BIRD AND BAT CONSERVATION PLAN
SILVER STATE SOLAR POWER SOUTH
BLM CASE FILE NUMBERS: NVN-089530, NVN-085801
CLARK COUNTY, NEVADA

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LIST OF ACRONYMS

ABPP	Avian and Bat Protection Plan
ACEC	Area of Critical Environmental Concern
AMMP	Avian Mortality and Monitoring Plan
Applicant	Silver State Solar Power South, LLC
BBCM	Bird and Bat Conservation Measure
BBCS	Bird and Bat Conservation Strategy
BGEPA	Bald and Golden Eagle Protection Act
BLM	Bureau of Land Management
BMAP	Bird Monitoring and Avoidance Plan
BMP	Best Management Practice
CHU	Critical Habitat Unit
DSEIS	Draft Supplemental Environmental Impact Statement
DWMA	Desert Wildlife Management Area
EIS	Environmental Impact Statement
FSEIS	Final Supplemental Environmental Impact Statement
IBA	Important Bird Area
FCR	Field Contact Representative
Ironwood	Ironwood Consulting, Inc.
MBTA	Migratory Bird Treaty Act
MM	Mitigation Measure
MSHCP	Multiple Species Habitat Conservation Plan
MWAC	Megawatt Alternating Current
NDOW	Nevada Department of Wildlife
NEPA	National Environmental Policy Act
NNHP	Nevada Natural Heritage Program
NRS	Nevada Revised Statutes
O&M	Operations and Maintenance
PDF	Project Design Features
Project	Silver State Solar Power South
PV	Photovoltaic
RMM	Raven Management Measure
RMP	Raven Management Plan
ROD	Record of Decision
ROW	Right-of-way
SCE	Southern California Edison
USGS	United States Geological Survey
USFWS	United States Fish and Wildlife Service
UTM	Universal Transverse Mercator
WRI	Wildlife Research Institute

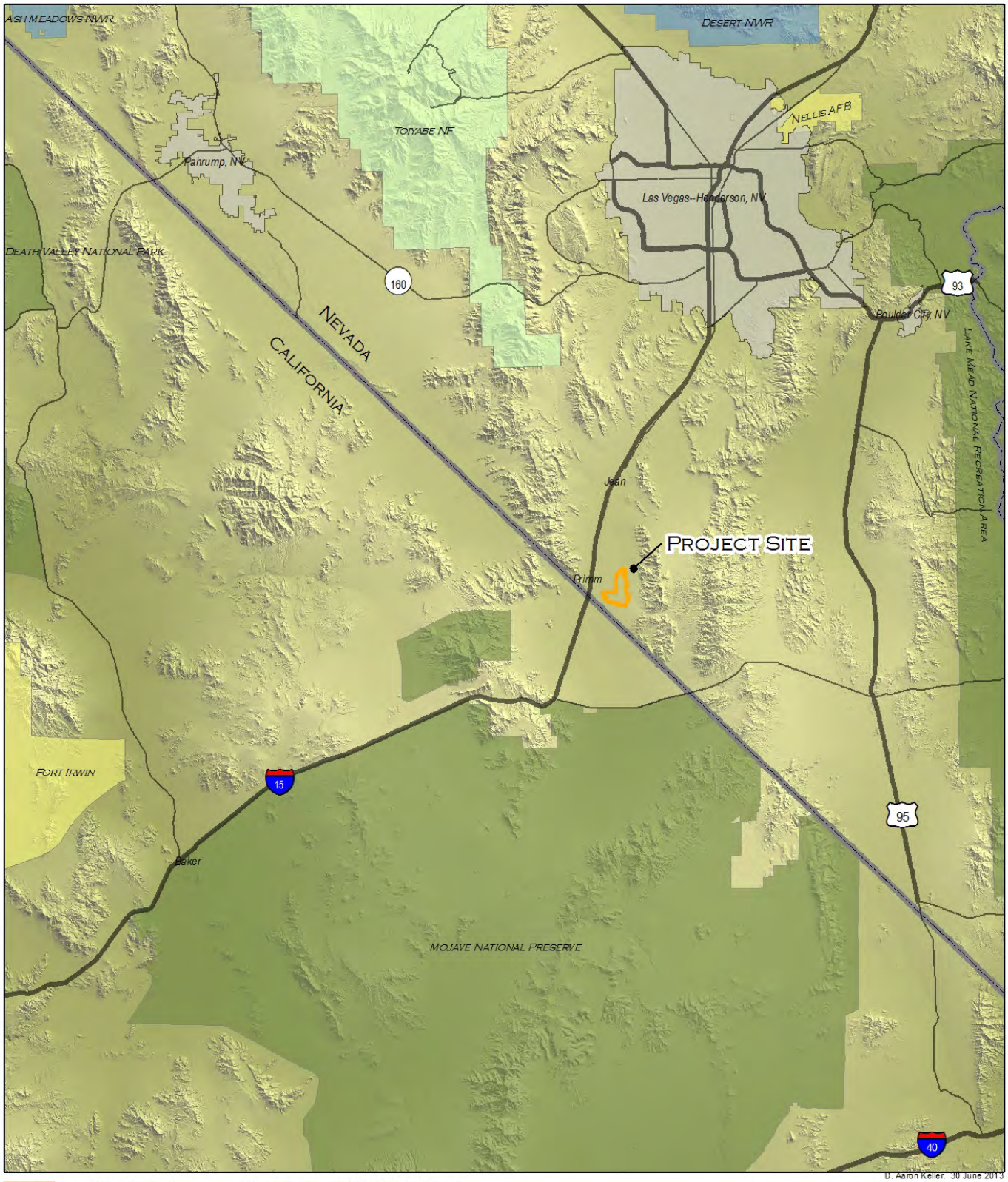
1.0 INTRODUCTION

Silver State Solar Power South, LLC (Silver State Solar Power South or Applicant) has requested a right-of-way (ROW) grant from the Bureau of Land Management (BLM) to construct, operate, maintain, and decommission a 2,427-acre photovoltaic (PV) solar generating facility referred to as the Silver State Solar South Project (Project) (Case File # NVN-085801). This Bird and Bat Conservation Strategy (BBCS) is intended to address potential impacts to birds and bats during the construction, operations, and maintenance (O&M) phases of the Project. For the purposes of this document, O&M is defined as the phase of the project beginning after construction activities across the site have been completed. The BLM is the lead agency under the National Environmental Policy Act (NEPA), and the Final Supplemental Environmental Impact Statement (FSEIS, BLM 2013b) associated with the Project analyzes various alternatives for Project configuration. This BBCS addresses potential impacts to avian and bat resources for an alternative presented in response to comments from the public and agencies on the Draft SEIS (DSEIS, BLM 2012a), and is referred to the Revised Project (hereinafter the "Project" or "Proposed Action"), as set forth as the BLM "Preferred Alternative" in the FSEIS.

1.1 PROJECT DESCRIPTION

The Project is located in unincorporated Clark County, NV, near the interstate boundary of California and Nevada, east of Primm, NV, and immediately adjacent to the existing 50 MW Silver State Solar North facility (Figure 1). The Project site can be found on the Roach and Desert 7.5-Minute U.S. Geological Survey (USGS) topographic quadrangles. The site is located on entirely on BLM-administered lands and outside the boundaries of existing BLM Areas of Critical Concern (ACEC), Desert Wildlife Management Areas (DWMA), BLM wilderness areas, U.S. Fish and Wildlife Service (USFWS) designated critical habitat units (CHU) for desert tortoise, and National Audubon Society Important Bird Areas (IBA). These nearest of these management designations to the Project is the Stateline Wilderness Area, located approximately 6.1km to the west of the Project boundary.

The current Project components include solar PV arrays on fixed-tilt mounting systems within the primary generating facility area, five 30-foot tall meteorological monitoring towers, a construction lay-down yard, perimeter security roads and fencing, external drainage features, and access roads. These components will be constructed and owned by the Applicant. Additional Project components, including a switchyard and related facilities (loop-in lines, telecommunications site, microwave site, fiber optic installation and separate access road) will be constructed, owned, and operated by Southern California Edison (SCE). A detailed Project description is included in the Plan of Development (CH2MHill 2011) and the FSEIS. Table 1 provides acreages for permanent and temporary disturbances related to the project components.



D. Aaron Keller, 30 June 2013

Silver State Solar South
State Boundary
Primary Road
Secondary Road
Urban Area
Non-BLM Federal Lands
Department of Defense
USFWS
USFS
NPS

N

0 5 10 20 30 Miles
1:750,000
1 in = 12 miles

FIGURE 1 - REGIONAL SETTING

SILVER STATE SOLAR SOUTH | CLARK COUNTY, NEVADA

Table 1. Disturbance acreage for the Silver State Solar South facility components.

Facility Component	Temporary	Permanent
Silver State Solar South Components		
Generating Facility Components and laydown yard	28	1,898
External Drainage Features	0	374
External Access Roads	0	65
Gen-Tie Line	7	21
Subtotal Silver State Solar South		*2,393*
SCE Components		
SCE new road/tower buffers and material and equipment staging areas	4	2
SCE Primm Switchyard, new access roads, and telecom site	0	28
Subtotal SCE		*34*
Total		**2,427**

1.2 PURPOSE

U.S. Fish and Wildlife Service (USFWS) and Nevada Department of Wildlife (NDOW) currently recommends the development of a project-specific BBCS, formerly called the Avian and Bat Protection Plan (ABPP), for all renewable energy projects that may impact bird and bat resources. The BBCS provides a summary of current biological conditions and describes conservation measures intended to avoid, minimize, and mitigate potential impacts to bird and bat species, which may include state and/or federally designated special status species. This BBCS corresponds to Mitigation Measure (MM) BIO-9 found in the FSEIS (BLM 2013b), and includes the following objectives:

- Identify baseline conditions for bird and bat species currently present at the Project site;
- Identify construction and operational activities that may increase the potential of adverse effects to these species on and adjacent to the Project site;
- Specify steps that should be taken to avoid, minimize, and mitigate any potential adverse effects on these species, including necessary permits to collect bird and bat carcasses for data collection and research; and
- Detail long-term monitoring and reporting goals, including collection and reporting of bird and bat carcasses, including applicable approved protocols that would be used for any surveys and/or monitoring conducted.

1.3 REGULATORY FRAMEWORK

Several federal and state laws and regulations, including NEPA, the Migratory Bird Treaty Act (MBTA), Bald and Golden Eagle Protection Act (BGEPA), and Nevada State Codes, provide the foundation for the development and enforcement of the BBCS. This document represents a comprehensive plan to meet the requirements of these regulatory mechanisms as they apply to birds and bats in the Project Area.

1.3.1 National Environmental Policy Act

Under NEPA (42 U.S.C. §§ 4321-4370h), federal agencies are required to prepare an environmental impact statement (EIS) for any major federal action significantly affecting the quality of the human environment. An EIS must include an examination of the environmental impacts of a proposed project, a reasonable range of alternatives for a project, and other related matters. The environmental impacts of the Project have been addressed by the FSEIS (BLM 2013b). This BBCS corresponds to Mitigation Measure BIO-9 contained in the FSEIS requiring a strategy to reduce the potential risks for avian and bat resources from the construction and operation of the Project.

1.3.2 Migratory Bird Treaty Act

The MBTA (16 U.S.C. §§ 703, *et seq*.), passed by the U.S. 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 within the United States, which includes over 1000 species. In the continental U.S., native non-covered species generally belong to the Order Galliformes. Common non-native species not protect by the MBTA include rock pigeon (*Columba liva*), Eurasion collared-doves (*Streptopelia decaocto*), European starling (*Sturnus vulgaris*), and house sparrow (*Passer domesticus*) (USFWS 2005). The MBTA does not provide any mechanism for incidental take; therefore, action agencies (such as BLM) must coordinate with USFWS to avoid, minimize, and mitigate potential project-related impacts to covered species.

1.3.3 Bald and Golden Eagle Protection Act

The Bald and Golden Eagle Protection Act (16 U.S.C. §§ 668-668d) of 1940 prohibits the take, defined as "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest, or disturb," of any bald eagle (*Halieetus leucocephalus*) or golden eagle (*Aquila chrysaetos*) or the parts, nests, or eggs of such birds without prior authorization. Although bald eagles were removed from the Endangered Species Act in 2007, bald and golden eagles are protected under BGEPA and MBTA. Through recent regulation (50 C.F.R. § 22.26), 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 has 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 plants, and have been incorporated into this BBCS.

1.3.4 Nevada State Codes

Nevada Revised Statutes (NRS) Section 503 prohibits the take, defined as "kill, capture, shoot, trap, catch, wound, possess, collect, seine, snare or net, and every attempt to do so", of protected species. Section 503.093 states that protected species include wildlife species that are classified as sensitive, threatened or endangered by the Nevada Department of Wildlife (NDOW) and that an appropriate license, permit or authorization is required to hunt, take or possess protected wildlife (NRS 501.105, 501.181). NRS 503.030 and NRS 503.050 provide a list of currently protects bat and bird species within the state of Nevada. Protected species with potential to occur within the Project are listed in Table 1 in Section 2.1.

1.4. CORPORATE POLICY AND COORDINATION

Silver State Solar Power South maintains a commitment to work cooperatively with federal and state agencies regarding the protection of migratory birds and bats. The Applicant recognizes the importance of coordination with agency personnel at BLM, USFWS, and NDOW so that all parties understand the scope of the Project and can discuss facilities and features that may require specific attention for bird and bat species. The Applicant and their consultants have been working in coordination with federal and state agency personnel regarding necessary wildlife surveys and siting considerations to ensure that all parties understood the scope of the Project and potential issues could be identified early in the planning process.

1.5 KEY PERSONNEL RESPONSIBILITIES AND DUTIES

Four key positions—Lead Avian Biologist (Avian Lead), Lead Bat Biologist (Bat Lead), Avian Biologists, and Biological Monitors —will be responsible for the implementation of the BBCS.

1.5.1 Lead Avian Biologist

The Applicant will assign an Avian Lead to the Project. The Avian Lead will be responsible for overseeing the implementation of the BBCS and ensuring all monitoring and reporting requirements are met. The Applicant shall submit the resume of the proposed Avian Lead to the BLM for approval in consultation with the NDOW and USFWS. The Applicant shall also designate alternate Avian Leads with the same qualifications as the Avian Lead, to be approved by the BLM and USFWS.

The Avian Lead and alternate Avian Leads will have the following minimum qualifications:

- A bachelor's degree in biological sciences, zoology, botany, ecology, or a related field and three years of experience in field biology or current certification of a nationally recognized biological society, such as The Ecological Society of America or The Wildlife Society; and
- At least one year of field experience with avian resources found in or near the Project site.

In lieu of the above requirements, the resume shall demonstrate to the satisfaction of the BLM, the proposed Avian Lead, and alternate Avian Leads have the appropriate training and background to effectively implement the BBCS. The Applicant shall ensure that the Avian Lead performs the activities specified in the BBCS.

1.5.2 Lead Bat Biologist

The Applicant will assign Bat Lead to the Project. The Bat Lead will be responsible for overseeing the implementation of the portions of the BBCS addressing bat conservation and ensuring all bat-related monitoring and reporting requirements are met. The Applicant shall submit the resume of the proposed Bat Lead to the BLM for approval in consultation with the NDOW and USFWS. The proposed Bat Lead must have at least one year of experience with bat resources in the Mojave Desert; demonstrate proficiency at current bat survey and monitoring techniques; and possess at least a bachelor's degree in biological sciences, zoology, botany, ecology, or a related field and three years of experience in field biology or current certification of a nationally recognized biological society.

1.5.3 Avian Biologists

The Applicant will designate qualified Avian Biologists to the Project. Avian Biologists will be responsible for conducting field work required by the conservation measures included in the BBCS. Field tasks will include general avian point counts, nest surveys, raptor migration surveys, golden eagle surveys, burrowing owl surveys, and avian mortality surveys. The resume of all proposed Avian Biologists will be submitted to the BLM for approval. Avian Biologists will have the following qualifications:

- A bachelor's degree in biological sciences, zoology, botany, ecology, or a related field;
- Three years of experience in field biology with an emphasis on avian ecology; and
- At least one year of field experience with avian research and/or monitoring in the Mojave Desert.

In lieu of the above requirements, the resume shall demonstrate to the satisfaction of the BLM that the proposed Avian Biologists have the appropriate training and background to effectively implement the BBCS. The Avian Lead shall ensure that the Avian Biologists perform the activities specified in the BBCS and may assist the Avian Lead in the field as needed.

1.5.4 Biological Monitors

The Applicant will designate Biological Monitors to the Project. The Biological Monitors will be responsible for recording daily observations of sensitive avian species on the Project site and vicinity, as well as instances of avian or bat mortality. The Biological Monitors may assist the Avian Biologists, under supervision of the Avian Biologists or Avian Lead, with certain avian-related field tasks. The resumes of proposed Biological Monitors will be submitted to the BLM for approval.

2.0 EXISTING CONDITIONS

Existing bird conditions were determined by the collective results of all avian related surveys conducted on the Project Site and surrounding areas, incidental observations of special status species recorded during other biological surveys, and will be further informed by continuing pre-construction surveys to be conducted in the fall of 2013 and seasonally until construction begins. No bat surveys have been performed on the project site to date. Existing bat conditions were informed by habitat surveys and acoustic monitoring performing on the Stateline Solar Farm Study Area within 6 miles of the Project Site by Patricia Brown, Ph.D. (Brown-Berry Biological Consulting) during the spring of 2010 and 2011 (Brown 2012). Additionally, bat occurrence data from the Searchlight Wind Energy Project (Tetra Tech Inc. 2012), located approximately 32 miles southeast of the Project Site, were used to help determine possible bat species occurrences in similar habitat within the region.

The baseline avian surveys were conducted within the 2,427-acre Project Site, as defined by the *BLM Preferred Alternative* in the FSEIS (BLM 2013b), and a larger area surrounding the Project Site which includes approximately 9,930 acres of land extending east into the base of the Lucy Gray Mountains and north along the edge of Roach Dry Lake (Figure 2). This larger area encompassing the Project Site and additional surrounding land will hereafter be referred to as the Study Area. These data will provide the basis for before and after control impact studies and aim to provide an understanding of (1) the occurrence of species of birds and bats that utilize the Project Site, (2) temporal variation of these species' presence and abundance within potential risk zones, (3) estimated range of bird and bat mortality resulting from the Project, (4) nesting raptors on or within three miles of the Project, and (5) nesting golden eagles within ten miles of the Project.

2.1 LITERATURE REVIEW AND INITIAL SITE ASSESSMENT

Existing information of avian resources in the vicinity of the Project Site was reviewed prior to the development of this BBCS. Information sources included the Nevada Natural Heritage Program (NNHP), the Clark County Multiple Species Habitat Conservation Plan (MSHCP, CCDCP 2000), and several documents pertaining to other active projects and planned projects occurring in the Ivanpah Valley (BLM 2010a, BLM 2010b, BLM 2012a, BLM 2012b, Ironwood 2012). Habitat assessments and field-based evaluations determining the potential for special status species occurrences were made during site visits between 2010 and 2013.

The review of existing information and literature pertaining to bird habitat and special status species occurrences on the Project Site, combined with field-based habitat evaluations on the potential for special status avian species occurrence, revealed 13 avian species with at least some potential to occur on the Project Site. Table 2 presents of list of these special status species and their potential for occurrence on site. Species were considered special status if they are currently afforded protected or special conservation status with at least one of the following agencies: USFWS, BLM, or NDOW.

Table 2. Special status bird species and known occurrences at Silver State Solar South, 2011-2013.

