site or training center presentation in which supporting written material and electronic media, including photographs of protected species, is made available to all participants. The training presentation shall be made available in the language best understood by the participants;

2. Discuss the locations and types of sensitive biological resources on the project site and adjacent areas, and explain the reasons for protecting these resources; provide information to participants that no snakes, reptiles, or other wildlife shall be intentionally harmed (unless posing a reasonable and immediate threat to humans);

3. Place special emphasis on desert tortoise, including information on physical characteristics, distribution, behavior, ecology, sensitivity to human activities, legal protection, penalties for violations, reporting requirements, and protection measures;

4. Provide pictures of desert tortoise, golden eagles, American badger, kit fox, and burrowing owl, provide information on sensitivity to human activities, legal protection, reporting requirements, and how to identify construction avoidance zones for these species as marked by flagging, staking, or other means, also describe the protections for bird nests and provide information as described above;

5. Provide overview [for operational staff] of potential impacts to avian species from concentrated solar flux created during operations phase, reporting requirements, and protection measures;

6. Include a discussion of fire prevention measures to be implemented by workers during Project activities and request workers to: a) use designated smoking areas and dispose of cigarettes and cigars appropriately and not leave them on the ground or buried, b) keep vehicles on graveled or well-maintained roads at all times, unless performing prescribed construction activities, to prevent vehicle exhaust systems from coming in contact with roadside weeds, c) use and maintain approved spark arresters on all power equipment, and d) keep a fire extinguisher on hand at all times;

7. Present the meaning of various temporary and permanent habitat protection measures;

8. Identify whom to contact if there are further comments and questions about the material discussed in the program; and

9. Include a training acknowledgment form to be signed by each worker indicating that they received training and shall abide by the guidelines.

The specific program can be administered by a competent individual(s) acceptable to the Designated Biologist, and documented within the Monthly Compliance Report.

Verification: At least 60 days prior to the start of any project-related site disturbance activities, the project owner shall provide to the CPM (for review and approval, and to the CDFG and/or USFWS for review and comment), electronic copies of the WEAP and all supporting written materials and/or electronic media prepared by the Designated Biologist and a resume of the person(s) administering the program. At least 30 days prior to the start of any project-related ground disturbing activities, the project owner will provide two copies of the final WEAP to the CPM and implement the training for all workers.

The project owner shall provide in the Monthly Compliance Report the number of persons who have completed the training in the prior month and a running total of all persons who have completed the training to date.

Training acknowledgement forms signed during construction shall be kept on file by the project owner for at least six months after the start of commercial operation.

Throughout the life of the project, the worker education program shall be repeated annually for permanent employees, and shall be routinely administered within one week of arrival to any new construction personnel, foremen, contractors, subcontractors, and other personnel potentially working within the project area. Upon completion of the orientation, employees shall sign a form stating that they attended the program and understand all protection measures. These forms shall be maintained by the project owner and shall be made available to the CPM upon request. Workers shall receive and be required to visibly display a hardhat sticker or certificate that they have completed the training.

During project operation, signed statements for operational personnel shall be kept on file for six months following the termination of an individual's employment.

BIOLOGICAL RESOURCES MITIGATION IMPLEMENTATION AND MONITORING PLAN (BRMIMP)

BIO-7 The project owner shall develop and implement a Biological Resources Mitigation Implementation and Monitoring Plan (BRMIMP) for the project. The BRMIMP shall incorporate avoidance and minimization measures described in final versions of the Desert Tortoise Translocation Plan, the USFWS Biological Opinion for the HHSEGS project, the Raven Management Plan, the American Badger and Kit Fox Management Plan, the Avian, Bat, and Golden Eagle Protection Plans, Burrowing Owl Impact Avoidance and Minimization Measures, and Closure, Revegetation, and Reclamation Plan.

The BRMIMP shall be prepared in consultation with the Designated Biologist and include the following:

1. All biological resources mitigation, monitoring, and compliance measures proposed by the project owner and approved by the Commission;

2. All biological resources mitigation, monitoring, and compliance measures specified in the conditions of certification;

3. All biological resource mitigation, monitoring and compliance measures required in state and federal agency terms and conditions, including but not limited to: USFWS Biological Opinion, USFWS Golden Eagle Conservation Permit (if issued), U.S. Army Corps of Engineers 404 Certification, 401 Certification from the Lahontan Regional Water Quality Control Board, California Department of Fish and Game Lake and Streambed Alteration Agreement, and a Food and Agricultural Code Section 80001 native plant harvesting permit;

4. All sensitive biological resources to be impacted, avoided, or mitigated by project construction, operation, and closure;

5. All required mitigation measures for each sensitive biological resource and remedial actions for standing water onsite, including known or suspected disease outbreaks on the project site;

6. All locations on a map, at an approved scale, of sensitive biological resource areas and two rain collectors subject to disturbance and areas requiring temporary protection and avoidance during construction and operation;

7. Aerial photographs, at an approved scale, of all areas to be disturbed during project construction activities; include one set prior to any site or related facilities mobilization disturbance and one set subsequent to completion of project construction. Provide planned timing of aerial photography and a description of why times were chosen. Provide a final accounting of the before/after acreages and a determination of whether additional habitat compensation is necessary in the Construction Termination Report;

8. Duration for each type of monitoring and a description of monitoring methodologies and frequency;

9. Performance standards to be used to help decide if/when proposed mitigation is or is not successful;

10. All performance standards and remedial measures to be implemented if performance standards are not met;

11. A discussion of biological resources-related facility closure measures; and

12. A process for proposing plan modifications to the CPM.

Verification: The project owner shall submit two copies of the draft BRMIMP to the CPM for review and approval at least 60 days prior to start of any project-related site disturbance activities. No less than 30 days prior to any project-related ground disturbing activities, the final revised BRMIMP shall be submitted to the CPM. No ground disturbance may occur prior to approval of the final BRMIMP by the CPM.

If there are any permits that have not yet been received when the BRMIMP is first submitted, these permits shall be submitted to the CPM within five days of their receipt, and the BRMIMP shall be revised or supplemented to reflect the permit condition within at least 10 days of their receipt by the project owner.

The project owner shall notify the CPM no less than five working days before implementing any modifications to the approved BRMIMP.

Any changes to the approved BRMIMP must be approved by the CPM and in consultation with appropriate agencies to ensure no conflicts exist.

Implementation of BRMIMP measures (construction activities that were monitored, species observed) will be reported in the Monthly Compliance Reports by the Designated Biologist. Within 30 days after completion of project construction, the project owner shall provide to the CPM, for review and approval, a written construction termination report identifying which items of the BRMIMP have been completed, a summary of all modifications to mitigation measures made during the project's site

mobilization, ground disturbance, grading, and construction phases, and which mitigation and monitoring items are still outstanding.

GENERAL IMPACT AVOIDANCE AND MINIMIZATION MEASURES

BIO-8 The project owner shall undertake the following measures to manage the construction site and related facilities in a manner to avoid or minimize impacts to biological resources:

1. Limit Disturbance Area. The boundaries of all areas to be disturbed (including staging areas, access roads, and sites for temporary placement of spoils) shall be delineated with stakes and flagging prior to construction activities in consultation with the Designated Biologist. All disturbances, vehicles, and equipment shall be confined to the flagged areas.

2. Minimize Road Impacts. New and existing roads that are planned for construction, widening, or other improvements shall not extend beyond the flagged impact area as described above. All vehicles passing or turning around will do so within the planned impact area or in previously disturbed areas. Where new access is required outside of existing roads (e.g. new spur roads) or the construction zone, the route will be clearly marked (i.e., flagged and/or staked) prior to the onset of construction.

3. Minimize Traffic Impacts. Vehicular traffic during project construction and operation shall be confined to existing routes of travel to and from the project site, and cross country vehicle and equipment use outside designated work areas shall be prohibited. With the exception of the dirt roads that run between Tecopa Road and the project site, overland vehicle traffic shall be prohibited. The speed limit shall not exceed 25 miles per hour within the project area, on maintenance roads for linear facilities, or on dirt access roads to the HHSEGS site. Vehicles shall abide by posted speed limits on paved roads.

4. Monitor During Construction. The Designated Biologist or Biological Monitor shall be present at the construction site during all project activities that have potential to disturb soil, vegetation, and wildlife. In areas that could support desert tortoise or any other sensitive wildlife species, the USFWS-approved Designated Biologist or Biological Monitor shall walk immediately ahead of equipment during brushing and grading activities.

5. Salvage Wildlife during Clearing and Grubbing. The Designated Biologist or Biological Monitor shall salvage and relocate sensitive wildlife during clearing and grading operations. The species shall be salvaged when conditions will not jeopardize the health and safety of the monitor and relocated off-site habitat.

6. Avoid Roosting Bats. The project owner shall minimize disturbance to roosting bats. If night or day roosting bats are identified in project structures they shall not be disturbed and a 100 foot non disturbance buffer shall be placed around the bats. If the Designated Biologist, in

consultation with a qualified bat biologist, determines roosting bats consist of a non-breeding roost the individuals shall be safely evicted, under the direction of a qualified bat biologist. The CPM and CDFG shall be notified of any bat evictions within 48 hours. Maternity colonies shall not be disturbed. The CPM shall be notified within 48 hours of any active nurseries that are identified within the construction area.

7. Minimize Impacts of Transmission/Pipeline Alignments, Roads, and Staging Areas. For construction activities outside of the plant site (transmission line, pipeline alignments) access roads, pulling sites, and storage and parking areas shall be designed, installed, and maintained with the goal of minimizing impacts to native plant communities and sensitive biological resources. Transmission lines and all electrical components shall be designed, installed, and maintained in accordance with the Avian Power Line Interaction Committee's (APLIC's) *Suggested Practices for Avian Protection on Power Lines* (APLIC 2006)and *Mitigating Bird Collisions with Power Lines* (APLIC 2004)to reduce the likelihood of bird electrocutions and collisions.

8. Avoid Use of Toxic Substances. Road surfacing and sealants as well as soil bonding and weighting agents used on unpaved surfaces shall be non-toxic to wildlife and plants. Anticoagulants shall not be used for rodent control. Pre-emergents and other herbicides with documented residual toxicity shall not be used. Herbicides shall be applied in conformance with federal, State, and local laws and according to the guidelines for wildlife-safe use of herbicides in **BIO-18** (Weed Management Plan).

9. Minimize Lighting Impacts. Facility lighting shall be designed, installed, and maintained to prevent side casting of light towards wildlife habitat.

10. Cap Vertical Pipes. All vertical pipes greater than 4-inches in diameter shall be capped to prevent the entrapment of birds or bats.

11. Avoid Vehicle Impacts to Desert Tortoise. Parking and storage shall occur within the area enclosed by desert tortoise exclusion fencing to the extent feasible. No vehicles or construction equipment parked outside the fenced area shall be moved prior to an inspection of the ground beneath the vehicle for the presence of desert tortoise. If a desert tortoise is observed, it shall be left to move on its own. If it does not move within 15 minutes, a Designated Biologist or Biological Monitor under the Designated Biologist's direct supervision may remove and relocate the animal to a safe location if temperatures are within the range described in the USFWS' 2009 Desert Tortoise Field Manual (http://www.fws.gov/ventura/speciesinfo/protocols_guidelines). All access roads outside of the fenced project footprint shall be delineated with temporary desert tortoise exclusion fencing on either side of the access road, unless otherwise authorized by the CPM.

12. Avoid Wildlife Pitfalls.

a. Backfill Trenches. At the end of each work day, the Designated Biologist shall ensure that all potential wildlife pitfalls (trenches, bores, and other excavations) have been backfilled. If backfilling is not feasible, all trenches, bores, and other excavations shall be sloped at a 3:1 ratio at the ends to provide wildlife escape ramps, or covered completely to prevent wildlife access, or fully enclosed with desert tortoise-exclusion fencing. All trenches, bores, and other excavations outside the areas permanently fenced with desert tortoise exclusion fencing shall be inspected periodically, but no less than three times, throughout the day and at the end of each workday by the Designated Biologist or a Biological Monitor. Should a tortoise or other wildlife become trapped, the Designated Biologist or Biological Monitor shall remove and relocate the individual as described in the Desert Tortoise Relocation/Translocation Plan. Any wildlife encountered during the course of construction shall be allowed to leave the construction area unharmed.

b. Avoid Entrapment of Desert Tortoise. Any construction pipe, culvert, or similar structure with a diameter greater than 3 inches, stored less than 8 inches aboveground, and within desert tortoise habitat (i.e., outside the permanently fenced area) for one or more nights, shall be inspected for tortoises before the material is moved, buried, or capped. As an alternative, all such structures may be capped before being stored outside the fenced area, or placed on pipe racks. These materials would not need to be inspected or capped if they are stored within the permanently fenced area after the clearance surveys have been completed.

13. Minimize Standing Water. Water applied to dirt roads and construction areas (trenches or spoil piles) for dust abatement shall use the minimal amount needed to meet safety and air quality standards in an effort to prevent the formation of puddles, which could attract desert tortoises and common ravens to construction sites. A Biological Monitor shall patrol these areas to ensure water does not puddle and attract desert tortoise, common ravens, and other wildlife to the site and shall take appropriate action to reduce water application where necessary.

14. Minimize Standing Water in the Retention Basin. Water shall be prohibited from collecting or pooling for more than 24 hours after a storm event within the project retention basin. Standing water within the retention basin shall be removed, pumped, raked, or covered. Alternative methods or the time water is allowed to pool may be approved with the approval of the CPM.

15. Minimize Spills of Hazardous Materials. All vehicles and equipment shall be maintained in proper working condition to minimize the potential for fugitive emissions of motor oil, antifreeze, hydraulic fluid, grease, or other hazardous materials. The Designated Biologist shall be informed of any hazardous spills immediately as directed in the project Hazardous Materials Plan. Hazardous spills shall be immediately cleaned up and the

contaminated soil properly disposed of at a licensed facility. Servicing of construction equipment shall take place only at a designated area. Service/maintenance vehicles shall carry a bucket and pads to absorb leaks or spills.

16. Dispose of Road-killed Animals. Road-killed animals or other carcasses detected on Tecopa Road and other project roads within one mile of the project site shall be picked up immediately and delivered to the Biological Monitor. For special-status species road kill, the Biological Monitor shall contact USFWS and CDFG within 1 working day of receipt of the carcass for guidance on disposal or storage of the carcass. The Biological Monitor shall report the special-status species record as described in Condition of Certification **BIO-2**.

17. Worker Guidelines. During construction all trash and food-related waste shall be placed in self-closing containers and removed daily from the site. Workers shall not feed wildlife or bring pets to the project site. Except for law enforcement or security personnel, no workers or visitors to the site shall bring firearms or weapons.

18. Avoid Spread of Noxious Weeds. The project owner shall implement the following Best Management Practices during construction and operation, and all other measures as required in the final approved Weed Management Plan (**BIO-18**) to prevent the spread and propagation of noxious weeds and other invasive plants:

    a. Limit the size of any vegetation and/or ground disturbance to the absolute minimum and limit ingress and egress to defined routes;

    b. Prevent spread of non-native plants via vehicular sources by implementing Trackclean™ or other methods of vehicle cleaning for vehicles coming and going from construction sites. Earth-moving equipment shall be cleaned prior to transport to the construction site; and

    c. Use only weed-free straw, hay bales, and seed for erosion control and sediment barrier installations.

19. Implement Erosion Control Measures. Standard erosion control measures shall be implemented for all phases of construction and operation where sediment run-off from exposed slopes threatens to enter “Waters of the State”. Sediment and other flow-restricting materials shall be moved to a location where they shall not be washed back into the stream. All disturbed soils and roads within the project site shall be stabilized to reduce erosion potential, both during and following construction. Areas of disturbed soils (access and staging areas) with slopes toward a drainage shall be stabilized to reduce erosion potential.

20. Monitor Ground-Disturbing Activities Prior to Site Mobilization. If ground-disturbing activities are required prior to site mobilization, such as for

geotechnical borings or hazardous waste evaluations, a Designated Biologist or Biological Monitor shall be present to monitor any actions that could disturb soil, vegetation, or wildlife.

21. Control and Regulate Fugitive Dust. To reduce the potential for the transmission of fugitive dust the owner shall implement dust control measures. These shall include:

    a. The owner shall apply non-toxic soil binders, equivalent or better in efficiencies than the CARB- approved soil binders, to active unpaved roadways, unpaved staging areas, and unpaved parking area(s) throughout construction to reduce fugitive dust emissions.

    b. Water the disturbed areas of the active construction sites at least three times per day and more often if uncontrolled fugitive dust is noted.

    c. Enclose, cover, water twice daily, and/or apply non-toxic soil binders according to manufacturer's specifications to exposed piles with a 5% or greater silt content. Agents with known toxicity to wildlife shall not be used unless approved by the CPM.

    d. Establish a vegetative ground cover (in compliance with biological resources impact mitigation measures above) or otherwise create stabilized surfaces on all unpaved areas at each of the construction sites within 21 days after active construction operations have ceased.

    e. Increase the frequency of watering, if water is used as a soil binder for disturbed surfaces, or implement other additional fugitive dust mitigation measures, to all active disturbed fugitive dust emission sources when wind speeds (as instantaneous wind gusts) exceed 25 mph.

All mitigation measures and their implementation methods shall be included in the BRMIMP and implemented. Implementation of the measures shall be reported in the Monthly Compliance Reports by the Designated Biologist. Within 30 days after completion of project construction, the project owner shall provide to the CPM, for review and approval, a written construction termination report identifying how measures have been completed.

DESERT TORTOISE CLEARANCE SURVEYS AND EXCLUSION FENCING

BIO-9 The project owner shall undertake appropriate measures to manage the construction site and related facilities in a manner to avoid or minimize impacts to desert tortoise. Methods for clearance surveys, fence specification and installation, tortoise handling, artificial burrow construction, egg handling and other procedures shall be consistent with those described in the USFWS' 2009 *Desert Tortoise Field Manual*<http://www.fws.gov/ventura/speciesinfo/protocols_guidelines> or more current guidance provided by CDFG and USFWS. The project owner

shall also implement all terms and conditions described in the Biological Opinion for the project prepared by USFWS. These measures include, but are not limited to, the following:

1. Desert Tortoise Exclusion Fence Installation. To avoid impacts to desert tortoises, permanent desert tortoise exclusion fencing shall be installed along the permanent, which may or may not be combined with the perimeter security fence. Temporary fencing along the underground utility corridors in California may be required for activities that require trenching and will be implemented at the approval of the CPM. The proposed alignments for the permanent perimeter fence and utility rights-of-way fencing shall be flagged and surveyed within 24 hours prior to the initiation of fence construction. Clearance surveys of the perimeter fence and utility rights-of-way alignments shall be conducted by the Designated Biologist(s) using techniques approved by the USFWS and CDFG and may be conducted in any season with USFWS and CDFG approval. Biological Monitors may assist the Designated Biologist under his or her supervision with the approval of the CPM and USFWS. These fence clearance surveys shall provide 100 percent coverage of all areas to be disturbed and an additional transect along both sides of the fence line. This fence line transect shall cover an area approximately 90 feet wide centered on the fence alignment. Transects shall be no greater than 15 feet apart. All desert tortoise burrows, and burrows constructed by other species that might be used by desert tortoises, shall be examined to assess occupancy of each burrow by desert tortoises and handled in accordance with the USFWS' 2009 *Desert Tortoise Field Manual,* or the most recent agency guidance with the approval of the CPM. Any desert tortoise located during fence clearance surveys shall be handled by the Designated Biologist(s) in accordance with the USFWS' 2009 *Desert Tortoise Field Manual* or the most recent agency guidance with the approval of the CPM.

    a. Timing, Supervision of Fence Installation. The exclusion fencing shall be installed prior to the onset of site clearing and grubbing. Fencing shall also be placed on the proposed access roads in tortoise habitat unless otherwise approved by the CPM. The fence installation shall be supervised by the Designated Biologist and monitored by the Biological Monitors to ensure the safety of any tortoise present. The CPM shall be notified within 48 hours of fence completion. If the project is constructed in phases, prior to the initiation of clearing or grubbing for each solar plant, the project owner shall enclose the boundary of the affected solar plant with chain link fencing for security purposes and permanent desert tortoise exclusion fencing.

    b. Fence Material and Installation. The permanent tortoise exclusionary fencing shall be constructed in accordance with the USFWS' 2009 *Desert Tortoise Field Manual* (Chapter 8 – Desert Tortoise Exclusion Fence) or the most recent agency guidance with the approval of the CPM.

c. Temporary Construction Activities: Temporary construction activities including staging or parking outside of the permanent fencing shall be temporarily fenced with desert tortoise fencing to fully encompass the area prior to grounds disturbing activities to prevent desert tortoise from entering the area. The fencing use of the fencing in specific areas may be adjusted in consultation with the CPM. All fencing but be installed compliant with the timing and survey requirements identified in paragraph a, above.

d. Security Gates. Security gates shall be designed with minimal ground clearance to deter ingress by tortoises. The gates may be electronically activated to open and close immediately after the vehicle(s) have entered or exited to prevent the gates from being kept open for long periods of time. Cattle grating designed to safely exclude desert tortoise shall be installed at the gated entries to discourage tortoises from gaining entry.

e. Fence Inspections. Following installation of the desert tortoise exclusion fencing for both the permanent site fencing and temporary fencing in the utility corridors, the fencing shall be regularly inspected. Any fencing, whether temporary or permanent that is installed when tortoise are active shall be inspected two to three times daily for two weeks to ensure that desert tortoise are not fence walking to the point of exhaustion or overexposure. The same process shall occur for the first two weeks of the activity period if the fence is installed during the winter. Thereafter, permanent fencing shall be inspected monthly and during and within 24 hours following all major rainfall events. A major rainfall event is defined as one for which flow is detectable within the fenced drainage. Any damage to the fencing shall be temporarily repaired immediately to keep tortoises out of the site, and permanently repaired within 48 hours of observing damage. Inspections of permanent site fencing shall occur for the life of the project. Temporary fencing shall be inspected weekly and more often, as needed where activities are occurring in the vicinity that could damage the fence. Where drainages intersect the fencing, fencing shall be during and within 24 hours following major rainfall events. All temporary fencing shall be repaired immediately upon discovery and, if the fence may have permitted tortoise entry while damaged, the Designated Biologist shall inspect the area for tortoise.

2. Desert Tortoise Clearance Surveys within the Plant Site. Following construction of the permanent perimeter security fence and the attached tortoise exclusion fence, the permanently fenced power plant site shall be cleared of tortoises by the Designated Biologist, who may be assisted by the Biological Monitors. Clearance surveys shall be conducted in accordance with the USFWS' 2009 *Desert Tortoise Field Manual* (Chapter 6 – Clearance Survey Protocol for the Desert Tortoise – Mojave Population) or the most recent agency guidance with the approval of the CPM and shall consist of two surveys covering 100% the project area by walking transects no more

than 15-feet apart. If a desert tortoise is located on the second survey, a third survey shall be conducted. Each separate survey shall be walked in a different direction to allow opposing angles of observation. Clearance surveys of the power plant site may only be conducted when tortoises are most active (April through May or September through October). Surveys outside of these time periods require approval by USFWS and CDFG. Any tortoise located during clearance surveys of the power plant site shall be relocated and monitored in accordance with the Desert Tortoise Relocation/Translocation Plan (Condition of Certification **BIO-10**).

3. Burrow Searches. During clearance surveys all desert tortoise burrows, and burrows constructed by other species that might be used by desert tortoises, shall be examined by the Designated Biologist, who may be assisted by the Biological Monitors, to assess occupancy of each burrow by desert tortoises and handled in accordance with the USFWS' 2009 *Desert Tortoise Field Manual*. To prevent reentry by a tortoise or other wildlife, all burrows shall be collapsed once absence has been determined. Tortoises taken from burrows and from elsewhere on the power plant site shall be relocated or translocated as described in the Desert Tortoise Relocation/Translocation Plan.

4. Burrow Excavation/Handling. All potential desert tortoise burrows located during clearance surveys shall be excavated by hand (unless authorized by the CPM and USFWS), tortoises removed, and the burrows collapsed or blocked to prevent occupation by desert tortoises. All desert tortoise handling and removal, and burrow excavations, including nests, would be conducted by the Designated Biologist, who may be assisted by a Biological Monitor in accordance with the USFWS' 2009 *Desert Tortoise Field Manual.*

5. Monitoring Following Clearing. Following the desert tortoise clearance and removal from the power plant site and utility corridors, workers and heavy equipment shall be allowed to enter the project site to perform clearing, grubbing, leveling, and trenching. A Designated Biologist shall monitor clearing and grading activities to find and move tortoises missed during the initial tortoise clearance survey. Should a tortoise be discovered, it shall be relocated or translocated as described in the Desert Tortoise Relocation/ Translocation Plan to an area approved by the Designated Biologist.

6. Reporting. The Designated Biologist shall record the following information for any desert tortoises handled: a) the locations (narrative and maps) and dates of observation; b) general condition and health, including injuries, state of healing and whether desert tortoise voided their bladders; c) location moved from and location moved to (using GPS technology); d) gender, carapace length, and diagnostic markings (i.e., identification numbers or marked lateral scutes); e) ambient temperature when handled and released; and f) digital photograph of each handled desert tortoise as described in the paragraph below. Desert tortoise moved from within

project areas shall be marked and monitored in accordance with the Desert Tortoise Relocation/Translocation Plan.

Verification: All mitigation measures and their implementation methods shall be included in the BRMIMP and implemented during project construction and operation. Implementation of the measures shall be reported in the Monthly Compliance Reports by the Designated Biologist. Within 30 days after completion of desert tortoise clearance surveys the Designated Biologist shall submit a report to the CPM, USFWS, and CDFG describing implementation of each of the mitigation measures listed above. The report shall include the desert tortoise survey results, capture, and release locations of any relocated desert tortoises, and any other information needed to demonstrate compliance with the measures described above. All of these measures will be done in accordance with the approved Desert Tortoise Relocation Plan (see Condition of Certification **BIO-10**, below).

DESERT TORTOISE RELOCATION/TRANSLOCATION PLAN

BIO-10 The project owner shall develop and implement a Desert Tortoise Relocation/Translocation Plan (Plan) that is consistent with current USFWS approved guidelines. The goal of the plan shall be to safely exclude desert tortoises from within the fenced project area and relocate/translocate them to suitable habitat capable of supporting them, while minimizing stress and potential for disease transmission. The plan shall be developed in consultation with the USFWS to ensure the document does not conflict with conditions issued under an Incidental Take Statement. The plan shall include but not be limited to:

1. Translocation and Control Locations. The plan shall identify the proposed translocation recipient sites and control area. Sites shall be ranked based on the distance from the project site; distance from known hazards such as off highway vehicle locations, busy roads, or other known treats; proximity to existing populations; and known linkage areas. Translocation sites shall consider the value for recovery of local populations. The plan shall utilize the most recent USFWS guidance on translocation that includes required siting criteria. If moved outside their home range the translocation criteria include:

    a. The translocation site supports desert tortoise habitat suitable for all life stages.

    b. Disease prevalence within the resident desert tortoise population is less than 20 percent.

    c. The site is at least 10 km from major unfenced roads or highways. Distance from roads may be reduced if the proposed action includes provisions to install and maintain desert tortoise exclusion fencing as a minimization measure.

    d. The site is within 40 km of the project site, with no natural barriers to movement between them, to ensure that the desert tortoises at the two

sites were likely part of a larger mixing population and similar genetically.

e. The site occurs on lands where desert tortoise populations have been depleted or extirpated yet still support suitable habitat. Depleted areas may include lands adjacent to highways.

f. The site has no detrimental rights-of-way (ROWs) or other encumbrances.

g. The site will be managed for conservation so that potential threats from future impacts are precluded. In the project region, DWMAs, designated critical habitat units (CHUs), areas of critical environmental concern (ACECs), National Park Service lands, and BLM Wilderness Areas are managed for conservation.

2. Control Site. The plan shall consider the following USFWS guidelines for the control site.

   a. be similar in habitat type/quality, desert tortoise population size/structure, and disease status to the recipient sites;

   b. not have been previously used as a recipient site for other projects; and

   c. be a minimum distance of 10 km (6 miles) from an unfenced recipient site that has no substantial anthropogenic or natural barriers to prevent the interaction of control, resident, and translocated desert tortoises.

3. Host Population. The plan shall provide an evaluation of the habitat quality on the translocation and control sites; provide a determination of existing tortoise density, and an assessment of the sites' ability to accommodate additional tortoises above baseline conditions.

4. Holding Pens. The plan shall provide information on the type holding pens for quarantined translocated tortoises prior to their release into host populations. Pens shall be located on the project site in an area capable of ensuring the protection of the tortoises. The size of the pen shall be designed based on the expected number of desert tortoise that occur on the project site or in an area approved by the CPM. The pen shall contain adequate cover and be in an area supporting suitable soils for burrowing.

5. Tracking, Monitoring, Disease Testing, and Reporting. The plan shall provide information on the use of tracking units (GPS) on tortoises from the project site, translocation site, and control site; provide information on the short and long term monitoring and reporting of control, translocated and host populations; provide information on disease testing for long distance translocated tortoises, host, and control sites; and, identify remedial actions should excessive predation or mortality be observed. The plan shall also include provisions for removing diseased tortoises; the

development of quarantine pens; accommodating eggs hatchlings or juvenile tortoise.

Verification: At least 90 days prior to the start of any project-ground disturbing activity, the project owner shall submit the draft Desert Tortoise Relocation/Translocation Plan to the CPM for review and approval and to USFWS and CDFG for review and comment. No less than 30 days prior to the start of any project-ground disturbing activity, the project owner shall provide the CPM with the final version of a Desert Tortoise Relocation/Translocation Plan. No relocation/translocation activities may occur prior to approval of the final plan by the CPM. Any modifications to the approved plan shall be made only after approval by the CPM and in consultation with USFWS and CDFG.

Within 30 days after initiation of relocation and/or translocation activities, the Designated Biologist shall provide to the CPM for review and approval, a written report identifying which items of the plan have been completed, and a summary of all modifications to measures made during implementation of the plan. Written monthly progress reports shall be provided to the CPM for the duration of the plan implementation.

COMPLIANCE VERIFICATION

BIO-11 This condition of certification has been deleted.

DESERT TORTOISE COMPENSATORY MITIGATION

BIO-12 To fully mitigate for habitat loss and potential take of desert tortoise, the project owner shall provide compensatory mitigation for impacts to 3,258 acres of habitat or whatever acreage is actually impacted by the project footprint. Impacts to areas supporting Mojave Desert scrub shall be mitigated at ratio of 3:1 ratio (1580.5 acres) for and areas that support shadscale scrub communities at a ratio of 1:1 (1,616.5 acres). The total compensatory land acquisition required to mitigate impacts to desert tortoise shall be 6,358 acres or the ratio of lands actually impacted by the project footprint. The requirements for acquisition of the 6,358 acres of compensation lands shall include the following:

1. Responsibility for Acquisition of Lands: The responsibility for acquisition of lands may be delegated by written agreement from the CPM to a third party, such as a non-governmental organization supportive of habitat conservation. Such delegation shall be subject to approval by the CPM, in consultation with USFWS and CDFG, prior to land acquisition, enhancement, or management activities. If habitat disturbance exceeds that described in this analysis, the project owner shall be responsible for funding acquisition, habitat improvements, and long-term management of additional compensation lands or additional funds required to compensate for any additional habitat disturbances. Additional funds shall be based on the adjusted market value of compensation lands at the time of construction to acquire and manage habitat. Water and mineral rights shall be included as part of the land acquisition. Agreements to delegate land acquisition to CDFG or an approved third party and to manage

compensation lands shall be implemented within 18 months of the Energy Commission's License Decision.

2. Selection Criteria for Compensation Lands. The compensation lands selected for acquisition to meet Energy Commission and CESA requirements shall:

    a. be of equal or better habitat quality for desert tortoise and within the Eastern Mojave Recovery Unit or other location approved by the CPM in consultation with the CDFG and USFWS, with potential to contribute to desert tortoise habitat connectivity and build linkages between desert tortoise designated critical habitat, known populations of desert tortoise, and/or other preserve lands;

    b. provide habitat for desert tortoise with capacity to regenerate naturally when disturbances are removed;

    c. be near larger blocks of lands that are either already protected or planned for protection, or which could feasibly be protected long-term by a public resource agency or a non-governmental organization dedicated to habitat preservation;

    d. be connected to lands currently occupied by desert tortoise, ideally with populations that are stable, recovering, or likely to recover;

    e. not have a history of intensive recreational use or other disturbance that exceed conditions on the project site that might make habitat recovery and restoration infeasible;

    f. Compensation lands may not include existing roads in the calculations of habitat acreages;

    g. not be characterized by densities of invasive species that exceed those on the project site, either on or immediately adjacent to the parcels under consideration, that might jeopardize habitat recovery and restoration; and

    h. not contain hazardous wastes.

3. Review and Approval of Compensation Lands Prior to Acquisition. A minimum of three months prior to acquisition of the property, the project owner shall submit a formal acquisition proposal to the CPM, CDFG, and USFWS describing the parcel(s) intended for purchase. This acquisition proposal shall discuss the suitability of the proposed parcel(s) as compensation lands for desert tortoise in relation to the criteria listed above. Approval from the CPM, in consultation with CDFG and the USFWS, shall be required for acquisition of all parcels comprising the compensation acres.

4. Commission Mitigation Security: The project owner shall provide written verification to the CPM and CDFG with copies of the document(s) to the USFWS, to guarantee that an adequate level of funding is available to implement the Energy Commission Complementary Mitigation Measures described in this condition. These funds shall be used solely for implementation of the measures associated with the project. Alternatively, financial assurance can be provided to the CPM and CDFG in the form of an irrevocable letter of credit, a pledged savings account or another form of security ("security") prior to initiating ground-disturbing project activities. Prior to submittal to the CPM, the security shall be approved by CDFG and the CPM, in consultation with the USFWS, to ensure funding in the amount of $21,779,329.00. This security amount was calculated as follows and may be revised upon completion of a Property Analysis Record (PAR) or PAR-like analysis of the proposed compensation lands:

    a. land acquisition costs for compensation lands, calculated at $1,000/acre = $6,358,000;

    b. costs of initial habitat improvements to compensation lands, calculated at $250/acre = $1,589,500.00;

    c. costs of establishing an endowment for long-term management of compensation lands, calculated at $1,450/acre = $9,219,100.00;

    d. costs associated with conducting required surveys, assessments for hazardous materials, escrow fees, third party administrative costs and agency costs to accept the parcel; calculated at $4,612,729.00 (See Biological resource Table 9 for a breakdown of these costs).

5. Compensation Lands Acquisition Conditions: The project owner shall comply with the following conditions relating to acquisition of the compensation lands after the CPM, in consultation with CDFG and the USFWS, has approved the proposed compensation lands and received security as applicable and as described above.

    a. Preliminary Report: The project owner, or approved third party, shall provide a recent preliminary title report, initial hazardous materials survey report, biological analysis, and other necessary documents for the proposed acquisition acres. All documents conveying or conserving compensation lands and all conditions of title/easement are subject to a field review and approval by CDFG and the CPM, in consultation with the USFWS, California Department of General Services and, if applicable, the Fish and Game Commission and/or the Wildlife Conservation Board.

    b. Title/Conveyance: The project owner shall transfer fee title or a conservation easement to the compensation lands to CDFG under terms approved by CDFG. Alternatively, a non-profit organization qualified to manage compensation lands (pursuant to California

Government Code section 65965) and approved by CDFG and the CPM may hold fee title or a conservation easement over the habitat mitigation lands. If the approved non-profit organization holds title, a conservation easement shall be recorded in favor of CDFG in a form approved by CDFG. If the approved non-profit holds a conservation easement, CDFG shall be named a third party beneficiary. If a Security is provided, the project owner or an approved third party shall complete the proposed compensation lands acquisition within 18 months of the start of project ground-disturbing activities.

c. Initial Habitat Improvement Fund. The project owner shall fund the initial protection and habitat improvement of the compensation lands. Alternatively, a non-profit organization may hold the habitat improvement funds if they are qualified to manage the compensation lands (pursuant to California Government Code section 65965) and if they meet the approval of CDFG and the CPM. If CDFG takes fee title to the compensation lands, the habitat improvement fund must go to CDFG.

d. Long-Term Management Endowment Fund. Prior to ground-disturbing project activities, the project owner shall provide to CDFG a capital endowment in the amount determined through the Property Analysis Record (PAR) or PAR-like analysis that would be conducted for the compensation acres. Alternatively, a non-profit organization may hold the endowment fees if they are qualified to manage the compensation lands (pursuant to California Government Code section 65965) and if they meet the approval of CDFG and the CPM. If CDFG takes fee title to the compensation lands, the endowment must go to CDFG, where it would be held in the special deposit fund established pursuant to California Government Code section 16370. If the special deposit fund is not used to manage the endowment, the California Wildlife Foundation or similarly approved entity identified by CDFG shall manage the endowment for CDFG and with CDFG supervision.

e. Interest, Principal, and Pooling of Funds. The project owner, CDFG and the CPM shall ensure that an agreement is in place with the endowment holder/manager to ensure the following conditions:

   i. Interest. Interest generated from the initial capital endowment shall be available for reinvestment into the principal and for the long-term operation, management, and protection of the approved compensation lands, including reasonable administrative overhead, biological monitoring, improvements to carrying capacity, law enforcement measures, and any other action approved by CDFG designed to protect or improve the habitat values of the compensation lands.

   ii. Withdrawal of Principal. The endowment principal shall not be drawn upon unless such withdrawal is deemed necessary by the CDFG or the approved third-party endowment manager to ensure the continued viability of the species on the compensation lands. If

CDFG takes fee title to the compensation lands, monies received by CDFG pursuant to this provision shall be deposited in a special deposit fund established pursuant to Government Code section 16370. If the special deposit fund is not used to manage the endowment, the California Wildlife Foundation or similarly approved entity identified by CDFG would manage the endowment for CDFG with CDFG supervision.

iii. Pooling Endowment Funds. CDFG, or a CPM and CDFG approved non-profit organization qualified to hold endowments pursuant to California Government Code section 65965, may pool the endowment with other endowments for the operation, management, and protection of the compensation lands for local populations of desert tortoise. However, for reporting purposes, the endowment fund must be tracked and reported individually to the CDFG and CPM.

iv. Reimbursement Fund. The project owner shall provide reimbursement to CDFG or an approved third party for reasonable expenses incurred during title, easement, and documentation review; expenses incurred from other State or State-approved federal agency reviews; and overhead related to providing compensation lands.

The project owner is responsible for all compensation lands acquisition/costs, including but not limited to, title and document review costs, as well as expenses incurred from other State agency reviews and overhead related to providing compensation lands to the department or approved third party; escrow fees or costs; environmental contaminants clearance; and other site cleanup measures. The project owner shall receive a credit or refund of commission mitigation securities for all unused project areas.

Verification: No less than 30 days prior to beginning project ground-disturbing activities, the project owner shall provide written verification to the CPM that the security has been established in accordance with this condition of certification. No less than 90 days prior to acquisition of the property, the project owner shall submit a formal acquisition proposal to the CPM, CDFG, and USFWS describing the parcels intended for purchase.

The project owner, or an approved third party, shall complete and provide written verification of the proposed compensation lands acquisition within 18 months of the start of project ground-disturbing activities. Within 180 days of the land or easement purchase, as determined by the date on the title, the project owner, or an approved third party, shall provide the CPM, CDFG, and USFWS with a management plan for the compensation lands and associated funds. The CPM shall review and approve the management plan, in consultation with CDFG and the USFWS.

Within 90 days after completion of project construction, the project owner shall provide to the CPM and CDFG an analysis with the final accounting of the amount of habitat disturbed during project construction.

RAVEN MONITORING, MANAGEMENT, CONTROL PLAN AND FEE

BIO-13 The project owner shall design and implement a Raven Monitoring, Management, and Control Plan (Raven Plan) that is consistent with the most current USFWS-approved raven management guidelines. The goal of the Raven Plan shall be to minimize predation on desert tortoises by minimizing project-related increases in raven abundance. The Raven Plan shall include but not be limited to:

1. Prepare and Implement a Raven Management Plan that includes the following:

    a. Identify conditions associated with the project that might provide raven subsidies or attractants;

    b. Describe management practices to avoid or minimize conditions that might increase raven numbers and predatory activities;

    c. Describe control practices for ravens;

    d. Address monitoring and nest removal during construction and for the life of the project, and;

    e. Discuss reporting requirements.

2. Contribute to the REAT Regional Raven Management Program. The project owner shall submit payment to the project sub-account of the REAT Account held by the National Fish and Wildlife Foundation (NFWF) to support the REAT Regional Raven Management Program. The amount shall be a one-time payment of $105 per acre (3,258 acres) of permanent disturbance plus a two percent fund management fee of $348,932.00.

    For the first year of reporting the project owner shall provide quarterly reports describing implementation of the Raven Plan. Thereafter the reports shall be submitted annually for the life of the project.

Verification: At least 60 days prior to any project-related ground disturbance activities, the project owner shall submit the draft Raven Plan to the CPM for review and approval and CDFG and USFWS for review and comment. At least 30 days prior to start of any project-related ground disturbance activities, the project owner shall provide the CPM the final version of the Raven Plan. No ground disturbing activities may occur until the final plan is approved by the CPM. Any modifications to the approved Raven Plan must be approved by the CPM in consultation with USFWS and CDFG. The project owner shall notify the CPM no less than five working days before implementing any CPM approved modifications to the Raven Plan.

No fewer than 30 days prior to the start of any project-related ground disturbing activity, the project owner shall provide written verification to the CPM that the Raven Management Fee has been paid to NFWF.

Within 30 days after completion of project construction, the project owner shall provide to the CPM for review and approval a report identifying which items of the Raven Plan have been completed, a summary of all modifications to mitigation measures made during the project's construction phase, and which items are still outstanding.

AMERICAN BADGER AND DESERT KIT FOX MANAGEMENT PLAN

BIO-14 The owner shall prepare and implement an American Badger and Desert Kit Fox Management Plan. The plan shall be prepared in accordance with the most current CDFG guidelines for these species. The Management Plan must be approved by the CPM prior to implementation, and shall contain the following provisions:

Preconstruction surveys and mapping efforts: biological monitors shall perform pre-construction surveys for badger and kit fox dens in the project area, including areas within 250 feet of all project facilities, utility corridors, and access roads. If dens are detected, each den shall be classified as potentially active, or known active, including characterization of den type for kit fox (natal, pupping, likely satellite, atypical) per CDFG and/or CPM guidance, and mapped along with major project design elements.

Directions for collapse of inactive dens. Inactive dens that would be directly impacted by construction activities shall be excavated by hand and backfilled to prevent reuse by badgers or kit fox. Potentially and known active dens shall not be disturbed during the whelping/pupping season (approximately February 1 – September 30). A den may only be declared "inactive" after three days of monitoring via camera(s) and tracking medium have shown no kit fox or American badger activity.

Monitoring requirements:potentially and definitely active dens that would be directly impacted by construction activities shall be monitored by the Biological Monitor for three consecutive nights (during weather conditions favorable for detection) using a tracking medium (such as diatomaceous earth or fire clay) and/or infrared camera stations at the entrance. If no tracks are observed in the tracking medium or no photos of the target species are captured after three nights, the den shall be excavated and backfilled by hand. Backfilling dens ensure no badgers or kit fox are trapped in the den.

Passive relocation strategies: the management plan shall contain, at a minimum, several strategies to passively relocate animals from the site. These methods may entail strategic mowing, fencing, or other feasible construction methods to assist in moving animals offsite toward desirable land. The plan shall also detail methods used to discourage occupation of dens within the project site, such as use of noisemakers, citronella-based chemical deterrents, strobe lighting, ect., and shall incorporate temperature constraints if requested by the CPM or CDFG. The Plan shall address location of preferred offsite movement of animals, based on CDFG data and land ownership. Private land is to be avoided to the maximum extent practicable. The Plan shall also indicate that passive hazing is not to be used at natal dens, and shall include guidelines specific to determining when kit fox

pups are functioning independently, and when passive relocation strategies may be safely implemented. The Plan shall also prescribe use of buffer zones around dens to protect against accidental collapse or crushing by people or equipment.

Kit fox disease prevention measures. The Designated Biologist shall notify the CDFG and CPM within 24 hours if a dead kit fox is found or appears sick. The plan must also detail a response to a kit fox injury, including a necropsy plan, reporting methods, and scope of adaptive methods in the event of a known or suspected outbreak. The project owner will pay for any necropsy work.

Verification: At least 60 days prior to any project-related ground disturbing activity, the project owner shall submit an American badger and desert kit fox management plan to the CPM for review and approval and to CDFG for review and comment. No less than 30 days prior to any ground disturbing activity, the project owner shall provide one copy of the final approved plan to the CPM and implement the plan.

The project owner shall submit a report to the CPM and CDFG within 30 days of completion of badger and kit fox surveys. The report shall describe survey methods, findings, provide preliminary classification of dens and rationale, and map dens along with project features. Results of ongoing monitoring and relocation efforts shall be reported in the Monthly Compliance Reports. The project owner shall provide the CPM 24 hour notice before excavating a den classified as natal.

AVIAN, BAT, AND GOLDEN EAGLE PROTECTION PLANS

BIO-15 The project owner shall implement the following measures to monitor, mitigate and adaptively manage operational impacts to birds and bats.

1. Monitoring Study: The project owner shall prepare and implement a monitoring study to monitor the death and injury of birds and bats caused by collisions with project facilities including heliostats and solar receiver tower, injury caused by flying through concentrated solar energy within the solar field, or other project-related causes of injury or mortality including the gen-tie line and evaporation ponds. The study design shall be based on the USFWS's Monitoring Migratory Bird Take at Solar Power Facilities: An Experimental Approach (Nicolai et al 2011) or more current guidelines if available. Visual surveillance of the heliostat field shall be incorporated into study design, with the intent of documenting species and flight behavior of birds entering heliostat field, measuring elevation at which birds are flying, and documentation of effects of solar flux exposure. Special effort shall be made to collect the carcass of any bird observed colliding with project features or coming to the ground within the project boundaries, including recording Global Positioning Satellite (GPS) data. The Monitoring Study shall be subject to review and approval by the CPM in consultation with CDFG and USFWS, shall be incorporated into the project's BBCS and BRMIMP, and implemented by the Designated Biologist in coordination with the project owner, CPM, CDFG, and USFWS. The study shall be implemented, for a period of not less than 5 years (60 months) total, including the entire construction phase and not

less than 2 years during the operational phase and shall continue until the CPM concludes, in consultation with the other agencies, that the cumulative monitoring data provide sufficient basis for estimating long-term bird mortality for the project. Compensatory mitigation, if required by the CPM, shall be developed using results of the monitoring study, and in consultation with the USFWS and CDFG.

The Monitoring Study shall also detail disposition of avian and bat carcasses. All carcasses found on the solar field should be collected, labeled, and stored in a freezer. The Monitoring Study shall provide techniques and protocols to follow in proper techniques for collection, processing, and preservation of carcasses; and specifically, shall specify that flight feathers must be plucked and bagged separately from the carcass. Feather samples are not to be frozen or refrigerated. Carcass and feather samples shall be provided to the CPM or CPM's designee upon request. The CPM shall receive notification within 24 hours of detection of a threatened, endangered, or special status bird or bat carcass, and procedures to report other mortality or sublethal injury will also be included in the Monitoring Study.

2. Bird and Bat Conservation Strategy (BBCS): The project owner shall prepare and implement a Bird and Bat Conservation Strategy adopting **BIO-16**, and all applicable guidelines recommended by the USFWS (2010e) or more current guidelines that may be released. The BBCS will describe all proposed measures to minimize death and injury of birds or bats from (1) collisions with facility features including the heliostats, power towers, and gen-tie line towers or transmission lines and (2) concentrated solar energy (flux) present in the airspace over each heliosat field, and require implementation of conservation actions in response to bird, bat, and golden eagle mortality.

3. Eagle Conservation Plan (ECP): The project owner shall prepare and implement an Eagle Protection Plan adopting all applicable guidelines recommended by the USFWS (2011b) or more current guidelines that may be released. The ECP may be prepared as a stand-alone document or it may be included as a chapter within the BBCS. The ECP shall describe all available baseline data on golden eagle occurrence, seasonality, activity, and behavior throughout the project area and vicinity. The ECP shall outline a study protocol to include annual pedestrian and/or helicopter surveys of golden eagle breeding sites within a 10 mile radius of the project site, to be reviewed and approved by the CPM, in consultation with the USFWS.

   The ECP shall describe all proposed measures to minimize death and injury of eagles from (1) collisions with facility features including the heliostats, power towers, and gen-tie line towers or transmission lines, electrocutions on transmission lines or other project components, and (3) concentrated solar flux created over the solar field. The ECP shall specify the project owner's anticipated take of golden eagles. The ECP shall provide an inventory of existing electrical distribution lines within a 20-mile radius of the project site that do not conform to APLIC (2006) design

standards to prevent golden eagle electrocution. The inventory shall identify the owner or operator and estimate the number of non-conforming poles for each distribution line. The ECP shall specify that for each anticipated project-related take of a bald or golden eagle, 11 utility poles will be retrofitted to APLICstandards within one year of the take.

The ECP shall also include any feasible modifications to proposed plant operation to avoid or minimize focusing heliostats at standby points and, instead, move heliostats into a stowed position or another alternative configuration when the power plant is in partial standby mode. The ECP also shall identify any additional feasible conservation measures to minimize collisions and exposure to solar flux. The ECP shall provide a reporting schedule for all monitoring or other activities related to bird or bat conservation or protection to be taken during project construction or operation. The ECP shall be subject to review and approval by the CPM in consultation with CDFG and USFWS, and shall be incorporated into the project's BRMIMP and BBCS, and implemented.

Verification: The draft Monitoring Study, BBCS and ECP shall be submitted to the CPM for review in consultation with CDFG, and USFWS, and shall be finalized by the project owner and submitted to the CPM and other agencies no less than 30 days prior to construction. At least 30 days prior to the start of any project-related ground disturbance activities, the project owner shall provide the CPM, CDFG, and USFWS with the a final draft of all three documents, as reviewed and approved by the CPM in coordination with the other agencies. The project owner shall obtain the CPM's written approval of the Monitoring Study, BBCS and ECP prior to the start of any project-related ground disturbance activities.

The project owner shall provide the CPM with copies of any written or electronic transmittal from the USFWS indicating the status of Monitoring Study, BBCS and ECP review and any permit that may be required, and any follow-up actions required by the applicant, within 30 days of receiving such transmittal from USFWS.

Methods and results of the Monitoring Study shall be submitted to the CPM in Monthly and Annual Compliance Reports throughout the course of the study and until the CPM, in consultation with the other agencies, concludes that the cumulative monitoring data provide sufficient basis for estimating long-term bird mortality for the project. The Reports will include all monitoring data required as part of the monitoring program.

Each year throughout the minimum 5 year monitoring period, the Designated Biologist shall submit an Annual Report to the CPM, CDFG, and USFWS by January 31 of each calendar year, summarizing all available bird and bat mortality data (species, date and location collected, evidence of injury and cause of death) collected over the course of the year. The report shall provide any recommendations for future monitoring and adaptive management actions. The report also shall summarize any additional wildlife mortality or injury documented on the project site during the year, regardless of cause. The Annual Report shall be subject to review and approval by the CPM in consultation with CDFG and USFWS. The project owner shall submit revisions within 30 days of receiving written comments from the CPM. At the direction of the CPM, in consultation with the other agencies, the study period will be extended based on data quality and

sufficiency for analysis or if needed to document efficacy of any adaptive management measures undertaken by the project owner. If a carcass of a golden eagle or any state or federally listed threatened or endangered species is found at any time, the project owner or Designated Biologist shall contact CDFG and USFWS within one working day of receipt of the carcass to report the mortality and for guidance on disposition of the carcass.

PRE-CONSTRUCTION NESTING BIRD SURVEYS

BIO-16 Pre-construction nest surveys shall be conducted if construction activities will occur from February 1 through August 15. The Designated Biologist or Biological Monitor conducting the surveys shall be experienced bird surveyors and familiar with standard nest-locating techniques. Surveys shall be conducted in accordance with the following guidelines:

1. Surveys shall cover all potential nesting habitat in the project site and within 500 feet of the boundaries of the plant site and linear facilities;

2. At least two pre-construction surveys shall be conducted, separated by a minimum 10-day interval. One of the surveys shall to be conducted within the 10 days preceding initiation of construction activity. Additional follow-up surveys may be required if periods of construction inactivity exceed one week in any given area, an interval during which birds may establish a nesting territory and initiate egg laying and incubation;

3. If active nests are detected during the survey, a no-disturbance buffer zone (protected area surrounding the nest, the size of which is to be determined by the Designated Biologist in consultation with CDFG, USFWS, and CPM) and a monitoring plan shall be developed. The nesting bird plan shall identify the types of birds that may nest in the project area, the proposed buffers, monitoring requirements, and reporting standards that will be implemented to ensure compliance with the Migratory Bird Treaty Act and Fish and Game Codes 3505 and 3505.3. Nest locations shall be mapped using GPS technology and submitted, along with a weekly report stating the survey results, to the CPM; and

4. The Designated Biologist shall monitor the nest until he or she determines that nestlings have fledged and dispersed. Activities that might, in the opinion of the Designated Biologist and in consultation with the CPM, disturb nesting activities shall be prohibited within the buffer zone until such a determination is made.

Verification: At least 10 days prior to the start of any project-related ground disturbance activities, the project owner shall provide the CPM a letter-report describing the findings of the pre-construction nest surveys, including the time, date, and duration of the survey; identity and qualifications of the surveyor(s); and a list of species observed. If active nests are detected during the survey, the report shall include a map or aerial photo identifying the location of the nest and shall depict the boundaries of the no-disturbance buffer zone around the nest. All nest avoidance measures will be implemented and reported in the Monthly Compliance Report.

BURROWING OWL IMPACT AVOIDANCE, MINIMIZATION, AND COMPENSATION MEASURES

BIO-17 The project owner shall implement the following measures to avoid and offset impacts to burrowing owls:

1. Pre-Construction Surveys. Concurrent with desert tortoise clearance surveys the Designated Biologist shall conduct pre-construction surveys for burrowing owls within the project site and along all linear facilities in accordance with CDFG guidelines (CDFG 2012). Pre-construction surveys for burrowing owls shall occur no more than 30 days prior to initiation of ground disturbance or site mobilization activities. The survey area shall include the Project Disturbance Area (the Project Disturbance Area means all lands disturbed in the construction and operation of the HHSEGS Project) and surrounding 500 foot survey buffer where access is legally available.

2. Implement Impact Avoidance Measures. If an active burrowing owl burrow is detected within 500 feet from the Project Disturbance Area the following avoidance and minimization measures shall be implemented:

   a. Establish Non-Disturbance Buffer. Fencing shall be installed at a 250-foot radius from the occupied burrow to create a non-disturbance buffer around the burrow. The non-disturbance buffer and fence line may be reduced to 160 feet if all project-related activities that might disturb burrowing owls would be conducted during the non-breeding season (September 1st through January 31st). Signs shall be posted in English and Spanish at the fence line indicating no entry or disturbance is permitted within the fenced buffer.

   b. Monitoring: If construction activities would occur within 500 feet of the occupied burrow during the nesting season (February 1 – August 31st) the Designated Biologist or Biological Monitor shall monitor to determine if these activities have potential to adversely affect nesting efforts, and shall implement measures to minimize or avoid such disturbance.

