Bird and Bat Conservation Strategy

Sunshine Valley Solar Project
Nye County, Nevada

Prepared for:

Sunshine Valley Solar, LLC

135 Main St., 6th Floor

San Francisco, CA 94105 85281

Prepared by:

Western EcoSystems Technology, Inc.
415 W. 17th St.
Cheyenne, WY 82001

FINAL
April 7, 2017

Table of Contents

LIST OF APPENDICES

1 INTRODUCTION

Sunshine Valley Solar, LLC (Sunshine Valley), a subsidiary of First Solar Development, LLC, intends to construct, own, operate, and maintain an up to 110-megawatt (MW) photovoltaic (PV) solar electric generation facility, the Sunshine Valley Solar Power Project (Project), located in an unincorporated portion of Nye County, Nevada. The Project would be located on approximately 745 acres (301.5 hectares) of private land in of the town of Amargosa, Nevada (Figure 1).

Project components include onsite facilities, offsite facilities and temporary on-site facilities needed to construct the Project. The major onsite facilities comprise solar array blocks of PV modules, 34.5-kilovolt (kV) alternating current (AC) power collection systems, and a substation. Operation and maintenance (O&M) facilities will be constructed onsite or immediately adjacent to the site. The offsite facilities include a 0.6-mile (1-kilometer) 138-kV generation tie transmission (gen-tie) line, access road, and electric distribution and communication lines. Temporary on-site facilities, which would be removed at the end of the construction period, include mobilization, laydown, and construction areas. Several above ground temporary water storage tanks for dust suppression will also be present during construction. Power produced by the Project would be conveyed to the bulk transmission system via the gen-tie line, which would interconnect to Valley Electric Association's 138-kV Valley Substation near the intersection of Power Line Road and Anvil Road northeast of the Project.

Since the Project is not located on federal land or otherwise subject to federal jurisdiction, this Bird and Bat Conservation Plan (BBCS) was developed voluntarily by Sunshine Valley to provide a written record of Sunshine Valley's efforts to evaluate potential Project impacts to birds and bats and to document conservation measures that would be implemented to avoid, minimize, and/or mitigate for those potential impacts. After introductory material on Project description, the BBCS purpose, and regulatory framework, the BBCS includes the following major sections:

- Baseline conditions,
- Risk assessment,
- Bird and bat conservation measures,
- Construction and post-construction monitoring, and
- Adaptive management.

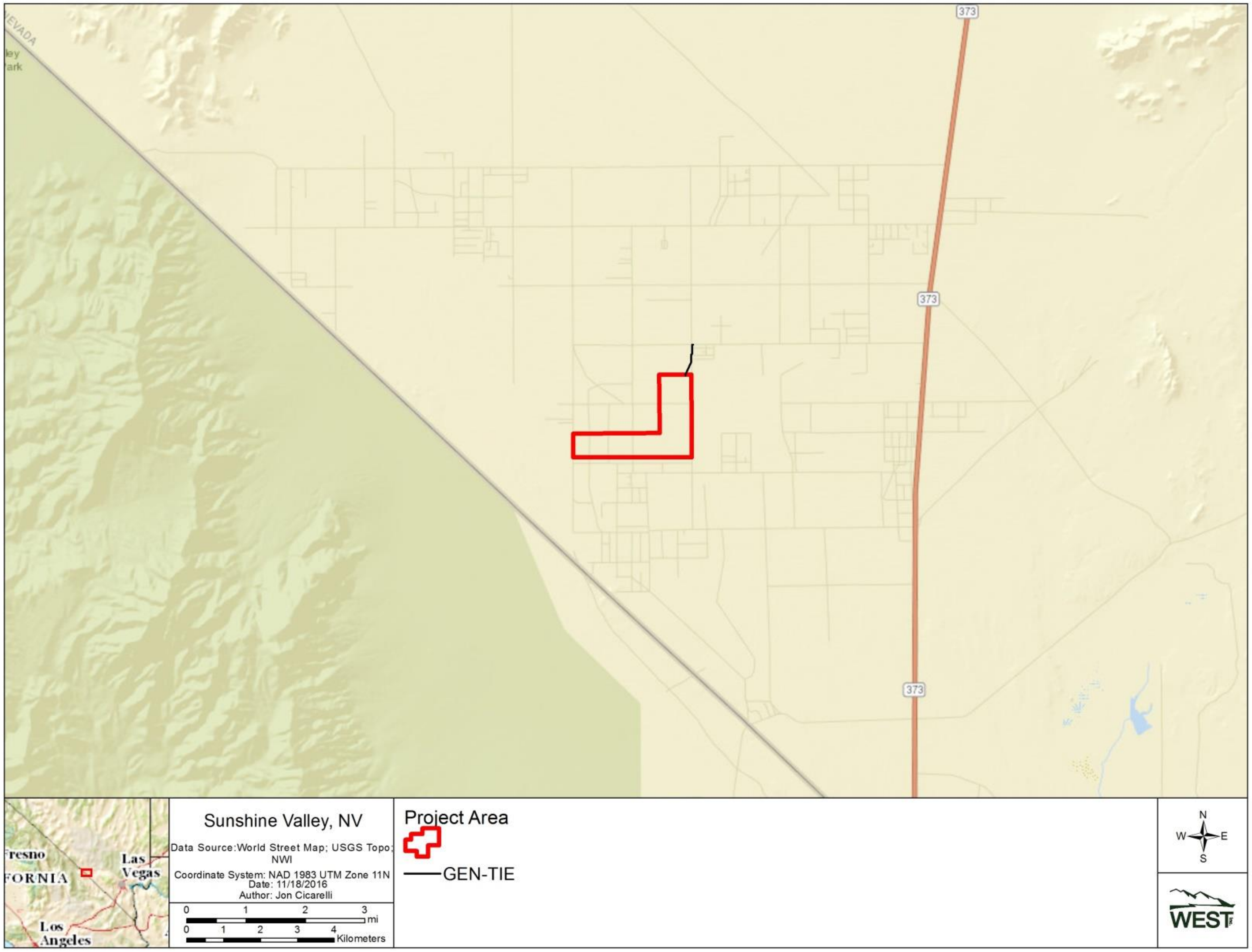

Figure 1. Location of the Sunshine Valley Solar Power Project, Nye County, Nevada.

1.1 Purpose

The U.S. Fish and Wildlife Service (USFWS or Service) currently recommends the development of a project-specific BBCS, formerly called an Avian and Bat Protection Plan, for all renewable energy projects that may impact bird and bat resources. The BBCS is not intended to initiate formal consultation for take of federal or state listed or protected species or any other federal regulatory action; rather, it provides a summary of current biological conditions and describes conservation measures intended to avoid, minimize, and/or mitigate potential impacts to bird and bat species. Information in this BBCS is intended to correspond to Sunshine Valley's proposed measures and mitigation described in documentation prepared for the Project and includes the following objectives:

- Describe baseline conditions for bird and bat species present within the Project site, including results of surveys performed to date;
- Present a risk assessment identifying activities during the construction, operation and maintenance, and decommissioning phases that may contribute to potential adverse effects to bird and bat species occurring in and near areas of Project development;
- Specify conservation measures that would be employed to avoid, minimize, and/or mitigate any potential adverse effects to these species;
- Provide details for an Avian and Bat Fatality Monitoring Study to be conducted post-construction, including applicable approved protocols that would be used for any surveys and/or monitoring conducted; and
- Detail an adaptive management approach to potential adverse impacts and reporting goals for the Project. This BBCS would be in effect through development, construction, operation, maintenance, and decommissioning of the Project. This BBCS would cover the anticipated 35-year functional life of the solar facility and potential extended operations and/or decommissioning of the Project. Sunshine Valley would update this BBCS, as needed, through adaptive management throughout the Project life. Should the Project be re-powered at the end of the Project's expected life, the BBCS would remain in effect until the Project is decommissioned.

1.2 Regulatory Setting

Several federal and state laws and regulations including Endangered Species Act (ESA), the Migratory Bird Treaty Act (MBTA), Bald and Golden Eagle Protection Act (BGEPA), and Nevada State Codes provide context for the development of this BBCS. This document addresses the applicable regulatory mechanisms from these authorities as they apply to birds and bats that may be present at the Project site.

1.2.1 Endangered Species Act

Certain species at risk of extinction, including bird and bat species, are protected under the federal ESA of 1973, as amended. The ESA 1973 defines and lists species as "endangered" and "threatened" and provides regulatory protection for the listed species. The ESA provides a program for conservation and recovery of threatened and endangered species. The purpose of the ESA is to provide a means to identify and protect endangered and threatened species and their critical habitat. Projects involving federal lands, funding, or authorizations that may affect listed species require consultation between the federal agency and the USFWS, pursuant to Section 7 of the ESA. Proponents of projects without a federal nexus that have potential to adversely impact listed species should work directly with the USFWS to avoid or authorize impacting those species and their critical habitats. ESA-listed species with potential to occur within the Project site are listed in Sections 2.2 and 2.3 of this BBCS and potential impacts to these species are addressed in the risk assessment and conservation measures described in this BBCS.

1.2.2 Migratory Bird Treaty Act

The MBTA (16 USC §§ 703, *et seq*.), passed by the US Congress and signed into law in 1918, makes it unlawful to "pursue, hunt, take, capture or kill; attempt to take capture or kill; possess; offer to or sell, barter, purchase, or deliver; or cause to be shipped, exported, imported, transported, or received any native migratory bird, part, nest, egg, or product." The MBTA, enforced by USFWS, protects all MBTA-listed migratory birds from "take" as previously defined, within the United States. In the continental US, native non-covered species generally belong to the Order Galliformes. Common non-native species not protected by the MBTA include rock pigeon (*Columba livia*), Eurasian collared-doves (*Streptopelia decaocto*), European starling (*Sturnus vulgaris*), and house sparrow (*Passer domesticus*) (USFWS 1973, USFWS 2005). Although permits may be obtained to collect MBTA-listed birds for scientific purposes or to destroy depredating migratory birds, the MBTA does not provide any permit mechanism authorizing the incidental take of migratory birds in connection with otherwise lawful activities, as incidental mechanisms are not defined in the Act as a take. Nevertheless, federal agencies have been directed to evaluate the effects of its actions on migratory birds, with an emphasis on species of concern. Executive Order 13186 (Responsibilities of Federal Agencies to Protect Migratory Birds, signed in January 2001) requires the USFWS to evaluate the effects of federal actions on migratory birds. Potential impacts to migratory birds are addressed in the risk assessment and conservation measures described in this BBCS.

1.2.3 Bald and Golden Eagle Protection Act

The BGEPA (16 USC §§ 668-668d) prohibits the take, defined as "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest, or disturb," of any bald eagle (*Haliaeetus leucocephalus*) or golden eagle (*Aquila chrysaetos*). Through recent regulation (50 Code of Federal Regulations [CFR] § 22.26; USFWS 2009), the USFWS can authorize take of bald and golden eagles when the take is associated with, but not the purpose of, an otherwise lawful activity and cannot practicably be avoided. The USFWS recently published a notice of intent for a revised final rule in the Federal Register (December 16, 2016). In this revision, the USFWS proposes changes to permit issuance criteria and duration, definitions, compensatory mitigation standards, criteria for eagle nest removal permits, permit application requirements, and fees. The USFWS had issued Eagle Conservation Plan Guidance (USFWS 2013) for land-based wind energy projects to help project proponents avoid unanticipated take of bald and golden eagles and comply with the BGEPA. Although the guidelines were developed for land-based wind energy projects, certain components of eagle surveys and monitoring are applicable to other renewable energy projects, including PV solar facilities. Potential impacts to eagles are addressed in the risk assessment and conservation measures described in this BBCS.

1.2.4 Nevada State Codes

Under Nevada law and regulation, any wildlife receiving the distinction of fully protected species may not be captured, removed or destroyed at any time except with special permit as provided under Nevada Revised Statutes (NRS) 503.584-503.589 and Nevada Administrative Code (NAC) 503.093. Section 503.095 indicates that protected species include wildlife species that are classified as sensitive, threatened or endangered by Nevada Department of Wildlife (NDOW) and that an appropriate license, permit or authorization required to hunt, take or possess protected wildlife (NRS 501.105, 501.181) is necessary. A number of bird and bat species are protected under NRS 501; protected species with potential to occur within the Project site are listed in Sections 2.2 and 2.3 of this BBCS and potential impacts to these species are addressed in the risk assessment and conservation measures described in this BBCS.

1.3 Corporate Policy and Coordination

Sunshine Valley maintains a commitment to work cooperatively with regulatory agencies to minimize adverse impacts to protected bird and bat species. Through the planning stages of the Project, Sunshine Valley and its consultants have been working in coordination with federal and state agency personnel regarding wildlife surveys and siting considerations to ensure that all parties understand the scope of the Project and potential issues that could be identified and addressed early in the planning process. Sunshine Valley will continue to work with the agencies to implement conservation measures intended to avoid, minimize, and/or mitigate potential impacts to bird and bat species, including those measures identified in this BBCS.

2 BASELINE CONDITIONS

Baseline information on biological resources was obtained through field surveys and database reviews conducted for the Project between 2013 and 2016. The following section briefly describes these findings.

2.1 Existing Site Conditions

The Project would be located in the Amargosa Valley, a basin generally surrounded by the Spring Mountains to the east, the Funeral Mountains spanning to the south and west, Bare Mountain to the northwest, the Yucca Mountains to the north, and Specter Range to the northeast. Ash Meadows National Wildlife Refuge is located approximately 8.2 miles (12.9 kilometers) east/southeast of the Project. No other Areas of Critical Environmental Concern, Important Bird Areas, National Wildlife Refuges, Wilderness Areas, important migratory pathways or stopover sites, or other specially designated areas were identified near the Project area.

The Project is located in an area of Nye County with a low density of development. Most of the region is undeveloped shrub/scrub cover with limited agricultural use and infrastructure development. The Project would be located on privately owned lands that have historically been used for agriculture. The area has since returned to a disturbed desert setting with apparent low biological diversity and can be characterized as Sonoran-Mojave Creosotebush-White Bursage Desert Scrub vegetation community (SVS 2013a and 2013b). According to the U.S. Geological Survey (USGS) National Land Cover Database (NLCD), lands within the Project area consist of approximately 94.7% shrub/scrub cover, with 5.3% low intensity development and <0.1% developed open space (Figure 2). Pivot-irrigated agricultural practices (cultivated crop fields and hay fields) are the major land use types immediately outside of the Project area, but not within the Project area. Land uses depicted by the USGS NLCD (Figure 2) as developed open space and low intensity development appeared to coincide with roads and utility corridors.

On July 8, 2016, a Western EcoSystems Technology, Inc. (WEST) avian biologist performed a site reconnaissance visit of the Project area and surrounding vicinity to generally identify what available habitat was present. The site visit confirmed that vegetation on-site and in the surrounding area was dominated by desert shrub/scrub cover, generally limited to creosote (*Larrea tridentate*) and white bursage (*Ambrosia dumosa*) with scattered Devil's spineflower (*Chorizanthe rigda*) and Booth's evening primrose (*Camissonia boothii*). Additional land cover and land use in the area included several paved and unpaved rural roads, pivot-irrigated agricultural fields, additional desert shrub/scrub cover and barren lands. Named roads in the immediate vicinity of the Project area include Casada Road to the west, Roberts Road to the south, Powerline Road to the east and Smith Lane traversing across the northern portion of the Project site. Several other roads were also identified in the area, including: TNT Ranch Road, Weiss Boulevard, Cottonwood Road, South Miner Road and Conestoga Road (DeLorme 2012).

The Project area's flattened topography, as illustrated on USGS topographic maps, indicates a 0.5% grade (SVS 2013a/b) which is likely the result of decades of historic agricultural practices. Project site topography, as observed during field investigations, is relatively level but gently sloping from north to south.

A desktop review of the National Wetland Inventory (NWI; NWI 2016) showed areas of wetlands and open water habitat within 10 miles (16.1 kilometers) of the Project, however, the nearest wetland was located approximately 2 miles (3.2 kilometers) southeast of the Project area, adjacent to Windjammer Road (Google Earth 2015, Figure 3). Water regimes of some of these wetlands are highly variable in response to ephemeral run-off during the wet season (Brown 1994). However, wetlands within the Ash Meadows National Wildlife Refuge are generally considered stable as these habitats are supplied by a deep and ancient aquifer that outputs over 10,000 gallons of water an minute within the refuge (USFWS 2016, NWI 2016).

A jurisdictional water delineation (JD) and associated report for the Project were completed in October 2013 (SVS 2013b). During field investigations, no wetlands or non-wetland water features were identified. The JD report stated that the on-site drainage patterns observed were representative of sheet flow with no areas observed to contain strong evidence of an ordinary high water mark, a characteristic of a defined water feature. Based on the lack of an observed ordinary high water mark, wetlands, or non-wetland waters, the JD report concluded that the Project area did not contain features that would be considered jurisdictional under the Clean Water Act or guidance provided in the Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region Version 2.0 (ACOE 2008). In a letter dated October 30, 2013, US Army Corps of Engineers (ACOE) St. George Regulatory Office of the Sacramento District issued a jurisdictional delineation letter concurring that no federal jurisdictional waters were located in the Project area (McQueary 2013). The ACOE jurisdictional delineation is valid for five years from the date of the letter, unless new data warranted additional review (McQueary 2013).

Based on the above information, habitat available to birds and bats within the Project area consists primarily of desert shrub/scrub habitat surrounded by pivot-irrigated agriculture. Although the Ash Meadows Wildlife Refuge, located approximately 8.2 miles (12.9 kilometers) east/southeast of the Project, provides wetland habitat, the Project area and immediate vicinity lack any wetland or non-wetland water features. The lack of wetlands within and near the Project area would limit the attraction of birds and bats to the Project area and immediate vicinity.

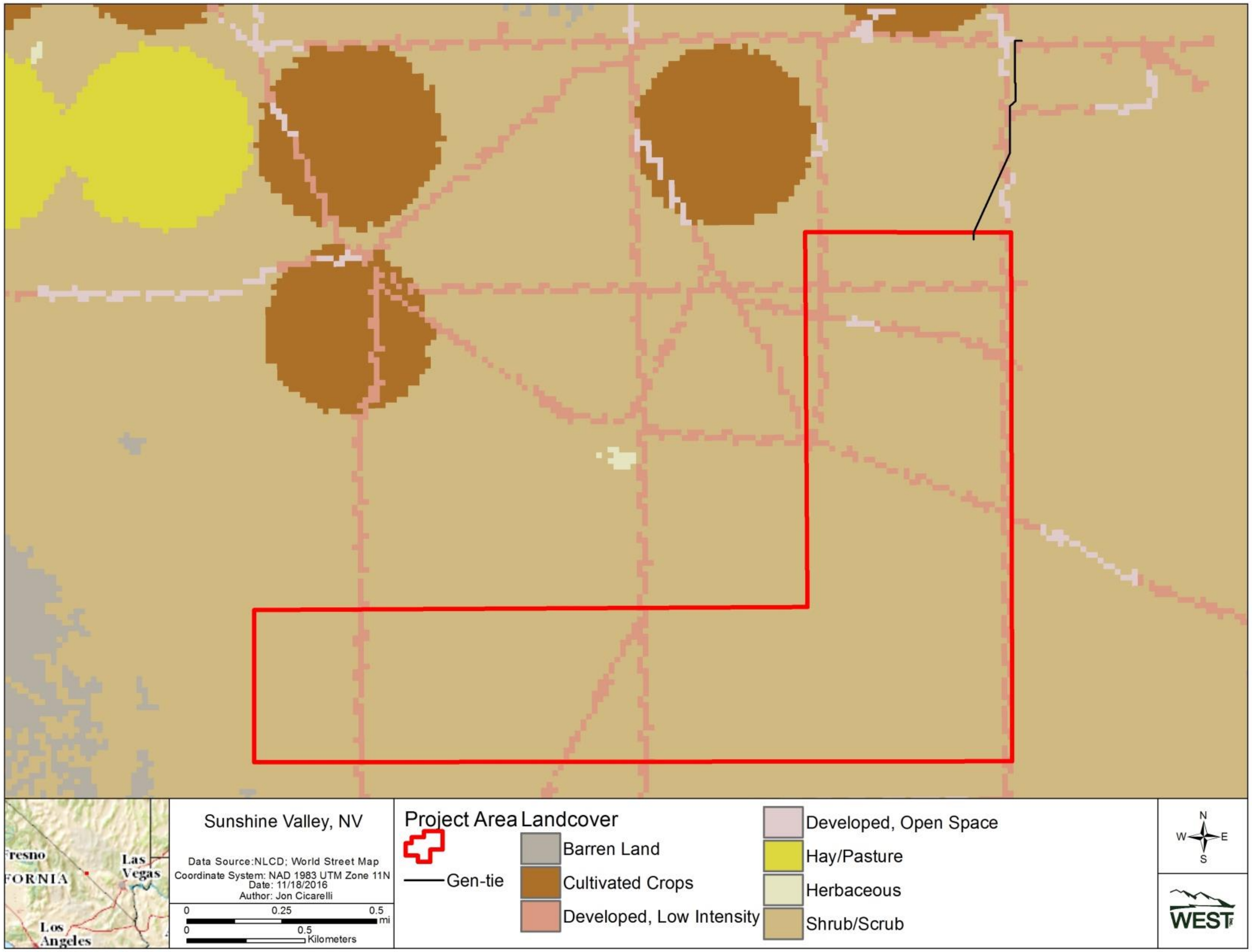

Figure 2. Land cover/land use types in the surrounding area of the Sunshine Valley Solar Power Project.