Scientific Name	Common Name	Status	Occurrence within Study Area
Aquila chrysaetos	golden eagle	BLM: Sensitive IUCN: LC	**Present – Resident** Nesting habitat absent within Project alternatives, but 5 historical abandoned nests and one active (2013) nest located within 5mile buffer. Foraging habitat present.
Asio otus	long-eared owl	BLM: Sensitive IUCN: LC	**Present—Possible Resident** One individual observed adjacent to site during non-breeding season. No observations of breeding individuals.
Athene cunicularia	western burrowing owl	BLM: Sensitive IUCN: LC USFWS:BCC	**Present – Likely Resident** Four observation of burrowing with owl sign during surveys. May be present throughout year. Nesting habitat present.
Buteo regalis	ferruginous hawk	BLM: Sensitive IUCN: LC USFWS:BCC	**Not observed – Low Potential** Nesting habitat absent. May use site vicinity for overwintering.
Buteo swainsoni	Swainson's hawk	BLM: Sensitive IUCN: LC USFWS:BCC	**Not observed—Likely Migrant** Not observed on site, but two individuals were observed in migration approximately 5 miles west of the site in 2011. Nesting habitat absent. May be present (foraging) during summer and fall during migration.
Charadrius alexandrinus nivosus	western snowy plover	BLM: Sensitive ESA: Threatened USFWS:BCC	**Not observed – Low Potential** May be a rare migrant to Ivanpah Dry Lake during winter months.
Falco mexicanus	prairie falcon	BLM: Sensitive IUCN: LC USFWS:BCC	**Present – Foraging** One individual observed on site. Foraging habitat present. Nesting substrate present in the Project Site in the form of transmission towers.
Falco peregrinus anatum	peregrine falcon	BLM: Sensitive NDOW: SE USFWS:BCC	**Present – Migration** Known to be present in area during migration from 4 observations made approximately 5 miles southwest of site. Known to be present and breeding in the area year-round in the South Spring Mountains and MuCullough Mountains. Nesting habitat absent from site. Nesting habitat absent from site.
Lanius ludovicianus	loggerhead shrike	BLM: Sensitive NDOW: SS IUCN: NT USFWS:BCC	**Present –Resident** Individuals have been observed on the Project Site throughout the year. Common on site.
Phainopepla nitans	phainopepla	BLM: Sensitive IUCN:LC	**Present—Resident** Observed on site during breeding season. Nesting habitat present.
Spizella breweri	Brewer's sparrow	BLM:Sensitive NDOW: SS IUCN: LC	**Present—Resident** Observed on the Project Site.
Toxostoma bendirei	Bendire's thrasher	BLM: Sensitive IUCN: VU USFWS:BCC	**Not observed - Moderate Potential** Nesting habitat present.
Toxostoma crissale	crissal thrasher	BLM: Sensitive IUCN: LC USFWS:BCC	**Present—Possible resident** One individual has been observed on the site, mid-March 2013.
Toxostoma lecontei	Le Conte's thrasher	BLM: Sensitive IUCN: LC USFWS:BCC	**Present –Resident** Individuals have been observed on the Project Site throughout the year. Nesting habitat present.

NDOW- Nevada Department of Wildlife
SE – State Endangered
SS – State Sensitive
USFWS - Fish and Wildlife Service
BCC - Birds of Conservation Concern

IUCN - International Union for Conservation of Nature
LC – Least Concern
NT – Near Threatened
VU – Vulnerable

Bald eagle (*Haliaeetus leucocepahlus*) was excluded from list of potential special status species because essential features of breeding, migratory, and wintering bald eagle habitat are absent from the Project Site. Bald eagles require open bodies of water with access to fish prey during both the breeding season and winter (Buehler 2000). There are records of Bald Eagle occurrences (eBird 2013) along the Colorado River approximately 35 miles east of the Project Site. There is a very low probability that a vagrant individual could be seen in the vicinity of the Project Site. No information on occurrences of bald eagle in the Ivanpah Valley was found during the literature review for the assessment of baseline conditions.

2.1.1 Vegetation Commuities

An initial site assessment conducted during site visits in spring 2011 provided information on habitat and vegetation communities (Ironwood 2011). The Study Area (defined below in Section 2.2) supports three vegetation alliances that are based on the Nevada Natural Heritage Program classification: *Larrea tridentata-Ambrosia dumosa* Shrubland, *Yucca schidigera-Larrea tridentata-Ambrosia dumosa* Shrubland, and *Atriplex polycarpa* Shrubland. Over 150 species of plants were identified within Study Area during the surveys.

Larrea tridentata-Ambrosia dumosa Shrubland is dominated by creosote bush (*Larrea tridentata*) and burro brush (*Ambrosia dumosa).* This alliance is most prevalent within the Study Area and primarily occurs in the mid-elevation range. Additional plant species characteristic of these alliances include Death Valley ephedra (*Ephedra funerea*), littleleaf ratany (*Krameria erecta*), California buckwheat (*Eriogonum fasciculatum*), beavertail cactus (*Cylindropuntia basilaris*), and golden cholla (*Cylindropuntia echinocarpa*).

Yucca schidigera-Larrea tridentata-Ambrosia dumosa Shrubland is dominated by creosote bush, burro brush and Mojave yucca (*Yucca schidigera*). This alliance occurs higher in the alluvial fan within soils that contain higher proportion of gravel and rocks. Plant diversity and cacti/yucca density is higher in these regions as compared to the *Larrea tridentata-Ambrosia dumosa* Shrubland and provides greater avian habitat structure complexity than the other two vegetation communities found on the Study Area.

Atriplex polycarpa Shrubland occurs at the lowest elevation range within the Study Area along the edges of Roach Lake where soils are relatively fine. This alliance is dominated by allscale (*Atriplex polycarpa*) and contains other shrubs including creosote bush, burro brush and big galleta (*Pleuraphis rigida).* The lower height and reduced complexity of vegetation structure in this alliance potentially supports reduced avian diversity.

2.2 BASELINE SURVEYS AND METHODS

Focused avian surveys and general wildlife surveys have been conducted on the Project Site and surrounding area from 2010 to 2013. Data collected during avian point counts, burrowing owl (*Athene cunicularia*) surveys, golden eagle aerial surveys, ground-based golden eagle nest monitoring, and golden eagle point counts provide information on baseline avian conditions at the Project Site and surrounding area. Additionally, incidental observations of special status bird species were recorded

during these surveys and other biological surveys conducted on the Project Site. Bat resources and baseline conditions have been inferred from existing data in the vicinity of the project site and from a bat survey and habitat assessment performed within 5 miles of the Project Site. Table 3 provides a list of all focused avian and bat surveys performed on the Project Site and surrounding area to date.

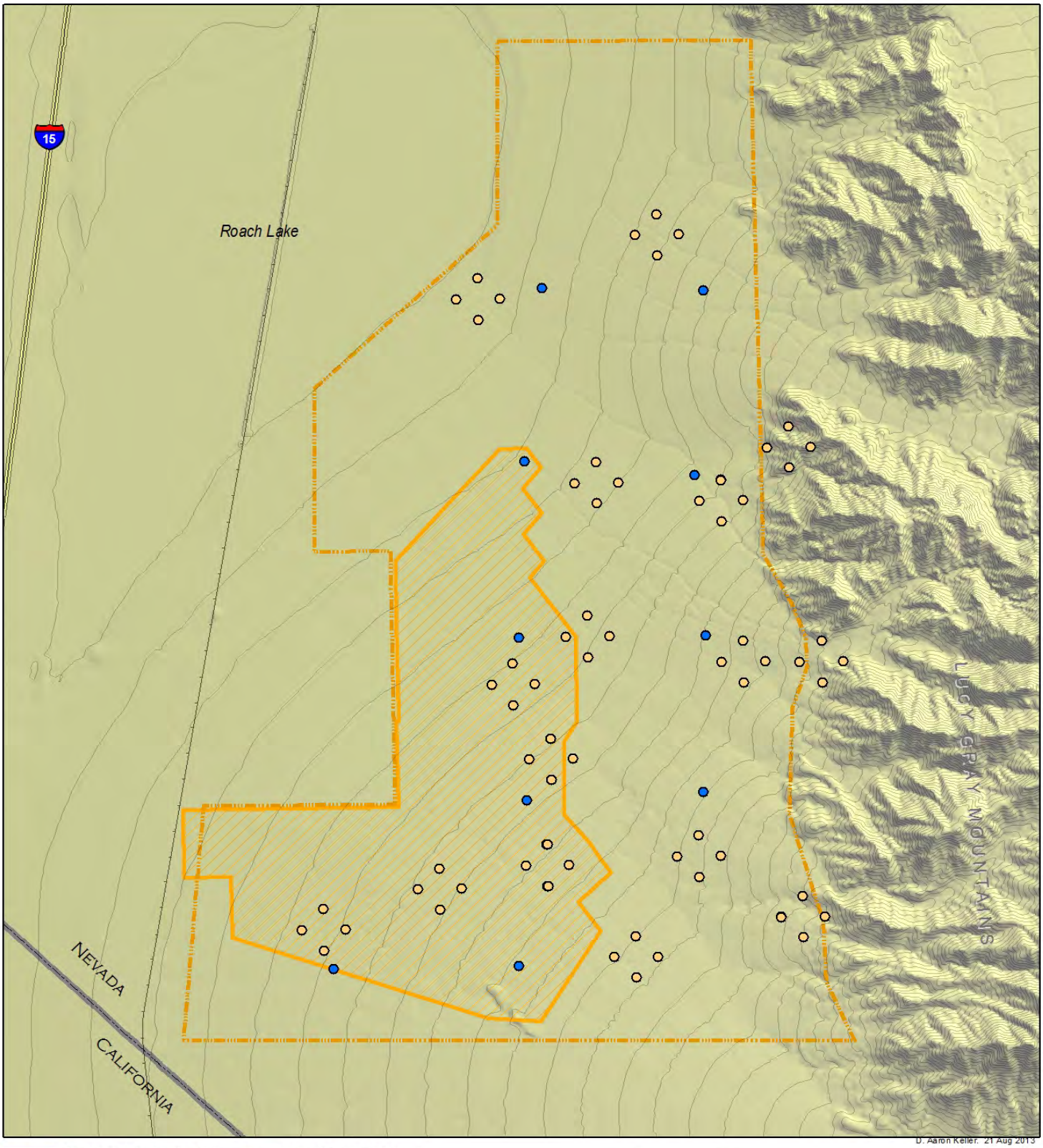
Table 3. List of avian-related biological surveys performed at Silver State Solar South, 2010-2013.

Survey	Dates	Coverage	Description
Avian Point Counts	2012 (Spring, Fall) 2013 (Winter, Spring)	64 sampling points in Study Area (Figure 2).	Surveys conducted once per season
Golden Eagle Aerial Surveys	2010 (May, June)	Project Site and 10-mile buffer	Helicopter survey following USFWS Protocol (USFWS 2010)
Golden Eagle Point Counts	2012 (Winter, Spring, Fall), 2013 (Winter, Spring)	10 survey points in Study Area	30 minute counts, 800-m radius
Common Raven Point Counts	2012, 2013 (Winter, Spring, Fall), 2013 (Winter, Spring)	10 survey points	10 minute counts, 800-m radius. Results provided in Silver State Solar South Raven Management Plan (Ironwood 2013)
Golden Eagle Nest Monitoring	2013 (Throughout breeding season)	5 known nests in 5-mi buffer	Ground-based nest monitoring following USFWS Protocol (USFWS 2010)
Burrowing Owl Surveys	2011 (Spring) 2012 (Spring, Fall)	Full coverage of Project Site	Performed concurrent with USFWS protocol desert tortoise surveys, 10-m transect spacing.
Incidental Observation	2011, 2012, 2013 (Throughout)	Throughout Study Area	Special status bird species observations were recorded during the course of other biological surveys

2.2.1 Avian Point Counts

Point counts were conducted in the spring and fall of 2012, winter of 2012-2013, and spring of 2013 by qualified ornithologists using a modified point count methodology as described in *Monitoring Bird Populations by Point Counts* (Ralph et al. 1995). Once per season, point counts were surveyed at 16 randomly placed locations throughout the Study Area.

At each of these points, four separate sampling stations were established, spaced 200 meters in the cardinal directions from point center, for a total point count sample size of 64. Throughout the planning process for the Project, changes in the project boundary have resulted in changes to the distribution of sampling points falling inside and outside the footprint. Currently, there are 20 sampling stations within the Project Site and 44 sampling stations outside of the Project Site within the greater Study Area.



Silver State Solar South ROW
Study Area
State Boundary
Railroad
Contour (50 ft)
General Avian Point Count
Raven Point Count

0 0.5 1 2 Miles
1:47,000
1 in = 0.75 miles

N

Figure 2 - Point Count Locations, 2012-2013

Silver State Solar South | Clark County, Nevada

Point counts were performed during the hours of peak morning bird activity (i.e., between sunrise and 4 hours following sunrise) and during mild weather conditions (i.e., avoiding extreme temperatures, rain and high wind events). Each sampling station was visited 10 minutes, and the survey period was divided into three survey periods consisting of the first three minutes, minutes 3 to 5, and minutes 5 to 10 in order to provide data necessary for the development of detectability measures and to correct for observer bias when necessary. Observers also recorded distance to detected bird, necessary information for the development of density estimates.

Point count data were used to develop distance models in Program DISTANCE (Thomas et al. 2010) estimating total bird density on the site by season. Density estimates were also developed for individual species with sufficient numbers of detections. Shannon's diversity indices (Hunter 1990) were calculated for the study area (all points) by season and throughout the year.

Distance Model Development

Distance sampling provides a way of estimating density when a full inventory of items within an area is not feasible. During an avian point count, a tally of all detected birds within an area and distances of each bird from the observer is recorded. Some basic assumptions of the nature of area to be sample are as follows:

- Objects to be measured are distributed according to some stochastic process with the parameter D (number/unit area)
- Sampling points (or lines when using line transects) are distributed randomly throughout the study area

A key concept in distance sampling is the detection function, g(y), or the probability of detecting an object given its distance from a line or point. The first assumption of the detection function is that objects at distance 0 are detected 100% of the time (g(0) = 1). The second assumption is that objects are detected and distance recorded at their initial location (i.e. the location of the bird when first seen rather than where it lands after being disturbed). The final assumption is that the distances are accurately measured. During a survey, the number of objects detected, *n*, is a function of the total density of those objects as well as the probability of being detected $\widehat{P_a}$. In an ideal world, *n*, would be related only to the actual density (D). However, actual density ($\widehat{D}$) is estimated by the following equation,

$$\widehat{D} = \frac{n}{(\hat{P}_a k \pi w^2)}$$

where k is the number of points and w is the sampling radius. The unconditional probability $\widehat{P_a}$ of an object being detected is a function of the detection function at each distance r given by the equation

$$\widehat{P_a} = \int_0^w \frac{2\pi r g(r) dr}{\pi w^2}$$

The sample of distance measurements is used to obtain the detection function, which is necessary to develop a good estimate a density. Program DISTANCE allows estimating the shape of the detection function. Models are chosen based on model robustness, shape criterion, efficiency (low variance), and have adequate goodness of fit based on actual data. In program DISTANCE, the user can select from several "key functions" which are starting points for models of g(y). The program offers four key function choices, uniform, half-normal, hazard-rate, and negative exponential. Generally the key functions are selected by looking at histograms of the data. To adjust the key function, series expansions can be added to the models (cosine, simple polynomial, and hermite polynomial). In general, several models are run for a set of data and various tests are used to determine the best model for the given data. Akaike's Information Criteria (AIC) is a method for model selection that takes into consideration fit of the data using maximum likelihood estimates as well as model simplicity (the principal of parsimony). In a group of models based on the same data, the one with the lowest AIC value is generally the best choice.

2.2.2 Burrowing Owl Surveys

A preliminary habitat assessment conducted in 2011 concluded that suitable wintering and breeding habitat for burrowing owl was present throughout the Project Site and greater Study Area. To confirm the presence of burrowing owls on the Project Site, biologists performed burrowing owl surveys following established guidelines for survey intensity and coverage (CA Burrowing Owl Consortium 1998, CDFG 2012) during the spring of 2011 and the spring and fall of 2012. The entire Study Area encompassing the Project Site was surveyed from April 4th to May 27th, 2011. The eastern portions of the Study Area between the Project Site and the base of the Lucy Gray Mountains were surveyed again from April 3rd to May 18th, 2012, and the southern half of the Project Site was resurveyed from September 19th to October 18th, 2012. The burrowing owl surveys were conducted concurrently with desert tortoise surveys using pedestrian transects spaced no greater than 10 meters apart. All burrowing owl sign, including presence of individuals, feathers, tracks, white wash, pellets, and suitable burrows suitable were recorded during the survey. Incidental observations of burrowing owls and sign were recorded during other biological surveys performed on the site from 2011 to 2013.

2.2.3 Golden Eagle Aerial Surveys

Aerial surveys to assess golden eagle occupancy and productivity were conducted in 2010 by the Wildlife Research Institute (WRI) following USFWS Golden Eagle Inventory and Monitoring Protocol (USFWS 2010). These surveys were conducted for the adjacent Stateline Solar Farm Project, but coverage overlapped the majority of a 10-mile buffer zone around the Project Site. Additional subsequent aerial surveys were not conducted specific to the Silver State Solar South Site because existing BLM helicopter survey data covering the 10-mile buffer area was made available for 2012 (Larry LaPre, pers. comm., September 2013)

WRI conducted helicopter surveys on the Project Site and vicinity on May 7 and 8, 2010 (Phase 1) and June 14, 2010 (Phase 2). Helicopter survey teams consisted of two golden eagle biologists and a

helicopter pilot. Phase 1 aerial transects covered habitats likely to support golden eagle nesting, with in flight transect modifications made in response to terrain. Phase 1 surveys were conducted in an effort to confirm reproductive activity and ensure mountainous areas with intricate canyons were thoroughly investigated. Phase 2 surveys were focused on revisiting potentially active territories identified during Phase 1 surveys. During both Phase 1 and Phase 2 aerial transects, nest sites and other location-specific data were recorded using hand-held Global Positioning Satellite (GPS) units, with supplemental field notes documenting species and corresponding to each recorded waypoint. A total of 32 person-hours were logged during the Phase 1 survey with an additional 17 person-hours logged during Phase 2 surveys.

During both Phase 1 and Phase 2 surveys, two optically-stabilized zoom cameras were used to capture high-resolution, wide-angle and close-up, digital photographs of active and inactive golden eagle nests, other raptor nests, and significant wildlife species. Collected digital images were used to confirm species identification, nest condition, nest activity, nest occupation, and nest arrangement (WRI 2010). An active nest was defined as supporting evidence of new material having been added during the season and typically included the use of yucca, grasses and mosses in the construction of a bowl, used for incubation. An active nest may or may not have been occupied by a golden eagle (e.g., an incubating female or a young bird) at the time of survey. An occupied nest was defined an active nest in which an adult or young golden eagle, or a new egg, has been observed during the survey.

2.2.4 Ground-based Golden Eagle Nest Monitoring

To supplement the aerial surveys conducted in 2010, qualified avian biologists conducted ground based nest searches for Golden Eagle nests in March of 2011, 2012, and 2013 following USFWS protocols (USFWS 2010). Potential nesting habitat was searched within 5 miles of the Project Site. The breeding status of each nest was determined from behavioral observations made from observation points no closer than 300 meters from the nests providing an unobstructed view from which eagle activity could be observed with binoculars or a spotting scope. All bird observations made during these surveys were recorded. During 2011 and 2012, active nests were not monitored throughout the breeding season in order to minimize disturbance to nesting eagles. In 2013, based on consultation with the BLM, nest observations were made throughout the breeding season to determine nest fate.

2.2.5 Golden Eagle Point Counts

Golden eagle point counts were conducted at 10 locations on the Project Site and surrounding areas (Figure 2) in order to acquire baseline golden eagle occurrence data. The 10 point count locations were systematically placed across the vicinity of the Project site on a grid with 1-mile square grid cells. Based on the current proposed footprint of the project, 4 golden eagle point counts fell within the boundaries of the Project Site and 6 point counts fell outside the boundaries within the larger Study Area. Four rounds of surveys were conducted: October 2012, January/early February 2013, March 2013, and April 2013. All bird species within 800 meters of the center point were recorded during an observation period of 30 minutes. Eagle flight activity located more than 175 meters above ground was recorded, but

separated from other data. Approximate flight paths and heights of eagles plus notes on general behavior and activity were recorded. Behavior noted during each 1-minute interval was recorded as either soaring flight, flapping-gliding, kiting-hovering, stooping or diving at prey, stooping or diving in an agonistic context with other eagles or other bird species, being mobbed, undulating/territorial flight, or perched. All observations of foraging were documented and referenced on a map or by Universal Transverse Mercator (UTM) coordinates.