3. Prepare Burrowing Owl Relocation and Mitigation Plan. The project owner shall prepare and implement a Burrowing Owl Relocation and Mitigation Plan, in addition to the avoidance measures described above. The final Burrowing Owl Relocation and Mitigation Plan shall be approved by the CPM, in consultation with USFWS and CDFG, and shall:

   a. Identify and describe potential relocation sites on lands controlled by the applicant and describe measures to ensure that burrow installation or improvements would not affect sensitive species habitat or existing burrowing owl colonies in the relocation area;

   b. Provide guidelines for creation or enhancement of at least two natural or artificial burrows per relocated owl, including a discussion of timing

of burrow improvements, specific location of burrow installation, and burrow design. Design of the artificial burrows shall be consistent with CDFG guidelines (CDFG 2012) and shall be approved by the CPM in consultation with CDFG and USFWS;

c. Passive relocation sites shall be in areas of suitable habitat for burrowing owl nesting, and be characterized by minimal human disturbance and access. Relative cover of non-native plants within the proposed relocation sites shall not exceed the relative cover of non-native plants in the adjacent habitats;

d. Provide detailed methods and guidance for passive relocation of burrowing owls occurring within the Project Disturbance Area; and

4. Acquire Compensatory Mitigation Lands for Burrowing Owls. For the purposes of the FSA staff is assuming that a minimum of two burrowing owl territories would be lost on the project site. Assuming the project will result in the loss of two territories (each with a territory of 300 acres (CDFG 2012) the Project owner shall acquire, in fee or in easement, 600 acres of land the total compensatory requirements for this project will be based on the number of burrowing owls determined during pre-construction surveys but shall be no less than two territories described in this condition.

   The project owner shall provide funding for the enhancement and long-term management of these compensation lands. The acquisition and management of the compensation lands may be delegated by written agreement to CDFG or to a third party, such as a non-governmental organization dedicated to habitat conservation, subject to approval by the CPM, in consultation with CDFG and USFWS prior to land acquisition or management activities. Additional funds shall be based on the adjusted market value of compensation lands at the time of construction to acquire and manage habitat. In lieu of acquiring lands itself, the Project owner may satisfy the requirements of this condition by depositing funds into the Renewable Energy Action Team (REAT) Account established with the National Fish and Wildlife Foundation (NFWF), as described in Section 3.i. of Condition of Certification **BIO-12**.

   Criteria for Burrowing Owl Mitigation Lands. The terms and conditions of this acquisition or easement shall be as described in Paragraph 1 of **BIO-12** [Desert Tortoise Compensatory Mitigation], with the additional criteria to include: 1) the mitigation land must provide suitable habitat for burrowing owls, and 2) the acquisition lands must either currently support burrowing owls or be within dispersal distance from an active burrowing owl nesting territory (generally approximately 5 miles). The burrowing owl mitigation lands may be included with the desert tortoise mitigation lands ONLY if these two burrowing owl criteria are met. If the burrowing owl mitigation land is separate from the acquisition required for desert tortoise compensation lands, the Project owner shall fulfill the requirements described below in this condition.

Security. If burrowing owl mitigation land is separate from the acreage required for desert tortoise, the project owner or an approved third party shall complete acquisition of the proposed compensation lands prior to initiating ground-disturbing Project activities. The project owner shall provide financial assurances to the CPM and CDFG to guarantee that an adequate level of funding is available to implement the Energy Commission Complementary Mitigation Measures described in this condition. These funds shall be used solely for implementation of the measures associated with the project. Alternatively, financial assurance can be provided to the CPM and CDFG in the form of an irrevocable letter of credit, a pledged savings account or another form of financial security ("security") prior to initiating ground-disturbing project activities. Prior to submittal to the CPM, the security shall be approved by CDFG and the CPM, to ensure funding in the amount of $1,185,000.00. This security amount was calculated as follows and may be revised upon completion of a Property Analysis Record (PAR) or PAR-like analysis of the proposed compensation lands:

a. land acquisition costs for compensation lands, calculated at $1,000/acre = $600,00.00;

b. costs of initial habitat improvements to compensation lands, calculated at $250/acre = $150,000.00;

c. costs of establishing an endowment for long-term management of compensation lands, calculated at $1,450/acre = $870,000.00.

d. costs associated with conducting required surveys, assessments for hazardous materials, escrow fees, third party administrative costs and agency costs to accept the parcel; calculated at $585,000.00 (See Biological resource Table 9 for a breakdown of these costs).

The final amount due will be determined by the PAR analysis conducted pursuant to **BIO-12**.

Verification: If staff determines that compensatory mitigation is required, the project owner will provide the CPM with verification that security has been provided prior to the start of any project-related ground disturbance activities.

If pre-construction surveys detect burrowing owls within 500 feet of proposed construction activities, the Designated Biologist shall provide to the CPM, CDFG and USFWS documentation indicating that non-disturbance buffer fencing has been installed at least 10 days prior to the start of any construction-related ground disturbance activities. The project owner shall report monthly to the CPM, CDFG, and USFWS for the duration of construction on the implementation of burrowing owl avoidance and minimization measures. Within 30 days after completion of construction the project owner shall provide to the CPM, CDFG and USFWS a written construction termination report identifying how mitigation measures described in the plan have been completed.

If pre-construction surveys detect burrowing owls within the Project Disturbance Area, the project owner shall notify the CPM, CDFG and USFWS no less than 10 days of completing the surveys that a relocation of owls is necessary. The project owner shall do all of the following if relocation of one or more burrowing owls is required:

1. Within 30 days of completion of the burrowing owl pre-construction surveys, submit to the CPM, CDFG and USFWS a Burrowing Owl Relocation and Mitigation Plan.

2. No later than 30 days prior to the start of construction-related ground disturbing activities, the project owner shall provide written verification to the CPM of the establishment of the financial security in accordance with this condition of certification.

3. Within 90 days of the land or easement purchase, as determined by the date on the title, the project owner shall provide the CPM with a management plan for review and approval, in consultation with CDFG and USFWS, for the compensation lands and associated fund.

4. No less than 90 days prior to acquisition of the burrowing owl compensation lands, the project owner, or an approved third party, shall submit a formal acquisition proposal to the CPM, CDFG, and USFWS describing the parcel intended for purchase. At the same time the project owner shall submit a PAR or PAR-like analysis for the parcels for review and approval by the CPM, CDFG and USFWS.
5. No later than 18 months after the start of construction-related ground disturbance activities, the project owner shall provide written verification to the CPM, CDFG and USFWS that the compensation lands or conservation easements have been acquired and recorded in favor of the approved recipient.

6. By January 31st of each year following construction for a period of five years, the Designated Biologist shall provide a report to the CPM, USFWS, and CDFG that describes the results of monitoring and management of the burrowing owl relocation area, if applicable. The annual report shall provide an assessment of the status of the relocation area with respect to burrow function and weed infestation, and shall include recommendations for actions the following year for maintaining the burrows as functional burrowing owl nesting sites and minimizing the occurrence of weeds.

WEED MANAGEMENT PLAN

BIO-18 To minimize the potential indirect effects of weeds on biological resources adjacent to the project, the project owner shall submit a draft Weed Management Plan subject to review and approval by the CPM. The general objective of the Weed Management Plan shall be to: 1) manage or contain weed species of greatest environmental concern for the life of the project to prevent their spread into adjacent offsite habitat, and 2) prevent the accidental introduction of new weed species from contaminated vehicles and equipment entering the site during construction or soil disturbing activities

"Target" weed species for long-term containment shall include any weed occurring within the WMAs described above that meet the following definition: a) California Invasive Plant Council (Cal-IPC) "High"-rank weeds; b) California

Department of Food & Agriculture (CDFA) and Nevada Department of Agriculture (NDA) "A"-rated and "B"-rated weeds, and c) all weeds on the Federal weed list. Only the species of greatest environmental concern and/or limited distribution onsite shall be mandated for eradication. Weed management is not required for common and widespread weed species.

The draft weed management plan shall include the following:

1. Weed Plan Requirements. The draft plan shall include the following information: a) specific weed management objectives and measures for each target non-native weed species; b) description of the baseline conditions; c) map of the weed management and monitoring areas showing locations of existing populations of target weeds; d) weed risk assessment based on Cal-IPC[8],Nature Conservancy[9]; BLM, or other acceptable criteria, and e) measures that would be used to contain, manage, or monitor identified priority weed species; f) measures that would be used to prevent the introduction and spread of weeds on vehicles, equipment, and materials (e.g., infested seed, straw, gravel, etc.); g) measures to minimize the risk of unintended harm to wildlife and other plants from weed control activities; h) monitoring and surveying methods; and i) reporting requirements.

2. Avoidance and Treatment of Dense Weed Populations. The draft plan shall include guidelines for avoiding or treating dense populations of the weed species identified as priorities for containment. If grading and construction cannot avoid the worst, they shall be contained by one of the following methods: a) requiring tires of vehicles and equipment operating in infested areas to be cleaned before leaving the infested area; b) treating the infested areas in the season prior to construction and spraying the new crop of plants that emerge in early spring, c) removing the upper 2 inches of soil and disposing it offsite at a sanitary landfill or other site approved by the County Agricultural Commissioner, or d) burying the infested soil, e.g., under the solar facility or in a pit, and covering the infested soil with at least three feet of uncontaminated soil.

3. Cleaning Vehicles and Equipment. The draft plan shall include specifications and requirements for establishing a cleaning station for removal of weed seed and weed plant parts from vehicles and equipment entering and leaving the site. Vehicles and equipment working in weed-infested areas (including previous job sites) shall be required to clean the equipment tires, tracks, and undercarriage before entering the project area and before moving from infested areas of the project site to uninfested

[8] Warner, Peter J., Carla C. Bossard, Matthew L. Brooks, Joseph M. DiTomaso, John A. Hall, Ann M. Howald, Douglas W. Johnson, John M. Randall, Cynthia L. Roye, Maria M. Ryan, and Alison E. Stanton. 2003. *Criteria for Categorizing Invasive Non-Native Plants that Threaten Wildlands.*California Exotic Pest Plant Council and Southwest Vegetation Management Association. 24 pp. Online:.

[9]Morse, L.E., J.M. Randall, N. Benton, R. Hiebert, and S. Lu. 2004. *An Invasive Species Assessment Protocol: Evaluating Non-Native Plants for Their Impact on Biodiversity.*[v1]. The Nature Conservancy. Arlington, Va. Online: http://www.natureserve.org/library/invasiveSpeciesAssessmentProtocol.pdf

areas. Cleaning shall adequately remove all visible dirt and plant debris. Cleaning using hand tools, such as brushes, brooms, rakes, or shovels, is preferred. If water must be used, the water/slurry shall be contained to prevent seeds and plant parts from washing into adjacent habitat.

4. Treatment of Weed Populations near Special-status Plants. The draft plan shall include a requirement to prioritize the containment of invasive non-native weeds onsite that occur onsite and within 100 feet of any of the nine offsite special-status plant occurrences immediately adjacent to the project boundary. The draft plan shall also include measures for preventing accidental harm to the adjacent offsite occurrences during spraying or other weed management activities according to the guidelines in #6, below. The plan shall not include spraying or mechanical treatments of common and widespread weeds around the perimeter to avoid harming wildlife; the focus shall instead be on spot treatment of new outbreaks and small populations of the most invasive species, and according to the guidelines for wildlife-safe herbicide use described under #7 and #8, below.

5. Employee Weed Awareness Training. A program shall be developed and incorporated into the WEAP and BRMIMP to train construction and operation employees to recognize the most common and most invasive species in the area, how to avoid contaminating vehicles and equipment, how to avoid spreading weeds offsite or introducing new weed species onsite, and how to protect wildlife and adjacent offsite special-status plant occurrences from accidental harm during weed management activities. Employees shall be trained to understand the common vectors and conduits for spread, the economic and ecological impacts of weeds, and trained on procedures for reporting infestations.

6. Compensate Local Agencies for Increased Weed Monitoring and Abatement. The project owner and the Inyo/Mono Agricultural Commissioner shall establish an amount for a fee to be paid annually by the project owner to the local agency for increased offsite monitoring and abatement costs resulting from the construction and operation of the project. A summary of California's weed laws is available online: <http://www.cdfa.ca.gov/plant/ipc/encycloweedia/winfo_weedlaws.htm>

7. Safe Use of Herbicides. The draft plan shall include a list of herbicides and soil stabilizers that will be used on the project with manufacturer's guidance on appropriate use. The draft plan shall indicate under what circumstances herbicides will be used, and what techniques will be used to avoid chemical drift. Guidance for safe herbicide use is available in *Safe Herbicide Handling in Natural Areas* (Hillmer et al. 2003). Only weed control measures for target weeds with a demonstrated record of success shall be used, based on the best available information from sources such as The Global Invasive Species Team "Invasipedia"[10], Cal-IPC Invasive

[10] http://wiki.bugwood.org/Invasipedia

Plant Profiles[11],and the California Department of Food & Agriculture Encycloweedia[12].

8. Weed Control Methods. The methods for weed control described in the draft plan shall meet the following criteria:

   a. Manual: Seed heads and plants removed manually must be disposed of in accordance with guidelines from the Inyo County Agricultural Commissioner (or Clark or Nye County commissioners if disposed in Nevada).

   b. Chemical: Herbicides known to have residual toxicity, such as soil fumigants, pre-emergent herbicides and pellets shall not be used. In sensitive areas immediately adjacent to offsite special-status plant occurrences, sprayers shall be operated at low pressure or with a shield attachment to control drift, and spraying conducted on windless days;

   c. Biological: Biological methods, if used, shall be subject to agency review to avoid inadvertent naturalizing, hybridizing with native species;

   d. Mechanical: Mechanical trimmers shall not be used during periods of high fire risk or shall only be implemented during early morning hours when the fire risk is lowest. Contact information for the local fire department and Cal-Fire shall be clearly posted at all times. A live water supply, shovels, and fire extinguishers shall be available at all times during mowing and other mechanical weed controls.

Verification: At least 90 days prior to the start of any project-ground disturbing activity, the project owner shall submit the draft Weed Management Plan to the CPM for review and approval. No less than 30 days prior to the start of any project-ground disturbing activity, the project owner shall provide the CPM with the final version of the Weed Management Plan. Any modifications to the approved plan shall be made only after approval by the CPM.

No less than 60 days prior to start of any project-related ground disturbance activities, the project owner shall provide the CPM with a copy of an agreement between the project owner and local agricultural commissioner(s) regarding compensation for increased weed monitoring and abatement costs, and provide written evidence that the first annual fee has been paid.

Within 60 days after completion of project construction, the project owner shall provide to the CPM for review and approval a written report identifying which items of the Weed Management Plan have been completed, a summary of all modifications to mitigation measures made during the project's construction phase, and which items are still outstanding.

[11] http://www.cal-ipc.org/ip/management/plant_profiles/index.php

[12] http://www.cdfa.ca.gov/plant/ipc/encycloweedia/encycloweedia_hp.htm

As part of the Annual Compliance Report, each year following construction the Designated Biologist shall provide a report to the CPM that includes: a) a summary of the results of noxious weed surveys and management activities for the year; b) discussion of whether weed management goals and objectives for the year were met; c) documentation that weeds targeted for containment did not spread offsite (beyond existing background levels for species that also occur offsite); documentation that methods were employed to prevent accidental harm to adjacent sensitive resources, and d) recommendations for weed management activities for the upcoming year.

SPECIAL-STATUS PLANT IMPACT AVOIDANCE AND MINIMIZATION MEASURES

BIO-19 The project owner shall prevent accidental impacts to special-status plant occurrences offsite that are in close proximity to project activities through the measures described below. The project owner is not responsible for managing or monitoring special-status plant occurrences offsite. The project owner shall incorporate all measures for protecting special-status plants in close proximity to the site into the BRMIMP (BIO-7). These measures shall include the following elements:

a. Modify construction techniques: Incorporate modifications to construction techniques to avoid accidental and indirect impacts to special-status plants around the project perimeter. Examples include: limiting the width of the work area; adjusting the location of staging areas, lay downs, secondary access roads; and modifying the location of discharge points of any diverted channels to maintain existing surface drainage patterns.

b. Establish Environmentally Sensitive Areas (ESAs). Prior to the start of any ground- or vegetation-disturbing activities, the Biological Monitor shall establish special-status plants located outside of the project and adjacent to the project boundary as temporary Environmentally Sensitive Areas (ESAs) to protect the offsite occurrences from accidental impacts during construction and operation. The adjacent offsite occurrences shall be marked at the project boundary with temporary construction fencing and temporary signage during construction activities in close proximity to the offsite occurrences. The adjacent offsite occurrences shall also be clearly depicted on construction drawings as ESAs.

c. Worker Environmental Awareness Program (WEAP). The WEAP **(BIO-6)** shall include a requirement for informing employees and contractors about the presence of adjacent offsite special-status plant occurrences and components specific to protection of special-status plants as outlined in this condition.

d. Herbicide and Soil Stabilizer Drift Control Measures. Special-status plant occurrences shall be protected from herbicide as described in the Weed Management Plan (**BIO-18**), and shall also be protected from fugitive dust and soil stabilizer drift..

e. Avoid Weed Contaminated Erosion and Sediment Control Materials. Any seed mixes used for erosion control shall not include invasive plants. Erosion-control seed mixes, straw, and other mulches, if used, shall be certified weed-free. These specifications shall be incorporated in the Drainage, Erosion, and Sedimentation Control Plan required under **SOIL-1**.

f. Locate Staging, Parking, Spoils, and Storage Areas Away from Special-Status Plant Occurrences. Spoil piles, equipment, vehicles, and materials storage areas, parking areas, equipment and vehicle maintenance areas, and wash areas shall be placed at least 100 feet from any offsite special-status plant occurrences.

g. Monitoring and Reporting Requirements. The Designated Biologist shall conduct regularly scheduled monitoring of the ESAs and other measures designed to protect adjacent offsite special-status plant occurrences during construction activities in close proximity. The monitoring report shall include: a) dates of worker awareness training sessions and attendees; b) map showing the location of all special-status plant occurrences within 100 feet of the project boundary (including linears and access roads); c) location and description of avoidance measures implemented; d) description of the status, health, and threats to special-status plant occurrences adjacent to the project boundary; e) location description of any unanticipated or unpermitted adverse impacts to occurrences and remedial action taken; and f) outstanding follow-up items and recommendations for remedial action in the next year.

Verification: The Monthly Compliance Reports prepared by the Designated Biologist during construction shall include documentation that the special-status plant avoidance and minimization measures were implemented as described in this condition.

The project owner shall submit a monitoring report every year for the life of the project according to the specifications listed above to monitor effectiveness of protection measures for all avoided special-status plants to the CPM.

SPECIAL-STATUS PLANT COMPENSATORY MITIGATION PLAN

BIO-20 To mitigate for significant impacts to special-status plants that occur on the project site, the project owner shall implement mitigation to offset the impact as described below. One or more mitigation options could be implemented to fulfill the mitigation ratios and requirements described below. These options include: a) acquisition of mitigation lands containing viable occurrences that meet the criteria and performance standards described below, and protecting those occurrences in perpetuity under a conservation easement, or b) restoration of at-risk occurrences according to the criteria and performance standards described below. The project owner shall provide funding for the acquisition and long-term maintenance and management of the acquired lands as described below.

1) Compensatory Mitigation Ratio for Compensation Lands. Significant impacts to four species (gravel milk-vetch, Wheeler's skeletonweed, Torrey's joint-fir, and Preuss' milk-vetch) shall be mitigated by acquiring and preserving offsite occurrences under a permanent conservation easement. Three offsite occurrences shall be protected for every S1 ("critically imperiled") species affected and two offsite occurrences protected for every S2 ("imperiled") species affected. Range ranks (e.g., an S1S2 rank) shall defer to the more imperiled rank. Acquisition lands containing more than one of the affected species shall be credited for both species. Integration of special-status plant mitigation land with other mitigation lands is described below.

   The compensation lands selected for acquisition must meet the following selection criteria: a) the compensation lands selected for acquisition shall be occupied by the target plant population and shall be characterized by site integrity and habitat quality adequate to sustain the population, and b) shall be of equal or better habitat quality than that of the affected occurrence. The occurrence of the target special-status plant on the proposed acquisition lands should be viable, stable or increasing.

2) Review and Approval of Compensation Lands Prior to Acquisition. A Draft Special-status Plant Mitigation Plan (Plan) shall be prepared subject to review and approval of the CPM prior to acquisition. The Draft Plan shall discuss the suitability of the proposed parcel(s) as compensation lands for special-status plants in relation to the criteria listed above. The project owner shall submit the final Plan and formal acquisition proposal to the CPM describing the parcel(s) intended for purchase, and must be approved by the CPM.

3) Management Plan. The project owner, or approved third party as described below under "Title and Conveyance", shall prepare a management plan for the compensation lands in consultation with the entity that will be managing the lands. The goal of the management plan shall be to support and enhance the long-term viability of the target special-status plant occurrences. The management plan shall also include long-term monitoring and reporting on the implementation, effectiveness and compliance with the conservation goals and objectives of the mitigation. The Management Plan shall be submitted for review and approval to the CPM.

4) Integrating Special-Status Plant Mitigation with Other Mitigation Lands. If all or any portion of the acquired Desert Tortoise, Waters of the State, or other required compensation lands meets the criteria above for special-status plant compensation lands, the portion of the other species' or habitat compensation lands that meets any of the criteria above may be used to fulfill that portion of the obligation for special-status plant mitigation. Mitigation obligations for special-status plants shall not be fulfilled by nesting with other mitigation lands if the lands do not meet all the criteria and performance standards described in this condition.

Potential mitigation lands containing more than one of the significantly affected species would be credited for both species, i.e., one parcel could be used to fulfill the mitigation obligations for more than one special-status plant species providing the parcel met all the selection criteria.

5) Compensation Lands Acquisition Requirements. The project owner shall comply with the following requirements relating to acquisition of the compensation lands after the CPM, has approved the proposed compensation lands:

   a. Preliminary Report. The project owner, or an approved third party, shall provide a recent preliminary title report, biological analysis, and other necessary or requested documents for the proposed compensation land to the CPM. All documents conveying or conserving compensation lands and all conditions of title are subject to review and approval by the CPM.

   b. Title/Conveyance. The project owner shall acquire and transfer fee title to the compensation lands, a conservation easement over the lands, or both fee title and conservation easement, as required by the CPM. Any transfer of a conservation easement or fee title must be to a non-profit organization qualified to hold title to and manage compensation lands (pursuant to California Government Code section 65965), or to CDFG or other public agency approved by the CPM. If an approved non-profit organization holds fee title to the compensation lands, a conservation easement shall be recorded in favor of the deed holder approved by the CPM. The CPM may require that another entity approved by the CPM be named a third party beneficiary of the conservation easement. The project owner shall obtain approval of the CPM of the terms of any transfer of fee title or conservation easement to the compensation lands.

   c. Initial Protection and Habitat Improvement. The project owner shall fund activities that the CPM requires for the initial protection and habitat improvement of the compensation lands, if habitat improvement is necessary. These activities will vary depending on the condition and location of the land acquired, but may include: initial enhancement (e.g., signs, fencing, protection from off-road vehicles); restoration actions needed to maintain the viability of the occurrences (e.g., removal of invasive species, barricading and decommissioning off-road vehicle trails, protection from herbivores, managing public access, enforcement); and monitoring and reporting on implementation, effectiveness and compliance with the conservation goals and objectives of the mitigation. For determining the amount of security, the cost of these activities would use the estimated cost per acre for Desert Tortoise mitigation as a best available proxy. The actual costs will vary depending on the measures that are required for the compensation lands and shall be determined by a PAR or similar analysis. A non-profit organization or another public agency may hold

and expend the habitat improvement funds if it is qualified to manage the compensation lands (pursuant to California Government Code section 65965), and if it meets the approval of the CPM.

d. Property Analysis Record. Upon identification of the compensation lands, the project owner shall conduct a Property Analysis Record (PAR) or PAR-like analysis to establish the appropriate amount of the long-term maintenance and management fund to pay the in-perpetuity management of the compensation lands. The PAR or PAR-like analysis must be approved by the CPM before it can be used to establish funding levels or management activities for the compensation lands.

e. Long-term Maintenance and Management Funding. The project owner shall deposit into an account managed by a land trust or other non-profit organization to fund a capital long-term maintenance and management fee (endowment) in the amount determined through the Property Analysis Record (PAR) or PAR-like analysis conducted for the compensation lands. The CPM may designate another non-profit organization to hold the long-term maintenance and management fee if the organization is qualified to manage the compensation lands in perpetuity.

f. Interest, Principal, and Pooling of Funds. The project owner shall ensure that an agreement is in place with the long-term maintenance and management fund (endowment) holder/manager to ensure the following requirements are met:

   i. Interest. Interest generated from the initial capital long-term maintenance and management fund shall be available for reinvestment into the principal and for the long-term operation, management, and protection of the approved compensation lands, including reasonable administrative overhead, biological monitoring, improvements to carrying capacity, law enforcement measures, and any other action that is approved by the CPM and is designed to protect or improve the habitat values of the compensation lands.

   ii. Withdrawal of Principal. The long-term maintenance and management fund principal shall not be drawn upon unless such withdrawal is deemed necessary by the CPM or by the approved third-party long-term maintenance and management fund manager, to ensure the continued viability of the target species on the compensation lands.

   iii. Pooling Long-Term Maintenance and Management Funds. An entity approved to hold long-term maintenance and management funds for the project may pool those funds with similar funds that it holds from other projects for long-term maintenance and

management of compensation lands for special-status plants. However, for reporting purposes, the long-term maintenance and management funds for this project must be tracked and reported individually to the CPM.

g. Other Expenses. In addition to the costs listed above, the project owner shall be responsible for all other costs related to acquisition of compensation lands and conservation easements, including but not limited to the title and document review costs incurred from other state agency reviews, overhead related to providing compensation lands to an approved third party, escrow fees or costs, environmental contaminants clearance, and other site cleanup measures.

h. Mitigation Security. The project owner shall provide financial assurances to the CPM to guarantee that an adequate level of funding is available to implement any of the mitigation measures required by this condition that are not completed prior to the start of ground-disturbing project activities. Financial assurances shall be provided to the CPM in the form of an irrevocable letter of credit, a pledged savings account or another form of financial security ("Security") approved by the CPM. The estimated acquisition costs and amount of the security shall be calculated based on the estimated cost per acre for Desert Tortoise mitigation as a best available proxy. The actual costs to comply with this condition will vary depending on the actual costs of acquiring compensation habitat, the costs of initially improving the habitat, and the actual costs of long-term management as determined by a PAR report. Prior to submitting the Security to the CPM, the project owner shall obtain the CPM's approval of the form of the Security. The CPM may draw on the Security if the CPM determines the project owner has failed to comply with the requirements specified in this condition. The CPM may use money from the Security solely for implementation of the requirements of this condition. The CPM's use of the Security to implement measures in this condition may not fully satisfy the project owner's obligations under this condition, and the project owner remains responsible for satisfying the obligations under this condition if the Security is insufficient. The unused Security shall be returned to the project owner in whole or in part upon successful completion of the associated requirements in this condition.

2. Compensation through Restoration of At-Risk Occurrences. As an alternative or adjunct to acquisition of compensation lands, the project owner may undertake or fund habitat enhancement or restoration for at-risk occurrences of the target special-status plant species. Examples of suitable restoration projects include but are not limited to the following: a) control of unauthorized vehicle use into an occurrence; b) control of invasive non-native plants that pose an immediate threat to an occurrence; c) fencing to exclude grazing by wild burros or livestock from an occurrence; d) protection from other herbivores (e.g. lagomorphs) if

damaging to the occurrence, or e) restore lost or degraded hydrologic or geomorphic functions critical to the species (e.g., restoring previously diverted stream flows, removing obstructions to the wind sand transport corridor above an occurrence, or increasing groundwater availability for dependent species). Ex-situ mitigation through transplanting or replacement planting is not an acceptable mitigation option due to the high rate of failure.

i. Performance Standards. If the project owner elects to undertake a habitat enhancement project for mitigation, the project must meet the following performance standards: The proposed enhancement project shall achieve rescue of an off-site occurrence that is currently assessed, based on the NatureServe threat ranking system, with one or more of the following: a) long-term decline >30%; b) an immediate threat that affects >30% of the population, or c) has an overall threat impact that is High to Very High. “Rescue” would be considered successful if it achieves an improvement in the occurrence trend to “stable” or “increasing” status, or downgrading of the overall threat rank to slight or low (from “High” to “Very High”).

ii. Mitigation Security. The project owner shall provide financial assurances to the CPM to guarantee that an adequate level of funding is available to implement the restoration project. Financial assurances shall be provided to the CPM in the form of an irrevocable letter of credit, a pledged savings account or another form of financial security (“Security”) approved by the CPM. The amount of the security shall be based on the estimated total cost for the restoration project, including implementation, monitoring, and contingency measures. The implementation and monitoring of the restoration may be undertaken by an appropriate third party, or the project owner may fund an agency to implement the restoration, subject to approval by the CPM. Any restoration undertaken on private lands must be protected in perpetuity under a conservation easement.

iii. Prepare Restoration Plan. If the project owner elects to undertake a restoration project for mitigation, they shall submit a Restoration Plan to the CPM for review and approval. The Restoration Plan shall include each of the following components:

i. Goals, Objectives, and Performance Standards. Define the goals of the restoration or enhancement project and a measurable course of action developed to achieve those goals. The objective of the proposed habitat enhancement plan shall include restoration of a target special-status plant occurrence that is currently threatened with a long-term decline. The proposed enhancement plan shall achieve an improvement in the occurrence trend to “stable” or “increasing” status, or downgrading of the overall threat rank to slight or low (from “High” to “Very High”).

ii. Baseline, Historical, and Desired Conditions. Provide a description of the pre-project baseline conditions (prior to the start of

restoration), an estimate of the pre-impact historical conditions (before the site was degraded by weeds or grazing or ORV, etc.), and the desired conditions.

iii. Site Characteristics. Describe other site characteristics relevant to the restoration or enhancement project (e.g., composition of native and pest plants, topography and drainage patterns, soil types, geomorphic and hydrologic processes important to the site or species).

iv. Ecological Factors. Describe other important ecological factors of the species being protected, restored, or enhanced such as total population, reproduction, distribution, pollinators, etc.

v. Methods. Describe the restoration methods that will be used (e.g., invasive exotics control, site protection, seedling protection, propagation techniques, etc.) and the long-term maintenance required. The implementation phase of the enhancement must be completed within five years.

vi. Budget. Provide a detailed budget and time-line, and develop clear, measurable, objective-driven annual success criteria.

vii. Monitoring. Develop clear, measurable monitoring methods that can be used to evaluate the effectiveness of the restoration and the benefit to the affected species. The Plan shall include a minimum of five years of quarterly monitoring, and then annual monitoring for the remainder of the enhancement project, and until the performance standards for rescue of a threatened occurrence are met. At a minimum the progress reports shall include: quantitative measurements of the projects progress in meeting the enhancement project success criteria, detailed description of remedial actions taken or proposed, and contact information for the responsible parties.

viii. Reporting Program. The Plan shall ensure accountability with a reporting program that includes progress toward goals and success criteria. Include names of responsible parties.

ix. Contingency Plan. Describe the contingency plan for failure to meet annual goals.

x. Long-term Protection. Include proof of long-term protection for the restoration site. For private lands this would include conservations easements or other deed restrictions; projects on public lands must be protected under a Wilderness designation, ACEC, DWMA, National Park or State Park lands.

3. Preservation of the Germplasm of Affected Special-Status Plants. This is not an alternative to mitigation by acquisition or restoration, but is a required contingency measure for all significantly affected special-status plants as a contingency in the event of mitigation failure. Mitigation by acquisition or restoration shall also include seed or propagule collection from the affected special-status plants population onsite prior to

construction to conserve the germplasm and provide a seed source for restoration efforts. The seed shall be collected under the supervision or guidance of a reputable seed storage facility such as the Rancho Santa Ana Botanical Garden Seed Conservation Program, San Diego Natural History Museum, or the Missouri Botanical Garden. The costs associated with the long-term storage of the seed shall be the responsibility of the Project owner. Any efforts to propagate and reintroduce special-status plants from seeds in the wild shall be carried out under the direct supervision of specialists such as those listed above and as part of a Restoration Plan approved by the CPM.

4. Criteria for Adjusting Mitigation Ratio for Torrey's joint-fir. Due to the uniquely high potential for finding many additional Torrey's joint-fir occurrences (see Special-status Plant Impacts subsection for explanation), the project owner may conduct pre-construction surveys before June 1, 2013, focused on Torrey's joint-fir. Surveys must be conducted onsite as well as offsite. If the discovery of new occurrences in fall 2012 or spring 2013 results in a downgrading of the CNDDB Element Rank from an S1 to S2, the species will be mitigated as an S2 species (see subparagraph #1). If the new occurrences result in a downgrading from S1 to S3 ("vulnerable but not under immediate threat of extinction"), AND the proportion of the statewide distribution affected by the project is less than 10 percent, then mitigation for Torrey's joint-fir shall no longer be required.

Verification: No fewer than 90 days prior to the start of project ground-disturbing activities, the project owner shall submit to the CPM for review and approval a conceptual proposal for mitigation by one or both of the two methods described in this condition (acquisition and restoration) that meets the criteria and performance standards described above, and according to the mitigation ratios described above.

The project owner shall provide the CPM, no less than 30 days prior to the start of any project related ground-disturbing activities, written verification that an approved financial security in accordance with this condition of certification has been established.

No later than June 15 of the first summer following the Final Decision, the project owner shall provide the CPM documentation that seed or other propagules have been collected for all the affected species and submitted to either Rancho Santa Ana Botanical Garden Seed Conservation Program, San Diego Natural History Museum, or the Missouri Botanical Garden.

No later than 30 days following the discovery of any new occurrences of Torrey's joint-fir, the project owner shall submit raw GPS data, metadata, and CNDDB field forms to the CPM. The project owner shall immediately provide written notification to the CPM, CDFG and/or USFWS and BLM if it detects a state- or federal-listed plant species.

Prior to acquisition of the property, the project owner shall submit a formal acquisition proposal to the CPM describing the parcels intended for purchase, or final restoration plan, according to the minimum requirements for a plan described above.

The project owner, or an approved third party, shall complete and provide written verification of the proposed compensation lands acquisition no later than 18 months following the start of project ground disturbing activities. Within 180 days of the land or easement purchase, as determined by the date on the title, the project owner, or an approved third party, shall provide the CPM, with a management plan for the compensation lands and associated funds. The CPM shall review and approve the management plan.

No fewer than 30 days after acquisition of the property the Project owner shall deposit the funds required for long term management, as described above, and provide proof of the deposit to the CPM.

The Project owner or an approved third party shall complete the acquisition and all required transfers of the compensation lands, and provide written verification to the CPM of such completion no later than 12 months after the start of Project ground-disturbing activities. If NFWF or another approved third party is being used for the acquisition, the Project owner shall ensure that funds needed to accomplish the acquisition are transferred in timely manner to facilitate the planned acquisition and to ensure the land can be acquired and transferred prior to the 18-month deadline. If habitat enhancement is proposed, no later than six months following the start of ground-disturbing activities, the Project owner shall obtain CPM approval of the final Habitat Enhancement/Restoration Plan, prepared in accordance with Section D, and submit to the CPM or a third party approved by the CPM Security adequate for long-term implementation and monitoring of the Habitat Enhancement/Restoration Plan.

Restoration activities shall be initiated no later than 12 months following the start of construction. The implementation phase of the enhancement project shall be completed within five years of initiation. Until completion of the five-year implementation portion of the enhancement action, a report shall be prepared and submitted as part of the Annual Compliance Report. This report shall provide, at a minimum: a summary of activities for the preceding year and a summary of activities for the following year; quantitative measurements of the Project's progress in meeting the enhancement project success criteria; detailed description of remedial actions taken or proposed; and contact information for the responsible parties.

BOTANIST QUALIFICATIONS AND DUTIES

BIO-21 The project owner's approved Designated Biologist shall oversee the selection and hiring of qualified botanist(s) to implement the tasks in **BIO-18** (Weed Management Plan), **BIO-19** (Special-status Plant Avoidance and Minimization Measures), **BIO-20** (Special-status Plant Compensatory Mitigation), and **BIO-23** (Groundwater-dependent Vegetation Monitoring) specified below that must be accomplished by a qualified botanist. All other tasks described in these measures not contained in the list below may be accomplished by the Designated Biologist. The Designated Biologist shall submit to the CPM for approval the resume, at least three references, and contact information for the qualified botanist(s) to fulfill the tasks below. The resume(s) shall demonstrate, to the satisfaction of the CPM the appropriate education and experience to accomplish the assigned botanical resource tasks.

Botanist(s) must meet the following minimum qualifications:

1) Demonstrated knowledge of: a) general plant taxonomy and natural community ecology; b) familiarity with the plants of the area, including special status species; and c) familiarity with natural communities of the project area;

2) At least five years experience conducting floristic field surveys;

3) At least five years experience working in the California Desert region;

4) Familiarity with the appropriate state and federal statutes related to plants and protocols or guidelines for conducting botanical inventories; and

5) At least five years experience analyzing the impacts of development on native plant species and natural communities.

Tasks requiring a qualified botanist shall include the following:

1) Advise the project owner's construction and operation managers, and the Designated Biologist on the implementation of botanical resource conditions of certification;

2) Conduct and/or train, supervise and coordinate botanical resources compliance efforts in close proximity to special-status plant occurrences as described in **BIO-18** (Weed Management Plan) and **BIO-19** (Special-status Plant Avoidance and Minimization Measures);

3) Mark special-status plant occurrences in close proximity to the project and inspect these areas at appropriate intervals for compliance with conditions of certification affecting or relating to special-status plants as described in **BIO-19**;

4) Prepare the Weed Management Plan as described in **BIO-18** and conduct the surveying and annual monitoring required in the plan;

5) Consult and/or prepare the Special-status Plant Compensatory Mitigation plans for restoration and/or proposals for acquiring compensation lands, and conduct annual monitoring required in the plans; and

6) Conduct and/or train and supervise the Designated Biologist in the implementation of **BIO-23** (Groundwater-dependent Vegetation Monitoring).

Verification: At least 60 days prior to construction-related ground disturbance, the project owner shall submit the resume to the CPM for a botanist to conduct the tasks described above under tasks #1 and #2. Once approved, the project owner shall provide written verification to the CPM that the qualified botanist is available to implement the required mitigation measures during construction. No construction-

related ground disturbance, site mobilization, grading, boring, trenching, chemical spraying, or weed management within 100 feet of a special-status plant occurrence shall commence until an approved botanist has surveyed and marked the special-status plant occurrences adjacent to the project as Environmentally Sensitive Areas as described in **BIO-19** (Special-status Plant Avoidance and Minimization Measures).

STATE WATERS COMPENSATORY MITIGATION AND IMPACT AVOIDANCE & MINIMIZATION MEASURES

BIO-22 To satisfy requirements of California Fish and Game Code sections 1600 and 1607, the project owner shall implement measures contained herein for: 1) compensating unavoidable impacts to all Waters of the State located within the project footprint, and 2) for avoiding and minimizing accidental, incidental and indirect impacts to waters located outside the project footprint. For purposes of this condition, "project footprint" means all lands contained within the boundaries of the project components, including access roads, utility and transmission alignments, staging areas, and temporary construction areas. Avoidance and minimization measures for work within or adjacent to waters shall be implemented during construction, operation, and decommissioning, including site mobilization.

1. Complete and Submit Section 1600 Notification Form and Fees. Coordinate with CDFG to submit a formal 1600 application and associated fees. Submit a final revised state waters delineation report to include additional features identified during the field verification of the state waters delineation.

2. Compensatory Mitigation. The project owner shall acquire and preserve under a permanent conservation easement a parcel or parcels of land that contain jurisdictional state waters in an amount equal to the area of state waters delineated within the project footprint and mitigated at a ratio of 2:1 (two acres for every acre of state waters onsite) for permanent impacts to habitat functions and values. This ratio assumes that impacts to the hydrologic and geomorphic functions will be minimized by not diverting streams around the site in artificial channels. If the channels are diverted around the site, the mitigation ratio shall increase to a ratio of 3:1. The project owner shall provide associated funding for the long-term stewardship of the acquired lands, as specified below.

    a. Selection Criteria. Compensation lands for impacts to state waters shall meet the following criteria:

        i. Located in California and within the Pahrump Valley Hydrologic Unit. If the project owner demonstrates that suitable compensation lands are not available within Pahrump Valley, lands may be acquired in California Valley, or the California portions of Sandy (Mesquite) Valley and Stewart Valley or other adjacent watersheds.

        ii. Contain waters in a general physiographic setting similar to the affected waters (i.e., alluvial fan washes) or that provide similar

habitat function and values. Proposed mitigation sites shall be described in terms of habitat function and values, in the context of the habitat function and values that were impacted at the project site, in a proposal submitted to the CEC and subject to approval by the CPM in consultation with CDFG;

iii. Contain waters of a similar or better quality than the affected waters. Subject to review and approval of the CPM in consultation with CDFG, lands degraded by unauthorized off-road vehicles (ORV) may be considered if the project owner can demonstrate that the unauthorized ORV can be excluded and controlled with road decommissioning and signage;

iv. Contain waters that are hydrologically unimpaired upstream by dams or diversions. Subject to review and approval of the CPM in consultation with CDFG, impaired waters may be considered if it can be demonstrated that the hydrologic functions can be restored and are accompanied by a restoration proposal;

v. Do not contain hazardous wastes that cannot be removed; and

vi. Contain water and mineral rights as part of the acquisition, unless the CPM, in consultation with CDFG, agrees in writing to the acceptability of the land.

b. Integrating Special-Status Plant Mitigation with Other Mitigation Lands. Any portion of the acquired Desert Tortoise or other required compensation lands meets the criteria above for state waters may be used to fulfill that portion of the obligation for state waters mitigation.

c. Security for Implementation of Mitigation: The project owner shall provide financial assurances to the CPM to guarantee that an adequate level of funding is available to implement the acquisitions and enhancement of state waters as described in this condition. These funds shall be used solely for implementation of the measures associated with the project. Financial assurance can be provided to the CPM in the form of an irrevocable letter of credit, a pledged savings account or Security prior to initiating ground-disturbing project activities. Prior to submittal to the CPM, the mitigation security shall be approved by the CPM, in consultation with CDFG. The final amount due shall be determined by updated appraisals and the PAR analysis conducted pursuant to **BIO-12** (Desert Tortoise Compensatory Mitigation).

d. Prepare Management Plan for Stewardship of Acquired Lands: The project owner shall submit a draft State Waters Mitigation Management Plan subject to review and approval by the CPM and CDFG. The goal of the plan is to protect the integrity of the washes and their habitat functions and values from unauthorized ORV and other threats, or to restore degraded functions and values as described in #2 (a) above.

Acquired lands must be protected in perpetuity under a conservation easement as described in **BIO-12** (Desert Tortoise Compensatory Mitigation).

e. Compensation Lands Acquisition Requirements. The project owner shall comply with the requirements relating to acquisition of the compensation lands described in **BIO-12** (Desert Tortoise Compensatory Mitigation).

3. Avoidance and Minimization Measures. The measures described below shall be implemented during construction, operation, and closure for any project-related activity that may directly or indirectly affect offsite waters adjacent to the project boundary, and to minimize impacts to the hydrologic and geomorphic functions of waters onsite, including water quality. Such activities include ground or vegetation disturbing activities, weed and vegetation management activities, and pre-construction mobilization. The project owner shall provide a discussion of work in or adjacent to Waters of the State, and the avoidance and minimization measures employed to protect offsite waters from accidental or indirect effects in the Annual Compliance Reports.

   a) Guidelines for Stream Crossings. The project owner shall minimize disturbance to surface drainage patterns and sediment transport in watercourses downstream of the project. Arizona crossings shall be employed for improvements to project access roads wherever such crossings do not present a safety hazard and where the roadbed elevation allows the construction of such crossings. Crossings shall be constructed to accommodate the full natural width of the channel (bank-to-bank) for single-thread channels, and the full width of the floodplain for braided distributary channels. Streams that have been graded for temporary construction access shall be restored to original contours and surface drainage patterns and shall be stabilized according to specifications in **SOIL-1**.

   b) Diffuser Design. For any diverted watercourse, the project owner shall maintain pre-development surface drainage patterns downstream of the project, in location and approximate volume of flows. Flows shall not be discharged indiscriminately as sheet flow across the entire length of the diffusers, irrespective of the natural surface drainage patterns, but shall instead be designed to discharge within existing watercourse boundaries downstream, or within the active floodplain of braided distributary stream types.

   c) Documentation at the Site and Project Entry. The project owner shall provide a copy of this condition from the Energy Commission Decision to all contractors, subcontractors, and the owner's project supervisors and Designated Biologist. Copies shall be readily available at work sites at all times during periods of active work and must be presented to any CDFG personnel upon demand. The CPM reserves the right to

issue a stop work order or allow CDFG to issue a stop work order after giving notice to the project owner and the CPM, if the CPM in consultation with CDFG, determines that the project owner has breached any of the terms or conditions or for other reasons, including but not limited to the following:

i) The information provided by the project regarding impacts to waters of the state is incomplete or inaccurate;

ii) New information becomes available that was not known in preparing the terms and conditions; or

iii) The project or project activities as described in the Staff Assessment have changed.

d) Best Management Practices. During construction, operation, closure, and pre-construction mobilization, the following Best Management Practices (BMPs) shall be implemented to avoid accidental impact during construction or indirect effects to state waters:

i) During the pre-construction planning stage identify gravel storage areas, staging areas, access roads, parking, turnarounds, and equipment refueling & maintenance areas to minimize impacts to any delineated state waters outside of the permitted work area. Staging, storage, equipment maintenance and re-fueling shall be located a minimum of 30 feet from the uphill side of streams and their active floodplain to protect water quality downstream. The boundaries of those work areas shall be clearly marked on all final site plan and construction drawings.

ii) Prior to the start of construction, establish the stream zones offsite or outside the permitted work area that are adjacent to work activities as Environmentally Sensitive Areas (ESAs). No earth-moving activities, vegetation removal, vehicles, heavy equipment, material storage, equipment maintenance or re-fueling, or other construction activities shall be permitted within the ESAs. Work shall not begin until the boundary of the ESAs are delineated on the ground with orange safety netting where they occur adjacent to work activities (e.g., along the project boundary) under supervision of the Biological Monitor. The ESAs shall be depicted on all final maps and specifications.

iii) Construction activities shall be timed with awareness of precipitation forecasts, and shall be started only if the local weather forecast predicts no probability of rain for a period of 72 hours. Construction activities shall cease and water quality, erosion and sediment control measures shall be implemented prior to storm events to prevent erosion and sedimentation, and contamination of stormwater runoff. Activities outside of the sensitive areas

described above are not confined to this time period, but at no time shall heavy equipment operate during wet weather.

iv) The project owner shall minimize road building, construction activities and vegetation clearing on streams within the site wherever possible by limiting the width of the work area. Access to the site shall be on existing access roads.

v) In the event of wet weather, the project owner shall not allow water containing mud, silt, or other pollutants from grading, aggregate washing, or other activities to enter streams outside the permitted work area, or be placed in locations that may be subjected to storm runoff. Prior to the start of work, including any equipment move-on or materials storage, install silt-fencing, straw bales, sediment catch basins, straw or coir logs or rolls, or other sediment barriers to keep erodible soils and other pollutants from entering state waters outside the permitted work area. Extra sediment, pollutant, and erosion control materials shall be stockpiled onsite to address any unanticipated rain events, problems and emergencies.

vi) No broken concrete, debris, soil, silt, sand, gravel, rubbish, cement or concrete wash water, oil or petroleum products, or other contaminants shall be allowed to enter into, or placed where it may be washed by rainfall or runoff into waters of the state outside the permitted work area. The contractor shall immediately contain and clean up any petroleum or other chemical spills with absorbent materials such as sawdust or cat litter. For other hazardous materials, follow cleanup instructions on the package.

e) Changes of Conditions. A formal notification shall be provided to the CPM and CDFG if a change of conditions is identified. As used here, change of condition refers to the process, procedures, and methods of operation of a project; the biological and physical characteristics of a project area; or the laws or regulations pertinent to the project as defined below. A copy of the change of conditions notification shall be included in the annual reports or until it is deemed unnecessary by the CPM, in consultation with CDFG. A change in biological conditions includes, but is not limited to, the following: the presence of biological resources within or adjacent to the project area, whether native or non-native, not previously known to occur in the area; or the presence of biological resources within or adjacent to the project area, whether native or non-native, the status of which has changed to endangered, rare, or threatened, as defined in section 15380 of Title 14 of the California Code of Regulations. A change in physical conditions includes, but is not limited to, the following: a change in the morphology of a river, stream, channel or lake, such as the lowering of a bed or scouring of a bank, or substantial changes in stream form and configuration caused by storm events; the movement of a river or stream channel to a different location; a reduction of or other change in

vegetation on the bed, channel, or bank of a drainage; or changes to the hydrologic regime such as fluctuations in the timing or volume of water flows in a river or stream.

f) Legal Conditions: a change in legal conditions includes, but is not limited to, a change in Regulations, Statutory Law, a Judicial or Court decision, or the listing of a species, the status of which has changed to endangered, rare, or threatened, as defined in section 15380 of Title 14 of the California Code of Regulations.

Verification: No less than 60 days prior to beginning project ground-disturbing activities, the project owner shall provide to the CPM design drawings of drainage diffusers or other discharge points depicting how these structures restore pre-development drainage patterns (location and volume of flows) to any watercourses located downstream of the project boundaries. At the same time the project owner shall provide design drawings for temporary and permanent stream crossings.

No less than 30 days prior to the start of construction-related ground disturbance activities, the project owner shall provide written verification (i.e., through incorporation into the BRMIMP) to the CPM that the above BMPs will be implemented. No later than 60 days prior to beginning ground-disturbing activities, a formal 1600 application and fees shall be submitted to CDFG, and the project owner shall provide the CPM a copy of the 1600application and verification of payment of CDFG 1600 fees. A copy of the final state waters delineation shall be incorporated into the BMIMP.

The project owner shall provide the CPM, no less than 30 days prior to the start of any project related ground-disturbing activities, written verification that an approved security for compensatory mitigation in accordance with this condition of certification has been established. The financial security will be used to purchase compensatory habitat for impacts to state waters and must be accomplished no later than 18 months from the start of any project-related construction activities. A copy of the final recorded deed showing transfer of mitigation land or documentation of other approved mitigation transaction as approved by the CPM.

No less than 90 days prior to the acquisition of the compensation lands, the project owner shall submit a formal acquisition proposal, including PAR analysis, to the CPM and CDFG. The draft State Waters Mitigation Management Plan shall be provided to the CDFG and CPM no less than 60 days after acquisition of the compensation lands.

GROUNDWATER-DEPENDENT VEGETATION MONITORING PLAN

BIO-23 The project owner shall prepare and implement a draft and final Groundwater-dependent Vegetation Monitoring Plan (Vegetation Monitoring Plan) that, in conjunction with the Groundwater Monitoring, Mitigation, and Reporting Plan (**WATER SUPPLY-4**), will protect groundwater-dependent ecosystems (GDEs) within the influence of the project pumping wells from the impacts of project-related groundwater drawdown. The plans require monitoring to track the impacts of pumping to groundwater levels as they develop during the life of the project, and define triggers for adaptive management to be implemented if data indicate impending adverse effects.

The project owner shall submit a draft Vegetation Monitoring Plan to the CPM for review and approval by the CPM, in consultation with the BLM Nevada and BLM California State Lead for Soil, Water, Air and Riparian Programs, the BLM Southern Nevada District and Barstow District Hydrologist and Botanist, and Inyo County Water Department. The Vegetation Monitoring Plan shall meet the performance standards, monitoring objectives, and guidelines for content of the plan and monitoring methods specified in this condition.

If water level monitoring, as described in **WATER SUPPLY-4**, identifies a projected 0.5 foot or greater water level decline at the property boundary due to project pumping, the project owner shall cease pumping and reduce or modify pumping to restore water levels to pre-threshold levels unless evidence, subject to review and approval by the CPM, in consultation with the parties listed above, demonstrates the drawdown trigger was exceeded due to factors other than the project pumping *and* the project did not contribute to the drawdown. Alternatively, the project may provide evidence through vegetation monitoring and soil coring described in this condition, and through updated predictive hydrologic trend analysis, that a greater drawdown will meet all performance standards contained in this condition for avoiding significant adverse impacts to groundwater-dependent vegetation.

1. Trigger for Adaptive Management. If water levels in either of the Power Block 1 or Power Block 2 Onsite Monitoring Wells identify a projected 0.5 foot or greater water level decline at the property boundary due to project pumping during construction or operation, as described in **WATER SUPPLY-4**, the project owner shall stop project pumping until the project owner provides evidence, subject to approval by the CPM, can demonstrate:

   a) the pumping can be reduced or modified to maintain groundwater levels above the 0.5 ft. drawdown threshold at the project boundary; or

   b) the drawdown trigger was exceeded due to factors other than the project pumping and the project did not contribute to the drawdown; or

   c) through vegetation monitoring and soil coring described in this condition, and predictive water level trend analysis described in **WATER SUPPLY-4**, subsection C.2, that a greater groundwater drawdown will not result in significant adverse impacts to the groundwater dependent vegetation.

2. Peer Review. The draft Vegetation Monitoring Plan shall undergo a peer review by three or more recognized experts in the development of sampling and monitoring plans for plant populations; responses of desert phreatophytes (groundwater-dependent plants) to drought stress or groundwater depletion; and biostatistics. The peer reviewers shall be selected and organized by the CPM, in consultation with the BLM Nevada and BLM California state leads for Soil, Water, Air and Riparian Programs, and the BLM Southern Nevada District and BLM Barstow District

Hydrologist and Botanist, and Inyo County Water Department. The cost of the peer review shall be paid by the project owner. The peer review panel described above is required only for the review of the draft Vegetation Monitoring Plan; all other approvals shall be made by the CPM, in consultation with BLM and Inyo County as described in this condition.

3. Monitoring Objectives and Performance Standards. The goal of the monitoring is to avoid impacts to the mesquite habitats and other nearby GDEs from project groundwater pumping before it results in any plant mortality or any drawdown-related stress from which the GDEs cannot recover fully within one season following detection, and based on the techniques for field measurements and establishing normal seasonal variation and variability between populations described in this condition under "Field Techniques". The objectives of the Vegetation Monitoring Plan shall be to monitor the project effects of groundwater pumping on GDEs at a level of detail necessary for: a) protecting GDEs from significant adverse effects; b) distinguishing project effects from the effects of background trends or normal seasonal variation; and c) distinguishing project effects from natural variability between populations or monitoring plots. Distinguishing project water level effects from background effects or the effects of nearby wells shall be accomplished through the monitoring plan described in **WATER SUPPLY-4**.

4. Definitions. "Sampling", as used in this condition, is the process of selecting a part of something with the intent of showing the quality or nature of the whole. "Baseline monitoring" is the assessment of existing (pre-pumping) conditions to provide a standard, or baseline against which future change is measured. "Normal seasonal variation" in vegetation attributes shall be established by comparing attributes in vegetation between the peak growing season and the hottest and driest time of year. "Variability within the population" shall be established by measuring differences in the vegetation attributes between plots. "Groundwater-dependent vegetation" shall include any plant communities dominated or obligate or facultative "phreatophytes" (groundwater-dependent plant). GDEs include these plant communities and aquatic habitats that are groundwater-supported, such as seeps and springs. A "significant adverse effect to the GDEs" shall be defined as the level of drought stress from which a groundwater-dependent species or habitat cannot fully recover in one season following detection.

5. Minimum Standards for Revising Drawdown Trigger. As described in **WATER SUPPLY-4** subsection C.5, and in this condition under "Trigger for Adaptive Management", the water level-based trigger for adaptive action may be revised in 0.5-foot increments if the project owner can demonstrate that a groundwater drawdown greater than 0.5 feet will not result in significant adverse impacts to the groundwater-dependent vegetation. Modification of the drawdown trigger requires consideration of the following evidence: a) observed water level changes in monitoring wells; b) quantitative field measures of groundwater-dependent vegetation

response to lowering water tables as described in this condition; c) observations of rooting depths from soil cores, as described in this condition; d) updated predictive hydrologic trend analyses from well data collected during project operation, as described in **WATER SUPPLY-4**; and e) hydrogeologic variability between populations or monitoring plots. BLM and Inyo County shall be consulted regarding the resetting of the adaptive action trigger.