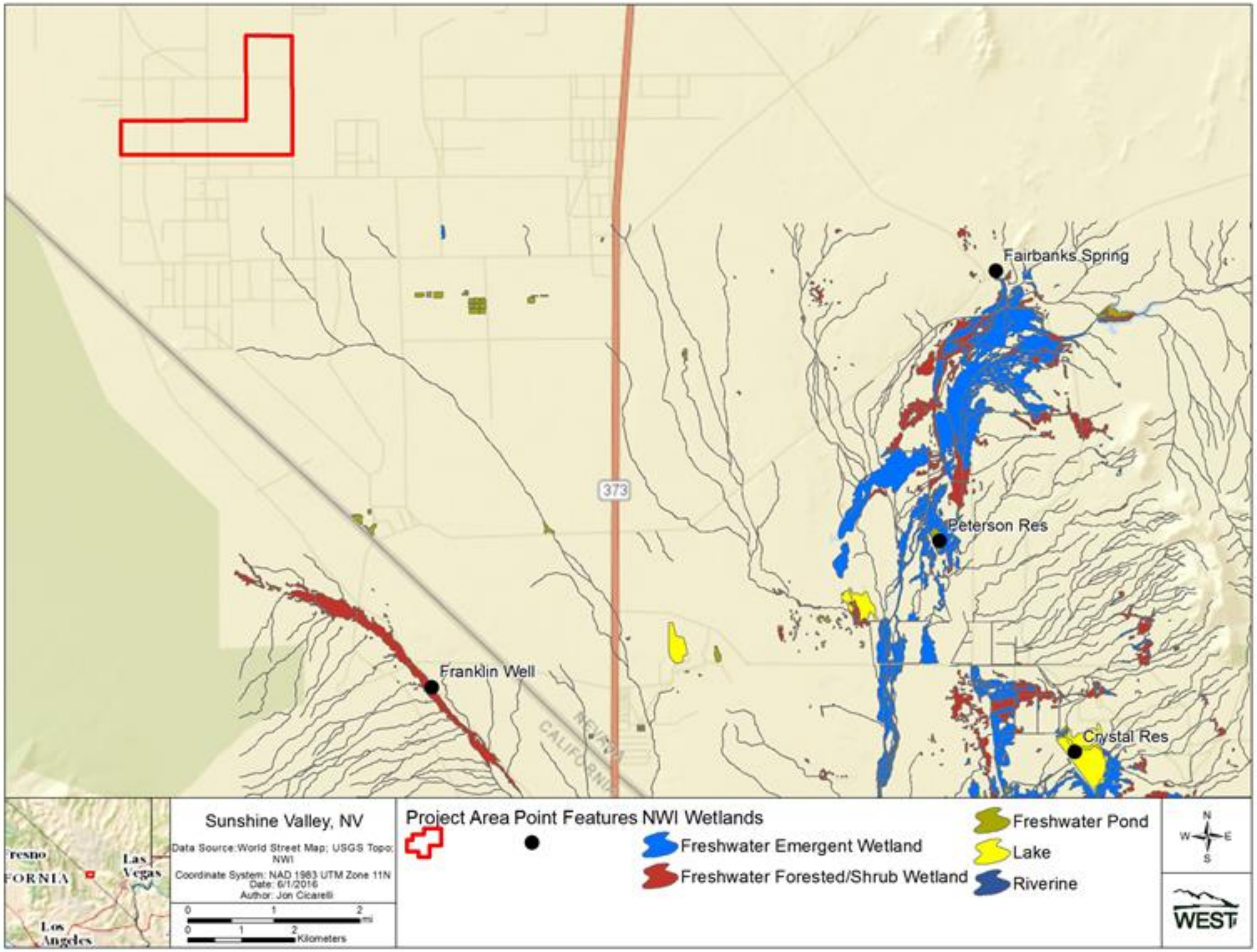

Figure 3. National Wetland Inventory recorded wetlands in the vicinity of the Sunshine Valley Solar Power Project.

2.2 Baseline Information and Surveys: Birds

An Information for Planning and Conservation (IPaC) Trust Resources Report (IPaC Report) generated through the Environmental Conservation Online System of the USFWS listed 11 ESA-listed species as potentially occurring in the broader region that encompasses the Project area. The IPaC Report listed three bird species, four fish species, two plants, one insect and one reptile. The Nevada Natural Heritage Program (NNHP) website to identified 52 state-protected (NAC 503) wildlife and plant species with the potential to occur in Nye County, Nevada. Bird species identified in the data received from the IPaC Report and NNHP, i.e., “special-status” bird species, are listed in Table 1. A general description of each identified bird species, including availability of suitable habitat for each species and whether or not that species is expected to be found within the Project area or surrounding vicinity, is also included in Table 1.

Table 1. Special-status bird species with a potential to occur in the area of Sunshine Valley Solar Power Project .

Common Name	Scientific Name	Status	Habitat	Occurrence - Availability of Habitat
Southwestern willow flycatcher	*Empidonax traillii extimus*	FE, NV-EB, SCP	Shrubby areas with standing or flowing water.	Unlikely - No suitable breeding or foraging habitat available on-site. Migrants could pass over Project
Yellow-billed cuckoo	*Coccyzus americanus*	FT	Dense wooded vegetative cover with water nearby.	Unlikely - No suitable breeding or foraging habitat available on-site. Migrants could pass over Project
Ridgway’s Rail formerly Yuma clapper rail	*Rallus obsoletus* *Rallus longirostris yumanensis*	FE, NV-EB	Generally associated with marshes along the Lower Colorado River. Known occurrence at Ash Meadows National Wildlife Refuge.	Unlikely - No suitable breeding or foraging habitat available on-site. Known population at Ash Meadows National Wildlife Refuge, 8.2 miles east of Project. USFWS expressed concern of potential impacts to Ridgway’s rail (Senn 2014)

Table 1. Special-status bird species with a potential to occur in the area of Sunshine Valley Solar Power Project .

Common Name	Scientific Name	Status	Habitat	Occurrence - Availability of Habitat
Golden eagle	*Aquila chrysaetos*	SCP	Generally associated with open country, in prairies, open wooded country, and barren areas, especially in hilly or mountainous regions. In NV, nests predominantly on the rock ledge of a cliff; occasionally in a large tree.	Low - No suitable breeding habitat on-site or near site. Nearest nesting habitat > 5 miles from Project. Some migrants could pass over the Project. Possible that some eagles could forage onsite.
Western burrowing owl	*Athene cunicularia hypugaea*	SCP	Found in open grasslands, sagebrush, and sagebrush-steppe, sometimes in open areas with by short vegetation and presence of fresh small mammal burrows.	Likely breeding and foraging habitat - burrows observed on site (SVS 2013a). Migrants may pass over the Project.
Western snowy plover	*Charadrius nivosus nivosus*	SCP	Found on alkali playas near standing pools of shallow water.	Unlikely - No suitable breeding or foraging habitat available on-site. Migrants could pass over the Project.
Ferruginous hawk	*Buteo regalis*	SCP	Found in open country, sagebrush, saltbush-greasewood shrubland, and the periphery of pinyon-juniper and other woodland and desert communities. In NV, nests primarily in live juniper trees.	Low - No suitable nesting habitat available on-site. The Project falls within the winter range of this species (https://birdsna.org), and there is some potential foraging habitat.

Table 1. Special-status bird species with a potential to occur in the area of Sunshine Valley Solar Power Project .

Common Name	Scientific Name	Status	Habitat	Occurrence - Availability of Habitat
Prairie falcon	*Falco mexicanus*	SCP	Found in areas with cliffs adjacent to arid valleys with low vegetation. Often observed foraging over a variety of sagebrush, salt desert, and Mojave scrub shrublands throughout the year, and they also occur in agricultural lands, especially during the winter months.	Likely - Suitable foraging habitat may be present. Suitable breeding habitat > 5 miles away from Project. Migrants may pass over the Project.
Pinyon jay	*Gymnorhinus cyanocephalus*	SCP	Found in pinyon-juniper woodland, and pines in nonbreeding season. Seldom found in scrub oak and sagebrush.	Unlikely – Project is within the geographic range of this species, but no suitable breeding of foraging habitat available on-site.
Bald eagle	*Haliaeetus leucocephalus*	BGEPA	Near large rivers and lakes with ample fish population and stands of tall trees. Most bald eagles found in Nevada are wintering or transient.	Unlikely - No suitable breeding or foraging habitat available on-site. Migrant or wintering eagles could potentially pass over the Project.
Western least bittern	*Ixobrychus exilis hesperis*	SCP	Habitat consists of tall emergent vegetation in marshes, primarily freshwater.	Unlikely - No suitable breeding or foraging habitat available on-site and outside the known range for this species (https://birdsna.org).
Loggerhead shrike	*Lanius ludovicianus*	NV-SB, SCP	Open country with scattered trees and shrubs, savanna, desert scrub, and open woodlands.	Likely – Suitable foraging habitat may be present.
Gray-crowned rosy-finch	*Leucosticte tephrocotis*	SCP	In migration and winter, found in open situations, fields, cultivated lands, brushy areas, and around human habitation.	Unlikely – Project outside known range of this species (BirdLife 2016).

Table 1. Special-status bird species with a potential to occur in the area of Sunshine Valley Solar Power Project .

Common Name	Scientific Name	Status	Habitat	Occurrence - Availability of Habitat
Sage thrasher	*Oreoscoptes montanus*	NV-SB, SCP	Tall sagebrush/bunchgrass, juniper/sagebrush/bunchgrass, mountain mahogany/shrub, and aspen/sagebrush/bunchgrass communities	Unlikely - No suitable habitat available on-site. Migrants could pass over the Project.
White-faced ibis	*Plegadis chihi*	SCP	Primary habitat is marshes, swamps, ponds and rivers, mostly in freshwater habitats	Possible transient. Observed during site reconnaissance. May migrate over the Project. Potential for this species to forage on-site when standing water is present.
Flammulated owl	*Psiloscops flammeolus*	SCP	Found in montane forest, usually open conifer forests containing pine, with some brush or saplings	Unlikely - No suitable breeding or foraging habitat available on-site. Project area outside of known range for this species (https://birdsna.org). Closest location within this species range is > 70 miles south of the Project.
Brewer's sparrow	*Spizella breweri*	NV-SB, SCP	Sagebrush in areas with scattered shrubs and short grass.	Low -The Project is within the known breeding range for this species, but occurrence is unlikely given low suitability of habitat available on-site.

FE = listed as endangered under the federal Endangered Species Act (ESA 1973);
FT = listed as threatened under the federal Endangered Species Act (ESA 1973);
BGEPA = protected under the Bald and Golden Eagle Protection Act (BGEPA 1940);
NV-EB = endangered bird in the State of Nevada under NAC 503.050.2;
NV-SB = sensitive bird in the State of Nevada under NAC 503.050.3;
SCP = Species of Conservation Priority under the Nevada SWAP (NDOW 2012).

While data in the IPaC Report and the NNHP database are not specific to the Project area, these data do suggest a variety of birds have the potential to occur, either as a seasonal resident or as a migrating transient, in the region.

To acquire site-specific data, WEST submitted a query to NNHP requesting information on available data concerning protected species in the area of the Project. NNHP replied that according to their records, no state-listed endangered, threatened, candidate or “At Risk” species were documented in the Project area or within a 1.9 mile (3 kilometer) radius of the Project. NHHP indicated that habitat may be present for Le Conte’s thrasher (*Toxostoma lecontei)*. NHHP also recommended contacting NDOW concerning non-at risk raptor species that may be known to occur in the area.

WEST contacted NDOW requesting a query of NDOW records of known raptor nests within 10 miles (16.1 kilometers) of the Project. NDOW’s review identified 10 documented raptor nests between 8 and 10 miles (12.9 to 16.1 kilometers) from the Project area (Table 2, Figure 4). NDOW’s correspondence was limited to the raptor species of “probable use” for each nest, the date each nest was last checked, and the Township/Range/Section where each nest was located (Table 2, Figure 4). All nests were located within Township 15 South, Range 50 East, Sections 28 and 33. These locations are in the Skeleton Hills East, a small chain of rugged peaks at the west end of the Spectre Range, approximately 8.3 miles (13.6 kilometers) northeast of the Project.

Table 2. NDOW-documented raptor nests within 10 miles (16.1 kilometers) of the Sunshine Valley Solar Power Project.

Probable Use Species	Last Checked	Township, Range, Section of Nest
Buteo	May 9, 2013	Township 15S, Range 50E, Section 28
Eagle	May 9, 2013	Township 15S, Range 50E, Section 33
Eagle	May 9, 2013	Township 15S, Range 50E, Section 33
Eagle	May 9, 2013	Township 15S, Range 50E, Section 33
Eagle	May 9, 2013	Township 15S, Range 50E, Section 33
Eagle	May 9, 2013	Township 15S, Range 50E, Section 33
Eagle/Buteo	May 9, 2013	Township 15S, Range 50E, Section 33
Eagle/Buteo	May 9, 2013	Township 15S, Range 50E, Section 33
Eagle/Buteo	May 9, 2013	Township 15S, Range 50E, Section 33
Eagle/Buteo	May 9, 2013	Township 15S, Range 50E, Section 33

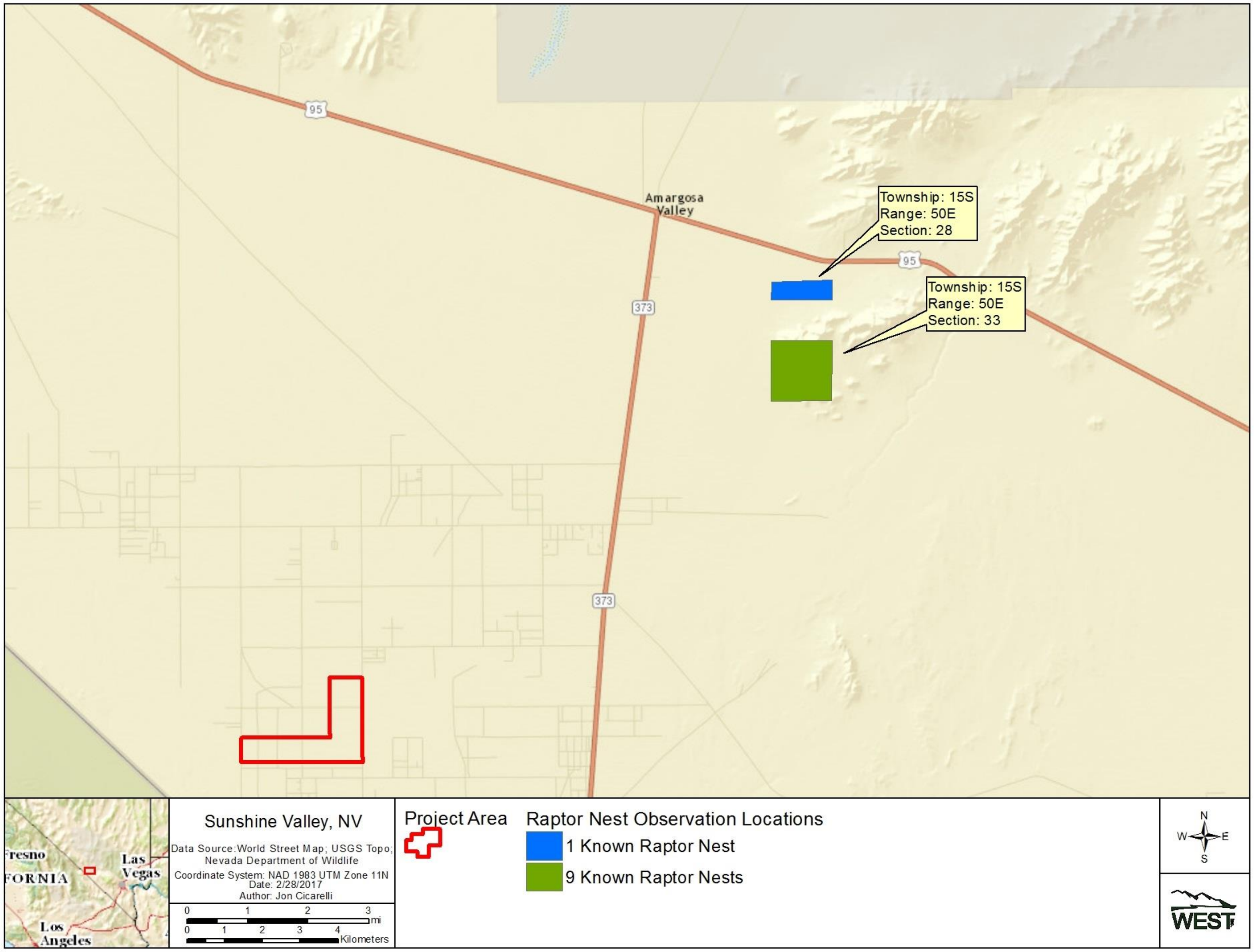

Figure 4. NDOW-documented raptor nests within 10 miles (16.1 kilometers) of the Sunshine Valley Solar Power Project.

During the July 8, 2016 WEST site reconnaissance visit, 42 observations of twelve different bird species were recorded (Table 3).

Table 3. Birds observed during the July 8, 2016 site reconnaissance visit to the Sunshine Valley Solar Power Project.

Common name	Number of individuals observed
Western kingbird*	3
Turkey vulture*	1
Common raven*	5
Horned lark*	14
Western sandpiper*	2
Greater roadrunner*	1
White-winged dove*	1
American kestrel*	1
Violet-green swallow	8
Tree swallow	4
White-faced ibis	1
Yellow-headed blackbird	1

* Denotes presence within Project area, all other observations were within 109 yards (100 meters) of the Project boundary.

Additionally, Sunshine Valley conducted desert tortoise surveys in September 2013 wherein all plant and wildlife species observed were recorded, including burrows and sign of burrowing owls. The desert tortoise survey followed Pre-Project Field Survey Protocol for Potential Desert Tortoise Habitats (USFWS 2010) and was conducted on September 10-13, 2013 (SVS 2013a). In general, four biologists walked 32.8 feet (10 meter) wide transects across the entire Project area between 0800 and 1600 hours each day (SVS 2013a). Four active burrowing owl burrows were detected and their locations were recorded using a hand held global positioning system (GPS, SVS 2013a); however no burrowing owls were observed. In addition to evidence of burrowing owl burrows, seven other bird species were documented in the Project area; turkey vulture (*Cathartes aura*); mourning dove (*Zenaida macroura*); common raven (*Corvus corax*); horned lark (*Eremophila alpestris*); lesser nighthawk (*Chordeiles acutipennis*); ferruginous hawk (*Buteo regalis*); and American kestrel (*Falco sparverius*, SVS 2013a). Sunshine Valley submitted the results of the desert tortoise survey to the Nevada Field Office of the USFWS in October 2013 (SVS 2013a). On October 23, 2013, USFWS Nevada Field Office personnel conducted a site visit to confirm the survey results and subsequently issued a letter to Sunshine

Valley concurring that the likelihood of desert tortoise occurrence within the Project area was very low (Senn 2013). During their site visit, USFWS Nevada Field office staff identified a fifth active burrowing owl burrow in the Project area (Senn 2013).