In an effort to develop an index of common raven (*Corvus corax*) occurrence, observations of ravens were also recorded during golden eagle exposure counts. Immediately before or after the golden eagle exposure count, a 10-minute observation period was conducted at the same location and only common ravens were recorded. Results of common raven point counts and detailed description of raven related baseline conditions at the Project Site is contained in the Draft Silver State Solar South Raven Management Plan (Ironwood Consulting 2013).

In accordance with the most recent USFWS Eagle Conservation Plan Guidance (USFWS 2013), future golden eagle survey efforts will include long-sit (5 hour) resident and migratory surveys as described in Section 5.2.3.

2.2.6 Incidental Observations of Special Status Species and Nests

Biologists conducting various biological surveys have been reporting incidental detections of sensitive bird species throughout the Study Area since 2011. During all biological survey efforts, bird species (including special status species and nests) were identified and/or tallied on standardized data forms (Ironwood Consulting 2012). The locations of special status species and nests were recorded. NDOW provided data on historical golden eagle nest locations and presence of other special status species within the project vicinity.

2.2.7 Bat Resources

Focused bat surveys have not been conducted on the Project Site to date. However, bat surveys and habitat assessments were performed on the Stateline Solar Farm Study Area 5 miles to the southwest of the Project Site by Patricia Brown, Ph.D. (Brown-Berry Biological Consulting) during the spring of 2010 and 2011 (Brown 2012). Due to the close proximity of the Stateline Solar Farm Study Area to the Project Site and similarities in habitat features, data from the Stateline bat surveys and existing data reported in the Silver State Solar South DSEIS (BLM 2012a) were used to inform existing bat conditions on the Project Site.

On May 14, 2010, Dr. Brown performed an assessment of potential bat habitat on the nearby Stateline Solar Farm project site. General areas that may serve as potential roosts and foraging sites were identified. Acoustic monitoring was conducted on July 28 and 29, 2010 and from May 14 to 16, 2011 to determine which bat species utilize the Study Area. Ultrasonic detectors (i.e., Anabat II and 1A) recorded echolocation signals overnight in thirteen locations in different areas of the Stateline Project Site to

identify bat species and document general activity levels. Roost surveys were conducted at rock shelters and mines in the mountains adjacent to the Stateline Project during the day and at night for evidence of bats and guano.

In addition to the Stateline bat data, bat occurrence data from the Searchlight Wind Energy Project (Tetra Tech Inc. 2012), located approximately 32 miles southeast of the Project Site, were used to help identify bat species with some possibility of presence on the Project Site. Bat occurrence data from the Searchligh Wind Energy Project were based on year-round acoustic monitoring from April 2008 to April 2010 at 8 stations dispersed across approximately 400 acres: 6 stations at meterological towers (each station recorded acoustic data at 2 m above ground and 40-50 m above ground) and 2 stations at two mine sites known to provide roosting habitat (Tetra Tech Inc. 2012). Data from Searchlight Wind Energy Project could not be used to infer bat occurrence at the Project Site because of the distance between the sites (approx. 32 miles) and habitat differences between the two locations (Searchlight Wind Energy Project site contains greater topographic variation and more rocky habitats than Silver State Solar South). However, the Searchlight bat data was used to supplement the list of possible bat species occurrences inferred from data collected at the Stateline Project 6 miles from the Project Site.

2.4 BASELINE SURVEY RESULTS

2.4.1 Avian Point Counts

A total of 49 bird species were detected during avian point counts across all seasons surveyed during 2012 and 2013. Appendix A contains a list of all bird species observed on the site, including those detected during avian point counts. 796 total detections were recorded during the point counts. Two special status species—loggerhead shrike and crissal thrasher—were observed during the point counts. The five most common species across all seasons were black-throated sparrow (*n*=139), common raven (*n*=90), house finch (*n*=66), horned lark (*n*=43), and rock wren (*n*=42).

Avian point count data were analyzed with the goal of developing metrics which may be used to describe current conditions and serve as a baseline to which future data may be compared. The following metrics were developed using methods described in Section 2.2.1:

- Total birds per survey per point by season;
- Total species/point by season;
- Bird density Study Area, species combined, within and across seasons;
- For species with sufficient sample sizes, individual species densities across the Study Area; and
- Shannon's index (H') for species diversity across the Study Area.

Table 4 presents total birds per point and species per point with associated 95% confidence intervals.

Table 4. Total species per point and detections per point per survey at Silver State Solar South Study Area, 2012-2013.

Survey	Species/ Point	95% CI Lower Limit	95% CI Upper Limit	Birds/Point/ Survey	95% CI Lower Limit	95% CI Upper Limit
All Seasons Combined	4.77	4.21	5.33	2.84	3.17	2.51
Fall	1.98	1.65	2.31	2.20	1.82	2.58
Spring	3.24	2.82	3.66	4.53	3.89	5.17
Winter	2.17	1.68	2.66	2.17	1.68	2.66

CI- Confidence Interval

Table 5 provides estimates of bird density within the Study Area and for 5 species with sufficient sample sizes—house finch, horned lark, black-throated sparrow, common raven, and rock wren. These estimates are based on best-fit distance models developed in Program DISTANCE (Thomas et al. 2010). The model name refers to the name of the key function used in the model. Distance modeling assumes that the detection function is uniform for all objects detected. This assumption can be problematic for bird surveys. It is unreasonable to expect that all bird species are detected with equal probability, therefore estimates of total bird densities may not be as accurate as estimates of individual species. For these analyses the Hazard-rate key function was the best fit for the data. An initial inspection of the data histograms showed evidence of heaping of distance measurements; that is, recorded distances often fell into round numbers such as 20 meters or 40 meters. There were also detection spikes at further intervals. Data were clumped into intervals compensate for heaping and were truncated at the 90th percentile of distance measurements. The Hazard-rate model with no series expansions performed the best for estimates of all birds lumped together while the half-normal key function with cosine expansion was generally the best model for individual species estimates (except in the case of Black-throated Sparrow in which the Hazard model with hermite polynomial expansion was chosen). The histogram of the detections of Black-throated Sparrow was problematic for model fitting as there were numerous spikes in the data.

Table 5. Bird density model estimates. Silver State Solar South Study Area, 2012-2013.

Data Group	Density (birds/ha)	CI Lower Limit	CI Upper Limit	Model Name
All Year (all species, *n*=582*)*	2.3	1.8	2.9	Hazard-Hermite
Fall (all species, *n*=186)	2.6	1.5	4.2	Hazard
Spring (all species, *n*=395)	2.1	1.5	2.8	Hazard
Winter (all species, *n*=211)	2.7	1.6	4.4	Hazard-Hermite
Black-throated sparrow (*n*=139)	1.14	0.66	1.95	Hazard-Hermite
House finch (*n*=73)	0.45	0.34	0.6	Half Normal Cosine
Horned lark (*n=66*)	0.42	0.28	0.62	Half Normal Cosine
Common raven (*n*=90)	0.004	0.002	0.006	Half Normal Cosine
Rock wren (*n=42*)	0.07	0.04	0.11	Half Normal Cosine

CI- Confidence Interval

The Shannon diversity index (H') for the Study Area was 2.97 across all surveyed seasons, 2.78 during spring surveys, 2.46 during winter surveys, and 2.44 during fall surveys. The smaller H' value for the fall season combined with the slighter greater mean species per point observed in the fall indicate that species are less evenly distributed across the Study Area during the fall season.

As part of this initial analysis of point count data, a power analysis was performed to determine the study's ability to detect changes in detections per point and overall avian density in future years. Statistical power can be summarized as the probability that a statistical test will reject the null hypothesis when the null hypothesis is false and there is, in fact, a difference between population means (Zar 1999). The power analyses were conducted using the following parameters: 1)an alpha-level of 0.05; 2) the observed standard error in the dataset; 3) two different sample size scenarios with our current sampling effort and a doubled sampling effort; and 4) desired detectable effect sizes of 0.5 bird per ha and 1 bird per survey per point. Table 6 presents the results of these power analyses.

Table 6. Power analyses of point count data, Silver State Solar South Study Area, 2012-2013

Statistic	Sample size (*n*)	Desired Effect Size	α	Power (1-β)
Overall bird density	537	1 bird/ha	0.05	0.74
Overall bird density	1074	1 bird/ha	0.05	0.96
Detections/survey/point (Overall)	64	1 bird/survey/point	0.05	1.00
Detections/survey/point (Overall)	128	1 bird/survey/point	0.05	1.00
Detections/survey/point (Spring)	64	1 bird/survey/point	0.05	0.99
Detections/survey/point (Spring)	128	1 bird/survey/point	0.05	1.00
Detections/survey/point (Fall)	64	1 bird/survey/point	0.05	0.70
Detections/survey/point (Fall)	128	1 bird/survey/point	0.05	0.92
Detections/survey/point (Winter)	64	1 bird/survey/point	0.05	0.39
Detections/survey/point (Winter)	128	1 bird/survey/point	0.05	0.62

The power analyses suggest that the current sampling has inadequate statistical power (<0.90) to detect the desired effect sizes for overall bird density, birds per survey per point during the fall, and birds per survey per point during the winter. A doubling of sample size effort would likely provide adequate statistical power for all metrics except birds per survey per point during the winter, when the number of bird detections is lower than other seasons. This larger sample size is necessary to be able to detect statistically and potentially biologically significant changes in bird densities and detections during the construction process and post-construction. It will also provide a better estimate of bird densities and detections that may be used to compare point count data with avian mortality results.

Based on the results of the power analysis described above, an additional 64 point count survey stations will be placed across the Study Area beginning in the fall of 2013 in order to obtain a more robust sample size. The total sample size for future point counts will be 128 points at 32 sampling stations and these points will be randomly placed and stratified by placement inside the Project boundary and

outside the Project boundary. The power analysis indicates that the resulting sample size will be sufficient to detect meaningful changes in overall bird densities. Maintaining the number and location of these sampling stations from baseline through post-contruction is necessary to provide direct comparisons of bird detections and densities among seasons and years.

2.4.2 Burrowing Owl Surveys

During burrowing owl surveys conducted in the spring of 2011, four burrows were observed with burrowing owl pellets, white wash, and feathers. No burrowing owl individuals were observed. These burrows may have been occupied by winter resident owls or may have been active breeding-season burrows at the time of observation.

No burrowing owls or burrowing owl sign were observed during spring 2012 surveys conducted on the northern half of the Project Site. During fall 2012 surveys of the southern portions of the Project Site, 4 burrows with burrowing owl sign were observed. All burrows had whitewash near the entrance and three burrows also had pellets and feathers present, indicating that the burrows were likely active at the time of the survey. No burrowing owl individuals were recorded on the site during the surveys. Figure 3 provides locations of all burrowing owl sign observations along with along special status species occurrences.

No burrowing owls or confirmed active burrows have been observed on site during the breeding season; however, suitable nesting habitat is present on site and burrowing owl is considered a likely year-round occupant of the Study Area.

2.4.3 Golden Eagle Aerial Surveys

Aerial surveys conducted in 2010 did not detect any golden eagles or Golden Eagle nests within Project Site or the nearby Lucy Gray Mountains. However, a total of 7 GOEA nests were observed within 10 miles of the Project Site during subsequent ground based nest-searching efforts from 2011 to 2013 (Table 4, nests within 5 miles of site shown in Figure 4). These nests were monitored from 2011 to 2013 as described in Section 2.4.4. These nests likely correspond with 4 potential territories that were estimated based on the proximity of observed nests to eachother and a qualitative assessment of average golden eagle breeding territory size.

Aerial survey data from March 2012 provided by the BLM (Larry LaPre, pers. comm.) showed one active nest within the 10 mile buffer of the Project Site, corresponding to nest X01GESN-0 found during Ironwood's ground-based nest searching efforts.

2.4.4 Ground-based Golden Eagle Nest Monitoring

A total of 7 GOEA nests within 4 potential territories have been observed during ground-based nest monitoring in the spring of 2011, 2012, and 2013. Table 7 provides a list of these nests and their corresponding labels, territories, and locations.

Table 7. Observed Golden Eagle Nests during Ground-based nest searching, Project Site, 2011-2013.

Territory name	Nest ID	Location Relative to Closest Project Boundary	Breeding Status		
			2011	2012	2013
Jean West	X01GESN-0	14.5 km northwest of northwestern project boundary	Not yet detected	Active (fate unknown)	Not visited
Lucy Gray North	P10GESN-2	3.8 km northeast of northeastern corner of project boundary	Active (fate unknown)	Inactive	Inactive
	X02GESN-0	4.0 km northeast of northeastern corner of project boundary	Not yet observed	Active (fate unknown)	Inactive
Lucy Gray West	P12GESN-0	3.1 km east of eastern project boundary	Inactive, RTHA use	Inactive	Inactive
	X04GESN-0	3.1 km east of eastern project boundary	Not yet detected	Not yet detected	Active (fledged)
Lucy Gray South	P14AGESN-0	8.3 km southeast of southeastern corner of project boundary	Inactive	Inactive	Inactive
	P14BGESN-0	8.3 km southeast of southeastern corner of project boundary	Inactive	Inactive	Inactive

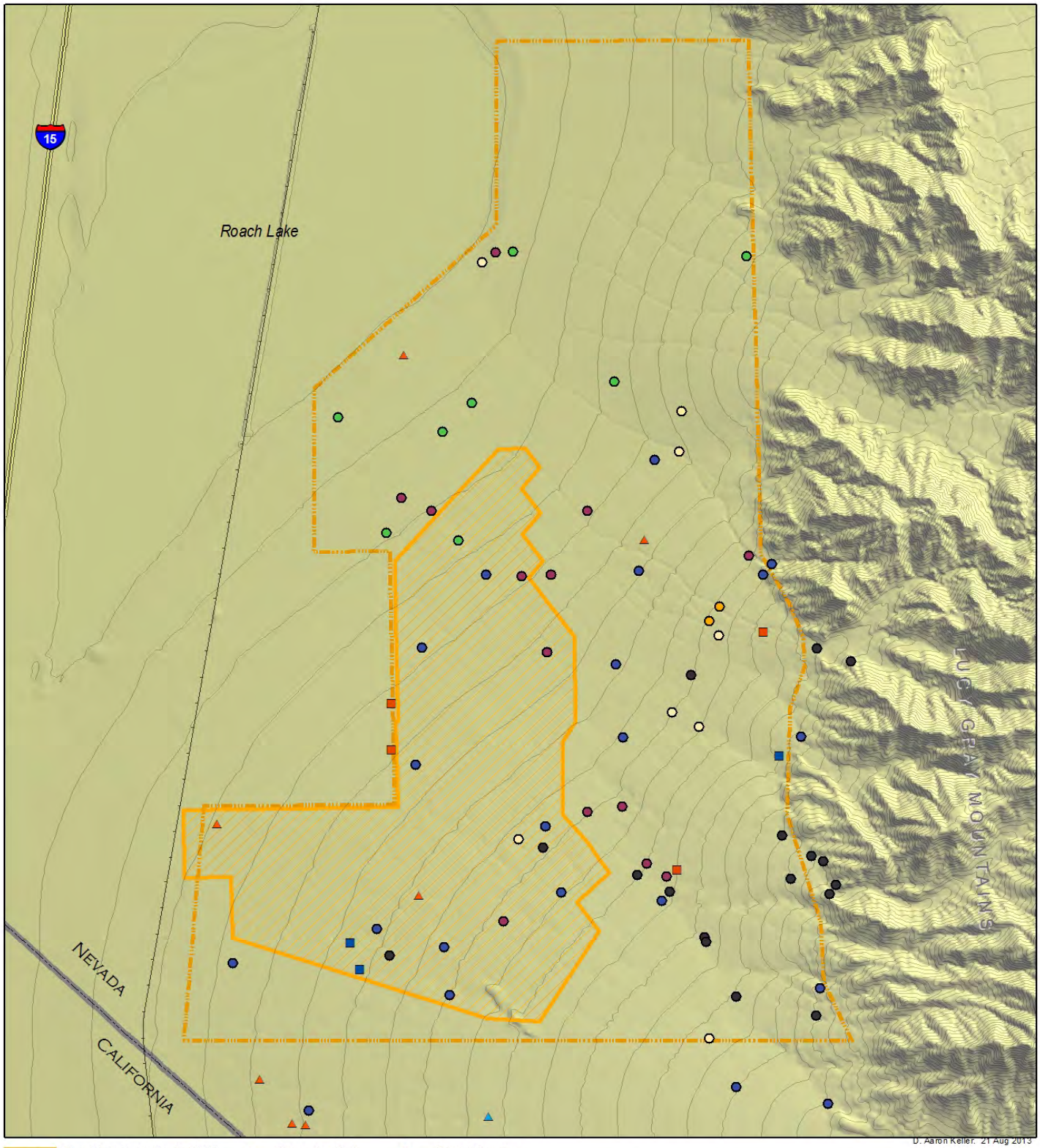
Prior to 2013, nests were only determined as active or inactive early in the breeding season and were not followed in order to minimize disturbance to breeding eagles. In 2013, based on consultation with the BLM, nest observations were made throughout the breeding season to determine nest fate. In 2013, nest X04GESN-0 was observed throughout the breeding season and was determined to have successfully fledged two young. A review of available data indicated no additional information of estimates of production for other potential active nests within a 10-mile radius of the project.

2.4.5 Golden Eagle Point Counts

A total of 12 golden eagles observations were recorded during the four golden eagle point count surveys: six in October 2012, two in late January/early February 2013, four in March 2013, and one in April 2013. Nine of the golden eagle observations involved birds flying at a distance greater than one kilometer from the observer. Two of the detections involved golden eagles within the 800m radius of the point count. Due to the low number of golden eagle detections and an inability to detect meaningful temporal changes in golden eagle occurrences with such a small sample size, this methodology will be abandoned in future survey efforts. The golden eagle point counts will be replaced with a long-sit migration count protocol as described in Section 5.2.3.

2.4.6 Incidental Observations of Special Status Species and Nests

Figure 3 displays locations of all special status species and Figure 4 provides locations of avian nests observed in the Study Area from 2011-2013. Information about occurrences of special status species is included in Table 2 in Section 2.1. Appendix B provides a summary of special status species observations within the Study Area.