Alternately, the pumping can be reduced or modified to maintain groundwater levels above the 0.5 ft. drawdown threshold at the project boundary. Using methods described in **WATER SUPPLY-4** for statistical trend analysis of monitoring well data, the project must provide evidence, subject to approval by the CPM in consultation with BLM and Inyo County, of the maximum pumping rate that will not exceed the maximum drawdown indicated by the data for the life of the project.

6. Prepare an Updated Inventory and Map of Groundwater-dependent Species and Ecosystems (GDEs). The map of GDEs prepared for this project (CH2 2011c, Data Response Set 1A, Figure D48-1), shall be amended to include seeps and springs identified by BLM or through ground surveys and any plant community dominated by obligate or facultative phreatophytes. The map shall be accompanied by a list of all obligate and facultative phreatophytes contained in each GDE. Phreatophytes observed in the project botanical resource study area include (but are not limited to): honey mesquite (*Prosopis glandulosa*); four-wing saltbush (*Atriplex canescens*); allscale (*A. polycarpa*); spiny saltbush (*A. spinescens*); bush seep-weed (*Suaeda moquinii*); desert baccharis (*Baccharis sergiloides*); alkali goldenbush (*Isocoma acradenia*); the non-native salt cedar (*Tamarix* spp.).

7. Permanent Monitoring Plots. The vegetation monitoring shall be conducted within GDEs located: a) east of the project and nearest to the project boundary, as depicted in HHSEGS Data Response Set 1A, Figure D48-1 (CH2 2011c), and b) within the BLM Stump Spring ACEC and between the ACEC and the project pumping wells. No GDEs occur within the project boundary and monitoring plots shall not be located in upland plant communities that are not groundwater-dependent.

8. Baseline and Long-term Data Collection. Baseline data shall be collected at all vegetation monitoring sites beginning as soon as feasible upon project approval to facilitate the determination of background trends (decline) from other sources, including climate conditions. Data on existing or baseline conditions shall be updated each year until a drawdown is detected at the project boundary to establish any background trends. Future change is compared against the baseline, and adjusted for any background decline, such as a regional drop in water levels or vegetation decline from climate conditions established in the baseline trend. Data collection shall continue for the life of the project unless the CPM determines, in consultation with BLM Nevada and BLM California state

leads for Soil, Water, Air and Riparian Programs, BLM Southern Nevada District and BLM Barstow District Hydrologist and Botanist, and Inyo County Water Department, that if no project-related drawdown is detected at the project boundary and not expected based on refined hydrologic trend analysis, or pumping ceases and groundwater levels have returned to baseline levels, the project may stop or reduce its monitoring obligation.

9. Timing. Vegetation monitoring shall be conducted twice annually during the same two week time period during the peak growing period and during the hottest and driest time of year locally. Timing of well monitoring shall be conducted as described in **WATER SUPPLY-4**.

10. Monitoring Controls. The "controls" shall consist of the data collected at plots during the baseline (pre-pumping) data collection period and compared against future change following the start of pumping. Because of the potential for variability in GDE characteristics and depth to groundwater among the different monitoring plot locations, the study design shall treat the monitoring plot and corresponding control (i.e., baseline data from the same plot) as a pair, rather than comparing the mean of all treatment plots to the mean of all control plots. Appropriate statistical methods shall be used to analyze the differences between the control and monitoring plots (for example, a one-tailed paired-sample statistical test (Manly 2008)[13].

11. Field Techniques for Measuring Vegetation Response to Drought Stress. Vegetation monitoring shall employ only sensitive, reliable, and objective field measures of drought stress that can detect the earliest warning signs of an adverse effect. These include: 1) xylem (stem) water potential; 2) gas exchange rate, and 3) transpiration rate. Ecophysiological thresholds shall be established only after field calibrating the measurements to establish normal seasonal variation, and variability between plots or populations. The Vegetation Monitoring Plan must demonstrate knowledge of the biology of the species and their morphological responses to stress. Photo monitoring shall not be considered an acceptable monitoring method but may be useful to aid in the presentation of monitoring results. Field techniques that rely on visual estimates shall not be used. The draft Plan shall describe how the data will be recorded in the field, processed and stored.

12. Minimum Standards for Sampling Design. The sample size and sampling design shall be sufficient to achieve adequate statistical power of 90 percent or better, with a Type I error rate (false-change error rate) of 10 percent or less. The minimum detectable change, or biologically significant change in vegetative measurements of drought stress, shall be established by conducting measurements in the field as described under "Field techniques" in this condition, and calibrated or adjusted for normal seasonal variation and variability between plots.

[13] Manly 2008 – Manly, B., *Statistics for Environmental Science and Management* (2nd ed), CRC Press/Chapman and Hall, 292 pp.

Following collection of the first year baseline data, statistical analysis shall be conducted to refine the power analysis and evaluate the adequacy of the sampling design. If the analysis of baseline data (at the near-project plots and reference plots) indicates that the sampling design is insufficient to achieve adequate statistical power, the design shall be modified (for example, by adding additional monitoring sites or reducing the deviation among sampling units) to attain the desired level of precision. The sampling design shall be informed by *Measuring and Monitoring Plant Populations* (Elzinga et al. 1998)[14] and *Sampling Vegetation Attributes* (Coulloudon et al. 1999)[15]. The draft Vegetation Monitoring Plan shall also describe how groundwater elevation monitoring data collected pursuant to **WATER SUPPLY-4** would be used to interpret the vegetation data.

13. Soil Core Sampling. Subject to approval by BLM or other appropriate local, state, or federal permit requirements, soil core samples may be collected from the GDEs on BLM lands offsite to establish the rooting depth of the mesquite and other phreatophytes. The coring method must provide a continuous core that will provide visual examination of roots and root nodules, soil profile, and soil moisture.

14. Parties Responsible for Monitoring. All data collection shall be conducted or supervised by a qualified botanist (**BIO-21**). The Designated Biologist may conduct monitoring under the training and supervision of a qualified botanist. Monitoring data shall be quality-checked annually by the CPM, in consultation with BLM Nevada and BLM California, and the Inyo County Water Department.

15. Access to Monitoring Data. Copies of monitoring reports and data shall be available to the CPM and BLM at all times. The CPM reserves the right to issue a stop pumping order after giving notice to the project owner if the CPM determines the monitoring data provided is incomplete or inaccurate.

16. Semi-Annual Monitoring Report. Monitoring Reports shall be submitted to the CPM, BLM Nevada and BLM California state leads for Soil, Water, Air and Riparian Programs, the BLM Southern Nevada District and BLM Barstow District Hydrologist and Botanist, and Inyo County Water Department twice annually and shall include: names and contact information for the responsible parties and monitoring personnel; description of sampling and monitoring techniques used for each attribute; results of the vegetation and groundwater level monitoring; comparison of predicted versus actual water table declines; trends and other analyses based on the statistical tests and methods described in this condition and in the final Vegetation Monitoring Plan; photos; and

[14]Elzinga, C.L., D.W. Salzer, and J.W. Willoughby. 1998*. Measuring and monitoring plant populations.* BLM Technical Reference 1730-1, Denver, CO. 477 pages.

[15]Coulloudon et al. 1999.*Sampling Vegetation Attributes*. BLM Technical Reference 1734-4.National Business Center, Denver, CO. 158 p.

conclusions and recommendations. The first Annual Monitoring Report shall also include an appropriate statistical analysis of baseline monitoring data to assess whether the sampling design was adequate to attain sampling precision as described above, and how the study design was adjusted to ensure performance standards were met.

Verification: No less than 90 days prior to start of any project-related groundwater pumping, the project owner shall provide a draft Groundwater-dependent Vegetation Monitoring Plan to the CPM for peer review. The project owner shall revise the final draft based on the recommendations of the peer review within 45 days, and submit the final draft to the CPM for review and approval, in consultation with BLM Nevada and BLM California state leads for Soil, Water, Air and Riparian Programs, and the BLM Southern Nevada District and BLM Barstow District Hydrologist and Botanist, and Inyo County Water Department.

Collection of baseline monitoring data shall begin the first spring or fall following the Final Decision.

The Vegetation Monitoring Plan semi-annual monitoring reports shall be provided to the CPM, BLM Nevada and BLM California state leads for Soil, Water, Air and Riparian Programs, and the BLM Southern Nevada District and BLM Barstow District Hydrologist and Botanist, and Inyo County Water Department no more than 90 days following the collection of spring and fall monitoring data and every spring and fall thereafter for the life of the project.

BIO-24 DELETED (SEE BIO-23)

IN-LIEU FEE AND ADVANCED MITIGATION OPTION

BIO-25 The project owner may choose to satisfy certain compensatory mitigation obligations identified for desert tortoise, burrowing owls, special status plants, and jurisdictional waters by paying an in lieu fee to the Department of Fish and Game pursuant to Fish and Game code sections 2069 and 2099, or the Advanced Mitigation option available through the California Department of Fish and Game's Advanced Mitigation Program established by Senate Bill X8 34. If the project owner chooses to satisfy its mitigation obligations through this program, the advance mitigation lands shall meet the criteria as stated in all applicable compensation conditions of certification in the Commission Decision.

Verification: If electing to use this option, the project owner shall notify the CPM that it has chosen to take advantage of the options available through the Department of Fish and Game's program. If approved by the CPM and CDFG, the project owner shall provide written verification that adequate funds have been provided to CDFG to meet the mitigation requirements identified in the Commission Decision and that the advanced mitigation lands meet selection criteria as stated in all applicable compensation conditions of certification in the Commission Decision. As with the other compensatory mitigation, this compensatory mitigation must be completed within 18 months of the start of any project-related ground disturbing activity.

If the project owner chooses the Advance Mitigation option, the owner shall submit to the CPM a copy of the final recorded deed showing transfer of mitigation land or other mitigation transaction documentation as approved by the CPM, within 60 days of CDFG finalizing land transactions.

FACILITY CLOSURE, REVEGETATION, AND RECLAMATION PLAN

BIO-26 The project owner shall develop and implement a Closure, Revegetation and Reclamation Plan (Plan) for the reclamation/revegetation of the project site and other facilities at the time that the facility is decommissioned, or otherwise ceases to be operational, and shall establish site-specific criteria for evaluating and monitoring compliance with the approved reclamation plan. The plan will guide site restoration and closure activities, including methods proposed for revegetation of disturbed areas immediately following construction and rehabilitation and revegetation upon closure of the facility. The plan must address all revegetation, reclamation, and other required facility closure activities pursuant to the Inyo County Renewable Energy Ordinance (Title 21) provisions. In the case of unexpected closure, the plan should assume restoration activities could possibly take place prior to the anticipated lifespan of the plant. The plan shall include but is not limited to the following elements:

1. Plan Purpose: The plan shall explicitly identify the objective of the revegetation plan to be re-creation of the types of habitats lost during construction and operation of the proposed solar energy facility. The final revegetation plan shall include introduction of mid- to late-successional species to ensure revegetation/reclamation success.

2. Standards/Monitoring: Performance standards for success thresholds, weed cover, performance monitoring methods and schedule, and maintenance monitoring.

3. Baseline Surveys – Methods to perform baseline vegetation surveys for planning restoration efforts, with a level sufficient to collect data necessary to prepare the Plan**.**

4. Seed Handling: Methods for seed collection, testing and application.

5. Soil Preparation: If determined necessary by baseline surveys conducted pursuant to part 3 (above). Soil descriptions, compaction measurements, mulch application, soil storage, seed farming, mycorrhizal inoculation, biological crust collection, or other soil preparations may be included as part of the Plan.

6. Weed Management. Discussion of scope, duration, success criteria, and monitoring of weed management activities shall be included in the Plan.

Verification: At least one year prior to planned closure and decommissioning, the project owner shall submit to the CPM for review and approval, in consultation with the Inyo County Planning Department, a draft plan. The project owner shall incorporate all required revisions submit a final plan to the CPM no less than 90 days prior to the start

of ground disturbing activities associated with project closure and decommissioning activities.

Any modifications to the plan shall be made only after consultation and approval of the CPM, in consultation with the Inyo County Planning Department. The project owner shall notify the CPM no less than 90 days before implementing any proposed modifications to the plan.

Within 30 days after completion of project construction for each phase of development, the project owner shall provide to the CPM a written report identifying which items of the Closure, Revegetation and Reclamation Plan have been completed, a summary of all modifications to mitigation measures made during the project's construction phase, and which items are still outstanding.

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Keeler-Wolf, Todd, Senior Vegetation Ecologist, Biogeographic Data Branch, California Department of Fish and Game, various electronic communications with Carolyn Chainey-Davis, California Energy Commission regarding impacts of groundwater pumping on mesquite woodlands in California, classification of mesquite habitats, rarity of mesquite communities, mesquite germination and asexual reproduction. April to October 2010 and May to October, 2012.

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Stromberg, Juliet, Plant Ecologist and Associate Professor, Arizona State University, various electronic communications with Carolyn Chainey-Davis, California Energy Commission, regarding design and adequacy of the permit condition for monitoring impacts of groundwater pumping on vegetation, Hidden Hills Solar Electric Generating System project, and the Palen Solar Power Project, mesquite rooting depths, and field techniques for monitoring early responses of mesquite to declining water tables. August 2010, and May to August 2012.

Sudmeier, Glenn, California Department of Fish and Game, retired annuitant and member of Society for Conservation of Bighorn Sheep, with Carol Watson, California Energy Commission. Telephone discussion of bighorn sheep presence within Pahrump Valley and surrounding environs; and presence of intermountain movement corridors. Telephone communication and electronic review of FSA bighorn sheep impact analysis. September 5, 2012.

Vyverberg, Kris, Senior Engineering Geologist, California Department of Fish and Game, Lake and Streambed Alteration Program. Various telephone and electronic communications with Carolyn Chainey-Davis, California Energy Commission, regarding delineation of state waters in desert regions, protection for desert washes under Fish and Game Code, and CDFG interpretation of Fish and Game Code. July to October 2012.

Wehausen, John, retired University of California professor. Telephone discussion of bighorn sheep presence within Pahrump Valley and surrounding environs; and presence of intermountain movement corridors. Telephone communication and electronic review of FSA bighorn sheep impact analysis. September 2012.

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APPENDIX BIO1 - BIOLOGICAL RESOURCES RISK ASSESSMENT OF AVIAN EXPOSURE TO CONCENTRATED SOLAR RADIATION

Testimony Of
Rick Tyler, Geoff Lesh PE, Alvin Greenberg Ph.D., William E. Hass MS

SUMMARY OF CONCLUSIONS

The risk assessment examines the potential effect of avian exposure to concentrated solar radiation. Staff examines the nature and probability of adverse effects to birds, when exposed to concentrated solar electromagnetic radiation, including infrared, visible and ultraviolet light.

Staff's analysis of avian exposure to concentrated solar radiation indicates that a threshold of safe exposure does not exist above a solar flux density of 4 kilowatts per square meter or kW/m^2 for a one-minute exposure. The analysis also indicates that both the Hidden Hills and Rio Mesa facilities pose significant risk to avian populations that may encounter the air space in the facilities where concentrated flux density is above the safe levels, potentially resulting in avian morbidity and mortality. The available data regarding avian impacts is very limited; however, such data does provide at least some perspective regarding potential for impact.

There are significant questions regarding extrapolation from the available information regarding avian impacts. The most vexing is the complete absence of data that would allow estimation of avian morbidity. Staff's assessment provides estimates of exposure and dose that can lead to injury and late fatality. In addition, there are major unknowns in estimation of differences in avian populations from one site to the next. These limitations in the available data require exercise of considerable judgment in extrapolation of data from one site to another. However, the errors introduced by the lack of site specific data are likely to be small in comparison to the absence of morbidity estimates and effects of dramatically increased potential exposure duration resulting from the increased volume of the air space affected by concentrated solar flux at commercial-sized facilities like Hidden Hills as compared to pilot-scale facilities.

Staff reviewed the following list of submittals provided by Bright Source regarding potential for impacts on avian resources as a result of potential exposure to concentrated solar flux. While providing descriptions of the heat flux field strengths around the solar receiver steam generator tower, the references are unpublished, lack peer review, are of very limited duration, and are from facilities that are much smaller than the proposed facility with regard to observed adverse avian effects of concentrated solar radiation.

Bright Source contends based on this information that the proposed Hidden Hills Project poses no significant risk to birds that would be exposed to the concentrated flux field associated with the project. They also contend that $50kW/m^2$ is a safe level of exposure for a duration of 30 seconds and that exposures to lower flux densities are without

consequence. Staff disagrees with these conclusions, and provides its own independent analysis, with references, of the potential for impacts on avian resources associated with the proposed Hidden Hills Project.

1. BS 2012a – Bright Source (tn 63357). Rio Mesa Solar Electric Generating Facility CEC Biological Resources Workshop Presentation, dated January 6, 2012. Submitted to CEC Docket Unit on January 12, 2012.
2. BS 2012c – Bright Source/T. Stewart (tn 63365). Rio Mesa Avian Survey Counterproposal, dated January 12, 2012. Submitted to CEC Docket Unit on January 13, 2012.
3. ESH 2012a – Ellison Schneider & Harris, LLP/C. Ellison (tn 63475). Bright Source Comments on Issues Identification Report, dated January 30, 2012. Submitted to CEC Dockets Unit on January 30, 2012.
4. CBD 2012a – Center for Biological Diversity/L. Belenky (tn 63521). Comments on Issues Identification Report, dated January 31, 2012. Submitted to CEC / Dockets Unit on February 2, 2012.
5. FWS 2012a - Fish and Wildlife Services (tn 63565) Rio Mesa Golden Eagle Survey Clarification, dated January 31, 2012. Submitted to CEC Dockets Unit on February 6, 2012.
6. ESH 2012b – Ellison Schneider & Harris, LLP (tn 63956) Applicant's Notice Pursuant to 20 C.C.R. § 1716(f) For California Energy Commission's Staff Data Request Set 1A, dated March 2, 2012. Submitted to CEC Dockets Unit on March 2, 2012.
7. URS 2012a – URS/A. Leiba (tn 64060) Applicant's Data Response to Data Request Set 1A, dated March 8, 2012. Submitted to CEC Dockets Unit on March 8, 2012.
8. BS 2012m – Bright Source (tn 64467) Biological Workshop Presentation, dated March 13, 2012. Submitted to CEC Dockets Unit on March 28, 2012.
9. EHS 2012c – Ellison Schneider & Harris/C. Ellison (tn 64093) Applicant's Opening Brief for March 19, 2012. Status Conference, dated March 9, 2012. Submitted to CEC Dockets Unit on March 9, 2012.
10. CBD 2012c – Center for Biological Diversity/L. Belenky (tn 64173) Center for Biological Diversity Data Request, dated March 15, 2012. Submitted to CEC Dockets Unit on March 16, 2012.
11. URS 2012c – URS/A. Leiba (tn 64722) Response to Center for Biological Diversity Data Request, dated April 12, 2012. Submitted to CEC Dockets Unit on April 12, 2012.
12. URS 2012e – URS/A. Leiba (tn 64814) Supplemental Response, dated April 16, 2012. Submitted to CEC Dockets on April 16, 2012.
13. MDM 2012a – Michael D. McCrary, etal. (tn 64807) Avian Mortality at a Solar Energy Power Plant, accepted January 24,1986. Submitted to CEC Dockets Unit on April 17, 2012.
14. BS 2012r – Bright Source (tn 65431) Applicant's Supplemental Response to Data Requests, Set 1B, 143 and 144, dated May 23, 2012. Submitted to CEC Dockets Unit on May 23, 2012.
15. ESH 2012c – Ellison Schneider & Harris, LLP (tn 65696) Applicant's Notice – Staff's Data Requests Set 2A, dated June 8, 2012. Submitted to CEC Dockets Unit on June 8, 2012.
16. ESH 2012e – Ellison Schneider & Harris, LLP (tn 65745) Applicant's Supplemental Notice for CEC Staff's Data Requests Set 2A, dated June 13, 2012. Submitted to CEC Dockets Unit on June 13, 2012.
17. BS 2012u – Bright Source/ T. Stewart (tn 66280) Applicant's Response to Data Requests, Set 2A, #159 dated July 20, 2012. Submitted to CEC Dockets Unit on July 20, 2012.

18. BS 2012v – BrightSource (tn 68364) Applicant Submitted Power Point Presentation (Flux Impacts on Avian Species) for August 28, 2012 Joint Workshop on Rio Mesa SEGF and Hidden Hills SEGS , dated August 28, 2012. Submitted to CEC Dockets Unit on November 5, 2012.
19. BS 2012w – BrightSource (tn 68360) Applicant Submitted Slide on Dr. Pleguezuelos' Conclusions at GEMASolar Plant in Andulusia, Spain, for August 28, 2012 Joint Workshop on Rio Mesa SEGF and Hidden Hills SEGS. Submitted to CEC Dockets Unit on November 5, 2012.
20. BS 2012u – Bright Source/ T. Stewart (tn 66280) Applicant's Response to Data Requests, Set 2A, #159 dated July 20, 2012. Submitted to CEC Dockets Unit on July 20, 2012.
21. BS 2012v – BrightSource (tn 68364) Applicant Submitted Power Point Presentation (Flux Impacts on Avian Species) for August 28, 2012 Joint Workshop on Rio Mesa SEGF and Hidden Hills SEGS , dated August 28, 2012. Submitted to CEC Dockets Unit on November 5, 2012.
22. BS 2012w – BrightSource (tn 68360) Applicant Submitted Slide on Dr. Pleguezuelos' Conclusions at GEMASolar Plant in Andulusia, Spain, for August 28, 2012 Joint Workshop on Rio Mesa SEGF and Hidden Hills SEGS. Submitted to CEC Dockets Unit on November 5, 2012.
23. BS 2012x – BrightSource (tn 68294) Applicant Supplemental Avian Study Information – 1: Assessment of Potential Impacts to Birds from Solar Thermal Power Plant, Dimona Israel; 2: Environmental Impact of the GEMASOLAR Thermosolar Plant on the Bird Community in the Monclova Surrounding Area (Fuentes de Andalucía, Seville, Spain, Juan M Pleguezuelos, Granada, 08-23-2012); 3: Impact of the GEMASOLAR Solar Power Plant (La Monclova, Fuentes de Andalucía, Province of Seville) on the Bird Population, Report 4 (September 2010): Nesting avifauna in the study area during the plant construction phase (March – July 2009-2010); 4: Impact of the GEMASOLAR Solar Power Plant (La Monclova, Fuentes de Andalucía, Province of Seville) on the Bird Population,
24. CH2 2012qq- CH2MHill/j. Carrier (tn: 68630) Data Response, Set 3. 11/21/2012
25. SJ 2012a- Dr. Johnsen Ph.D (tn 68785) Dr. Johnsen's Presentation at December 5, 2012 Joint Rio Mesa SEGF and Hidden Hills SEGF Workshop Submitted to CEC Docket Unit On December 5, 2012.

SETTING

Concentrating solar thermal power plants, like Hidden Hills and Rio Mesa, collect ambient solar radiation and concentrate it onto a solar receiver to generate steam for the steam turbine generator. The concentration of the solar radiation creates a range of solar radiation flux densities between the solar receiver steam generator located atop the power tower and the reflecting mirrors arrayed on the ground. At ground level, nominal solar radiation, or solar energy per unit area, is about 1 kilowatt per square meter (kW/m^2). At the solar receiver steam generator, the reflected concentrated solar radiation is about 600 kW/m^2.

However, because the heliostat mirror arrays do not form a continuous reflective surface across the solar field due to gaps from roads or non-uniform spacing due to terrain or maintenance spacing, the solar flux density does not increase linearly with increasing elevation up to the maximum at the receiver. Gaps in the mirror array result in discontinuities in flux overlaps at elevations closer to the mirrors.

The applicant provided flux density modeling results of the proposed Rio Mesa solar flux fields in response to Staff Data Request 159. Staff relied upon these modeling results for this analysis, but has not been provided the necessary information to independently verify the modeling results. Consequently, staff's analysis remains subject to additional information and analysis of the flux fields. Nevertheless, as expected, values are low near the surface of the mirrors and increase in a non-linear manner in close proximity to the receiver. When the mirrors are concentrating sunlight onto the receiver, the shape of the higher flux regions between the receiver and mirror is an inverted cone, with a small section at the receiver that broadens as you descend towards the solar field. When the mirrors are directed off the receiver in standby mode, the shape of the higher flux regions are like two cones, one facing downward towards the mirrors and one upward away from the focal point (BS 2012u, Fig. 5).

Note that our sun emits a broad spectrum of radiation, including radio waves, visible light, and x-rays. The earth's atmospheric layers filter much of the radiation, diminishing and/or eliminating certain wavelengths particularly in the ultraviolet (UV) spectrum. And the solar field heliostat mirrors further diminish the reflected solar radiation of the shorter (e.g., UV) wave lengths.

It may not be obvious to the reader what the nature of these various flux intensities is, or at what point they could become dangerous. It is instructive because typically people are unaware of the level of flux exposure they are undergoing, aside from being under a sunny clear sky (a level of 1 kW/m^2), whether it is near a fireplace, radiant heater, or other warm device. Thus, to give some perspective to the lower range of values discussed herein, the following **Appendix BIO1 Table 1** (Drysdale 1998, p. 61) shows the effects of thermal radiation (flux) on various organic materials. Reported experiments have shown that several polymeric materials can be heated to beyond 300°C by radiant flux levels ranging from 11 to 15 kW/m^2. Similarly, experiments have shown that wood can be heated to 350 °C by 12 kW/m^2 and to 600°C by 28 kW/m^2 (Drysdale 1998, p. 221, Table 6.5). Staffs notes that these effects are for still air, and surface temperatures would be reduced somewhat in moving air.

Appendix BIO1 Table 1 Effects of thermal radiation

Radiant Heat flux (kW/m^2)	Observed effect
0.67	Summer sunshine in UK[a]
1	Maximum for indefinite skin exposure
6.4	Pain after 8 s skin exposure[b]
10.4	Pain after 3 s skin exposure[a]
12.5	Volatiles from wood may be ignited by pilot after prolonged exposure
16	Blistering of skin after 5 s[b]
29	Wood ignites spontaneously after prolonged exposure[a]
52	Fibreboard ignites spontaneously in 5 s[a]

[a]D. I. Lawson (1954) [b]S.H. Tan (1967)
The data quoted for human exposure are essentially in agreement with information given by Purser (1995) and Mudan and Croce (1995)

Table source: Drysdale 1998, An introduction to Fire Dynamics, 2nd Ed., by Dougal Drysdale, Publ. John Wiley and Sons, 1998, Table 2.8, P. 61

HIDDEN HILLS

The Hidden Hills Solar Electric Generating System (HHSEGS) would be located on Old Spanish Highway, near the community of Charleston View on approximately 3,277 acres (5.12 square miles) of privately owned land in Inyo County, California, adjacent to the Nevada border. The project site is approximately 8 miles south of Pahrump, Nevada, and approximately 45 miles west of Las Vegas, Nevada.

HHSEGS would consist of two 250 MW solar plants. Each solar plant would use heliostats which are elevated mirrors mounted on a pylon to focus the sun's rays on one solar receiver steam generator (SRSG) or receiver atop a 750-foot tall solar power tower near the center of each solar field. In each solar plant, one Rankine-cycle steam turbine would receive steam from the SRSG (or solar boiler) to generate electricity. The solar field and power generation equipment would start each morning after sunrise and would shut down when insolation[1] drops below the level required keeping the turbine online, or during upsets and emergencies.

Each of the heliostat assemblies would be composed of two mirrors, each approximately 12 feet high by 8.5 feet wide with a total reflecting surface of approximately 204 square feet (19 square meters – m^2). Each heliostat assembly would be mounted on a single pylon, along with a computer-programmed aiming control system that directs the motion of the heliostat to track the movement of the sun. The 85,000 heliostats have an effective total reflective area of approximately 1.7 million m^2. These heliostats concentrate solar radiation on the solar receiver boiler and superheater sections (the SRSG is four -sided, with boiler tube walls on the outside to be heated by the concentrated solar radiation).

The receiver absorbs the concentrated radiation from the heliostats and transfers the resultant heat into water and steam in steel tubes at the receiver surface. The efficiency of the Rankine-cycle (steam cycle) is about 43 percent under optimum conditions (summer mid-day). This equates to a solar energy transfer of about 610 million watts (610 MW) between the heliostats and the receiver. While the concentration to an energy density of 600 kW/m^2 is roughly analogous to focusing a 3 inch magnifying glass down to a 1/8 inch point, the power tower does not focus the reflected sun to a point, but rather overlays thousand of heliostat reflections onto the boiler tube walls of the receiver.

The total concentrated solar energy of 610 MWhr is approximately equal to burning 17,000 gallons of gasoline per hour. The solar flux density is intense enough that if the water and steam in the boiler were to stop flowing and the heliostats remained focused on the receiver, it would be destroyed in a short period of time.

[1] **Insolation** is a measure of solar radiation energy received on a given surface area and recorded during a given time. It is also called solar irradiation and expressed as hourly irradiation if recorded during an hour, daily irradiation if recorded during a day.

RIO MESA

The Rio Mesa Solar Electric Generating Facility (RMSEGF) is very similar to the Hidden Hills facility and consists of two 250-megawatt (MW) (nominal) solar concentration thermal power plants situated on the Palo Verde Mesa in Riverside County, California, 13 miles southwest of Blythe, and is located partially on private land and partially on public land administered by BLM. Design aspects of the RMSEGF are essentially the same as for the HHSEGS.

ANALYTICAL APPROACH

Staff's analysis includes the following analytical steps in estimating the avian mortality and morbidly from exposure to concentrated solar radiation:

a. Hazard Assessment -- the determination of whether a particular environmental exposure is or is not causally linked to particular health effects on the receptors

b. Dose-Response Assessment -- the determination of the relation between the magnitude of exposure and the probability of occurrence of the health effects in question

c. Exposure Assessment -- the determination of the extent of receptor exposure before or after application of regulatory controls

d. Risk Characterization -- the description of the nature and often the magnitude of receptor risk.

e. Analysis of Uncertainty -- Uncertainty represents a discussion of the gaps in knowledge about factors such as adverse effects or exposure levels which may be reduced with additional study. Generally, risk assessments carry several categories of uncertainty, and each merits consideration. Measurement uncertainty refers to the usual error that accompanies scientific measurements -- standard statistical techniques can often be used to express measurement uncertainty. An amount of uncertainty is often inherent in environmental sampling. There are likewise uncertainties associated with the use of scientific models, e.g., dose-response models, models of the physical environment, the assumed values of material properties that may vary in nature or not be well characterized, the probability of occurrence of particular circumstances, etc.

Birds are exposed to this concentrated solar radiation when they enter the flux field and receive the incident radiant energy that is reflected from the array of heliostats on the ground. The radiant energy that exists in the flux field is converted to heat when it is absorbed on any solid opaque surface that receives the transmission of the radiant energy through an otherwise transparent medium (air).

The absorption efficiency of radiant flux is governed by the emissivity of the surface of the object that receives it. Emissivity can range from 0 to 1 with 0 representing perfect reflection of all the incident radiation and 1 representing complete absorption and conversion to heat. It is also governed by the angle of incidence between the radiant flux and the surface that receives it. A mirror is an example of a surface with a low emissivity (typically below 0.05) absorbing and converting to heat less than 5 percent of the incident light. Black pavement is an example of a surface with high emissivity (about 0.95) absorbing 95 percent of the incident light. This is the reason that blacktop becomes so hot when exposed to sunlight.

In actual circumstances the rise in temperature of a surface exposed to radiant flux is often diminished by the transfer of heat to the surrounding air from that surface. This is typically referred to as convective heat transfer. The amount of heat removed by convection is governed by the speed and turbulence of the air passing over the surface and the temperature difference between the air and the heated surface. In the case of birds, the speed of flight through the air is equivalent to a velocity of air over the surface.

The convective heat transfer between bird feathers and the ambient air is analogous to the convective heat transfer between the heated boiler tubes in the receiver and the water and steam flowing in the receivers at the Hidden Hills and Rio Mesa power plants. In the absence of this continuous convective heat removal by the water and steam inside the boiler tubes (i.e. if the tubes were too empty) the temperature of the boiler tubes would rise rapidly to a new higher equilibrium temperature much higher than the normal 540 ^{o}C operating temperature. The surface of the receiver would be damaged unless the incident radiation is removed by putting the heliostats in a standby mode whereby radiant flux is no longer directed on to the receiver.

The potential for injury to birds that fly through a concentrated solar flux field results from heating of the outer surface feathers and subsequent conduction of heat into the exposed feathers causing breakdown of their molecular structure. Conduction is the transfer of heat into a solid object due to the temperature difference between the object and its surroundings. While exposure could also cause a rise in body temperature it is likely that severe damage to the outer feathers would occur much more quickly as a result of the insulating effect of the plumage covering the bird's body.

In this analysis, staff has attempted to estimate levels of exposure to concentrated radiant flux that are safe and would result in little or no damage to exposed birds. It can then be concluded that exposures above such safe levels would result in irreversible and potentially significant impact to exposed birds that enter the flux field.

HAZARD ASSESSMENT

While the highest flux density occurs at the surface of the receiver, high concentration solar flux densities also occur in other parts of the air space above the heliostats, ranging continuously from 1 up to 600 times the background solar radiation of about 1 kW per square meter (1.0 kW/m^2). The applicant's response to Data Request 159 (BS 2012u) provides maps of flux densities throughout the air space above the Rio Mesa Solar fields. Similar flux density fields will exist at the proposed Hidden Hills facility.

When high solar flux densities impinge on objects, for example, a bird's flight feathers (primary, secondary, and tail feathers), the solar radiant flux is converted to heat, which can cause damage resulting in injury or death depending on the exposure level and duration of exposure (i.e. dose). For example, for exposed (bare) human skin, at an exposure level of 5 kW/m^2, first-degree burns would occur within 20 seconds of continuous exposure; second-degree burns would occur within 30 seconds; and third-degree burns would occur within 50 seconds with a 1 percent fatality rate. Because feathers are effectively dead structural protein similar to hair without nerves and other physiological activity, bare human skin is more sensitive than avian feathers to the effects of thermal radiation but does serve as a useful comparison.

Exposures of birds to concentrated solar flux did actually occur at the Solar One facility near Daggett California (McCrary et. al. 1986). Birds were found dead on the site that had clear evidence of thermally induced damage to flight feathers caused by exposure to concentrated solar flux. The birds had near complete removal of both barbules and barbs of flight feathers leaving only the rachis (the main central shaft of the flight feather) remaining. This suggests that the flight feathers had reached temperatures in excess of 300 ^{o}C and demonstrates the potential for damage to flight feathers resulting from exposure to concentrated solar flux. The barbules, which comprise the major resistance to air flow through surface of the feather, are essential to the creation of lift by wing flapping. The barbules are very small (less than 1/1000 of an inch thick) and have very low mass. Thus, damage to barbules from exposure to concentrated flux will be virtually instantaneous, and damage to barbs, feathers and birds very likely.

DOSE RESPONSE ASSESSMENT

This assessment provides an analysis of the potential damage to flight feathers of the bird associated with exposure to concentrated solar flux. Staff has determined that damage to surface feathers is one of the most sensitive types of adverse effects that can occur in avian species from such exposure. Staff's dose response assessment provides analysis of the relationship of potential feather damage associated with increasing levels of concentrated radiant flux exposure. Staff's analysis identifies levels of concentrated solar flux exposure that are just below the levels that could cause irreversible damage to flight feathers as the criteria to establish safe avian exposure levels.

Bird feathers are composed predominantly of keratin which is a naturally occurring polymeric protein chain. These polymer chains of keratins also form secondary structures creating hard natural fibers (for example hair and wool) and hard fibrous sheets (for example feathers, claws, nails, and hooves). The keratin in feathers is the beta form of keratin, or β-keratin. It has a macromolecular secondary form resulting from folding and cross linking at the edges of the poly peptide polymer primary chains. The β-keratin in feathers also typically contains small amounts of both loosely bound water and more tightly bound water that exists in the molecular structures of the secondary proteins (Conn et al 1987 pages 84-99) (Mazur and Harrow 1968 pages 61-72) (Greenwold and Sawer 2010 page1).

The structural properties (strength, stiffness, elasticity etc.) of the keratin that makes up feathers is central to the feathers function in flight (Bachmann et. al. 2007) (Bachmann an Wagner 2011) (Videler 2005 pages 46 -55). Intact keratin structure is also essential to maintenance of the feather's aerodynamic shape and surface smoothness. Both structural and molecular changes occur when keratin is exposed to temperatures above about 160 ^{o}C (Takahashi et. al. 2004) (Senoz.et.al. 2011) (Istrate et. al. 2011). Alpha and Beta keratin from wool, hair, and feathers have remarkably similar thermal decomposition characteristics (Brebu et. al. 2011).

At ambient, atmospheric pressure, feathers lose unbound water before the feather surface temperature can rise above 100 ^{o}C. Unbound water can also be lost through evaporation at temperatures below 100 ^{o}C with low relative humidity. Heating above 100 ^{o}C in the absence of water is often referred to as heating in the dry state. Keratin is more resistant to thermal degradation when heated in a dry state than in a wet state (Takahashi et. all 2004). Because unbound water cannot exist in the keratin at temperatures above 100 ^{o}C at ambient atmospheric pressure, exposures to concentrated radiant solar flux at ambient conditions will result in dry heating.

Loss of water that is unbound (not molecularly bound) is reversible. Typically the presence of unbound water would result in a transient period before temperatures inside the feather would rise upon heating above 100 ^{o}C due to latent heat required to vaporize the unbound water. However, in the environment of the project site in summer the elevated ambient temperatures and low humidity would suggest very low moisture content in the feathers of indigenous birds, particularly for the flight feathers.

At about 160 ^{o}C, bonds in the molecular structure of secondary proteins are broken leading to loss of structural integrity of the β-keratin molecular structure and a permanently weakened feather. The keratin begins to melt at about 250 ^{o}C. At temperatures of 250 to 450 ^{o}C, bonds in the primary polymer protein chains are broken into smaller molecular compounds through pyrolysis (Senoz et. al. 2011) (Brebu et. al. 2011). When temperatures reach 450 to 500 ^{o}C, keratin will almost completely break down and carbon will be the primary constituent of what remains.

Once bonds on the ends of the protein chains are broken, damage to the keratin is not reversible and thus the structural properties of the secondary proteins and ultimately the exposed feathers are adversely affected. This breaking of the chemical bonds that secure the secondary molecular structure of keratin, which leads to structural changes without affecting the primary protein chains is referred to as denaturing (Istrate 2011) (Takahashi et. al. 2004). This is very similar to the boiling of an egg where the protein structures in the albumin (egg whites) are permanently changed but the basic protein chains are not disrupted. Ultimately the level of damage to the flight feathers will be a function of both the magnitude of exposure and its duration. The dose will thus have units of kilowatt-seconds per square meter or kW-s/m^2.

Based on the results of staff's thermodynamic equilibrium analysis discussed below, exposure to solar flux greater than 4kW/m^2 can result in temperatures above 160 ^{o}C with 60 seconds of exposure. Exposure of 4kW/m^2 can be considered a no observed adverse effect level (NOAEL). Exposures above this level can compromise the keratin

molecular structure of a bird's flight feathers, therefore potentially causing irreversibly weakening of feathers leading to an irreversible adverse impact on the feathers. While molting may ultimately replace some damaged feathers, it will in most cases not occur for some time after that damage occurs. Feathers, in which the quill was heated enough to damage the follicle from which the feather grows, might not get replaced during molt.

EXPOSURE ASSESSMENT

To estimate exposure staff modeled the change in surface temperature of flight feathers of a bird during flight when the bird's feathers are exposed on their underside to a concentrated flux in a solar heliostat field. The intensity of exposure depends on the path the bird traverses from the point where it enters a space with concentrated flux until it exits that space. The figures in the applicant's response to Data Request 159 (BS 2012u) are contour plot depictions of concentrated flux density isopleths indicating the locations of flux density levels of 5, 10, 25, 50, 100, and 150 kW/m^2.

To evaluate the potential for damage, it is necessary to convert the radiant flux to a resultant increase in the temperature at the surface of the exposed feathers. During flight, concentrated solar radiation is reflected from the heliostats on to the bottom surface of the feather, causing heating of the surface. The rate of heating depends upon the intensity, or flux, and how fast the surface is simultaneously being cooled. By summing the heat being gained from the incoming flux together with the heat losses occurring through convection and radiation, the resulting feather surface temperature can be estimated.

Potential cooling of the exposed feather surface results from the ongoing heat loss from the bottom surface of the wing feather by multiple mechanisms. The most important of these is convection of heat to the air stream passing under the wing bottom surface (at the bird's air speed). Additional losses include re-radiation of heat (energy) from the hot surface, and by conduction of heat through the feather to its backside, where it can be lost through convection to the air stream passing over the top side of the feather, but only for those areas of the backside that are exposed to topside airflow. Staff has assumed that most flux-exposed feathers will have much of their backside surfaces covered by either other feathers or body skin. Therefore, for purposes of conducting a worst-case risk analysis, staff has ignored the potential heat loss mechanisms of back-side convection and back-side re-radiation (i.e. heat loss from the top of the wing). Staff modeled convective loss from the wing using a heat transfer coefficient from a flat or cambered plate assuming laminar flow over the plate (McArthur 2008, Mueller 1999, Pelletier and Muller 2000, Tucker 1987, Tucker and Parrot 1969). Approximation of a wing using a flat or cambered plate model is the accepted method of modeling fluid flow over wings and is, therefore, also the best method for modeling heat transfer to and from a wing, particularly on the underside where there is no issue of flow separation from the wing surface (Ward 1999), (Withers 1981), Holman 1976), (Incroera 2007), Cengel 2007), (MERM 2001).

These loss mechanisms depend upon the difference between the surface temperature of the feather and the temperature of the ambient air, and they increase in effectiveness

as the temperature difference increases. Thus, as the feather surface temperature heats from solar radiation exposure, the heat losses increase until they collectively match in their heat loss rate, the heat gain rate caused by the concentrated solar radiation. At that point the surface temperature stabilizes, and becomes what is called "steady-state." Due to the extremely small size and low mass density of the keratin micro structures that make up the surface of the feather, at realistic bird flight speeds in the gradually changing solar flux densities of a solar field, surface temperatures reach to within a few degrees of this steady-state temperature virtually instantaneously. During realistic flight conditions in the power plant's solar field, flux densities change continuously with location, so any sudden change is an unrealistic simplification of actual conditions experienced in flying through the air space having concentrated flux densities.

Because changes in flux density occur gradually during flight, there are no large "step changes", so temperature rise-times for re-equilibration to changing flux levels can be ignored. After conducting dynamic analyses and examination of several plausible flight paths and comparing those results to the simple assumption of instantaneous equilibrium, staff used the assumption of instantaneous equilibrium to establish safe exposure criteria as this assumption created little error in the result. Assuming instantaneous equilibrium eliminates the dependence on flight path in analyzing potential avian exposures to concentrated solar radiation. **Appendix BIO1 Tables 1** and **2** below provide estimates of equilibrium temperatures for a range of plausible exposure intensities and exposure conditions, a flight speed of 18 miles-per-hour (about 8 meters-per-second), an ambient temperature of 45 ^{o}C, and at incidence angles of 0 degrees and 71 degrees off-perpendicular to the feather surfaces.

Appendix BIO1 Figures 1 through **4** below show the results of dynamic modeling of a range of plausible flight paths. The simplification of using instantaneous equilibrium, allows staff to reduce multiple variables (flux level, emissivity, angle of incidence, flight speed, path through solar field) down to a simpler set of only two variables (flux level and exposure time). Equilibrium surface temperatures are also largely dependent on the cord length of the bird wing (i.e. the distance from the front of the wing to the trailing edge). **Appendix BIO 1 Figure 5** provides an analysis of flux levels causing 160 ^{o}C surface temperatures for different cord lengths and flight speeds. The vast majority of bird species fly within a range of 6 to 16 meters-per-second (Videler 2005 Pages 154 and 155) (Alerstam et. al.)). During flap gliding flight, birds fly at the lower end of the range. Therefore, staff used a flight speed of 8 meters-per-second or 18 miles-per-hour.

Dynamic modeling was conducted by choosing several plausible straight-line flight paths through the solar field, utilizing the isopleth solar field diagrams provided by the applicant. This was be done by re-calculating the feather surface temperature at one-hundredth of a second intervals along a presumed flight path by adjusting for the incoming radiant flux and convective and radiative loses that would be occurring at each interval using the assumed ambient air temperature, flight speed, and incidence angle, etc.

Staff used linear interpolation to estimate flux intensities between isopleths, then plotted temperature on a continuous basis during the flight path through the field. Points where

exposure resulted in estimated surface temperatures above 160 ^{o}C, and 300 ^{o}C were noted. **Appendix BIO1 Tables 2** and **3** provide estimates and comparisons of maximum surface temperatures reached based on varying flux densities, and flight paths to assumed steady-state exposure to flux levels.

Appendix BIO1 Table 2 Feather Surface Temperatures vs Flux Intensity

Flux Intensity (kW/m^2)	Steady State Temp (deg C)	Flight Condition		
		Directly at Tower Temp (deg C)	Tangent to 100yds off Tower (deg C)	Flying upward near tower (deg C)
1	80	70	68	60
5	170	160	160	140
10	260	240	240	160
25	430	360	410	220
50	610	600	na	410
100	810	740	na	Na
150	950	930	na	Na

All at 18mph, View factor = 1 (Angle of incidence = 0 deg)

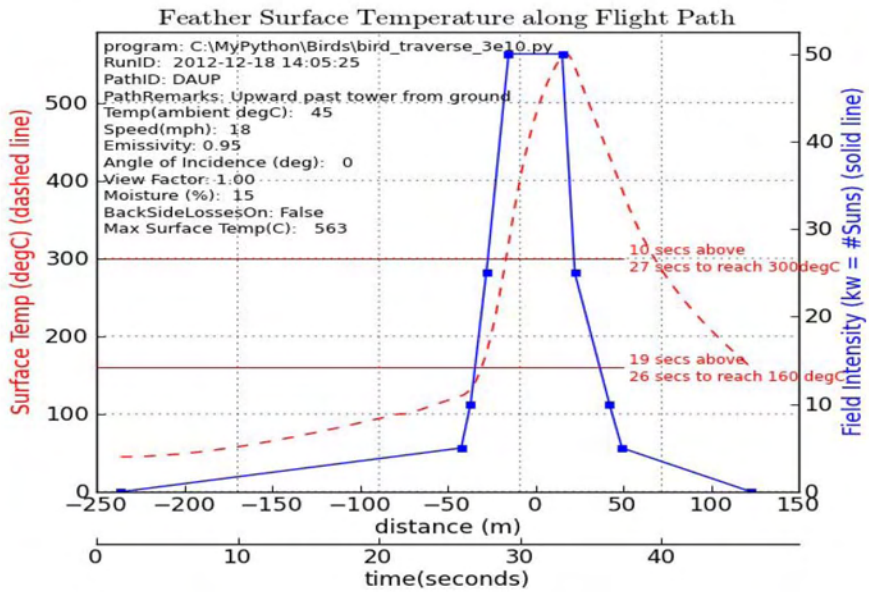
Appendix BIO1 Table 3 Feather Surface Temperatures vs Flux Intensity

Flux Intensity (kW/m^2)	Steady State Temp (deg C)	Flight Condition	
		Directly at Tower Temp (deg C)	Tangent to 100yds off Tower (deg C)
1	60	54	55
5	90	87	88
10	130	120	120
25	220	160	200
50	340	330	na
100	500	380	na
150	600	500	na

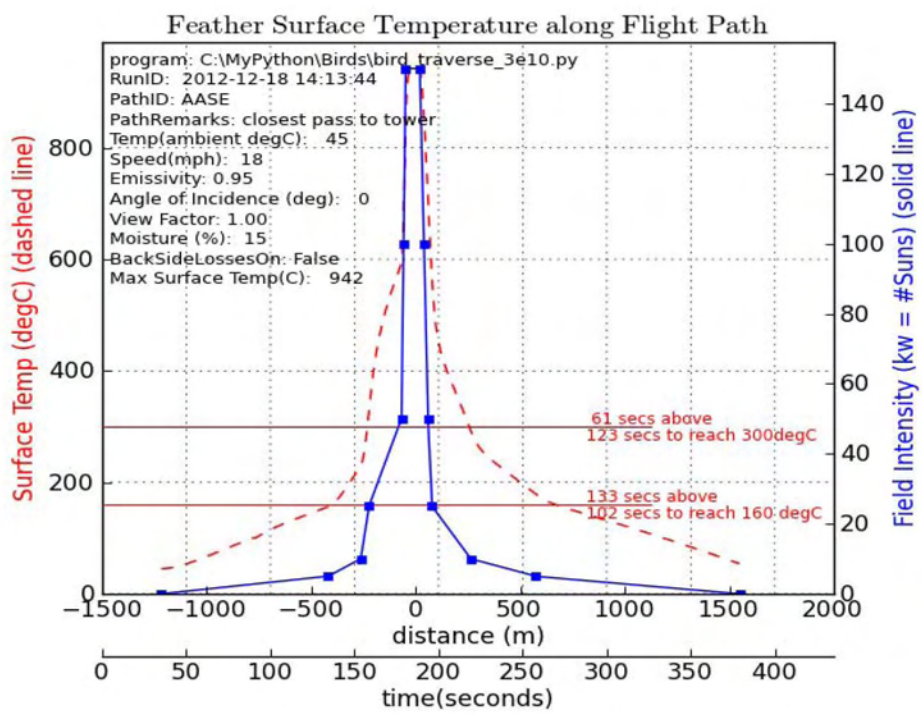
All at 18mph, View factor = 0.33 (Angle of incidence = 71 deg)

Staff modeled absorption of flux by the feather to occur in the initial half-thickness of material, at and just beneath the surface of the feather. The resultant heating is the cause of the temperature rise in the feather material and of the subsequent damage to the fragile keratin structures and molecules that provide the structural integrity of feathers.

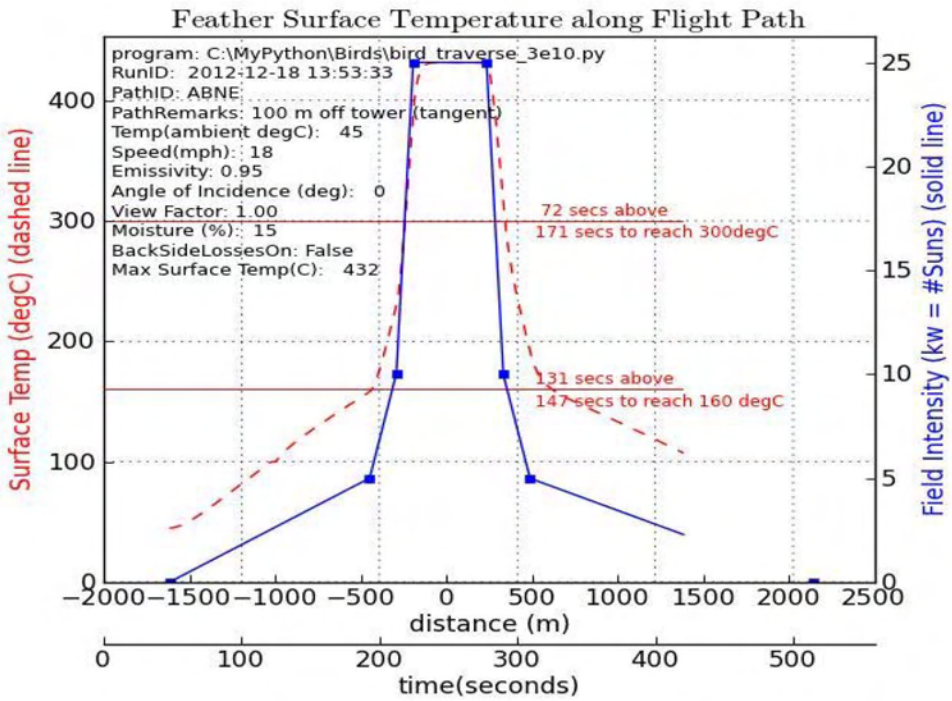
Appendix BIO1 Figure 1 Path is from ground up past tower receiver while operating at full load



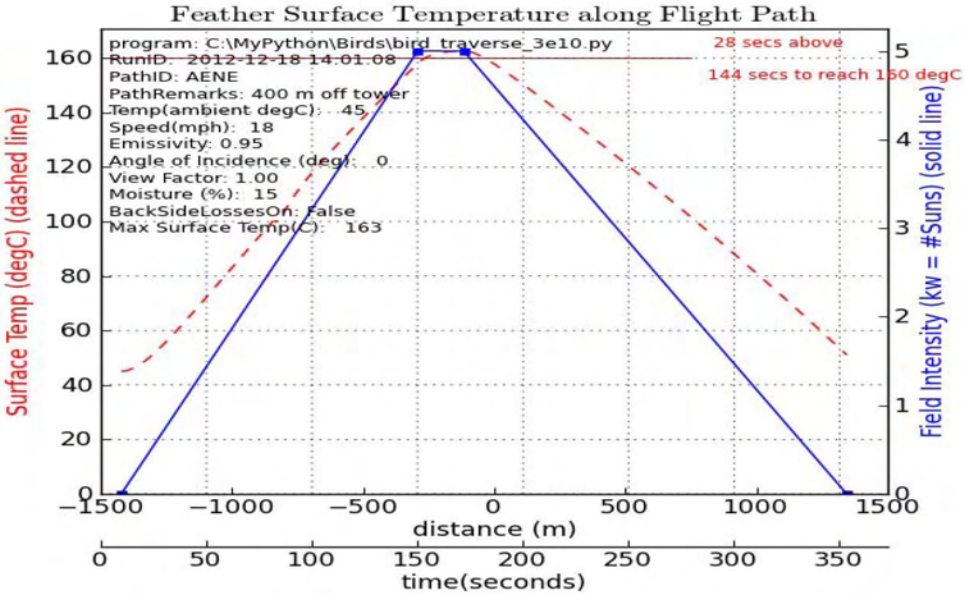
Appendix BIO1 Figure 2 Path is straight line from edge of solar field going close b**y tower to opposite edge of field**



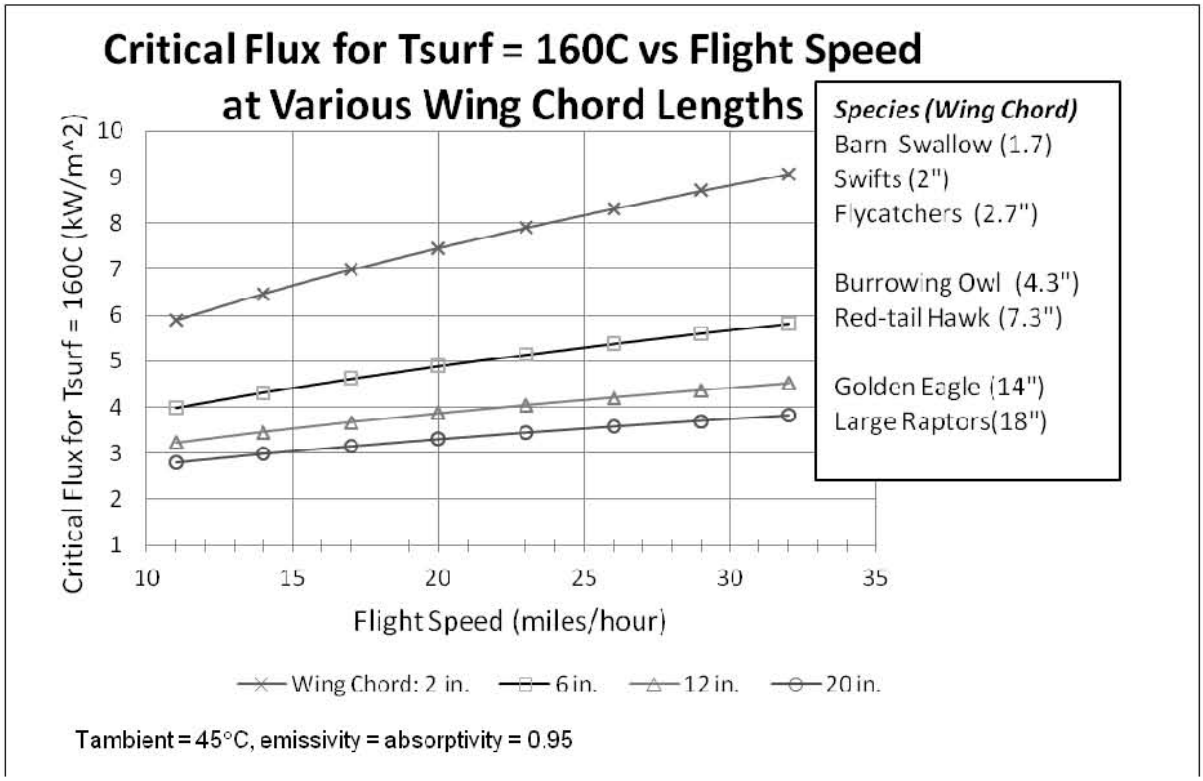
Appendix BIO1 Figure 3 Flight path is straight line tangent to circle with radius of 100 meters around tower



Appendix BIO1 Figure 4 Flight path is tangent to circle with radius of 400 meters



Appendix BIO1 Figure 5 Critical Flux Levels for Tsurf = 160°C vs Wing Chord



Appendix BIO2 provides documentation of the equations, calculations, and source codes for programs used to produce staff's results.