2.3 Baseline Information: Bats

The IPaC Report for the Project did not identify any federally listed bat species as potentially occurring in the region of the Project area. In response to requests for information on documented occurrences of state-listed species for the Project, NDOW did not identify any bat species within 4 miles (6.4 kilometers) of the Project. NNHP responded that they had no records of "at risk" bat species within 3 miles (4.8 kilometers) on the Project. However, the NNHP website showed four state-listed bat species that may occur in Nye County: pallid bat (*Antrozous pallidus)*, Townsend's big-eared bat (*Corynorhinus townsendii),* spotted bat (*Euderma maculatum)*, and fringed myotis *(Myotis thysanodes)*. Additionally, nine other bat species may occur in Nye County; California myotis (*Myotis californicus*), western small-footed myotis (*Myotis ciliolabrum*), long-legged myotis (*Myotis volans*), long-eared myotis (*Myotis evotis*), Mexican free-tailed bat (*Tadarida brasiliensis*), silver-haired bat (*Lasionycteris noctivagans*), western pipistrelle (*Parastrellus hesperus*), big brown bat (*Eptesicus fuscus*), and hoary bay (*Lasiurus cinereus*). A general description of each species' preferred habitat and whether or not that species is expected to be found in the general area of the Project is included in Table 4.

Table 4. Bat species with a potential to occur in the general area of the Sunshine Valley Solar Power Project.

Common Name	Scientific Name	Status	Habitat	Occurrence - Availability of Habitat
Pallid bat	*Antrozous pallidus*	NV-PM	Mountainous areas, inter-montane basins, and lowland desert scrub, arid areas, and grasslands near rock outcrops and water.	Likely - Suitable habitat may be present.
Townsend's big-eared bat	*Corynorhinus townsendii*	NV-SM, SCP	In Nevada, all known roost sites are in abandoned mines. Forages along riparian and wooded habitats.	Unlikely - No suitable habitat available on-site.
Spotted bat	*Euderma maculatum*	NV-TM, SCP	Found in a range of habitats, from low desert scrub to high elevation conifer forests.	Likely - Suitable habitat may be present.
Fringed myotis	*Myotis thysanodes*	NV-PM, SCP	Found in a range of habitats, from low desert scrub to high elevation conifer forests	Likely - Suitable habitat may be present.

Table 4. Bat species with a potential to occur in the general area of the Sunshine Valley Solar Power Project.

Common Name	Scientific Name	Status	Habitat	Occurrence - Availability of Habitat
California myotis	*Myotis californicus*	NV-S4	Found in a range of habitats, from, desert scrub, oak-juniper woodlands, montane forests, mountain meadows, canyons, riparian woodlands, grasslands, rural residential areas, and towns.	Likely - Suitable habitat may be present.
Western small-footed myotis	*Myotis ciliolabrum*	NV-S3, SCP	Found in a range of habitats from desert scrub, grasslands, sagebrush steppe, blackbrush, greasewood, pinyon-juniper woodlands, pine-fir forests, agriculture, and urban areas.	Likely - Suitable habitat may be present.
Long-legged myotis	*Myotis volans*	NV-S4, SCP	Primarily found in coniferous forests, but also occurs seasonally in riparian and desert habitats.	Likely – Suitable habitat may be present.
Long-eared myotis	*Myotis evotis*	NV-S4, SCP	Long-eared myotis are usually associated with coniferous forests.	Unlikely - No suitable habitat available on-site.
Mexican free-tailed bat	*Tadarida brasiliensis*	NV-S3S4B, SCP	Found in a range of habitats, from low desert to high mountains.	Likely - Suitable habitat may be present.
silver-haired bat	*Lasionycteris noctivagans*	NV-S3B, SCP	Silver-haired bats are a forest-associated species and are more commonly found in mature forests.	Low - No suitable habitat available on-site. Migrants may pass through site.
western pipistrelle	*Parastrellus hesperus*	NV-S4	Found in a range of habitats from desert mountain ranges, desert scrub flats, shrub-steppe, rocky canyons, and associated riparian zones, and most often close to water.	Likely - Suitable habitat may be present.
big brown bat	*Eptesicus fuscus*	NV-S4	Found in a range of habitats from high mountains to low deserts, including cities.	Likely - Suitable habitat may be present.

Table 4. Bat species with a potential to occur in the general area of the Sunshine Valley Solar Power Project.

Common Name	Scientific Name	Status	Habitat	Occurrence - Availability of Habitat
hoary bat	*Lasiurus cinereus*	NV-S3, SCP	Hoary bats are a tree-roosting species, found primarily in forested upland habitats such as pinyon-juniper and conifers, as well as in gallery forest riparian zones.	Low - No suitable habitat available on-site. Migrants may pass through site.

NV-TM = threatened mammal in the State of Nevada under NAC 503.030.2;
NV-SM = sensitive mammal in the State of Nevada under NAC 503.030.3;
NV-PM = protected mammal in the State of Nevada under NAC 503.030.1;
NV-S1 = ranked as S1 (critically imperiled) in the state of Nevada (NNHP 2016);
NV-S2 = ranked as S2 (imperiled) in the state of Nevada (NNHP 2016);
NV-S3 = ranked as S3 (vulnerable) in the state of Nevada (NNHP 2016)
NV-S4 = Ranked as S4 (apparently secure) in the state of Nevada (NNHP 2016)
SCP = Species of Conservation Priority under the Nevada SWAP (NDOW 2012).
B = Breeding populations

3 RISK ASSESSMENT

The prediction of impacts to birds and bats from the construction and operation of various types of solar facilities is preliminary in nature, as systematic studies detailing the impacts to birds and bats from these types of facilities are in an early stage of development and relevant information is presently being collected, analyzed, and documented. The following section discusses potential risks by referring to known information regarding impacts to birds and bats from other types of facilities (e.g., transmission facilities) as well as presenting some information that is just beginning to become available from several new and existing solar facilities where efforts have been made to collect data regarding impacts to birds and bats.

3.1 Direct Impacts

Direct impacts include disturbances and the introduction of development and human activities to the landscape that potentially pose immediate threats to resident and migratory bird and bat populations.

Potential direct impacts include:

- Collision risk: transmission lines, solar array blocks, buildings, fences, vehicle and equipment collisions;
- Electrocution potential associated with transmission lines; or
- Habitat loss, fragmentation and/or alteration.

3.1.1 Collision Risk

Based on a review of sources of avian mortality at three existing utility scale PV solar projects in California, fatality rates for solar arrays, while preliminary, are not high in relation to other anthropogenic mortality (WEST 2014). While concern over wind projects is primarily focused on raptor and bat mortality, few fatalities of those groups have been found at PV facilities. Overall, songbird fatalities appeared in the largest numbers at the PV facilities surveyed, which is consistent with their prolific population levels relative to other avian species. The observed mortality is spread out among species, with no species appearing to account for a large percentage of the fatality finds at all facilities. Concern over deaths at solar facilities of waterbirds or waterfowl (i.e., “water-associated” birds) is centered on the hypothesis that these species may potentially mistake the extensive solar arrays for water features on which the birds can land, usually at night. Such collisions can occur at structures like paved parking lots and train yards (usually a black cinder surface), both of which resemble water bodies at night, but often do not result in direct mortality because the angle of collision is relatively shallow. Such birds sometimes cannot take off after they land because they are adapted to take off from water, not dry land. These birds can perish due to exposure to the elements and/or predators.

At this time there are publicly available studies from utility-scale solar facilities with data collected under standardized monitoring protocols: California Valley Solar Ranch (CVSR;

H.T.Harvey and Associates 2014), Topaz (Althouse and Meade 2014), and Desert Sunlight (DSL; WEST 2016). CVSR and Topaz are located in San Luis Obispo County, CA, and have rated capacities of 250 and 550 MW, respectively; DSL is located in Riverside County, CA, and has a rated capacity of 550 MW. The CVSR and Topaz projects are located in a predominantly agricultural and grassland setting. In contrast, the DSL project is located in a desert environment. Several other monitoring efforts are currently underway at other projects, including the Blythe and McCoy projects in Riverside County, CA, the Stateline project in San Bernardino County, CA, and the Silver State South project in Clark County, NV.

During weekly post-construction monitoring at all elements (e.g. arrays, fences, overhead lines, references sites, and evaporation ponds) of CVSR, there were 368 detections of bird fatalities. The most frequent bird type (taxonomic group) observed was passerines (56%), followed by doves and pigeons (30%). Only one water-associated bird fatality was discovered (American coot [*Fulica americana*]) during the 12-month period analyzed and it was found during fatality searches under the gen-tie line, away from solar array blocks. The most frequently found individual species were mourning doves (30%), horned larks (26%), house finches (14%), and western meadowlarks (7%). Overall, the majority of detections on regular weekly surveys occurred in the sampled arrays (approximately 55%).

At Topaz, 66 bird fatalities were detected during the 12-month monitoring period with carcasses found in construction areas (prior to operations), reference sites outside of the facility, energized arrays, energized power equipment, and linear features (e.g. fences and overhead lines). Six fatalities were domestic chickens from adjacent private land, likely brought into the project by a canid and thus not attributable to the project (Althouse and Meade 2014). Passerines constituted the largest percentage (33%) of the 60 fatalities potentially attributable to the project, followed by corvids (22%) and doves/pigeons (20%). The most frequently found individual species were common ravens (22%), horned larks (20%), and mourning doves (12%). Only 7% (4 detections) of the birds found were water-associated birds and they were found in construction areas, along a road, or in a water retention pond. Of the 41 detections found on regular surveys, 34% of birds were found among arrays, 64% within reference sites, and 2% were found under overhead lines.

The first year of standardized monitoring at DSL, which is situated in a desert habitat, was completed in February 2016 (WEST 2016), and there were 149 detections of avian fatalities. Water-associated birds were the most frequently discovered carcass or feather-spot type within sampled arrays during standardized searches, with 36 (52%), followed by passerines with 16 (23%). The most common water-associated birds observed were grebes (36% of water-associated birds in the arrays including western, eared and pied-bill grebe), American coot (16%), common loon (7%), ruddy duck (5%) and sora (5%). The estimated density of carcasses for the DSL project components within the fence (solar arrays and fence) was approximately 0.19 carcasses/acre/year, or 1.05 fatalities/megawatt/year, which translates to an estimated 579 fatalities within the facility during the first year of monitoring. The estimates of water-associated birds and passerines were nearly the same for the solar arrays (265 and 252, respectively), with an estimated density of 0.08 birds/acre/year. In other words, despite finding more water-associated bird carcasses or feather spots, the estimated fatalities per acre, per year for water-associated birds was similar to passerines because most water-associated birds are large-bodied animals that persist for longer than small passerines, and are detected at high rates within the solar arrays compared to small songbirds. Also, more fatalities were estimated for the gen-tie line – which is a common feature on the landscape, associated with all varieties of power infrastructure – than the solar arrays. Waterfowl and waterbird collision risk with tall structures, such as unmarked transmission lines, is often elevated near wetlands, playas and other suitable habitat. As described in Section 2.1, the Project area is devoid of such resources. Additionally, the Project's gen-tie line has been sited to reduce potential impacts (Section 4.1).

Equipment and vehicles could collide with slower-moving species, species in subsurface burrows, and ground-nesting birds resulting in injury or mortality. Some species of birds go into a state of torpor and become immobile during periods of cold weather (Fletcher el al. 2003), increasing the potential for impacts from vehicles or equipment. For most bird species, direct impacts would be limited to areas within the Project footprint or immediately adjacent to it. Active bird nests in shrubs or near the ground would be vulnerable to crushing during ground-disturbing activities. Measures described in Section 4 would avoid and minimize this risk.

During the construction phase, an increase in vehicle traffic from construction personnel, biologists and other Project-related persons, potentially poses an increased risk to birds that inhabit remote desert regions. Birds nesting adjacent to Project access roads are more likely to be impacted due to an increase in the number of vehicles using the road during construction. Due to a decrease in Project personnel and habitat alterations, these types of risks will be lessened during the O&M phase, compared to the construction phase. Measures described in Section 4 would avoid and minimize this risk.

PV solar projects pose little risk to bats, particularly among PV arrays, based on the data collected to date. For example, no bat fatalities were reported during the first year of standardized monitoring at DSL; four bats were discovered incidentally within the facility prior to initiation of operations, and all four were associated with buildings or fences (WEST 2016). No bats were discovered during monitoring at CVSR (H.T.Harvey and Associates 2014). A single bat was detected incidentally at Topaz; however, it was discovered upon opening a shipping container for the first time, and was identified as a non-native species, and thus not attributable to the Topaz project (Althouse and Meade 2014).

3.1.2 Electrocution Potential

Power lines may introduce a risk of electrocution for certain bird species. The potential for avian electrocutions depends on the arrangement and spacing of energized and grounded components of poles and towers that are sometimes used by birds for perching, nesting and other activities (APLIC 2006). Research has found that nearly all electrocutions occur on smaller, more tightly spaced residential and commercial electrical distribution lines that are less than 69 kV (APLIC 2006). All transmission and sub-transmission towers and poles would be designed to minimize the risk of avian electrocutions (Section 4.3). Bats are not known to be at risk of electrocution from power lines.

3.1.3 Habitat Loss or Alteration

Clearing and grubbing construction practices would result in habitat loss and displacement of local bird and bat populations as vegetation communities and existing habitats are altered to support Project development. Altering the landscape through Project development would likely result in the loss of cover, perches, breeding habitat, shelter and foraging sites used by resident species and the loss of perches, roost sites and foraging sites for migratory species. The vast majority of the Project area is characterized by previously disturbed Sonoran-Mojave Creosotebush-White Bursage Desert Scrub vegetation community, which is available throughout the surrounding landscape. Project design and siting measures (Sections 4.1 and 4.2) would reduce the amount of habitat loss due to Project construction.

3.2 Indirect Impacts

Indirect impacts include changes to the landscape with unintended and often unforeseen consequences to bird and bat populations. Indirect impacts associated with habitat loss, land alterations and Project development on existing bird and bat populations within the vicinity of the Project are not easily assessed or determined.

Potential indirect impacts include:

- Territory abandonment, nest and roost site abandonment;
- Increased opportunities for predators of birds and bats;
- Habitat fragmentation;
- Wildlife avoidance and displacement due to increased human presence, noise and light;
- Dust and hazardous materials; and
- Altered hydrology.

3.2.1 Territory Abandonment, Nest and Roost Site Abandonment

Most wildlife species are susceptible to visual and noise disturbances caused by the presence of humans and construction equipment. Such disturbances can result in the alteration of species' behavior. Noise and visual disturbance caused by construction and vehicles would have the potential to cause nest abandonment or habitat avoidance directly adjacent to and within the proposed Project footprint. Birds and/or bats avoiding habitat in the vicinity of the Project area may opt for less suitable habitat, which could increase stress on these individuals as a result of increased energetic costs. This could also place additional stress on available resources through increased density of birds and bats in off-site areas.

Without the inclusion of conservation measures (see Section 4), direct nest removal during vegetation clearing activities could result in nest and roost site disturbances and territory abandonment.

3.2.2 Predation Risk

The Project may indirectly result in injury/mortality to wildlife through an increased risk of predation. Though some predators may avoid areas with human activity, some predator species such as ravens (*Corvus corax*) and coyotes (*Canis latrans*) are attracted to human activity and associated food resources. Installation of fencing and transmission towers create additional perching structures from which ravens and raptors may hunt for prey and carrion. Construction, operation, and maintenance of the Project could result in trash and debris that would further attract species, such as ravens and coyotes. To avoid or minimize human impacts a Worker Environmental Awareness Program (WEAP) and trash abatement program would be implemented (see Sections 4.2 and 4.3).

3.2.3 Habitat Fragmentation

Along with removal of habitat, permanent fencing of the Project area would possibly reduce access for terrestrial species potentially resulting in habitat fragmentation. This fragmentation could cause wildlife to rely more heavily on habitat within the surrounding area for foraging, shelter, and nesting opportunities. This could have an indirect effect on wildlife inhabiting areas adjacent to the Project area, although this would not be a new impact in the region because most of the area around the Project is already fragmented by agriculture and rural residences. Wildlife inhabiting adjacent areas could be faced with increased competition as a result of the displaced individuals relocating into their home ranges.

3.2.4 Human Presence, Noise, and Light

Indirect impacts to wildlife species would result from human presence, noise, and light in the Project area. Increased levels of noise and human activity could be detrimental to many wildlife species. Noise from construction activities could temporarily discourage wildlife from foraging and nesting immediately adjacent to the Project area. Many bird species rely on vocalization during the breeding season to attract a mate within their territory. Noise levels from certain construction, operations, and decommissioning activities could reduce the reproductive success of nesting birds.

The most common wildlife responses to noise and human presence are avoidance or accommodation. Avoidance would result in displacement of wildlife from an area larger than the actual disturbance area. The total extent of habitat lost as a result of wildlife avoidance response is impossible to predict because the degree of this response varies from species to species, and can even vary between different individuals of the same species. Also, after initial avoidance of human activity and noise producing areas, certain wildlife species may acclimate to the activity and begin to reoccupy areas formerly avoided.

Artificial lighting impacts on wildlife species may include disorientation from and attraction to artificial light, collision-related mortality due to disorientation, and effects on the light-sensitive cycles of many species (Saleh 2007). Lighting plays a substantial role in collision risk because lights attract nocturnal migrant songbirds, and major bird kill events have been reported at lighted communications towers (Manville 2001). Bright night lighting close to the ground can attract flying insects and consequently increase activity by foraging bats, but can also disturb other wildlife (e.g., nesting birds, foraging mammals).

Impacts associated with human presence, noise, and light would be reduced through implementation of conservation measures (see Section 4.3).

3.2.5 Dust and Hazardous Materials

Habitat loss and degradation both inside and outside of the Project area could occur if Project activities resulted in release of dust or hazardous materials. This could result in modification of soil erosion or sedimentation rates, or introduce or encourage the growth of noxious weeds. Hazardous material and pollutant releases could occur as a result of the Project. Materials released could include fuels and other materials used by work crews as part of routine construction and maintenance activities; however, compliance with existing statutory requirements makes releases highly unlikely. Hazardous materials could also be released if construction-related excavation were to disturb areas that have existing environmental contamination. However, a Phase I Environmental Site Assessment completed for the Project concluded that no recognized environmental conditions, as defined by ASTM E1527, were identified within the Project area (URS 2013), suggesting very low risk of existing surficial environmental contamination. Hazardous materials release could impact biological resources by injuring or killing vegetation and wildlife through either short-term acute exposure or long-term chronic exposure. Soil erosion from site preparation could adversely affect wildlife foraging and burrowing habitat on lands outside of the Project boundaries, but site preparation grading will be limited and restricted to roadways and specific areas onsite. Most of the Project is suitable for mowing as the primary site preparation method, which reduces overall ground disturbance.

Impacts associated with dust and hazardous materials would be reduced through compliance with existing statutory requirements of the Clean Air Act and the Clean Water Act and best-practices related to those requirements (see Section 4).

3.2.6 Altered Hydrology

Biological resources could potentially be impacted if the Project were to modify the availability or quality of surface water and/or groundwater. The baseline hydrologic conditions within 2 miles (3.2 kilometers) of the Project suggest that water resources (i.e., wetlands and non-wetland waterbodies) are scarce or not present, and that the primary potential for impacts resulting from solar energy development comes from surface disturbances (i.e., drainage patterns and groundwater recharge and discharge patterns) and groundwater use.