Silver State Solar South ROW
Study Area
State Boundary
Railroad
Contour (50 ft)

Burrowing Owl
Long-eared Owl
Golden Eagle
Northern Harrier
Prairie Falcon
Brewer's Sparrow

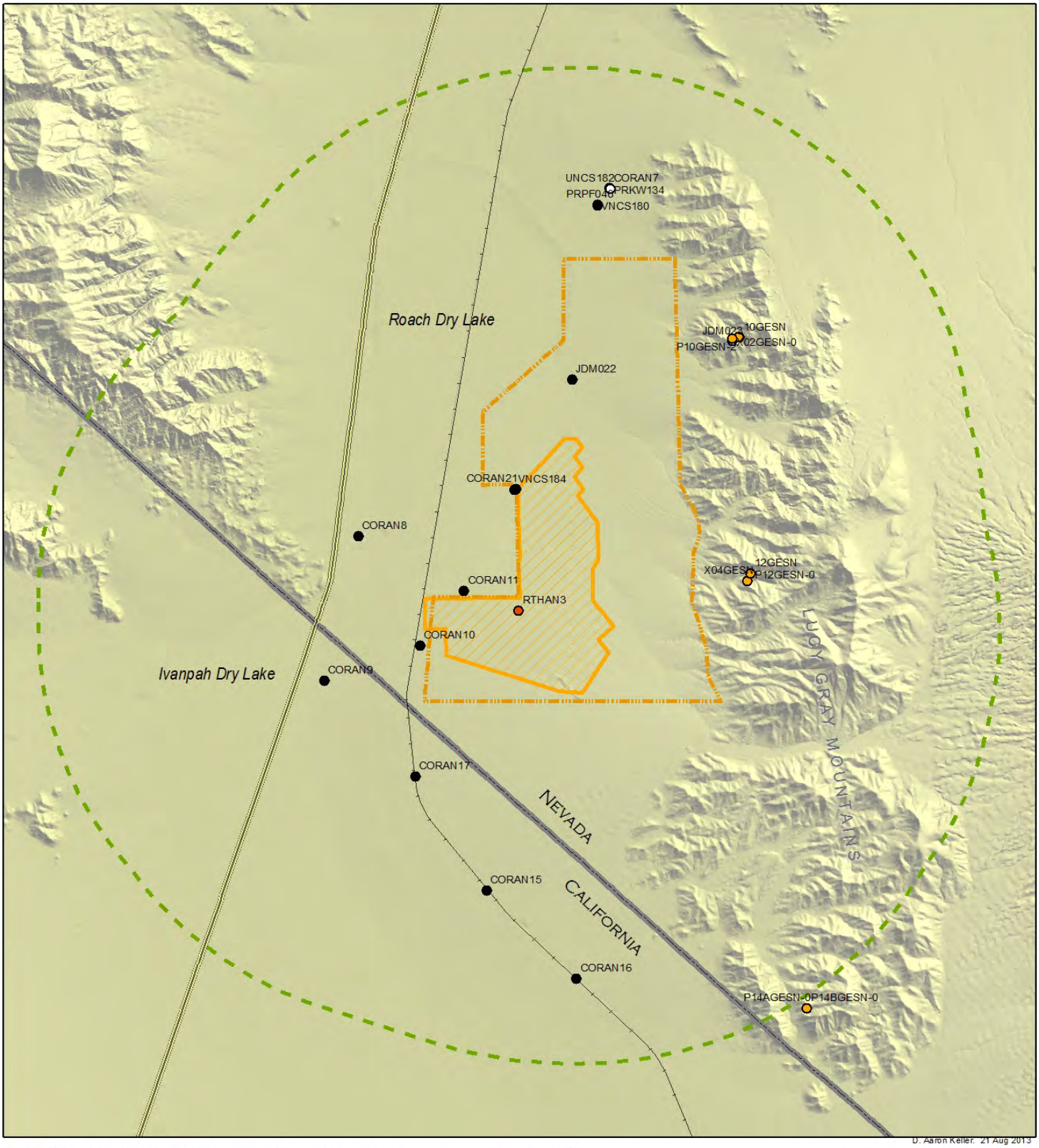
Crissal Thrasher
Le Contes Thrasher
LeConte's Thrasher
Loggerhead Shrike
Phainopepla

0 0.5 1 2 Miles
1:47,000
1 in = 0.75 miles

N

Figure 3 - Special Status Species Locations, 2011-2013

Silver State Solar South | Clark County, Nevada



D. Aaron Keller, 21 Aug 2013

Silver State Solar South ROW
Study Area
5 mile buffer
State Boundary
Railroad
Known Nests
Common Raven
Golden Eagle
Prairie Falcon
Red-tailed Hawk
Unknown Stick Nest

0 1 2 4 Miles
1:110,000
1 in = 1.7 miles

N

Figure 4 - Avian Nest Locations 2011-2013

Silver State Solar South | Clark County, Nevada

2.4.7 Bat Resources

A review of existing data pertaining to the vicinity of the Project Site (Brown 2011) and region (Tetra Tech 2012) revealed 16 bat species with potential to occur within the Project Site (Table 8). Species were included in this list if they had been observed during at least one of the two referenced studies and were determined to have potential for occurrence on the project site. No mines are located within the Project Study Area.

The data reported in Initial Bat Habitat Survey for the First Solar Stateline Solar Farm (Brown 2011) show 8 bat species were detected within or near the Study Area and nine species have the potential to occur. Canyon bats (Parastrellus hesperus), California myotis (Myotis californicus), and Mexican free-tailed bats (Tadarida brasiliensis) were the most common species detected during acoustic surveys (Brown 2011).

Table 8. Potential bat species occurrence on Silver State Solar South.

SPECIES	STATUS		OCCURRENCE
Antrozous pallidus Pallid bat	Federal: BLM: NDOW:	SOSC sensitive SP	Moderate potential to occur within rocky substrate in upper elevations of the Study Area. Observed within 5 miles of site (Brown 2011). Observed year-round at Searchlight Wind Energy Project site (Tetra Tech 2012).
Corynorhinus townsendii Townsend's big-eared bat	Federal: BLM: NDOW:	SOSC sensitive SS	Low potential for occurrence. Large cavities for roosting and hibernation not located within Study Area. No observations from referenced studies (Brown 2011, Tetra Tech 2012).
Eptesicus fuscus big brown bat	Federal: BLM: NDOW:	none none none	Some potential to occur on site based on observations year-round at Searchlight Wind Energy Project site (Tetra Tech 2012).
Eumops perotis californicus greater western mastiff bat	Federal: BLM: NDOW:	SOSC none SS	Observed during migration at Searchlight Wind Energy Project site (Tetra Tech 2012).
Lasiurus blossevillii western red bat	Federal: BLM: NDOW:	none sensitive SS	Potential to ocurr on site during migration. Observed during migration at Searchlight Wind Energy Project site (Tetra Tech 2012).
Lasiurus cinereus *Hoary bat*	Federal: BLM: NDOW:	none none none	Observed during migration at Primm Valley Golf Course within 4 miles of the site (Brown 2011). Observed during migration at Searchlight Wind Energy Project site (Tetra Tech 2012).
Lasionycteris noctivagans silver-haired bat	Federal: BLM: NDOW:	none none none	Observed during migration at Searchlight Wind Energy Project site (Tetra Tech 2012).
Macrotus californicus California leaf-nosed bat	Federal: BLM: NDOW:	SOSC none SS	Some potential to occur on site based on observations year-round at Searchlight Wind Energy Project site (Tetra Tech 2012).

SPECIES	STATUS		OCCURRENCE
Myotis californicus California myotis	Federal: BLM: NDOW:	none none none	Moderate potential to occur within rocky substrate in upper elevations of the Study Area. Has been detected within 5 miles of site (Brown 2011). Observed year-round at Searchlight Wind Energy Project site (Tetra Tech 2012).
Myotis ciliolabrum western small-footed myotis bat	Federal: BLM: NDOW:	SOSC sensitive none	Moderate potential to occur within rocky substrate in upper elevations of the Study Area. Has been detected within 5 miles of site (Brown 2011). Observed year-round at Searchlight Wind Energy Project site (Tetra Tech 2012).
Myotis thysanodes fringed myotis	Federal: BLM: NDOW:	SOSC sensitive SP	Observed during migration at Searchlight Wind Energy Project site (Tetra Tech 2012).
Myotis yumanensis Yuma myotis bat	Federal: BLM: NDOW:	SOSC sensitive none	Moderate potential to occur. Individuals were detected near Primm Valley Golf Course within 4 miles of site (Brown 2011). Observed year-round at Searchlight Wind Energy Project site (Tetra Tech 2012).
Nyctinomops femorosaccus pocketed free-tailed bat	Federal: BLM: NDOW:	none none none	Observed during migration at Searchlight Wind Energy Project site (Tetra Tech 2012).
Nyctinomops macrotis big free-tailed bat	Federal: BLM: NDOW:	SOSC none none	Observed during migration at Searchlight Wind Energy Project site (Tetra Tech 2012).
Parastrellus hesperus western pipistrelle	Federal: BLM: NDOW:	None none none	Some potential to occur on site based on observations year-round at Searchlight Wind Energy Project site (Tetra Tech 2012).
Tadarida brasiliensis Brazilian free-tailed bat	Federal: BLM: NDOW:	none sensitive SP	Moderate potential to occur within rocky substrate in upper elevations of the Study Area. Has been detected within 5 miles of site (Brown 2011)

FWS - U.S. Fish and Wildlife Service
NNHP - Nevada Natural Heritage Program
MSHCP –Clark County Multiple Species Habitat Conservation Plan
Protected - NRS 501

FWS Classification
SOSC- Species of Special Concern

NDOW Classification
SS- State Sensitive
SP- State Protected

3.0 RISK ASSESSMENT

This section outlines the potential risks to bird and bats and supports the implementation of avoidance and minimization measures. Little information is currently available regarding observed impacts of photovoltaic solar energy developments on bird and bat resources. Some components of solar development (overhead lines, transmission lines, project lighting) are common to other types of energy developments, and the mechanisms of bird and bat impacts resulting from those project components may be applicable to solar energy development. Potential risks to birds and bats can be broken into two categories: direct impacts and indirect impacts.

3.1 DIRECT IMPACTS

Direct impacts include disturbances to the landscape which have immediate consequences to resident and migratory bird populations. Some potential direct impacts include:

- Collision risk: buildings, transmission line, solar modules, meteorological tower, or guy lines;
- Electrocution potential;
- Habitat loss; and
- Vehicle and equipment collisions.

3.1.1 Collision risk

Birds and bats have the potential to collide with buildings, transmission and distribution lines, solar modules, meteorological towers, guy lines, chain link fencing, and other similar physical features. The inclusion of avoidance and minimization measures has the potential to decrease the risk of collision. The number of avian collisions is not related to flight frequency, (Rusz et al., 1986) but to blind spots in the vision of the bird, (Martin and Shaw 2010) flight performance (Savereno et al. 1996) or other factors such as density, age, residency status, season flight style and interactions with other birds. For solar modules, a hypothesis posits that birds may mistake the solar panels for a lake and attempt to land. To date there have been no studies to substantiate or refute this hypothesis. Collision rates may increase during the late summer and early fall when immature and inexperienced hatch-year birds undertake the perils of post breeding dispersal and/or migration.

One existing study has examined avian mortality at a solar energy plant near Daggett, CA (McCrary et. Al 1986). The study occurred at Solar One, a solar thermal facility using power tower technology rather than photovoltaic technology. Mortality events were split into two categories: those caused by collision with heliostats (reflective mirrors) and those caused by burns related to reflected sunlight concentrated at “standby points,” the focal points of the heliostat reflectivity. Results from the 1986 study at Solar One found 57 avian fatalities during 40 weekly full-coverage surveys of the site. The 57 fatalities represented an estimate 0.6-0.7% of the “local” avian population.

A contributing factor to avian collision risk is attraction to artificial lighting, especially during migration (Gauthreaux and Belser 2006). Little is known regarding the physiological and behavorial mechanisms governing avian attraction to light (Verheijen 1985), but it has been postulated that birds flighting into light at night lose their ability to discern the horizon and become disoriented (Herbert 1970). Numerous studies have documented avian mortality at lighted tower structures (Gauthreaux and Belser 2006) and examined the effects of different lightening methods on avian behavior and collision-realted mortality (Gauthreaux and Belser 2006, Gauthreaux and Belser 1999).

As described in Section 4.0 and required by Mitigation Measure BIO-13 in the FSEIS (BLM 2013b), the project will use reduced night lighting to minimize light-related avian attraction to the Project Site and surrounding area. Specific lighting measures will be reported to resource agencies for approval prior to construction.

The factors that may influence bats to collide with transmission lines are not well studied or understood (Heritage 2012). In theory, similar collision risks identified above that relate to birds may also apply to bats.

3.1.2 Electrocution potential

The potential for electrocutions depends on the arrangement and spacing of energized and grounded components of poles and towers that are sometimes used for perching, nesting and other activities (APLIC 2012). 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 2012).

All transmission and subtransmission towers and poles will be designed to be avian safe in accordance with the Suggested Practices for Avian Protection on Power Lines: the State of the Art in 2006 (APLIC 2012).

3.1.3 Habitat loss and displacement

Clearing and grubbing construction practices would result in habitat loss and displacement of local bird populations as vegetation communities and existing habitats are altered to support Project development. An inherent consequence of development is the loss of habitat that supports bird populations. Altering the landscape through Project development will 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.

3.1.4 Human disturbance and vehicle and equipment collisions

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. Studies have also demonstrated vehicle collision risk to bats (Lesinski 2007).

During the construction phase, an increase in vehicle traffic from construction personnel, biologist and other project-related persons, potentially poses an increase 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.

Loggerhead Shrikes (*Lanius ludovicianus)* have a rapid flight pattern that is low to the ground and are at an increased risk because of this behavior.

Due to a decrease in project personnel, these types of risks will be lessened during the operations and maintenance phase, compared to the construction phase.

3.2 INDIRECT IMPACTS

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

Potential indirect impacts include:

- Territory abandonment, nest and roost site abandonment;
- Increase opportunities for predators of special status species; and
- Habitat fragmentation and displacement.

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 avoiding habitat in the vicinity of the Project area may opt for less suitable habitat which could increase stress on these birds as a result of increased energetic costs. This would also place additional stress on available resources through increased density of birds in off-site areas.

Without the inclusion of avoidance and minimization measures, (see section 4.3 BBCM-10, BBCM-11, BBCM-19, BBCM-20, BBCM-21) nest and roost site disturbances and territory abandonment could occur due to direct nest removal during vegetation removal activities.

3.2.2 Increase opportunities for predators of special status species

The Project may indirectly result in mortality to wildlife through an increased risk of predation. Some predator species such as ravens and coyotes are attracted to human activity. Installation of fencing and transmission towers create additional perching structures from which ravens and raptors may hunt for prey (see Section 4.2). Construction, operation, and maintenance of the Project would 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 will be implemented (see section 4.3: BBCM-12 and BBCM-17). The Projects Raven Management Plan (RMP) will control for potential negative impacts due to the presence of ravens by ensuring that their existence is not subsidized by development of the Project.

3.2.3 Habitat fragmentation and displacement

The displacement and fragmentation of native habitat resulting from the Project may have additional indirect effects on avian population. The habitat loss could cause wildlife to rely more heavily on habitat within the surrounding area for foraging, shelter, and nesting opportunities causing an indirect effect on wildlife inhabiting areas adjacent to the Project area. Wildlife inhabiting adjacent areas could be faced with increased competition as a result of the displaced individuals relocating into their home ranges.

3.3 POTENTIAL IMPACTS TO SPECIAL STATUS SPECIES

The Project area provides habitat for cover, breeding, foraging, and/or traveling for 14 special status bird species (section 2.1, table 2): golden eagle (*Aquila chrysaetos*), peregrine falcon (*Falco peregrines anatum*), prairie falcon (*Falco mexicanus*), western burrowing owl (*Athene cunicularia*), loggerhead shrike, (*Lanius ludovicianus*), LeConte's thrasher (*Taxostoma lecontei*), crissal thrasher (*Taxostoma crissale*), Brewer's sparrow (*Spizella brewerii*), long-eared owl (*Asio otus*) and phainopepla (*Phainopepla nitans*). Western burrowing owl (see section 4.3 BBCM-12 and 4.4.3), loggerhead shrike, LeConte's thrasher, phainopepla, and crissal thrasher likely use the Project area for nesting and foraging. Additionally, 10 special status bat species (Table 8) have the potential to occur in the Project area based on studies conducted locally within 6 miles of the Project Site (Brown 2011) and regionally within 32 miles of the Project Site (Tetra Tech 2012).

These sensitive avian species would be vulnerable to loss of nesting or foraging habitat and/or behavioral disruptions due to noise and vibrations during construction. Alteration of foraging behavior during nesting season could result in nest abandonment or malnourished chicks. The implementation of Construction Conservation Measures (section 4.3) is intended to reduce the potential for these types of impacts.

Prairie falcons, Brewer's sparrow, long-eared owl and peregrine falcons would only use the Project area for foraging as there is no suitable nesting habitat present. Temporal detections of Brewer's sparrows, and long-eared owls within the Project boundary indicate that they use the site for roosting and foraging

during migration and as winter residents. Alteration in foraging behavior could result in nest abandonment for local breeders that utilize the site for foraging purposes, or decreased fitness of adults and chicks. Falcons are also susceptible to injury as a result of collision with power lines and transmission structures or from electrocution. The proposed Gen Tie will be built according to APLIC standards (APLIC 2012) and, therefore, is not anticipated to result in adverse impacts to falcons.

Potential golden eagle nesting habitat does not exist within the proposed Project footprint but golden eagles have been documented nesting within 10-miles of the Project. Project development will possibly result in a loss of golden eagle foraging habitat. Eagles require large areas for foraging, whether as dispersed, non-nesting adults or as pairs defending a nest and territory. Human disturbance has been known to result in nest abandonment by eagles; however, the closest documented nest is approximately 3 miles from the proposed footprint (section 2.4.4, table 7, nest X04GESN-0). This nest is situated below a ridge-line on a north-facing cliff face and the Project site is not visible from the nest location, nor is the nest within line-of-sight from the Project. Therefore, there is little likelihood of nest abandonment by golden eagles as a result of the Project. Golden eagles may be susceptible to injury and/or mortality from collision with power lines and transmission structures or electrocution. The project will follow Avian Power Line Interaction Committee (APLIC) guidelines, to reduce this risk through facility design. Based on the distance to the nearest golden eagle nesting habitat (> 2 miles), construction of the proposed Gen Tie will not result in adverse impacts to golden eagles.

The Applicant shall fund avian biologists to monitor and enforce disturbance buffers around all active bird nests (for raptors and species protected by the Migratory Bird Treaty Act) found in the Project area during construction as described in BBCM-11 and Section 4.4. The general bird breeding season for this area is February 15 to August 31. For raptors, specifically, the Applicant shall use the USFWS Utah Field Office Guidelines for Raptor Protection from Human and Land Use Disturbances (1999) and coordinate with the BLM to determine appropriate survey areas and disturbance buffers for active nests. For all non-raptor bird species, biologists shall survey within the proposed Project area. Because there are no standardized disturbance buffers for active non-raptor bird nests, the Applicant shall consult with the appropriate agencies (BLM, USFWS, and NDOW) on a case-by-case basis when active nests are found in Project areas, unless directed to do otherwise by all these agencies. These measures will protect local breeding birds, including the sensitive species mentioned above that have the potential to nest within the proposed Project boundary, including: burrowing owl, loggerhead shrike, phainopepla, crissal thrasher and LeConte's thrasher.

Disturbance to avian nests constitute a violation of the MBTA; therefore, active bird nests will not be disturbed or moved during breeding season, unless the Project is expressly permitted to do so by the USFWS.

All active nests and disturbance or harm to active nests shall be reported to: USFWS, BLM, and NDOW. Work shall be halted if it is determined by the biological monitor that active nests are being disturbed by construction activities, until further direction or approval to work is obtained from the Project's Lead Avian Biologist.

3.4 CUMULATIVE IMPACTS

Three additional renewable energy projects are in various phases of development within 10 miles of the Project Site. Silver State Solar North, a 50 MWAC approximately 600-acre photovoltaic generating station immediately adjacent to the west of the Project Site, has completed construction and is currently operating. The approximately 3,670-acre Ivanpah Solar Electric Generating Station (ISEGS) is currently under construction 6 miles to the southwest of the Project Site. A third project, the planned Stateline Solar Farm, is currently undergoing agency permitting review and is projected to occupy 1,685 acres, approximately 4 miles west southwest of the Project Site. Together with the proposed Silver State Solar South Project, recent and planned renewable energy projects in the Ivanpah Valley total approximately 8,382 acres. Silver State Solar South comprises approximately 29% of the cumulative acreage impacts of the four projects. The Ivanpah valley is approximately 165,120 acres in size. The proposed Silver State Solar South Project would occupy approximately 1% of the land area within the Ivanpah Valley and all of the planned renewable energy projects combined would account for approximately 5% of the total land area.

As photovoltaic generating stations with similar project components, Silver State Solar North and the planned Stateline Solar Project both have projected avian and bat impacts similar to the proposed Project. ISEGS is a power tower-style solar thermal generating station and, as such, could present additional direct mortality threats to bird and bat species through the presence of "radiant flux", reflected solar light, broadcast on three power towers associated with the project (BLM 2010b).

3.4 AVIAN RISK REDUCTION MEASURES

Bird and bat conservation measures are described in the following section, "4.0 Bird and Bat Conservation Measures." The Applicant intends to implement the described measures in an effort to reduce the unintentional direct and indirect risks that the development (construction, operaration, maintenace, and decommissioning) of this project could pose to migratory birds and bats. Bird and bat conservation measures include: project siting, facility design, construction conservation measures and the implementation of exclusion zones.