CHARACTERIZATION OF RISK

In flying completely across areas of the facility with flux densities above 5kW/m^2, maximum distances would be between 900 to 1000 meters. At a flight speed of 4.5 meters per second (about 10 miles per hour), the flight would take about 200 seconds and at 18 meters per second (about 40 miles per hour) it would take about 50 seconds to traverse 900 meters. During such flight, the bird would receive exposures ranging from 5 kW/m^2 up to possibly 500 kW/m^2 of varying duration depending on the flight path taken. This exposure including heat loss mechanisms and duration is integrated along the flight path to obtain a time / temperature profile. Integrating flux level and duration along the flight path provides an exposure dose.

As stated previously, when the exposure and duration are sufficient to cause the feather to reach temperatures above 160 ^{o}C, the bird would suffer some level of irreversible damage to feathers that are critical to its ability to fly. This damage can lead to secondary effects such as collision with towers, heliostats and the ground if damage is sufficient to impair normal flight, or even the ability to become and remain air-borne.

Feather damage that results in impairment of flight capability could also decrease the bird's overall probability of survival and life expectancy. For birds of prey, the ability to carry small animals that are caught could be severely compromised leading to potential malnutrition or even starvation of the bird or its young. The carrying of prey significantly increases load-carrying demands placed on the wings and critical flight feathers. For other birds, damaged feathers will impair their ability to forage or to flee predators.

In conducting any risk assessment where fatality is used as the metric to evaluate risk to an exposed population the analyst should always be cognizant that the existence of fatality implies the high likelihood of a significantly higher number of injuries (i.e. morbidity). The ratio of morbidity to mortality can range from less than 5 to one to over 100 to one for different hazards and levels of injury deemed significant. For example, for every death from an explosion, one should expect about 5 serious injuries (K.T. Bogen, E.D. Jones 2005) (Stellman 1998, Table 39.10). For hazards that result in direct trauma to the exposed receptor there is a general relationship of level of damage and level of energy or power to which the receptor is exposed (Frank P. Lees 1980). McCrary did not, nor would it have been practical, to survey a region of sufficient size surrounding the project to account for scavenging of injured birds or latent fatality offsite. Thus staff cannot, based on available data, define morbidity due to exposure to concentrated solar radiation from actual survey data. Staff believes that the hazard to birds from this facility is most analogous to explosive hazards as both have high energy or power levels at a central point with energy levels decreasing exponentially with distance radially from the center. Based on this analogy the level of seriously injured birds for every death is likely to be between 5 and 10.

Thus, the potential damage caused by avian exposure to concentrated solar flux can range from minor impairment (and potentially leading to death) to near immediate fatality depending on the dose received. Low doses of 5 kW/m^2 to 15 kW/m^2 for short exposure periods may not cause effects that are observable to the naked eye but could nonetheless result in significant flight impairment. For example if a significant portion of the feather barbules (the fragile micro structure between barbs) (See Reddy and Yang 2007) were lost the feather's structural integrity would be impaired. Because loss of barbules would significantly compromise integrity of a large portion of the feathers surface area, the differential pressure between the top and bottom of the feather necessary to produce lift and thrust (Videler 2005 Page 55) will also be compromised (Werner and Patone 1998). Such impairment could reduce the bird's level and climbing flight speeds. Longer but still short term exposures to the 10 to 25 kW/m^2 flux densities could cause nearly complete loss of barbules or even complete feather vanes on one or both sides of the rachis and result in loss of flight capability and inability to remain airborne. Staff has identified 4kW/m^2 as a safe level for short exposures (less than 60 seconds). This level of exposure should not result in any damage to flight feathers.

Using the only available data on avian mortality, provided by (McCrary et. al. 1986), staff estimates that the proposed Hidden Hills and Rio Mesa facilities could each result in avian mortality in excess of 22 times that of the Solar One facility previously studied based on linear extrapolation from total relative mirror surface area of the two facilities. This extrapolation is based on mirror area as collision with mirrors played a major role in the total avian fatalities documented at the Solar One facility. It should be noted that the

McCrary study provides no data to assess avian morbidity. It should be recognized that estimates of avian mortality that ignore excess morbidity will necessarily underestimate ultimate fatality that will be associated with that excess morbidity (i.e. latent fatality). It should also be noted that damage to flight feathers could be cumulative if flights through concentrated flux are repeated. Such factors would be expected to contribute to substantial underestimation of avian impacts.

In addition to these concerns extrapolation from a 10 MW pilot plant to a 250 MW facility with many thousands of heliostats and a much taller receiver tower "may produce non-linear increases in the rate of avian mortality when compared to Solar One…" according to McCrary. Also, the volume of the air space with solar flux densities greater than 4 kW/m^2 (i.e. the hazardous air space) would increase with increasing power output rating or solar field size, increasing the likelihood of avian exposure. The effect of a larger volume of the proposed projects would have a greater effect on bird mortality and morbidity given that exposure duration at high intensities would be much greater.

To evaluate the potential for non-linear effect of scale-up in facility size from a pilot scale to a commercial scale, staff estimated the relative volume of air space and relative dose for both a facility the size of Solar One and Hidden Hills/Rio Mesa (see **Appendix BIO1 Figures 5** and **6**) below. Staff chose a range of plausible straight-line flight paths past a Rio Mesa-like facility re-scaled to the reduced size of the Solar One heliostat field having a heliostat field of approximately one-fourth the diameter of Rio Mesa. Three paths were taken from this Solar One model: one having a closest approach distance to the tower at the radius of the 5 kW/m^2 isopleth, another at one-half of that closest approach distance, and a third at one-fourth of that closest approach distance, providing three hypothetical flight paths at distances of 120 feet, 60 feet and 30 feet from the assumed center of the receiver tower. Exposure doses were calculated using these three flight paths at Solar One. Staff then calculated the comparative doses associated with the analogous three hypothetical flight paths, again at distances of 120 feet, 60 feet and 30 feet from the center of the receiver tower at the Rio Mesa facility. **Appendix BIO1 Tables 4** and **5** below provide the results of this comparative analysis.

The volume of the flux field at the Hidden Hills / Rio Mesa size facility with concentrated flux above 5 kW/m^2 is about 20 times larger than the similar flux field volume of the Solar One size facility. The magnitude of the doses resulting from flights at the same distances from the receiver towers described above is between 5 and 6 times larger at the Rio Mesa-size than at the Solar One-sized facility. The product of increased dose and volume is about 100 times larger at Hidden Hills / Rio Mesa as compared to Solar One. This analysis confirms the validity of McCrary's concern regarding the potential for non-linear increase in scaling of adverse effects on avian populations associated with exposure to concentrated solar flux from scale up of a small 10 MW pilot plant like Solar One to a 250 MW or greater facility like Hidden Hills / Rio Mesa.

Table 4 Comparison of Dose Resulting From Flight Paths at Equal Distance from the Center of Each Receiver Tower (view factor 1.0)

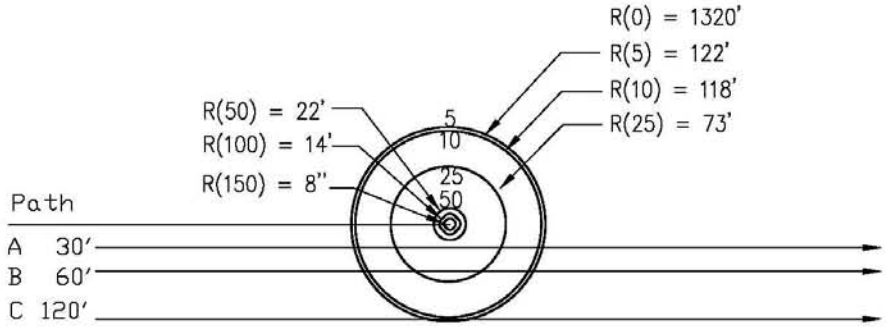
ViewFactor= 1.0 Speed = 18 mph	Path closest approach to tower (feet)	Max flux (kW/m^2)	Exposure time (secs)	Total Dose ($kW\text{-}secs/m^2$)	Dose above Threshold ($kW\text{-}secs/m^2$)
Rio Mesa	30	100	372	2000	1400
	60	50	372	1800	1200
	120	25	372	1500	900
Solar One	30	25	100	400	250
	60	25	100	370	220
	120	5	100	240	80
Solar One Standby Points[1]	NA	1500	0.3	440	440

[1.] assumes flight speed of 18mph through 8ft flight path

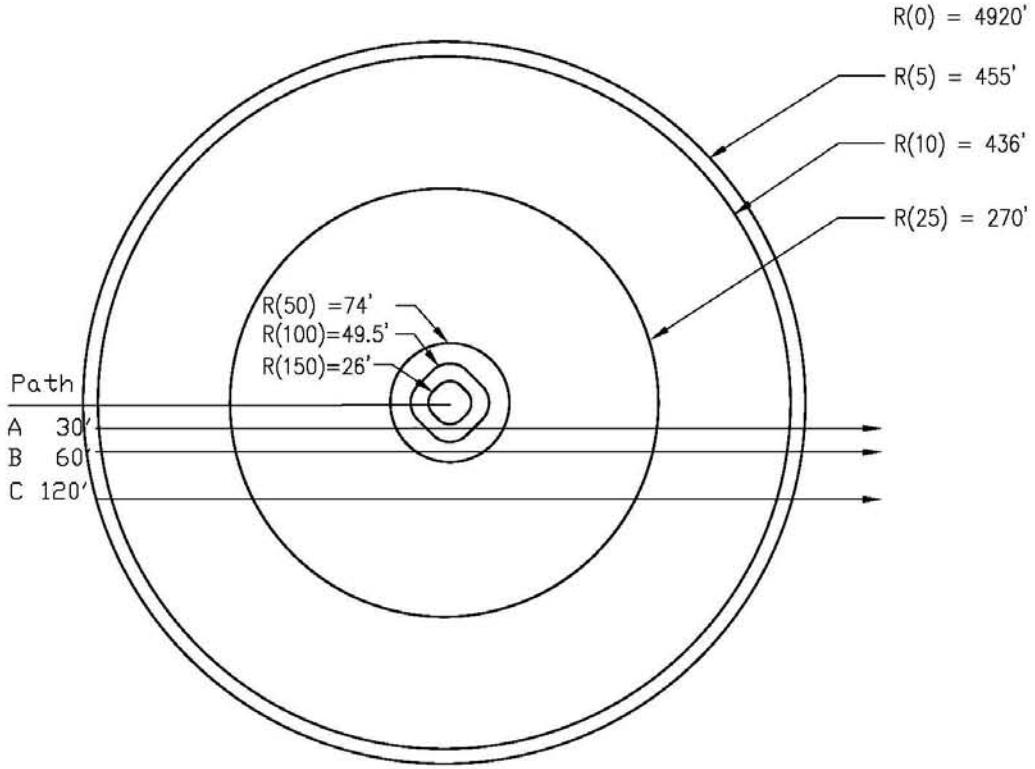
Table 5 Comparison of Dose Resulting From Flight Paths at Equal Distance from the Center of Each Receiver Tower (view factor 0.33)

View Factor=0.33 Speed = 18 mph	Path closest approach to tower (feet)	Max flux (kW/m^2)	Exposure time (secs)	Total Dose ($kW\text{-}secs/m^2$)	Dose above Threshold ($kW\text{-}secs/m^2$)
Rio Mesa	30	100	372	650	380
	60	50	372	580	300
	120	25	372	480	210
Solar One	30	25	100	130	60
	60	25	100	120	50
	120	5	100	80	0

COMPARATIVE FLIGHT PATHS FOR SOLAR ONE & RIO MESA/HIDDEN HILLS



Appendix B-C1 Figure 5 SOLAR ONE - FLUX ARRAY AT TOWER



Appendix B-C1 Figure 6 RIO MESA / HIDDEN HILLS - FLUX ARRAY AT TOWER

ANALYSIS OF UNCERTAINTY

There are significant uncertainties associated with staff's analysis of risk to avian plumage potentially resulting from exposure to concentrated solar flux. Evaluation of the relative sensitivity to various inputs to the thermodynamic equilibrium calculation indicates that the orientation of the bird in the flux field causes the greatest effect on the resultant radiant exposure. This is the result of the strong effect of the angle of incidence on effective flux density. This is reflected in the view factor of the incident rays on the surface (i.e., the angle of the rays to the object's surface). The view factor used in staff's model can vary from about 0.25 to 1 depending on the bird's orientation in the radiant field. This can result in a fourfold change in effective exposure level between level flight and flight that causes the feathers to be perpendicular to the incident solar radiation.

The choice of chord length of the potentially exposed bird wing has the next largest effect on the estimated feather surface temperature. Cord lengths for potentially exposed birds range from about 2 to about 20 inches with the longest cord lengths resulting in the most impact. Choice of chord length can change the analysis outcome by about a factor of three.

The choice of flight speed of the bird is also an important variable in estimation of the resultant surface temperature reached. A decrease in flight speed from 40 miles per hour to 20 miles per hour would increase resultant relative surface temperature rise by about 50 percent. This is the result of decreased convective heat transfer from the feather surface to the ambient air at lower flight speeds.

The emissivity (the fraction of the incident radiation that is absorbed or not reflected from the surface) of the feather would also affect the resultant temperature. However, staff used an emissivity of 0.95 as a plausible worst case eliminating the potential variability associated with differences in emissivity of different feathers. It should also be noted that the micro structure of the feathers may allow radiant energy to penetrate deeply into the feather below the boundary of the outer surface. For example the radiant energy could first contact the barbules that are well within the feather. This could substantially reduce the effect of convection and substantially increase the rate of temperature rise on these surfaces. If this does in fact occur, staff's analysis could substantially underestimate the effect of flight feather damage associated with exposure to concentrated flux.

It is also conceivable that conduction of heat down the quill of the feather could result in damage to the follicle resulting in complete loss of the feather and loss of ability to re-grow a new feather during subsequent molting cycles.

Another uncertainty is the effect of exposure of the feather surface to UV radiation with concurrent exposure to high temperatures. Staff was not able to include the potential effect of increased keratin molecular bond scission that could be associated with concurrent exposures. Such exposure could result in adverse effects on keratin integrity at lower surface temperatures than would otherwise be required, accelerating the rate of damage.

Exposure to summer ambient conditions mid-day results in exposure to solar flux of 1 kW/m^2, and is thus the base line beyond which excess damage can occur. Preexisting exposure of 1 kW/m^2 with or without the existence of the proposed facilities places a lower limit on exposure. An exposure to 5 kW/m^2 is the lowest exposure that results in a surface temperature of 160 ^oC which can be considered a lowest observed adverse effect level (LOAEL). Use of an uncertainty factor greater than 5 and a LOAEL of 5 kW/m^2 would render the exposure criteria moot as it would require exposure to remain below the preexisting background of 1kW/m^2. Exposures below 4 kW/m^2 did not result in surface temperatures of above 160° C and can be considered a NOAEL. Use of an uncertainty factor of 2 and a LOAEL of 5 kW/m^2 results in an estimated safe exposure level of 2.5 kW/m^2. Based on this analysis, staff estimates that a one-time exposure to a solar flux density between 2.5 kW/m^2 and 4 kW/m^2, for a duration not exceeding 1 minute or so, would cause little if any damage to flight feathers and can be considered safe.

CONCLUSIONS

Staff's analysis of avian exposure to concentrated solar radiation indicates that a threshold of safe exposure does not exist above a solar flux density of about 4 kW/m^2. The analysis also indicates that both the Hidden Hills and Rio Mesa facilities pose potentially significant risk to avian populations that may encounter the air space in the facilities where concentrated flux density is above staff's estimated safe levels, resulting in avian morbidity and mortality. The available data regarding avian impacts is very limited; however, such data does provide at least some perspective regarding potential for impact.

There are significant questions regarding extrapolation from the available information regarding avian impacts. The most vexing is the complete absence of data that would allow estimation of avian morbidity (i.e. reliable dose response data). Staff's assessment provides estimates of exposure and dose that can lead to injury and late fatality. In addition, there are major unknowns in estimation of differences in avian populations from one site to the next. These limitations in the available data require exercise of considerable judgment in extrapolation of data from one site to another. However, the errors introduced by the lack of site specific data are likely to be small in comparison to the absence of morbidity estimates and effects of dramatically increased potential exposure duration resulting from the increased volume of the air space affected by concentrated solar flux of the proposed project.

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APPENDIX BIO2 - PROCEDURAL MODEL AND CALCULATIONS USED TO ESTIMATE AVIAN EXPOSURE TO CONCENTRATED SOLAR RADIATION

FOR HIDDEN HILLS BIOLOGY RESOURCES APPENDIX BIO1

Introduction

A surface exposed to and thus absorbing incident concentrated solar flux will convert the absorbed flux to heat and rise in temperature until it reaches a thermal equilibrium with its surroundings, including the incident flux. The heat loss mechanisms of convection and radiation will increase their rate of removing heat from the surface until they together match the rate of incoming heat from the incoming solar flux, then the temperature will stabilize. The stable temperature at which this thermal equilibrium occurs is determined by the level of incoming solar flux and parameters that affect the loss mechanisms such as flight speed, ambient temperature, and the view factor. Thus it is possible to, within a reasonable degree of accuracy (with some dependence on materials and circumstances), to relate an incoming solar flux level to the steady-state temperature to which a material surface may rise.

To determine this relationship between solar flux and temperature, staff modeled the temperature response of exposed feather surfaces to concentrated solar flux using a dynamic iterative method that allows for the examination of the various mechanisms of cooling that begin to operate when the material is heated. This method allows for the variation of material properties and allows examination of changing external conditions (e.g. flux levels with position). Transient responses of the material being heated (i.e. the time needed for the material to respond to those changes of external conditions) can also be examined to see how quickly the surface temperature rises and falls.

The surface temperature model is driven by the incoming thermal radiation (flux) to the surface. The absorbed flux causes the absorbing material (the feather in this case) to rise in temperature. The rising temperature causes the material to heat to a temperature above its surroundings, and so the material starts to lose heat back to its surroundings through convection and re-radiation. These three mechanisms are well understood and characterized and can be found in nearly any college level textbook on heat transfer and fluid mechanics (Holman 1976) (Incropera 2007) (Cengel 2007) (MERM 2001).

The model assumes that the material being heated maintains its integrity throughout the modeled flight path regardless of temperatures predicted so that potential temperature rise and response to changing input flux can be observed. The observation of steady-state as well as transient responses help to verify that the model is responding according to well established and verified expected thermal behaviors.

In the real world, most organic materials will begin to decompose (pyrolize) at some elevated temperature (about 160 °C for keratin, the material of feathers), and the material's properties (mass, thickness, stiffness, composition, toughness, brittleness, density, dimensions, etc.) will begin to change. Shrinkage and melting of filamentary structures is expected to occur by approximately 300 °C. Upon reaching a temperature of 400 °C the remaining material would be mostly carbon and have little if any remaining structural integrity. Therefore, for the purpose of risk assessment to evaluate potential damage to feathers, accurately predicting temperatures very much over 300 ^{o}C is not meaningful. By then the keratin will have pyrolized and out-gassed most of its volatile components leaving behind a mostly carbonaceous material. For more information and references on this see **APPENDIX BIO1**. References listed throughout this document refer to the list of references published at the end of **APPENDIX BIO1.**

The following is an outline of the logical steps through which the computerized model proceeds to predict the temperature response of a feather-covered surface (i.e. bird's wing) as it flies along some chosen path above and across a solar concentrated flux field. Some assumptions regarding the material properties and the actual scenario must be made, and attempts have been made to choose reasonable and realistic values and cases for use in conducting a risk assessment of avian exposure to concentrated flux.

Outline of Steps Followed in Bird Flight Model (with references where applicable)

1) Set path conditions

   a) Pick a straight-line path through the applicant-provided flux map (provided in **Response to Data Request, Set 2A, #159**). Note: The diagram used for cross-field paths and to get location and flux density values along that path is included in the top half of the applicant's Figure 3, page 9 of the data response. Most paths were directed northeast, passing at some selected distance of nearest approach to the tower on its northwest side.

   b) Measure the distances to each of the flux contours across the heliostat field

      i) Assume flux = 0 at edge of field, linearly interpolated elsewhere between flux levels indicated on the diagram. (Note: Where paths penetrated inside an indicated contour, but did not penetrate the next higher contour before passing the tower, flux levels were not taken to increase beyond the last penetrated contour. This assumption would tend to underestimate the actual maximum flux level along the path.)

      ii) Make a linear interpolation table of distance and path / flux level. This table is comprised of two vectors (nSunsVect and distData) included for each path shown in the **pathData()** section of the computer program code. The paths modeled are mostly straight lines crossing the solar field coming within some selected nearest approach distance to the solar receiver tower. One reported path involves a short path upward from the ground near the tower at an angle of approximately 45 degrees, to simulate a bird leaving the ground, and flying up through the flux pattern to a level above the tower.

2) Set environmental and flight conditions

   a) Ambient temperature Tambient = 45°C (113 °F). This is a temperature that is near the expected maximum, but which would still be expected to occur several times during the summer months. Ultimately, a shift in the assumed ambient temperature affects the flux-exposed equilibrium temperature by an amount similar to the temperature shift for temperature of interest (less than 300 °C). Thus, an ambient temperature shift of 4 °C, would affect the flux level to reach 160 °C on a surface by about 0.2 kW/m^2.

   b) Flight speed V = 18 mph is used in the risk assessment. This is a speed, within the lower-middle range of speeds (Alerstam 2007) that would be expected of birds at these solar sites.

   c) Angle of incidence of flux to feather surface (angle from perpendicular incidence) "offVert". Values used were (a) 71 degrees as a likely angle to the underside of a horizontal surface (e.g. bird wing) estimated from applicants flux maps, and (b) 0 degrees as there would always be some portion of the surface of any three-dimensional object (e.g. bird) exposed to the flux at this angle.
   The term "vew factor" is equal to the trigonometric cosine of the incidence angle, (i.e. cosine(offVert angle)) is used to indicate the heating "effectiveness" of incident flux on a surface.

   d) Wing chord length (distance from leading to trailing edge of a wing) "L" (6 inches was chosen as representative), is a factor used in determination of the fluid mechanics-related Reynolds number, and thus is a factor in whether airflow over the wing surface is laminar or turbulent, which in turn affects rate of convective cooling of the surface. The L = 6" assumption yields a Reynolds number of approximately 70,000, well within the range spanning bird flight (Videler 2005, p. 17). With the commonly used for air flow over a wing "external flow over a flat plate" analogy model (Ward 1999), the resulting Reynolds number for the underside of the wing remains well below the accepted critical value of 500,000 where air flow would be expected to become turbulent. For all considered cases of bird flight, the air flow passing the underside of the wing is considered to be laminar (Withers 1981). This choice drives the equations used for determining the appropriate convective heat transfer coefficient (Holman 1976) (Incropera 2007) (Cengel 2007) (MERM 2001).

3) Assume feather's physical properties

   a) Thickness = 600 microns (assumed)

   b) Optical emissivity = 0.95 (assumes a dark colored bird) (Ward 1999) Staff assumes for this risk assessment that the absorbance coefficient for solar flux will be the same as the emissivity of the surface for re-radiation of infrared radiation. This assumption is based on reported data on values reported for black plumage, the effects of dirt on surfaces, and the properties of the feathers structure (Quintiere 1974, Osorio 2002, Bass 1995).

c) Optical transmissivity = 0 (assumes incident flux does not pass through without being blocked and absorbed)

d) Optical absorption depth = 0.5 (Assume incident flux is absorbed in first half of thickness)

e) Mass density of solid keratin = 1.3e3 kg/m^3 Ref: (Munn 2009)

f) Void density (to account for the open keratin structure of feathers) (assumed to be 50% of volume). Note that the density characteristics affect transient effects (the timing) of the heating effects, but not the steady-state temperatures used for this risk assessment.

g) Mass density per unit area of plumage = half that of solid keratin to account for void volume of feather structure (See note above on effect of void density).

h) Thermal conductivity of keratin = 0.05 W/m-K Ref: (Dawson 1999), (Baxter 1946),(Martinez 2012)

i) Thermal conductivity of plumage = 0.074 W/m-K Ref: (Walsberg 1988)

j) Moisture level delays heating by adding water mass to the plumage that must be heated to 100 °C. Heating beyond 100 °C, is further delayed as the water consumes and carries away heat during its evaporation. This effect is minor (on the order of 2-3 seconds) for the flight paths modeled.

4) Set initial conditions:

a) Tsurf = Tambient (Assume initial surface temperature is at the ambient air temperature.)

b) Qin = 0 (Solar radiation arriving at the top of the wing surface directly from the sun, is not considered in this analysis).

c) t = 0

5) Start clock (intervals of dt). Repeat the following steps for each clock tick interval, until all way across the heliostat field. Output and graph are stored in viewable files. See Hidden Hills **Appendix BIO1 Figures 1** thorough **4** and **Appendix BIO1 Tables 2** and **5** for examples:

a) Calculate new time (t) from clock ticks by adding dt (the time interval)

b) Calculate position along path
X = V * t where t = elapsed time, V = flight speed

c) Calculate flux Level from position by interpolation between flux contours (from applicant)

d) Calculate solar energy received in from Flux Level, emissivity, view factor, transmissivity

Qin = 1000 * (SunsIn+1) * emissivity * viewFactor * (1 - transmissivity)
Ref: MERM 2001, p. 37-2, eqtn. 37.8

e) Calculate hot-side convective energy losses
Qv = h * (Tsurf - Tambient) Ref: MERM 2001, p. 36-3, eqtn. 36.14

f) Calculate hot-side re-radiative losses energy losses
Qrad = SBsigma * emissivity * ($Tsurf^4$ - $Tambient^4$) Ref: MERM 2001 p. 37-4, eqtn 37.14

g) If backside of plumage is uncovered (i.e. feather is solely protruding without being covered on front or back side by either plumage or flesh), calculate conductive-convective combination losses as:
Qcomb = (Tsurf-Tamb) / (thkPlumage * (1-abDepth) / kPlumage + 1/h) going through the feather with heat going out to the air flowing over the backside of the feather (Holman 1976 p. 29); (this option not used for the conservative general case of this analysis)

if backside of feather is covered by other feathers or the bird's body, set Qcomb = 0. (option used in this analysis)

h) Calculate energy change during interval as Qnet = Qin – Qv – Qcomb – Qrad

i) Calculate change in surface temperature during interval
dT = Qnet * dt / (CpPlumage * mDryfeather + CpWater * mWater)
ref: MERM 2001, p. 34.15
Note: Possible moisture in the feather is accounted for by making the incoming flux warm its mass as well as the feather's, until 100 °C. At 100 °C, temperature rise is stalled until the water has been vaporized from the liquid state, then is assumed to be released to the atmosphere. A moisture level of constituting 15 percent of the mass of the dry feather is assumed.

j) Calculate new surface temperature Tsurf = Tsurf + dT

k) Repeat the loop until path has traversed the solar field.

BIRD FLIGHT MODEL MATERIAL PROPERTIES ASSUMPTIONS WITH REFERENCES

FOR HIDDEN HILLS BIOLOGY RESOURCES APPENDIX BIO1

Printed in mono-spaced font here for readability .

Selected code extractions showing values used, and source references

```
# bird plumage characteristics

    Tskin = 41                    #  degC assumed body temperature of bird

    transmissivity = 0.0          # of bird plumage
```

```
    emissivity = 0.95             # of bird feather  ref: Ward 1999, Wolf 2000

    kPlumage = .074               #  W/m-K plumage thermal conductivity   ref: Walsberg 1988

    rhoPlumage = 1.3e3 *.5        #  density in kg/m^3 (keratin density is assumed halved by void
                                                                  density)

    thkPlumage =    60e-5         #  meters

    CpPlumage =     1.53e3        #  J/kg-K

    abDepth = .5                  # fraction of plumage thickness that
                                     absorbs the Qin flux

    Tsurf =  Tamb                 # start here for initial temp

    mDryFeather = rhoPlumage * thkPlumage   # feather mass in kg/m^2

    mWater = waterFraction * mDryFeather    # water mass per unit area
                                             (kg/m^2 )  adds mass to feathers

    m = mDryFeather + mWater      #water absorbs heat until 100C

    #initialized constants and parameters

    viewFactor = math.cos(offVert * math.pi/180.)

    L = L / 39.4        # Convert from inches to meters

    Pr = 0.705          # Prantl number (dimensionless) air       ref: MERM App 35.D

    V =  Vmph / 2.237   # convert flight speed from mph to meters/sec

    airVis = 1.78e-5    # air kinematic viscosity at 49°C         ref: MERM App 35.D

    kAir = .028         # air thermal conductivity W/(m-degK)     ref: MERM App 35.D

    Qthresh = 4000.     # in watts/m^2 (staff-determined)

    Reynolds = V * L / airVis     # Ref: MERM 2001, p. 36-4 eq. 36.18

    Nu = 0.664 * Reynolds**0.5 * Pr**(.33333333)    #Nusselt number  Ref: MERM 2001, p. 36-4 eq.
36.18

    h = kAir * Nu / L             # convective heat transfer coeff   Ref: MERM 2001, p. 36-3
eq.36.14

    SBSigma = 5.6704e-8           #  W/(m^2 * K^4) Stephan-Boltzman constant Ref: MERM 2001, p.
37-2
```

The following source code listing contains the computer model used for the risk assessment. It is written in the Python Open Source Programming Language, Version 2.7.2. An interpreter for executing the code is available at http://www.python.org/ . This program code was designed and written by staff for this particular project-specific risk assessment, and should not be considered a general purpose heat transfer modeling code. Lines and portions of lines that begin with a '#' mark are comment lines for use in

understanding the code. The code is included here for completeness in discussing staff's analytical method and assumptions. No user manual has been written.

Printed in mono-spaced font for readability of computer code.

Source Code

```
# heat rise of bird surface temperature
# bird_traverse_3e10.py  10/28/2012  Geoff Lesh
# added: option for backside losses
def pathData():

    global distVect, nSunsVect, towerLocation, waterFraction, offVert, runID, emissivity,Tamb, ,\
           pathID, pathRemarks

    #findPathID = 'modelRMOff30'
    #findPathID = 'modelRMOff120'
#

    ##if findPathID == 'modelRMOff30':
    #scale =  12/39.4  #meters real world per feet scale
    #pathID = 'modelRMOff30'
    #pathRemarks = 'Modeled RM Off Tower 30 ft'
    #towerDist = 0
    #nSunsVect = (0,   5,      10,     25,     50,     100,100,50,25,10,5,0)
    #distData=   [ -4920,-454,-435,-268,-68,-39,     39,68,268,435,454,4920] # units in feet



    ##if findPathID == 'modelRMOff60':
    #scale =  12/39.4  #meters real world per feet scale
    #pathID = 'modelRMOff60'
    #pathRemarks = 'Modeled RM Off Tower 60 ft'
    #towerDist = 0
    #nSunsVect = (0, 5, 10, 25, 50, 50, 25, 10, 5, 0)
    #distData=   [ -4920,-451,-432,-263,-43,43,263,432,451,4920] # units in feet


    ##if findPathID == 'modelRMOff120':
    #scale =  12/39.4  #meters real world per feet scale
    #pathID = 'modelRMOff120'
    #pathRemarks = 'Modeled RM Off Tower 120 ft'
    #towerDist = 0
    #nSunsVect = (0,   5,      10,     25,     25,10,5,0)
    #distData=   [ -4919,-439,-419,-242,242,419,439,4919] # units in feet


    ##if findPathID == 'modelS1Off30':
    #scale =  12/39.4  #meters real world per feet scale
    #pathID = 'modelS1Off30'
    #pathRemarks = 'Modeled S1 Off Tower 30 ft'
    #towerDist = 0
    #nSunsVect = (0,   5,      10,     25,     25,10,5,0)
    #distData=   [ -1320,-118,-114,-67,67,114,118,1320] # units in feet

    ##if findPathID == 'modelS1Off60':
     #scale =  12/39.4  #meters real world per feet scale
     #pathID = 'modelS1Off60'
     #pathRemarks = 'Modeled S1 Off Tower 60 ft'
     #towerDist = 0
     #nSunsVect = (0,  5,      10,     25,     25,10,5,0)
```

```
     #distData=   [ -1319,-106,-102,-42,42,102,106,1319] # units in feet

    ##if findPathID == 'modelS1Off120':
    #scale =  12/39.4  #meters real world per feet scale
    #pathID = 'modelS1Off120'
    #pathRemarks = 'Modeled S1 Off Tower 120 ft'
    #towerDist = 0
    #nSunsVect = (0.,  5.,     5.,0.)
    #distData=   [ -1315,-22,22,1315] # units in feet

    #scale=1500./7.7   # meters real world per cm on scale This is general scale for path not
having their own scale

    ###flying upward  Note: this path has its own scale!
    #scale=300 / 16.7  #meters Real world per cm on map: map data is in same cm.
    #pathID =  'DAUP'
    #pathRemarks = 'Upward past tower from ground'
    #towerDist = 13.15
    #nSunsVect = (0,5,10,25,50,50,25,10,5,0)
    #distData=   [0,10.8,11.1,11.6,12.3,14,14.4,15.5,15.9,20]  #cm of scale #

    #pathID = 'Constant 1KW'
        #scale=1500./7.7   # meters real world per cm on scale This is general scale for path not
having their own scale
    #pathRemarks = 'Constant 1KW'
    #towerDist = 24.3
    #nSunsVect = (0,1,1,0)
    #distData=   [16.95,17.0, 31.2, 31.25]  #cm of scale #

    #pathID = 'Constant 5KW'
    #pathRemarks = 'Constant 5KW'
    #scale=1500./7.7   # meters real world per cm on scale This is general scale for path not
having their own scale
    #towerDist = 24.3
    #nSunsVect = (0,5,5,0)
    #distData=   [16.95,17.0, 31.2, 31.25]  #cm of scale #

    #pathID = 'Constant 8KW'
    #pathRemarks = 'Constant 8KW'
    #scale=1500./7.7   # meters real world per cm on scale This is general scale for path not
having their own scale
    #towerDist = 24.3
    #nSunsVect = (0,8,8,0)
    #distData=   [16.95,17.0, 31.2, 31.25]  #cm of scale #


    #pathID = 'Constant 10KW'
    #pathRemarks = 'Constant 10KW'
    #scale=1500./7.7   # meters real world per cm on scale This is general scale for path not
having their own scale
    #towerDist = 24.3
    #nSunsVect = (0,10,10,0)
    #distData=   [16.95,17.0, 31.2, 31.25]  #cm of scale #


    #pathID = 'Constant 25W'
    #pathRemarks = 'Constant 25KW'
    #scale=1500./7.7   # meters real world per cm on scale This is general scale for path not
having their own scale
    #towerDist = 24.3
    #nSunsVect = (0,25,25,0)
    #distData=   [16.95,17.0, 31.2, 31.25]  #cm of scale #
```

```
    #pathID = 'Constant 50KW'
    #pathRemarks = 'Constant 50KW'
    #scale=1500./7.7   # meters real world per cm on scale This is general scale for path not
having their own scale
    #towerDist = 24.3
    #nSunsVect = (0,50,50,0)
    #distData=   [16.95,17.0, 31.2, 31.25]  #cm of scale #

    #pathID = 'Constant 100KW'
    #pathRemarks = 'Constant 100KW'
    #scale=1500./7.7   # meters real world per cm on scale This is general scale for path not
having their own scale
    #towerDist = 24.3
    #nSunsVect = (0,100,100,0)
    #distData=   [16.95,17.0, 31.2, 31.25]  #cm of scale #

    #pathID = 'Constant 150KW'
    #pathRemarks = 'Constant 150KW'
    #scale=1500./7.7   # meters real world per cm on scale This is general scale for path not
having their own scale
    #towerDist = 24.3
    #nSunsVect = (0,150,150,0)
    #distData=   [16.95,17.0, 31.2, 31.25]  #cm of scale #


    #pathID = 'AASE'
    #scale=1500./7.7   # meters real world per cm on scale
    #pathRemarks = 'closest pass to tower'
    #towerDist = 21.55
    #distData=   [15.3, 19.4, 20.2, 20.4, 21.2, 21.25, 21.3, 21.65, 21.75, 21.85, 21.95, 22.9,
24.5, 29.5]  #cm of scale # path A1 next to tower
    #nSunsVect = (0,5,10,25,50,100,150,150,100,50,25,10,5,0)
# path A1 next to tower

    #pathID = 'ABNE'
    #pathRemarks = '100 m off tower (tangent)'
    #scale=1500./7.7   # meters real world per cm on scale This is general scale for path not
having their own scale
    #towerDist = 20.0
    #nSunsVect = (0,5,10,25,25,10,5,0)                                          # path ABNE 100
m off tower
    #distData=   [11.7, 17.7, 18.5, 19.0, 21.2, 21.7, 22.5, 31.0]  #cm of scale #        path
ABNE 100 m off tower

    pathID = 'ACNE' #
    pathRemarks = '200 m off tower'
    scale=1500./7.7   # meters real world per cm on scale This is general scale for path not
having their own scale
    towerDist = 20.1
    nSunsVect = (0,5,10,10,5,0)                                       # path acNE 200 m off tower
    distData=   [12.2,18.2,19.4,19.7,22.7,29.9]  #cm of scale #        path acNE 200 m off tower

    #pathID = 'ADNE'
    #pathRemarks = '300 m off tower'
    #scale=1500./7.7   # meters real world per cm on scale This is general scale for path not
having their own scale
    #towerDist = 21.0
    #nSunsVect = (0,5,10,10,5,0)                                        # path ADNE 300 m off
tower
    #distData=   [13.7,19.3,22.3,23.,23.5,31.0]  #cm of scale #        path ADNE 300 m off tower

    #pathID = 'AENE'
    #pathRemarks = '400 m off tower'
```

```
    #scale=1500./7.7   # meters real world per cm on scale This is general scale for path not
having their own scale
    #towerDist = 24.3
    #nSunsVect = (0,5,5,0)                                        # path AENE 400 m off tower
    #distData=   [17., 22.8, 23.7, 31.2]  #cm of scale #        path AENE 400 m off tower

    if 1:
        distOffSet=distData[0]   # gets subtracted from initial and all values of distData
        towerLocation= (towerDist - distOffSet) * scale
        checkdata = len(distData)== len(nSunsVect)
        print 'Checkdata:  %s'%checkdata
        if not checkdata:
            print 'distData size: %s'%len(distData)
            print 'nSunsVect size: %s'%len(nSunsVect)
            raise Exception( 'Data vector lengths do not match.  Quitting. See output file.'  )
            #sys.exit()
        else:
            for i in zip(distData,nSunsVect):
                print i
            distVect  = tuple( scale * (i - distOffSet) for i in distData)  # in meters
            #distVect = tuple( scale * (i - towerDist) for i in distData)   # in meters centered
at tower

def userData():
    global Tamb, Tskin, dt, emissivity, offVert, L, V, nSteps, waterFraction,
maxDistance,waterFraction, offVert, RunID, emissivity,Tamb, V ,\
           pathID, Vmph, maxTime, transmissivity,backSideLossesOn
    nSteps= 44000
    dt = .01              # seconds, recheck frequency = clock tick
    Tamb = 49.            # degC
    waterFraction = .15   # mass of water

    offVert = 0.          # degrees  angle of incidence  Usually 0 or 71
    L = 6.                # inches wing length front to back
    Vmph = 18.            # mph bird flight speed
    maxDistance = 3000    # meters
    maxTime =  800        # seconds
    backSideLossesOn = False  # True turns on heatloss through backside as Qcomb + QradBackside

def setConstants():  # initialize

    #initialize   constants  and data vectors
    viewFactor = math.cos(offVert * math.pi/180.)
    L = L / 39.4        # Convert from inches to meters
    Pr = 0.705          # Prandtl number for air (dimensionless)
    heatVapWater = 2257 # kJ/kg Heat of vaporization of water
    V =  Vmph / 2.237   # convert from mph to meters/sec
    airVis = 1.78e-5    # Air kinematic viscosity (m^2/s)
    kAir = .028         # air thermal conductivity (W/(m-degK))
    Qthresh = 4000.     # watts/m^2
    Reynolds = V * L / airVis     # Reynolds number  (dimensionless)
    Nu = 0.664 * Reynolds**0.5 * Pr**(.33333333)    #Nusselt number (dimensionless)
    h = kAir * Nu / L             # convective heat transfer coeff (W/m^2 - K)
    SBSigma = 5.6704e-8           # Stephan-Boltzman constant (W/(m^2-K^4))
    CpWater = 4.1813e3            # heat capacity of liquid water (J/kg-K)
    HvWater = 2257e3              # entalpy of vaporization for water (J/kg)

    # bird plumage characteristics
    Tskin = 41                    #  bird body temperature degC
    transmissivity = 0.0          #  of bird feather (dimensionless)
    emissivity = 0.95             #  of bird feather (dimensionless)
    kPlumage = .074               #  (W/m-K) plumage thermal conductivity
    rhoPlumage = 1.3e3 *.5        #  density in kg/m^3
```

```
    thkPlumage =    60e-5         #  meters          ref:
    CpPlumage =     1.53e3        #  J/kg-K          ref:
    abDepth = .5                  # fraction of plumage thickness absorbing the flux (assumed)
    Tsurf =  Tamb                 # start here for initial temp
    mDryFeather = rhoPlumage * thkPlumage   # feather mass in kg/m^2
    mWater = waterFraction * mDryFeather    # water mass per unit area (kg/m^2 )adds mass to
plumage


        t=0               # initialize start time
        timeTo160 = -99
        timeAbove160 = 0
        timeTo300 = -99
        timeAbove300 = 0
        #maxTsurf = 0
        lHit160 =  False
        lHit300 = False
        if mWater > 0:
            lFeatherIsDry = False
        else:
            lFeatherIsDry = True
        doseTotal = 0
        doseBefore160 = 0
        doseAbove160 = 0
        doseAbove300 = 0
        doseAboveThresh = 0

def qDotIn(d):
    global i, distVect, nSunsVect
    intensity = np.interp(d,distVect,nSunsVect)
    return intensity

def mainLoop():
    # input data
    ## could add 1 sun to backside then add convection and conduction

    for i in range(1,nSteps):  # i is clock ticks
        t = i*dt   #new time
        d = t*V    #new distance


        Qrad = SBSigma * emissivity * ((Tsurf+273)**4 - (Tamb+273)**4)# (Watts/m^2)re-Rad of
                                                                        energy absorption

        Qv =   h * (Tsurf - Tamb)                   # 'Front' surface convection in Watts/m^2
        #Qc =   kPlumage * (Tsurf - Tskin)          # in Watts conduction to body (not used with
                                                      Qcomb)

        if backSideLossesOn:
            Qin = 1000 * (SunsIn+1) * emissivity * viewFactor * (1 - transmissivity) # in Watts
            Qcomb = (Tsurf-Tamb) / (thkPlumage * (1-abDepth)/kPlumage + 1/h) # combined
'backside' conduction + convection in Watts/m^2
            Tbackside = Qcomb/h + Tamb # temperature of back side of feather
            QradBackSide = SBSigma * emissivity * ((Tbackside + 273)**4 - (Tamb + 273)**4)  # in
Watts/m^2  Rad of energy absorption
            Qnet = Qin - Qv  - Qrad - Qcomb - QradBackSide                                  # net
heat gain during clock tick (W/m^2)

        elif not backSideLossesOn:
            Qin = 1000 * SunsIn * emissivity * viewFactor * (1 - transmissivity)            # in
Watts
            Qnet = Qin - Qv - Qrad                                                          # net
heat gain during clock tick (W/m^2)
```

```
            Tbackside = Tsurf
            Qcomb = 0

        if Tsurf >= 100. and not lFeatherIsDry:    #evaporate any remaining water and subtract
its mass
            dmWater = Qnet / HvWater               # potential water that could be evaporated off
            if dmWater <= mWater:                  # all remaining heat to be used to remove
water so temp won't rise (i.e. too much water)
                Qnet -= dmWater * HvWater          #Qnet is zeroed
                mWater -= dmWater                  # adjust for water removed

            else:
                Qnet -= mWater * HvWater           # remaining water is evaporated with energy
left over (limited to mWater not dmWater)
                mWater = 0
                lFeatherIsDry = True               # feather is now dry

        dTemp = Qnet * dt / ( CpPlumage * mDryFeather* abDepth + CpWater * mWater * abDepth )
#change in temp of feather surface (front side) during clock tick (assumes all mass participates)
            #fixme

        Tsurf += dTemp  #new temp

        doseTotal += Qin * dt

        if Tsurf > 160:
            doseAbove160 += Qin * dt
        if Tsurf > 300:
            doseAbove300 += Qin * dt
        if Qin > Qthresh:
            doseAboveThresh += Qin * dt

        #t +=  dt  #new time
        tSecsVect.append(t)
        TsurfVect.append(Tsurf)
        pathDistVect.append(d)
        IntensityVect.append(SunsIn)


        if lHit160 and Tsurf >= 160:
            timeAbove160 +=dt

        if lHit300 and Tsurf >= 300:
            timeAbove300 +=dt


        if Tsurf>=160 and not lHit160:
            lHit160=True
            timeTo160 = t

        if not lHit160:
            doseBefore160 += Qin * dt

        if Tsurf >= 300 and not lHit300:
            lHit300 = True
            timeTo300 = t


        print '%6.1f  , %6.1f,    %6.1f,   %9.1f,   %9.1f,  %9.1f, %9.1f, %9.1f, %9.1f, %9.1f'\
              %(t, d, SunsIn, Tsurf, Tbackside, Qin, Qnet, Qv, Qcomb, Qrad)

    maxSurfTemp =  max(TsurfVect)
    textLines=[]
```

```
    textLines.append(['RunID: %s'%runID])
    textLines.append(['PathID: %s'%pathID])
    textLines.append(['PathRemarks: %s'%pathRemarks])
    textLines.append(['Temp(ambient degC): %4.0f'%Tamb])
    textLines.append(['Speed(mph): %3.0f'%Vmph])
    textLines.append(['Emissivity: %4.2f'%emissivity])
    textLines.append(['Angle of Incidence (deg): %3.0f'%offVert])
    textLines.append(['View Factor: %4.2f'%viewFactor])
    textLines.append(['Moisture (%%): %3.0f'%(waterFraction * 100)])

    textLines.append(['PlumageThk (mils): %8.1f'%(thkPlumage * 39400)])  #converting from meters
to mils
    textLines.append(['BackSideLossesOn: %s'%(backSideLossesOn)])  #converting from meters to
mils
    textLines.append(['Max Surface Temp(C): %5.0f'% maxSurfTemp])

    print
    for  line in textLines: #
        print line[0]

    print
    print    'Time to  Time above  Time to  Time above (secs)'
    print    '   160C        160C     300C        300C'
    print    ' %5.0f       %5.0f    %5.0f       %5.0f'%(timeTo160, timeAbove160, timeTo300,
timeAbove300)
    print
    print 'h (convection coeff)(W/m^2-K): %7.1f'%h
    print 'Reynolds number:              %9.1f'%(Reynolds)
    print 'Max Surface Temp reached:         %5.0f'% maxSurfTemp
    print 'Flight Speed (ft/min):          %7.1f (%7.1f mph)'% (Vmph*5280/60., Vmph)
    print 'Total flight time (secs):       %7.0f'%(t)
    print 'Dose_total (kW-secs/m^2):       %7.1f'% (doseTotal/60000.*60)
    print 'DoseBefore160 (kW-secs/m^2):    %7.1f'% (doseBefore160/60000.*60)
    print 'DoseAbove160 (kW-secs/m^2):     %7.1f'% (doseAbove160/60000.*60)
    print 'DoseAbove300 (kW-secs/m^2):     %7.1f'% (doseAbove300/60000.*60)
    print 'DoseAboveThresh (kW-secs/m^2):  %7.1f'% (doseAboveThresh/60000.*60)


def makePlot():
    global pathDistVect, IntensityVect, TsurfVect, tSecsVect, towerLocation,
distVect,waterFraction, offVert, runID,emissivity,Tamb, V ,\
           pathID,Vmph,pathRemarks, viewFactor, timeTo160, timeAbove160, timeTo300,
timeAbove300,maxSurfTemp, fname, textLines


    newIntensity = [a for a in IntensityVect]
    pathDistVectMod = [a- towerLocation for a in  pathDistVect]
    distVectMod = [a- towerLocation for a in  distVect]  # these are the markers for the field
map countour measurements
    #tSecsVectMod =  [a- towerLocation/V for a in  tSecsVect]
    maxIntensity = max(newIntensity)
    plt = matplotlib.pyplot

    host = host_subplot(111, axes_class=AA.Axes)
    plt.subplots_adjust(right=0.75)
    plt.subplots_adjust(bottom= 0.180)

    par1 = host.twinx()
    par2 = host.twiny()

    offset = 60
    new_fixed_axis = par2.get_grid_helper().new_fixed_axis
    par2.axis["bottom"] = new_fixed_axis(loc="bottom",
```

```
                                        axes=par2,
                                        offset=(0, -35))

    par2.axis["bottom"].toggle(all =  True)
    par2.axis["top"].toggle(all =  False)


    host.set_ylim(0, maxSurfTemp*1.05)
    par1.set_ylim(0,1.05*maxIntensity)
    host.set_xlabel("distance (m)")
    host.set_ylabel("Surface Temp (degC) (dashed line)")
    par2.grid(True)
    par1.set_ylabel("Field Intensity (kw = #Suns) (solid line)")
    par2.set_xlabel("time(seconds)")

    p1, = host.plot(pathDistVectMod, TsurfVect,'r--')
    p2, = par1.plot(pathDistVectMod,newIntensity)# , label="kW (= Suns)")
    p3, = par2.plot(tSecsVect, TsurfVect, alpha=0)# ,label="time")
    p4, = par1.plot(distVectMod, nSunsVect, 's', markersize=4,
markerfacecolor='blue',markeredgecolor='blue')
    if timeTo160 > 0:
        jjl=host.axhspan(160,160,0.0,0.75,color='r', linewidth=.5)
        jj2=par2.text(tSecsVect[int(len(tSecsVect)*.83)],156,'%4.0f secs to reach 160
degC'%timeTo160,color='r', horizontalalignment='left',
                verticalalignment='top', fontsize = 'x-small')#,transform = host.transAxes)
        jj2=par2.text(tSecsVect[int(len(tSecsVect)*.83)],164,'%4.0f secs
above'%timeAbove160,color='r', horizontalalignment='left',
                verticalalignment='bottom', fontsize = 'x-small')#,transform = host.transAxes)


    if timeTo300 > 0: #p = plt.axhspan(0.25, 0.75, facecolor='0.5', alpha=0.5)
        Tval=300
        jjl=host.axhspan(Tval,Tval,0.0,0.75,color='r', linewidth=.5)
        jj2=par2.text(tSecsVect[int(len(tSecsVect)*.83)],Tval-4,'%4.0f secs to reach
300degC'%timeTo300,color='r', \
                        horizontalalignment='left',
            verticalalignment='top', fontsize = 'x-small')#,transform = host.transAxes)
        jj2=par2.text(tSecsVect[int(len(tSecsVect)*.83)],Tval+4,'%4.0f secs
above'%timeAbove300,color='r', horizontalalignment='left',
            verticalalignment='bottom', fontsize = 'x-small')#,transform = host.transAxes)

    #par1.set_ylim(0, 4)
    #par2.set_ylim(1, 65)


    host.axis["left"].label.set_color(p1.get_color())
    par1.axis["right"].label.set_color(p2.get_color())

    par2Span=(host.axis()[1]-host.axis()[0])/V
    par2.set_xlim(0,par2Span)

   ##plt.title(r'$\mathrm{Histogram\ of\ IQ:}\ \mu=100,\ \sigma=15$')
    plt.title(r'$\mathrm{Feather\ Surface\ Temperature\ along\ Flight\ Path\ }$')



    for  line in enumerate(textLines): #
        ##incr x, incr y
        host.text(0.01, .98-line[0]*.036,line[1][0], \
            horizontalalignment='left',
            verticalalignment='top',
            fontsize = 9,
            transform = host.transAxes)
```

```
    fullFname=str('c:\\mypython\\birds\\%s.png'%fname)
    myStr='saved to '+ fullFname
    print myStr
    plt.savefig('c:\\mypython\\birds\\%s.png'%fname)
    #plt.show()
    appfile= "c:\\program files\\quicktime\\pictureviewer.exe "

    subprocess.Popen([appfile, fullFname] )
    #plt.show()  #Tk causes prolems? after second plot won't close!

if __name__ == "__main__":

    try:
        import math
        import sys
        import datetime
        import math
        import numpy as np
        import matplotlib
        import matplotlib.pylab
        from mpl_toolkits.axes_grid1 import host_subplot
        import mpl_toolkits.axisartist as AA
        from datetime import datetime
        import subprocess
        runID = '%20s'%str(datetime.now())[:19] #'Dummy' #fixme
        fname=runID.replace(':','')
        fname2=fname.replace('.','')
        fname='Bird'+fname2

        textFileName=str('c:\\mypython\\birds\\%s.txt'%fname)
        print 'output is being redirected to : %s'%textFileName
        sys.stdout = open(textFileName,'w')

        print datetime.now().ctime()
        print 'This text file: %s'%textFileName
        print 'program: sys.argv[0] = %s'%sys.argv[0]



        userData()
        setConstants()
        pathData()
        mainLoop()
        sys.stdout = sys.__stdout__
        print 'Time(s)   Dist(m)    Tsurf(C)     Intensity(suns)'
        for a in zip(tSecsVect,pathDistVect,TsurfVect, IntensityVect):
            print '%6.1f  , %6.1f  , %6.1f  ,   %5.1f'%a # (a[0],a[1],a[2])

        print

        for  line in textLines: #
            print line[0]

        print
        print    'Time to  Time above  Time to  Time above (secs)'
        print    '   160C        160C     300C        300C'
        print ' %5.0f       %5.0f    %5.0f       %5.0f'%(timeTo160, timeAbove160, timeTo300,
timeAbove300)
        print
        print 'Max Surface Temp(C):             %5.0f'% maxSurfTemp
        print 'Reynolds number:               %9.1f'%(Reynolds)
```

```
    print 'h (convection coeff)(W/m^2-K): %7.1f'%h

    print 'Flight Speed (ft/min):           %7.1f (%3.1f mph)'% (Vmph*5280/60., Vmph)
    print 'Total flight time (secs):     %7.0f'%(t)
    print 'Dose_total (kW-secs/m^2):       %7.1f'% (doseTotal/60000.*60)
    print 'doseBefore160 (kW-secs/m^2):    %7.1f'% (doseBefore160/60000.*60)
    print 'DoseAbove160 (kW-secs/m^2):     %7.1f'% (doseAbove160/60000.*60)
    print 'DoseAbove300 (kW-secs/m^2):     %7.1f'% (doseAbove300/60000.*60)
    print 'DoseAboveThresh (kW-secs/m^2):  %7.1f'% (doseAboveThresh/60000.*60)
    print 'BackSideLossesOn: %s'%(backSideLossesOn)

    makePlot()
    print 'This text file: %s'%textFileName

    print 'program: sys.argv[0] = %s'%sys.argv[0]

finally:
    sys.stdout = sys.__stdout__  #restore stdout back to normal
    print "done."
```

BIOLOGICAL RESOURCES

	List of Comment Letters	Biological Resources Comments?
1	Inyo County	X
2	Bureau of Land Management	X
3	National Park Service	
4	The Nature Conservancy	X
5	Amargosa Conservancy	X
6	Basin & Range Watch	X
7	Pahrump Paiute Tribe	X
8	Richard Arnold, Pahrump Piahute Tribe	X
9	Big Pine Tribe of Owens Valley	X
10	Intervenor Cindy MacDonald	X
11	Intervenor Center for Biological Diversity	X
12	Intervenor, Old Spanish Trail Association	
13	Applicant, BrightSource Energy, Inc.	X

Comment #	DATE	COMMENT TOPIC	RESPONSE
1	**July 17, 2012**	**Inyo County**	
1.8		Inyo County states objection to the location of mitigation lands in Inyo County.	The Commission acknowledges the limited quantities of privately held lands in Inyo County and appreciates the comments and concerns regarding the proposed mitigation strategy identified in the PSA and FSA. As identified in Condition of Certification BIO-12 the selection criteria for land acquisition for desert tortoise is not restricted to Inyo County but encompasses lands in California that occur within the Eastern Recovery unit or other lands approved by the CPM in consultation with the regulatory agencies. This will allow flexibility should the applicant elect to purchase lands outside of Inyo County.
1.18		Add new Condition to enhance public land for mitigation purposes.	The use of public lands for mitigation purposes is presented on pages 4.2-85 and 4.2-86 of the PSA. The current mitigation approach is required to mitigate the direct loss of habitat to desert tortoise from the development of the proposed project. This section identifies that in order to fully mitigate impacts to desert tortoise mitigation lands must be preserved and managed for the sole benefit of the target species. Land acquisition and preservation removes existing threats to resources on the acquired lands and is considered an important mechanism to achieving the full mitigation standard. However, land acquisition alone is inadequate if the land is not managed and enhanced for the benefit of the species. Condition of Certification BIO-12 requires the acquisition, enhancement, and long term preservation and management for the benefit of desert tortoise and other associated wildlife and vegetation. While staff concurs that further benefits to desert tortoise could be achieved through land management actions, most public lands, with the exception of wilderness areas, are managed for multiple public uses that can accommodate actions inconsistent with established mitigation requirements. Mitigation for non-listed CEQA species, such as non-listed special-status plants, is more flexible,

1.19		Revise BIO-22 to enhance public lands rather than use private lands for compensatory mitigation.	Thank you for your comment. The discussion regarding the use of public lands for compensatory mitigation is described in response to comment 1.18.
1.21		Revise BIO-18 to include the Inyo/Mono Agricultural Commissioner when developing annual fees.	Thank you; BIO-18, subsection 6, was revised as suggested.
1.22		Revise BIO-23 per language provided.	BIO-23 subparagraph "Definitions" was revised as suggested, with several additions.
1.23		Replace subparagraph 3 of BIO-23 with provided language.	The BIO-23 subparagraph on "Thresholds" was revised as suggested, with the exception that a drawdown threshold based on rooting depths of mesquite cannot be established without examining soil cores and monitoring the mesquite response to a declining water table. Mesquite is a deep-rooted species that roots at variable depths depending on the soil profile, soil chemistry, depth to water table, soil oxygen, maximum effective rooting depth relative to existing background groundwater declines, and other factors. There are a few atypical examples of mesquite rooting to depths near 60 meters, but 15 meters is more typical and rooting may be limited to as little as 3m in settings with restrictive soil layers (Stromberg pers. comm.; and others). Because of the geologic and hydrogeologic complexity of the project vicinity, staff expects that rooting depths are quite variable and no single threshold could be applied without resulting in unintended mesquite losses, and no studies have been conducted in the area that could inform such a threshold. Staff did an extensive literature review prior to the PSA, and consulted several recognized experts in groundwater pumping impacts on southwestern phreatophytes (see Stromberg pers. comm.; Wilhoughby pers. comm; Keeler-Wolf pers. comm.; Froend pers. comm.; Showers pers. comm., and others. See also Silva et al. 1989; Martinez et al. 2009; Crampton et al. 2006; Stromberg et al. 1992; Fisher et al. 1973; Heitschmidt et al. 1988; Ansley et al. 1989; Steinberg 2001; Phillips 1963; Virginia et al. 1976; and Bleby et al. 2010). BIO-23 was revised, however, to include a provision for revising the drawdown threshold when evidence is provided, based on soil core investigation and monitoring, that a different threshold is warranted, subject to review and approval by the CPM in consultation with BLM and the Inyo Water Department.