The Project could potentially have an indirect effect on wildlife habitat adjacent to the Project area if the Project were to modify down-gradient sedimentation or erosion rates. This could occur as a result of the removal of soil-stabilizing vegetation or modification of on-site precipitation infiltration rates. However, based on the JD investigation, the associated report (SVS 2013b) and ACOE jurisdictional determination letter (McQueary 2013), no jurisdictional surface water resources are present in the Project area and current surface drainage is limited to sheet flows.

Conservation measures designed to protect and mitigate for impacts to intermittent/ephemeral water features and groundwater depletion/quality are described in Section 4.

3.3 Potential Impacts to Special-Status Species

Special-status species (i.e., federally and state listed endangered and threatened and state listed candidate and at risk species) were evaluated for their potential to occur in the Project area and immediate vicinity. Evaluation was based on WEST field observations, information readily available in public databases, and species-specific range and habitat information. There are 13 special-status bird and bat species (6 birds and 7 bats) that have at least some potential for occurrence within the Project area and surrounding vicinity (Tables 1 and 6). The following section describes relevant natural history information and the potential for impacts to these species.

3.3.1 Eagles

The golden eagle is a potential year-round resident in southern Nevada; however no suitable breeding habitat exists within the Project area. The nearest breeding habitat is greater than 5 miles (8 kilometers) from the Project. Historical nest data provided by NDOW have identified five likely eagle nests and four possible buteo or eagle nest within a search radius of 10 miles (16 kilometers) of the Project (Table 2, Figure 4). The nearest nest identified from past surveys was located 8.3 miles (13.6 kilometers) from the Project boundary. While no golden or bald eagle nesting habitat is present within the Project area or immediate vicinity, potential nesting and foraging habitat for golden eagles is present within the mountains and rocky terrain surrounding the Amargosa Valley. It is possible that some eagles could forage within the Project. Migrant eagles could potentially pass over the Project.

Potential direct impacts to eagles as a result of construction and operation activities could include injury or mortality due to vehicle collisions, if eagles are foraging near roads within or adjacent to the Project. Abandonment of a breeding territory or nest site, or the potential loss of eggs or young, which would reduce productivity for that breeding season, is highly unlikely given that the nearest potential eagle nest is located more than 8 miles (12.9 kilometers) northeast of the Project area (NDOW 2016). Direct impacts also include the permanent reduction of approximately 745 acres (301.5 hectare) of potential foraging habitat associated with development of the Project. Because habitat suitable for eagle foraging is present throughout the approximately 20 million acres (8.1 million hectares) of creosote bush desert scrub habitat within the larger Mojave ecoregion (BLM 2014), impacts due to construction of the Project should be minimal, however, there may still be some concerns over cumulative impacts across all development to this habitat. Development of the Project would result in an incremental increase in noise and human presence (primarily during the construction time period), and these could cause an indirect temporary impact to eagles. The Project would also include an approximately 0.6-mile (1-kilometer) gen-tie line, which could present a potential collision hazard.

Potential impacts to eagles would be reduced through implementation of conservation measures and mitigation measures for protection of wildlife and other resources (see Section 4).

3.3.2 Prairie Falcon

Prairie falcons are year-round residents of the region. There is no suitable nesting habitat within the Project. The nearest nesting habitat is greater than 5 miles (8 kilometers) from the Project. Potential direct impacts to prairie falcon and other raptors as a result of construction and operation activities could include injury or mortality due to vehicle collisions. Direct impacts also include the permanent reduction of approximately 745 acres (301.5 hectares) of potential foraging habitat associated with development of the Project. However, suitable foraging habitat for a variety of raptor species is present throughout the approximately 20 million acres (8.1 million hectares) of creosote bush desert scrub habitat within the larger Mojave ecoregion (BLM 2014), impacts due to loss of habitat should be minimal. Development of the Project would result in an incremental increase in noise and human presence during construction, and these could cause an indirect temporary impact to these raptor species as well. The Project would also include a gen-tie transmission line, which could present a potential collision hazard and electrocution hazard.

Impacts to prairie falcon, and other possible transient or migratory raptors would be reduced through implementation of conservation and mitigation measures for protection of wildlife and other resources (see Section 4).

3.3.3 Western Burrowing Owl

The western burrowing owl is a year-round resident of the region, inhabiting grasslands, shrublands, and open disturbed areas. They nest in burrows usually constructed by mammals. As described in the Desert Tortoise (*Gopherus agassizii*) and Burrowing Owl (*Athena cunicularia*) Survey Report for the Project (SVS 2013a), four active burrowing owl burrows were detected and recorded within the Project area during a September 2013 site survey for burrowing owls (SVS 2013a). Additionally, USFWS surveyed the Project in October 2013 to verify the findings of the September 2013 survey and identified and recorded a fifth burrowing owl burrow in the Project area. Although no burrowing owls were observed, the presence of active burrows indicates that the species could be impacted by the Project.

Potential direct impacts to western burrowing owls include injury or mortality of individuals, either above ground or within burrow. Collapsed burrows may also destroy active nests or eggs within a burrow. Potential direct impacts to burrowing owls as a result of construction and operation activities could include injury or mortality due to vehicle collisions. Risk of collision with Project infrastructure is expected to be minimal based on limited public monitoring at solar sites where burrowing owls are known to occur (ANL/NREL 2015, WEST 2015). Direct impacts also would include the permanent reduction of approximately 745 acres (301.5 hectares) of potential foraging and nesting habitat associated with development of the Project. Development of the Project would result in an incremental increase in noise and human presence during construction, and these could cause an indirect temporary impact to the species. The Project would also include an approximately 0.6-mile (1-kilometer) gen-tie line, which could present a potential collision hazard.

Impacts to western burrowing owls would be reduced through implementation of conservation and mitigation measures for the protection of wildlife and other resources (see Section 4).

3.3.4 Ridgway's Rail

Ridgway's rail (*Rallus obsoletus yumanensis*) is the only rail to breed in freshwater (Patten 2005) with a preference for cattails (*Typha spp*.) and bulrush (*Scirpus spp*.). Until relatively recently, the rail was thought to be an accidental visitor and not believed to breed in Nevada (Floyd et al. 2007); however, in 2001, several nesting Ridgway's rails were confirmed in Clark County, Nevada. It is not known if the rails were part of a recent expansion of the species up the Colorado River as has been documented since the mid-1900's (Wise-Gervais 2005, AZGF 2001) or if the secretive marsh bird has been in Nevada for decades but undetected. The NNHP database identified Ash Meadow Nation Wildlife Refuge, approximately 8.3 miles (13.3 km) east/southeast of the Project area, as a known location for the Ridgway's rail. Little is certain about the migratory or dispersal behavior of the Ridgway's rail (USFWS 2009). The species likely follows river/lake corridors for dispersal and there is no evidence to indicate that dispersal would occur within the general area of the Project. The Project is not within a path that would connect any aquatic features and the closest current documented records for the species and its habitat is over 8 miles (12.9 kilometers) from the Project area (Figure 3).

In addition to not being located between any aquatic features, the Project area would be unlikely to attract any individuals dispersing from the Ash Meadows population because Project area conditions do not provide suitable habitat for the Ridgway's rail. A jurisdictional water delineation report (SVS 2013b) was prepared for the Project and documented no observed surface waters on-site, with evidence of only limited sheet flow during and immediately following precipitation events. The US Army Corps of Engineers St. George Regulatory Office issued a jurisdictional delineation concurring that the Project area contained no jurisdictional waters (McQueary 2013). Furthermore, during WEST's sire reconnaissance visit in 2016, no surface waters were observed and vegetation on-site was dominated by loosely distributed creosote and white bursage. The Project area lacks the marshy conditions and vegetative communities preferred as suitable habitat by the Ridgway's rail. While some water-associated birds have been found at the Desert Sunlight PV facility, the causal mechanism for their presence there is unknown. They have not been found in any other PV facilities, however, including other PV projects close to Desert Sunlight where standardized monitoring has been reported (Section 3.1.1). Project impacts to the rail are therefore considered highly unlikely.

Any unexpected impacts to this species would be detected through the standardized systematic monitoring (e.g., including increased monitoring effort during the periods of anticipated rail dispersal) and incidental monitoring system (see WIRS) and addressed through adaptive management (Section 7).

3.3.5 Loggerhead Shrike

Loggerhead shrike has a potential to be found within the Project area and the immediate vicinity. Loggerhead shrikes are known to breed in open country with scattered shrubs or desert scrub, similar to what is found within the Project area. Furthermore, loggerhead shrikes have been known to capture their prey, including large insects and small lizards, and impale them on barber wired which is also plentiful in the rural, agricultural setting of the Project.

Potential direct impacts to loggerhead shrike as a result of construction and operation activities could include injury or mortality due to vehicle collisions. Abandonment of a breeding territory or nest site, or the potential loss of eggs or young, which would reduce productivity for that breeding season. Direct impacts also include the permanent reduction of approximately 745 acres (301.5 hectares) of potential foraging and breeding habitat associated with development of the Project. However, as suitable habitat for loggerhead shrike is present throughout the approximately 20 million acres (8.1 million hectares) of creosote bush desert scrub habitat within the larger Mojave ecoregion (BLM 2014a), impacts due to construction of the Project should be minimal, but there are still some concerns over cumulative impacts across all development to this habitat. Development of the Project would result in an incremental increase in noise and human presence during construction, and these could cause an indirect temporary impact to loggerhead shrike. The Project would also include an approximately 0.6-mile (1 kilometer) long gen-tie transmission line, which does present a potential collision hazard (Bevanger 1994).

Potential impacts to loggerhead shrike would be reduced through implementation of conservation measures and mitigation measures for protection of wildlife and other resources (see Section 4).

3.3.6 White-faced Ibis

White-faced ibis is generally a marsh bird, nesting in low trees, bulrushes, weeds or on floating mats in fresh water habitats. However, in Nevada, this species is also known to forage in flooded agricultural fields (NNHP 2016), feeding on earthworms. During the July 2016 site reconnaissance visit, a white-faced ibis was observed within 109 yards (100 meters) of the Project area, suggesting this species has the potential to occur in the area.

Potential direct impacts to white-faced ibis as a result of construction and operation activities could include injury or mortality due to vehicle collisions. Direct impacts may also include the permanent reduction of approximately 745 acres (301.5 hectares) of habitat that could potentially be suitable for foraging when standing water is present, although lands within the Project area are not irrigated and standing water is not expected to regularly occur. However, suitable foraging habitat for the ibis will remain intact in nearby irrigated agricultural fields with higher quality foraging and nesting habitat available at the Ash Meadows National Wildlife

Refuge approximately 8.5 miles (13.7 kilometers) east/southeast of the Project area. Development of the Project would result in an incremental increase in noise and human presence during construction, and these could cause an indirect temporary impact to white-face ibis. The Project would also include an approximately 0.6-mile (1-kilometer) long gen-tie line, which could present a potential collision hazard.

Potential impacts to white-faced ibis would be reduced through implementation of conservation measures and mitigation measures for protection of wildlife and other resources (See Section 4).

3.3.7 Bats

Of the 13 bat species identified by NNHP to have a potential to occur in Nye County, Nevada, several are likely to occur in the Project area and surrounding vicinity, as suitable habitat may be present or the species may migrate through the area (Table 4). None of these species are federally-listed as threatened or endangered. The general area where the Project is proposes may provide suitable habitat for three state-listed bats. In several bat species classified as Species of Conservation Priority (SCP) by NDOW (NDOW 2012) may occur in the Project area; while SCP species are not afforded specific protections, it is NDOW's preference to limit impacts on these species. Populations of the other bat species likely to occur within the Project area are classified as either vulnerable (S3) or assumed secure (S4, Table 4) in Nevada and are therefore not protected under NAC 503 (NNHP 2016).

Roosting habitat for all bat species is in general very limited within the Project area and the surrounding vicinity, particularly for species that roost in cliffs/rocky outcrops (e.g., bat, pallid bat, and spotted bat) and in trees (e.g., silver-haired bat and hoary bat). The Project area provides suitable foraging or migration habitat for the majority of special-status bat species that occur in the region. However, the Project area does not currently include attractant features such as riparian corridors, springs, or other permanently wet areas that would potentially increase foraging activity. On a landscape scale, the addition of solar arrays to an area that previously had minimal structural attributes may affect bat activity in several ways. Bats are known to commute and forage along linear landscape elements (Verboom and Huitema 1997). At clearly demarcated edges, such as forest-field interfaces in early stages of succession, all bat species have been shown to increase their activity (Jantzen and Fenton 2013). Morris et al. (2010) found higher concentrations of flying insects on the leeward side of trees on windy nights. As such, it is possible that flying insects could similarly gather in higher concentrations at the leeward edges of the PV solar arrays on windy nights. As observed at CVSR, high frequency bats (California myotis, western small-footed bats, and canyon bats) that forage in situations with clutter (e.g., with shrubs and trees) are likely to take advantage of this effect and are expected to increase their activity at the leeward edges of the arrays (HTH 2013). Additionally, bright night lighting close to the ground can attract flying insects and consequently may increase bat foraging activity near any lighted areas at the Project.

Limited information is available on the potential for bat collision risk at PV facilities; however, bat carcasses are uncommon at static structures such as communication and television towers

(Crawford 1981). During the construction and early operations phases of DSL four bat carcasses were found, including a pallid bat, a western mastiff bat, a Townsend's big-eared bat, and a California myotis (WEST 2014). Cause of death was uncertain for these bats, but the carcasses were not located in the solar arrays; one was located near a transmission tower, another near the perimeter fence, and two near buildings. Bat carcasses were not discovered during systematic carcass searches for both birds and bats at the CVSR (H.T. Harvey and Associates 2014) or at Topaz (Althouse and Meade 2014) or during the first year of operations at the DSL facility (WEST 2016).

In an experimental setting Greif and Siemers (2010) found that although bats could differentiate a smooth metal surface from water. However, the metal plates used in the experiment differ from the substrate and configuration of the solar panels used for most utility scale solar projects. Further, Grief and Siemers (2010) did not report bat casualties as part of their study, and bat carcasses could not be attributed to the solar array studied and were not detected during monitoring at other solar facilities. Thus, based on limited data, risk associated with collision with the solar panels appears unlikely.

The predominant habitat type present in the Project area is creosotebush-white bursage desert scrub, a widespread habitat type in the Mojave Desert. O'Farrell (2009, 2010) conducted acoustic bat monitoring in similar habitat in the Mojave Desert and found that bat activity recorded over a two-year sampling period was an order of magnitude lower than areas sampled that contained attractant features (e.g., riparian corridors). Thus, the permanent removal of creosote bush-white bursage desert scrub is not expected to represent a loss of high quality bat foraging habitat. Further, as documented by O'Farrell (2009, 2010), 96% of the bat activity was represented by four common and widespread species in the Southwestern U.S. Thus, the species most likely affected by habitat removal for the Project are common species. As most construction will take place during the day, it is not expected that normal bat activity patterns such as movement between roosting and foraging areas will be disturbed by construction traffic or noise associated with construction activities.

4 BIRD AND BAT CONSERVATION MEASURES

4.1 Project Siting

To minimize impacts to bird and bat species, the Project is located in an area of previous agricultural disturbance, reducing impacts to native, undisturbed vegetation communities. Additionally, the Project area is devoid of water resources that might attract birds and bats or provide suitable habitat. To further reduce impacts from development, the Project is located an area with existing overhead utility infrastructure. The 0.6-mile (1-kilometer) gen-tie line would be sited in close proximity to other overhead electrical and telecommunication utilities to avoid additional impacts in undeveloped areas and to avoid creating a large visual que to bird and bat species, potentially providing these species a better opportunity to avoid collisions with such structures (Drewitt and Langstrom 2008, Bevanger 1994, APLIC 2012). Sunshine Valley has also selected a location that provides existing road access to the Project; therefore, no additional roads or associated disturbances would be necessary.

Macro-siting considerations for the Project included:

- The Project is located in an area with existing electrical infrastructure so that a minimal gen-tie line and system upgrades will be required.
- The Project is located in an area that lacks jurisdictional waters and any other substantial riparian or xeroriparian vegetative communities or other features that may attract or provide habitat for large concentrations of resident or migrating birds or bats.
- Special-status bird and bat species are unlikely to be attracted to the general area of the Project, nor does designated critical habitat for any species exist in the general area of the Project.
- The Project is located outside of areas designated for environmental resource conservation, such as Areas of Critical Environmental Concern, Important Bird Areas, National Wildlife Refuges, Wilderness Areas, important migratory pathways or stopover sites, or other specially designated areas.

Sunshine Valley has been in communication with the USFWS and NDOW concerning potential impacts to species of concern that may not be avoided through the Project siting measures. USFWS and NDOW have been instrumental in advising Sunshine Valley of species to be aware of and measures to limit potential impacts on those species.

4.2 Project Design and Construction

The following risk reduction measures would be incorporated into the design and construction of the Project.

- APLIC suggested practices (APLIC 2006 and 2012) will be followed in the design of the gen-tie line in order to minimize the potential for collisions or electrocutions of raptors and other birds. Although bird electrocution risk is recognized more for distribution (12.47/7.2 kV and 29.4/24.4 kV) and sub-transmission voltages (34.5-kV) (APLIC 2006), the design of the Project's 138-kV gen-tie will provide adequate clearances to prevent or minimize bird electrocution risk in accordance with APLIC (2006). The use of guy wires would be avoided to minimize impacts on birds and bats. If guy wires are necessary, permanent markers (e.g., bird flight diverters) would be used to increase their visibility.

- A qualified biologist would be retained to prepare a WEAP that shall be presented to all construction personnel and employees before any ground-disturbing activities commence at the Project. The WEAP and associated presentation would explain to construction personnel how best to avoid the accidental take of special-status species during construction and what steps to take upon detection of any wildlife incident. The program would consist of a brief presentation explaining species concerns to all personnel involved in the Project. The program would include a description of special-status species potentially occurring in the Project area and their habitat needs; an explanation of the status of the species and their protection under the ESA, BGEPA, MBTA, and NAC 503; specific mitigation measures applicable to special-status species; and the penalties for take. The program would be recorded electronically, and all future facility employees would be required to review the recording before the initiation of work on the Project area. The WEAP would be implemented by Sunshine Valley before the start of ground disturbance and would be continued through the construction phase for all construction personnel.
- Measures for proper trash removal and storage would be implemented for the Project, such as using secured containers and periodic emptying, to reduce attracting scavengers and opportunistic species such as common ravens, coyotes, and feral cats and dogs.
- Habitat-altering construction activities in suitable nesting areas would be scheduled outside of the bird-breeding season, which generally occurs between February 15 and August 31, to the greatest extent feasible. If construction activity has to occur in these areas during the breeding season, then a qualified biologist would survey the area for nests immediately prior to commencement of construction activities. This would include burrowing and ground-nesting species in addition to those nesting in vegetation. If any active nests are found, an appropriately-sized buffer area would be established and maintained until the young birds fledge. As the above dates are a general guideline, if active nest are observed outside this range they would be avoided as described above.
- All construction vehicle traffic would be restricted to established roads, construction areas, and other designated areas. To the extent possible, these areas would be established in locations disturbed by previous activities to prevent new impacts.
- Construction vehicles on-site would observe a 20 mile-per-hour (mph, 32 kilometer-per-hour [kph]) speed limit during daylight hours, except on county roads and state and federal highways. During limited nighttime activities, all construction and operation vehicles would observe a 10 mph (16 kph) speed limit.
- The number of areas where wildlife could hide or be trapped (e.g., open sheds, pits, uncovered basins, hollow posts, and laydown areas) would be minimized. Movement of a discovered special status species that is hidden or trapped would be prohibited except by a licensed individual and to move the animal from the path of harmful activity until it could escape.

- A fence would be constructed around the Project, which would exclude livestock from Project facilities; thereby avoiding harmful effects of livestock on ground-nesting birds.
- Sunshine Valley would prohibit Project personnel from bringing firearms and pets to the Project facilities.

4.3 Operations and Maintenance

The following risk reduction measures would be incorporated into the operation and maintenance of the Project.