3.5 SUMMARY AND DISCUSSION OF RISK ASSESSMENTS

Through inherent risks and consequences associated with new development, there will possibly be long-term residual effects on local and migratory birds and bats. The loss of habitat including: foraging areas, shelters, perches, and nesting habitat; as well as the other direct and indirect risks described herein are inclusive for the threats identified through the application of baseline studies. Additional threats may be identified through the course of project development and by the application of ongoing survey efforts. Adaptive management measures (section 3.6) will be implemented to address additional and unforeseen threats, identified by the analysis of survey data. Sampling design, including temporal constraints, and existing conditions create limitations to the risk assessment. Many migratory birds and bats move at night and fly at high elevations where they are not detected by sampling measures.

Additionally, conditions on the Project site are much different during the pre-development stage compared to post development.

Risks to the birds and bats will likely vary temporally, with seasonal fluctuations in species composition, abundance, and site use. It is possible that mortality rates will increase during migratory periods, when more birds and bats are present on the site (see Table 4, spring; where the number of birds per point was approximately doubled compared to other seasons). Appendix D contains a list of migratory bird species common within the United States, which have the potential (however slight) to show up on the project over time.

An avian mortality study shall be conducted by the Applicant, with review by BLM, to monitor for incidents of bird strikes during the construction and first 2-3 years post-construction of the proposed Project (BLM 2012a). A proposed post-construction Avian Mortality Monitoring Plan (AMMP) has been included in this BBCS. Post construction avian mortality monitoring and instances of avian mortality reported on site will be used to monitor the effectiveness of mitigation measures that are intended to reduce project risks to birds and bats. Additional measures aimed at further reducing risks to birds and bats may be implemented through adaptive management if the results from avian mortality monitoring and agency consultation warrant such action.

4.0 BIRD AND BAT CONSERVATION MEASURES

4.1 PROJECT SITING

The Applicant has sited the Project to avoid and minimize impacts to bird and bat species where possible. The process of siting of the Project included both macro- and micro-siting considerations. The Project is not within the boundaries of a desingnated critical habitat unit, Area of Critical Environmental Concern, Audubon Society Important Bird Area (IBA), a Western Hemisphere Shorebird Reserve Network, or an area designated by the Convention on Wetlands of International Importance (Ramsar Convention). The East Mojave Peaks IBA is located within the Clark, Kingston and New York Mountain Ranges, approximately 24 air-miles from the Project. These areas support unique avian habitats. The large majority of this IBA is protected within Wilderness Areas. Other macro-siting considerations for the Project components also included the avoidance of:

- *Locations with federally or state listed, or otherwise designated sensitive species, and areas managed for the conservation of listed species* - Project avoids Desert Wildlife Management Areas (DWMAs), CHUs, ACECs, and IBAs and was sighted in the area of lowest known concentration for special status bird and bat species available.
- *Areas frequently used for daily bird and bat movements (i.e., areas between roosting and feeding sites)* - Areas of greater topographic and vegetative diversity (upper alluvial fan adjacent to Lucy Gray Mountains) were avoided to the maximum extent possible.
- *Breeding and wintering eagle use areas* - These areas were identified and avoided for all Project components. Valley floor areas where the Project would be located do not provide wintering or breeding habitat for eagles but may provide foraging habitat for resident golden eagles and other raptor species.
- *Known migration flyways for birds and bats* – No known major migratory flyways have been identified within the Project based on baseline avian data collected to date.
- *Areas near known bat hibernacula, breeding, and maternity/nursery colonies* - The rocky foothills of the Lucy Gray Mountains approximately 1.5 miles east of the Project Site provide ample crevice roosting habitat for several bat species. This area was avoided during site planning and the buffer distance between the eastern edge of the Project and the western edge of the Lucy Gray Mountains was increased to approximately 1.25 miles.
- *Fragmentation of large, contiguous tracts of wildlife habitat* - Many desert special status bird and bat species require large undisturbed areas that are highly sensitive to fragmentation effects. In siting the Project, all areas with greater vegetation structure, density and diversity were avoided or reduced to the extent possible. These areas included the upper alluvial fan that supports greater topographical and vegetative diversity.

These siting considerations are in compliance with MM BIO-4 contained within the Project's FSEIS (BLM 2012a). Micro-siting considerations for the Project components began at the inception of the Project and actively continued as further wildlife surveys were conducted and through informal meetings with the BLM, USFWS and NDOW throughout the Project's planning process. Biological studies indicated that

topographical and vegetative diversity was greater within the rocky terrain of the stabilized alluvial fan, which occurred in the higher elevations (generally above 2,500 feet). This mid-alluvial fan region likely supports more nesting and foraging habitat for both bird and bat species due to plant structure and presence of rock outcrops. Topographic and vegetative diversity lessened near the Ivanpah and Roach Dry Lakes. Siting of the alternatives took these habitat gradients into consideration. The Project has been sited to avoid the upper alluvial fan habitats to the maximum extent feasible and utilized areas of lower diversity near the lakebed. The Project site does not provide habitat for state- or federal-listed listed bird or bat species, but does provide habitat for several State and BLM special-status bird and bat species (Section 2.3). Beyond continuing to refine the boundaries of the solar farm, additional considerations of micro-siting included:

- *Avoiding features that attract raptors (areas supporting tall perching structures including trees, utility poles, etc.)* – By following APLIC guidelines (APLIC 2012), the Applicant has designed features to reduce perching by raptors to the maximum extent practicable.
- *Avoiding features that attract migrant birds (e.g., water sources, riparian vegetation) Minimize the potential for enhancing habitats suitable for raptor prey species such as rodents that would likely attract raptors to the project site* - Project construction and O&M phases will minimize the potential for creating habitats suitable for rodents, such as rock piles, that could attract raptors.

4.2 FACILITY DESIGN

The following bird and bat conservation measures (BBCMs) have been incorporated into the design of Project facilities.

BBCM-1 *Avoid using lattice-type structures, placing external ladders and platforms on towers to minimize perching and nesting.* – The generation portion of the Project will not incorporate towers or similar structures. The use of lattice towers, platforms, and ladders for transmission purposes have been minimized to the extent practicable. Although lattice structures will be used for meteorological towers, three transmission towers at the loop-in to the Primm substation, and possibly to mount and elevate a microwave communication dish on the Project Site, these will be in an area designated as a utility corridor that currently supports existing transmission lines, including those on lattice towers. The Project would not cause a substantial increase on the number of lattice towers within this corridor. This BBCM corresponds to requirements within MM BIO-10 of the FSEIS (BLM 2013b).

BBCM-2 *Implement measures to reduce or buffer adverse noise effects associated with operation of the facility on surrounding wildlife habitat. Noise impacts to birds (Rheindt 2003, Brumm 2004, Parris and Schneider 2009) and bats (Schaub et al. 2008) have generally been found to be negative; therefore facility design should*

take this fact into consideration when selecting the type of solar technology (such as photovoltaic panels vs. parabolic dish engines) to be used and the placement of the solar power plant within bird and bat habitats. The Project utilizes photovoltaic panel technology which has little potential for noise impacts. Noise impacts during construction would include noise generated from the operation of construction equipment and construction vehicles. The O&M phase of the Project would have little or no noise for both the solar farm.

BBCM-3 *Avoid the use of guy wires for all meteorological towers and do not light them unless the Federal Aviation Administration (FAA) requires them to be lit, which is generally >60 meters (>199 ft) AGL in height.* Any necessary guy wires on meterological towers should be marked with recommended bird deterrent devices (APLIC 2012, USFWS 2000).

BBCM-4 *Facility lights will be focused downward to reduce skyward illumination and keep light within the boundaries of the site. Lights should be equipped with motion detectors to reduce continuous illumination*. The Applicant and its contractors shall reduce night lighting in the proposed Project area and the surrounding non-developed areas to avoid unnecessary visual disturbance to wildlife. Night lighting during construction, operations, and maintenance shall be reduced in the proposed Project area and the surrounding non-developed areas using directed lighting, shielding methods, and or/reduced lumen intensity. The Applicant shall indicate anticipated measures to resource agencies for approval prior to construction. This BBCM corresponds to MM BIO-13 in the FSEIS (BLM 2013b).

BBCM-5 *Where feasible, place electric power lines underground or on the surface as insulated, shielded wire to avoid electrocution of birds. Use recommendations of the Bird Power Line Interaction Committee (APLIC 2012) for any required above-ground lines, transformers, or conductors*. Power lines will be in accordance with Bird Power Line Interaction Committee guidelines.

BBCM-6 *Avoiding the creation of roads to minimize further loss and fragmentation of migratory bird habitat.* New roads associated with Project activities will be kept to a minimum. Roads associated with the solar farm site will be within the Project fence whenever practical.

BBCM-7 *If evaporation ponds are required for the operation of the facility, placement of netting over the surface of the ponds has been encouraged to prevent birds and bats from contacting the water's surface*. There will be no evaporation ponds for operation of the facility. Temporary construction ponds will be used only during the construction phase. Ponds will be monitored for instances of avian mortality in lieu of utilizing exclusion netting.

BBCM-8 *Assessing the impact potential of solar panels to birds will help reduce the potential threats that these facilities pose to birds and bats*. Monitoring conducted during the construction phase and first year of the post-construction phase of the Project is discussed in Section 5.0 and will assist in determining whether the Project's photovoltaic panels attract birds and bats.

4.3 CONSTRUCTION CONSERVATION MEASURES

Bird and bat conservation measure that will be implemented during construction that relate to conservation include:

BBCM-9 **Road minimization.** Minimize permanent disturbance area such as creating unneeded access roads. The Gen-tie access road will serve as the main access road to SCE's switchyard. Construction of the gen-tie line and other linear features will avoid vegetation clearing, and grading whenever possible.

BBCM-10 **Vegetation clearing.** Vegetation within the Project footprint that will be disturbed will be cleared outside of the bird breeding season to the maximum extent practicable. If the Project plans vegetation removal within the bird breeding season (February 15- August 31 for passerines), it would be because desert tortoise (a federally and state threatened species) protection measures and timing may take precedence, or that reason for work to be completed during the breeding season were beyond the Applicant's control. When vegetation removal cannot take place outside of the breeding season the Lead Avian Biologist, or a person under their direct supervision, will be on site during construction activities to: locate active nests, establish exclusion zones around active nests, watch for new nesting activity; and if necessary stop, construction when noise and general activity threaten to disturb an active nest. All active nests of protected birds (e.g., MBTA, ESA, state protected) would not be disturbed until the nest is determined to be inactive by the Lead Avian Biologist. This BBCM corresponds to requirements contained within MM BIO-8 in the Project FSEIS (BLM 2013b).

BBCM-11 **Nest searching measures.** In areas with planned construction or other activities with potential to disturb nesting, surveys for avian nests will be conducted throughout the breeding season by the Avian Lead and Avian Biologists. A combination of full-coverage transect-based surveys and behavioral-based nest searches (Martin and Guepel 1993) will be used to locate nests active nests in the Project Site and surrounding 300-ft buffer. These nest searches will be continuous throughout the breeding season during the construction phase. The entire Project Site and buffer area should be covered at least once within 4 days prior to planned construction activities. Nest search surveys will contine within active construction areas at the discretion of the Project's Lead Avian Biologist.

Exclusion zones will be established around active nest sites. Details for specific exclusion zones for passerines, raptors and eagles are described in Section 4.4. Biological monitors working with construction crews will inspect work areas for nests and enforce exclusion zones found in the Project during construction and during nest searching efforts. This BBCS corresponds to requirements contained within MM BIO-8 in the Project FSEIS (BLM 2013).

BBCM-12 **Burrowing owl measures.** Within 30-days prior to initiation of construction, a burrowing owl survey will be conducted in the construction area and a 250-foot buffer. These surveys shall be performed using pedestrian transects spaced no greater than 20 meters apart. All burrows with burrowing owl sign will be observed by an Avian Biologist to determine occupancy. During the breeding season (February 1 to August 31), occupied burrows will not be disturbed. If an active nest is identified, there will be no construction activities within 250 feet of the nest to prevent isturbance until the chicks have fledged, as determined by a qualified biologist. The occurrence and location of any western burrowing owl will be documented by biological monitors in daily reports and submitted to the authorized biologist on a daily basis. Within 24 hours of all incidents of disturbance or harm to burrowing owls, the authorized biologist will report such incidents to the appropriate resource agencies (USFWS [Michael Burroughs 702 515-5230], BLM [Melanie Cota 702-515-5233], and NDOW [Christy Klinger 702-486-5127 ext 3717]). This BBCM corresponds to MM BIO-11 in the FSEIS (BLM 2013b).

BBCM-13 **Bat colonies.** Bat colonies have not been observed on site. However, in the event that a bat colony is found during pre-construction clearance surveys, the colony will be identified and clearly marked with an exclusion zone of at least 165 feet (50 meters). Whenever possible, these zones will be avoided by construction activities.

BBCM-14 **WEAP.** Discussions of nest avoidance for passerines, raptors, and golden eagles will be part of mandatory site training for all construction personnel and will be included in the Worker Environmental Awareness Plan (WEAP) training briefings. Bat colony avoidance discussions will be part of mandatory site training for all construction personnel and will also be included in WEAP training briefings. Training will include identification of exclusion zones and requirements for these zones.

BBCM-15 **Inclusion of APLIC guidelines.** The Project will follow APLIC guidelines for overhead utilities to the extent practicable (APLIC 2012) and reporting requirements.

BBCM-16 **Trash abatement.** During construction, all trash will be removed promptly and disposed of properly to avoid creating attractants for birds and bats. Trash and food items will be contained in closed, secured containers on site and removed

frequently to reduce the attractiveness to ravens and other opportunistic scavengers; regular litter pick-up schedule will be established within and around the perimeter of the Project site; all work vehicles will have a sufficient supply of durable garbage bags and closed containers to assist in collection of any refuse found on-site; trash and recycling bin locations will be selected to accommodate frequent pick up and removal and be able to be sealed completely to prevent encroachment by wildlife; and trash containers will be inspected daily by Biological Monitors (during construction and decommissioning). This BBCM corresponds to requirements within RMM-5 contained within the Silver State Solar South Raven Management Plan (Ironwood 2013)

BBCM-17 **Vegetation and Noxious Weeds.** Appropriate control measures will be implemented to prevent the introduction and spread of invasive plant species within and surrounding the Project Site. Only plants native to the area will be used seeding or planting during any required habitat revegetation and/or restoration efforts. A Noxious Weed Control Plan, corresponding to APM-9 in the FSEIS (BLM 2013b), will be developed and implemented.

BBCM-18 **Avian and Bat Fatality Monitoring.** An Avian and Bat Fatality Monitoring Plan (Appendix C) will be adopted. This plan will require monitoring and reporting of avian and bat fatalities. The project will apply for a Special Purpose Utility Permit (SPUT) through coordination with USFWS. This BBCM corresponds to MM BIO-10 in the FSEIS (BLM 2013b).

BBCM-19: **Removal of Hollow Plastic Mine Claim Markers**. Upon detection of an uncapped hollow plastic mine claim marker found within the Project area, construction personnel will inform an Avian Biologist or Biological Monitor and report the location of the marker. The Monitor or Coordinator will remove the marker and place it on the ground at the location from which it was removed. NDOW will be notified of any hollow plastic mine claim markers.

BBCM-20 **Additional avian and bat monitoring**. Additional avian and bat monitoring activities will be conducted as described in Section 5.0 of the BBCS.

BBCM-21 **Raven Management Plan**. A Raven Management Plan will be developed and implemented for the life of the Project (Ironwood 2012). The objectives of the RMP are to identifiy the Project-specific conditions of concern that may attract ravens to the Project site; provide specific measures intended to avoid, minimize, and/or mitigate raven impacts on desert tortoises; provide plans for monitoring raven activity at the Project site; specify plans for reporting frequency and content; and specify the conditions under which adaptive management measures will be selected and implemented, should the monitoring data suggest the original measures are not meeting Project goals in controlling local raven populations.

4.3.2 Operations and Maintenance

During the O&M phase of the Project, BBCMs will be enforced to reduce the attractiveness of the facility to breeding, migrating, and wintering birds and bats to ensure mortality is minimized:

BBCM-22 **Road kill management.** The Project will not create or maintain attraction features for birds and bats by removing and disposing of road kills near the Project that attracts raptors and other scavengers to the site, regularly removing vegetation around larger facilities such as substations to reduce raptor foraging, and eliminating open water sources after the construction phase of the Project.

BBCM-23 **Project Lighting.** The Project will minimize the use of lighting that could attract migrating birds and bats (feeding on concentrations of insects at lights). Lighting will be kept to the minimum level necessary for safety and security. High intensity, steady burning, bright lights such as sodium vapor or spotlights will not be used on Project facilities. Lighting will be motion-sensored where practicable and allowed by safety regulations. This BBCM corresponds to MM BIO-13 in the FEIS (BLM 2013b).

BBCM-24 **Anthropogenic noise.** The Project will minimize anthropogenic noise which been found to be potentially adverse for birds (e.g., Rheindt 2003, Brumm 2004, Parris and Schneider 2009) and bats (Schaub et al. 2008), though not all species are affected to the same degree (Brumm 2004). During the O&M phase, methods to buffer, muffle, or otherwise dampen any anthropogenic noise pollution that exceeds ambient noise will be considered and may serve as additional adaptive management measures.

4.3.3 Decomissioning

This BBCS is intended to provide bird and bat conservation measures applicable to the construction and operations and maintenance phases of the Project. Prior to decommissioning, a detailed decommissioning plan will be developed and bird and bat conservation measures specific to the decommissioning phase will be provided to the appropriate resource agencies at that time.

4.4 EXCLUSION ZONES

Exclusion zones will be established to protect active raptor and other bird nests, areas of high bird and bat use, and known bat roosts from disturbance related to the construction of the solar farm. Nest surveys will be conducted within 2 days prior to vegetation removal, construction activities, or any other activities with the potential to disturb nesting birds in order to locate any active nests, burrowing owl burrows, or bat roosts. Vegetation removal will occur outside of the breeding season for all protected bird and bats species to the maximum extent possible. If any active nests, roosts or burrows are located during these surveys, exclusion zones will be established by the Avian Lead in coordination with BLM.

Active bird nests shall be definied as nests containing at least one egg that is being incubated or belonging to a female in the process of laying. Inactive nests may be removed by the Avian Lead or Avian Biologists. The Lead Avian Biologist will be responsible for ensuring all exclusion zones are correctly established and Avian Biologists will monitor nest activity throughout the nesting cycle to determine potential disturbance level nest fate. Nest exclusion zones may be changed based on observed evidence of disturbance. The Avian Lead will also be responsible for managing the collection of data for these exclusion zones, nests, roosts and burrows.

4.4.1 Passerines

Exclusion distances for active passerine nests will be determined by the Lead Avian Biologist based on species, terrain, habitat type, and existing anthropogenic activity level as these features relate to the bird alert distance and bird flight initiation distance (Whitfield et al. 2008). Exclusion zones will initially be established upon discovery of an active nest minimum using a minimum 100-foot radius. Any changes in this minimum exclusion distance based on circumstances such as topography and type of construction activities would be determined by the Avian Lead. Nests will be checked within a week prior to construction to determine success and whether young have fledged. The exclusion zone boundary will not be removed until the Avian Lead 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 will be avoided within 500 feet of an active raptor nest and within one mile of any active golden eagle nest. Recommendations for appropriate buffer distances to minimize disturbance vary by geographical location and by activity, but are not explicitly stated in current USFWS guidance (USFWS 2013). Any changes in this buffer distance based on conditions such as topography and type of construction activities would be determined by the Lead Biologist. All nests will be checked within a week prior to construction to determine nest success and whether young have fledged. The exclusion zone boundary will not be removed until the biological monitor has determined that the nest has failed or the young have fledged. Surveys for golden eagle nests will be conducted during each year of construction, both within and outside the nesting season. These surveys and subsequent monitoring of active nests will be completed in accordance with current USFWS guidance and protocols (USFWS 2010) under the Ground-based Golden Eagle Nest Surveys and Monitoring discussed below in Section 5.1.2.