1.24		Revise BIO-23 subparagraph 13 per provided language.	COC BIO-23 included a requirement to map groundwater-dependent vegetation and springs within the 1-foot drawdown contour in Water Supply Figure 23 (see BIO-23 subparagraph 14, PSA p. 4.2-238-239). However, the recommended additional language was accepted, with a few additions, and added to BIO-23 in the FSA.
1.25		Revise the first 2 paragraphs of BIO-24 per provided language.	Thank you; BIO-24 has been revised accordingly.
1.26		Revise the first 2 paragraphs of BIO-24 verification language per provided language.	Thank you; BIO-24 has been revised accordingly.
1.27		Revise BIO-26 verification language as directed.	Condition of certification LAND-2 addresses the financial assurances related to project closure and decommissioning. Please refer to condition of certification LAND-2 (Land Use Section) and BIO-26 for revised language regarding development of draft and final closure plans. The Energy Commission would issue final approvals.
1.73a		Management of wildlife is compliant with Policy 8.1	Thank you for your comment. This information will be provided to the decision makers.

1.83a		Project is noncompliant with Goal WR-3; groundwater drawdown may impact vegetation in the region.	Staff accepted many of the Water Department's suggested edits to BIO-23, with the exception of the comment uner 1.23. Staff discussed the differences, and to the satisfaction of the Inyo County Water Department. With the revisions, conditions of certification are compliant with Inyo County General Plan Goal WR-3, and will ensure the project protects and restores environmental resources in Inyo County from significant adverse effects of groundwater withdrawal.
1.83a		Project is noncompliant with Policy BIO-1.2/Preservation of Riparian Habitat and Wetlands	With the FSA revisions to BIO-23 and BIO-24 suggested by Inyo County (and others), the project is compliant with Inyo County General Plan Policy BIO-1.2 for Preservation of Riparian Habitats and Wetlands, and will ensure the project protects and restores environmental resources in Inyo County from significant adverse effects of groundwater withdrawal.
1.84b		Groundwater drawdown may significantly impact the Stump Springs ACEC and other dependent vegetation (Policy BIO-1.2)	Staff accepted the new or revised conditions of certification with the following exceptions: see responses to comment 22 and comment 23. Staff discussed the differences with Inyo County's water department, and concluded that with the revisions to COC BIO-23 and COC BIO-24 the conditions of certification are now compliant with Inyo County General Plan Policy BIO-1.2. The revisions to BIO-23 and BIO-24 will ensure that the project preserves and protects important riparian areas and wetlands identified by the County (Stump Springs ACEC).
1.85		If offset mitigation for sensitive species is infeasible, then the project impacts may be significant and immitigable.	The PSA and FSA contain several compensatory mitigation requirements. The project owner will have the opportunity to mitigate offsite for project impacts via condition BIO-17. Offsite mitigation that fully mitigates effects of solar flux on avian species has not been identified by staff or applicant, and staff believes the project may not achieve federal LORS compliance. The Committee has the responsibility of ultimately determining the significance of the LORS violation.
1.91a		Condition BIO-23 needs clarification of methodology and declaration of thresholds.	BIO-23 was revised to provide greater clarification and more sensitive field measures of drought-stress, based on consultation with Stromberg (pers. comm.) and others.
1.91b		Applicant should be allowed to resume pumping if a factor other than pumping can be shown to contribute to groundwater drawdown.	BIO-24 was revised with a provision that if adequate evidence was provided, based on monitoring data, that the project was neither the cause nor a contributor to a drawdown, the project could resume pumping, subject to the CPM approval, in consultation with BLM Nevada and BLM California soil and water state leads, and botanists, and the Inyo County Water Department.
1.91c		The use of reference plots in monitoring groundwater dependent vegetation must be enhanced.	The use of reference plots was revised in BIO-23; background trends can be established from baseline data collected at the near-project plots and a trend determined by updating the baseline annually until the groundwater monitoring wells show a project-related drawdown at the project boundary.

1.91d		The project owner should prepare an inventory of groundwater dependent habitat.	The applicant submitted a detailed mapping of groundwater-dependent vegetation in Data Response Figure 48-1 (CH2 2011g.). BIO-23 was revised according to the suggested edits, with a few additions. Staff disagrees, however, that -- in the absence of site-specific studies -- that a single quantitative threshold can be uniformly applied across the study area for any given resource due to the geologic and hydrogeologic complexity, and past and present groundwater use. Consequently, staff chose a more conservative approach and established a threshold based on the smallest detectable and statistically significant drawdown. BIO-24 was revised, however, with a provision that if adequate evidence was provided, based on future monitoring data, that the project was neither the cause nor a contributor to a drawdown, the project could resume pumping, or reduce or modify pumping to sustainable levels, subject to the CPM approval, in consultation with BLM Nevada and BLM California soil and water state leads, and botanists, and the Inyo County Water Department.
Comment #	**DATE**	**COMMENT TOPIC**	**RESPONSE**
2	**July 16, 2012**	**Bureau of Land Management**	
2.1		The cumulative effects analysis should take into account all proposed development within the groundwater basin…	Staff contacted BLM Nevada and BLM California for a list of cumulative renewable energy projects, and other projects affecting the local groundwater aquifer; these cumulative impacts were quantified quantitatively in the Water Supply section of the PSA and FSA. A qualitative cumulative effects analysis of other past and present groundwater impacts, including historical impacts from agricultural pumping, were analyzed thoroughly in the "Cumulative Impacts" section (a separate chapter, see PSA pp. 4.2-168-171.
2.2		Requests additional clarification of BIO-23, and how a 20% decline in vegetation vigor would be determined.	Stromberg and Wilhoughby (pers. comm.) felt a 20 percent decline in biomass and crown density (vigor indicators) was a good threshold *assuming* the water table would recover immediately after pumping stopped. Hydrogeologists from CDFG (Custis pers. comm.), Inyo County, and others indicated a high probability that the water table would not recover immediately. Consequently, monitoring guidelines were revised to utilize more sensitive field measures, i.e., earlier warning signs, including xylem (stem) water potential, gas exchange rate, and transpiration rate. However, the threshold was revised, based on consultation with Inyo County hydrologists and others to require pumping to stop if the groundwater trigger alone is exceeded: See the specific threshold language in BIO-23 and BIO-24.
2.2		BLM objects to 2-parameter threshold and recommends trigger based on drawdown or vegetation impacts.	Similar comments were received from Inyo County Water Department and others. BIO-23 and BIO-24 thresholds were modified to require pumping stop if the drawdown trigger alone is exceeded, at which point the project must provide evidence, based on monitoring data, that the project was not the cause or that a reduced or modified pumping would not exceed the threshold. Monitoring wells located between the project boundary and project wells will provide the project with ample lead time, or warning of an impending drawdown sufficient to exceed the threshold.

Comment #	DATE	COMMENT TOPIC	RESPONSE
4	**July 21, 2012**	**The Nature Conservancy**	
4.12		TNC objects to the trigger conditions of BIO-23 and BIO-24	Thank you. Similar comments were received from BLM, Inyo County, and others. More sensitive field measurements of drought-stress were added based on consultation with Stromberg (pers. comm.). However, the threshold was revised to require the project stop, reduce, or modify pumping based only on exceedance of the 0.5 ft drawdown at the project boundary. Please see WATER SUPPLY Condition of Certification **WS-6.**
4.12a		Lag time after reaching 20% vegetation decline will allow further degradation of the ecosystem	Stromberg and Wilhoughby (pers. comm.) felt a 20 percent decline in biomass and crown density (vigor indicators; not indicators of plant mortality) was a good threshold *assuming* the water table would recover immediately after pumping stopped. Hydrogeologists from CDFG (Custis pers. comm.), Inyo County, and others indicated a high probability that the water table would not recover immediately. Consequently, the threshold was revised based on more sensitive measures, i.e., earlier warning signs, and to require pumping to stop if the groundwater trigger alone is exceeded. The project can then provide evidence, subject to approval by the CPM in consultation with BLM and Inyo County hydrologists and botanists, and based on monitoring using more sensitive field measurements, that the 0.5 ft. drawdown is not causing an adverse effect. See specific language in **BIO-23** regarding thresholds.
4.13		TNC objects to 2-parameter threshold and recommends basing remedial action on drawdown alone.	Inyo County, BLM, and The Amargosa Conservancy expressed similar concerns about the potential for the 2-parameter threshold to result in unintended adverse effects. The BIO-23 and BIO-24 triggers were revised to address these concerns. See the revised threshold in **BIO-23**.
Comment #	**DATE**	**COMMENT TOPIC**	**RESPONSE**
5	**July 21, 2012**	**The Amargosa Conservancy**	
5.2a		States that only 1 trigger, a decline in monitoring well levels is necessary before shutting off pumps.	Inyo County, BLM, and The Nature Conservancy expressed similar concerns about the 2-parameter threshold. The trigger in BIO-23 and BIO-24 were revised accordingly. See specific language in **BIO-23** regarding thresholds.

Comment #	DATE	COMMENT TOPIC	RESPONSE
6	**July 23, 2012**	**Basin and Range Watch**	
6.23		Stump Springs could be impacted by invasive weeds	Staff consulted BLM on strategies to address the potential for the spread of weeds into adjacent BLM lands from contaminated vehicles (project employees and contractors) using area roads. Condition of Certification BIO-18 (Weed Management Plan) was revised to address this additional concern, and includes requirements for cleaning vehicles and equipment operating in infested areas, and worker awareness training about weeds, their consequences, common vectors, and how to avoid inadvertent spread of weeds on, for example, contaminated vehicles and equipment. BIO-18 also includes a requirement to compensate the local agricultural commissioners for increased monitoring and abatement costs for weeds introduced on area roads from project employees and contractors commuting from areas with known infestations of A-rated (highly invasive) pest plants (Pahrump and Las Vegas areas).
6.24		Requests Swainson's hawk be added to the species list for the project	Thank you for the supplemental information regarding the observation of Swainson's hawk at Stump Springs. Surveys conducted by the applicant in support of the application for certification including avian point counts and golden eagle surveys did not detect this species at the project site. Nesting habitat for this species is not present on the project site however nesting could occur in areas outside the project footprint. Staff reviewed the photos provided in the comment letter and consulted with ornithology experts familiar with the ecology of this species. Based on this review staff is unconvinced that the bird is a Swainson's hawk. Some of the prominent features of this species were not detected. A concise list of these is provided below. These include: 1. Yellow eyes (gray or blue-gray in juveniles, brown in adults); 2. Lack of apparent chest markings; 3. A slight hint of a belly (lower abdomen) band in the ground-perched individual; 4. Lack of apparent terminal tail band in the individual perched atop the small tree; and 5. Barring of the undersides of the primaries and secondary feathers seem far less heavily streaked than would be expected of a Swainson's hawk.
6.25		Provides photos of a juvenile raptor observed at the site, and requests that Swainson's hawk be added to the project's species list	See response to comment 6.24.

6.26		Provides a reference for solar flux mortality	The applicant has investigated effects of concentrated solar energy on bird carcasses and presented its findings to staff during a workshop on August 28, 2012. Carcasses of three species (chickens, doves, and quail) were exposed to various energy flux level for periods of 10 to 30 seconds. Burned or singed feathers and discolored or dried muscle tissue were observed in the carcasses exposed for 20 to 30 seconds to flux levels above 50 kW/m2. These effects were not observed in carcasses exposed to lower flux levels for the same intervals. No data on longer exposures were available. The applicant notes that feather temperatures in living birds probably would not reach the same temperatures during the same exposure periods due to convective heat dissipation by air motion surrounding them. Staff believes that the levels of feather and tissue damage reported for these exposures at 50 kW/m2 or above would be likely to kill living birds. In addition, staff believes that shorter exposures at these energy flux levels would be likely to cause other tissue or feather damage that could impair flight or vision or cause physiological effects and ultimately cause or contribute to mortality from other causes (e.g., reduce ability to forage, escape from predators, or thermoregulate). Staff also believes that longer exposures to lower energy flux levels are likely to cause feather damage or physiological effects.
6.27		States that HHSEGS may impact birds that use the relic white fir forest on Kingston Peak.	Staff agrees that it is possible for avian species within the project vicinity to be potentially impacted from collision, electrocution or solar flux.
6.28		The PSA fails to analyze flux on individual species	The PSA presented adequate information on solar flux based on the best available information. However, the FSA was revised to provide greater disclosure and specificity for individual birds.
6.29		Requests a study on which birds could be impacted by flux, and requests flux be considered	Please see response to comment 6.28.
6.3O	Requests solar flux impacts be studied during operatio		Condition of certification **BIO-15** requires the project owner to comply with the provisions of an Avian, Bat, and Golden eagle Protection Plan. This includes a monitoring program to evaluate the effects of solar flux on birds from the operation of the facility.
6.31		Mitigation for golden eagle has not yet been developed	The PSA presented a variety of mitigation to reduce impacts to nesting birds and golden eagles. Specific mitigation regarding this species is included in Condition of Certification BIO-15 which requires the development of an Eagle Management Plan which provides prescriptive actions to enhance habitat or reduce threats to this species.

6.32		Bighorn sheep utilize the project site and the project will serve as a barrier.	Bighorn sheep are known from the project region and have been documented to use valley floors to support intermountain movement. As described in the PSA the site has not been classified as an important or designated movement corridor rather as an area likely subject to periodic use by bighorn sheep. The presence of a horn fragment and potential pellets were identified in Section 5.2.6.7.3 of the AFC and support the periodic use of the site by this species. However, there is no indication the site is an important pathway nor will the project pose a complete barrier to movement. Suitable habitat will remain north and south of the project post development.
6.33		A study and monitoring plan for bighorn sheep movement corridors should be implemented	Impacts of the proposed project would not pose a complete barrier to dispersal for this species and the project is not located in a constrained linkage area. Please see response to comment 6.32 for additional information on bighorn sheep.
6.34		Kit fox should be treated as a potential species of special concern	For the purposes of the PSA this species is being treated as sensitive in accordance with the regulations identified in Title 14. Staff disclosed potential; project impacts and PSA presents reasonable minimizations measures to avoid the loss of this species.
6.35		The applicant should be required to test for canine distemper in kit fox, and develop further plans.	Condition of certification **BIO-14** currently requires the applicant to fund disease testing for sick or injured kit fox.
6.36		Mitigation for shadscale scrub should be at a 3:1 ratio.	The Commission recognizes the importance of fully mitigating impacts to desert tortoise in compliance with the requirements of the California Endangered Species Act. However, the Commission believes that the mitigation ratios identified in the PSA are adequate to mitigate project impacts to desert tortoise. Staff considered a wide range of biotic and abiotic factors when developing the mitigation approach for desert tortoise. These included but were not limited to the existing vegetation communities; annual plant composition; percentage and distribution of weeds; presence of soil crusts; level of site disturbance; soil composition; proximity to adjacent lands supporting desert tortoise populations; and proximity to developed lands. Staff took into consideration the number and distribution of desert tortoise on the project site; the landscape level scale of the project; the projects location; the sites importance for connectivity and regional movement and gene flow; and the cumulative effects of other projects. Staff weighed these factors in the development of mitigation ratios in light of the fact that project development ultimately results in a net loss of habitat range wide. To address this loss the Conditions of Certifications identified in the PSA, including **BIO-8, BIO-9, BIO-10, BIO-12,** and **BIO-13**, require a combination of minimization, salvage, and relocation activities; land acquisition, preservation and enhancement; and management activities such as regional raven control. Staff considers these measures to be adequate to fully mitigate impacts of the proposed project to desert tortoise.

6.37		Expresses concern over state law and moving tortoise near the NV border.	Desert tortoise will not be transported across State lines. Currently, any desert tortoise that is translocated to lands east of the site will be placed on a segment of land located in California that is contiguous with natural lands located in Nevada. Staff considers the ecological value of this approach to be feasible provided the desert tortoises are not diseased and the land maintains a reasonable level of protection from future development.
6.38 NEW		Provides several new species of rare plants for the project species list.	Twenty-seven of the species on the list provided by the commentor were not on the applicant's table of special-status potentially occurring on the project (DR 63 1-A, Appendix B, Table B). The surveys for special-status plants were comprehensive and conducted in accordance with California Department of Fish and Game and California Native Plant Society botanical survey guidelines. Because the surveys were floristic, spanned several years, and included spring and fall surveys, and crews were highly qualified, it can be assumed that any additional species not on the original target list, if present, would have been detected. Nevertheless, the applicant indicated they would address these additional species in a data response.
Comment #	**DATE**	**COMMENT TOPIC**	**RESPONSE**
7		**Pahrump Paiute Tribe**	
7.7 NEW		Concerns about displacement of wildlife (all animals) and mortality associated with displacement. Also concerned about groundwater use and its impact on springs, and the cumulative effects of groundwater use. Request involvement in the development of plans and mitigation	Thank you for the comment regarding the displacement of wildlife. In an effort to minimize project related impacts to wildlife from displacement the PSA identified a series of conditions that provide for the salvage, relocation and preservation of natural lands for the benefit of both plant and wildlife species. Conditions of certifications **BIO-8, BIO-9, BIO-10, BIO-12,** and **BIO-13,** require a combination of minimization, salvage, and relocation activities; land acquisition, preservation and enhancement; and management activities to ensure the land is persevered and managed to foster the long term survival of wildlife. Currently, these plans are reviewed by the State and federal wildlife agencies and approved by the Commission. The Commission believes the plans will receive adequate review by the natural resources agencies and will be available for review by the public once they are completed. Staff shares the Pahrump Paiute Tribe's concerns about groundwater impacts and cumulative impacts to springs. The PSA and FSA (Biological Resources and Water Supply sections) conclude that the project pumping alone, and the cumulative impact of all area projects on groundwater, springs, and mesquite are significant. Conditions of certification **BIO-23**, and **WATER SUPPLY-6** will ensure the project's effects are not significant by requiring monitoring of vegetation and groundwater levels, and if a 0.5 ft. drawdown threshold at the project boundary is exceeded, the project must stop pumping. Pumping cannot resume unless the project provides evidence, subject to review and approval by the CPM in consultation with hydrologists and botanists from BLM and the Inyo Water Department, that the drawdown is not affecting the mesquite, or that a reduced pumping amount is sustainable. Staff welcomes the Tribe's input on the plans and mitigation developed to protect wildlife, groundwater, and the important resources supported by groundwater. See also **WATER SUPPLY-8** in the Water Supply section of the FSA.

Comment #	DATE	COMMENT TOPIC	RESPONSE
8	**July 23, 2012**	**Richard Arnold, Pahrump Paiute Tribe**	
8.8		Local populations of bighorn sheep must be protected and preserved.	Bighorn sheep are known from the project region and have been documented to use valley floors to support intermountain movement. As described in the PSA, the site is not located in an important or designated movement corridor but may support periodic use by bighorn sheep. Staff considers the current conditions of certification identified in the PSA to be adequate to reduce impacts to bighorn sheep.
Comment #	**DATE**	**COMMENT TOPIC**	**RESPONSE**
9	**July 21, 2012**	**Big Pine Tribe of Owens Valley**	
9.2		Groundwater use may impact desert vegetation and other sensitive plant associations.	Staff recognizes the importance of the mesquite habitats to wildlife, to local biodiversity, to resource agencies and the public, as well as the cultural significance of the species. Concerns about impacts to these groundwater-dependent ecosystems have been expressed by nearly every commenter: BLM California; BLM Nevada; Inyo County; the Pahrump Paiute Tribe; Nevada Department of Wildlife; Basin & Range Watch; The Nature Conservancy; Amargosa Conservancy; Center for Biological Diversity; Nye County Water District; local resident Cindy Macdonald, and others. Staff considered all comments -- scoping comments and PSA comments -- and consulted numerous experts in the development of the conditions of certification **BIO-23** (Groundwater-dependent Vegetation Monitoring). Staff has incorporated many of the recommendations into the analysis and revised conditions in the FSA. Staff is confident that the revised conditions will ensure these important resources are protected. Please also see response to comment 14.5 from the Pahrump Paiute Tribe.
9.3		States that groundwater drawdown impacts to vegetation are significant and the groundwater monitoring plan is insufficient to prevent this.	A similar concern about the threshold in **BIO-23** and **BIO-24** from the PSA was expressed by several commenters. The 20 percent decline in mesquite vigor referred to in the PSA is a measure of drought stress in individual mesquite; not a measure of plant mortality or a decline in the total vegetative cover of mesquite. The experts consulted by staff in the development of that threshold believe it is a non-lethal threshold from which the mesquite could readily recover. However, this was based on the assumption that the groundwater levels would recover to pre-threshold levels within a year or two following cessation of pumping. In recognition of the possibility that groundwater levels may not restore that quickly, staff has identified -- based on consultation with recognized experts -- other more sensitive measures of drought stress, i.e., the earliest warning signs and the most objective quantifiable indicators.

Comment #	DATE	COMMENT TOPIC	RESPONSE
10	**July 21, 2012**	**Intervenor Cindy MacDonald**	
10.1 (PAGE 1-1)		Significance thresholds are not quantified.	The threshold for determining significance are based on the biological resources present or potentially present within the proposed project area in consideration of the proposed projects effects to those resources. Generally, the thresholds for determining significance are based on Appendix G of the CEQA Guidelines (CCR 2006) and performance standards or thresholds identified by the Energy Commission staff. The determination of whether a project has a significant effect on biological resources is based on the best scientific and factual data that could be reviewed for the project.
10.2		What criteria were used to develop significance thresholds, and subsequent evaluation of mitigation efficacy.	Significance thresholds are based on if a fair argument can be made that the project will result in substantial adverse effects to a given resource. See Response to Comment 10.1 for further information regarding significance thresholds.
16.1 (P 3-24)		Are impact studies of dust, emissions, and dust suppressant on desert tortoise available.	The Commission is aware of a number of studies, including the Desert Tortoise Recovery Plan, which acknowledge the detrimental effects of fugitive dust to desert tortoise. As described in the PSA dust would pose a potential impact to species occurring on and adjacent to the project area. Project related effects of dust to desert tortoise and their habitat were considered a significant impact in the PSA and Conditions of Certification were proposed to reduce or minimize these impacts. Condition of Certification BIO-8 contains a variety of requirements to reduce and control fugitive dust. The condition also specifies the use on non-toxic soil binders to reduce the potential for ingestion by desert tortoise. On site monitoring and reporting would also be required to reduce the potential for large dust plumes occurring outside the project area.
16.2 (pg 3-24)		What is the zone of impact to tortoise and other species from project emissions.	The PSA addresses potential impacts to a variety of plant, animal, and vegetation communities that occur on and adjacent to the project site. Project impacts include an analysis to desert tortoise that are directly lost on the project site or indirectly to lands adjacent to the site. Desert tortoise or other species that are in close the proximity to the project site have the potential to incur a higher degree of direct and indirect impacts from disturbance, dust, noise, or weeds. For the proposed project a specific buffer was not identified however surveys for desert tortoise included zone of influence surveys in order to ascertain the distribution of animals in adjacent lands. Similarly, surveys for burrowing owls included all areas within 150 meters of the project boundary. Generally staff considers the project buffer on a species specific basis and considers the type of resource, distribution, and the species or communities tolerance of disturbance to direct and indirect impacts. For desert tortoise staff considered animals detected by the applicant within the 150 meter buffer to warrant consideration in the PSA.

17.2 (pg 3-27)		Are there any types of vegetation potentially affected by nutrient absorption (Nox)	Please see rare plant discussion.
17.9 (pg 3-27)		Could the project potentially reduce pollinators, thereby affecting pollination of food crops	Although Solar flux created by the project has the potential to adversely affect insects it is unlikely to result in any large scale meaningful loss to insect populations in the region. Animal pollinators in North America include bees, butterflies, moths, wasps, beetles, ants, bats, and hummingbirds (Black et al. 2009). In a review of research addressing the reproductive requirements of twenty-six rare or endangered plants species in the western United States, Tepedino et al. (1997) found that in order to set fruit most of the plants required pollination, usually by native bees. Most native bees are relatively low flying and would not likely be adversely affected by the solar flux. The most likely adverse effect would be from habitat degradation, mowing, herbicide application and dust. For agricultural processes honey bees provide the bulk of crop pollination in the United State, yet the number of managed bee hives has declined by 60 percent in the United States since 1950 (Winfree et al. 2007. Nonetheless, recent research(much of it in Yolo County) on crop pollination, has demonstrated that native bees also make a significant contribution to crop pollination-in some cases providing all of the pollination required when enough habitat is available (Greenleaf and Kremen 2006, Klein et al. 2007). Based on this information it is unlikely the project would result in offsite effects to pollinators. <u>Literature cited</u>: Black, H, S., Shepard, M., Vaughan, M., LaBar, C., and Hodges, N. 2009. Yolo County natural Heritage Program (HCP/NCCP) Pollinator Conservation Strategy prepared by the Xerces Society for Invertebrate Conservation Portland Oregon and Sacramento California. Greenleaf, S. S., and C. Kremen. 2006. Wild bees enhance honey bees' pollination of hybrid sunflower. Proceedings of the Royal Society (Series B) 103(37): 13890-13895. Klein, A.M., Vaissiere, J. H. Cane, I Steffan-Dewenter, S. A. Cunningham, C. Kremen and T. Tscharntke. 2007 Importance of pollinators in changing landscapes for world crops. Proceedings of the Royal Society-B Biological Sciences 274 (1608): 303-313. Tepedino, V, J. 1979. The importance of bees and other insect pollinators in maintaining floral species composition. In Great Basin naturalist memoirs no. 3: the endangered species: a symposium; 7-8 Dec 1978. Pp. 39-150 Provo: Brigham Young University. Winfree, R., N. M. Williams, J. Dushoff, and C. Kremen. 2007. Native bees provide insurance against ongoing honey bee losses. Ecology Letters 10: 1105-1113.
10.3 (pg 20-1)		How can the project be screened in a way that won't attract wildlife.	Staff does not consider the use of vegetation to screen the project to pose a significant additional risk to wildlife when compared to the expected operational effects to wildlife. While it is likely that some disturbance tolerant species will nest in the trees used to screen the facility the prohibition on trees recommended by the commenter is not warranted.

10.4		How many trees would be required to screen the project and what is water requirement.	The landscaping plan for the proposed project has not been finalized. This information including the type of trees proposed for screening will be identified prior to the operation of the facility.
10.5		Do special status plants on or adjacent the project site require pollinators?	With the exception of the Torrey's joint-fir (Ephedra torreyana), which is wind-pollinated, all of the remaining 10 species are insect-pollinated. In a review of research addressing the reproductive requirements of twenty-six rare or endangered plants species in the western United States, Tepedino et al. (1997) found that in order to set fruit most of the plants required pollination, usually by native bees. Please see response to comment 17.9 for further information.
10.6		Would pollination still occur in the event the project is permitted and built?	Staff consulted University of California, Davis entomologist and professor Lynn Kimsey regarding potential impacts to pollinators (Kimsey pers. comm.). Dr. Kimsey noted that any of the rare plant pollinators, which would be primarily bees, would fly at elevations below approximately 10 feet above ground level (below the mirrors) unless they were pollinating trees. Because none of the special status plant species are trees, and no trees occur on the site (with the exception of a few scattered low-growing mesquite less than 8 ft high) impacts to special status species' pollinators would not be significant. Additionally, no special-status plant mitigation will occur within the heliostat fields. Plant occurrences within the solar fields are presumed to be significantly affected due to long-term indirect effects from mowing, mirror-washing, dust control, alteration of the surface hydrology, herbicide drift, shading. These impacts will be mitigated offsite through preservation or restoration (see **BIO-19** and **BIO-20**). Dr. Kimsey noted that some dispersing forms, such as dragon flies, painted lady butterflies could be affected, but the impact on painted ladies would not be significant "because they migrate north out of much of the desert areas." Based on the wide variety of pollinators that occur in the desert staff expects that pollination will continue to occur. For additional information please see response to comment 17.9.
3.1 (pg 20-5)		How many fairy shrimp species and occurrences exist in Pahrump Valley	A review of existing literature did not find any comprehensive study describing the species of fairy shrimp expected to occur in the Pahrump Valley. However, approximately 23 species of fairy or brine shrimp are known to occur in California (Bauder et al. 1998) and five species are known from 100 miles from the project site (Eriksen and Bell, 1999). These include, ranging from farthest to closest, the giant fairy shrimp (Branchinecta gigas), Colorado fairy shrimp (Branchinecta coloradensis), San Francisco brine shrimp (Artemia franciscana), versatile fairy shrimp (Branchinecta lindahli), and the alkali fairy shrimp (Branchinecta mackini). Tadpole fairy shrimp (Lepidurus lemmoni) are also known from Nevada and are common in plays across the great basin. None of these species have California or federal status. Based on the photo included by the commenter it is likely the shrimp identified as most similar to a tadpole fairy shrimp. Based on the known distribution and habitat requirements of sensitive fairy shrimp; the PSA found that sensitive species were not likely to occur on or near the proposed project site. Literature Cited:

3.2 (pg. 20-5)		What habitat elements could protected species of fairy shrimp utilize on the project site.	In arid climates, such as that found in the Mojave desert, fairy shrimp inhabit pools that may last from as little as three days to as long as four months, with much more variable levels of dissolved salts than found in pools that found in humid climates (Brown and Carpelan 1971). It is possible that during periods of heavy or prolonged rainfall that small depressions, road ruts or gullies may support conditions that allow for the presence of common fairy shrimp. It is also likely that fairy shrimp occur in the dray lake west of the project site and that portions of the project site are periodically inoculated with cysts carried by mammals or shorebirds. Therefore it is possible small pooled areas could support fairy shrimp during extremely wet years. In response to these and other comments staff conducted biological surveys to investigate the potential for the presence of pooled areas after recent July monsoonal activity. Staff inspected the site after a minimum one-inch rainfall event and did find small pooled areas; however most of these pools had lost standing water within 24 hours. Nonetheless without extensive sampling it is not possible to determine whether fairy shrimp are present on the project site. Staff considered the low number of potential pooled areas and the fact that sensitive fairy shrimp do not occur in the region to not warrant additional studies on the project site. Based on the known distribution and habitat requirements of sensitive fairy shrimp; the PSA found that protected fairy shrimp were not likely to occur on or near the proposed project site.
3.3 (pg. 20-5)		Would installation of the project result in permanent loss of shrimp on the project site.	Construction of the proposed project could result in the loss of fairy or tadpole shrimp should they occur on the project site. However, the PSA concluded that listed or sensitive fairy shrimp are not expected to be present and the site does not support large playas or pooled areas important for the conservation of these species.
Comment #	**DATE**	**COMMENT TOPIC**	**RESPONSE**
11	**July 23, 2012**	**Intervenor Center for Biological Diversity**	
11.12		The PSA fails to quantify kit fox density on the project site.	The PSA provides adequate information to analyze project level effects to desert kit fox. Neither CEQA (Pub. Resources Code §21000 et seq.), nor the CEQA Guidelines (14 Cal. Code Regs §14000 et seq.), require that protocol level surveys be performed and incorporated into a Draft EIR. Association of Irritated Residents v. County of Madera (2003) 107 Cal.App.4th 1383. As described in the PSA, the “environmental setting” is based on expert review and analysis of existing information provided by the applicant. Desert kit fox is known to occur on the project site and the applicant mapped potential burrows during previous surveys of the project site. Staff also noted the presence of this species on the site and acknowledges that population densities likely vary on an annual basis as a result of prey base, presence of coyotes and existing mortality. For the purposes of the PSA it is not required to account for every animal on the project site. Staff has treated this species as sensitive in accordance with the regulations identified in Title 14 and the PSA presents reasonable minimizations measures to minimize the loss of this species. Further, a complete assessment of all potential dens for this species will be mapped prior to project disturbance.

11.13		Kit fox should be fitted with radio trackers during passive relocation.	Under current CDFG regulations these animals may not be trapped by the project owner. Condition of Certification **BIO-14** provides for the development of a kit fox management plan to monitor the effects of passive relocation and to respond to potential disease outbreaks.
11.14		The project will result in the displacement of kit fox and further spread canine distemper.	The PSA acknowledges the project will displace desert kit fox and result in a net loss of habitat for this species. However, it is unknown and speculative if the project will either result in the manifestation or spread of distemper. However, to monitor the possible consequences of this threat the PSA included Condition of Certification **BIO-14** which requires monitoring, adaptive methods to reduce this threat.
11.15		The PSA fails to quantify kit fox territories or provide avoidance measures.	The PSA provides adequate information to analyze project level effects to desert kit fox and has provided conditions of certification to reduce potential impacts to this species. For further information please see response to comment 11.12.
11.16		The desert tortoise on the project site constitute a unique genetic group, and must have minimization/mitigation measures in place.	The information regarding the unique ecology and genetics of desert tortoise located in the Eastern Mojave Recovery Unit recovery unit was reviewed by staff and is referenced in the PSA. As identified in the USFWS Recovery Plan (USFWS 2011) the recovery unit designation does not afford the species additional legal protection. However, staff considered a variety of factors in the development the adequate conditions of certification that would be required to fully mitigate impacts to desert tortoise. This included the data provided by Murphy et al (2007) regarding the statement "that integral to desert tortoise recovery is maintaining the genetic variability of the species and sufficient ecological heterogeneity within and among populations." The PSA has proposed extensive mitigation requirements including, preconstruction surveys, fencing, translocation and the acquisition of compensatory lands at ratios ranging from 1:1 for shadscale communities to 3:1 for areas supporting relatively intact creosote bush scrub communities. Based on these and other factors staff considers the proposed Conditions of Certification to fully mitigate impacts to desert tortoise and their habitat.
11.17		If desert tortoise are translocated, a monitoring or research study should be implemented per the USFWS's recommendations as augmentation.	The commenter states the USFWS Desert Tortoise Recovery Office's Scientific Advisory Committee states that "translocation is fraught with long-term uncertainties…and therefore, any translocations should be accompanied by specific monitoring or research to study the effectiveness or success of the translocation….." The PSA acknowledges this concern and includes this language in the analysis of potential impacts to desert tortoise from translocation activities. The PSA also provides information from the USFWS and other researchers that suggest translocation may be an effective management tool to minimize impacts to desert tortoise from development projects under certain circumstances. In order to minimize impacts to desert tortoise that are present in the project area the PSA indicates that any translocation activities would be required to comply with the provisions of an agency approved and adopted translocation plan. This plan is a requirement of Condition of Certification BIO-10 which specifies a series of reporting, tracking, monitoring, and disease testing. In addition, this plan is expected to follow the most recent guidelines on translocation. Staff considers the existing conditions of certification to be adequate and considers translocation to be an accepted tool for minimizing project related impacts to desert tortoise on the project site.

11.18		A project alternative should be developed, or higher survey standards applied; impacts to tortoise are not identified due to failure to develop a translocation plan.	The current PSA includes alternatives that have reduce impacts to biological resources. This includes a reasonable range of alternatives as defined in CEQA. As with any alternatives analysis the Commission must consider impacts to the suite of issue areas. Surveys completed by the applicant complied with the USFWS's recommended guidelines for conducting surveys in desert tortoise habitat. The estimates of adult and subadult desert tortoise were presented by the applicant in the AFC and further estimates were calculated by staff to represent the theoretical numbers of juveniles and eggs that may occur on the project site. While the applicant is currently suggesting that the initial numbers used to calculate desert tortoise may overestimate the number of desert tortoise on the project site; staff maintains the original estimates are valid based on the expected use of the site by desert tortoises in adjacent areas. As presented in the PSA these calculations are only theoretical estimates of the expected number of desert tortoise that could be present and are presented using the best available scientific data on this species. Staff disagrees that the submittal of a completed translocation plan is required for the analysis of impacts to desert tortoise. The commenter stated that the conditions of certification in the PSA improperly defer mitigation by requiring the completion of future plans. The commission considers the conditions of certification in the PSA to be legally adequate and the analysis reflects a good faith effort to investigate and disclose environmental impacts of the proposed project (see CEQA Guidelines § 15003 (i) & 15144) and used survey information provided by the applicant. The PSA also identified conditions of certification that require the preparation of a more precise plans after certification of the FSA, which is acceptable under CEQA provided that practical considerations make it difficult to develop the plan at this stage of the planning process and the agency "commits itself to eventually devising mea¬sures that will satisfy specific performance criteria articulated at the time of approval" (Sacramento Old City Association v. City Council (1991) (229 Cal.App.3d 1011, 1028 1029). See also CEQA Guidelines (14 Cal. Code Regs 15123.4 (a) (1) (B)), which provides that mitigation measures may specify performance standards that would mitigate the significant effect of the project and that may be accomplished in more than one specific way. In addition, the desert tortoise translocation plan would also require coordination with the USFWS and would likely be a condition of the Biological Opinion.
11.19		A desert tortoise translocation plan should incorporate USFWS' latest guidance.	Thank you for the comment regarding the Translocation Plan. As specified in Condition of Certification BIO-10 the project owner is required to develop and implement the plan consistent with current USFWS approved guidelines. The intent of the condition is to utilize the most recent guidance available at the time of the licensing. As this Plan will be developed in consultation with the USFWS no revision to the condition has been made.
11.2O		Four recommendations are provided to augment a desert tortoise translocation plan.	Staff considers the development and implementation of the proposed Translocation Plan specified in Condition of Certification BIO-10 to be consistent with current USFWS approved guidelines. Therefore the recommended changes have not been adopted.

11.21		A mitigation ratio of 5:1 is necessary to mitigate impacts to desert tortoise.	The Commission recognizes the importance of fully mitigating impacts to desert tortoise in compliance with California Endangered Species Act requirements. However, the Commission disagrees with the contention that the mitigation ratios identified in the PSA are not adequate to mitigate project impacts to desert tortoise. Staff considered a wide range of biotic and abiotic factors when developing the mitigation approach for desert tortoise. These included but were not limited to the existing vegetation communities; annual plant composition; percentage and distribution of weeds; presence of soil crusts; level of site disturbance; soil composition; proximity to adjacent lands supporting desert tortoise populations; and proximity to developed lands. Staff also took into consideration the number and distribution of desert tortoise on the project site; the landscape level scale of the project; the projects location; the sites importance for connectivity and regional movement and gene flow; and the cumulative effects of other projects. Staff weighed these considerations in the development of mitigation ratios in light of the fact that project development ultimately results in a net loss of habitat range wide. To address this loss the Conditions of Certifications identified in the PSA, including BIO-8, BIO-9, BIO-10, BIO-12, and BIO-13, require a combination of minimization, salvage, and relocation activities; land acquisition, preservation and enhancement; and management activities such as regional raven control. Staff considers these measures to fully mitigate impacts of the proposed project to desert tortoise.
11.22		Bighorn sheep movement corridors must be avoided.	Bighorn sheep are known from the project region and have been documented to use valley floors to support intermountain. As described in the PSA the site has not been classified as an important or designated movement corridor rather as an area likely subject to periodic use by bighorn sheep. The presence of a horn fragment and potential pellets were identified in Section 5.2.6.7.3 of the AFC support use of the site by this species. However, the project site is located several miles away from the adjacent mountains which are used for spring forage; and while bighorn sheep may use any portion of the desert floor for intermountain movement the project will not act as a complete barrier to sheep movement.
11.23		What effect might project construction (specifically heliostats) have on bighorn sheep.	The use of this technology has not been well studied and it is speculative whether the reflectivity from the heliostats will adversely bighorn sheep in the adjacent mountains. Due to the position of the heliostats it is likely that bighorn sheep will not be exposed to damaging levels of solar flux.
11.24		Requests an analysis of effects of groundwater drawdown on bighorn sheep water sources.	The PSA adequately addressed potential impacts to bighorn sheep from the potential reduction in groundwater levels.

11.25		Rare plants must be avoided or other conservation sites must be selected.	After analysis of the spring 2012 survey results, staff concluded that impacts to four species were significant --- and mitigable. Avoidance within the solar fields is not an acceptable mitigation option due to the likelihood of long-term decline from indirect effects. There are adequate opportunities for offsite mitigation through preservation and restoration, however. This was analyzed by examining field forms and database reports of site quality and threats, and through a GIS analysis of ownership and management threats and opportunities. **BIO-20** (Special-status Plant Compensatory Mitigation) requires offsite mitigation for impacts to four of the 11 species through preservation or restoration. The condition includes specifications for site selection criteria, mitigation ratios, and performance standards. **BIO-19** (Special-Status Plant Avoidance & Minimization Measures) contains BMPs for protecting the nine rare plant occurrences in very close proximity to the project. The threat of indirect impacts from weeds is addressed in **BIO-18** (Weed Management Plan), and BIO-8 and BIO-18 include measures for fire prevention (accidental fire can have catastrophic ecological consequences in the desert). Staff considered avoidance along the eastern boundary but concluded that because the avoided area would be situated along a strip between the project and the stateline and a different habitat type (dunes versus the gravelly creosote bush scrub where rare plants are thriving), it lacked the connectivity and sustainability that preservation of other offsite occurrences could provide; occurrences better situated to protect the california range of those species. To address the net loss of the project site occurrences, the project could restore any of the at-risk occurrences (according to specific criteria contained in **BIO-20**) or mitigate through acquisition and preservation under a conservation easement at a ratio of three occurrences for each S1-rank species, and two occurrences for every S2-rank species. Mitigation would occur locally, largely, as that is where most of the offsite occurrences were found, i.e., in Pahrump Valley, Mesquite Valley, California Valley, Stewart and Chicago valleys.
11.26		Transplantation of rare plants should be accompanied by a monitoring plan, and made publically available.	Staff considers transplantation an unacceptable strategy for mitigation because of the high rate of failure of such plantings across the state, and because the strategy is untested for the affected species. **BIO-20** requires mitigation in the form of offsite preservation and restoration, and includes performance standards, monitoring and reporting requirements for restoration projects, and selection criteria for preservation (acquisition). All plans, which are subject to review and approval of the CPM (in consultation with Energy Commission botanists) will be made publicly available on the Compliance page of the project website. The adequacy of the conditions can be assessed through the detailed specifications and performance standards. The **FSA** includes a detailed description of the methods staff used to assess significance and the potential for offsite mitigation.
11.27		Seed collection and curation should be added to existing protective measures.	Staff agrees that seed collection and curation should be added as a contingency measure and BIO-20 has been revised accordingly.

11.28		Burrowing owl data on territories is unclear. A management plan for burrowing owl must be made publically available.	The applicant provided supplemental information regarding burrowing owl surveys including a Draft Burrowing Owl Mitigation Plan in Data Response 2e. This plan is available on the project website and will be reviewed by staff prior to its adoption as a component of Condition of Certification **BIO-17**. Staff reviewed these reports and concluded that it was not possible for the applicant to conclude that the site does not support breeding owls. Although avian point counts were conducted near areas where burrowing owl sign was observed, and no owls were detected during these surveys, the observations were not completed in accordance to CDFG and Burrowing Owl Consortium standards. Information provided by the applicant in Data Response 2e did indicate that CDFG suggested that since the site has been documented to support burrowing owls additional surveys to establish their breeding was not waranted. The PSA documents this information and concludes that in accordance with the previous observations burrowing owls are present on the project site at least seasonally and compensatory mitigation is required for the loss of foraging habitat. Although the applicant suggested that between two and five territories may occur on the project site the PSA concluded that because territories often overlap and are usually much larger in arid climates the project should provide compensatory mitigation for a mini mum of two territories.
11.29		How will golden eagle forage habitat be mitigated.	The PSA acknowledges that the construction of the proposed project will result in the net loss of foraging habitat for golden eagles. To off-set the loss of habitat the project owner is required to obtain compensatory mitigation lands for desert tortoise. This requires the acquisition, enhancement, and long term management of existing lands. The intent of the measure is to reduce threats to those lands and increase the potential prey base for eagles. Condition of Certification **BIO-15** also requires the project owner to develop and implement a management plan for golden eagles. This will include specific enhancement actions, mechanisms to reduce threats to golden eagles, and long term monitoring for collision, electrocution, or mortality from solar flux.
11.3O		Golden eagles' behavior can be impacted by project construction/operation, and must be mitigated.	The PSA addressed project level impacts to golden eagles and provided Conditions of Certification to reduce those threats where possible. For additional information please see response to comment 11.29.
11.31		The PSA fails to analyze impacts of solar flux on golden eagles.	The PSA presented an analysis of operational effects to birds including the risk of collision, electrocution, and solar flux. Although the analysis does not specifically address each species of bird the content focuses on the breadth of species which may occur in the project area. However, in to address the comment the FSA will include revised language on direct, indirect, and operational impacts to golden eagles.
11.32		The PSA failed to address transmission line impacts to golden eagles.	Please see response to comment 11.31.

11.33		The CEC must consider alternatives that would minimize impacts to golden eagle.	CEQA states that an EIR shall describe a range of reasonable alternatives to the project, or to the location of the project, which would feasibly attain most of the basic objectives of the project but would avoid or substantially lessen any of the significant effects of the project, and evaluate the comparative merits of the alternatives (CEQA Guidelines 15126.6(a)).The PSA presents a reasonable range of alternatives that would have varying effects to golden eagles and other biological resources. This included one alternative located in an area of degraded farm land. However, for many species, including the golden eagle, their wide distribution and use of open plant communities limits the ability to avoid impacts to this species.
11.34		Impacts to groundwater dependent vegetation in the Amargosa Valley must be evaluated; currently mitigation and analysis is incomplete.	The **FSA** and PSA include an inventory of the groundwater-dependent resources throughout the Amargosa Basin and Death valley Regional Groundwater Flow System. The analysis of potential impacts to groundwater in a wider context is available in the Water Supply section of the FSA. The analysis of impacts to Amargosa Valley is not as extensive as the analysis for the local groundwater-dependent resources because Water Resources staff concluded there would not be a significant impact to groundwater in areas distant from the project.
11.35		Mitigation for the desert tortoise must occur within the Eastern Mojave Recovery Unit.	Condition of Certification **BIO-12** requires the project owner to acquire compensatory mitigation lands for desert tortoise in the Eastern Mojave Recovery Unit or other location approved by the CPM in consultation with the CDFG and USFWS. This flexibility was provided in order to allow the regulatory agencies and the applicant to select lands that are deemed important to contribute to desert tortoise connectivity and because there may be a shortage of available mitigation lands within Inyo County. Provided the lands meet the requirements of the CDFG and USFWS staff considers this a viable mitigation option at this time. Staff also considers the nesting of mitigation to be appropriate should the lands support the target species and its habitat.
11.36		A potential mitigation site should be monitored prior to acquisition to determine species density.	The preservation of offsite lands is an acceptable mitigation strategy for the purposes of CEQA (see CEQA Guidelines, Section 15370) and the PSA is not required to include an analysis of the exact locations of proposed mitigation lands (see California Native Plant Society v. City Rancho Cordova [March 24, 2009] 172 Cal. App. 4th 603); however, Condition of Certification **BIO-12** outline specific performance standards for mitigation lands including: requirements for acreage, types of habitat to be protected, the potential locations, and minimum qualifications of conservation easement holders. The condition does not require the completion of protocol surveys prior to adoption provided the lands meet the basic criteria and are approved by the CPM in consultation with the CDFG and USFWS.
11.37		Mitigation offsets must be managed by a competent land management entity.	Condition of Certification **BIO-12** requires that the project owner transfer the title or conservation agreement of the mitigation lands to CDFG or other non-profit organization. Condition of Certification **BIO-12** does not authorize the use of public lands (i.e., lands held by the BLM) for mitigation purposes.

11.38		Management plans referenced in the PSA are not yet available for public review.	The required plans identified by the commenter are not deferred mitigation. The Conditions of Certification which require the completion of various plans or studies are legally adequate and reflects a good faith effort to investigate and disclose environmental impacts of the project (see CEQA Guidelines § 15003 (i) & 15144). The analysis used all available resources to determine where additional surveys are required in the future. The PSA also identified Conditions of Certification that require the preparation of a more precise plan after certification of the FSA, which is acceptable under CEQA provided that practical considerations make it difficult to develop the plan at this stage of the planning process and the agency "commits itself to eventually devising measures that will satisfy specific performance criteria articulated at the time of approval" (Sacramento Old City Association v. City Council (1991) (229 Cal.App.3d 1011, 1028 1029). See also CEQA Guidelines (14 Cal. Code Regs 15123.4 (a) (1) (B)), which provides that mitigation measures may specify performance standards that would mitigate the significant effect of the project and that may be accomplished in more than one specific way. In addition, the applicant has provided draft forms of the Burrowing Owl Mitigation Plan and Bird Monitoring study.
11.39		Is identical to comment 11.38.	See comment 11.38
11.42		Impacts to waters of the state are significant and alternative sitting must be considered.	Staff and CDFG agree that impacts to Waters of the State are significant. Staff coordinated with the CDFG regional office and the Lake and Streambed Alteration Program (LSA) in the analysis of impacts, the verification of the delineation, and the development of mitigation requirements contained in **BIO-22** (State Waters Compensatory Mitigation). The waters will be mitigated at a ratio of 2:1 within the Pahrump Hydrologic Unit or adjacent basins and, combined with other measures for protecting downstream and upstream waters from indirect effects, will ensure the impacts are mitigated to a level less than significant.
11.46		Cumulative impacts to desert tortoise stemming from translocation must be addressed. Cumulative impacts to bighorn sheep and groundwater pumping must also be addressed.	The PSA considered the cumulative project effects to desert tortoise and acknowledges that translocation of desert tortoise may occur for some of the proposed projects. However, without project specific data the conclusions drawn would be speculative. Nonetheless, the Commission considers the cumulative impact analysis presented in the PSA to be adequate and comply with the requirements of CEQA.

11.47		The Desert Renewable Energy Conservation Plan (DRECP) has identified the project site as a location for conservation.	Staff reviewed the preliminary maps for the DRECP and the site appears to be east of the proposed conservation area. However, even if the project site was proposed within an identified area of Conservation Opportunity, this would not preclude permitting or construction of the facility. Project analysis is completed on a case by case bases and compensatory mitigation is developed for each area. Projects located in conservation areas will likely have higher mitigation ratios because of the proposed conservation value of the area.
11.48		The PSA fails to evaluate the DRECP as a LOR.	The DRECP is currently in a draft form and has not yet been adopted by the REAT agencies.
Comment #	**DATE**	**COMMENT TOPIC**	**RESPONSE**
13	**July 23, 2012**	**Applicant, BrightSource Energy, Inc.**	
13.1		What performance thresholds does the PSA use, and how should Appendix G be applied.	The lead agency has the discretion to identify the significance criteria for a given project and develop thresholds for significance. Section 15064(b) of the CEQA guidelines identifies that "The determination of whether a project may have a significant effect on the environment calls for careful judgment on the part of the public agency involved, based to the extent possible on scientific and factual data. An ironclad definition of significant effect is not always possible because the significance of an activity may vary with the setting. For example, an activity which may not be significant in an urban area may be significant in a rural area." For the case of the HHEGS project staff utilized a variety of factors in determining whether a project would be a significant impact. This includes but was not limited to the scale and magnitude of the project; the current status, range, and population of the resource; the temporal effects to the specific resource; and whether the project would result in long term cumulative effects. In addition, staff relied on precedent from previous projects completed by the Commission and other lead agencies; existing management plans; polices, and professional experience.