- All vehicle parking and O&M-related materials would be confined to the permanently fenced Project area.
- Lighting would be kept to the minimum required for safety and security needs (including directional, hooded, and/or shielded, low-intensity, low-sodium lights equipped with motion sensors). All unnecessary lighting would be turned off at night to limit attracting wildlife, particularly migratory birds.
- During O&M, Sunshine Valley would continue to implement applicable measures from the construction phase, including: the WEAP, measures for proper trash removal and storage, restriction of on-site vehicle traffic to established roads, 20 mph (32 kph) daytime speed limit and 10 mph (16 kph) nighttime speed limit, the Integrated Weed Management Plan, noise reduction devices, and prohibition of Project personnel bringing firearms and pets to Project facilities.
- All transmission and sub-transmission towers and poles would be designed in accordance with the recommendations outlined in, "Suggested Practices for Avian Protection on Power Lines: The State of the Art in 2006" (APLIC 2006) therefore avoiding the potential for electrocutions.
- Where applicable, line design (isolation) would include clearances of 60 inches (152 centimeters) horizontal and 40 inches (102 centimeters) vertical between potential phase-to-phase or phase-to-ground contact points.
- Where sufficient clearances are not feasible, cover-up devices and materials would be used to allow incidental contact by birds. These would include covering any phase-to-phase and phase-to-ground contacts measuring less than 60 inches (152 centimeters) horizontally, less than 40 inches (102 centimeters) vertically, and less than 10 inches (25 centimeters) below a potential perch site.

4.4 Exclusion Zones

Although habitat for most species appears to be limited within the Project area, exclusion zones would be established as necessary and appropriate to protect any identified raptor and other bird nests and areas of suitable habitat for bat roosts or hibernacula located within the Project and rights-of-way from disturbance related to the construction of the Project. Vegetation removal would occur outside of the breeding season for special-status bird and bat species to the maximum extent possible. If vegetation removal would occur during the breeding season, preconstruction nesting bird surveys would be conducted within two to four days prior to vegetation removal to locate any active nests or burrows. If any active nests or burrows are located during these surveys, exclusion zones would be established as described below.

4.4.1 Passerines

Exclusion distances for active passerine nests would be determined based on species, terrain, habitat type, and existing anthropogenic activity level as these features related to the bird alert distance and bird flight initiation distance (Whitfield et al. 2008). Exclusion zones would initially be a minimum of 100 ft (30.5 m) from any active nest. Any changes in this minimum exclusion distance based on circumstances such as topography and type of construction activities would be determined in coordination with the USFWS. Nests would be checked within a week prior to construction to determine success and whether young have fledged. The exclusion zone boundary would not be removed until a qualified biologist has determined that the nest has failed or the young have fledged.

4.4.2 Raptors and Eagles

Project-related disturbances such as construction traffic, noise, lighting and dust would be avoided within 500 ft (152 m) of an active raptor nest and within 1 mile (1.6 kilometers) of any active golden eagle nest. Any changes in these exclusion distances based on circumstances such as topography and type of construction activities would be determined in coordination with the USFWS. All nests would be checked within a week prior to construction to determine nest success and whether young have fledged. The exclusion zone boundary would not be removed until a qualified biologist has determined that the nest has failed or the young have fledged. Efforts would be made to identify potential causes of nest failure. Causation is typically difficult to assign because nests fail for many natural reasons as well as for disturbance. Any clear indicators of nest disturbance would be documented.

4.4.3 Burrowing Owls

All active burrowing owl nests would be avoided with an exclusion of 250 ft (76 m) during the nesting season (February 1 – August 31) or an appropriate buffer determined in coordination with USFWS. Active burrowing owl burrows within the construction area would be collapsed during the non-breeding season (Sept 1 – January 31) after investigation using a video scope to ensure no owls are present. All occupied burrows outside or adjacent to construction areas would be avoided with an exclusion distance of 165 ft (50 m) during the non-breeding season) or an appropriate buffer determined in coordination with USFWS. If buffers cannot be maintained outside or adjacent to construction areas during the non-breeding season, birds would be appropriately and passively relocated. Any changes to these exclusion distances, based on circumstances such as topography and type of construction activities would be determined in coordination with the USFWS. Burrows would be observed at least one week prior to construction to determine success and whether young have fledged. The exclusion zone boundary would not be removed until a qualified biologist has determined that the nest has failed or the young have fledged.

4.4.4 Bats

Construction activities would either avoid any suitable habitat for bat roost sites, maternity colonies, or hibernacula found during clearance surveys, or a qualified biologist would be retained to conduct emergence surveys to determine use of these areas the night prior to construction activities. If the habitat is occupied, appropriate exclusion distances would be established in coordination with the USFWS, based on the disturbance type, distance to roost or hibernacula, time of year, and the duration of the disturbance.

4.5 Nest Management

Documentation of active nests located on Project structures may occur opportunistically by operations staff or during fatality or nest monitoring (Sections 5.2 and 5.1, respectively). Any discovered active nests whose presence does not compromise facility operations or personnel safety would be allowed to proceed undisturbed until a qualified biologist confirms that all young have fledged or the nest has failed. Provisions for minimizing disturbance of such nests, such as exclusion zones, would necessarily depend on the species, nest location, and proximity to essential facility operations and activities, and would be developed in consultation with a qualified biologist.

If necessary, procedures for removing problematic active nests during the breeding season or inactive nests outside of the breeding season would follow existing federal regulations and would be conducted in accordance with the suggested practices outlined in APLIC guidance (APLIC 2006). For ongoing nesting issues, it may be appropriate to (1) encourage birds to nest in desired areas through the installation of nesting platforms, boxes, or tubes, or (2) discourage nest construction in undesired locations through the installation of plastic piping, triangles, model owls, and/or small spikes on Project facilities (see APLIC 2006).

5 CONSTRUCTION AND POST-CONSTRUCTION MONITORING

A monitoring program would be implemented throughout the construction phase of the Project and for at least one year post-construction, as specified below. The monitoring would inform adaptive management decisions regarding any additional appropriate and practicable measures to avoid, minimize, and mitigate for observed impacts.

5.1 Construction Monitoring

5.1.1 Passerine Nest Surveys and Monitoring

Sunshine Valley would avoid potential impacts to MBTA-protected birds within the Project area and would attempt to schedule construction activities near nesting areas outside the bird breeding season, which generally occurs from February 15 through August 31, to the greatest extent feasible. If construction needs to occur during the breeding season, then a qualified biologist would perform pre-disturbance nesting bird surveys in the area for nests immediately (within two to four days) prior to commencement of construction activities. This would include burrowing and ground-nesting species in addition to those nesting in vegetation. If any active nests are found, an appropriately sized buffer would be established and maintained until the young birds fledge (Section 4.4). As the above dates are a general guideline, if active nests are observed outside this range they would be avoided as described above.

5.1.2 Raptor Nest Surveys and Monitoring

Surveys and monitoring for raptor nests within the Project area and a 1-mile (1.6-kilometer) buffer around the Project area would be performed during the construction phase of the Project. For golden eagles, surveys and monitoring would be expanded to cover a 2-mile (3.2-kilometer) buffer around the Project. These surveys would be conducted once per month during the breeding season (January 1 to August 31) and would entail inspecting all potentially suitable structures for the presence of raptor nests to the extent practicable, with some potential access restrictions on private land. Where access is restricted, surveys and monitoring would be conducted to the greatest extent possible from public roads. Active raptor nests would be monitored twice per month to determine nest fate and make behavioral observations to evaluate the effectiveness of associated exclusion zones.

5.1.3 Incidental Mortality Observations during Construction

Throughout the construction phase of the Project, all incidentally discovered carcasses of birds and bats (i.e., incidental fatality discoveries by WEAP-trained construction facility workers and staff as well as environmental staff when on-site) would be reported to Sunshine Valley's environmental manager. Facility workers and staff would be instructed during WEAP training to report mortalities to the appropriate supervisor who would in turn contact the environmental manager. During construction periods when a monitor or avian biologist is not on-site, responsible facility personnel would be required to contact a designated on-call biologist or the environmental manager, who would be responsible for recording the fatality information. The carcass will be left in place, or if raven management is an issue, the carcass will be rolled in and covered with native soil, assuming this action is acceptable to the USFWS. The environmental manager would be responsible for keeping records.

5.2 Post-construction Avian and Bat Fatality Monitoring

5.2.1 Monitoring Plan

A post-construction Avian and Bat Fatality Monitoring Plan has been developed for the Project and is included in Appendix A. Monitoring would be implemented for at least one year post construction, with the potential for a second year contingent upon the findings from the first years of surveys. Data and results of the study would be used to inform adaptive management decisions and serve as a basis for avian fatality comparisons across other regional renewable energy projects.

5.2.2 Risk Assessment Validation

Using monitoring data and any other best-available information, Sunshine Valley would validate, and update as necessary, the original risk assessment for the Project. The validation process would use the monitoring data to evaluate if the implemented conservation measures are adequately minimizing impacts to bird and bat resources, and other best-available information would inform consideration of any alternative and appropriate conservation measures to reduce avian and/or bat mortality rates.

5.2.3 Reporting

Data summaries would be submitted to USFWS twice per year. The summaries would document results of the post-construction monitoring and may include recommendations for possible adaptive management actions (see Section 6 below). Reporting would include all fatality occurrences at the Project as well as suspected causes of mortality, where field-observable evidence exists, with an emphasis on any special-status species occurrences. Maps detailing locations of mortality events and photos would be provided as requested.

6 Wildlife Incident and Handling System

In addition to the post-construction fatality monitoring, Sunshine Valley would implement a Wildlife Incident Reporting System (WIRS) at the start of operations, and it would remain active for the life of the Project. The purpose of the WIRS is to standardize the actions taken by Project personnel in response to wildlife incidents encountered at the Project and to fulfill the obligations for reporting wildlife incidents. The WIRS would be utilized by Project O&M personnel who encounter dead or injured wildlife incidentally while conducting general facility maintenance activities. The WIRS is designed to provide a means of recording fatalities at the Project to increase the understanding of solar panel and wildlife interactions. During the standardized post-construction monitoring studies, any carcass found incidentally by Project O&M personnel would be reported to the contractor conducting the post-construction monitoring studies so that the contractor can process the carcass. Additionally, injured wildlife found within the Project area may be taken to the nearest appropriate wildlife rehabilitation facility as described below. Any incident (i.e., mortality or injury) involving a federally listed threatened or endangered species or a bald or golden eagle would be reported to the USFWS within 24 hours of identification. Sunshine Valley maintains an ongoing commitment to investigate wildlife incidents involving company facilities and to work cooperatively with federal and state agencies in an effort to prevent and mitigate future bird and wildlife fatalities. It would be the responsibility of Sunshine Valley employees and subcontractors to report all avian incidents to their immediate supervisor.

If during operations, injured wildlife were found within the Project facility, a qualified biologist would be contacted to confirm the species and coordinate for the disposition of the injured animal. Any injured raptor or state or federal endangered or threatened species, or other species accepted at the nearest appropriate wildlife rehabilitation facility, would be transported to the facility assuming handling permission is granted by the USFWS and NDOW. The wildlife facilities potentially contacted include, but are not limited to:

- Wild Animal Infirmary for Nevada: Carson City, Nevada; telephone (775) 849-0345
- Animal Kingdom Veterinary Hospital: Las Vegas, Nevada; telephone (702) 735-7184
- Safe Haven Rescue Zoo: Imlay, Nevada; telephone (775) 538-7093

- Wild Wing Project: Las Vegas, Nevada: telephone (702) 338-4382

Handling or transportation of injured wildlife would only be completed under the direction of a qualified biologist and with the appropriate permits and/or agency approvals. The transportation of migratory birds to a wildlife rehabilitation center is authorized under a Good Samaritan clause of the MBTA.

7 ADAPTIVE MANAGEMENT

Adaptive management measures would be implemented in response to data collected during the year of post-construction fatality monitoring, as necessary and as needed for the life of the Project. This adaptive management approach would include the following six key concepts described by Williams and Brown (2012):

- Problem Assessment
- Design
- Implementation
- Monitoring
- Evaluation
- Adjustment

The Project would submit mortality data summaries to the USFWS twice per year during the time period of monitoring. The USFWS, in consultation with Sunshine Valley, and NDOW as appropriate, would discuss the findings.

Based on results of post-construction monitoring and the WIRS, adaptive management measures could be considered based on an evaluation of certain relevant criteria:

- Take of an individual of a bird or bat species listed as endangered/threatened under the federal ESA;
- Take of bald or golden eagles within the meaning of the BGEPA; or
- Significant levels of mortality of any bird or bat species. Significance would be determined in coordination with USFWS and would be based on the best available information, including the most recent data on species' population sizes and trends. For example, even relatively high levels of mortality of common species may not be significant. Conversely, lower levels of mortalities of less common species may be of more concern, particularly if these species appear to be at risk (e.g., NAC 503 species).

Potential adaptive management responses may include but would not be limited to:

- Additional monitoring to assess if impacts represent ongoing and significant risk;
- A root-cause assessment to evaluate why impacts are occurring and to aid in developing appropriate actions to further avoid, minimize or mitigate the impacts;

- Modifications to prey-base or habitat to reduce ongoing risk (e.g., additional on-site carcass removal, increased frequency of vegetation management), as appropriate;
- Installation of bird deterrent devices that have been scientifically demonstrated to be effective within solar arrays and/or along fence lines; or
- Additional anti-perching, anti-nesting, anti-electrocution, or flight diverter devices to transmission/collector lines or within substations/switchyard, as appropriate.

Post-construction Project-related impact assessment is highly complex, particularly with regard to relatively new technologies such as utility-scale solar PV projects. It is therefore critical for stakeholders and resource managers to incorporate statistically sound modeling into any iterative feedback cycle prior to implementation of additional or modified control measures (Williams and Brown 2012).

8 REFERENCES

43 Code of Federal Regulations (CFR) 46. Title 43 - Public Lands: Interior; Part 46—Implementation of the National Environmental Policy Act of 1969. Available online at: http://www.gpo.gov/fdsys/pkg/CFR-2011-title43-vol1/pdf/CFR-2011-title43-vol1-part46.pdf

Althouse and Meade, Inc. 2014. Topaz Solar Farms 2013 Fourth Quarter/Second Annual Report for Avian and Bat Protection Plan and Bird Monitoring and Avoidance Plan. Prepared for Topaz Solar Farms LLC, Santa Margarita, California. Prepared by Althouse and Meade, Inc., Paso Robles, California. March 2014.

Argonne National Laboratory and National Renewable Energy Laboratory (ANL/NREL). 2015. A Review of Avian Monitoring and Mitigation Information at Existing Utility-Scale Solar Facilities. Prepared for the United States Department of Energy (Doe). Prepared for U.S. Department of Energy, SunShot Initiative and Office of Energy Efficiency & Renewable Energy. Information available at: http://www.evs.anl.gov/downloads/ANL-EVS_15-2.pdf

Arizona Game and Fish Department (AZGFD). 2001. Unpublished abstract compiled and edited by the Heritage Data Management System, Arizona Game and Fish Department, Phoenix, AZ. 10 pp.

Avian Power Line Interaction Committee (APLIC). 2006. Suggested Practices for Avian Protection on Power Lines: The State of the Art in 2006. Public Interest Energy Research Program (PIER) Final Project Report CEC-500-2006-022. Edison Electric Institute, APLIC, and the California Energy Commission. Washington D.C. and Sacramento, California.

Avian Power Line Interaction Committee (APLIC). 2012. Reducing Avian Collisions with Power Lines: The State of the Art in 2012. Edison Electric Institute and APLIC, Washington D.C.

Bald and Golden Eagle Protection Act (BGEPA). 1940. 16 United States Code (USC) § 668-668d. Bald Eagle Protection Act of 1940, June 8, 1940, Chapter 278, § 2, 54 Statute (Stat.) 251; Expanded to include the related species of the golden eagle October 24, 1962, Public Law (PL) 87-884, 76 Stat. 1246. As amended: October 23, 1972, PL 92-535, § 2, 86 Stat. 1065; November 8, 1978, PL 95-616, § 9, 92 Stat. 3114.

Bevanger, Kjetil. 1994. Bird interaction with utility structures: collision and electrocution, causes and mitigation measures. Norwegian Institute for Natural Research, Division of Terrestrial Ecology. Tungasletta 2, N-7005 Trondeim, Norway.

BirdLife International (2016) Species factsheet: *Leucosticte tephrocotis*. Downloaded from http://www.birdlife.org on 21/11/2016

Brown, David E. 1994. *Biotic Communities Southwestern United States and Northwestern Mexico*. University of Utah Press, Salt Lake City. 341 pp.

Boeker, E. L. and T. D. Ray. 1971. Golden Eagle Population, Studies in the Southwest. Condor 73: 463-467.

Bureau of Land Management (BLM). 2007. Final Programmatic Environmental Impact Statement Vegetation Treatments Using Herbicides on Bureau of Land Management Lands in 17 Western States. US Department of the Interior (USDI) BLM. Available online at: http://www.blm.gov/wo/st/en/prog/more/veg_eis.html

Bureau of Land Management (BLM). 2010. Instruction Memorandum No. 2010-156. Bald and Golden Eagle Protection Act – Golden Eagle National Environmental Policy Act and Avian Protection Plan Guidance for Renewable Energy. July 13, 2010. Expires September 30, 2011. Available online at: http://www.blm.gov/wo/st/en/info/regulations/Instruction_Memos_and_Bulletins/national_instruction/2010/IM_2010-156.html

Bureau of Land Management (BLM). 2012. Approved Resource Management Plan Amendments/Record of Decision (Rod) for Solar Energy Development in Six Southwestern States. October 2012. US Department of the Interior (USDI) BLM. Available online at: http://solareis.anl.gov/documents/docs/Solar_PEIS_ROD.pdf

Bureau of Land Management (BLM). 2014. Playa Solar Project (Dry Lake Solar Energy Zone Parcels 2, 3, & 4) Environmental Assessment. Environmental Assessment DOI-BLM-NV-S010-2014-0127-EA. December 2014. Southern Nevada District office. Las Vegas Field Office. 508 pp. Available at: https://eplanning.blm.gov/epl-front-office/projects/nepa/42099/52184/56875/Playa_Solar_Project_EA_508.pdf

Bureau of Land Management (BLM) and Department of Energy (DOE). 2010. Draft Programmatic Environmental Impact Statement (Peis) for Solar Energy Development in Six Southwestern States. US Department of the Interior (USDI) BLM and DOE. Available online at: http://solareis.anl.gov/documents/dpeis/index.cfm#vol1

Bureau of Land Management (BLM) and Department of Energy (DOE). 2011. Supplement to the Draft Programmatic Environmental Impact Statement for Solar Energy Development in Six Southwestern States. October 2011. DES 11-49. DOE/EIS-0403D-S. Available online at: http://solareis.anl.gov/documents/supp/Supplement_to_the_Draft_Solar_PEIS.pdf

Bureau of Land Management (BLM) and US Department of Energy (DOE). 2012. Final Programmatic Environmental Impact Statement (Peis) for Solar Energy Development in Six Southwestern States. US Department of the Interior (USDI) BLM. Information available at: http://energy.gov/sites/prod/files/EIS-0403-FEIS-Volume1-2012_0.pdf

DeLorme. 2012. Nevada Atlas & Gazetteer. DeLorme. Yarmouth, Maine. 2012

Driscoll, D. E. 2010. Protocol for Golden Eagle Occupancy, Reproduction, and Prey Population Assessment. American Eagle Research Institute, Apache Junction, Arizona. 55 pp.

Drewitt, Allan L. and Rowena H.W. Langstrom. 2008. Collision effects of wind-power generators and other obstacles on birds. New York Academy of Sciences. 1134: 233-266.

Endangered Species Act (ESA). 1973. 16 United States Code (USC) §§ 1531-1544, Public Law (PL) 93-205, December 28, 1973, as amended, PL 100-478 [16 USC 1531 *et seq.*]; 50 Code of Federal Regulations (CFR) 402.

Executive Order (EO) 13186. 2001. Responsibilities of Federal Agencies to Protect Migratory Birds. EO 13186 of January 10, 2001. 66 Federal Register (FR) 11: 3853-3856. Published in the FR January 17, 2001. Available online at: https://www.fws.gov/migratorybirds/Partnerships/migbrdeo.pdf

Floyd, T., C. S. Elphick, G. Chisholm, K. Mack, R. Elston, E. M. Ammon, and J. D. Boone. 2007. Atlas of the Breeding Birds of Nevada. University of Nevada Press.