4.4.3 Burrowing Owls

All active burrowing owl burrows will be avoided with a 250-ft radius exclusion zone during the nesting season (February 1 – August 31st). All occupied burrows outside or adjacent to construction areas will be avoided with an exclusion of 165 feet during the non-breeding season (Sept 1-January 31). Any changes to these exclusion distances, based on circumstances such as topography and type of construction activities, would be determined by the Lead Biologist. Nests will be observed by an Avian

Biologist at least one week prior to construction or other activities with the potential to disturb the nest to determine success and whether young have fledged. The exclusion zone boundary will not be removed until the biological monitor has determined that the nest has failed or the young have fledged. Outside the nesting season or after determining a nest has failed or young have fledged, owls will be passively relocated after approval of specific methods by NDOW and BLM. Passive relocation will include:

- Identifying suitable relocation sites within one mile of the Project;
- Creating or enhancing at least two natural or artificial burrows per relocated owl;
- Passively relocating burrowing owls using accepted methods for excluding owls from burrows such as one-way doors or otherwise ensuring owls are not in burrows while burrows are collapsed; and
- Monitoring and reporting the results of the passive relocation including the number and original location of each owl, and known additional locations for each individual.

4.4.4 Bats

Construction activities will avoid any bat roost sites, maternity colonies, or hibernacula found during clearance surveys. Appropriate exclusion distances will be established by the Lead Bat Biologist in consideration of the disturbance type, distance to roost or hibernacula, time of year of, and the duration of the disturbance.

5.0 CONSTRUCTION AND POST-CONSTRUCTION MONITORING

A bird and bat monitoring program will continue to be implemented throughout the construction and for at least one year post construction, as specified below. The ongoing monitoring will inform adaptive management decisions regarding and additional appropriate and practicable BBCMs to avoid, minimize, and mitigation observed impacts to bird and bats on the Project Site and vicinity.

5.1 CONTINUATION OF BASELINE DATA SURVEYS

The following surveys conducted for the acquisition of baseline data will be continued during the Construction and Post-construction phases of the Project with modifications as described below.

5.1.1 Avian Point Counts

Avian point counts will continue to be conducted at the 64 sampling stations used during baseline surveys. Based on statistical power analyses discussed in Section 2.4.1, additional sampling stations will be needed in order to have sufficient likelihood of detecting meaningful changes in total avian density and detections per survey per point. Sixty-four additional sampling stations will be placed throughout the Study Area. The new points will be randomly placed on the landscape and stratified by the vegetation types described in Section 2.1. Existing points will be classified within these same vegetation types. These point count data are expected to provide a means of tracking temporal changes in avian density and occurrences throughout the progression of the project. During the construction phase and for the first one year post construction, point counts will continue to be conducted once per season in the spring, fall, and winter during the same weeks they were conducted in the pre-construction phase. Density estimates and detection data from the post-construction point counts may be used in conjunction with the data from the Avian Mortality Monitoring Plan to identify species with mortality risk disproportionate to their local population size.

5.1.2 Ground-based Golden Eagle Nest Searching and Monitoring

Golden eagle nest survey and monitoring will continue during the construction phase and for the first one year post construction. During the peak of each breeding season throughout the construction phase, an inventory of all golden eagle territories within 10 miles of Project facilities will be conducted to determine whether any territory is occupied (USFWS 2010). Potential golden eagle nesting habitat within 10 miles of the Project Site will be searched on foot for new active nests and to check historical nests. Data collected during the inventory shall include:

- Territory status (unknown, vacant, occupied, breeding successful, breeding unsuccessful);
- Nest location;
- Nest elevation;
- Age class of golden eagles observed;
- Nesting chronology; number of young at each visit;

- Digital photographs;
- Substrate upon which nest is placed; and
- Nesting status (active/nonactive and productivity).

If an occupied nest is detected during construction within 10 miles of any Project component, the Applicant will coordinate with BLM, USFWS, and NDOW for the duration of construction to ensure that construction activities do not result in injury or disturbance to golden eagles (USFWS 2010).

5.1.3 Incidental Sightings of Special Status Species and Fatalities

Throughout the construction phase of the Project, all incidental sightings of special-status bird and bat species and fatalities of all species will be recorded by Biological Monitors and Avian Biologists. Additionally, other non-biological project personnel will be instructed during the required WEAP training to report all observation of species fatalities to a Biological Monitor, Avian Biologist, or Avian Lead. All fatalities recorded during construction will be reported to the resource agencies. The Lead Avian Biologist will be responsible for keeping records and reporting these data. Incidental data would not be used in quantitative analysis; rather these data would be reviewed for evidence of general changes in species composition that could warrant more focused evaluation.

5.2 CONSTRUCTION AND POST-CONSTRUCTION MONITORING

To provide data on potential impacts to bird and bat resources during the construction and post-construction phases of the Project, additional monitoring efforts will be implemented as described below. Monitoring activities related to common raven management are described in the Silver State Solar South Raven Management Plan (Ironwood 2013).

5.2.1 Passerine Nest Surveys and Monitoring

Nest surveys and monitoring activities for passerine species are described above in Section 4.3 by BBCM-11.

5.2.2 Raptor Nest Surveys and Monitoring

In addition to the golden eagle-specific nest searching and monitoring described in Section 5.1.2, surveys and monitoring for other raptor nests within the Project Site and a 1-mile buffer will be performed during the construction phase of the project. These surveys will be conducted once per month during the raptor breeding season (February 1 to August 31) and will entail inspecting all potential structures and trees within the Project site and 1 mile buffer for the presence of raptor nests. Active raptor nests will be monitored twice per month to determine nest fate and make behavioral observations to evaluate the effectiveness of any associated exclusion zones.

5.2.3 Long-sit Migration Surveys/Eagle Counts

As recommended by USFWS Eagle Conservation Plan Guidance (USFWS 2013), long-sit migration surveys will be conducted in order to characterize non-breeding season golden eagle and raptor use of the Study Area during the construction phase and for one year post-construction. These surveys will be conducted once per week from September to December at two locations immediately adjacent to the Project Site. The survey locations will be consistent among years, and 1) allow wide expanse of observation area from a single point with visibility of the surrounding airspace, at topographic funnels or corridors such as ridges, cliff rims, or saddles in mountains; 2) be away from public view; and 3) afford a location where topographic and biological features are likely to be used by raptors during migration. Migration surveys are conducted weekly from each observation survey point from 15 March through 31 May (spring migration) and from 1 September through 15 November (fall migration). The survey will consist of an Avian Biologist remaining at a single survey point for 5 consecutive hours, recording all avian species observed passing through the survey area. Data will be collected on species, behavior (i.e. flying, foraging, perching), estimated distance from observed, estimated height off ground, flight directions, and weather conditions (USFWS 2013). Additionally, observers will record incidental observation of passerine species in order to characterize migratory bird use of the Study Area. The long-sit migration surveys are intended to replace the golden eagle point counts, used for establishing baseline conditions and conducted from 2012-2013.

5.2.4 Avian Mortality Monitoring Plan

Appendix C provides details of the avian and bat fatality study to be conducted during the post-construction phase of the project. This study will be implemented for two years post-construction with the potential for a third year contigent upon the findings from the first two years of surveys. Data and results of the study will be used to inform adaptive management decisions and serve as a basis for avian fatality comparisons across other regional renewable energy projects.

5.3 RISK ASSESSMENT VALIDATION

Using data collected throughout this process, the Applicant will attempt to validate the identified risks of the Project. The validation process will use data from the baseline surveys and ongoing monitoring to evaluate if the implemented conservation measures are adequately minimizing impacts to bird and bat resources to the maximum extent practicable, and if additional and appropriate conservation measures would likely further reduce avian and bat mortality rates.

Updates on risk assessment validation will be made during each annual report as described in Section 6.0.

5.4 ADAPTIVE MANAGEMENT

Silver State Solar Power South LLC has implemented adaptive management at the Project throughout pre-construction baseline data collection efforts and during project planning and siting. Adaptive management measures will be implemented during construction and for 1-3 years post-construction. This adaptive management approach will include the following six key concepts described by Williams and Brown (2012):

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

The Project will submit mortality survey results to the regulatory agencies on a quarterly basis. The BLM, in consultation with the Project Owner, USFWS and NDOW, will discuss the findings. Further avian and bat mortality monitoring for up to three years post-construciton may be implemented to help understand impacts.

Post-construction decision making is complex and the results of action implementation may require several years of assessment before results are apparent. 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).

After end of first year of post construction monitoring, the Project Owner will coordinate with BLM, NDOW, and USFWS to determine if additional monitoring would be required. If additional monitoring is required, triggers and thresholds for additional adaptive management measures will be established at that time.

6.0 REPORTING

Quarterly e-mail summaries of all biological monitoring activities will be submitted to BLM, USFWS, and NDOW by the Avian Lead. A specific section of these quarterly reports will document results of the avian and bat fatality study. The reports may also include recommendations for possible adaptive management actions.

On or before January 15th of each calendar year during the construction phase and for the first 1-3 years post-construction, an annual report will be submitted to the BLM that summarizes all avian and bat monitoring activities sufficient for the BLM to provide necessary reporting to the USFWS and NDOW in their annual permitting report, due on or before February 1 of each year. This annual report will summarize all quarterly reports and be submitted via e-mail and hard copy by the Avian Lead.

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Appendix A. List of Bird Species Observed at Silver State Solar South and Vicinity, 2011-2013

Common Name	Scientific Name	Sign
American Kestrel	*Falco sparverius*	O
Anna's Hummingbird	*Calypte anna*	O
Ash-throated Flycatcher	*Myiarchus cinerascens*	O,V
Barn Swallow	*Hirundo rustica*	O
Blue-Gray Gnatcatcher	*Polioptila caerulea*	O,V
Black-headed Grosbeak	*Pheucticus melanocephalus*	O
Brewers Sparrow	*Spizella breweri*	O,V
Broad-tailed Hummingbird	*Selasphorus platycercus*	O
Black-tailed Gnatcatcher	*Polioptila melanura*	O,V
Black-throated Sparrow	*Amphispiza bilineata*	O,V
Bullock's Oriole	*Icterus bullockii*	O
Burrowing Owl	*Athene cunicularia*	S
Cactus Wren	*Campylorhynchus brunneicapillus*	O,V,N
Canyon Wren	*Catherpes mexicanus*	V
Chipping Sparrow	*Spizella passerina*	V
Cliff Swallow	*Petrochelidon pyrrhonota*	O,V
Coopers Hawk	*Accipiter cooperii*	I
Common Raven	*Corvus corax*	O,V
Crissal Thrasher	*Toxostoma crissale*	
Golden Eagle	*Aquila chrysaetos*	O
Gray Flycatcher	*Empidonax wrightii*	V
Greater Roadrunner	*Geococcyx californianus*	V
Horned Lark	*Eremophila alpestris*	O,V
House Finch	*Carpodacus mexicanus*	O,V
House Wren	*Troglodytes aedon*	I
Ladder-backed Woodpecker	*Picoides scalaris*	O,V
Le Conte’s Thrasher	*Toxostoma lecontei*	O,V,N
Lesser Goldfinch	*Carduelis psaltria*	O,V
Lesser Nighthawk	*Chordeiles acutipennis*	O,V
Loggerhead Shrike	*Lanius ludovicianus*	O,V
Northern Flicker	*Colaptes auratus*	I
Mourning Dove	*Zenaida macroura*	O
Northern Harrier	*Circus cyaneus*	O

Common Name	Scientific Name	Sign
Northern Mockingbird	*Mimus polyglottos*	V
Osprey	*Pandion haliaetus*	I
Peregrine Falcon	*Falco peregrinus*	I
Phainopepla	*Phainopepla nitens*	O,V
Prairie Falcon	*Falco mexicanus*	I
Pine Siskin	*Spinus pinus*	O,V
Red-tailed Hawk	*Buteo jamaicensis*	O,V,N
Rock Wren	*Salpinctes obsoletus*	O,V
Ruby-crowned Kinglet	*Regulus calendula*	V
Sage Sparrow	*Amphispiza belli*	O,V
Sage Thrasher	*Oreoscoptes montanus*	I
Say's Phoebe	*Sayornis saya*	O,V
Scott's Oriole	*Icterus parisorum*	O,V
Sharp-shinned Hawk	*Accipiter striatus*	I
Tree Swallow	*Tachycineta bicolor*	I
Turkey Vulture	*Cathartes aura*	O
Verdin	*Auriparus flaviceps*	O,V,N
Violet-green Swallow	*Tachycineta thalassina*	O
Western Kingbird	*Tyrannus verticalis*	O
Western Meadowlark	*Sturnella neglecta*	I
Western Tanager	*Piranga ludoviciana*	O
White-crowned Sparrow	*Zonotrichia leucophrys*	O,V
White-throated Swift	*Aeronautes saxatalis*	O,V
Wilson's Warbler	*Wilsonia pusilla*	O,V
Yellow-rumped Warbler	*Dendroica coronata*	O,V
Yellow Warbler	*Setophaga petechia*	O

O – Observed Directly
V – Vocalization
N – Nest
I – Incidental Observation (not made during point count survey)
S—Sign (Burrowing Owl)

Appendix B. Summary of special status species occurrences, Silver State Solar South, 2011-2013

Species	Number of Observations		
	Fall (Sep-Nov)	Winter (Dec-Feb)	Spring (Mar-May)
Brewer's Sparrow	0	0	14
Burrowing Owl (burrows with sign)	4	0	4
Crissal Thrasher	0	0	2
Golden Eagle	0	2	2
Le Conte's Thrasher	5	0	25
Loggerhead Shrike	12	0	16
Long-eared Owl	1	0	0
Northern Harrier	4	0	0
Phainopepla	6	0	16
Prairie Falcon	0	0	1

Appendix C. Avian and Bat Mortality Monitoring Plan

Silver State Solar South Avian and Bat Mortality Monitoring Plan

Prepared for:

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1.0 OVERVIEW

Silver State Solar South Project (hereafter; Silver State or Project) is a solar power generating facility proposed by Silver State Solar Power South, LLC, in unincorporated Clark County, NV, near the interstate boundary of California and Nevada, east of Primm, NV (Figure 1). Silver State is anticipated to have a final development footprint of 2,427 acres, located on Bureau of Land Management (BLM) administered lands outside the boundaries of existing BLM Area of Critical Concern (ACEC) and Desert Wildlife Management Area (DWMA), and wilderness areas.

When complete, Silver State will include 1) a 250 MW fixed panel PV array solar farm with associated operations and maintenance buildings, 2) a 220kV on-site substation, and 3) approximately 1 mile of 220kv overhead interconnect to the existing Eldorado to Ivanpah transmission line.

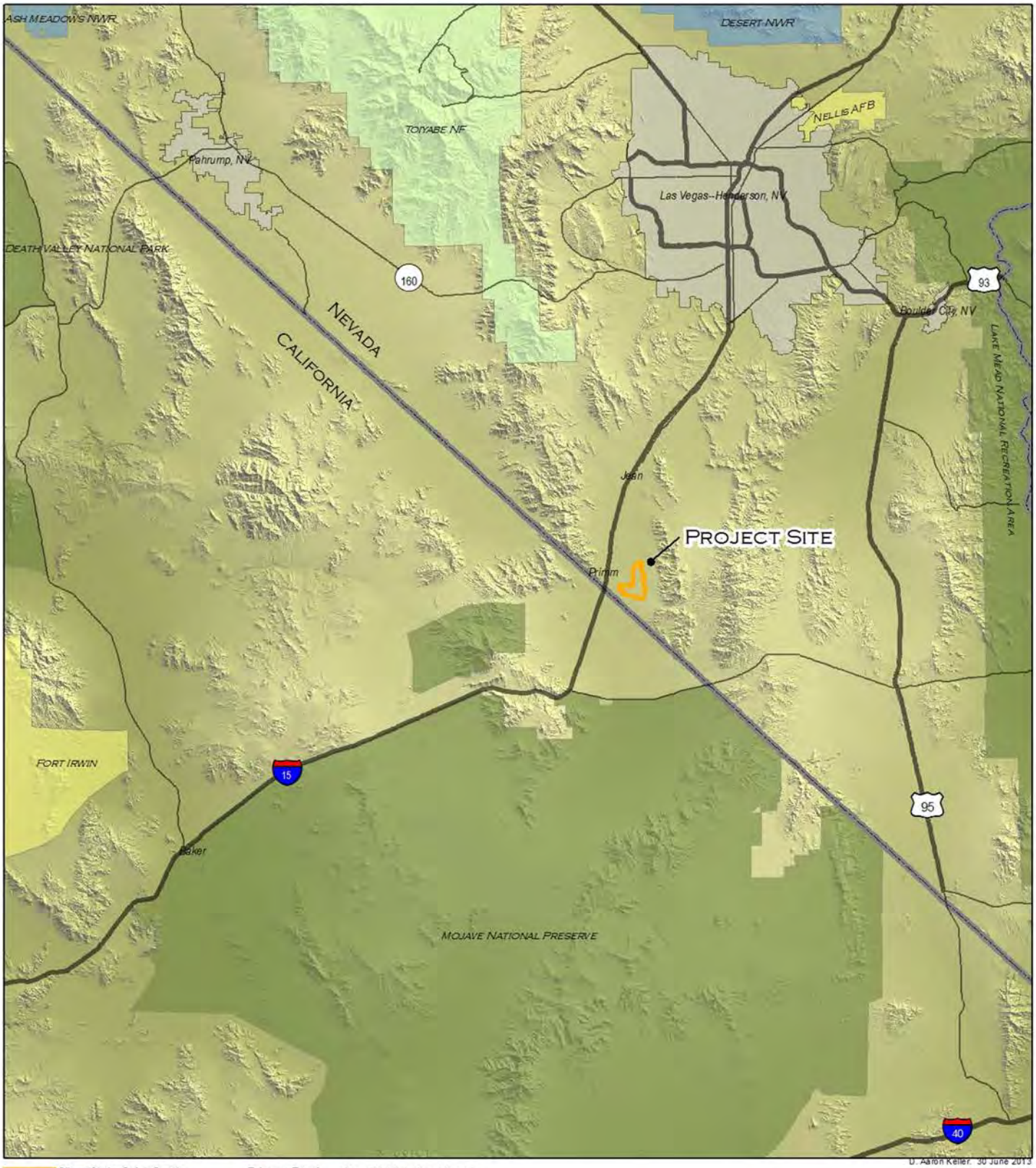
Some Project feature may present a potential risk for injury and mortality to birds and bats. Prerequisite to issuance of a right-of-way (ROW) permit (NVN-089530, NVN-085801, NVN-090050, NVN-090823), BLM requires a Bird Monitoring and Avoidance Plan (BMAP) to be developed in consultation with and approved by U.S. Fish and Wildlife Service (FWS) as a component of the Bird and Bat Conservation Strategy (BBCS). The avoidance component of the BMAP is addressed within the Risk Analysis segment of the BBCS and the monitoring component is presented herein, as the Avian and Bat Mortality Monitoring Plan (AMMP).

This AMMP will standardize the documentation of bird injuries and potential fatalities that may be associated with the development of Silver State and quantitatively estimate avian fatality at the facility once the Project is complete. The plan's design incorporates guidelines developed for the electric utility industries to mitigate the potential risks to birds and bats by the development of energy infrastructure such as wind turbines, transmission lines and solar panels. It includes survey protocols that:

- schedule carcass searches;
- describe a spatial and temporal sampling plan;
- detail methods for handling dead or injured birds and bats;
- specify the data to be collected;
- specify reporting procedures.

The AMMP also includes components that:

- validate the spatial and temporal sampling plan;
- correct for searcher efficiency;
- estimate carcass removal rates.