13.2		The site is more disturbed than the PSA acknowledges	The PSA presented a thoughtful and accurate description of the physical and biological characteristics that are present on the project site. The biological resource section of the PSA based this information on data provided by the applicant in the AFC, supplemental biological technical reports, aerial photography, and physical inspections of the project site. The PSA describes the physical setting objectively and does not suggest the site supports a pristine desert ecosystem. However, although the AFC indicates the site has been previously disturbed and developed for a housing subdivision only a portion of the site appear to have been subject to ground disturbance. These include a network of roads, an orchard, a small area surrounded by an earthen berm, and several larger areas that indicate either grading or agriculture. The new data provided by the applicant regarding disturbed areas will be incorporated into the FSA after a review of the updated calculations. Staff also objects to the applicant's mischaracterization of habitat quality on the project site. Despite the presence of weeds which are acknowledged in the PSA as locally abundant in some areas, most of the lands present on the project site are relatively intact and are characterized by areas supporting biotic soil crusts, native shrub cover, and a diverse assemblage of annual plant life. Most of the heavily disturbed areas are located along the primary access roads that form a grid pattern across much of the site; however, lands within the existing road system continue to support large areas of native vegetation. For example, Section 5.2.6.3.1 of the AFC indicates that for creosote bush scrub communities " the understory consists of a large variety of mainly annual forbs, a few species of native grasses, and a few species of non-native grasses" . Staff confirmed this during biological surveys of the project site and a review of the annual plant species detected during botanical surveys conducted by the applicant. In addition, based on a review of information provided in the AFC approximately 131 native annuals and shrubs occur on the project site.
			This includes approximately ten plants considered rare by the California Department of fish and Game and California Native Plant Society. Similarly, approximately 63 species of birds, 18 reptiles, and nine mammals were detected or expected to occur on the project site. Notwithstanding the presence of invasive weeds, and some heavily disturbed areas a large the presence and distribution of native plants and animals indicates the site supports a fairly diverse assemblage of wildlife which are not associated with more heavily disturbed areas. In regards to habitat for the desert tortoise the commenter suggests that the existing levels of weeds and disturbance renders portions of the site unsuitable for desert tortoise. Staff presented a discussion of weeds and their adverse effects to both desert ecosystems and the desert tortoise in the PSA. However, only limited areas of the projects site are infested to levels that would likely preclude use by desert tortoise. As previously described most of the project site still supports a broad assemblage of native annuals and perennial plant species. While weeds do reduce habitat value there is no data available which supports the applicants position that the abundance of weeds on the project site excludes use by desert tortoise.

13.3		The site is not a bighorn corridor.	Bighorn sheep are known from the project region and have been documented to use valley floors to support intermountain. As described in the PSA the site has not been classified as an important or designated movement corridor rather as an area likely subject to periodic use by bighorn sheep. The presence of a horn fragment and potential pellets were identified in Section 5.2.6.7.3 of the AFC and support use of the site by this species. The contention presented by the commenter that the horn may have been dragged or deposited at the project site by predators, storm flows, or other mechanisms is speculation and not supported by other data. Further the argument that multiple pellet piles for bighorn sheep were not observed may have merit; however there is no indication that survey crews were focusing on the detection of bighorn sheep scat. As noted in the AFC the pellets and horn fragment were detected as incidental observations during botanical surveys. Regarding the recent observation of potential bighorn sheep by residents of Charleston View; staff considers the observations legitimate and not inconsistent with sporadic use of the valley floor to support intermountain movement.
13.4		Mitigation for desert tortoise should be negotiated further, and a revised translocation plan will be submitted to the Energy Commission.	Staff reviewed the proposed compensatory mitigation plan for desert tortoise provided by BSE and determined the plan has some merit but was overly dismissive of habitat quality and potential use of the site by desert tortoise. However, staff would consider continued negotiations on this subject. For additional discussion on this subject please refer to Report of Conversation (ROC) Monasmith C Huntley TN-66649.pdf. on the Commission web site. Additional language regarding mitigation and translocation is presented in the FSA.
13.5		The PSA does not treat species correctly pursuant to ESA and CESA.	The PSA properly evaluated project level impacts to common, sensitive and listed plants and wildlife. Where impacts were considered significant Conditions of Certification were recommended to reduce or minimize adverse effects to these species. In some circumstances this included the acquisition and management of compensatory mitigation lands. The PSA does not attempt to bundle mitigation together or require the applicant to mitigate collectively. Rather the PSA allows nesting of mitigation where land acquisition required to mitigate for desert tortoise may also satisfy mitigation requirements for species such as rare plants, owls, or State waters.

13.6		The FSA should not declare a species rare unless the statement is supported.	The PSA properly evaluated project level impacts to common, sensitive and listed plants and wildlife. Where impacts were considered significant Conditions of Certification were recommended to reduce or minimize adverse effects to these species. Staff considers landscape level project effects to many common species to pose a significant impact and have the potential to cumulatively effect the populations of some species.
13.7		BrightSource does not agree with descriptions of certain plants are "rare"	“Rare” and “rarity” are generic, commonly used terms in the scientific literature used to describe scarcity, a statement about the geographic distribution and population sizes of a particular species. The terms “threatened” and “endangered” typically refer to human activities and other processes that are increasing a species’ vulnerability to extinction, and the degree of endangerment. Rarity is based upon patterns of distribution and abundance. There are three basic kinds of rarity based on these two factors: 1) restricted in distribution, but locally abundant (e.g., Pahrump Valley buckwheat); 2) more widespread, but never abundant; and 3) localized and not abundant. The affected species’ rarity and endangerment is clearly demonstrated in Biological Resources Table 15, and in the spatial representation of these species’ highly restricted range in California (Biological Resources Figure X). The case for rarity and concern is also reflected in the CNDDB Element Rank, an index of extinction risk within the state.

13.8		Significant criteria were incorrectly applied to plants on the project site.	CEQA provides protection not only for State-listed or Federally-listed species, but "also for any species that can be shown to meet the criteria for listing (CEQA Guidelines Section 15380(d)) "*A species not included in any listing identified in subdivision (c) shall nevertheless be considered to be endangered, rare or threatened, if the species can be shown to meet the criteria in subdivision (b).* " CEQA requires a "mandatory finding of significance" for special-status species that meet CEQA's definition of "rare" or "endangered," regardless of their formal listing status under the Native Plant Protection Act (NPPA), California Endangered Species Act (CESA) or any other law: "*When any of the following conditions occur the lead agency shall find that a project may have a significant effect on the environment which will require a Mandatory Finding of Significance...When a project has the potential to substantially degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, reduce the number or restrict the range of an endangered, rare or threatened species.*" Cal. Code Regs., tit. 14, § 15380, subds. (b) and (d). The CEQA Guidelines are located at Cal. Code Regs., tit. 14, § 15000 et seq. The CEQA Guidelines independently define a species to be "rare" when "either: (A) Although not presently threatened with extinction, the species is existing in such small numbers throughout all or a significant portion of its range that it may become endangered if its environment worsens; or (B) The species is likely to become endangered within the foreseeable future throughout all or [a] significant portion of its range and may be considered "threatened" as that term is used in the Federal Endangered Species Act." (Cal. Code Regs., tit. 14, § 15380, subd. (b)(2).) CEQA independently defines a species to be "endangered" when "its survival and reproduction in the wild are in immediate jeopardy from one or more causes, including loss of habitat, change in habitat, overexploitation, predation, competition, disease, or other factors . . . ." (Cal. Code Regs., tit. 14, § 15380, subd. (b)(1).) The project would eliminate a substantial portion of the entire California range of four species (gravel milk-vetch; Wheeler's skeletonweed; Preuss' milk-vetch, and Torrey's joint-fir); with impacts ranging from 18% to 50% of all documented occurrences in California for species whose entire distribution is limited to 19 to 25 occurrences in a very small region of the eastern Mojave. The degree of the impact, relative to the entire California distribution is shown in Biological Resources Table 15 and depicted spatially in Biological Resources **Figures 9 and 10.**

13.9		Different data sources are used in determinations of "rare" for plants.	The applicant incorrectly states that “The CNDDB process is well-documented in the PSA, though the reliance on NatureServe to access CNDDB information is new” and “the California Native Plant Society list process is not well-described”. The NatureServe rank is, in fact, synonymous with the CNDDB rank and CNPS rank have been included in the CNDDB reports and CDFG Special Plants List since the early 1980s (Bittman pers. comm.). The CNDDB Element Rank (NatureServe rank) is described in the PSA on page 4.2-131 and in the CDFG *Special Plants List (* CNDDB 2012b). The definitions of the ranks are provided in the footnotes to Biological Resources Table 15 (PSA p. 4.2-134). The applicant incorrectly states that the CNPS (CRPR) listing process is not well documented. PSA page 4.2-131 summarizes the process “The Rare Plant Status Review groups—a consortium of over 300 botanical experts from government, academia, non-governmental organizations, and private consultants—is jointly managed by CNPS and CDFG; the “CNPS List” rank assignments are the product of a collaborative effort and not solely a CNPS assignment.” The CNPS website , a site familiar to the applicant’s botanical consultants and accessible to the general public, provides over 18 pages of details on the Rare Plant Program and Rare Plant Status Review Groups, including: the rare plant status review process; the relationship between CNPS and CDFG in establishing the lists, or ranks; staff and leadership; the Rare Plant Program Committee; contact information; a flow chart of the process; instructions for recommending an addition, list change, deletion, or name change; a description of the regional plant status review groups; a description of the rare plant status review public forum; and sample forms for proposed additions and proposed status changes. CDFG, BLM, USFWS, California Board of Forestry and other agencies have long regarded CNPS as an authority on rare and endangered plants of California. The CNPS *Inventory* is considered by CDFG and other agencies as a primary source of information for determining whether non-listed plants meet CEQA’s independent definitions of “rare” and “endangered,” thus triggering a mandatory finding of significance, environmental review, and the implementation of all feasible mitigation measures to reduce or avoid impacts to such special-status, non-listed plants.

13.1O		Condition BIO-19 should be deleted.	Condition of Certification BIO-19 merely specifies best management practices (BMPs) to be implemented *onsite* that will protect the nine rare plant occurrences offsite - and in close proximity to the project boundary - from the indirect effects of operation, including: the spread of weeds already present onsite; chemical drift relating to weed management and dust control; fugitive dust from mowing and road maintenance, increased risk of wildfire from project operation and increased traffic on area roads; sedimentation of washes offsite from erosion of channels onsite and upstream, and other impacts discussed under "Indirect Impacts to Special Status Plants". A map showing the location of the vulnerable offsite rare plant occurrences near the project boundary is provided in Biological Resources Figure 10. The avoidance measures in BIO-19 are standard BMPs for protecting oaks, streams, wetlands, and other sensitive resources adjacent to work activities, and recommended in the Energy Commission BMP Manual (CEC 2010). A similar condition was adopted for at least three other Energy Commission-licensed projects (Blythe, Genesis, Palen) to protect rare plants adjacent to the project boundary.
13.11		Mitigation ratios for plants are not legally supported.	The four (of 11) species determined to require mitigation are among the most imperiled of the non-listed species in California, as indicated by the CNDDB Element Rank (NatureServe rank), and documented in CNDDB (2012a),the CNPS *Inventory* (CNPS 2012), and the Consortium of California Herbaria (CCH 2012). Staff provided a clear, science-based justification for the mitigation of rare plants based on CNDDB Element Rank in the FSA. Staff chose to use these ranks as a basis for the mitigation ratios because they are an index of a species' extinction risk, based on rarity, threats, and population trend based on a widely recognized methodology used by CNDDB and other natural heritage programs around the world (Master et al. 2009). The same mitigation strategy and a similar condition of certification was required to minimize special-status plant impacts on at least three other Energy Commission-licensed projects (Blythe, Genesis, Palen). **BIO-20** requires the project acquire and preserve 3 offsite occcurrences for every S1-rank ("critically imperiled") species affected, and 2 offsite occurrences for every S2-rank ("imperiled") species affected. **BIO-20** also includes an option for mitigation through restoration of an at-risk population.
13.12		Condition BIO-21 should be deleted.	**BIO-21** (Botanist Qualifiecations) lists six specific mitigation measures that require implementation by a qualified botanist; all other mitigation measures relating to plants may be carried out by the Designated Biologist. It is not a full time position; it merely indicates which taks require expertise, and lists the minimum qualifications. **BIO-21** was revised to allow for more tasks to be carried out by the Designated Biologist, as requested by the applicant in the July 2, 2012 public workshop.

13.13		The PSA is overly conservative in treatment of burrowing owl.	Burrowing owls are considered a species of special concern (CSC) by the CDFG and are treated accordingly in the PSA. As defined by the CDFG a species is considered a CSC if it meets a set of criteria that include but are not limited to "is experiencing, or formerly experienced, serious (noncyclical) population declines or range retractions (not reversed) that, if continued or resumed, could qualify it for State threatened or endangered status." The species are also protected by both the federal Migratory Bird Treaty Act and relevant CDFG codes including 3503 and 3503.5. As such the PSA identifies potential impacts to this species on the project site in accordance with CEQA and provides conditions of certification to reduce but not avoid impacts to the species. The applicant also suggests that burrowing owl is common based on their distribution and due to the fact they are commonly detected during surveys for other energy commission projects. Notwithstanding the current conservation designation assigned to this species by the CDFG and BLM habitat for burrowing owls continues to be lost through development. A ranking of the most important threats to the species included loss of habitat, reduced burrow availability due to rodent control, and pesticides (James and Espie 1997). In addition, in a 2003 report by the U.S. Fish and Wildlife Service, breeding burrowing owls were thought to be largely extirpated during the last 10-15 years from multiple areas in California, including Napa, Marin, San Francisco, Santa Cruz, and Ventura counties, coastal San Luis Obispo county and Coachella Valley (http://burrowingowlconservation.org/PR12-09-2010.html). The observation of this species on other Energy Commission projects in no way substantiates the claim by the applicant that this species is abundant in California. The applicant indicated that the requirement for the acquisition of 600 acres of compensatory mitigation is unprecedented. Staff acknowledges that the current approach to mitigation has not been applied to previous Energy Commission Projects. The current mitigation approach was developed after review of The Staff Report on Burrowing Owl Mitigation (CDFG 2012) which indicates that "reversing declining population and range trends for burrowing owls will require implementation of more effective conservation actions, and evaluating the efficacy of the Departments' existing recommended avoidance, minimization and mitigation approaches for burrowing owls. The requirement in the PSA based the mitigation requirement on a subset of the potential home range of burrowing owls in an arid ecosystem. Because burrowing owls can exhibit high site-fidelity and reuse burrows year after year (County of Riverside 2008), replacing a portion of the realized home range was determined to be an effective strategy for reducing project impacts to this species. Citations: James, P.C., and R.H.M. Espie. 1997. "Current Status of the Burrowing Owl in North America: An Agency Survey." Journal of Raptor Research 9:3–5.
13.14		The PSA did not identify what "groundwater dependent vegetation" is.	The PSA explicitly defines "groundwater-dependent vegetation" on page 4.2-37 to 44 of the PSA, beginning with a discussion of characteristic groundwater-dependent habitats, and then describing in detail the groundwater-dependent resources contained within an approximate 5 mile radius of the project. A list of groundwater-dependent plant species known to occur in the 5-mile area centered on the project was provided in subparagraph 14 of Condition of Certification **BIO-23** (Groundwater-dependent Vegetation Monitoring). The list of plant species contained in **BIO-23** has been added to the setting section of the FSA, as well as definitions of "obligate" versus "facultative" groundwater-dependent species.

13.15		CEQA analysis should not be performed for project effects occurring in Nevada.	This issue was addressed by the Commissioner's in the "ORDER RE: APPLICANT'S MOTION IN LIMINE" dated and posted October 2, 2012 (Docket No. 11-AFC-02).From the Order: "This [Public Resources Code section 21080(b)(14)] does not exempt in-state project activities whose impacts are only felt out-of-state. For example, if a project dug a well inside California and the project's water consumption from the well caused an impact in another state but not in California, then that out-of-state impact must be analyzed under CEQA because the impact was generated in California."
13.16		The PSA requires the project to monitor groundwater with a precision that is not possible. The requirement to monitor is unprecedented.	The applicant incorrectly states that groundwater level monitoring requires a precision that is not possible (staff responded to the same comment at the June 14, 2012 public workshop), and in the Water Supply sections of the PSA and FSA. Water Resources staff concluded that because water levels on the project site are stable (unlike offsite wells in other parts of the basin), the 0.5 foot drawdown can be detected with nearly 100 percent confidence. The requirement to monitor groundwater impacts and to stop, modify, or reduce pumping if demonstrated by monitoring to adversely affect sensitive resources is hardly unprecedented. Not only was an almost identical condition imposed on another Energy Commission-licensed project (Palen Solar Power Project) – a project that was ultimately financed – but it is now common practice to require monitoring, management, and mitigation plans for groundwater impacts; so common that the term "3M plans" is used by practitioners (Harrington pers. comm.; Custis pers. comm.). As an example, the monitoring plan for the Coso Hay Ranch Water Extraction Project in Inyo County requires monthly monitoring at 10 well locations for the life of the 30-year project, identifies triggers at each well, some as low as 0.2 ft, and specifies that pumping must stop, change, or reduce pumping: "Requiring that observed drawdown values [at intervening monitoring wells],over time be kept below these defined trigger levels would provide an early warning system, allowing for the system operations to *change, to reduce or stop pumping* before maximum acceptable drawdown levels propagated down the valley to Little Lake."
13.17		BIO-23 is over conservative in its approach to groundwater monitoring.	As indicated under comment 13.16, above, requirements for groundwater monitoring are not unprecedented; nor is the scale of the groundwater monitoring specified "astounding"; in addition to a nearly identical condition adopted for an Energy Commission-licensed project, similar monitoring plans have been imposed by the County of Inyo (Harrington pers. comm.). The monitoring requirements in **BIO-23** and **WATER SUPPLY-8** (Groundwater Level Monitoring) are consistent with the specifications for monitoring recommended by hydrologists from BLM Nevada and BLM California, Inyo County, The Nature Conservancy, and Amargosa Conservancy (BLM 2012a; BLM 2012b; Inyo 2012a; Inyo 2012b; TNC 2012b; ARM 2012a).
13.18		Conditions BIO-23 and BIO-24 should be deleted.	Comment noted.

13.19		Condition BIO-22 reflects inaccurate acreages of waters of the State.	The PSA was clear that the total acres of state waters on the project was a preliminary figure, pending a field verification of the delineation. Staff and CDFG conducted a field verification and identified a number of new, previously unmapped features. Additionally, the delineated road puddles and roadside ditches with no hydrologic connection to a stream were removed from the total. The applicant has since revised the delineation maps and calculated new acreage totals (23.21 ac. jurisdictional state waters onsite; 0.45 ac. upstream of the project and within CA).
13.20		The PSA overstates potential project effects upon desert washes.	CDFG typically requires 3:1 mitigation for permanent impacts and 1:1 mitigation for temporary impacts (Vyverberg pers. comm). The FSA acknowledges that the project will maintain at least some portion of the hydrologic functioning of the stream by not diverting them around the site. This is reflected in the reduction of the mitigation from 3:1 to 2:1. However, staff and CDFG are united in their assessment that habitat functions and values will be eliminated for all but the most disturbance-tolerant species due to perimeter exclusion fencing, partial grading, noise, glare, and human disturbance, vegetation mowing, etc.
13.21		Avian survey information is complete.	In response to staff questions the applicant continues to provide additional data regarding solar flux modeling, avian risk and potential mortality associated with the facility. This information will be included in the **FSA**.

13.22		Solar flux impacts will not be "substantial".	The applicant has provided a variety of useful information regarding potential impacts to birds from solar flux. This includes a study that investigated effects of concentrated solar energy on bird carcasses presented during a workshop conducted on August 28, 2012. Staff considers the data useful but not conclusive. Carcasses of three species (chickens, doves, and quail) were exposed to various energy flux level for periods of 10 to 30 seconds. Burned or singed feathers and discolored or dried muscle tissue were observed in the carcasses exposed for 20 to 30 seconds to flux levels above 50 kW/m2. These effects were not observed in carcasses exposed to lower flux levels for the same intervals. No data on longer exposures were available. The applicant notes that feather temperatures in living birds probably would not reach the same temperatures during the same exposure periods due to convective heat dissipation by air motion surrounding them. Staff believes that the levels of feather and tissue damage reported for these exposures at 50 kW/m2 or above would be likely to kill living birds. In addition, staff believes that shorter exposures at these energy flux levels would be likely to cause other tissue or feather damage that could impair flight or vision or cause physiological effects and ultimately cause or contribute to mortality from other causes (e.g., reduce ability to forage, escape from predators, or thermoregulate). Staff also believes that longer exposures to lower energy flux levels are likely to cause feather damage or physiological effects. Based on staff's understanding of energy flux intensity and exposure times, staff believes that birds flying for short periods through energy flux exceeding about 25 kW/m2 will likely suffer significant damage to flight feathers, eyes, or skin so that they will be unable to survive longer than a few days. Staff does not have estimates of potential bird mortality however staff considers it likely that some loss will occur either through collision, electrocution or from exposure to solar flux. Therefore staff concludes that project effects are substantial and warrant mitigation. Additional language regarding solar flux is presented in the FSA.
13.23		Responses to staff's questions regarding flux are comprehensive.	Comment noted.

13.24		Avian issues are treated too conservatively.	Project related impacts to birds from collision, electrocution, and solar flux are presented using the best available information and relevant scientific literature. The conclusions presented in the report are valuable but irrelevant in the context of the project specific analysis. The fact that the study cites collisions with buildings and windows and the predation risk from domestic cats to be the primary sources of avian mortality does not diminish the projects potential to result in the loss of both common and protected bird species. Considering the vast areas of the United States that have been developed and the millions of house cats that predate birds it is not surprising theses sources pose risks to birds. The further contention that the project will result in a lower risk to birds than a wind farm may be accurate but depends on many factors including siting, scale of the project, and the type of wind turbines that are used at the site. In addition this technology has not been extensively studied and there does not appear to be any rigorous scientific studies to support this claim. Where data on bird mortality is available, bird mortality was found to occur both through collision with heliostats and from exposure to solar flux (McCray et al., 1986). Based on bird use in the project area including the presence of golden eagles staff considers the potential risk to birds from collision and solar flux to be appropriately addressed in the PSA and pose a significant impact to common and sensitive birds.
13.25		Desert kit fox will not be hunted for fur.	The PSA does not treat the desert kit fox as a State Fully Protected Species pursuant to Fish and Game Code Sections 3511, 4700, 5050 and 5515 or as a State listed species protected under Fish and Game Code 2050 et seq. For the purposes of the PSA this species is being treated as sensitive in accordance with the regulations identified in Title 14. While staff acknowledges that the project owner does not intend to conduct hunting or trapping on the project site the PSA presents reasonable minimizations measures to avoid the loss of this species.
13.26		The project is not located within NEMO.	The PSA acknowledges the HHSEGS facility site is located on private lands and not subject to the NEMO. The text will be clarified on the PSA.
13.27		The California Desert Conservation Area Plan does not apply to the project.	The PSA acknowledges the HHSEGS facility site is located on private lands. The text will be clarified on the PSA.
13.28		No wild and scenic rivers exist within the project area.	The PSA included a discussion of potential ground water related impacts to Wild and Scenic Rivers. No changes have been made to the PSA.
13.29		Applicant notes that badger may be "taken".	The American badger is a California species of special concern and is treated accordingly in the PSA. Although hunting of this species is allowed, Section 465 of the Fish and Game Code (Method of Take) describes the legally approved methods of take. As described in the Fish and Game Code furbearing mammals may be taken only with a firearm, bow and arrow, or with the use of dogs, or traps in accordance with the provisions of Section 465.5 of these regulations and Section 3003.1. The reference to unlimited take of this species is not relevant to the analysis of potential impacts to this species under CEQA.
13.30		CDFG code was incorrectly referenced.	The incorrect reference to American badger as a fully protected species in the PSA will be corrected.

13.31		Add provided language.	The recommend language was added to the FSA.
13.32		Add provided language regarding bird nests.	The recommend language was added to the FSA.
13.33		Add provided language regarding Migratory Bird Treaty Act.	The recommend language was added to the FSA.
13.34		Add language regarding the California Native Plants Act	The recommend language was added to the FSA.
13.35		Please refer back general comments regarding project size.	The FSA will be revised to include a description of land disturbance provided by the applicant. For the purposes of the PSA and FSA temporary impacts to desert tortoise habitat have been treated as permanent due to the temporal loss of habitat and extremely long recovery times required in desert ecosystems.
13.36		Please update pipeline description.	The FSA will be revised to include this information.
13.37		Please update transmission system description.	The FSA will be revised to include this information.
13.38		Add a temporary construction well to the FSA.	The FSA will be revised to include this information.
13.39		Revise ACEC description.	The FSA will be revised to include this information.
13.40		The land for the proposed project site is not abandoned.	The FSA will be revised to clarify the orchard has been left fallow and the site remains largely undeveloped.
13.41		Acreages in the PSA were incorrect.	The FSA will be revised to include this information; however preliminary data was based on the contents of the AFC.
13.42		Revise acreages in the FSA.	The FSA will be revised to include this information.
13.43		Revise sentence regarding native vegetation.	The FSA will be revised to include this information.
13.44		Describe why a developed project site would not be suitable habitat for wildlife.	The conclusions drawn in the PSA are accurate and are based on the basic tenants of ecology and conservation biology. An analysis of these effects is described in detail in the PSA under Project Operation Impacts and Mitigation. This includes the rational for lost functional values to wildlife, including numerous scientific citations describing the ecological effects of roads, noise, lighting, and weed management activities.

13.45		The FSA must include data on nest failure.	The FSA will provide additional language regarding human and disturbance related effects to birds. However, disturbance and human intrusion near nest sites are well studied and has been documented to reduce nest success in many birds. Some of the studies that have correlated human intrusion with degree of reproductive success for birds include Reijnen et al. (1995), Gramza (1967), Ellison and Cleary (1978), Tremblay and Ellison (1979), Westmoreland and Best (1985), Rodgers and Smith (1995), Gutzwiller et al. (1997), Swarthout and Steidl (2003), Weidinger (2008), and Grubb et al. (2010). <u>Citations</u>: Ellison, L. N., and Cleary, L. 1978. Effects of human disturbance on breeding of Double-crested Cormorants. Auk 95:510–517. Gramza, A. F. 1967. Responses of brooding nighthawks to a disturbance stimulus. Auk 84:72–86. Gutzwiller,K. J., Kroese, E. A., Anderson, S. H., and Wilkins, C. A. 1997. Does human intrusion alter the seasonal timing of avian song during breeding periods? Auk 114:55–65. Grubb, T. G., DeLaney, D. K., Bowerman, W. W., and Werda, M. R. 2010. Golden eagle indifference to heli-skiing and military helicopters in northern Utah. Journal of Wildlife Management 74:1276–1285. Reijnen, R., Foppen, R., Braak, C.T., and Thissen, J. 1995. The effects of car traffic on breeding bird populations in woodland: III. Reduction of density in relation to the proximity of main roads. Journal of Applied Ecology 32:187–202. Rodgers, J. A., and Smith, H. T. 1995. Set-back distances to protect nesting bird colonies from human disturbance in Florida. Conservation Biology 9:89–99. Swarthout, E. C. H., and Steidl, R. J. 2003. Experimental effects of hiking on breeding Mexican spotted owls. Conservation Biology 17:307–315. Tremblay, J., and Ellison, L. N. 1979. Effects of human disturbance on breeding of Black-crowned Night Herons. Auk 96:364–369. Weidinger, K. 2008. Nest monitoring does not increase nest predation in open-nesting songbirds: Inference from continuous nest-survival data. Auk 125:859–868.
13.46		Construction effects on common wildlife are insignificant.	The PSA concluded that impacts to common wildlife were significant due to the large scale land use conversion and expected mortality to common wildlife. The lead agency has great discretion in the determination of significance under CEQA. Based on the potential impacts to common wildlife the PSA concluded that impacts were significant. Please note that while Conditions of Certification were applied to salvage wildlife compensatory land acquisition was not required for common species.

13.47		The site has only two plant communities.	The site does include more than two plant communities according Sawyer et al. (2009). Creosote bush scrub and shadscale scrub are two broad plant community descriptions when mapped according to Preliminary Descriptions of the Terrestrial Natural Communities of California by Holland (1986). However surveys conducted by staff noted that each of the two dominant plant communities varied across the site both in species composition and diversity of dominant shrub cover. At the association level at least one sensitive plant community Creosote bush scrub/big galleta was also noted.
13.48		Revise sentence regarding diversity of mammalian species detected on the project site.	The site does appear to support a wide variety of mammals. As identified by the applicant 12 species of mammals were noted on the project site. This included a range of species from small pocket mice to larger carnivores. In addition, staff observed weasel scat on lands due east of the project site. The PSA language regarding well represented is not intended to suggest the site supports unique assemblages of mammals but rather acknowledges the number and type of mammals present.
13.49		Bobcat do not use the project site.	The PSA erroneously suggested that bobcat were observed on the site. This fact will be rectified in the FSA. However, there is no reason why this species would not be a periodic to routine visitor at the project site. The species is known from the region and would be expected to forage within the community types present on the project site.
13.50		Revise FSA description of bat species survey data.	The FSA will be revised to include this information.
13.51		Pallid bat use the project site.	The FSA will be revised to include this information.
13.52		There is no evidence that bats could roost on solar structures.	Bats are known to roost on a variety of manmade structures including bridges, buildings, bell towers, under the eaves of houses and water tanks. Because of the size and scale of the project staff included this language to ensure that roosting bats, should they use the project site, are afforded protection.
13.53		The project would not impact the Amargosa Wild and Scenic River	Please refer to staff's analysis of the project's groundwater pumping impacts on the Amargosa Wild and Scenic River (Water Supply section of the FSA).
13.54		The HHSEGS project poses no collision threat to bats.	The PSA acknowledges that due to the unique ecology of most bats; project construction is unlikely to result in direct mortality. However, pallid bats, which forage on the ground, will incur a loss of habitat. In addition, while bats generally are capable of avoiding structures through the use of echolocation, bats still periodically collide with facility structures during inclement weather.
13.55		There is a difference between tortoise in Nevada and tortoise occurring in California.	The PSA correctly identifies where desert tortoise occur on and near the project site. Staff considers desert tortoise found within 150 meters of the project site to have the potential to utilize home ranges that include portions of the project site.

13.56		Mesquite thickets are not scientifically shown to be of importance in the greater ecosystem.	The importance of mesquite habitats -- in all forms -- is a matter of empirical fact, supported by the literature, and by resource agency policy and practice. All mesquite in southern Nevada, and particularly the mesquite in Pahrump Valley and Stump Springs, are recognized conservation priorities in the BLM-sponsored "Mesquite-Acacia Conservation Management Strategy (Crampton et al. 2006), adopted for the Clark County Multiple Species Habitat Conservation Plan. The applicant has provided no evidence to support this arbitrary and unsupported statement.
13.57		There is not "an abundance" of prey onsite for bats.	The FSA will be revised to further describe the sites value to bats.
13.58		Tecopa Road should not be fenced with desert tortoise fencing.	The FSA will be revised to further describe the location of proposed desert tortoise fencing. Staff does not believe that fencing on the south side of Tecopa Road is warranted.
13.59		Revise language regarding applicant's proposed use of an onsite retention area.	The FSA will be revised to clarify the retention pond would hold water only after significant rainfall events.
13.6		The project will not cause an increase in polarized light.	The PSA attempts to provide a thorough discussion of the potential effects of the projects to birds from collision. Polarized light may not pose a significant concern for the project however the PSA discloses potential effects from this effect. Nonetheless studies conducted at other facilities using reflective technologies cite collision as a source of bird mortality. Considering the heliostats would likely reflect conditions including clouds or a darkened sky there does appear to be potential for birds to mistake the site for a pool of water.
13.61		Update project acreages relative to desert tortoise impacts.	The FSA will be revised to include the disturbance acreage provided by BSE.
13.62		Revise sentence regarding desert tortoise.	The FSA will be revised to clarify this statement.
13.63		Please refer to applicant's comments regarding desert tortoise population estimate.	The PSA based the estimate of potential desert tortoise on the project site on information identified in Section 5.2.6.2 (Federally Listed Desert tortoise Protocol Survey). Staff acknowledges the approach of not including animals found adjacent to the site in the calculations; however this rationale disregards the fact that desert tortoise in adjacent areas likely use the site as a component of their home range and may use burrows on the project site. As the numbers reflect only an estimate of the potential desert tortoise that may occur on the project site staff considers the approach to be biologically sound and appropriate for the FSA.
13.64		Please refer to applicant's comments regarding desert tortoise population estimate.	Please see response to comment 13.4.
13.65		The applicant will submit a revised desert tortoise translocation plan.	Staff looks forward to working with BSE to develop an effective desert tortoise Translocation Plan.

13.66		Please refer to applicant's comments regarding desert tortoise population estimate.	Please see response to comment 13.4.
13.67		The project would not attract nuisance predators.	The PSA accurately presents information addressing existing nuisance predators that are present in the project area. Specifically, page 4.2-92 of the PSA (Ravens, Coyotes, and other Predators) describes the existing subsidized predators that occur near the community of Charleston View. Staff also considers the project to pose an additional attractant to ravens and other predators from road kill, trash, and the creation of perch and nesting sites.
13.68		Burrowing owl likely do not occupy the project site long-term.	Burrowing owl and their sign was detected on the project site during surveys desert tortoise conducted by the applicant. In addition, these burrows were revisited during winter months. What is not clear is if the applicant returned to the burrows to evaluate if any of the burrows supported breeding birds. However, there is some indication that supplemental surveys to detect breeding were not conducted as the site was considered to support burrowing owls. Nonetheless the FSA will be revised to clarify the potential use of the site by burrowing owls.
13.69		The developed project would provide habitat for birds.	The PSA accurately reflects the expected post development landscape and potential use by resident and migratory birds. With the exception of disturbance tolerant species the site is expected to have lost functional value for most nesting and foraging birds.
13.7		LORS with "may" in them are speculative.	Staff considers the large scale loss of foraging habitat to pose a substantial risk to golden eagles. The USFWS considers that foraging habitat loss may be interpreted as take under the Bald and Golden Eagle protection Act if it causes territory abandonment or reduced productivity. Staff believes the large scale loss of habitat could result in the loss of reproductive output or other lost fitness; however staff acknowledges it would be difficult to attribute the loss to the proposed project. Staff concludes that the loss of foraging habitat would be significant under CEQA but would not constitute take under state or federal LORS.
13.71		No residual impacts to golden eagles would occur if the project were developed.	Staff considers the potential risk of collision, electrocution, loss of habitat and risk of solar flux to be significant under CEQA. Staff believes the use of anti-perch devices and other mechanisms to be valuable and required to minimize impacts to golden eagles. However, the potential loss of birds would remain significant after mitigation.
13.72		Update FSA with spring 2012 nesting surveys.	The FSA will be updated with this information.
13.73		Remove reference to an evaporation pond.	The FSA will be updated with this information.
13.74		Only 3 eagles were seen at the same time on the project site.	The FSA will be updated with this information. However, use of the site by golden eagles is not in dispute. The surveys conducted by the applicant provide only a limited sampling time. Golden eagles have been observed by staff immediately adjacent to the site and soaring east of the project area. Additionally, applicant consultants docketed **FIGURE 30** -- a pair of golden eagles observed 1/11/2 along Stateline Road adjacent to the proposed project site.
13.75		The loss of forage is unimportant to golden eagle.	The project will result in the direct loss of over 3,000 acres of foraging habitat for this species. Staff considers this a significant impact under CEQA. Please see response to comment 13.70 for further information regarding the loss of golden eagle foraging habitat.

13.76		Clarify statements regarding mitigation of loss of golden eagle foraging habitat.	The language regarding significance conclusions will be revised in the FSA.
13.77		Bighorn sheep do not use the Stump Springs ACEC.	Thank you for the information regarding bighorn sheep. It is not clear whether bighorn sheep use the spring at Stump Springs or water in the adjacent drainages. Use of the spring would pose a predation risk to the animals due to the heavy brush cover which sheep often avoid.
13.78		The site is not a bighorn sheep corridor.	Bighorn sheep are known from the project region and have been documented to use valley floors to support intermountain. However, the PSA does not suggest the site is an important corridor for movement. Please see response to comment 13.2 for additional information regarding bighorn sheep.
13.79		Bighorn sheep do not cross Tecopa Road.	Staff disagrees with the assertion that bighorn sheep would not cross Tecopa Road for intermountain movement. Bighorn sheep may use almost any portion of the desert floor for movement and are known to cross major highways and existing roads.
13.80		The project owner is unwilling to pay for necropsy of dead kit fox found on the project site.	The PSA acknowledges the project will displace desert kit fox and result in a net loss of habitat for this species. However, it is unknown and speculative if the project will either result in the manifestation or spread of distemper. However, to monitor the possible consequences of this threat the PSA included condition of certification **BIO-14** which requires monitoring and adaptive methods to reduce this threat. As a condition of **BIO-14** disease testing may be required if animals succumb during project activities.
13.81		Provides data on kit fox behavior and habitat use patterns.	Thank you for the information regarding desert kit fox. The FSA will be revised to include the applicability of BLM lands east of the project site for desert kit fox.
13.82		Applicant states that badger may be "taken".	Please see response to comment 13.29.
13.83		Applicant presents a different interpretation of kit fox legal status.	Please see response to comment 13.25.
13.84		Please provide evidence that mammals are in high density on the project site.	The site does appear to support a wide variety of mammals and numerous rodent burrows. As identified by the applicant 12 species of mammals were noted on the project site. This included a range of species from small pocket mice to larger carnivores. In addition, dense concentrations of burrows, to numerous to count, were routinely observed across the site. Staff did not conduct small mammal trapping or complete a census of burrow. However, it is clear that small mammal density across much of the site is high.
13.85		Applicant is confused about what further information could have been collected for kit fox.	Staff considers the existing information on desert kit fox to be adequate for the purposes of the FSA. Additional data acquisition will be required as a component of Condition of Certification **BIO-14.**
13.86		Revise discussion of desert washes per provided language.	Thank you for the clarification; however, the acreages have been revised to reflect the additional and previously unmapped washes documented by staff during the field verification of the state waters delineation on August 1-2, 2012, and the removal of the artificial features on roads.

13.87		BIO-22 should be deleted.	Comment noted.
13.88		Applicant disputes potential for washes upstream of the project site to be impacted by project construction.	Staff agrees that the upstream portion of the delineated streams located in Nevada are not state waters. However, staff included the small portion of upstream waters (0.45 ac.) located in California that are immediately adjacent to the project boundary and pipeline alignment, and will be indirectly affected by the project. Construction of the pipeline would require trenching through many of these washes. Indirect impacts to the habitat functions and values of the adjacent streams are also expected during operation from human disturbance, noise, glare, lighting, and potential head-cutting or erosion immediately above the pipeline trench.
13.89		Revise discussion of state waters delineation.	Regarding the indirect effects of the project that extend across the state line into Nevada, staff maintains that 1) consistent with the CEQA Guidelines and statutory provisions, our analysis does not consider the impacts of projects or portions of parts of projects (in this case, the project linears in Nevada); however, our analysis does include analysis and mitigation for impacts of the power plant on both sides of the border
13.90		Revise sentence regarding waters of the U.S.	Thank you; the language was revised in the FSA as suggested.
13.91		Revise statement regarding Porter-Cologne Water Quality Control Act.	Agreed; Porter-Cologne was the authorizing legislation for the Water Quality Control Act, which is more correctly referenced as California Water Code Division 7. Water Quality Act, and the Waters of the State definition is section 13050(e). The language has been revised in the FSA.
13.92		Revise statement regarding onsite storm water retention.	The applicant's Drainage, Erosion, and Sedimentation Control Plan (DESCP) indicates the project would use strategically placed sediment controls in addition to the retention area at the western boundary. Staff understands the controls would not be placed within the retention area; however, staff expected that stone filters and check dams "strategically placed throughout the project site" would mean placement near the power blocks and perhaps and in spot locations in the solar fields. These would reduce sediment transport from one portion of the project to the other. Otherwise, there may be a significant build-up of sediment near the western boundary over time. Water Resources staff indicated they would still expect that stone filters and check dams "strategically placed throughout the project site to avoid blocking drainage pipes and changing the flood characteristics of the retention area.
13.93		Provides revisions to Table 2.	The acreages were revised in the PSA to reflect the most current figures for state waters, which include the additional and previously unmapped washes documented by staff during the field verification of the state waters delineation on August 1-2, 2012, and removal of the road puddles and unconnected roadside ditches originally delineated as state waters.
13.94		Provides revision to regulatory authority over desert washes.	The language was revised to include the federal Clean Water Act, as suggested. However, the proposed edit relating to mesquite woodland was rejected; this issue is discussed in detail in the FSA.

13.95		Provides revisions to the desert wash discussion.	The definition of a stream in Title 14, Section 1.72 of the California Code of Regulations (CCR) is not the definition used by Fish and Game Code (F&GC) Section 1600 *et seq* . *The Section 1.72 definition was developed to address a specific sports fish issue that came before the Fish & Game Commission* ; note that while the definition does speak to periodic and intermittent flow, *Section 1.72 is limited to fish-bearing or aquatic life-bearing streams* .
13.96		Provides revisions to discussion of U.S. Army Corp correspondence.	More importantly, rather than limiting CDFG jurisdiction to fish-bearing streams alone, F&GC Chapter 6, Fish and Wildlife Protection and Conservation, Section 1600 *et seq* was enacted to provide for the conservation of fish *and* wildlife resources associated with stream ecosystems. The F&GC further defines fish *and* wildlife to include: *all wild animals, birds, plants, fish, amphibians, invertebrates, reptiles, and related ecological communities, including the habitat upon which they depend for continued viability* (FGC Division 5, Chapter 1, section 45, and Division 2, Chapter 1, section 711.2(a), respectively). *Fish means wild fish, mollusks, crustaceans, invertebrates, or amphibians, including any part, spawn or ova thereof* (FGC, Division 5, Chapter 1, section 45).
13.97		Revise acres of state jurisdictional waters.	The language was revised in the PSA to reflect URS Corporation as the author of the delineation report (not CH2M Hill). However, the proposed edit to total acres of state waters is not consistent with the total established in the field verification (see comment 13.86).
13.98		Revise citation.	The citation for the delineation report in the PSA was revised as suggested (to "URS 2012").
13.99		Revise language regarding the 401 certification for the project.	This section was revised instead to reflect the results of staff and CDFGs field verification of the state waters delineation
13.1		Revise citation.	The citation was revised as suggested.
13.101		Disputes loss of habitat function and values. Correct acres of state waters impacted by the proposed project.	The importance of ephemeral desert washes is undisputed; it is well-documented in the literature, the sum of which represents decades of observations and surveys (Levick et al. 2008; Baxter 1988; Kirkpatrick et al. 2007; Kubick & Remsen 1977; Tomoff 1977; Daniels & Boyd 1979, and others); observations that are also consistent with staff's observations during multiple site visits by staff and CDFG biologists. The burden of proof is on the applicant to substantiate any assertion that -- contrary to the body of scientific body of knowledge -- these ephemeral streams have no value to wildlife. This comment was addressed in detail under 13.19 and 13.20.
13.102		Revise acreages of waters of the U.S.	As stated in the FSA and under comment 13.20, the project would maintain a portion of the hydrologic and geomorphic functions of the washes by allowing them to pass through the site, rather than diverting them around the project in an artificial channel; however, the habitat functions and values would be eliminated for most wildlife due to perimeter exclusion fencing, partial site grading, road construction and maintenance, vegetation maintenance, spraying, noise, glare, and human disturbance. Staff and CDFG consider this a significant impact

13.103		Revise sentence regarding importance of washes.	Staff rejects the proposed edit; this issue has been addressed in more detail under comments 13.19, 13.20, and 13.101, and in the FSA.
13.104		Provides suggested revisions and disputes staff's recommended mitigation ratio for waters of the state.	This argument was addressed by staff under comment 13.20. Fish and Game Code (FGC) Section 1605 assumes implicitly that some form of mitigation will likely be part of *any* Lake and Streambed Alteration Agreement issued for a project (Vyverberg pers. comm.). Combined with CDFGs policy that there be no net loss of riparian/riverine habitat - which includes desert washes and the vegetation that occurs along the washes - means that if a project results in a loss of one acre of stream then a minimum of two acres of compensatory stream mitigation are *required* to satisfy the no net loss goal. In practice, compensatory mitigation is typically mitigated at a minimum mitigation-to-effect ratio of 3:1 for permanent effects and 1:1 for temporary effects (*ibid.*)
13.105		Revise statement regarding Proposed edit accepted; the revised language is contained on	Proposed edit accepted; the language was revised in the FSA.
13.106		Mitigation is inappropriate unless functions are demonstrated.	This issue was addressed in detail under comments 13.19, 13.20, and 13.101.T he applicant has not provided any evidence to substantiate any assertion that -- contrary to the body of scientific body of knowledge about the habitat functions and values of ephemeral desert streams (Levick et al. 2008; Baxter 1988; Kirkpatrick et al. 2007; Kubick & Remsen 1977; Tomoff 1977; Daniels & Boyd 1979, and others) that the these ephemeral streams have no value to wildlife. The wildlife connection is presumed by CDFG and the agency will require compensatory mitigation for the washes under the authority of California Fish and Game Code (FGC), which links stream protection with the presence of fish or wildlife habitat. F&GC further defines fish and wildlife to include: "...all wild animals, birds, plants, fish, amphibians, invertebrates, reptiles, and related ecological communities, including the habitat upon which they depend for continued viability." (FGC, Division 5, Chapter 1, section 45, and Division 2, Chapter 1, section 711.2(a), respectively). "Fish means wild fish, mollusks, crustaceans, invertebrates, or amphibians, including any part, spawn or ova thereof." (FGC, Division 5, Chapter 1, section 45)
13.107		Applicant disagrees with staff's valuation of ephemeral stream values.	See comment above.

13.108		Provides suggested revisions to discussion of state and federally-regulated waters	Fish and wildlife resources are held in trust for the people of the State by and through the California Department of Fish and Game (Department) (FGC § 711.7). The Department is responsible for conserving, protecting, and managing fish, wildlife, native plants, and the habitat necessary for biologically sustainable populations of these species (FGC § 1802). FGC Sections 1600-1616 were enacted to conserve the natural resources associated with streams (and lakes), and the code sections are implemented by the Department through its Lake and Streambed Alteration (LSA) Program. Streams that are afforded protection under FGC Section 1600 et seq are those bodies of water associated with a local biological community, or that contribute to the chemical, physical, or biological integrity of downstream waters or ecosystems. Whether flow is ephemeral, intermittent or perennial, streams, their sources (e.g., swales, springs, ponds, lakes, marshes, wetlands, or other such features), floodplains, and associated ecosystems (i.e., the living flora and fauna, and physical processes that sustain their habitats) are all considered integral parts of a stream system and are extended protection accordingly. These comments have been addressed in more detail under comments 13.19, 13.20, 13.86-13.106.
13.109		Revise discussion of waters of the U.S.	Agreed; the language in the FSA was revised accordingly. Compensatory mitigation for the project impacts to desert washes is required for state waters impacts; not waters of the U.S.
13.110		Revise acreages of impacted state waters.	Staff disagreed with the total acres of state waters shown in the State Waters Delineation report (URS 2012). The total shown in the FSA (23.21 ac.) reflect additional, previously unmapped washes found by staff and CDFG during the field verification of the delineation, and the removal of non-jurisdictional features..
13.111		Provides a reference	Agreed; the citation was revised in the FSA as suggested (URS. 2012. BrightSource Energy Hidden Hills Solar Project, Inyo County, CA Preliminary Delineation of Jurisdictional Waters of the State. March 20, 2012. (Submitted as Attachment DR8-1, Data Response, Set 1C-2).
13.112		Revise Findings of Fact	Proposed edit accepted; the language was revised in the FSA.
13.113		Revise waters of the state acreage	See response to comment 13.11, above.
13.114		Revise findings for plant communities' value	Staff disagreed with the proposed changes in the PSA regarding the discussion of habitat value and movement.
13.115		Revise findings for bighorn sheep	Please see response to comment 13.
13.116		Revise findings of fact for groundwater dependent ecosystems.	Comment noted.

13.138		State groundwater table elevation in relation to mesquite vegetation.	The position of the groundwater table relative to the effective rooting depth of the mesquite can only be determined through groundwater monitoring, combined with vegetation monitoring or soil core samples (**BIO-23**, **WATER SUPPLY-4**). No previous studies have been conducted in the area east of the project; nor has the applicant provided any direct evidence. This is the basis for staff's recommendations for groundwater monitoring, and vegetation monitoring to monitor the effects of a declining water table, and/or soil core sampling. Regarding concerns about natural variations in water levels, Water Resources staff responded to the same comment during the June 14, 2012 public workshop. Water Resources staff stated it is the offsite wells east of the fault zone and in other parts of the valley that fluctuate; not the wells onsite (the trigger will be measured at the project boundary, on the stable side of the fault). Because water levels onsite are stable, (unlike offsite wells in other parts of the basin), the 0.5 foot drawdown can be detected with nearly 100 percent confidence.
13.139		PSA needs to included aquifer performance test results.	See comment 13.138, above, regarding groundwater information for the site and areas to the east. The groundwater analysis puts emphasis on the "region" because it is contained within the cone of depression (drawdown zone) identified in the applicant's groundwater analysis and staff's independent analysis of the project pump test results, and it is an area that supports extensive groundwater-dependent vegetation, as well as seasonal springs. Regarding the comment about what constitutes "onsite" versus "offsite", the PSA clearly states on page 4.2-18 that only two communities are present onsite -- creosote bush scrub and shadscale scrub – and on PSA page 4.2-20 "No mesquite-dominated habitats were mapped within the project boundary with the exception of a few scattered [mesquite]." Nevertheless, the statement was repeated in the several additional places in the FSA to address the applicant's concern.
13.140		PSA discussion must not emphasize regional context of groundwater.	See comments 13.138 and 13.139, above.

13.141		BIO-18 is too difficult to implement.	A very similar condition of certification was adopted for several Energy Commission-licensed projects (palen, Blythe, and Genesis projects). The guidelines in the condition are consistent with guidelines for weed plans by BLM and The Nature Conservancy (BLM 1992; Tu & Meyers-Rice 2001; Hilmer & Liedtke 2003). The applicant's proposed edits to BIO-18 (Weed Management Plan) were discussed in the July 2, 2012 public workshop. Staff accepted several but not all of the proposed edits. For example, additional language regarding an emphasis on the weed species of greatest ecological concern (versus common ubiquitous weed species) was accepted; it is a widely accepted approach to weed management. The accepted edits are incorporated into the revised BIO-18 in the FSA.
13.142		Data collection for special status plant species is ongoing.	Staff first raised the concern about recent additions to the CNDDB and CNPS inventory (CNPS 2012) in the PSA. It is not unreasonable to assume the possibility that newly added species—particularly species that are not even in the past or current state floras (Hickman 1993; Baldwin et al 2011), such as Torrey's joint-fir. However, two years of extensive offsite surveys have now been conducted to determine if these species were more common than previously understood, including the spring 2012 surveys, the results of which have been considered and addressed in the FSA. The applicant is now asking for another round of surveys following the publishing of the FSA (fall 2012) and a second round following the Final Decision (spring 2013). Staff concluded that surveys were adequate to determine if the four significantly affected species were more common, with one exception: --Torrey's joint-fir – because: 1) it was just added to the CNDDB and CNPS Inventory (CNPS 2012) in January 2012; and 2) the species was not known to occur in California before it was discovered on the project site, and it is not included in the state flora (Baldwin et al. 2011). This means, in this unique case, there is a high potential that it may have been overlooked by other surveyors, an opinion shared by at least one other recognized local expert (Silverman pers. comm.). Currently, only one round of surveys has been conducted to assess the size of the species' population in California. BIO-20 includes a provision that if many new occurrences are found in fall 2012 or spring 2013 that results in a downgrading of the CNDDB Element Rank from an S1 to an S3 ("vulnerable but not under immediate threat of extinction"), and the proportion of the statewide distribution affected by the project is less than 10 percent, the mitigation requirement for that species would be dismissed.
13.143		Provides a clarification of site geomorphology.	

13.144		Delete "scrubs [plural]"; replace with "scrub".	Edit accepted; the language was revised accordingly in the FSA.
13.145		No evidence exists to support that mesquite are stressed by groundwater pumping.	The comment the applicant is objecting to (was informed by the BLM document Conservation Management Strategy for Mesquite and Acacia Woodlands in Clark County, Nevada (Crampton et al. 2006) and literature on the groundwater declines in the Pahrump area during the last century: Harrill (1986); Malmberg (1967); Buqo (2004), and Comartin (2010). “Many local springs experienced precipitous water table declines and ultimately stopped flowing as a result of groundwater depletion in the middle of the last century (Harrill 1986; Malmberg 1967; Buqo 2004; Comartin 2010). Before extensive agricultural development, the Pahrump Valley playa area (northwest of the project) contained some phreatophytic vegetation. Groundwater pumping in the Pahrump Valley for agriculture (predominantly alfalfa and cotton) peaked in 1968 and there was a significant downward trend in static water levels between the years 1953 and 1996, based on an analysis of 651 wells within 1 mile of a mesquite woodland (Crampton et al. 2006). Groundwater withdrawals accompanying large-scale agricultural development caused some major springs in the area to stop flowing during this period of groundwater withdrawal. Some springs eventually recovered after some the pumping stopped (Moreo et al. 2003). Historically, Manse and Bennetts Springs discharged along the base of the broad alluvial fans at the foot of the Spring Mountains. Groundwater withdrawal in the valley caused these springs to cease flowing in the 1970s. In the late 1990s, after the heavy agricultural pumping stopped, Manse Spring began to flow again. Other springs have not recovered.” Groundwater pumping and water level declines are documented to have caused the decline or death of mesquite in many areas of the southwest (Sawyer et al. 2009; Judd et al. 1971; Webb & Leake 2006; Stromberg pers. comm.; Keeler-Wolf pers. comm.).
13.146		Vegetation monitoring isn't proportional to the projected impact.	See response to comment 13.135.