Google Earth. 2015. Nye County Nevada. Europa Technologies Image 2016, Digital Globe 2016, Google 2016. Accessed November 12-23, and December 15-21, 2016.

Greif, S. and B. M. Siemers. 2010. Innate Recognition of Water Bodies in Echolocating Bats. Nature Communications 2: 1:107. doi:10.1038/ncomms1110.

H.T. Harvey and Associates. 2014. California Valley Solar Ranch Project Avian and Bat Protection Plan Annual Postconstruction Fatality Report: 16 August 2012 – 15 August 2013. Project # 3326-03. Prepared for HPR II, LLC, California Valley Solar Ranch, Santa Margarita, California. Prepared by H.T. Harvey and Associates, San Luis Obispo, California. March 28, 2014.

Kochert, M. N., K. Steenhof, C. L. Mcintyre, and E. H. Craig. 2002. Golden Eagle (*Aquila Chrysaetos*). A. Poole, ed. The Birds of North America Online. Cornell Lab of Ornithology. Ithaca, New York. Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/684; doi:10.2173/bna.684

Manville, A. M. 2001. Avian Mortality at Communication Towers: Steps to Alleviate a Growing Problem. B. B. Levitt, ed. *In*: Cell Towers - Wireless Convenience? Or Environmental Hazard? Proceedings of the “Cell Towers Forum,” State of the Science/State of the Law. Dec. 2, 2000. Litchfield, Connecticut. New Century Publishing 2000, Markham, Ontario. Pp. 75-86.

McQueary, Patricai L. Patricai L. McQueary US Army Corps of Engineers to Mr. Ken Borngrebe First Solar. October 30, 2013

McGahan, J. 1968. Ecology of the Golden Eagle. Auk 85: 1-12.

Migratory Bird Treaty Act (MBTA). 1918. 16 United States Code (USC) §§ 703-712. July 13, 1918.

National Invasive Species Council. 2008. 2008-2012 National Invasive Species Management Plan. August 2008. Available online at: http://www.invasivespecies.gov/home_documents/2008-2012%20National%20Invasive%20Species%20Management%20Plan.pdf

National Land Cover Database (NLCD). 2016. Available at: http://www.mrlc.gov/. Accessed May 22-23, 2016.

Nevada Administrative Code (NAC) 503.030. Protected, Threatened and Sensitive Mammals. Available online at: https://www.leg.state.nv.us/NAC/NAC-503.html#NAC503Sec030

Nevada Administrative Code (NAC) 503.050. Protected, Endangered and Sensitive Birds. Available online at: https://www.leg.state.nv.us/NAC/NAC-503.html#NAC503Sec050

Nevada Administrative Code (NAC) 503.093. Appropriate License, Permit or Authorization Required to Hunt, Take or Possess Protected Wildlife; Exceptions; Limitation on Possession of Desert Tortoises. Available online at: https://www.leg.state.nv.us/NAC/NAC-503.html#NAC503Sec093

Nevada Administrative Code (NAC) 503.095. Permit to Collect Unprotected Wildlife for Commercial Purposes. Available online at: https://www.leg.state.nv.us/NAC/NAC-503.html#NAC503Sec095

Nevada Department of Wildlife (NDOW). 2016. Data request response letter. November 22, 2016.

Nevada Department of Wildlife (NDOW). 2012. Nevada State Wildlife Action Plan. Developed by the Wildlife Action Plan Team. NDOW, Reno, Nevada. Submitted September 6, 2012. Approved March 1, 2013. Available online from: http://www.ndow.org/Nevada_Wildlife/Conservation/Nevada_Wildlife_Action_Plan/

Nevada Natural Heritage Program (NNHP). 2016. Available at: http://www.heritage.nv.gov/. Accessed May 12-13, 16-18, June 2-3, and November 14-18, 2016.

Nevada Revised Statute (NRS) 501.105-501.181. 1947. Title 45 - Wildlife; Chapter 501 - Administration and Enforcement. As amended.

Nevada Revised Statute (NRS) 503. Chapter 503 - Hunting, Fishing and Trapping; Miscellaneous Protective Measures. As amended. Available online at: http://www.leg.state.nv.us/NRS/NRS-503.html

North American Datum (NAD). 1983. Nad83 Geodetic Datum.

O'Farrell, M. J. 2009. Final Progress Report April 2008 – April 2009. Baseline acoustic monitoring of Bat Populations within the Duke Energy Searchlight Wind Energy Project Site, Clark County, Nevada.

O'Farrell, M. J. 2010. Final Report May 2009 – April 2010. Baseline acoustic monitoring of Bat Populations within the Duke Energy Searchlight Wind Energy Project Site, Clark County, Nevada.

Pagel, J. E., D. M. Whittington, and G. T. Allen. 2010. Interim Golden Eagle Technical Guidance: Inventory and Monitoring Protocols; and Other Recommendations in Support of Golden Eagle Management and Permit Issuance. US Fish and Wildlife Service (USFWS). February 2010. Available online at: http://steinadlerschutz.lbv.de/fileadmin/www.steinadlerschutz.de/terimGoldenEagleTechnicalGuidanceProtocols25March2010_1_.pdf

Postupalsky, S. 1974. Raptor Reproductive Success: Some Problems with Methods, Criteria, and Terminology. Pp. 21-31. Raptor Research Report Part 4.

Saleh, T. 2007. Effects of Artificial Light on Wildlife. Wildlife CPR Notes.

Senn, Michael. Michael Senn US Fish and Wildlife Service to Mr. Ken Borngrebe First Solar Inc., San Francisco, California, July 11 2014.

Sunshine Valley Solar LLC (SVS). 2013a. Desert Tortoise (Gopherus agassizii) and Burrowing Owl (Athena cunicularia hypugaea) Survey Report for The Sunshine Valley Solar Power Project, Prepared for the United States Fish and Wildlife Service, Las Vegas, Nevada Field Office. October 2013

Sunshine Valley Solar LLC (SVS). 2013b. Jurisdictional Waters Delineation Report for The Sunshine Valley Solar Power Project, Prepared for the United States Army Corps of Engineers, Sacramento District; St. George Regulatory Office. October 2013.

Steenhof, K. and I. Newton. 2007. Assessing Raptor Nest Success and Productivity. Pp. 181-191. *In*: D. M. Bird and K. L. Bildstein, eds. Raptor Research and Management Techniques. Hancock House Publishing, Surrey, BC, Canada.

URS.Corporation (URS). 2013. Phase I Environmental Site Assessment for the First Solar Amargosa Valley Project Site, Nye County, Nevada, Purchase Order 4800014502. Prepared for First Solar. URS Project Number 28907465. August 1, 2013.

US Department of Agriculture (USDA) National Agriculture Imagery Program (NAIP). 2006. NAIP Imagery and Status Maps.

US Army Corps of Engineers (ACOE). 2008. *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region (Version 2.0),* ed. J. S. Wakeley, R. W. Lichvar, and C. V. Noble. ERDC/EL TR-08-28. Vicksburg, MS: U.S. Army Engineer Research and Development Center.

US Fish and Wildlife Service (USFWS). 1973. Title 50 - Wildlife and Fisheries; Chapter I -United States Fish and Wildlife Service, Department of the Interior; Subchapter B Taking, Possession, Transportation, Sale, Purchase, Barter, Exportation, and Importation of Wildlife and Plants; Part 10 - General Provisions; Subpart B - Definitions; Section (§)10.13. List of Migratory Birds. 50 Code of Federal Regulations (CFR) 10.13; 38 Federal Register (FR) 22015, August 15, 1973, as amended 50 FR 52889, December 26, 1985.

US Fish and Wildlife Service (USFWS). 2005. Avian Protection Plan Guidelines. http://www.fws.gov/ migratorybirds/CurrentBirdIssues/Hazards/APP/AVIAN%20PROTECTION%20PLAN%20FINAL%204%2019%2005.pdf

US Fish and Wildlife Service (USFWS). 2008. Birds of Conservation Concern 2008. December 2008. Division of Migratory Bird Management. Arlington, Virginia. http://www.fws.gov/migratorybirds/NewReportsPublications/SpecialTopics/BCC2008/BCC2008.pdf

US Fish and Wildlife Service (USFWS). 2009. Title 50 - Wildlife and Fisheries. Chapter I - United States Fish and Wildlife Service, Department of the Interior (Continued). Subchapter B - Taking, Possession, Transportation, Sale, Purchase, Barter, Exportation, and Importation of Wildlife and Plants (Continued). Part 22 - Eagle Permits. Subpart C - Eagle Permits: Permits for Eagle Take That Is Associated with, but Not the Purpose of, an Activity. 50 CFR § 22.26 (a)(2). October 1, 2009.

US Fish and Wildlife Service (USFWS). 2013. Eagle Conservation Plan Guidance: Module 1 - Land-Based Wind Energy, Version 2. US Department of the Interior, Fish and Wildlife Service, Division of Migratory Bird Management. April 2013. Executive Summary and frontmatter + 103 pp. Available online at: http://www.fws.gov/migratorybirds/Eagle_Conservation_Plan_Guidance-Module%201.pdf

US Fish and Wildlife Service (USFWS). 2016. Ash Meadows National Wildlife Refuge website, Available at: http://www.fws.gov/refuge/Ash_Meadows/. Accessed June 13, 2016.

US Fish and Wildlife Service Information for Planning and Conservation (IPaC). 2016. IPaC Trust Resources Report. Available at: https://ecos.fws.gov/ipac/project/VKXSX-IMVRR-HVZJX-NIU5G-3Z7SF4/overview. Accessed May 6, 2016.

US Geological Survey 2016. North American Breeding Bird Survey. Available at https://www.pwrc.usgs.gov/BBS/index.cfm?CFID=30514925&CFTOKEN=da4daa55f2dfdb17-89B25DBC-E4E0-73C4-C5E1E0917BB09B64. Accessed November 14-16, 2016.

Western Ecosystems Technology, Inc. (WEST). 2016. Avian and Bat Monitoring at the Desert Sunlight Solar Farm Project Riverside County, California, 2015 – 2016 Annual Report [*Draft*]. Prepared for Desert Sunlight 250, LLC and Desert Sunlight 300, LLC, Juno Beach, Florida. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne Wyoming.

Western EcoSystems Technology, Inc. (WEST). 2014. Sources of Avian Mortality and Risk Factors Based on Empirical Data from Three Photovoltaic Solar Facilities. Technical report prepared for First Solar. June 2014.

Whitfield, D. P., A. H. Fielding, D. R. A. McLeod, and P. F. Haworth. 2008. A Conservation Framework for the Golden Eagle in Scotland: Implications for Their Conservation and Management in Scotland. Scottish Natural Heritage Commissioned Report No.193.

Williams, B. K. and E. D. Brown. 2012. Adaptive Management: The U.S. Department of the Interior Applications Guide. Adaptive Management Working Group, U.S. Department of the Interior, Washington, D.C.

Wise-Gervais, C. 2005. Clapper Rail (*Rallus longirostris*).*In* Arizona Breeding Bird Atlas. pp. 162-163 (T. E. Corman and C. Wise-Gervais, eds.), University of New Mexico Press, Albuquerque.

Appendix A. Avian and Bat Post-Construction Fatality Monitoring Plan

Avian and Bat Post-Construction Fatality Monitoring Plan

Sunshine Valley Solar Project

Nye County, Nevada

Prepared for:

Sunshine Valley Solar, LLC

135 Main St., 6th Floor

San Francisco, CA 94105 85281

Prepared by:

Western EcoSystems Technology, Inc.
415 W. 17th St.
Cheyenne, WY 82001

FINAL
April 7, 2017

Draft Pre-Decisional Document - Privileged and Confidential - Not For Distribution

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

REPORT REFERENCE

Western EcoSystems Technology, Inc. (WEST). 2016. Avian and Bat Post-Construction Fatality Monitoring Plan for the Sunshine Valley Solar Project Nye County, Nevada. Prepared for Sunshine Valley Solar, LLC, San Francisco, California. Prepared by WEST, Cheyenne, Wyoming.

1.0 INTRODUCTION

This Avian and Bat Fatality Monitoring Plan (hereafter referred to as the “Plan”) establishes search protocols to monitor avian and bat fatalities at the site, and establishes analytic methods to estimate post-construction avian and bat fatality rates associated with development of the Sunshine Valley Solar Project. This Plan outlines a standardized approach to document bird and bat fatalities and injuries, and to estimate post-construction fatality rates associated with the Project. In particular, the Plan outlines a statistically sound yet reasonable spatial and temporal sampling plan, including protocols for establishing corrections for detection biases associated with estimating fatality rates, including searcher-efficiency and scavenger removal biases. It describes specific data to collect during scheduled carcass searches, protocols to address any injured birds that are found, and procedures for reporting incidents involving federally or state-listed species to US Fish and Wildlife Service (USFWS) or the Nevada Department of Wildlife (NDOW), as appropriate. This Plan is modeled on other regional plans including Playa, Silver State South and Aiya, and incorporates methodology outlined by Huso (2016).

1.1 Project Description

Sunshine Valley Solar, LLC (Sunshine Valley) intends to construct, own, operate, and maintain an up to 110-megawatt (MW) photovoltaic (PV) solar electric generation facility, the Sunshine Valley Solar Power Project (Project), in the town of Amargosa, Nevada (Figure 1). The Project would be located on approximately 745 acres (301.5 hectares) of private land in an unincorporated portion of Nye County, Nevada.

Project components include onsite facilities, offsite facilities and temporary facilities needed to construct the Project. The major onsite facilities comprise solar array blocks of PV modules, 34.5-kilovolt (kV) alternating current (AC) power collection systems, and a substation. Operation and maintenance (O&M) facilities will be constructed onsite or immediately adjacent to the site. The offsite facilities include a 0.6 mile (1 kilometer) 138-kV generation tie transmission (gen-tie) line, access road, and electric distribution and communication lines. Temporary facilities, which would be removed at the end of the construction period, include mobilization, laydown, and construction areas. One or two temporary water ponds for dust suppression may also be created. Power produced by the Project would be conveyed to the bulk transmission system via the gen-tie line, which would interconnect to Valley Electric Association’s 138-kV Valley Substation near the intersection of Power Line Road and Anvil Road northeast of the Project.

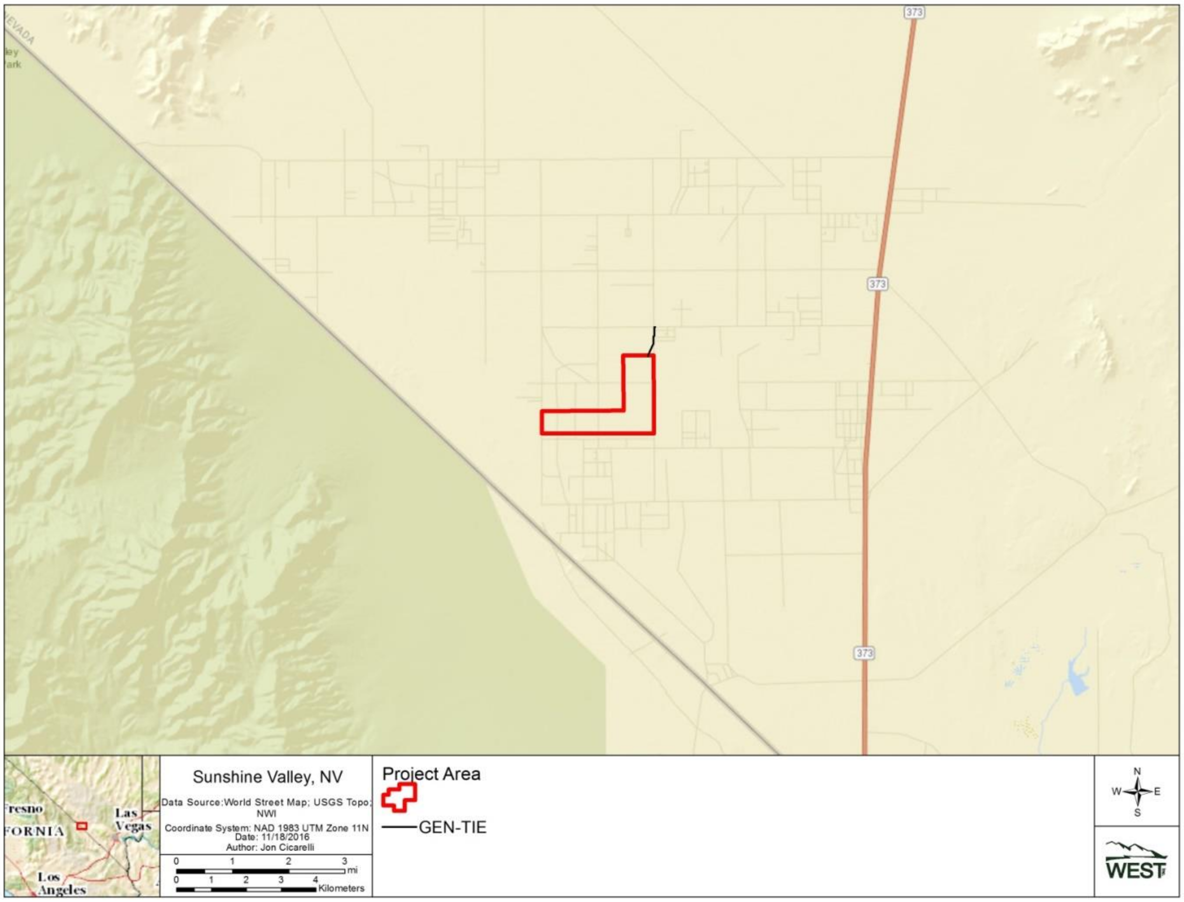

Figure 1. Location of the Sunshine Valley Solar Power Project, Nye County, Nevada.

1.2 Goals and Objectives

The goal of this Plan is to provide data and analysis that will assess the level of bird and bat fatalities within the PV array field and associated infrastructure (i.e., the perimeter fence and generation tie line [gen-tie line]). This post-construction study will be implemented for at least one year, consistent with the 2012 Land-based Wind Energy Guidelines (WEG, USFWS 2012). An additional 1-2 years (2-3 years total) of monitoring might be required based on the results of the first year as well as other information and data that will be available from other projects and research at that time.

The specific objectives of this Plan are as follows:

1. Conduct fatality searches for at least one year after construction is complete according to a spatial and temporal sampling plan that provides representative and statistically sound coverage of the solar array field, perimeter fence and gen-tie line.

2. Conduct statistically sound assessments to quantify and evaluate carcass removal rates (i.e., carcass removal, destruction, or burial in sand due to scavengers, decay, or other abiotic [e.g., wind] or human [e.g., vehicle activity] factors) and support calculation of adjusted fatality rates that account for variation in carcass removal rates by carcass type/size classes.
3. Use current, scientifically validated and accepted methods for calculating fatality rates adjusted for searcher efficiency, carcass removal rates, and spatial and temporal sampling intensity.

2.0 MONITORING METHODS

2.1 Post-Construction Monitoring

The fundamental components of a sampling program designed to produce valid estimates of fatality rates, and total numbers of fatalities, for a solar facility include: sampling methods, spatial sample coverage, temporal sample coverage, adjustment of counts for search efficiency, adjustment of counts for carcass removal, and selection of an appropriate statistical fatality estimator.

The following hierarchical terminology is useful for describing the spatial and temporal sampling design outlined here:

1. **PV module –** the basic unit of a photovoltaic solar facility consisting of a semiconductor material sandwiched between two layers of glass and measuring about 0.6 m by 1.2 m (two feet by four feet)
2. **Row –** A collection PV modules that are mounted on 18-m-long (60-foot- long) steel and aluminum support structures in a horizontal tracking device that follows the sun.
3. **Array –** A collection of rows treated as one electrical system and covering approximately 2.8 hectares (seven acres).
4. **PV Array Field –** The composition of all of the arrays that comprise the solar facility.