D. Aaron Keller. 30 June 2013

Silver State Solar South
State Boundary
Primary Road
Secondary Road
Urban Area

Non-BLM Federal Lands
Department of Defense
USFWS
USFS
NPS

N

0 5 10 20 30 Miles
1:750,000
1 in = 12 miles

FIGURE 1 - REGIONAL SETTING

SILVER STATE SOLAR SOUTH | CLARK COUNTY, NEVADA

2.0 OBJECTIVES

The primary objective of the AMMP is to provide information used to assess the level of potential impact from the solar facility on birds and bats, and to determine the need, if any, for impact reduction measures supplmental to those contained in the BBCS. This will be achieved by implementing an avian and bat fatality monitoring program at the facility that consists of standard carcass searches to record carcasses, and bias trials to adjust the observed carcass counts for detection and scavenging rates. Analyses will be conducted to:

- quantify bird and bat fatalities
- quantify fatalitesof species of concern
- if sufficient data are available, compare fatality rates at Silver State with those of existing projects with similar site characteristics and species composition
- use data from ongoing point count surveys to compare recorded fatalities with the species composition (resident and migrant) at the site.

Actual numbers of fatalities will be quantified and reported. The sampling design will estimate fatality rates with a high level of precision. Fatality rates will be reported with a confidence interval.

3.0 PROJECT SITE DESCRIPTION

3.1 ENVIRONMENTAL SETTING

Silver State is located in the Ivanpah Valley, within the Mojave Desert bioregion on undeveloped gentle slopes between 2600 feet and 3500 feet in elevation at the base of the Lucy Gray Mountains, intersected by numerous alluvial dry washes, which drain to Roach Dry Lake to the north and Ivanpah Dry Lake to the south. Streams, washes and playas are dry most of the year, with surface water present only following storm events. The most prevalent vegetation communities are dominated by creosote bush (*Larrea tridentata*) and white burro bush (*Ambrosia dumosa*).

Anthropogenic features are found throughout the Ivanpah Valley, but are concentrated near developed areas associated with Primm, NV. The existing casinos, restaurants, outlet mall, gas stations and other facilities (located within 1.5 miles of the Project boundary) represent the core area of human activity within the valley.

Water bodies within arid landscapes are attractants for many species of migratory birds. Although the Project Site contains no persistent natural surface water two sources of surface water are present within the vicinity of the site: 1) the Walter M Higgins NV Engergy Generating Facility has an assoicated suface pond located adjacent to the Project Site and 2) the Primm Valley Golf Course, located south of Primm and within 4 miles of the Project, contains water features and large mature trees that may be used by birds for roosting and/or nesting. Temporary artificial ponds with associated exclusion fencing, constructed on the Project site to provide construction water for the Silver State solar project may

present a potential avian hazard during construction. These ponds will be removed at completion of construction.

3.2 SITE DEVELOPMENT

The solar facility will be composed of PV arrays mounted on fixed-tilt mounting systems, supported on metal posts within approximately $2m^2$ of bare, compacted ground and connected in rows of uniform length and height. High-voltage (34.5 kV) collection lines will transfer power output from the PV arrays to the onsite substation via overhead lines supported by approximately 16m-tall wooden poles. The 1-mile long Gen Tie Line, will consist of steel monopoles approximately 40m-tall and spaced approximately 300m apart, and will occupy a 49m-wide transmission ROW connecting the on-site substation to a Southern California Edison (SCE) switchyard and related facilities (loop-in lines, telecommunications site, microwave site, fiber optic installation and separate access road) located adjacent to the Eldorado-Ivanpah Transmission Project (EITP).

Ancillary features will include approximately 21 miles of new access roads, a 1.4m high chain-link perimeter fence, a 3 mile long security perimeter road, and buildings for operations, maintenance, and security personnel.

3.3. AVIAN AND BAT USE OF SILVER STATE

Baseline pre-construction avian surveys collected data in spring seasons of 2008, 2009 and 2011, and in 2012 (Ironwood Consulting). Observed avian use of the project was typical of other creosote-scrub and playa desert communities. Avian surveys and incidental detections have documented 59 bird species within the Project Study Area, including 10 special-status species. An additional 4 special status avian species were not detected within the Project Study Area but were determined to have moderate potential for occurrence: ferruginous hawk (*Buteo regalis*), Swainson's hawk (*Buteo swainsoni*), western snowy plover (*Charadrius alexandrines nivosus*), and Bendire's thrasher (*Toxostoma bendirei*) (Table 1).

Table 1. Special status avian species.

Scientific Name	Common Name	Status	Occurrence within Study Area
Aquila chrysaetos	golden eagle	BLM: Sensitive IUCN: LC	**Present – Resident** Nesting habitat absent within Project alternatives, but 5 historical abandoned nests and one active (2013) nest located within 5mile buffer. Foraging habitat present.
Asio otus	long-eared owl	BLM: Sensitive IUCN: LC	**Present—Possible Resident** One individual observed adjacent to site during non-breeding season. No observations of breeding individuals.
Athene cunicularia	western burrowing owl	BLM: Sensitive IUCN: LC USFWS:BCC	**Present – Likely Resident** Four observation of burrowing with owl sign during surveys. May be present throughout year. Nesting habitat present.
Buteo regalis	ferruginous hawk	BLM: Sensitive IUCN: LC USFWS:BCC	**Not observed – Low Potential** Nesting habitat absent. May use site vicinity for overwintering.

Scientific Name	Common Name	Status	Occurrence within Study Area
Buteo swainsoni	Swainson's hawk	BLM: Sensitive IUCN: LC USFWS:BCC	**Not observed—Likely Migrant** Not observed on site, but two individuals were observed in migration approximately 5 miles west of the site in 2011. Nesting habitat absent. May be present (foraging) during summer and fall during migration.
Charadrius alexandrinus nivosus	western snowy plover	BLM: Sensitive ESA: Threatened USFWS:BCC	**Not observed – Low Potential** May be a rare migrant to Ivanpah Dry Lake during winter months.
Falco mexicanus	prairie falcon	BLM: Sensitive IUCN: LC USFWS:BCC	**Present – Foraging** One individual observed on site. Foraging habitat present. Nesting substrate present in the Project Site in the form of transmission towers.
Falco peregrinus anatum	peregrine falcon	BLM: Sensitive NDOW: SE USFWS:BCC	**Present – Migration** Known to be present in area during migration from 4 observations made approximately 5 miles southwest of site. Known to be present and breeding in the area year-round in the South Spring Mountains and MuCullough Mountains. Nesting habitat absent from site. Nesting habitat absent from site.
Lanius ludovicianus	loggerhead shrike	BLM: Sensitive NDOW: SS IUCN: NT USFWS:BCC	**Present –Resident** Individuals have been observed on the Project Site throughout the year. Common on site.
Phainopepla nitans	phainopepla	BLM: Sensitive IUCN:LC	**Present—Resident** Observed on site during breeding season. Nesting habitat present.
Spizella breweri	Brewer's sparrow	BLM:Sensitive NDOW: SS IUCN: LC	**Present—Resident** Observed on the Project Site.
Toxostoma bendirei	Bendire's thrasher	BLM: Sensitive IUCN: VU USFWS:BCC	**Not observed - Moderate Potential** Nesting habitat present.
Toxostoma crissale	crissal thrasher	BLM: Sensitive IUCN: LC USFWS:BCC	**Present—Possible resident** One individual has been observed on the site, mid-March 2013.
Toxostoma lecontei	Le Conte's thrasher	BLM: Sensitive IUCN: LC USFWS:BCC	**Present –Resident** Individuals have been observed on the Project Site throughout the year. Nesting habitat present.

NDOW- Nevada Department of Wildlife
SE – State Endangered
SS – State Sensitive
USFWS - Fish and Wildlife Service
BCC - Birds of Conservation Concern

IUCN - International Union for Conservation of Nature
LC – Least Concern
NT – Near Threatened
VU – Vulnerable

Black-throated Sparrow, Common Raven House Finch Horned Lark, and Rock Wren were the most common species detected.

As the primary avian scavenger in the area, Common Ravens have the potential to influence carcass removal rates. A Raven Management Plan has been prepared for the project (Ironwood Consulting 2013) and will be implemented to minimize site-wide occurrence of Common Ravens. Ravens occur throughout the site in low numbers and are relatively common in the area and may be attracted to the area from nearby Primm; where Ravens are heavily subsidized by the presence of humans.

Bat surveys have not been conducted on the Project Site. A review of existing data pertaining to the vicinity of the Project Site (Brown 2011) and region (Tetra Tech 2012) revealed 16 bat species with potential to occur within the Project Site. Species were included in this list if they had been observed

during at least one of the two referenced studies and were determined to have potential for occurrence on the project site. No mines are located within the Project Study Area.

Table 2. Bat species with potential for occurrence on Project Site.

SPECIES	STATUS		OCCURRENCE
Antrozous pallidus Pallid bat	Federal: BLM: NDOW:	SOSC sensitive SP	Moderate potential to occur within rocky substrate in upper elevations of the Study Area. Observed within 5 miles of site (Brown 2011). Observed year-round at Searchlight Wind Energy Project site (Tetra Tech 2012).
Corynorhinus townsendii Townsend's big-eared bat	Federal: BLM: NDOW:	SOSC sensitive SS	Low potential for occurrence. Large cavities for roosting and hibernation not located within Study Area. No observations from referenced studies (Brown 2011, Tetra Tech 2012).
Eptesicus fuscus big brown bat	Federal: BLM: NDOW:	none none none	Some potential to occur on site based on observations year-round at Searchlight Wind Energy Project site (Tetra Tech 2012).
Eumops perotis californicus greater western mastiff bat	Federal: BLM: NDOW:	SOSC none SS	Observed during migration at Searchlight Wind Energy Project site (Tetra Tech 2012).
Lasiurus blossevillii western red bat	Federal: BLM: NDOW:	none sensitive SS	Potential to ocurr on site during migration. Observed during migration at Searchlight Wind Energy Project site (Tetra Tech 2012).
Lasiurus cinereus *Hoary bat*	Federal: BLM: NDOW:	none none none	Observed during migration at Primm Valley Golf Course within 4 miles of the site (Brown 2011). Observed during migration at Searchlight Wind Energy Project site (Tetra Tech 2012).
Lasionycteris noctivagans silver-haired bat	Federal: BLM: NDOW:	none none none	Observed during migration at Searchlight Wind Energy Project site (Tetra Tech 2012).
Macrotus californicus California leaf-nosed bat	Federal: BLM: NDOW:	SOSC none SS	Some potential to occur on site based on observations year-round at Searchlight Wind Energy Project site (Tetra Tech 2012).
Myotis californicus California myotis	Federal: BLM: NDOW:	none none none	Moderate potential to occur within rocky substrate in upper elevations of the Study Area. Has been detected within 5 miles of site (Brown 2011). Observed year-round at Searchlight Wind Energy Project site (Tetra Tech 2012).
Myotis ciliolabrum western small-footed myotis bat	Federal: BLM: NDOW:	SOSC sensitive none	Moderate potential to occur within rocky substrate in upper elevations of the Study Area. Has been detected within 5 miles of site (Brown 2011). Observed year-round at Searchlight Wind Energy Project site (Tetra Tech 2012).
Myotis thysanodes fringed myotis	Federal: BLM: NDOW:	SOSC sensitive SP	Observed during migration at Searchlight Wind Energy Project site (Tetra Tech 2012).
Myotis yumanensis Yuma myotis bat	Federal: BLM: NDOW:	SOSC sensitive none	Moderate potential to occur. Individuals were detected near Primm Valley Golf Course within 4 miles of site (Brown 2011). Observed year-round at Searchlight Wind Energy Project site (Tetra Tech 2012).

SPECIES	STATUS		OCCURRENCE
Nyctinomops femorosaccus pocketed free-tailed bat	Federal: BLM: NDOW:	none none none	Observed during migration at Searchlight Wind Energy Project site (Tetra Tech 2012).
Nyctinomops macrotis big free-tailed bat	Federal: BLM: NDOW:	SOSC none none	Observed during migration at Searchlight Wind Energy Project site (Tetra Tech 2012).
Parastrellus hesperus western pipistrelle	Federal: BLM: NDOW:	None none none	Some potential to occur on site based on observations year-round at Searchlight Wind Energy Project site (Tetra Tech 2012).
Tadarida brasiliensis Brazilian free-tailed Bat	Federal: BLM: NDOW:	none sensitive SP	Moderate potential to occur within rocky substrate in upper elevations of the Study Area. Has been detected within 5 miles of site (Brown 2011)

FWS - U.S. Fish and Wildlife Service
NNHP - Nevada Natural Heritage Program
MSHCP –Clark County Multiple Species Habitat Conservation Plan
Protected - NRS 501

FWS Classification
SOSC- Species of Special Concern

NDOW Classification
SS- State Sensitive
SP- State Protected

Data from large solar arrays in California suggest there is very low bat mortality ratesassociated with PV projects. For example, the Desert Sunlight Solar Project recorded approximately 75 bird carcasses within an approximate 4,000 acre site over a two-year period (September 2011 through August 2013), while only a single bat carcass (Pallid bat, unknown causes, undeveloped desert) was identified over the same period. (Ironwood Consulting unpublished data, 2013).

4.0 SURVEY METHODS

Few avian and bat fatality studies have been conducted at large-scale PV solar facilities since few of those facilities have been completed. Most post-construction mortality studies for renewable energy projects to date have been conducted on wind energy facilities. Additionally, although FWS has issued monitoring guidance for wind energy projects, similar guidelines for solar projects have yet to be completed.

4.1 SPATIAL CONSIDERATIONS

Sample spatial designs for estimating post-construction impacts to birds and bats at wind-energy projects assume irregular distribution of injured birds (concentrations proximal to very tall turbines).

The comparatively uniform distribution of potential hazards in a PV installation (low installed height on relatively flat terrain), coupled with incidental observations from a small number of existing large-scale PV installations, suggests the potential for a more random distribution of avian mortality from a broader species spectrum across a PV project such as Silver State. This uniformity encourages a simple spatial sampling method constrained only by the physical layout of the installed panels and the limits of observer acuity. Statistical simulations conducted by Western Ecosystem Technology Inc. (Western Ecosystems Technology 2011) to understand the expected precision for the nearby Ivanpah solar project suggests that a sample of between 10% and 20% of the solar arrays should lead to reasonable precision in the fatality estimates.

- During the first year, the AMMP will sample 25% of project components including: solar arrays, perimeter fence and overhead powerlines, once construction activities at the facility have been completed. After one year, sampling effort will be re-evaluated and scaled back if appropriate. Sampling effort can be assessed by re-sampling subsets of the monitoring data and calculating variance in the estimates. Variance will decrease as sampling intensity increases up to a point; at this point, additional sampling does not improve the precision of the estimate.
- Carcass detection rates and precision will be assessed following the first round of searcher efficiency trials, and these data will be used to inform a sample size equivalent to 25% of Project components as described in section 4.3.

4.2 TEMPORAL CONSIDERATIONS

The length of time for which carcasses persist in the environment varies according to factors such as specimen size, weather, and scavenging; with larger carcasses persisting for several weeks and smaller carcasses often being removed from the environment within days (FWS 2012). Data from wind energy projects in the Mojave Desert (Chatfield et al. 2009, 2010; Thompson and Bay 2012) suggest average carcass persistence times of 29 days and 10 days for large and small birds respectively. However, a uniform, arid solar field mostly covered with PV panels, within a region supporting low avian abundance, and surrounded by a chain-link fence offers minimal foraging habitat for avian scavengers (mostly Ravens) and may reduce opportunities for terrestrial scavengers (mostly kit fox and coyote). The Silver State Solar Raven Management Plan will further deter avian scavenging and support a longer search interval.

Preliminary incidental data from Desert Sunlight (Ironwood Consulting, Appendix 2) supports reduced survey frequency from December through February due to corresponding seasonal reductions in transient avian movements during winter. Survey intervals will be based on the results of carcass removal trials (see Section 5.4). The BLM will be notified as soon as surveys intervals have been decided in order to provide justification for the determination.

Survey days will be spaced approximately evenly within interval periods to eliminate bias from irregular peak avian events that occur in response to meteorological and lunar conditions, and migratory pulses.

Results will be analyzed after the first quarter, and then after every quarter thereafter for the duration of the monitoring effort, in order to validate the search effort and adjust (if necessary) survey intervals to account for carcass persistence assumptions.

4.3 PROJECT COMPONENT SURVEY METHODOLOGIES

Surveys will occur within the solar arrays, under overhead power lines, and along the perimeter fence. Surface ponds are temporary during the construction phase and, therefore, will not be surveyed as part of this AMMP during the post-construction phase. The surface ponds will be monitored daily during the construction phase as specified in the BBCS. Project components surveyed as part of the AMMP may change as a result of ongoing agency consultation

4.3.1 Solar Arrays

PV modules are installed on an elevated rack support system mounted on metal posts which are driven into the ground, forming rows approximately 70m long and 3m wide, with a minimum height of approximately 1.5m. Rows are grouped into arrays which cover approximately 6-7 acres. Pedestrian access between rows is a simple unobstructed linear path, and trial surveys conducted by Ironwood Consulting at Desert Sunlight Solar Farm (Desert Center CA) indicated surveyors can accurately sample an 8m wide belt transect in one pass.

4.3.2 Overhead Power Lines

Overhead power lines present a potential collision threat both inside the solar farm, where 34.5kV lines connect array blocks to the onsite substation, and outside the solar farm, where a 220kV line transmits energy to the SCE switch yard. Distribution of birds killed or injured as a result of colliding with overhead lines depends on several factors, including species, flight speed, wind and height of the lines above ground. Overhead lines within the solar farm are typically suspended on wood poles (>16m high) alongside access roads where an absence of vegetation enhances search detections, but along the Gen Tie line, taller (>40m) monopole support structures spaced more widely (>275m) over uneven terrain and vegetative cover will reduce sample efficiency. To account for these differences:

- Surveys of overhead lines within the solar farm be conducted as a transect centered at 7m on each side of the line – surveyed as one return trip over a segment of distribution line the full length of an array. The nominal width of each transect will be 10m.
- The Gen-tie line will be divided into 20 segments of equal length.
- A start segment will be randomly selected and the sample area will be comprised of 2-4 stratified segments.
- Stratified random sampling will provide spatial representation of the site.
- Surveys along the Gen-tie line will be conducted as a 40m wide belt transect with passes centered 10m apart (at 5m and 15m respectively) on each side of the line.

4.3.3 Perimeter Fence

Silver State is bounded by 3 miles of 1.4m-high chain-link security fence. Fences that interrupt unbroken, open expanses, with few intervening obstacles 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 phenomonen 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 perimeter fence will be divided into 20 segments of equal length. A start segment will be randomly selected and the sample area will be comprised of 2-4 stratified segments.Stratified random sampling will provide spatial representation of the site.
- Surveys of perimeter fencing will be conducted as a two 10m wide transects. One transect will be centered 5m from the fence line, outside of the project footprint and the second transect will be centered 5m from the fence line inside the project footprint. Surveyors will search 5m on either side of the transect line. Both transects will cover the same predetermined segments.

5.0 SURVEY PROTOCOL

The sampling design is intended to optimize efficiency and spatial coverage of the study site. Good spatial coverage is important because it is unknown whether fatalities may be spatially heterogeneous due to landscape/habitat factors, or edge effects; or at what scale (project, block or array) edge effects may be a factor.

The following terminology is useful for describing the spatial sampling design that will be used to monitor the solar arrays for fatalities:

1) Module: an engineered PV cartridge assembly installed as a single unit (approximately 1.22 x 0.61 m or 4 x 2 ft)

2) Row: a collection of modules arranged side by side on a common, linear support structure (table) (approximately 71-73 m or 232-240 ft long)

3) Subsection: a collection of rows surrounded on all sides by open access routes; dimensions are uniform within blocks but vary slightly among blocks (dimensions are on the order of 71-73 x 84-87 m or 232-240 x 274-288 ft)

4) Array: a collection of four subsections connected to a common power converter station (PCS) and transformer, encompassing 2.4–2.8 ha (6–7 acres), depending on subsection dimensions and spacing between subsections. It is the sampling unit for analyses (n = 192 total units in the Solar Farm)

Assuming 20 rows of modules in a subsection, each array consists of approximately 20 x 71 x 4 = 5,680 meters of 4-m wide strips between rows (figure 1), plus about 350 m of interior roads between subsections. Based on the disk and roll site preparation, it is assumed an observer can detect a small bird out to a range of 20 m and will be tested as part of the study design.

5.1 CARCASS SEARCHES

Searchers will walk transects that are perpendicularly oriented with respect to the rows, and that follow interior subsection edges within each array (Figure 1).