13.147		Nomenclature for mesquites needs to be standardized.	Many of the applicant's comments on vegetation communities and their nomenclature are based on the incorrect application of old and obsolete classification systems and concepts no longer in usage in California. The CDFG Vegetation Program was consulted for information on the conservation status and classification of mesquite in California. The Senior Vegetation Ecologist (Keeler-Wolf pers. comm.) affirmed that the mesquite-dominant habitats (alliances) in California are classified as "Honey Mesquite Alliance" under the classification system used in California, not "thickets" or "bosque" or "woodland"; the state and national standard is based on dominant species, not on habitat structure. Under the US National Vegetation Classification system (USNVC) (a system still in development), honey mesquite alliances fall under several different "Ecological Systems" including "North American Warm Desert Riparian Low Bosque & Shrubland Group" (Keeler-Wolf pers. comm.). This might explain why BLM uses the term "bosque" to describe the mesquite habitats east of the project. In the Mesquite-Acacia Conservation Management Strategy (CMS) (Crampton et al. 2006) prepared for and adopted by the Clark County Multiple Species Habitat Conservation Plan, commissioned by BLM, the mesquite are referred to as "woodlands" throughout the study area, which includes the stands near the project. The management plan also notes that the southern portion of the Pahrump "Metapatch" (aggregation of smaller patches) known as Stump Spring is "...distinct from the rest of the region in topography, hydrology, soils and mesquite growth form...Many of these woodland patches are comprised of shrubby dune mesquite; however, larger shrubs and trees grow along the deeply eroded wash." (Crampton et al. 2006). Regardless of the terminology used, the conservation status of Stump Spring ACEC, the mesquite-dominant habitats north of the ACEC and east of the project, and the value of the habitats to wildlife, are a constant; the ACEC and the entire Pahrump Valley metapatch are identified conservation priorities in the Mesquite-Acacia Conservation Management Strategy (Crampton et al. 2006). BLM is in the process (early planning stages) of developing an additional ACEC that would encompass the mesquite habitats just east of the project (Poff pers. comm.). The importance of mesquite to wildlife are described in more detail under "Setting: Groundwater-dependent Ecosystems". Biological Resources Figure 4 contains photos of the mesquite habitats characteristic of the incised washes east of the project site.
13.148		Nomenclature for mesquites needs to be verified by other experts.	See comment 13.147, above.
13.149		Revise PSA language regarding mesquites.	The reference to m,esquite in the study area was revised to read "Sensitive plant communities *potentially* indirectly affected by the proposed project groundwater pumping....", and added "Groundwater-dependent communities (mesquite-dominant habitats) do not occur onsite except as a few scattered small stands. Offsite, the nearest mesquite habitats occur within 500-1000 feet of the eastern project boundary, predominantly in a shrubby form on coppice dunes."

13.150		Applicant questions the necessity of mitigating for Larrea-pleuraphis vegetation type.	During the field verification of the state waters delineation conducted by staff and CDFG on August 1-2, staff documented a one-acre stand of the creosote bush-galleta grass association (*Larrea tridentata/Pleuraphis rigida association*) -- a rare natural community --along the eastern boundary, where it occurs as an upland (non-riparian) habitat. Because the habitat does not occur along the washes, staff is not treating it as a feature subject to jurisdiction under Fish and Game Code. Although it is still considered a rare natural community (Sawyer et al. 2009) from a CEQA perspective, a one acre loss of a S3-ranked community ("vulnerable" but not imperiled) would not be significant and no mitigation is recommended.
13.151		The discussion of mesquite communities is confusing.	Page 4.2-20 of the PSA clearly states that “No mesquite woodlands were mapped within the project boundary, with the exception of a few scattered trees.” Nevertheless, the statement has repeated in the introduction to “Sensitive Plant Communities”, and the bulleted list of sensitive communities further subdivided as suggested to address the applicant’s concern.
13.152		Please add suggested language regarding mesquite.	See comment 13.151, above. The PSA clearly stated "The mesquite-dominated habitats closest to the project occur as lower-growing shrublands”. Nevertheless, to further address the applicant's concern, the language was revised to read “ ...as a shrub-like, rather than tree-like growth form, on the dunes east of the project.”
13.153		Add citiations supporting conclusions regarding mesquite and groundwater pumping.	The PSA never states that sand accumulation is a potential cause of mesquite die-off. The definition of coppice dunes was cited in the PSA (Huang et al. 2011) from Huang, P.M, Li, Y., and M.E. Summer, Handbook of Soil Sciences: Properties and Processes [2nd ed.] CRC Press, 2011. The citation was included in the References subsection of the PSA [pp. 4.2-256]. It is an industry standard, included in the USDA soil science reading list. The specific statement “If the sand accumulates faster than the plant can grow, however, the plant will die, and the dune will usually be deflated (wind-eroded and moved downwind) is from the U.S. Army Corps of Engineers description of coppice dunes <http://www.agc.army.mil/research/products/desert_guide/lsmsheet/lscopp.htm>
13.154		Please have document reflect that mesquite coppices are clones.	This is already implied on page 4.2-21 in the PSA “This same process fostered the development of ancient creosote bush clones (McAuliffe et al. 2007). Clones (off-shoots from a single parent that are genetically identically and connected to the older, original, and now dead parent plant) may reach ages of several thousand years and are most common in places where fluvial and aeolian deposition has repeatedly occurred throughout the Holocene (ibid.). Clones in such locations are derived from plants that originally established on surfaces of older, now buried surfaces.”
13.155		Mesquites present offsite are not bosques.	This distinction was clearly stated in the PSA (page 4.2-21). See also comment 13.147.

13.156		Clarify the importance of mesquite in Nevada.	The project is located on the California side of the California-Nevada state line. Groundwater-dependent vegetation occurs within 500-100 ft of the eastern boundary of the project, in Nevada, within the groundwater pumping cone of depression identified by the applicant in the AFC (HHSEGS 2011a, Appendix 5.15D) and in staff's independent groundwater analysis (Water Supply section of the FSA). The issue of analyzing and mitigating the impacts of California projects in Nevada is addressed by the Commissioner's in the "ORDER RE: APPLICANT'S MOTION IN LIMINE" dated and posted October 2, 2012 (Docket No. 11-AFC-02). From the Order: "This [Public Resources Code section 21080(b)(14)] does not exempt in-state project activities whose impacts are only felt out-of-state. For example, if a project dug a well inside California and the project's water consumption from the well caused an impact in another state but not in California, then that out-of-state impact must be analyzed under CEQA because the impact was generated in California." The PSA clearly states, in numerous locations, the planning documents that identify the mesquite habitats as a conservation priority (PSA p. 4.2-21, last paragraph of the subsection "Mesquite Woodlands and Mesquite Dune Scrub", also PSA p. 4.2-39-42; 143; 149). They are also referenced in the BLM comment letter from March 12, 2012 (BLM 2012a): "The local mesquite bosques, including Stump Spring ACEC, are located in both Nevada and California. These bosques are considered an important type of riparian habitat, getting their water from the shallow basin-fill aquifer. In 2006, the BLM developed a Conservation Management Strategy for Mesquite and Acacia Woodlands in Clark County, Nevada. This strategy identified the mesquite bosques located in the Pahrump Basin as a high priority area for conservation actions..." From the Summary of the Conservation Management Strategy (Crampton et al. 2006): "Mesquite and acacia woodlands are of significant biological importance, providing habitat to many wildlife species in southern Nevada, including several species covered under the Clark County Multiple Species Habitat Conservation Plan (MSHCP). A number of covered plant species also co-occur with these woodlands. The extent and condition of woodlands, however, is severely impacted by the diverse activities of a growing human population. In response, the development of a Mesquite-Acacia Conservation Management Strategy (eMS) was mandated in the MSCHP, with the goal of bringing the best available scientific information to bear on the protection and management of these woodlands and their associated species in Clark County.....In order for the CMS to satisfy the stated objectives ofthe MSCHP with regards to protecting covered species and their habitats, three Conservation Goals were developed: 1) To restore and maintain mesquite and acacia woodlands to the extent (area) they covered in year 2000 (inception of MSCHP), by protecting all woodlands on public land from habitat loss and acquiring (directly or with conservation partners and/or easements) as many woodlands as possible from private owners; 2) To restore and sustain mesquite and acacia woodlands in a healthy ecological condition (active recruitment of new plants, large trees with few stems, ability to support moderate mistletoe infection); 3) To maintain stable or increasing populations of mesquite- and acacia-dependent and associated species.
13.157		Make nomenclature updates for Hymenoclea.	Thank you; the language was revised in the FSA as suggested.
13.158		Revise summary language.	Edit accepted; the language was revised in the FSA as proposed.
13.159		Add text regarding invasive weed survey data.	Edit accepted; the language was revised in the PSA as proposed.

13.160		Clarify how the incremental effect of noxious weeds from this project was considered cumulatively considerable.	The PSA includes a 17-page analysis of cumulative impacts (PSA pp. 155-174). The cumulative impact analysis methods are discussed in three pages (PSA pp.155-157), and invasive weeds are discussed on pages 165-167 of the cumulative effects analysis.
13.161		Revise special status plants language.	The language was instead revised to reflect staff's analysis of the spring 2012 special-status plant survey results. The analysis concluded impacts were significant to four species (gravel milk-vetch; Wheeler's skeletonweed; Preuss' milk-vetch; Torrey's joint-fir), and that the impact could be mitigated offsite through acquisition and preservation, or restoration. Staff's analysis included an analysis of ownership and management threats and opportunities and the feasibility of offsite mitigation.
13.162		Delete compensation for special status plants.	Mitigation ratios are developed based on a combination of 1) the degree of rarity and extinction risk, as defined in the CNDDB (NatureServe) Element Rank, and 2) on agency policy and practice for species mitigation. Staff provided a clear, science-based justification for the mitigation of rare plants based on CNDDB Element Rank. Staff chose to use these ranks as a basis for the mitigation ratios because they are an index of a species' extinction risk, based on rarity, threats, and population trend based on a widely recognized methodology used by CNDDB and other natural heritage programs around the world (Master et al. 2009).
13.163		Revise discussion of halogeton infestations.	According to the California Department of Food and Agriculture (CDFA) website, halogeton is still an A-rated pest plant. The CDFA definition of the A rating: "A" = A pest of known economic or environmental detriment and is either not known to be established in California or it is present in a limited distribution that allows for the possibility of eradication or successful containment. A-rated pests are prohibited from entering the state because, by virtue of their rating, they have been placed on the of Plant Health and Pest Prevention Services Director's list of organisms "detrimental to agriculture" in accordance with the FAC Sections 5261 and 6461. The only exception is for organisms accompanied by an approved CDFA or USDA live organism permit for contained exhibit or research purposes. If found entering or established in the state, A-rated pests are subject to state (or commissioner when acting as a state agent) enforced action involving eradication, quarantine regulation, containment, rejection, or other holding action." Condition of Certification **BIO-18** (Weed Management Plan) requires plans include a "weed risk assessment based on Cal-IPC or Nature Conservancy criteria" (PSA pp. 4.2-215). BLM and CDFA have also created science-based, transparent, decision-making tools to help land managers prioritize weed populations for eradication. These ranking tools typically assess the relative impact, potential spread, and the cost and feasibility of eradication for each population; thus, the condition allows the project to systematically target weed infestations by putting their limited resources into populations known to cause the highest impacts and that are most feasible to eradicate.

13.164		Quality of habitat is affected by the presence of onsite weeds.	The presence of invasive weeds onsite is discussed throughout the PSA and FSA. However, the mere presence of weeds does not diminish the value of the habitat. Staff conducted a methodical field review of habitat quality and found that most areas still had good species diversity and were only lightly infested, or the ecological consequences still minor. The abundance and distribution of rare plants and native species diversity in the eastern half of the project is a testament to the habitat quality. The western portion of the project is more infested; however, there are still large areas where the native species diversity is largely unaffected and the habitat functional. Representative photos of the habitat quality in the western and eastern portions of the project area provided in **Biological Resources Figures 2 and 3**.
13.165		Noxious weeds exist both on and off the project site.	It is true that noxious weeds already occur offsite in the immediate vicinity of the project, particularly in disturbed areas and roadsides. However, staff is also concerned about the spread of weeds into the currently uninfested areas in the project vicinity; spread that can occur over many miles on contaminated vehicles and equipment. This concern was also expressed by the Inyo-Mono County Agricultural Commissioner (INYO 2012a).
13.166		Onsite noxious weed control is not possible.	Condition of Certification BIO-18 requires the project to manage weeds for "containment"; not eradication, which is infeasible in most cases, or would require heavy widespread use of herbicides. BIO-18 also guides the Plan to do a weed risk assessment to prioritize weed management activities on those species with the greatest ecological consequences or feasibility for containment. Small infestations of highly invasive weeds, however, can and should be eradicated.
13.167		Revise discussion of habitat degradation.	See comment 13.164.
13.168		Control of noxious weeds offsite is not feasible.	**BIO-18** does not require the project to control weeds offsite.
13.169		Special status plants within the project boundaries will not be avoided.	Onsite avoidance is not specified in either BIO-19 (Special-status Plant Avoidance and Minimization) or **BIO-20** (Special-status Plant Compensatory Mitigation). **BIO-18** (Weed Management Plan) specifies that invasive weeds onsite that occur in close proximity to the nine occurrences of rare plants just off the project boundary should be a management priority.
13.170		Revise discussion of noxious weeds and where they've been identified to exist.	The descriptions of these two species on PSA page 4.2-22-23 clearly state the two additional species of concern to the Inyo/Mono Counties Agricultural Commissioner were not found onsite; however, the FSA to revised to include the suggested subheading.

13.171		Revise sentence regarding Torrey's joint-fir.	This comment includes suggested additions/revisions to the special-status plant sections based on the results of the spring 2012 surveys. While staff has not yet received a final special-status plant report, the applicant has submitted the field data forms, GIS shape files, and displayed the data for staff on various GIS layers during two recent meetings, and answered questions regarding field methods, to facilitate staff's analysis of impacts. Staff accepts the proposed edit based on this evaluation of the raw data. CNDDB has updated the Element Rank (NatureServe rank) for all 11 species based on the spring 2012 data.
13.172		Eleven special status plant species occur on the project site.	Staff revised the reference to the total number of special-status species from 10 to 11 based on the applicant's recent confirmation of an eleventh species – Torrey's joint-fir. The reference to eight species in on PSA page 4.2-134 and is a correct reference to the total number of species with a CRPR 2 rank. No references to "nine species" were found.
13.173		Natureserve plant rankings may change as data is collected.	Staff coordinated with CNDDB to update the Element Rank (NatureServe rank) upon receipt of the applicant's 2012 survey in July-August to ensure the ranks used in the analysis and mitigation were current and reflect all new survey data. The new ranks are show in Biological Resources Table 3 and 15, and in all subsequent references to the ranks.
13.174		Revise discussion of special status plant impacts.	Edit accepted; the language was revised in the FSA.
13.175		Remove references to a mitigation ratio within the FSA.	The PSA stated in numerous locations that the special-status plant analysis was ongoing, that the PSA analysis was preliminary and would be revised upon receipt of the spring 2012 survey results. The FSA reflects new data from the spring surveys. Compensatory mitigation will be required for four species. See response to comment 13.162 regarding justification and precedent for the mitigation ratios.
13.176		Revise date that applicant performed reconnaissance-level surveys.	Edit accepted; the language in the PSA was revised accordingly.
13.177		Confirm Natureserve status codes for shadscale scrub.	CNDDB was not asked to update this status code because mitigation for shadscale scrub is based on the loss of habitat for the state and federal listed desert tortoise; not because of its CNDDB rank.
13.178		Add the status code for Torrey's joint-fir.	Edit accepted; the language in the PSA was revised to reflect the new spring 2012 data.
13.179		Use California Rare Plant Rank as opposed to the California Native Plant Society rankings.	Staff chose to use the old name ("CNPS List") in the PSA because the CRPR rank is quite new and unfamiliar to most readers. However, the new name "CRPR Rank" has been added to the FSA and the name change explained in the analysis.
13.180		Revise dates of special status plant surveys.	Edit accepted; the language in the PSA was revised to reflect the new spring 2012 data.

13.181		Revise text regarding performance of special status plant surveys.	Edit accepted; the language in the PSA was revised to reflect the new spring 2012 information on survey methods.
13.182		Add language regarding the description of Androstephium.	Edit accepted; the language in the PSA was revised to reflect the new spring 2012 information on survey methods.
13.183		Add language regarding Androstephium survey results.	Edit accepted; the language in the PSA was revised to reflect the new spring 2012 information on survey methods.
13.184		Revise the discussion of the Nye milkvetch.	Edit accepted; the language in the PSA was revised to reflect the new spring 2012 data and the applicant's conversation with the Nevada Natural Heritage Program (the CNDDB equivalent in Nevada).
13.185		Add language regarding Preuss' milkvetch.	Edit accepted; the language in the PSA was revised to reflect the new spring 2012 information on survey methods.
13.186		Add language regarding gravel milkvetch.	Edit accepted; the language in the PSA was revised to reflect the new spring 2012 information on survey methods.
13.187		Add language to description of Tidestrom's milkvetch.	Edit accepted; the language in the PSA was revised to reflect the new spring 2012 information on survey methods.
13.188		Revise discussion of Wheeler's skeletonweed.	Edit accepted; the language in the PSA was revised to reflect the new spring 2012 information on survey methods.
13.189		Revise discussion of Wheeler's skeletonweed.	Edit accepted; the language in the PSA was revised to reflect the new spring 2012 information on survey methods.
13.190		Add language regarding purple-nerve spring parsley.	Edit accepted; the language in the PSA was revised to reflect the new spring 2012 information on survey methods.
13.191		Discussion of Pahrump Valley buckwheat appears to be missing text.	Edit accepted; thank you for bringing this to our attention. The language in the PSA was also revised to reflect the new spring 2012 data.
13.192		Add language regarding the Pahrump valley buckwheat.	Edit accepted; the language in the PSA was revised to reflect the new spring 2012 data.
13.193		Add language regarding the Pahrump valley buckwheat.	Edit accepted; the language in the PSA was revised to reflect the new spring 2012 data.
13.194		Add discussion of surveys for Selinocarpus.	Edit accepted; the language in the PSA was revised to reflect the new spring 2012 data.
13.195		Update nomenclature for Selinocarpus.	Edit accepted; the language in the PSA was revised to reflect the new spring 2012 data.
13.196		Revise discussion of ephedra species identified onsite.	Edit accepted; the language in the PSA was revised to reflect the new spring 2012 data.

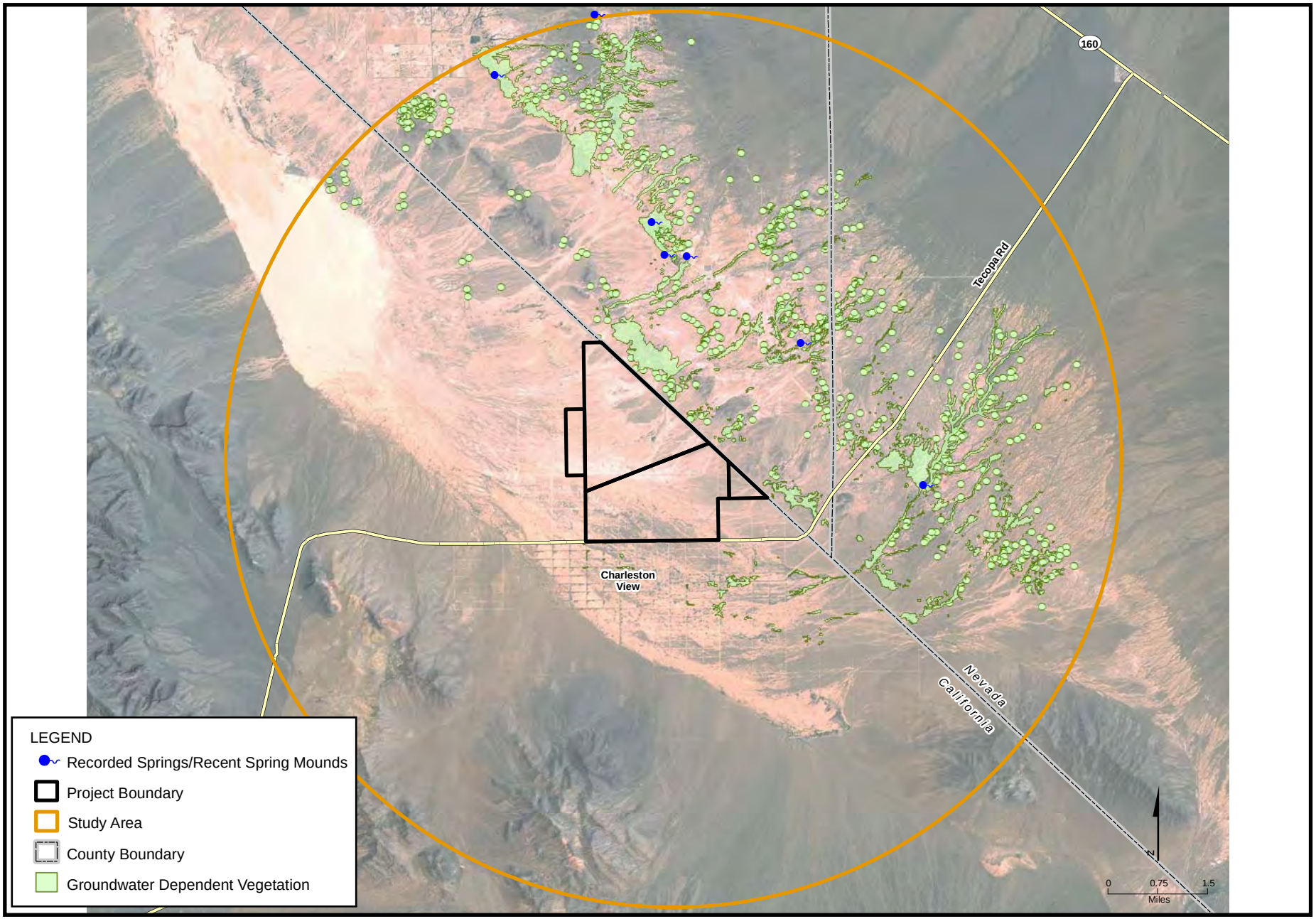
13.197		Update discussion of ephedra with 2012 survey data.	Edit accepted; the language in the PSA was revised to reflect the new spring 2012 data.
13.198		Revise discussion to reflect that 11 special status plant species have been found onsite.	Edit accepted; the language in the PSA was revised to reflect the new spring 2012 data.
13.199		Clarify what is a substantial loss of plant occurrences.	The question is answered quantitatively in Biological Resources Table 15, and in narrative under "Direct Impacts". The project would eliminate between 18 percent and 50 percent of all the known occurrences in California of four of the 11 special-status plant species that occur onsite. The PSA was clear that the analysis was preliminary, pending the results of spring 2012 surveys (PSA p. 4.2-9; 130; 137) and that the final analysis would consider a range of factors, not just rarity (PSA p. 4.2-137-138). The final analysis in the FSA reflects the results of the spring 2012 offsite surveys.
13.20		Clarify what is a significant impact for plant species.	See the comment above and the discussion of significance under "Conclusions and Discussion of Special-status Plant Mitigation".
13.201		BIO-20 is infeasible.	The comment is referring only to the metric for establishing mitigation security in **BIO-20** (Special-status Plant Compensatory Mitigation"). The compensatory mitigation ratios are clearly stated in the condition, and are based on the CNDDB Element Rank (Nature Serve rank), an index of extinction risk based on a nationally accepted methodology. **BIO-20** requires acquisition and preservation of 3 offsite occurrences for every S1-ranked species affected, and 2 offsite occurrences for every S2-rank species. This is entirely feasible, based on a GIS analysis of ownership and management opportunities. **BIO-20** also includes an option for mitigation through restoration of at-risk occurrences (occurrences threatened by, e.g., ORV, noxious weeds, etc.). The guidelines for establishing mitigation security in **BIO-20** were revised in the FSA; the estimated acquisition costs and amount of the security shall be calculated based on the estimated cost per acre for Desert Tortoise mitigation as a best available proxy.

13.202		Compensatory mitigation is not reflective of LORS.	See the comment above for simplifying the method for establishing mitigation security. The mitigation ratios are simple and straightforward (see discussion above under comment 13.201). The significance of the impacts are not based on LORS; CEQA requires a “mandatory finding of significance” for special-status species that meet CEQA’s definition of “rare” or “endangered,” regardless of their formal listing status under the NPPA, CESA or any other law:“When any of the following conditions occur the lead agency shall find that a project may have a significant effect on the environment which will require a Mandatory Finding of Significance. Such a finding shall require an EIR to be prepared (CEQA Guidelines Section 15065)...When a project has the potential to substantially degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, reduce the number or restrict the range of an endangered, rare or threatened species.” Staff’s conclusion that the significantly affected CRPR Rank 2 (CNPS List 2) species may meet the criteria for state listing is shared by CDFG . In the CDFG Special Plants List (CNDDB 2012b) “Taxa which meet the criteria for listing, even if not currently included on any list, as described in Section 15380 of the California Environmental Quality Act (CEQA) Guidelines; these taxa may indicate “None” under listing status, but note that all CNPS 1 and 2 and some List 3 and 4 (now known as California Rare Plant Ranks 1A, 1B, 2, 3, and 4) plants may fall under Section 15380 of CEQA.”
13.203		Securities held for the project should include both land acquisition and land management costs.	The guidelines for establishing mitigation security in BIO-20 were simplified in the FSA based on the discussion at the July 2, 2012 workshop. Tthe estimated acquisition costs and amount of the security shall be calculated based on the estimated cost per acre for Desert Tortoise mitigation as a best available proxy.
13.204		Plants ranked S1 should not be mitigated at 3:1.	**BIO-20** requires the offsite preservation of 3 occurrences for every S1-rank species affected. This mitigation ratio is justified given that S1-rank species are "critically imperiled in the state because of extreme rarity (often 5 or fewer occurrences) or because of some factor(s) such as very steep declines making it especially vulnerable to extirpation from the state/province." It's also entirely feasible, based on a GIS analysis of ownership and management threats and opportunities. **BIO-20** also includes an option for mitigating through restoration of occurrences that are threatened by unauthorized off-road vehicles, noxious weeds, or other factors. A 1:1 ratio still results in a net loss of an occurrence, thus impacts to such rare species must be mitigated at higher ratios to truly offset the impact. A similar condition was adopted for three Energy Commission-licensed projects (Palen, Blythe, and Genesis). CDFG, in practice, requires 3:1 mitigation for permament impacts to washes, and 1:1 for temporary.

BIOLOGICAL RESOURCES - FIGURE 1

Hidden Hills Solar Electric Generating System (HHSEGS) - Groundwater-dependent Vegetation in the Project Vicinity

* Mesquite-dominant groundwater-dependent habitats within the cone of depression of the project pumping wells identified by the applicant. Photos of the mesquite and springs provided in Biological Resources Figure 2a.



BIOLOGICAL RESOURCES

CALIFORNIA ENERGY COMMISSION - SITING, TRANSMISSION AND ENVIRONMENTAL PROTECTION DIVISION

SOURCE:CH2M Hill, Data Response Set 1A

BIOLOGICAL RESOURCES - FIGURE 2a

Hidden Hills Solar Electric Generating System (HHSEGS) - Groundwater-dependent Resources in the Project Vicinity*

*The resources shown below occur within the cone of depression identified by staff for the project pumping wells (see the Water Supply section of the FSA)

#1 – Mesquite canyon approximately 1.75 miles east of the project boundary near the airport; characteristic of the larger "mesquite washes". No evidence of surface water within the last 10 years or longer; the vegetation appears to be dependent wholly on groundwater. The mesquite range from approximately 6 to 15 feet in height, and many with a trunk diameter of 8 inches or larger, sufficient for cavity-nesting special-status birds. Similar groundwater-dependent habitat on washes near the firearms training center and throughout the Stump Springs area; the ephemeral hydrology of the washes is insufficient to support the mesquite – an "obligate phreatophyte" (groundwater-dependent).

#2 – Representative photo of the mesquite coppice dunes just east of the project (between 600 and 2600 feet east of the project boundary). The mesquite on coppice dunes are typically shorter in stature than the mesquite in washes, and associated with four-wing saltbush (Atriplex canescens), a facultative "phreatophyte" (groundwater-dependent plant). The coppice dunes are arranged linearly along the state line fault, and are supported wholly by groundwater (no washes or other surface water present). Honey mesquite (Prosopis glandulosa) is considered an obligate phreatophyte in California and southern Nevada (Sawyer et al. 2009; Crampton et al. 2006).

SOURCE: CEC Staff and BLM (Boris Poff, Southern Nevada District) photos

BIOLOGICAL RESOURCES - FIGURE 2b

Hidden Hills Solar Electric Generating System (HHSEGS) - Two seasonal spring-supported pools at Stump Springs ACEC. BLM reports that the pools are present from approximately December to June or July.

BIOLOGICAL RESOURCES

CALIFORNIA ENERGY COMMISSION - SITING, TRANSMISSION AND ENVIRONMENTAL PROTECTION DIVISION

SOURCE: CEC Staff and BLM (Boris Poff, Southern Nevada District) photos

BIOLOGICAL RESOURCES - FIGURE 2c

Hidden Hills Solar Electric Generating System (HHSEGS) - Groundwater-dependent Resources in the Project Vicinity*

*The resources shown below occur within the cone of depression identified by staff for the project pumping wells (see the Water Supply section of the FSA)

Active seep-spring, and groundwater-supported riparian vegetation just south of the Front Sight Firearms Training Center, approximately 1.5 miles east of the project. Surface water present.

Another active spring and wetland located west of Cottonwood Spring. Not currently in the BLM spring database.

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SOURCE: CEC Staff and BLM (Boris Poff, Southern Nevada District) photos

BIOLOGICAL RESOURCES - FIGURE 2d

Hidden Hills Solar Electric Generating System (HHSEGS) - Groundwater-dependent Resources in the Project Vicinity*

*The resources shown below occur within the cone of depression identified by staff for the project pumping wells (see the Water Supply section of the FSA)

Both photos: Healthy mesquite stand with many age classes, located approximately 3.5 miles northeast of the project boundary.

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SOURCE: CEC Staff and BLM (Boris Poff, Southern Nevada District) photos

BIOLOGICAL RESOURCES - FIGURE 2e

Hidden Hills Solar Electric Generating System (HHSEGS) - Lush mesquite coppice dune vegetation at Stump Springs Area of Critical Environmental Concern (ACEC) south of Tecopa Highway. Photo from applicant's data response #1A, Figure 49-1.

Relatively lush mesquite coppice dune vegetation south of the Tecopa Highway.

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SOURCE: CEC Staff and BLM (Boris Poff, Southern Nevada District) photos

BIOLOGICAL RESOURCES - FIGURE 3a

Hidden Hills Solar Electric Generating System (HHSEGS) - Characteristic Stream Forms on the Project Site

One of the larger features, a jurisdictional state waters and waters of the U.S., photographed at the eastern project boundary. A few widely scattered mesquite. At the eastern boundary, where there is a greater slope gradient, the washes are generally more incised and the channel forms are more or less single thread, as in this photo. The single-thread forms generally lack a true floodplain, unlike the “braid plain”.

The terminus of the washes, i.e., where the washes are less defined, were noticeably wetter than the upper single-thread reaches following a 0.2 inch storm event, and the changes in species composition along the washes more distinct. Germination of annuals like rattlesnake weed (Chamaesyce albomarginata) – a native favored by desert tortoise – was abundant in the lower, wetter reaches following an August summer storm event.

CALIFORNIA ENERGY COMMISSION - SITING, TRANSMISSION AND ENVIRONMENTAL PROTECTION DIVISION

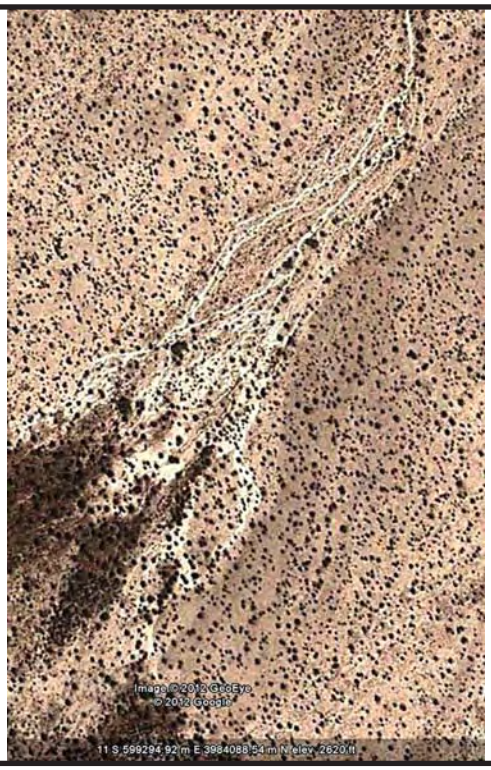
SOURCE: CEC Staff Photos

BIOLOGICAL RESOURCES - FIGURE 3b

Hidden Hills Solar Electric Generating System (HHSEGS) - Characteristic Stream Forms on the Project Site

One of the features delineated as a non-jurisdictional “pooled area” at the terminus of a wash, inundated for a day following a 0.2 in. storm event. The feature in the photo is one of multiple small channels across a larger “braid plain”, or floodplain of multiple small braided channels. It is the most common channel form on the project site, and characteristic of alluvial fan distributary networks.

An aerial photo of the watercourse described above, and a signature characteristic of alluvial fan distributary channel networks



CALIFORNIA ENERGY COMMISSION - SITING, TRANSMISSION AND ENVIRONMENTAL PROTECTION DIVISION

SOURCE: CEC Staff Photos and Google Earth Imagery

BIOLOGICAL RESOURCES - FIGURE 3c

Hidden Hills Solar Electric Generating System (HHSEGS) - Characteristic Stream Forms on the Project Site

Distributary channel characteristic of the smallest features; this feature one of several small channels across a larger braid plain. Unlike their temperate-region counterparts where streams typically decrease in number as they converge toward a single, larger channel, these distributary channels diverge from the single-thread source at the apex of the fan, and increase in number but decrease in size toward the toe of the fan, due to diversion of flow (avulsion) by channel blockages of sediment and debris deposited during previous flow events.

Another single thread channel form delineated near the eastern project boundary. Bunchgrasses like galleta grass (Pleuraphis rigida) and alkali sacaton (Sporobolus airoides) are often more abundant in the washes, as in this photo.

CALIFORNIA ENERGY COMMISSION - SITING, TRANSMISSION AND ENVIRONMENTAL PROTECTION DIVISION

SOURCE: CEC Staff Photos

BIOLOGICAL RESOURCES - FIGURE 4a

Hidden Hills Solar Electric Generating System (HHSEGS) - Desert Tortoise Habitat Mapping Field Verification

Photo and data point locations depicted in Biological Resources Figure 5

#1 - Creosote bush scrub; taken at applicant's demarcation between the Mojave desert scrub (creosote scrub) and Shadscale scrub but no apparent shift in type on the ground; creosote bush scrub in all directions. Away from the road edge, disturbance and weeds light.

#2 - Start of shadscale scrub to west (left) of disturbed area. Beyond the graded area disturbance light to moderate, weeds light.

#2 (east of point) - Creosote bush scrub to east of the graded area. Beyond the grading, the habitat is lightly disturbed and recovering.

#3 - Creosote bush scrub; shadscale present but not dominant, patchy disturbance near road edge, weeds moderate to heavy (>5% cover)

CALIFORNIA ENERGY COMMISSION - SITING, TRANSMISSION AND ENVIRONMENTAL PROTECTION DIVISION

SOURCE: CEC Staff Photos

BIOLOGICAL RESOURCES - FIGURE 4b

Hidden Hills Solar Electric Generating System (HHSEGS) - Desert Tortoise Habitat Mapping Field Verification

Photo and data point locations depicted in Biological Resources Figure 5

#4 - Creosote bush scrub; disturbance patchy, weeds associated largely with disturbed patches.

#5 - Creosote bush scrub to east and west; heavily disturbed, heavy weed component (10-15%)

#6 (no photo) #7 - Creosote bush scrub (beyond the road edge); diverse shrub layer, off road, disturbance is light, weeds moderate to heavy (7-10% cover) in patches in disturbed areas and concentrated in low-lying (moist) areas. Good to excellent habitat for all tortoise life-stages.

#8 - Creosote bush scrub (beyond the road edge); diverse shrub and herb layer, disturbance light with a moderate (7%) component of weeds (red brome), heavy weed cover (10-15%) of halogeton on the desert pavement.

CALIFORNIA ENERGY COMMISSION - SITING, TRANSMISSION AND ENVIRONMENTAL PROTECTION DIVISION

SOURCE: CEC Staff Photos

BIOLOGICAL RESOURCES - FIGURE 4c

Hidden Hills Solar Electric Generating System (HHSEGS) - Desert Tortoise Habitat Mapping Field Verification

Photo and data point locations depicted in Biological Resources Figure 5

#8 (west of point) - Creosote bush scrub; diverse shrub and herb layer, lightly disturbed with moderate weed componen of halogeton mostly on the desert pavement.

#9 (no photo)- #10 - Desert pavement and disturbed area with heavy component of halogeton (15-20%) and little natural vegetation (background of photo) interspersed with patches of intact and diverse shadscale scrub (shadscale-rabbit thorn with <2% creosote) in foreground.

#11 - Shadscale scrub; close-up of the shadscale-rabbit thorn ssociation described above (rabbit thorn dominant; not shadscale).

#12 - Creosote bush scrub (beyond the road edge); interspersed with pavement, lightly to moderately disturbed, moderately weedy but good diversity in shrub layer.

CALIFORNIA ENERGY COMMISSION - SITING, TRANSMISSION AND ENVIRONMENTAL PROTECTION DIVISION

SOURCE: CEC Staff Photos

BIOLOGICAL RESOURCES - FIGURE 4d

Hidden Hills Solar Electric Generating System (HHSEGS) - Desert Tortoise Habitat Mapping Field Verification

Photo and data point locations depicted in Biological Resources Figure 5

#13 - Shadscale scrub (to west, creosote bush scrub to east); diverse shrub and herb layer in both habitats, weed component light (3%).

#14 (no photo) - #15 - Shadscale scrub (all directions); heavy component of halogeton (10-15%) near roads but good shrub diversity and well-developed bio crust between shrubs beyond disturbed areas.

#16 - Shadscale scrub to west, cresosote bush scrub to east; disturbance and weeds light (<2%), good shrub diversity.

#17 (no photo; Creosote bush scrub of high quality with 10-15% cover of bio crust and only trace element of weeds) - #18 - Creosote bush scrub to east, shadscale scrub to west; light disturbance, moderately weedy (5%) with Russian thistle.

CALIFORNIA ENERGY COMMISSION - SITING, TRANSMISSION AND ENVIRONMENTAL PROTECTION DIVISION

SOURCE: CEC Staff Photos

BIOLOGICAL RESOURCES - FIGURE 4e

Hidden Hills Solar Electric Generating System (HHSEGS) - Desert Tortoise Habitat Mapping Field Verification

Photo and data point locations depicted in Biological Resources Figure 5

#19 - Creosote bush scrub to east (in photo), shadscale scrub to west; lightly disturbed but heavy component of Russian thistle (10-15%)

#20 (no photo; badger burrow) - #21 - Creosote bush scrub; nearly pristine, gravelly soils but low shrub species diversity relative to many other areas. Weeds nearly absent so may have a good component of native annuals in spring.

#22 - Highly disturbed; apparently disked historically with little native vegetation and heavy component of Russian thistle and halogeton

#23 - Shadscale scrub; undisturbed abd high quality, high shrub diversity, no (or trace) component of weeds.

CALIFORNIA ENERGY COMMISSION - SITING, TRANSMISSION AND ENVIRONMENTAL PROTECTION DIVISION

SOURCE: CEC Staff Photos

BIOLOGICAL RESOURCES - FIGURE 4f

Hidden Hills Solar Electric Generating System (HHSEGS) - Desert Tortoise Habitat Mapping Field Verification

Photo and data point locations depicted in Biological Resources Figure 5

#24 - Creosote bush scrub to west and east; lightly to moderately disturbed, moderately weedy.

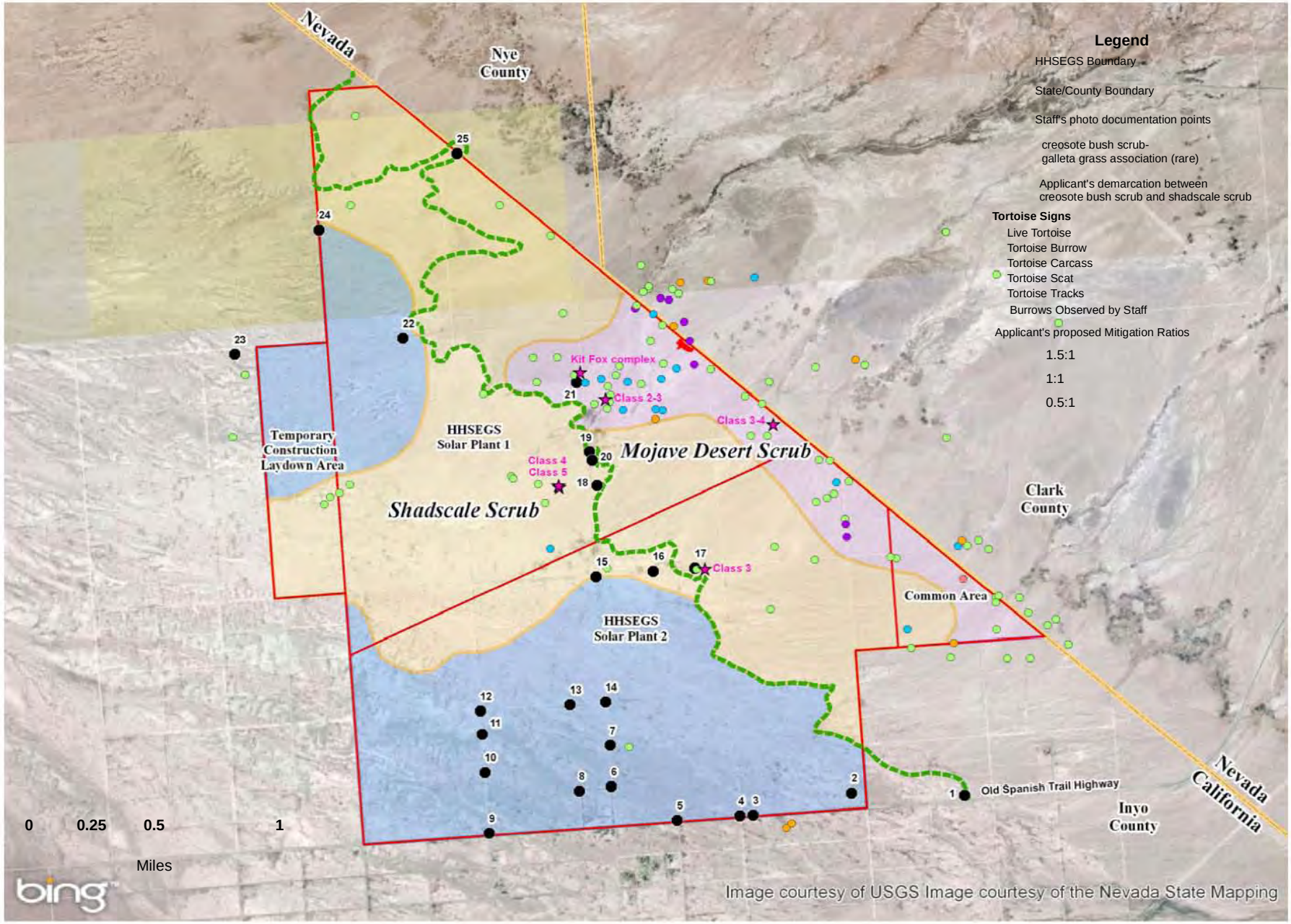
#25 - creosote bush scrub in all directions; lightly disturbed, light to moderate weed component (3%).

CALIFORNIA ENERGY COMMISSION - SITING, TRANSMISSION AND ENVIRONMENTAL PROTECTION DIVISION

SOURCE: CEC Staff Photos

BIOLOGICAL RESOURCES - FIGURE 5

Hidden Hills Solar Electric Generating System (HHSEGS) - Desert Tortoise Habitat Mapping Verification

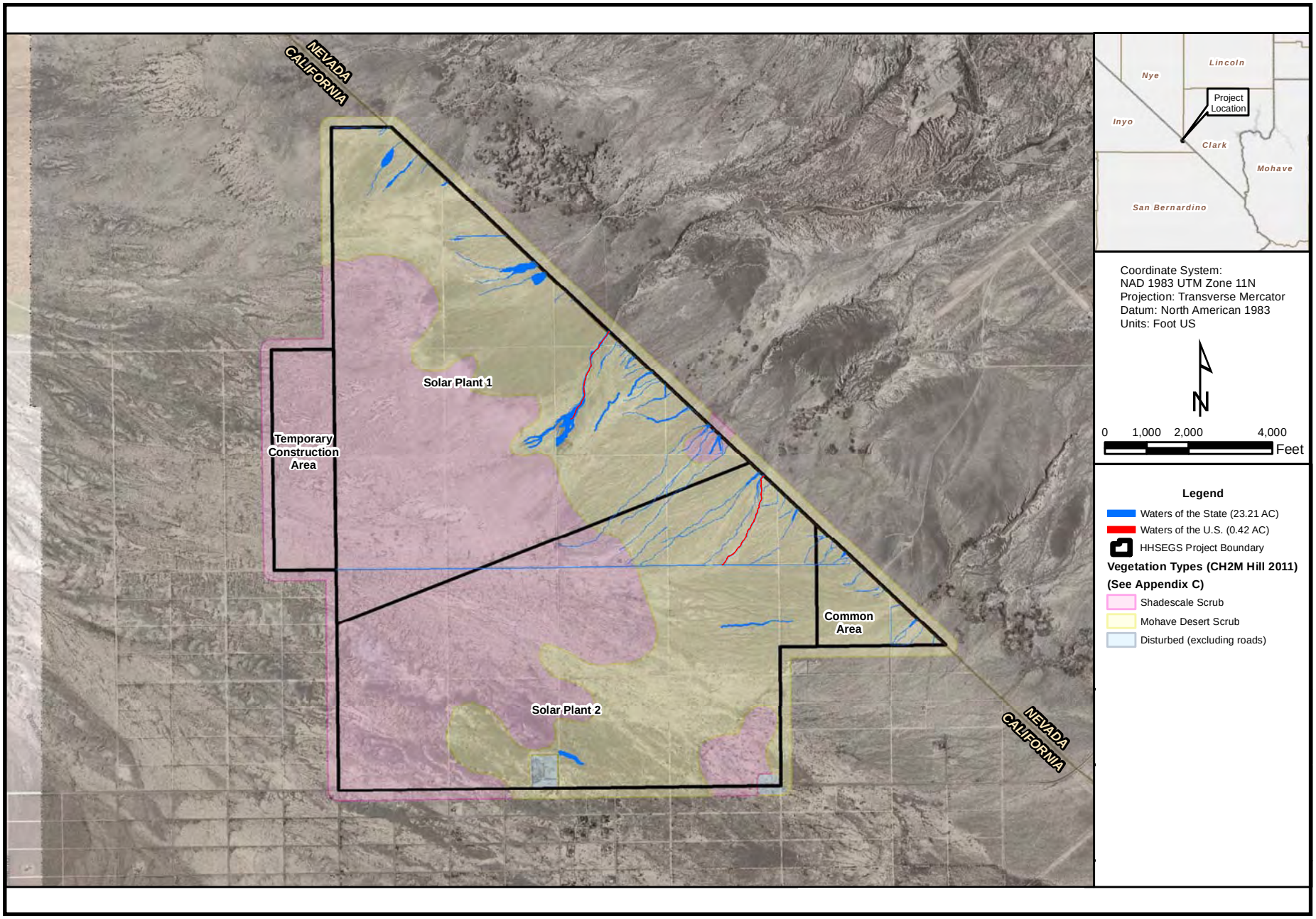


CALIFORNIA ENERGY COMMISSION, SITING, TRANSMISSION AND ENVIRONMENTAL PROTECTION DIVISION

SOURCE: CH2M HILL, CEC Staff

BIOLOGICAL RESOURCES - FIGURE 6

Hidden Hills Solar Electric Generating System (HHSEGS) - Revised Delineation of Waters of the State



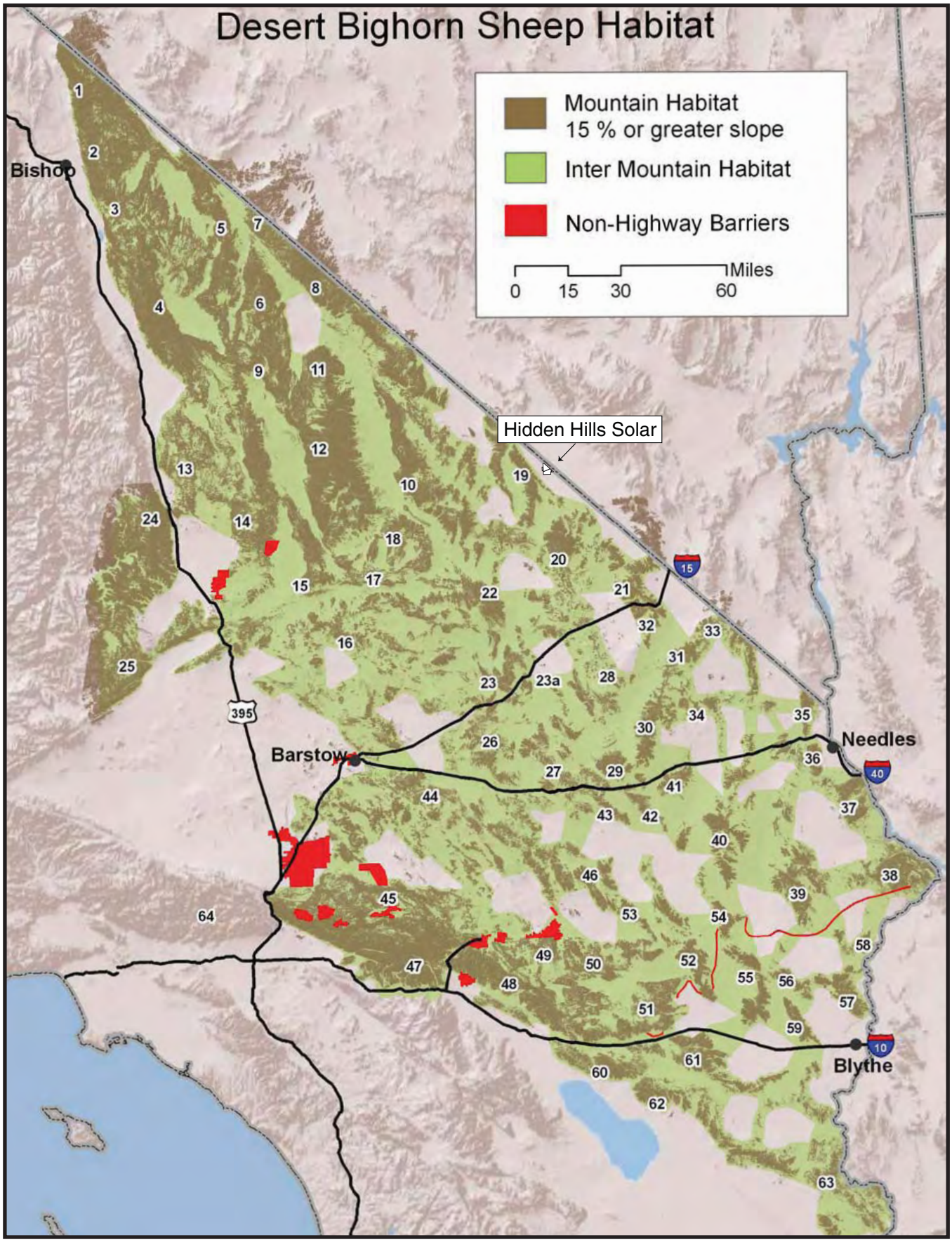
BIOLOGICAL RESOURCES

CALIFORNIA ENERGY COMMISSION - SITING, TRANSMISSION AND ENVIRONMENTAL PROTECTION DIVISION

SOURCE: M.J. Klinefelter GIS & Environmental Consulting

BIOLOGICAL RESOURCES - FIGURE 7

Hidden Hills Solar Electric Generating System (HHSEGS) - Desert Bighorn Sheep Habitat in California

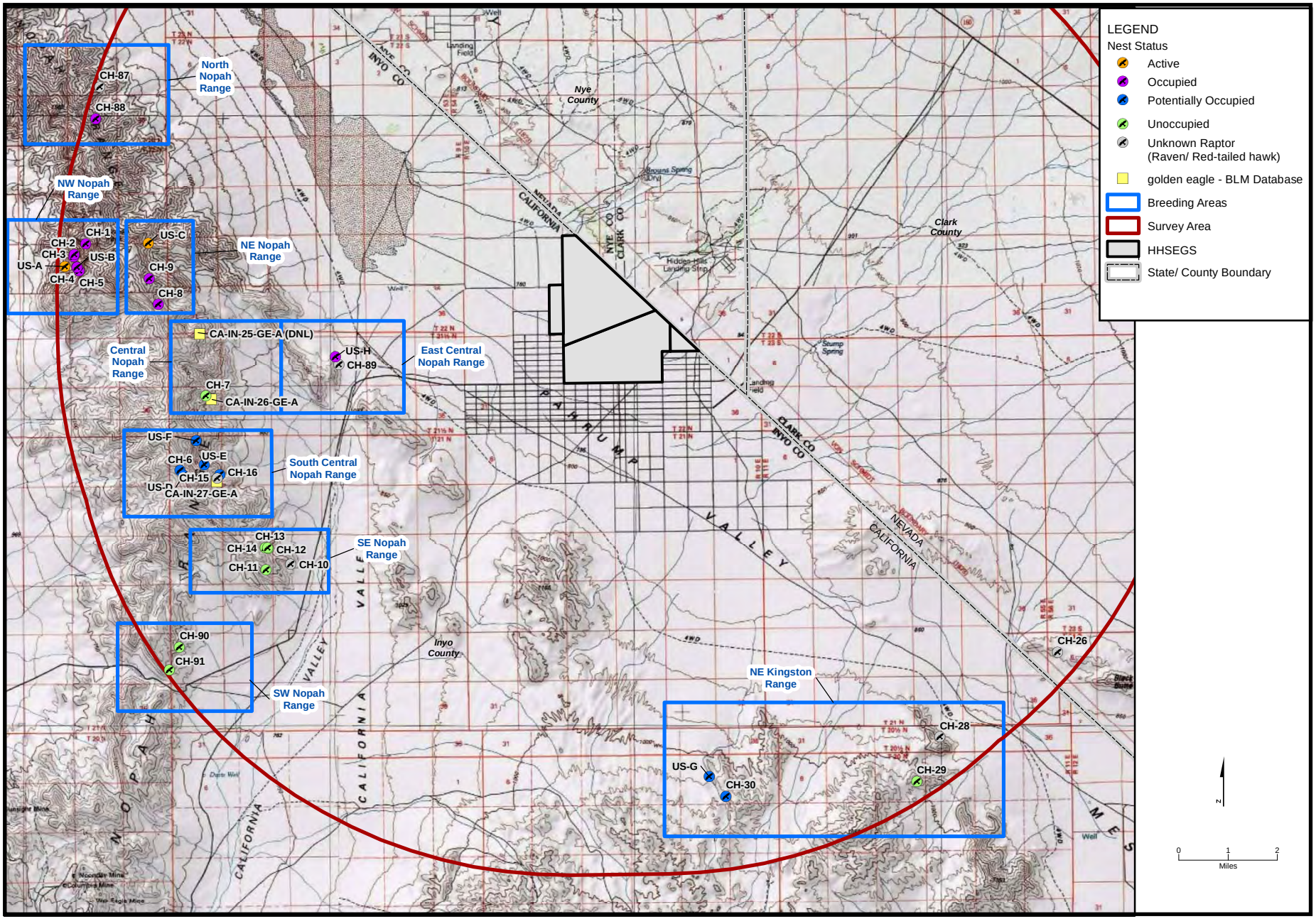


CALIFORNIA ENERGY COMMISSION - SITING, TRANSMISSION AND ENVIRONMENTAL PROTECTION DIVISION

SOURCE: CA DFG

BIOLOGICAL RESOURCES - FIGURE 8

Hidden Hills Solar Electric Generating System (HHSEGS) - Golden Eagle Observations in the Project Vicinity