2.1.1 Sampling Methods

Sampling strategies used in carcass searches at wind facilities have typically involved transect sampling, whereby searchers walk along pre-defined transects and search for carcasses in a swath that may be 10 – 30 m (33 – 98 feet) wide. The layout of a PV array field presents problems for a transect-sampling strategy, but it is highly amenable to a distance-sampling strategy. The problem with transect sampling within a PV array is that the rows of panels are close together (generally less than five m [16 feet]). Because the modules are fixed-tilt in nature or mounted on tracking devices to follow the sun, modules might be off-horizontal for most daylight hours. In addition, a searcher walking a transect between two rows can only effectively search one side of the transect (a 2.5-m [8.2-foot] swath); the other side is obscured by the edge of a PV row. Because the transect width is only 2.5 m, transects would need to be four to 12 times as long as if the width was 10 – 30 m to maintain the same search area.

On the other hand, the PV array field (and perimeter fence and gen-tie line) is flat and relatively clear of obstructions (i.e., vegetation), which sets up a scenario that is suitable for a distance sampling design (Huso et al. 2016). Distance sampling still involves searchers walking, or driving slowly, a transect line, but the transect is on the roads between solar arrays, and searchers search between the PV rows without leaving the road. Analytically, distance sampling departs from transect survey methodology in its treatment of carcass detection. Distance sampling is based on the assumption that searcher efficiency decreases as a function of distance from the observer. This leads to the expectation that the number of carcasses documented by a searcher will be highest along the transect line, and will decrease with distance from the transect. Searcher efficiency can be estimated as a function of distance using the distance-related decrease in documented carcasses.

For searcher efficiency to be estimated from the carcass data, it is necessary to assume that the probability of carcass occurrence does not change with distance from the transect. If carcass occurrence varied systematically within solar arrays, the detection function and the fatality estimate would be biased. Spatial analysis of carcass distribution from post-construction monitoring at another photovoltaic solar facility in central California (California Valley Solar Ranch; H.T. Harvey and Associates 2014) has indicated no systematic spatial variation of carcasses among the arrays suggesting that distance sampling is a viable option for mortality surveys within PV solar array fields.

One way to conceive of the way distance sampling adjusts carcass counts to account for variable searcher efficiency is that it estimates the *effective* area searched. Effective area is the actual area multiplied by the probability of detection at that distance. As a highly simplified example, if a searcher walks a 10-m long transect line and detects 100% of carcasses within five m of the line, 80% of all carcasses five to 10 m from the line, and 60% of carcasses that are 10 to 20 m from the line, then the effective area between zero and five m would be $5\,m \times 10\,m \times 1.0 = 50\,m^2$ the effective area searched between five and 10 m would be $5\,m \times 10\,m \times 0.8 = 40\,m^2$, and the effective area searched between 10 and 20 m would be $10\,m \times 10\,m \times 0.6 = 60\,m^2$. For the total 10 by 20-m area, the adjustment factor would be:

$$\frac{50\,m^2 + 40\,m^2 + 60\,m^2}{50\,m^2 + 50\,m^2 + 100\,m^2} = 0.75.$$

In practice, searcher efficiency is modeled as a continuous function of distance, and the detection function is estimated from the carcass data (as opposed to a bias trial). One advantage to a data-driven detection function is that it is not necessary to specify a transect width: the detection function includes information about the distance at which searcher efficiency drops to zero.

Distance sampling is a mature methodology that is well equipped to estimate population sizes even when the detection function indicates a rapid decay in detectability with distance, and is ideally suited to situations in which animals (or carcasses) are sparsely distributed across a landscape (Buckland et al. 1993). On this basis, fatality sampling will proceed using distance-sampling survey techniques and analytical methods, which include estimating and accounting for distance-related variation in searcher efficiency based on the carcass data; carcass removal bias trials will address carcass persistence as described below. Methods will be used to determine the effective viewshed, which will be determined using a point at which the detection is not zero (Buckland et al. 1993).

2.1.2 Spatial Sampling Design

A 40% sample of arrays will be selected for carcass surveys and monitored throughout the year. From February 1 through March 15, the entire facility will be searched to cover the period of Ridgway's rail (*Rallus obsoletus yumanensis*) dispersal. Observers will survey sampling units by either walking or driving slowly perpendicular to the rows, along the perimeter fence, or under the gen-tie line, scanning between each row or along the linear features for fatalities. Each side-specific survey within the array field will attempt to cover half the width of the array (Figure 2). Observers will carry binoculars, which they will use at their discretion to help identify objects that may be carcasses. The walking or driving surveys of the arrays will occur along roadways that run perpendicular to the rows, to facilitate scanning between rows. This survey design reflects two concerns: 1) minimizing movement between rows of solar panels, because the area between electrified panel rows is an area of elevated risk and best practices are to avoid sending personnel into elevated risk zones unnecessarily; and 2) achieving an effective balance between logistic efficiency and sampling rigor.

This survey methodology has been effective on other solar projects. Specifically, the first year of monitoring at Desert Sunlight demonstrated high detection especially for medium to large carcasses using this approach. Results of this study as well as trials conducted by H.T. Harvey (2012) showed that effective sampling for medium and larger birds could be expected to extend to 140 m, and for smaller birds or bats, effective sampling could extend potentially out to 100 m or beyond, depending on visibility.

The sampling approaches may be appropriately varied, however, depending on the type of technology (tracker vs. fixed). Current protocols at two tracker facilities (Blythe and McCoy) use vehicles because the width of rows height of panels is adequate to accommodate vehicles, while Desert Sunlight, which has fixed arrays, uses walking due to safety concerns associated with width of roads, distance between panels, and height of panels. The final survey approach for the Project will be discussed and approved by the agencies prior to the start of monitoring.

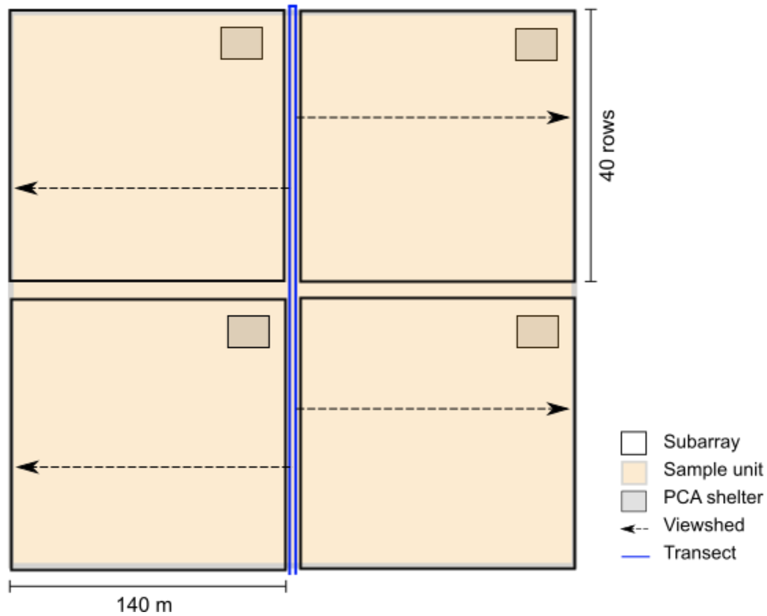

Figure 2. Illustration of a typical sampling unit and transect surveys. Direction of walking/driving will be consistently rotated. The viewsheds may vary depending on the dimensions of the arrays.

2.1.3 Gen-tie Line

Overhead power lines present a potential collision threat both inside the solar farm. The short 0.6 mile (1 kilometer) gen-tie line will be searched in its entirety. Surveys along the Gen-tie line will be conducted as a 30-m-wide belt transect with two passes centered 15 m apart on each side of the line. Surveys will be conducted from a vehicle if habitat and visibility are conducive to vehicle surveys. Otherwise, the surveys will be conducted on foot.

2.1.4 Perimeter Fence

The Project will be bounded by a chain-link security fence. Fences that interrupt unbroken, open expanses with few intervening obstacles may present a potential collision threat to flying birds, especially in low-light conditions. The nature of the barrier results in associated fatalities remaining close to the fence, a phenomenon that supports high search efficiency from a relatively narrow search transect. This search will be conducted for at least one year to determine if longer term monitoring is necessary. The entire perimeter fence will be driven during each survey, searching both inside and outside the fence for carcasses. Surveys of perimeter fencing will be conducted inside the fence and will include a 10-m-wide swath centered on the fence line. Surveyors will survey approximately 5 m on either side of the fence.

2.1.5 Temporal Sampling Design

The appropriate frequency of fatality surveys depends on the species of interest and average carcass persistence times (Smallwood 2007, Strickland et al. 2011, and USFWS 2012). Large raptors tend to persist and remain detectable for extended periods (weeks to months) due to low scavenging rates and relatively slow decay rates. If only large species were of interest, extended search intervals of 30–45 days might be appropriate; however, smaller birds and bats typically disappear at much faster rates, so shorter search intervals are required to ensure effective documentation of fatality rates among these species. Carcass persistence times may vary substantially depending on the habitat, the types of scavengers present, climatic conditions, the season, and the number of carcasses typically present on the landscape (Smallwood 2007, 2013).

The search interval for fatality monitoring ideally should be long enough to ensure a sizeable proportion of the potential carcasses are available to be found on regularly scheduled searches. The guidance provided in Huso et. al. (2016) suggests conducting intervals to achieve an initial target of 50% of carcasses persisting through the search interval, on average. Furthermore, modern estimators are robust to deviations from the planned search interval and perform well even when the planned temporal sampling design becomes interrupted, for example, by adverse weather conditions (Huso 2010, 2012; Korner-Nievergelt et al. 2011; Strickland et al. 2011).

A carcass persistence trial will be conducted prior to the first standardized searches to help inform the starting search intervals. Most other projects have used starting search intervals for the fatality monitoring of seven days during the spring and fall migration periods (March 1 – May 31, and September 1 – October 31, respectively), and every 21 days during summer and winter (June 1 – August 31, and November 1 – February 28/29, respectively).

The more intensive searching in the fall and migration periods has been a common approach for both wind and solar fatality monitoring and is designed to lead to more precise seasonal fatality estimates during a likely higher risk time for migrating birds and bats, including songbirds, waterfowl and other birds. Wider search intervals in the summer and winter when fewer birds are anticipated passing over and through the project, and consequently when fewer birds are potentially at risk, are more efficient with resources during these anticipated likely lower risk periods.

The anticipated starting search intervals for the fatality monitoring will be seven days during an extended spring migration period (February 1 – May 31st) and standard fall migration periods September 1 – October 31, respectively), and every 21 days during summer and winter (June 1 – August 31, and November 1 – February 28/29, respectively). The extended spring period is to capture the primary Ridgway's rail dispersal period. The summer and winter search intervals may be adjusted through consultation with the USFWS, and informed by the results of the initial and subsequent carcass persistence trials. Any adjustments to search interval will focus primarily on the anticipated precision for the water-associated species (medium and large birds), and less on small birds such as resident songbirds.

2.1.6 Survey and Data Collection Protocols

Fatality surveys will be conducted on foot or by slow moving vehicle, with the observers striving for a consistent pace and approach, and a uniform search effort throughout the search. Searchers will use binoculars at their discretion to survey for carcasses between each row of panels. When on foot, monitors will never be far from a truck with air conditioning and will be encouraged to take breaks. Additionally, Sunshine Valley has rigorous safety protocols that address heat issues.

If an observer detects a potential carcass or injured bird or bat, the observer shall immediately proceed down the row to confirm the detection and, if valid, fully document it according to standard protocols (see below). For those species protected pursuant to relevant federal or state law, carcasses and injured animals cannot be handled unless appropriate permits are obtained. To avoid counting carcasses multiple times during successive searches, the observer will mark the carcass by placing a brightly colored pin-flag next to it.

A Carcass is classified as a fatality according to commonly applied standards (i.e., Altamont Pass Monitoring Team 2007, CEC and CDFG 2007). As a result, each find must include a feather spot of at least five tail feathers or two primaries within five meters (16.4 feet) or less of each other, or a total of 10 feathers when only feathers are found.

Searchers will make their best attempt to classify feather spots by species and/or size according to the sizes or identifying features of the feathers. If size classification is impossible, these fatalities will be assigned to large or small bird categories at random, in proportion to the observed data so that they can be included in the fatality estimates. Digital photographs will be taken to document all incidents, and when possible, plausible cause of death will be indicated on data sheets based on evidence (such as blood or fecal smears on solar panels, burns that may indicate electrocution or blunt trauma that may indicate collisions).

Two additional protocols will be followed to ensure accurate distance-based estimation of fatality densities. First, to ensure accurate delineation of the fatality locations, the observer will record both Global Positioning System coordinates at the site of the fatality, using a handheld device accurate to ± three to four meters (9.8-13.1 ft), and a measurement of the distance from the fatality location to the end of the panel row from, which the carcass was detected, using a laser rangefinder accurate to one or two meters (3.3–6.6 ft). To ensure precise measuring with a laser rangefinder, before proceeding down the row, the observer will place a marker at the beginning of the row that is known to serve as a reliable laser reflection point. Second, when an observer proceeds down panel rows to confirm and document detected fatalities, they may detect other fatalities that they did not observe based on the perimeter-only survey. Including such detections in the fatality estimate will confound estimation of fatality density based on application of standard distance-sampling analytical methodology. Therefore, all such supplementary detections will be classified as “incidental” finds (discussed further below) and will be excluded from calculation of adjusted fatality estimates.

Data records for each survey will also include: 1) full first and last names of all relevant surveyors in case of future questions; 2) start and stop times for each individual sampling-unit survey; 3) a description of the weather conditions during each search; 4) a standardized description of the current habitat and visibility classes represented within each sampling unit; and 5) a description of any search-area access issues, if relevant.

Surveyors will record any injured or rescued birds and bats found during the surveys. Observers will immediately report injured birds and bats to the nearest permitted rehabilitation facility for rescue and proper care. Waterbirds that are found alive in the facility but unable to take off but otherwise uninjured will be immediately reported to the nearest permitted rehabilitation facility for rescue. Injured raptors will be handled only by experienced personnel and will be taken only to rehabilitation facilities that are permitted to handle raptors; this provision is particularly important for eagles. From the Project site, the closest rehabilitation facility capable of handling all avian and bat species (respectively) is:

- Animal Kingdom Veterinary Hospital, 1325 Vegas Valley Dr., Las Vegas, NV 89169. Phone: (702) 735-7184.

If a surveyor discovers a dead individual of a species that is fully protected federally or by the state or state-listed as threatened or endangered, he/she will collect data and photos as for any other fatality. If it is a federally or state-listed species, the surveyor will within 24 hours contact the USFWS Law Enforcement office (as applicable) to determine the appropriate follow-up action.

- USFWS OLE – Daniel Crum (916) 414-6660

2.1.7 Incidentally Discovered Carcasses and Fatalities

Bird and bat carcasses that are discovered incidentally will be documented and reported under the First Solar Wildlife Incident Reporting Procedures, but will not be included in fatality estimates. The statistical assumptions necessary in a distance sampling framework preclude using incidental discoveries in fatality estimates. However, in keeping with the general goal of providing a bellwether assessment of bird and bat fatality in the PV array field, incidental reporting of fatalities and injuries are another mechanism by which problematic fatality events may be detected.

2.1.8 Searcher-Efficiency

Estimating searcher-efficiency (distance-related detection functions) is a standard component of the distance-sampling approach. Moreover, because estimating detection functions is applied to all survey data and can be organized to variably adjust in relation to covariates of interest (e.g., season, habitat, and carcass size classes), application of this approach can account for typical factors of interest for fatality studies (CEC and CDFG 2007, Huso 2010, Korner-Nievergelt et al. 2011, USFWS 2012, Smallwood 2013). While distance sampling does not require the use of separate trials for searcher efficiency if enough carcasses are detected, trials will be conducted to ensure adequate sample sizes. A total of 120 birds will be placed per quarter in the areas to be searched during the first year (Table 1).

Table 1. Sample sizes for search efficiency trials per season.

Project component	Size	Initial Sample Size
Solar arrays	Small	30
	Medium	15
	Large	10
Fence	Small	15
	Medium	10
	Large	10
Gen-tie	Small	10
	Medium	10
	Large	10
Total		**120**

2.1.9 Carcass Persistence Assessments

The degree to which carcasses persist on the landscape depends on a variety of factors reflecting seasonal and inter-annual variation in landscape/climatic conditions and the scavenger community. The composition and activity patterns of the scavenger community often vary seasonally as birds migrate, new juvenile birds and mammals join the local population, and mammalian scavengers variably hibernate or estivate. The scavenger community may also vary substantially from year to year because of variation in annual reproduction and survival related to changes in landscape condition. Seasonally and annually variable climatic conditions also may contribute to variation in carcass decay and persistence rates due to variation in temperatures, solar insolation, wind patterns, and the frequency of flooding events. Therefore, to ensure accurate treatment of this bias factor, carcass-persistence rates typically are assessed on a quarterly or at least semi-annual basis during each year that fatality surveys are conducted (USFWS 2012, Smallwood 2013). It is also imperative that carcass-persistence trials effectively account for the influence of carcass type/size, given that persistence times may vary widely depending on the species and size class involved (Smallwood 2013).

To quantify carcass persistence rates, using the sample sizes shown in Table 2, carcasses will be distributed in each season to assess carcass persistence throughout the year, and carcasses will be dispersed to random locations throughout the study site. The carcasses will be monitored using either motion-triggered, digital trail cameras (e.g., see Smallwood et al. 2010), or visited (day 1, 2, 3, 4 and approximately every seven days thereafter) for 30 days or until the carcass has been removed to the point where it would no longer qualify as a documentable fatality. Fake cameras or cameras without bias trial carcasses will also be placed to avoid training scavengers to recognize cameras as “feeding stations”. To minimize potential bias caused by scavenger swamping (Smallwood 2007, Smallwood et al. 2010), carcass-persistence specimens will be distributed across the entire Solar Facility, not just in areas subject to standard surveys.

Table 2. Approximate carcass persistence trial sample sizes per season. Sample sizes for gen-tie are relatively low given the short length of the gen-tie and concerns over scavenger swamping.

Project component	Size	sample size
Solar arrays/fence	Small	30
	Medium	15
	Large	10
Gen-tie	Small	10
	Medium	10
	Large	10
Totals		**85**

Trial specimens will include only intact, fresh (i.e., estimated to be no more than one or two days old and not noticeably desiccated) bird carcasses that are either discovered during the study (if permission and permit granted by the USFWS and NDOW) or are acquired from other sources after having been frozen immediately following death. Fresh carcasses that are discovered during searches will be preferred to surrogates, such as game birds and domestic waterfowl, because the scavenging rates for these birds may be artificially high (Smallwood 2007, 2013). Carcasses discovered during searches will need to be monitored where they are found, rather than randomly placed.

To reduce possible biases related to leaving scent traces or visual cues that may unnecessarily alert potential scavengers, all carcasses used in carcass-persistence trials will be handled with latex gloves, and handling time will be minimized. All trial specimens will be inconspicuously marked with a small piece of green electrical tape wrapped around a leg to distinguish them from unmarked fatalities.

Upon conclusion of the relevant monitoring period, each trial specimen will be classified into one of the following categories:

- **Intact:** Whole and un-scavenged other than by insects
- **Scavenged/depredated:** Carcass present but incomplete, dismembered, or flesh removed
- **Feather spot:** Carcass scavenged and removed, but sufficient feathers remain to qualify as a fatality, as defined above
- **Removed:** Not enough remains to be considered a fatality during standard surveys, as defined above

2.1.10 Estimating Adjusted Fatality Rates

The sampling design will enable calculation of fatality estimates adjusted for searcher-efficiency, carcass-persistence rates, and proportion of area sampled. The adjustment for searcher efficiency will occur by virtue of applying standard methods for analyzing detection data collected using distance-sampling methods.

The fatality estimates will be adjusted for variation in carcass persistence, by applying seasonal and carcass-size-specific correction factors to the fatality estimates that have been adjusted for distance-related variation in the probability of detection.