BIOLOGICAL RESOURCES

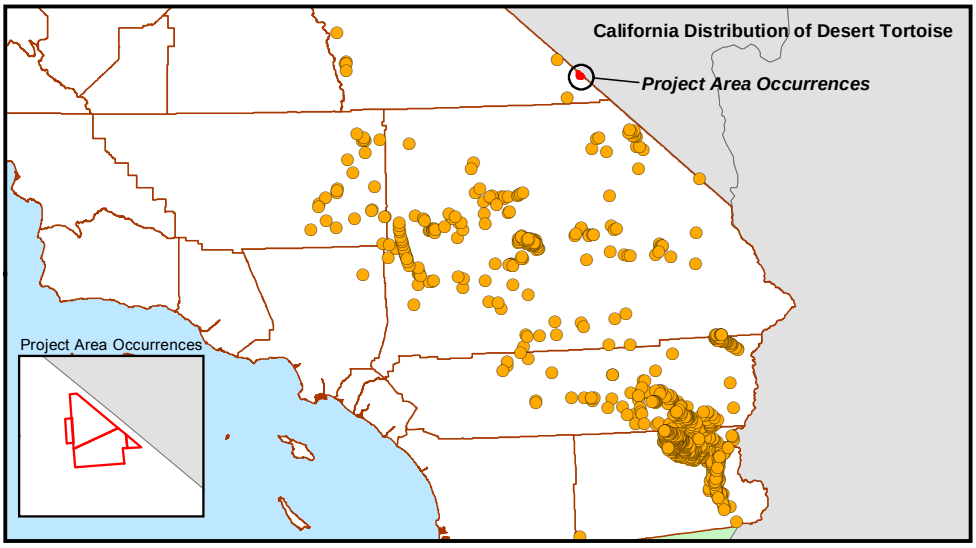
CALIFORNIA ENERGY COMMISSION - SITING, TRANSMISSION AND ENVIRONMENTAL PROTECTION DIVISION

SOURCE: DR52.3-1

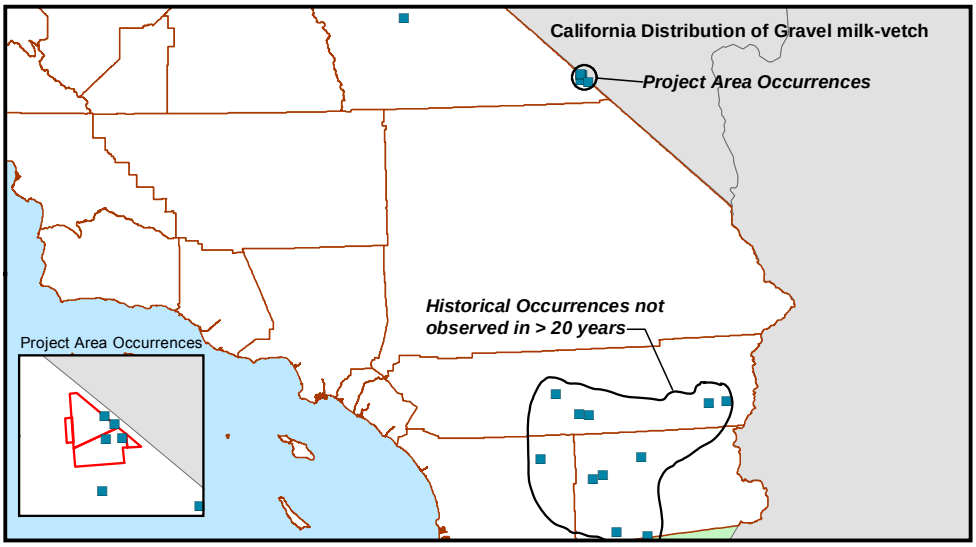
BIOLOGICAL RESOURCES FIGURE 9a

Hidden Hills Solar Generating System (HHSEGS) - California Range of Special-status Plants* Impacted by the Project

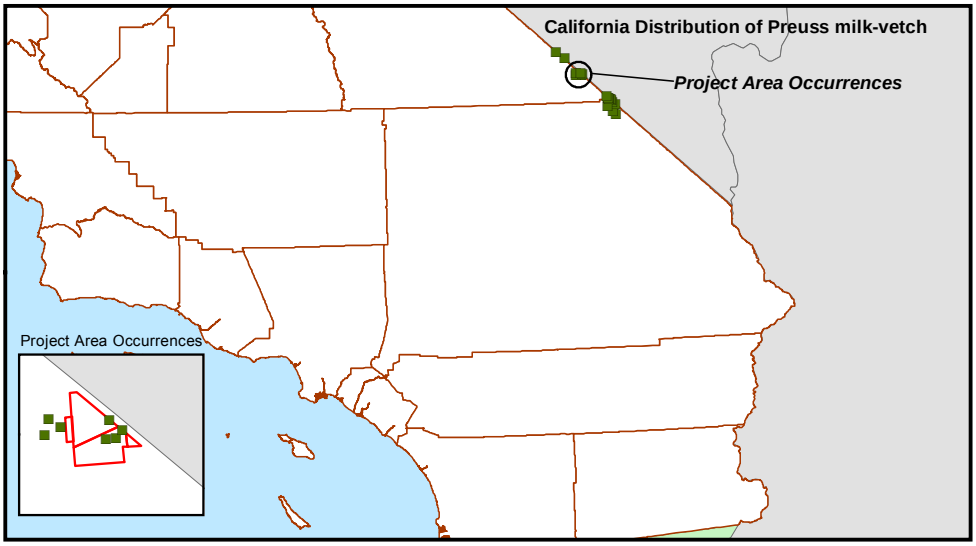
* State range maps are also provided for Desert Tortoise and Mohave Ground Squirrel to demonstrate the narrow range of the affected rare plant species relative to two listed wildlife species



Desert tortoise (*Gopherus agassazii*) – Federal Threatened, State Threatened



Gravel milk-vetch (*Astragalus sabulonum*) – CRPR 2; CNDDB S2



Preuss' milk-vetch (*Astragalus preussii var. preussii*) – CRPR 2; CNDDB S1

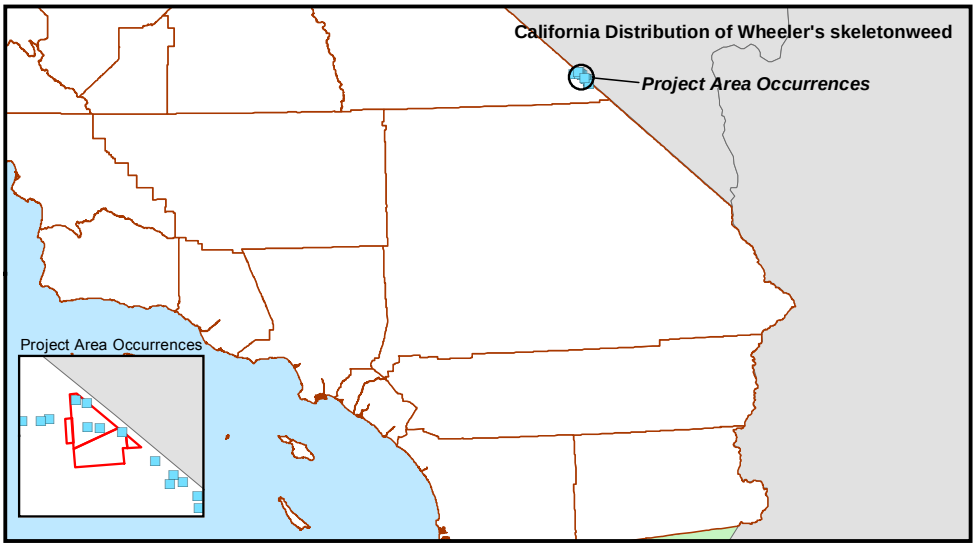
CALIFORNIA ENERGY COMMISSION - SITING, TRANSMISSION AND ENVIRONMENTAL PROTECTION DIVISION

SOURCE: CNDDB, 9-4-2012 and CH2MHILL

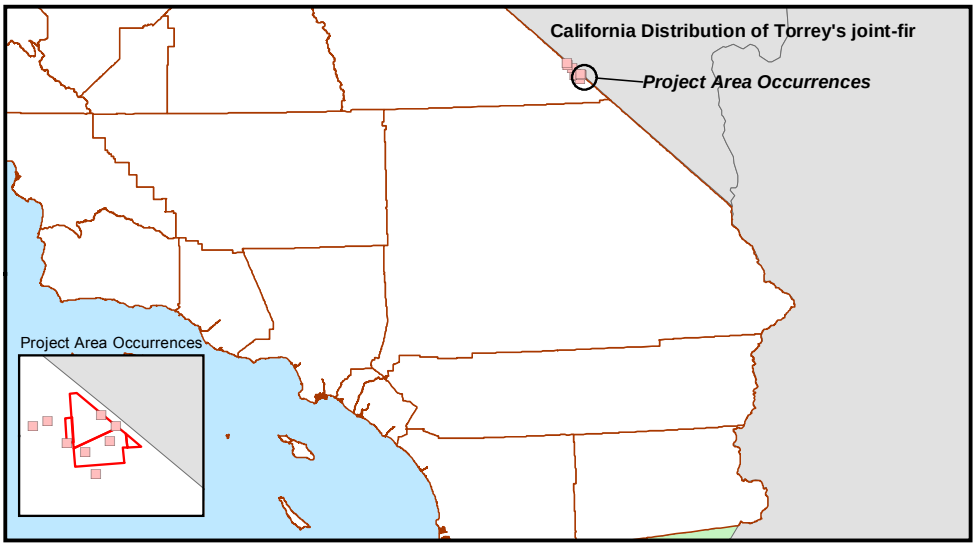
BIOLOGICAL RESOURCES FIGURE 9b

Hidden Hills Solar Generating System (HHSEGS) - California Range of Special-status Plants* Impacted by the Project

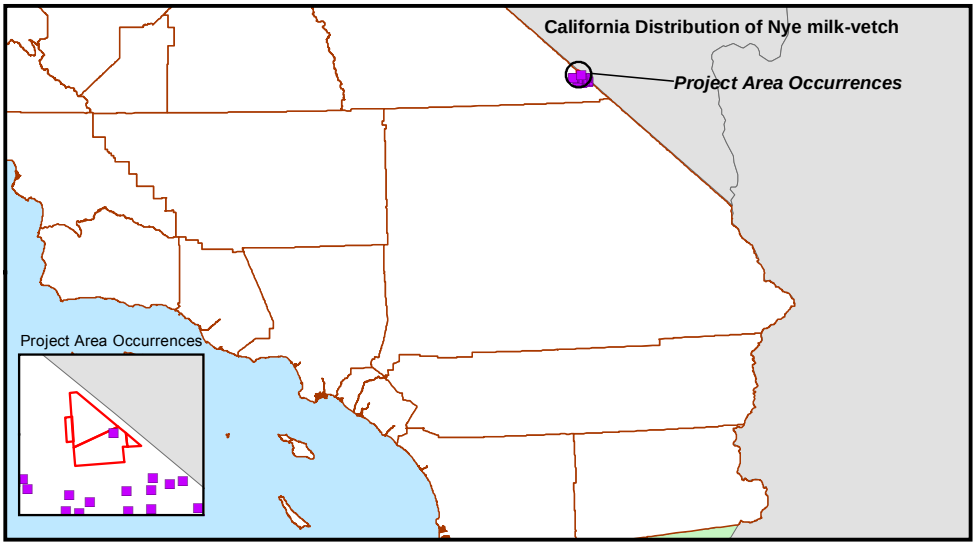
* State range maps are also provided for Desert Tortoise and Mohave Ground Squirrel to demonstrate the narrow range of the affected rare plant species relative to two listed wildlife species.



Wheeler's skeletonweed (*Chaetadelpha wheeleri*) – CRPR 2; CNDDB S1/S2



Torrey's joint-fir (*Ephedra torreyana*) – CRPR 2; CNDDB S1



Nye milk-vetch (*Astragalus nyensis*) – CRPR 1B; CNDDB S1

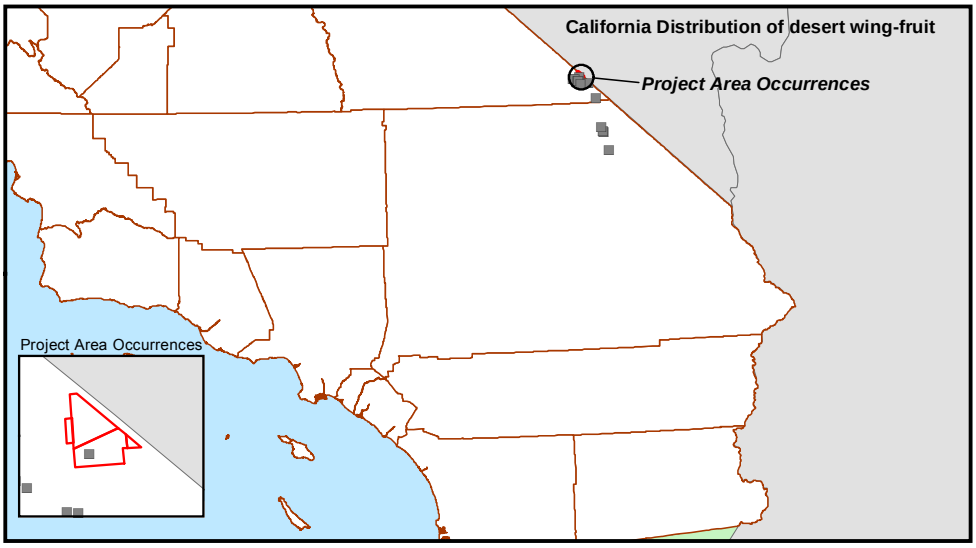
CALIFORNIA ENERGY COMMISSION - SITING, TRANSMISSION AND ENVIRONMENTAL PROTECTION DIVISION

SOURCE: CNDDB, 9-4-2012 and CH2MHILL

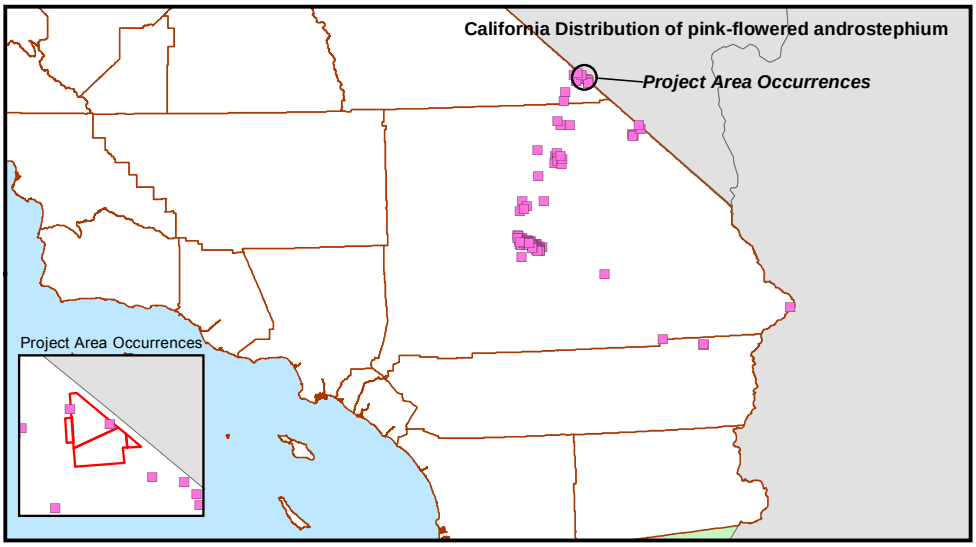
BIOLOGICAL RESOURCES FIGURE 9c

Hidden Hills Solar Generating System (HHSEGS) - California Range of Special-status Plants* Impacted by the Project

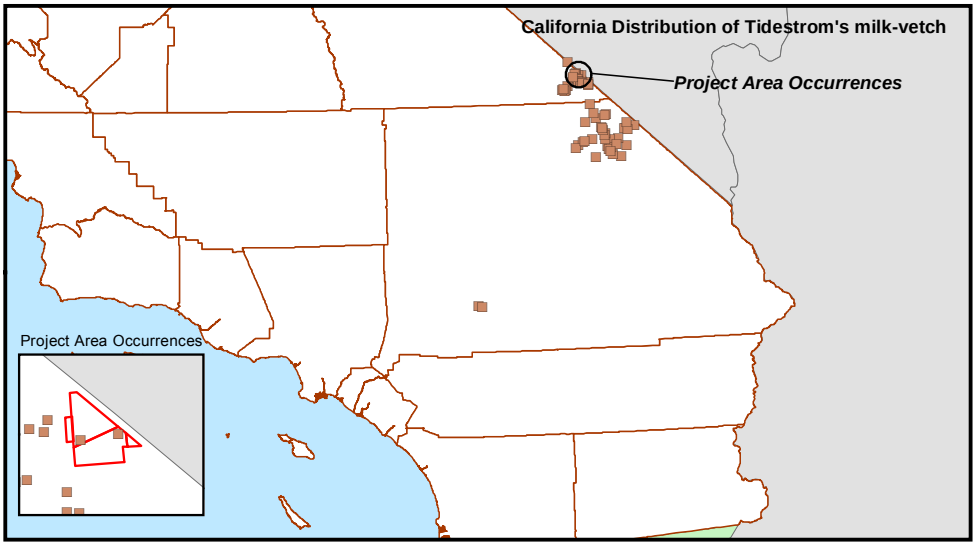
* State range maps are also provided for Desert Tortoise and Mohave Ground Squirrel to demonstrate the narrow range of the affected rare plant species relative to two listed wildlife species



desert wing-fruit (*Acleisanthes nevadadensis*) (syn=*Selinocarpus nevadensis*) – CRPR 2; CNDDB S1



pink-flowered androstephium (*Androstephium breviflorum*) – CRPR 2; CNDDB S3



Tidestrom's milk-vetch (*Astragalus tidestromii*) – CRPR 2; CNDDB S2

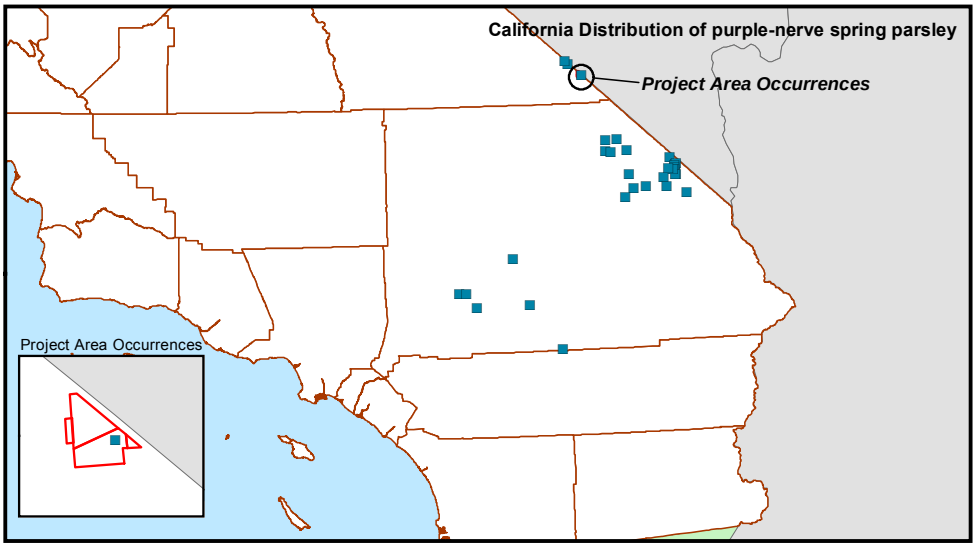
CALIFORNIA ENERGY COMMISSION - SITING, TRANSMISSION AND ENVIRONMENTAL PROTECTION DIVISION

SOURCE: CNDDB, 9-4-2012 and CH2MHILL

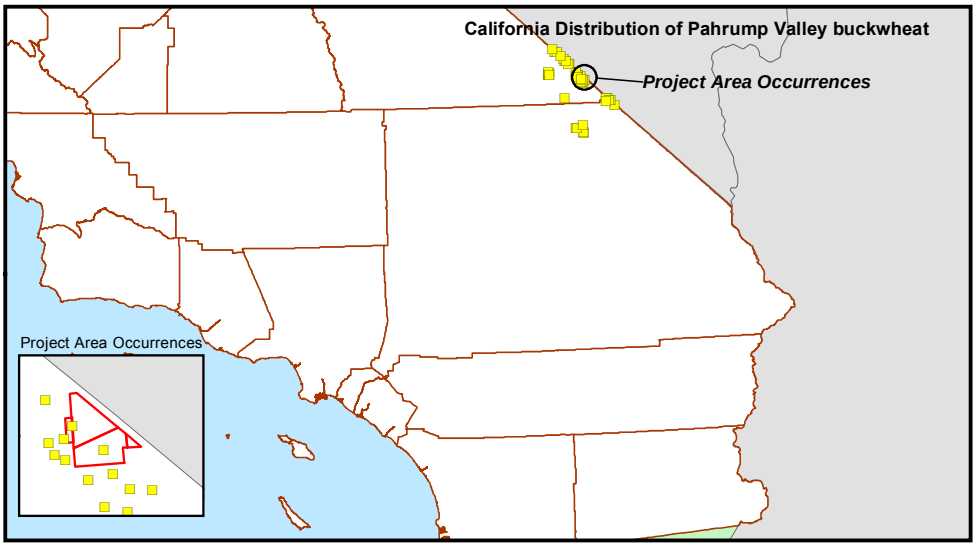
BIOLOGICAL RESOURCES FIGURE 9d

Hidden Hills Solar Generating System (HHSEGS) - California Range of Special-status Plants* Impacted by the Project

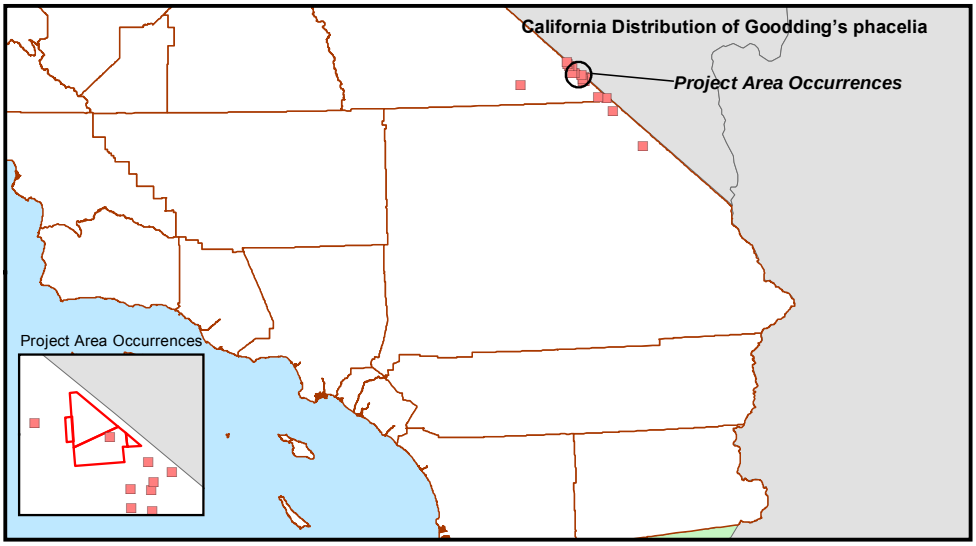
* State range maps are also provided for Desert Tortoise and Mohave Ground Squirrel to demonstrate the narrow range of the affected rare plant species relative to two listed wildlife species



purple-nerve spring parsley (*Cymopterus multinervatus*) – CRPR 2; CNDDB S2



Pahrump Valley buckwheat (*Eriogonum bifurcatum*) – CRPR 1B; CNDDB S3



Goodding's phacelia (*Phacelia pulchella var. gooddingii*) – CRPR 2; CNDDB S2

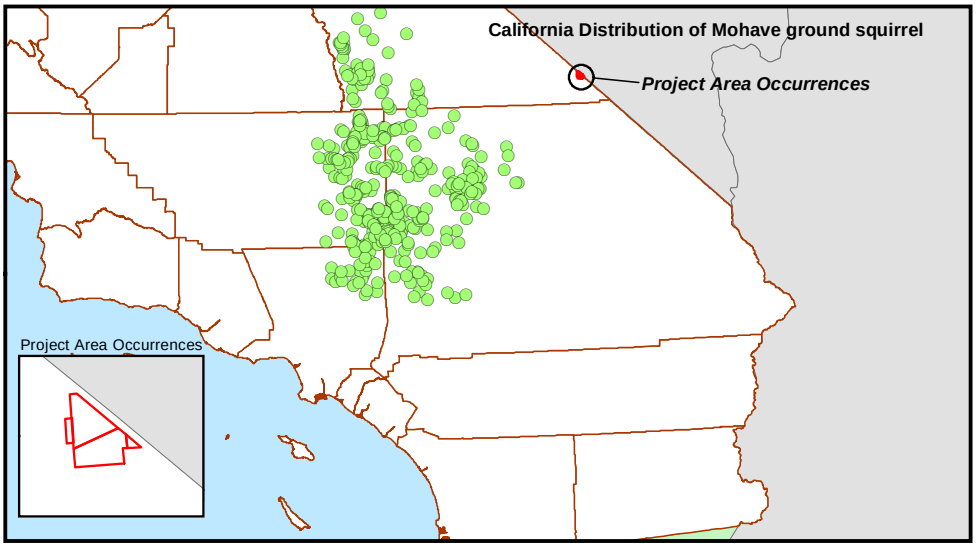
CALIFORNIA ENERGY COMMISSION - SITING, TRANSMISSION AND ENVIRONMENTAL PROTECTION DIVISION

SOURCE: CNDDB, 9-4-2012 and CH2MHILL

BIOLOGICAL RESOURCES FIGURE 9e

Hidden Hills Solar Generating System (HHSEGS) - California Range of Special-status Plants* Impacted by the Project

* State range maps are also provided for Desert Tortoise and Mohave Ground Squirrel to demonstrate the narrow range of the affected rare plant species relative to two listed wildlife species



Mohave ground squirrel (*Xerospermophilus mohavensis*) - State Threatened

STATUS CODES

CNDDB Element Rank (NatureServe):

State rank (S-rank) is a reflection of the overall condition of an element throughout its state range (Master et al.2009). Multiple rankings indicate a range of values.

S1 = Critically Imperiled Critically imperiled in the state because of extreme rarity (often 5 or fewer occurrences) or because of some factor(s) such as very steep declines making it especially vulnerable to extirpation from the state;

S2 = Imperiled Imperiled in the state because of rarity due to very restricted range, very few populations(often 20 or fewer), steep declines, or other factors making it very vulnerable to extirpation from the nation or state.

S3 = Vulnerable Vulnerable in the state due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors making it vulnerable to extirpation.

S4 = Apparently Secure Uncommon but not rare; some cause for long-term concern due to declines or other factors.

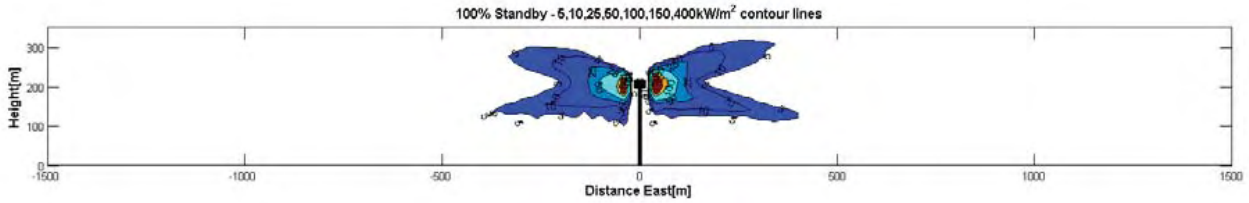
S5 = Secure Common, widespread, and abundant in the state.

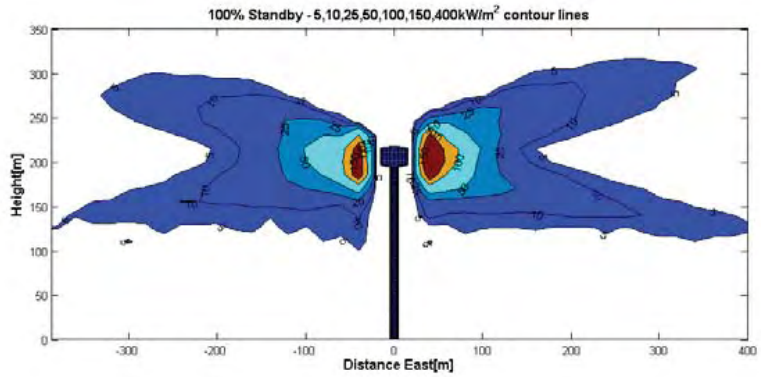
California Rare Plant Rank (former California Native Plant Society List):

CRPR 1B = Rare, threatened, or endangered in California and elsewhere
CPRP 2 = Rare, threatened, or endangered in California but more common elsewhere
CRPR 3 = Plants which need more information
CRPR 4 = Limited distribution - a watch list.

APPENDIX BIO2 - FIGURE 1

Hidden Hills Solar Electric Generating System (HHSEGS) - Full standby





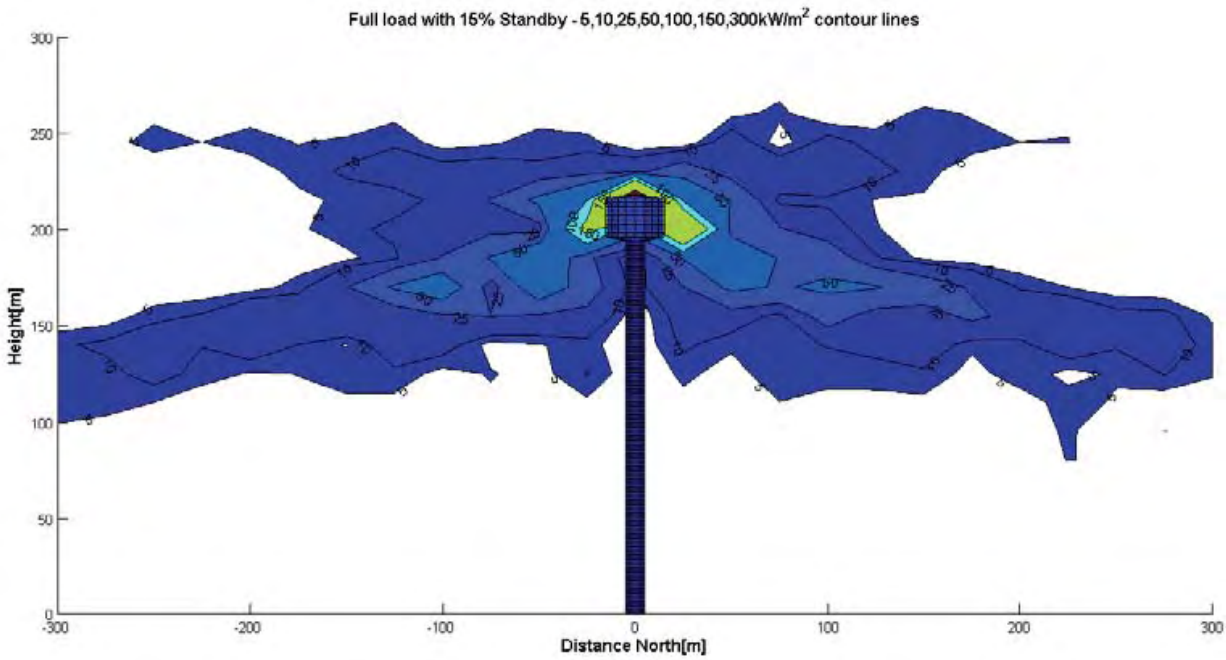
Side views of maximal flux quantifier vertical cross section plot at 20m resolution

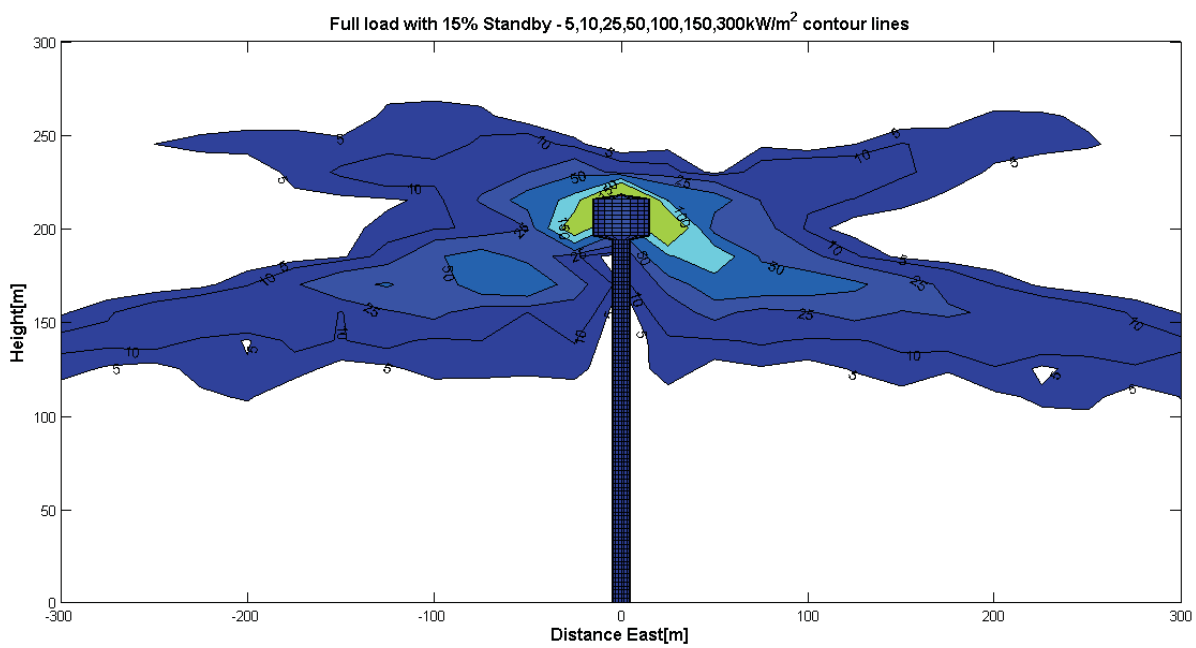
Top: view from east; bottom:zoom in of view from east.

Views from other direction are expected to be similar

APPENDIX BIO2 - FIGURE 2

Hidden Hills Solar Electric Generating System (HHSEGS) - Full load with 15% standby





View of vertical cross section through the tower of maximal flux quantifier at full load with 15% of solar field at standby.

Top: view from east (25m resolution),

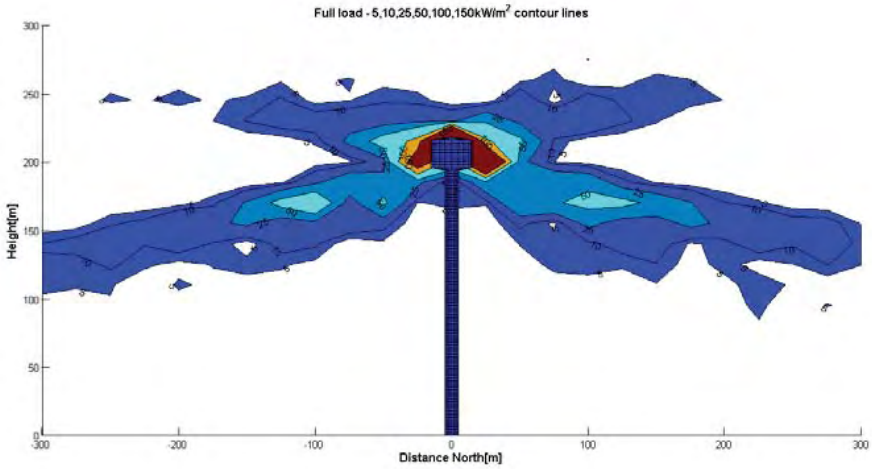
Bottom: view from south(25m resolution).

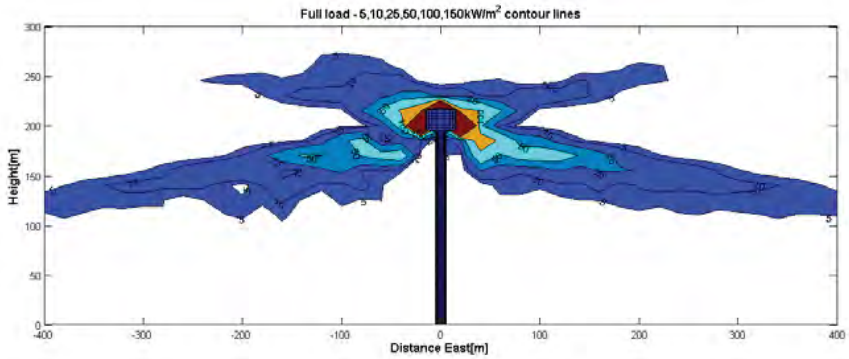
CALIFORNIA ENERGY COMMISSION - SITING, TRANSMISSION AND ENVIRONMENTAL PROTECTION DIVISION

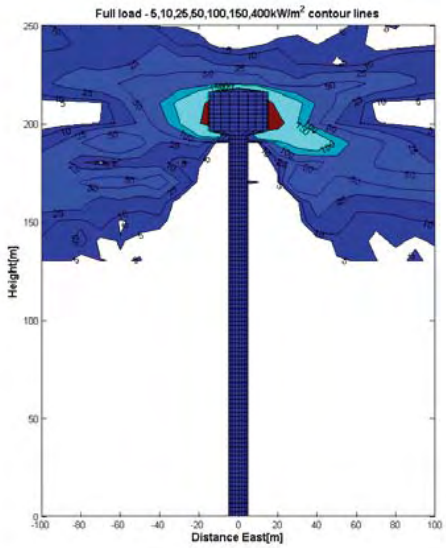
SOURCE:Applicant's Response to Data Requests, Set 2A, #159_Page 8, July 20, 2012

APPENDIX BIO2 - FIGURE 3

Hidden Hills Solar Electric Generating System (HHSEGS) - Full load with 0% standby







Profile views of Maximal Flux Quantifier at full load (with no standby)

Top: View from East (25m resolution)

Middle: View from South (25m resolution)

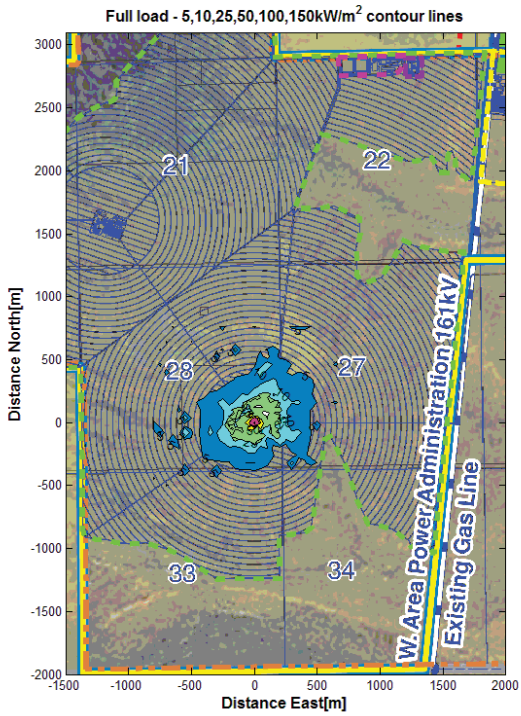
Bottom: Enlarged view from South (10m resolution)

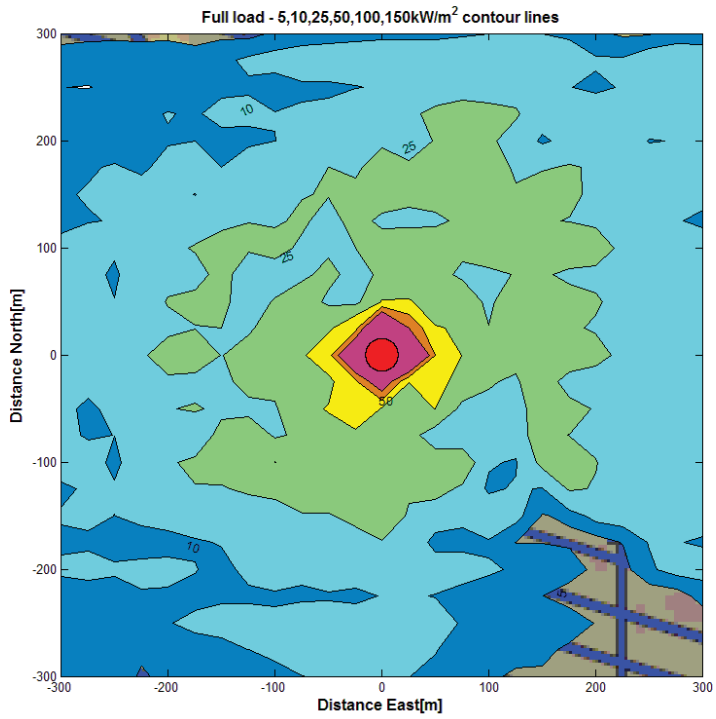
CALIFORNIA ENERGY COMMISSION - SITING, TRANSMISSION AND ENVIRONMENTAL PROTECTION DIVISION

SOURCE:Applicant's Response to Data Requests, Set 2A, #159_Page 6, July 20, 2012

APPENDIX BIO2 - FIGURE 4

Hidden Hills Solar Electric Generating System (HHSEGS) - Plan View of Flux at Full load with 0% standby over RMS 1 Solar Field





The above plan views show the maximal flux quantifier over the solar field at full load (no standby).

Top Image: Overview of the RMS site

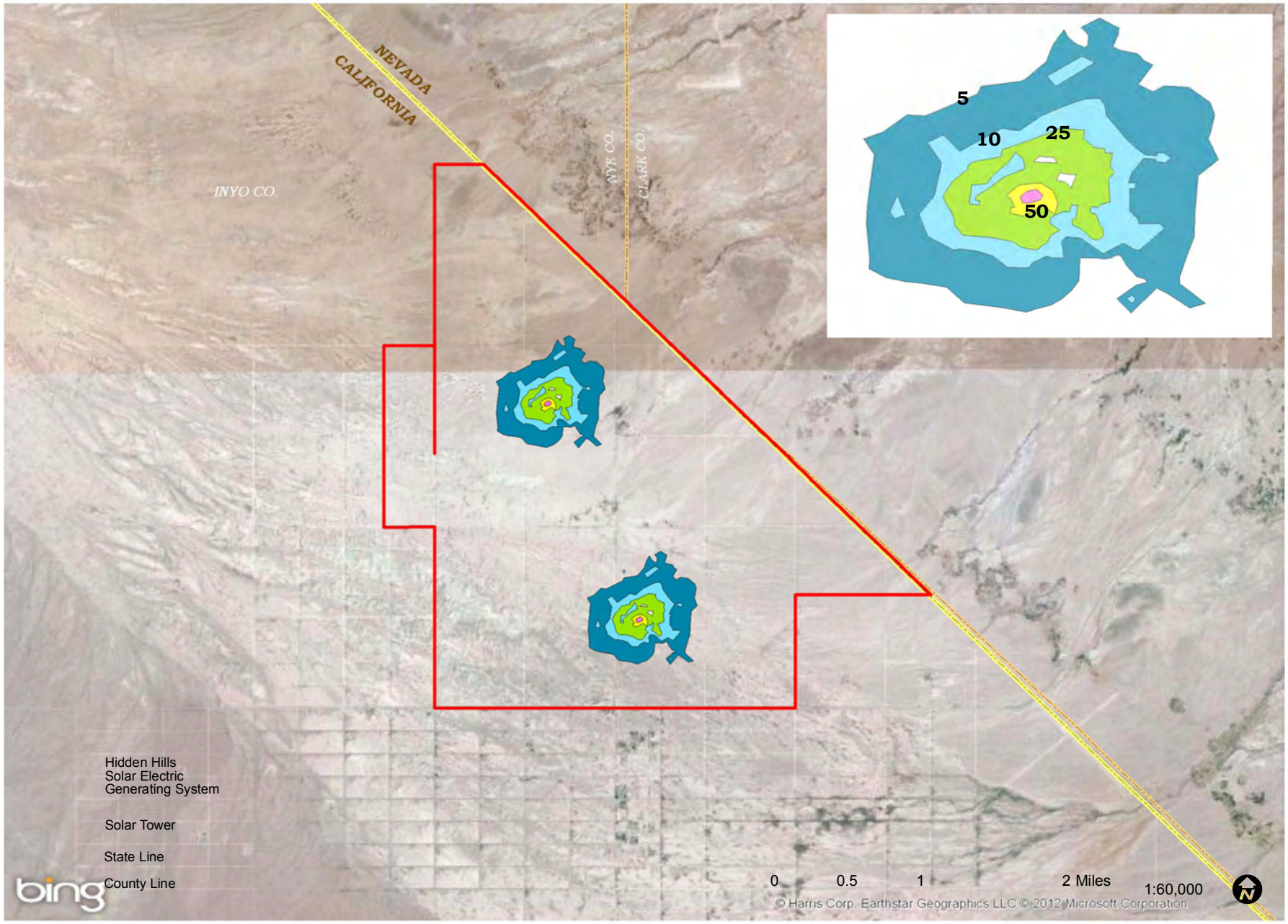
Bottom Image: Enlargement of inner rectangle. Red circle represents the receiver location

CALIFORNIA ENERGY COMMISSION - SITING, TRANSMISSION AND ENVIRONMENTAL PROTECTION DIVISION

SOURCE:Applicant's Response to Data Requests, Set 2A, #159_Page 7, July 20, 2012

APPENDIX BIO2 - FIGURE 5

Hidden Hills Solar Electric Generating System (HHSEGS) - Radiant Flux

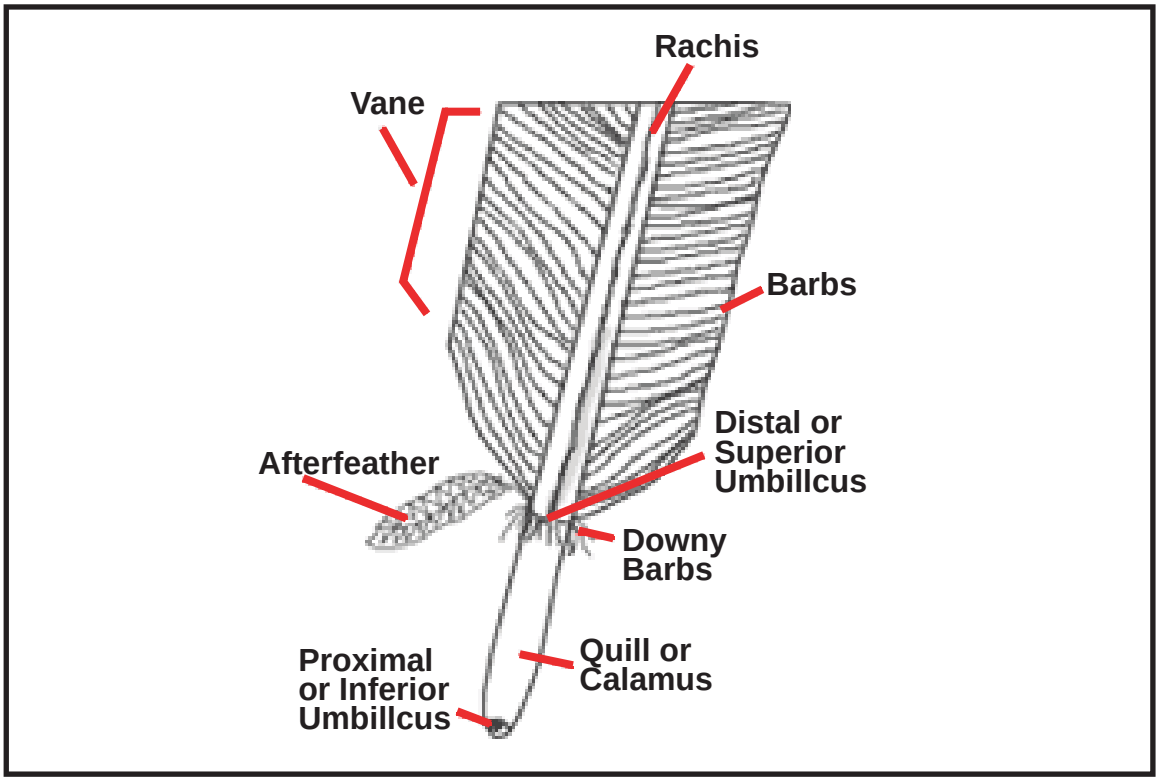


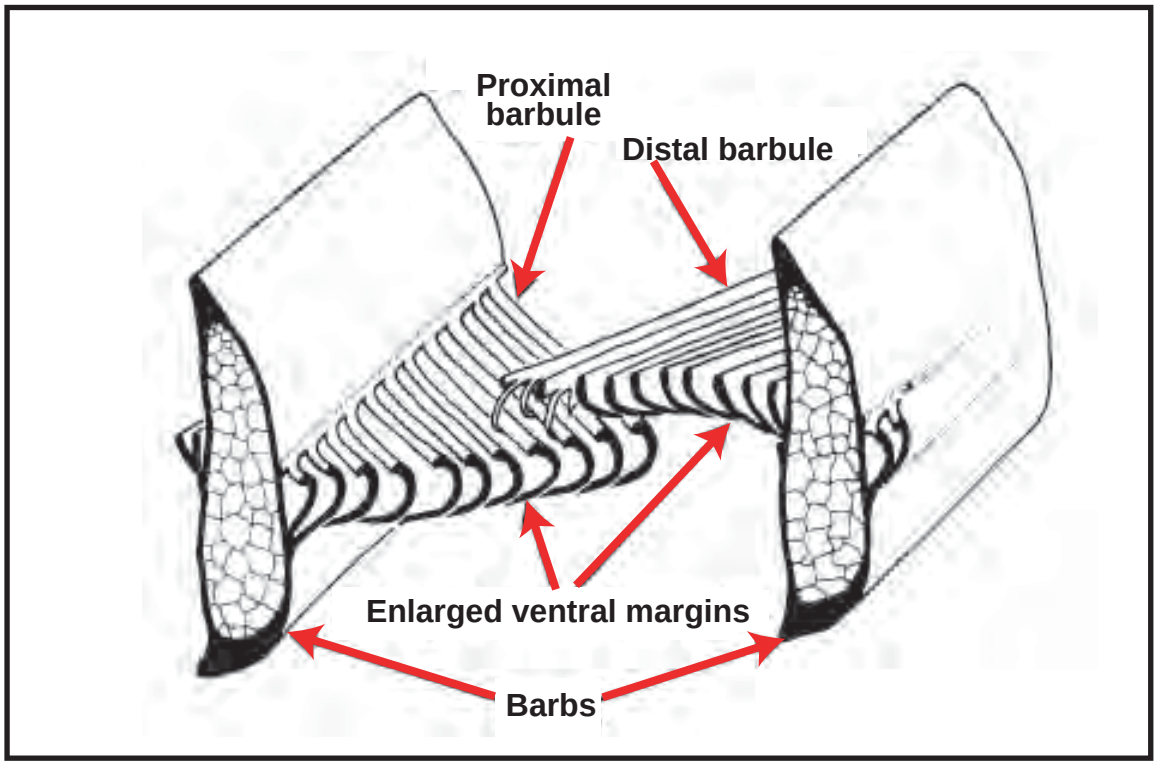
CALIFORNIA ENERGY COMMISSION, SITING, TRANSMISSION AND ENVIRONMENTAL PROTECTION DIVISION

SOURCE: Applicant's Response to Data Requests, Set 2A, #159_Page 7, July 20, 2012, Bing Aerial

APPENDIX BIO2 - FIGURE 6

Hidden Hills Solar Electric Generating System (HHSEGS) - Bird Feather Types





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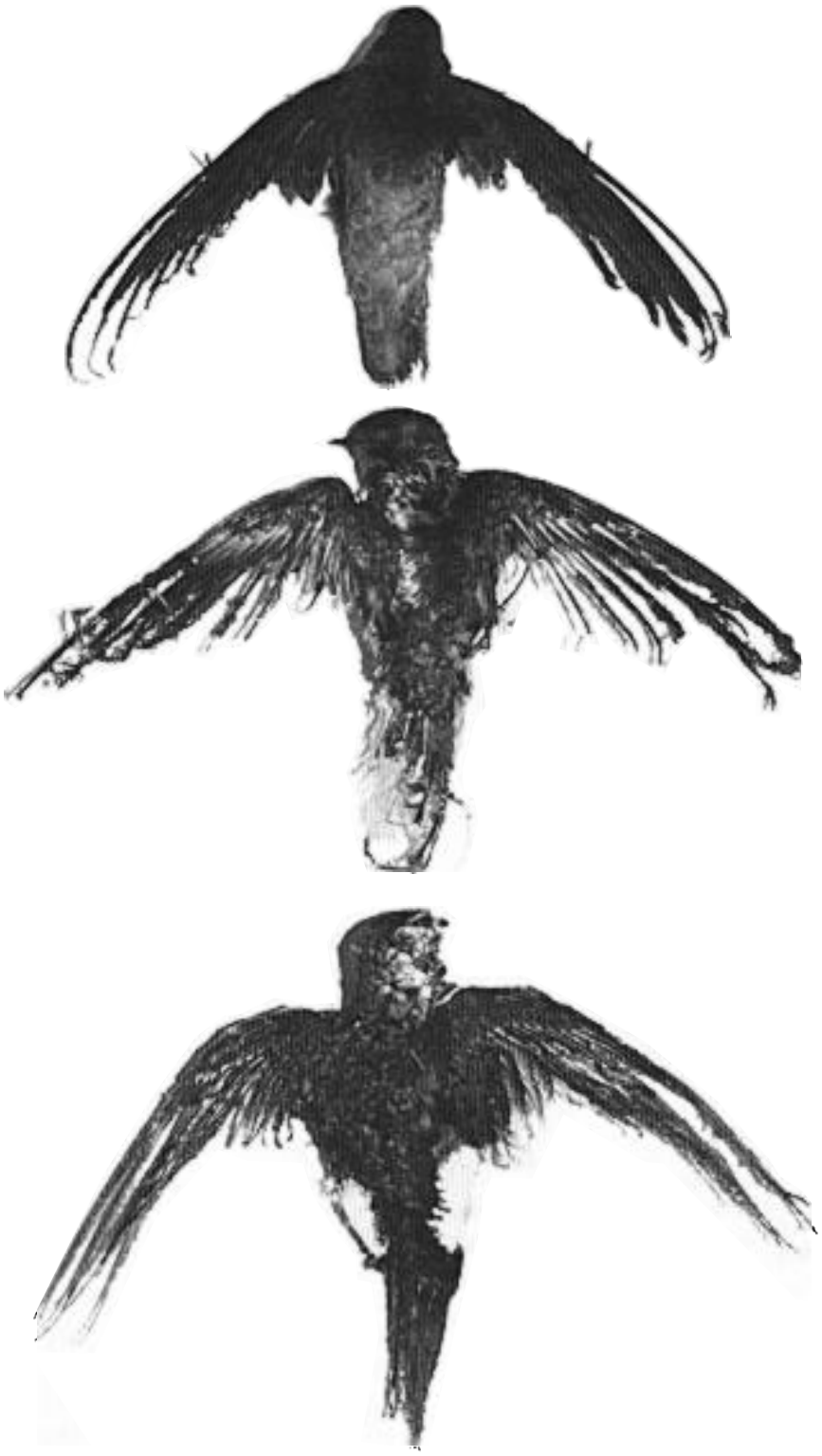
SOURCE: *Upper Figure:* Bird Feather Types, Anatomy, Growth, Color, and Molting by Doctors Foster and Smith at http://www.peteducation.com/article.cfm?c=15+1829&aid=2776

Lower Figure: Muller and Patone 1998 - Muller W. and G. Patone. 1998. Air Transmissivity of Feathers. The Journal of Experimental Biology 201, pages 2591-2599.

APPENDIX BIO2 - FIGURE 7

Hidden Hills Solar Electric Generating System (HHSEGS) - Burnt Birds



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SOURCE: McCrary et al. 1986 – McCrary, M. D., R. L. McKernan, R. W. Schreiber, W. D. Wagner, and T. C. Sciarrotta, Avian Mortality at a Solar Energy Plant, In: Journal of Field Ornithology 57(2): 135-141