The analytical approach used to calculate adjusted fatality estimates will be similar to that applied in cases where the fatality estimates are derived from strip transects. It is instructive to briefly review the history of methodologies applied in the context of renewable-energy studies, relevant insights about important factors to consider, and example formulations that will be applicable. It is also important to recognize that developing methods for conducting fatality surveys and associated bias trials, and for deriving accurate, adjusted, facility-wide fatality estimates is an actively evolving science. Accordingly, the analytical methods ultimately applied in this investigation may evolve over time to ensure application of the most current, rigorous and scientifically sound methods.

The recent history of estimating bird and bat fatalities at renewable-energy facilities involves use of primarily four estimators (Korner-Nievergelt et al. 2011, Smallwood 2013, Warren-Hicks et al. 2013). Erickson et al. (2000) and Johnson et al. (2000, 2003) first developed and used a “naïve” estimator, representing a straightforward adjustment of the raw fatality count for the probability of carcass persistence and probability of detection. Shoenfeld (2004) modified the “naïve” estimator by assuming a Poisson process for the occurrence of bird deaths and scavenger removal, with that modification applied by Kerns and Kerlinger (2004) and Erickson et al. (2004). The modified estimator proved to be biased low, however, after which Smallwood (2007) developed an estimator that incorporated an adjustment for periodic repetition of search events. Yet in practice, periods between searches often are inconsistent, which violates a primary assumption of Smallwood’s estimator. Huso (2010) then conducted simulations and conceptualized the logic behind development of a new estimator, based on Thompson (1992). Huso’s estimator is more flexible than the Shoenfeld and Smallwood estimators because it allows for unequal probability sampling, accounting for potential differences in searchability among plots and variation in detectability due to carcass size or type of habitat. It also incorporates an “effective search interval,” based on the mean carcass persistence time, which is defined as the length of time during which the probability of a carcass persisting is more than 1%. Based on simulations, Huso (2010) found that her estimator was consistently less biased than the Shoenfeld and Smallwood estimators. In addition, although the Shoenfeld estimator could perform similarly under certain conditions (e.g., when search intervals are relatively long [14–28 days] and mean carcass-persistence time is relatively short [less than 16 days]), Arnett et al. (2009) found that it greatly underestimated fatality when search efficiency was low (e.g., 13% for some bats).

A potential problem with both the Huso and Shoenfeld estimators is that their formulations assume that a given carcass is available to be discovered by a surveyor only once (Huso 2010), or that it is detectable with the same probability until it is removed (Shoenfeld 2004). In other words, the estimators make unrealistic assumptions about the probability that a carcass can be discovered in a subsequent survey if it was missed during the first survey conducted after deposition on the landscape. The idea that a given carcass may persist through more than one survey period is called “bleed through” (Smallwood 2013, Warren-Hicks et al. 2013).

More recently, Korner-Nievergelt et al. (2011) developed a new estimator, based on an explicit process model built from the conceptual model originally developed by Baerwald and Barclay (2009), which allowed for detection of carcasses during repeated searches, and accommodated decreasing searcher efficiency in repeated searches due to factors such as carcass decay. Based on simulations, they found that the Shoenfeld (2004) estimator generally underestimated fatalities unless carcass-persistence time was long. They found that the naïve (Johnson et al. 2003) and Huso (2010) estimators overestimated fatalities when searcher efficiency was constant (and low for the Huso estimator), the search interval was short (1-, 7-, and 14-day intervals were analyzed), and average persistence time was long (30 days), but both estimators performed well when searcher efficiency decreased over time. The Korner-Nievergelt estimator appeared unbiased under all simulated scenarios where searcher efficiency and the probability of carcass removal remained constant over time, but it underestimated fatalities when searcher efficiency decreased over time. The Huso estimator proved robust when searcher efficiency and the probability of carcass removal decreased over time, whereas the Korner-Nievergelt estimator appeared robust to decreasing removal probability, but underestimated fatalities when searcher efficiency decreased over time and the search interval was short. All of the compared estimators were similarly biased low when the probability of carcass removal was high and increased through time. In the end, Korner-Nievergelt et al. (2011) concluded that no single estimator consistently outperformed the others and was likely to work optimally in all study situations. For this reason, the estimator that will ultimately be used for this study will depend on the conditions measured at the site.

The expectations for the survey area (subject to modification as data are collected) are that: 1) overall searcher efficiency will be high and remain relatively constant through time; 2) carcass persistence times will be short to moderate; 3) the probability of carcass removal will decrease over time (because hot, dry conditions rapidly dry out carcasses, rendering them unattractive to scavengers). Therefore, based on the insights outlined above, analogs of both the Huso and Korner-Nievergelt estimators should perform well for the Project. Korner-Nievergelt et al. (2011) touted their new estimator as adaptable to different situations, because it was based on an explicit process model; however, the Huso (2010) estimator and related software (Huso et al. 2012; developed for wind-energy assessments but easily adaptable to solar-energy investigations) incorporates additional parameterization to model the influence carcass removal of covariates, such as season, carcass type/size, and habitat visibility classes.

For illustrative purposes, we summarize here a modification of the Huso estimator that accommodates distance sampling. The Huso estimator is currently the best-suited estimator for the proposed study design, but it should be noted that fatality estimation is an area of active research and ‘best methods’ are changing rapidly. The model is formulated in terms of different strata, or groups. Essentially, the smallest group for which fatalities are estimated can be considered a stratum, with stratum *k* representing, for example, a set of similarly sized birds within a defined habitat visibility class. Note that strata should be defined to ensure minimum variance in detection probabilities within individual strata, whereas probabilities may vary considerably among strata (e.g., for small versus large birds, or in habitats of low versus high visibility). Depending on the circumstances, there can be strata based on species groups, size classes, seasons, habitats, and/or infrastructure types.

For a particular stratum *k* for a given survey plot and search interval, fatality can be estimated as:

$$\hat{F}_k = \frac{c_k}{g_k},$$

where c_k is the number of observed carcasses and g_k is the probability of detecting a carcass. For simplicity, we drop the notation for stratum, understanding that the following applies to each stratum.

The detection probability *g* typically is the product of three variables: the probability of a carcass persisting (*r*), the probability of a carcass being observed given that it persists (*p*), and the effective proportion of the interval sampled (*v*):

$$\hat{g} = \hat{p} * \hat{r} * \hat{v}.$$

The probability of a carcass being observed given that it persists (i.e., searcher efficiency) is estimated using techniques for analyzing distance sampling data (Buckland et al. 1993). Without going into detail, detection (*d*) is estimated from the carcass data as a function of distance, (*x*):

$$\widehat{d} = \hat{f}(x)$$

and the overall probability of detection is the average value of the detection function between 0 (carcasses on the transect line) and some distance, *w*, which is the width of the search area (half the width of an array row):

$$\hat{p} = \frac{\int_0^w \hat{f}(x)\,dx}{w}$$

The probability of a carcass persisting is estimated as:

$$\hat{r} = \frac{\bar{t}(1-e^{-I/\bar{t}})}{I},$$

where $\bar{t}$ is the estimated mean carcass persistence time and *I* is estimated as:

$$I = \min(I_a, \tilde{I}),$$

where I_a is the minimum actual time between searches and $\tilde{I}$ is the effective search interval, defined as:

$$\tilde{I} = -\log(0.01) \cdot \bar{t}.$$

The effective proportion of the interval sampled is estimated as:

$$\hat{v} = \min(1, \tilde{I} / I_a) .$$

For a given plot in search interval *j*, the adjusted total number of fatalities is calculated as:

$$\hat{F}_j = \sum_{k=1}^{K} \hat{F}_{jk} ,$$

where $\hat{F}_{jk}$ is the estimated number of fatalities within stratum *k* of search interval *j*.

Finally, the estimate of Project-wide total fatalities during a given search interval is estimated as:

$$\hat{F} = \frac{1}{a} \times \left(\sum_{i=1}^{n} \sum_{j=1}^{J} \widehat{F_{ij}} \right)$$

where $\hat{F}_{ij}$ is the number of fatalities on plot *i* in search interval *j*, and *a* is the proportion of sample units that was searched. The total number of searched sample units is *n*, and the number of search intervals is *J*, assuming that there is the same number of search intervals for each plot. In practice, one need not assume that *J* is constant, but presenting it this way simplifies the notation.

Adjusted fatality estimates for the Project will be expressed per MW of nameplate capacity and per acre per year.

2.1.11 Clearance Surveys

A clearance survey will be conducted beginning 14 days before the first round of official surveys begins. The purpose of this survey will be to clear the survey area of any accumulated carcasses that may be present. This is necessary to ensure that carcasses detected during the first round of surveys represent only fatalities that occurred during a preceding interval equivalent to the search interval that will apply afterward. Carcasses that are missed during the clearance survey will cause an upward (conservative) bias in the fatality estimate.

2.1.12 Minimum Credentials of Monitoring Personnel or Appropriate Training

Monitoring personnel may include solar facility staff. Monitors will be trained in distance-sampling search methodology, correct identification and documentation of carcasses, implementation of carcass removal trials and notification of a rehabilitation center in the event of injured birds or bats. Accurate identification of rare, special status species will be emphasized during training. Training of personnel in monitoring methods will occur over a 2-day period and will be conducted by a qualified biologist prior to initiation of the study. Components of the training program will include:

- A classroom-based portion with lecture and handout materials, and photographic or specimen-based (if available) species identification;
- A field-based portion that allows trainees the opportunity to practice and receive feedback on conducting carcass searches and trials, identification of species, completing data forms, and following protocols for assessing and assisting injured birds and bats.
- Assessment of learning outcomes for each participant.
- A training log to be updated with each trainee's name and contact information upon successful completion of the course.

The biologist that will conduct the training will, minimally, have a master's degree in biological sciences, zoology, botany, ecology, or a related field, and at least one year of field experience with avian or bat research or monitoring in the region. A qualified biologist will be on call to assist with species identification (e.g., via review of photographs or onsite assistance if necessary) and other aspects of reporting.

3.0 REPORTING AND ADAPTIVE MANAGEMENT

Sunshine Valley will maintain an internal system in which to organize information derived from this monitoring program. This internal system will be designed to provide comprehensive tracking of survey effort, details of documented injuries and fatalities, and any relevant actions/responses taken to rectify or mitigate documented issues.

After the fourth quarter of monitoring, Sunshine Valley or its consultants will prepare and submit to the USFWS a report that will summarize the dates, durations, and results of all fatality monitoring conducted to date. The report will analyze any Project-related bird and bat fatalities or injuries detected; and provide context for the findings in the form of fatality rates at similar PV solar facilities or suitable reference sites. If the post-construction monitoring suggests that bird mortality caused by solar facilities is substantial and is having potentially adverse impacts on special-status bird populations, adaptive management strategies will be recommended such as installing additional bird flight diverters, alterations to project components that have been identified as key mortality features, or implementing other appropriate actions to address the relevant findings based on the data. To address the specific objectives of the monitoring plan, summary reports will include overall fatality estimates with confidence intervals.

It is important for stakeholders and resource managers to incorporate statistically sound modeling into any iterative feedback cycle prior to implementation of additional or modified control measures (Williams and Brown 2012). However, the dearth of information pertaining to avian mortality at large-scale photovoltaic solar energy facilities makes the establishment of additional adaptive management recommendations and trigger thresholds difficult. The Project will continue to consult with USFWS and NDOW to determine if any additional management action, including changes to the monitoring protocol, may be needed based on the initial results of the mortality surveys.

4.0 LITERATURE CITED

Altamont Pass Avian Monitoring Team. 2007. Altamont Pass Wind Resource Area Bird and Bat Monitoring Protocols. Accessed June 2013. Available online at: http://www.altamontsrc.org/ alt_doc/m1_apwra_monitoring_protocol_6_5_07.pdf

Arnett, E. B., M. R. Schirmacher, M. M. P. Huso, and J. P. Hayes. 2009. Patterns of Bat Fatality at the Casselman Wind Project in South-Central Pennsylvania. 2008 Annual Report. Annual report prepared for the Bats and Wind Energy Cooperative (BWEC) and the Pennsylvania Game C ommission. Bat Conservation International (BCI), Austin, Texas. June 2009. Available online at: http://www.batsandwind.org/pdf/2008%20Casselman%20Fatality%20Report.pdf

Avian Power Line Interaction Committee (APLIC). 2005. Avian Protection Plan (APP) Guidelines. Edison Electric Institute and US Fish and Wildlife Service (USFWS), Washington, D.C.

Avian Power Line Interaction Committee (APLIC). 2006. Suggested Practices for Avian Protection on Power Lines: The State of the Art in 2006. Public Interest Energy Research Program (PIER) Final Project Report CEC-500-2006-022. Edison Electric Institute, APLIC, and the California Energy Commission. Washington D.C. and Sacramento, California.

Avian Power Line Interaction Committee (APLIC). 2012. Reducing Avian Collisions with Power Lines: The State of the Art in 2012. Edison Electric Institute and APLIC, Washington D.C.

Baerwald, E. F. and R. M. R. Barclay. 2009. Geographic Variation in Activity and Fatality of Migratory Bats at Wind Energy Facilities. Journal of Mammalogy 90(6): 1341–1349.

Buckland, S. T., D. R. Anderson, K. P. Burnham, and J. L. Laake. 1993. Distance Sampling: Estimating Abundance of Biological Populations. Chapman & Hall, London, United Kingdom.

Bureau of Land Management (BLM). 1998. Las Vegas Resource Management Plan and Final Environmental Impact Statement. US Department of the Interior BLM, Las Vegas, Nevada. Available online at: http://www.blm.gov/nv/st/en/fo/lvfo/blm_programs/planning/las_vegas_field_office.html

California Energy Commission (CEC) and California Department of Fish and Game (CDFG). 2007. California Guidelines for Reducing Impacts to Birds and Bats from Wind Energy Development. Commission Final Report. CEC, Renewables Committee, and Energy Facilities Siting Division, and CDFG, Resources Management and Policy Division. CEC-700-2007-008-CMF.

Chatfield, A., W. Erickson, and K. Bay. 2009. Avian and Bat Fatality Study, Dillon Wind-Energy Facility, Riverside County, California. Final Report: March 26, 2008 - March 26, 2009. Prepared for Iberdrola Renewables, Portland, Oregon. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. June 3, 2009.

Chatfield, A., W.P. Erickson, and K. Bay. 2010. Final Report: Avian and Bat Fatality Study at the Alite Wind-Energy Facility, Kern County, California. Final Report: June 15, 2009 – June 15, 2010. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. Prepared for CH2M HILL, Oakland, California.

Erickson, W. P., J. Jeffrey, K. Kronner, and K. Bay. 2004. Stateline Wind Project Wildlife Monitoring Annual Report. July 2001 - December 2003. Technical report peer-reviewed by and submitted to FPL Energy, the Oregon Energy Facility Siting Council, and the Stateline Technical Advisory Committee. Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming, and Northwest Wildlife Consultants, Inc. (NWC), Pendleton, Oregon. December 2004.

Erickson, W. P., G. D. Johnson, M. D. Strickland, and K. Kronner. 2000. Avian and Bat Mortality Associated with the Vansycle Wind Project, Umatilla County, Oregon: 1999 Study Year. Final report prepared for Umatilla County Department of Resource Services and Development, Pendleton, Oregon. February 7, 2000.

ESRI. ArcInfo 10.0. ESRI, producers of ArcGIS software. Redlands, California.

H.T. Harvey and Associates. 2013. Desert Sunlight Solar Farm Carcass Detectability Study. Fresno, California. Prepared for Desert Sunlight Holdings, LLC, Oakland, California.

H.T. Harvey and Associates. 2014. Avian and Bat Protection Plan Annual Postconstruction Fatality Report for the California Valley Solar Ranch Project Covering 16 August 2012 to 15 August 2013. Prepared for High Plains Ranch II, LLC, Carlsbad, California.

Huso, M. 2010. An Estimator of Wildlife Fatality from Observed Carcasses. Environmetrics 22(3): 318-329. doi: 10.1002/env.1052.

Huso, M., N. Som, and L. Ladd. 2012. Fatality Estimator User's Guide. US Geological Survey (USGS) Data Series 729. Accessed April 2013. Available online at: http://pubs.usgs.gov/ds/729/pdf/ ds729.pdf

Johnson, G. D., W. P. Erickson, M. D. Strickland, M. F. Shepherd, and D. A. Shepherd. 2000. Avian Monitoring Studies at the Buffalo Ridge Wind Resource Area, Minnesota: Results of a 4-Year Study. Final report prepared for Northern States Power Company, Minneapolis, Minnesota, by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. September 22, 2000. 212 pp. http://www.west-inc.com

Johnson, G. D., W. P. Erickson, M. D. Strickland, M. F. Shepherd, D. A. Shepherd, and S. A. Sarappo. 2003. Mortality of Bats at a Large-Scale Wind Power Development at Buffalo Ridge, Minnesota. The American Midland Naturalist 150: 332-342.

Kerns, J. and P. Kerlinger. 2004. A Study of Bird and Bat Collision Fatalities at the Mountaineer Wind Energy Center, Tucker County, West Virginia: Annual Report for 2003. Prepared for FPL Energy and the Mountaineer Wind Energy Center Technical Review Committee. February 14, 2004. 39 pp. http://www.wvhighlands.org/Birds/MountaineerFinalAvianRpt-%203-15-04PKJK.pdf

Korner-Nievergelt, F., P. Korner-Nievergelt, O. Behr, I. Niermann, R. Brinkmann, and B. Hellriegel. 2011. A New Method to Determine Bird and Bat Fatality at Wind Energy Turbines from Carcass Searches. Wildlife Biology 17: 350-363.

Shoenfeld, P. 2004. Suggestions Regarding Avian Mortality Extrapolation. Technical memo provided to FPL Energy. West Virginia Highlands Conservancy, HC70, Box 553, Davis, West Virginia, 26260.

Smallwood, K. S. 2007. Estimating Wind Turbine-Caused Bird Mortality. Journal of Wildlife Management 71: 2781-2791.

Smallwood, K. S. 2013. Comparing Bird and Bat Fatality-Rate Estimates among North American Wind-Energy Projects. Wildlife Society Bulletin 37(1): 19-33.

Smallwood, K. S., D. A. Bell, S. A. Snyder, and J. E. DiDonato. 2010. Novel Scavenger Removal Trials Increase Wind Turbine-Caused Avian Fatality Estimates. Journal of Wildlife Management 74: 1089-1097.

Strickland, M. D., E. B. Arnett, W. P. Erickson, D. H. Johnson, G. D. Johnson, M. L. Morrison, J. A. Shaffer, and W. Warren-Hicks. 2011. Comprehensive Guide to Studying Wind Energy/Wildlife Interactions. Prepared for the National Wind Coordinating Collaborative (NWCC), Washington, D.C., USA. June 2011. Available online at: http://www.batsandwind.org/pdf/Comprehensive_ Guide_to_Studying_Wind_Energy_Wildlife_Interactions_2011.pdf

TerraStat Consulting Group. 2013. Estimation of 90% Confidence Bounds for Avian Mortality Estimates at Ivanpah 1. Seattle, Washington. Technical memorandum prepared on 13 August 2013 for H.T. Harvey and Associates, Los Gatos, California. Accessed June 5, 2014. Available online at: ftp://lgftp.harveyecology.com/DesertSun/TerraStat_Estimation%20of%20CIs%20for%20avian%20mortality%20studies%20at%20Ivanpah%20I_HTH%20Tech%20Memo%20Aug2013.pdf

Thompson, S. K. 1992. Sampling. John Wiley and Sons, Inc., New York, New York.

US Fish and Wildlife Service (USFWS). 2012. Final Land-Based Wind Energy Guidelines. March 23, 2012. 82 pp. Available online at: http://www.fws.gov/windenergy/docs/WEG_final.pdf

Warren-Hicks, W., J. Newman, R. Wolpert, B. Karas, and L. Tran. 2013. Improving Methods for Estimating Fatality of Birds and Bats at Wind Energy Facilities. Public Interest Energy Research (PIER) Program CEC-500-2012-086. Final Project Report. Prepared for the California Energy Commission, Prepared on behalf of the California Wind Energy Association (CalWEA). February 2013. Available online at: http://www.energy.ca.gov/2012publications/CEC-500-2012-086/CEC-500-2012-086.pdf