Searchers will look down each row in turn for carcasses. Searchers will carry binoculars to aide identification of carcasses. This system will produce coverage of 20 rows x 20 m x 4 subsections = 1600 meters (14%) of the strips between rows. This sampling strategy will allow searchers to search every array on the property. In addition, the broad spatial acreage increases the chances of detecting a large but localized mortality event. For statistical purposes, sampling units will be whole arrays.

The proposed design is a distance-sampling design. To complete a distance sample a searcher walks a transect and records the distance from transect to all observed carcasses. Two important assumptions required for distance sampling are 1) that the probability of detection along the transect (0 m from the observer) is 1.0, and 2) that the probability of carcass presence is uniform along the transect. Detection is assumed to decrease as a function of distance from the transect, and the analysis of distance sampling involves estimating the function, p(x), that describes how probability of detection (p) varies with distance from the transect (x). It is then possible to calculate the number of carcasses that were not detected, based on the prevalence and distribution of carcasses that were detected.

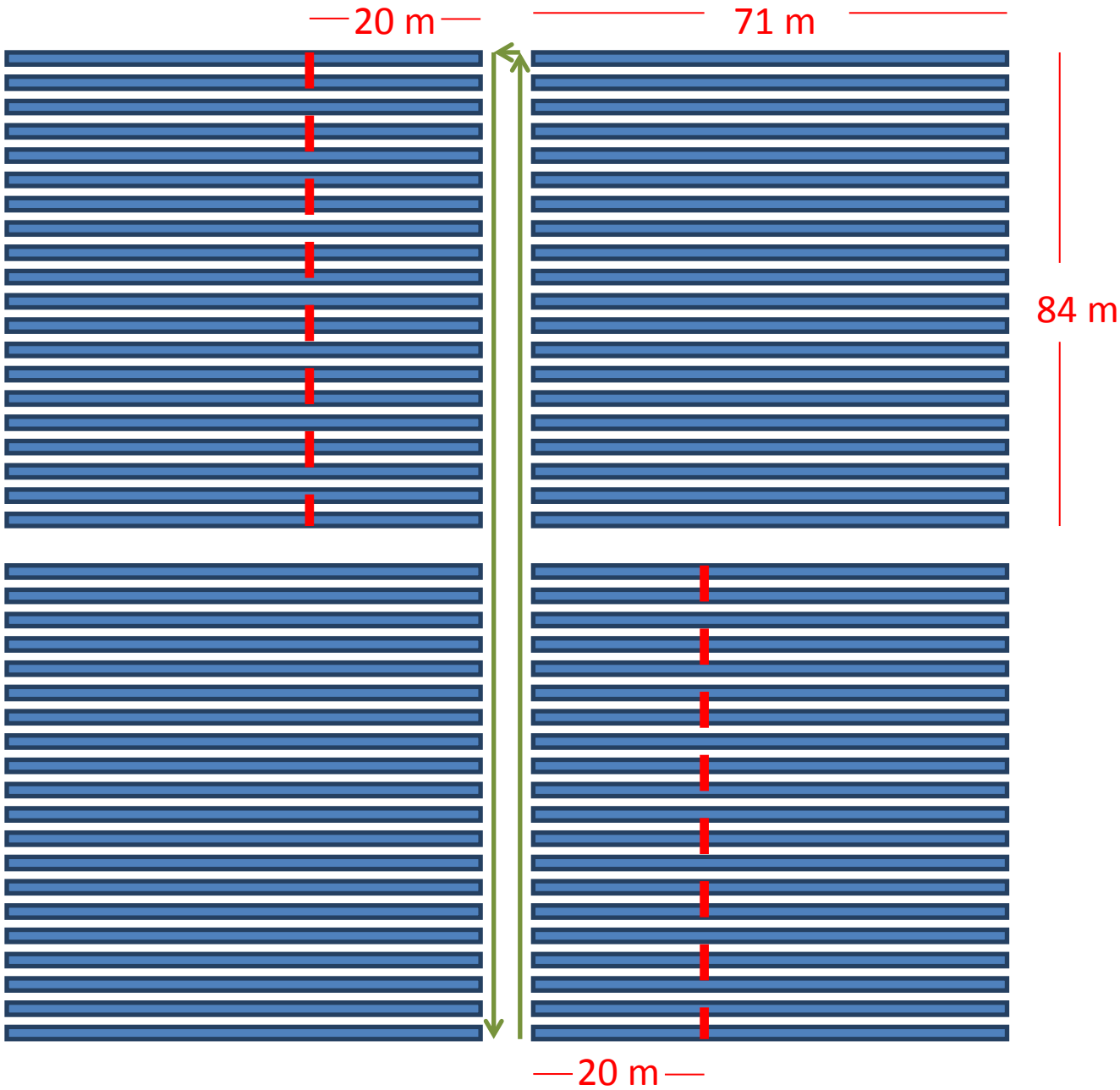


Figure 2. Layout of rows (blue strips), and subsections within arrays. Green arrows indicate travel pattern for searchers, and red dashed lines indicate the extent assumed to be searchable.

5.2 DATA COLLECTION

Surveyors will record data dectection data on a standardized form (Appendix 1). To conform to requirements from wildlife agencies (WLA), data collection will include:

- Surveyor name
- Discovery date and time
- Species
- Sex and age (if determined)
- Cause of death or injury (if determined)
- GPS waypoint of find (WGS84 datum)
- Nearest project component (PV array, power line, power line structure, building, fence, pond, materials storage, vehicle /equipment, other
- Distance to nearest project component
- Distance to nearest PV panel
- Identifiers for photographs taken in situ (close and wide)
- Observed weather (% cloud, temperature, wind)
- moon phase (C, Q, F, N)
- precipitation within previous 24 hours, and since previous survey
- Sustained high winds during previous 24 hours, and since previous survey
- Condition of specimen -
    - alive, no sign of physical trauma
    - dead and intact
    - dismembered
    - feather pile*
    - injured but alive
- Disposition of live bird/bat
    - released
    - sent to rehab
- Estimated Time since death
    - < 1 day (no rigor mortis)
    - 1 day (rigor mortis, no odor)
      2-3 days (odor present, eyes dried /missing)
    - 3-5 days (strong odor, decomposing)
    - Unknown (feather pile*/drowning)
    - N/A (animal still alive)
- Evidence of scavenging (Y/N)
- Additional relevant comments to support the recorded information.

*A feather pile consists of a minimum of 10 feathers, all found within 5m of each other, and must include at least 2 primaries or 5 tail feathers.

All specimen collectors will be covered under appropriate federal and state salvage or scientific collecting permits that authorize removing from the field all carcasses discovered during the study. Any species not authorized for collection under such permits will be photo-documented, left in place, and reported to appropriate agencies within 48 hours. Collectors will place all discovered carcasses in zip-

locked plastic bags, clearly label each bag with the incident number, and then deliver the bags for storage within a designated freezer at the facility. Injured birds/bats will be transported by qualified individuals to the nearest permitted rehabilitation facility for proper care. From the Project site, the closest rehabilitation facilities capable of handling avian species are:

- Wild Wing Project, Las Vegas, 702-238-0570 (non-raptors)
- Havasu Wildlife Rehabilitation Center, Lake Havasu, 928-855-5083 (all birds, incl. raptors)

5.3 SEARCHER EFFICIENCY TRIALS

It is assumed that as a result of varying surveyors, habitats, lighting, and carcass characteristics, not every avian or bat fatality will be found. However, by quantifying searcher efficiency (the ability of surveyors to detect carcasses of varying sizes under varying condition) and correcting for detection biases, an adjusted fatality estimate can be determined.

In principle it is not necessary to estimate searcher efficiency for a distance sampling design. However, distance sampling assumes that the sample of carcasses will be large enough to reliably fit the detection function. In the event that data are too sparse to estimate this function, and as a secondary check on the analysis, it is prudent to estimate searcher efficiency independently.

Searcher efficiency trials may be conducted concurrently with carcass searches, and searchers will be 'blind' to the presence and locations of trial carcasses. On the morning before searches an individual not involved with the search will place trial carcasses within arrays to be searched that day. Carcass locations will be randomly generated, and distances from the walking transect will vary between 0 and 40 m. At present the assumption is that searches will be effective to 20 m, but the effective search distance is still unknown, and may well be greater for large birds. Conducting searcher efficiency trials out to 40 m will resolve these uncertainties. Carcasses will be distributed on at least four separate dates and will include at least ten each of small and large sized birds. All searchers will be exposed to both sizes of carcass, so that an integrated estimate of staff searcher efficiency can be calculated.

Trial carcasses will be:

- discreetly marked so they may be identified as trial carcasses when found
- randomly distributed at GPS-recorded locations within search plots (by a person not taking part in the survey)
- dropped from waist height such that they land in a natural manner (to simulate a fall from a collision)
- promptly retrieved after surveys, if not found during surveys

Trial carcasses will be retrieved on the same day, after searches have been completed. Immediate carcass retrevial serves the dual purpose of verifying availability of carcasses that were not detected, and removing scavenger attractants from the site.

Uniformity of the solar farm landscape throughout the year suggests that searcher efficiency trials should not to be repeated in every season. Nevertheless, searcher efficiency trials will be conducted at least twice per year, every year, to ensure data integrity and will be conducted for all new search personnel. Differing conditions, such as vegetation densities, topography and transect width, demand independent searcher efficiency trials be conducted in order to produce sound data analysis. Specifically, trials will be needed for each stratum: 1) PV arrays , 2) along perimeter fence lines, 3) along overhead lines, and 4) gen-tie line. The goal will be to place approximately 15-20 small and 15-20 large carcasses within each of the stratum, for a total of 180-240 carcasses. If detection rates are similar among strata, pooling of information may occur, and sample sizes may decrease if future years. When available in sufficient sample sizes, bat carcasses may also be used during the searcher efficiency trails.

The desert landscape surrounding the Project generally exhibits little seasonal change, likely reducing the seasonal variability in carcass removal and searcher efficiency rates. This assumption can be tested seasonally during the first year of trials. Substrate within the solar facility is not anticipated to significantly change over the period of this plan. Adjustments in searcher efficiency trials may be necessary to adjust for changes in visibility should significant ground cover be permitted to emerge.

5.4 CARCASS REMOVAL TRIALS

It is assumed that not every avian or bat fatality will be discovered before the carcass is no longer present. By quantifying the length of time a carcass remains in the study area and is available for detection, an adjusted fatality estimate can be determined. Carcass removal will be quantified separately for small and large birds. At least ten fresh carcasses in each size class will be distributed in each season to assess carcass removal throughout the year, and carcasses will be dispersed to random locations throughout the study site and a few at a time to avoid affecting scavenger behavior. Carcasses will be checked on days 1, 2, 3, 4, 5, 7, 9, 11, 13, 15, 22, 29 and 36 after placement and at each visit will be scored as present, scavenged, or removed. Carcasses still present after 36 days will be removed from the study site.

Carcass removal trials will be conducted once per season throughout the study period, with carcasses scattered within search plots and overhead power line transects. Trial carcasses will be:

- discreetly marked so they may be identified as trial carcasses when found
- randomly distributed at GPS-recorded locations within arrays that are not a part of a mortality survey area
- dropped from waist height such that they land in a natural manner (to simulate a fall from a collision)
- checked daily for the first five days
- checked every other day between day 7 through day 15
- checked every 7th day between days 22 and 36
- retrieved on Day 36 if still present.

An estimator will be applied that is suitable for the proposed sampling design and associated trials. The most current models such as the USGS fatality CMR model (http://www.mbr-pwrc.usgs.gov/software.html) or Shoenfeld estimator will be considered.

5.5 Data Reporting

The Silver State Lead Avian Biologist will report all documented bird injuries and fatalities to the FWS Bird Fatality/Injury Reporting Program (https://birdreport.fws.gov/ BirdReportFAQs.cfm) on a monthly basis. Additionally, all mortality data will be submitted into an internal electronic database designed to assist a results analysis.

The Avian Lead will compile all Project-related bird fatalities and/or injuries detected and prepare and submit quarterly and annual reports to: BLM, FWS and NDOW. Reports will summarize the dates, durations, and results of all fatality monitoring conducted. Any mortality of special status species will be reported to BLM and NDOW within 48 hours of discorvery. Reporting will continue for the duration of the post-construction monitoring effort.

5.6 Analysis

The analysis will follow a distance-sampling methodology. Distance sampling analysis utilizes count data combined with detection distances from the transect to estimate a detection function that describes how probability of detection decreases with increasing distance from the transect. Based on these two pieces of information, the density of carcasses in an area can be estimated. Distance sampling relies on two core assumptions: first, that detection of carcasses right on the transect line is perfect, and second, that carcasses are equally likely to fall at any point in the sampled region. The first assumption is probably justified because transect lines are placed along cleared roadways (the decay in detection away from the transect line and under the panels is explicitly modeled and adjusted by distance sampling). The validity of the second assumption is less certain because edges of arrays may pose a different hazard than interiors of arrays. This assumption can be tested with the use of searcher efficiency trials. If the assumption is grossly violated, other methods of carcass density estimation are available, and can be calculated with the survey data, carcass removal trial data, and searcher efficiency data.

5.7 Incidental Avian and Bat Injury/Mortality Reporting

The surveys described by this AMMP will be conducted for two years during the post-construction phase. Data from the first two years will be used to determine if an additional (third year) is necessary. Project Managers and regulatory agencies, including the BLM and USFWS, will be involved in determinating the need for an additional survey beyond the first two years.

Logistical issues such as lack of access to active construction areas and safety regulations prevent a complete survey of the Project Site during the construction phase. Uncontrollable conditions (such as area closures and the inconsistent presence of construction personell) complicate sampling efforts

during the construction phase. However, duing the construction phase, biological monitors will be present on site as described in the Final Supplemental Environemental Impact Statement for the Project (BLM 2013). These monitors will record all instances of avian mortality observed during the course of their duties. All construction personnel will be required to attend a Worker Environmental Awareness Program (WEAP) training prior to project involvement, which will include required actions, such as the reporting of dead and injured birds. Construction workers and biological monitors will report and record all instances of dead and injured birds using the standardized data form (Appendix 1).

6.0 SURVEYOR REQUIREMENTS

Surveys will be conducted by qualified Avian Biologists. The Avian Lead will submit the resumes of all proposed Avian Biologists to the BLM for review. Avian Biologists will have the following minimum qualifications:

- A bachelor's degree in biological sciences, zoology, botany, ecology or a related field
- 3 years experience in field biology with an emphasis on avian ecology

In lieu of the above requirements, the resume shall demonstrate to the satisfaction of the BLM that the proposed Avian Biologists have the appropriate training and background to effectively implement the AMMP.

7.0 ADAPTIVE MANAGEMENT

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 BLM, 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.

Mortality monitoring protocols must also integrate with other monitoring components of the Silver State Project, including the Raven Management Plan. For example, if monitoring data suggests an increase in Raven activity in the Project area as a consequence of Carcass Removal Trials, adaptive management may be required to address both the methods and metrics of all associated protocols.

8.0 REFERENCES

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Appendix 1. Avian Mortality Form

Avian Mortality/Injury Form

Detection /Specimen Code_____ **Species Common Name**_____ **Number of Individ, or Nests?** _____

Age? ☐Adult ☐After Hatching Year ☐After Second Year ☐Hatching Year ☐Juvenile ☐Sub-Adult ☐Unknown ☐Mixed (multiple birds)

Gender? ☐ male ☐ female ☐ unknown ☐ mixed (multiple birds)

Date found_____

How was it found? ☐ Mortality Survey ☐ Incidental detection

Time Found (24 hr)? _____ **Who Found?**_____

Condition Of Animal? ☐ Active Nest Relocation ☐ Alive, injured ☐ Alive, no sign of physical trauma ☐ Alive, sick ☐Articulated skeletal ☐Broken up/dismembered ☐ Dead, fresh (eyes moist) ☐ Mummified ☐ Dead semi-fresh (eyes desiccated, rigor mortis) ☐ Feather spot

Time Since Death ☐ 0-8 hours ☐ 8-24 hours ☐ 2 days ☐ 3-6 days ☐ 7 days ☐ 2 weeks ☐ 3 weeks ☐ 1 month+ ☐ N/A Animal still alive ☐ Unknown (feather pile etc)

Describe Carcass or Injury_____

Evidence Of Scavenging ☐ yes ☐ no ☐ unknown

Describe Evidence Of Scavenging _____

Cause of Death/Injury ☐ Barotrauma ☐ Blinded/optical trauma (radiant flux) ☐ Collision (other) ☐ Collision w/solar panel/heliostat ☐ Collision with wind turbine

☐ Collision with wire ☐ De-oiled ☐ Disease/Illness ☐ Drowned (evaporation pond) ☐ Drowned (other) ☐ Drowned (stock tank) ☐ Electrocution ☐ Entangled (net) ☐ Entrapment

☐ Exposure/Dehydration ☐ Other (describe) ☐ Physical trauma (unknown) ☐ Poisoned (Lead) ☐ Poisoned (other) ☐ Poisoned (Pesticide) ☐ Predated ☐ Predated while entangled

☐ Scorched or singed ☐ Trauma (hard landing) ☐ Unknown

Level of Certainty on Cause of Death or Injury (% Certainty in parenthesis) ☐ Observed or Confirmed (100%) ☐ Valid (>90%) ☐ Probable (>50%) ☐ Possible (<50%,0) ☐ Not applicable or Unknown

Describe Evidence of Predation_____
_____
_____

Disposition Of Live Bird ☐ Sent to Rehab ☐ Released ☐ Euthanized ☐ Died

Location of release or Name of Rehab Facility_____

Comments_____
_____

Project _____ **Site Name**_____ Zone IIS **Easting**_____ **Northing**_____

Describe Habitat_____

<u>For detections within the Solar Farm:</u>

Nearest Block_____ **Nearest Array**_____ **Row (if bird/ bat is found within array)**_____

Precip Within Past 24 Hours? ☐ Yes ☐ No **Current Temperature (C)**_____ **Current Wind Speed (mph)**_____ **Cloud Cover %**_____

High Winds (25 Mph Sustained) Within Past 24 Hours? ☐ Yes ☐ No **Weather Conditions at Death/Inj** ☐ Clear ☐ Fog ☐ Raining ☐ Snowing ☐ Windy ☐ Unknown

Estimated Wind Speed at Death/Inj _____ **Estimated Max Wind Gust at Death/Inj** _____ **Estimated Wind Dir at Death/Inj (N, S, etc)** _____

Moon Phase ☐ New moon (no moon) ☐ Crescent (sliver) ☐ Quarter (1/2 full) ☐ Full Moon

Nearest Project Component ☐ Brine Pond ☐ Communications Tower ☐ Evaporation Pond ☐ Fencing ☐ Guy Wires ☐ Heliostat ☐ None-open deser
☐ Other (describe in comments) ☐ Other machinery ☐ Pond Net ☐ Project Building ☐ PV Panel ☐ Road ☐ Solar Array Framework (no panels) ☐ Solar Concentrating Towe
☐ Solar Trough ☐ Transmission Line ☐ Transmission Tower ☐ Vehicle ☐ Water Supply Pond ☐ Wind Turbine

Distance (m) From Nearest Project Component _____ **Azimuth to Nearest Component** _____ **Distance (m) To Nearest Photovoltaic Panels** _____

Flight Diverters Present? ☐ Yes ☐ No ☐ Unknown **Type of flight diverter**_____ **Transmission compliant with APLIC?** ☐ Yes ☐ No ☐ Unknown

Additional details about the nearest component _____

Biometric Details of the Bird _____

Photo Code 1 (Close up shot #1) _____ **Photo Code 2 (Close Up #2)** _____ **Photo Code 3 (Close up #3)** _____

Photo Code 4 (Area to N) _____ **Photo Code 5 (Area to E)** _____ **Photo Code 6 (Area to S)** _____

Photo Code 7 (Area to W) _____**Photo Code 8 (Infrastructure)** _____

Photo Code 9 (Infrastructure #2) _____

Carcass Disposition

Collector Name _____ **Date Of Collection** _____ **Time Of Collection (24 hr)** _____

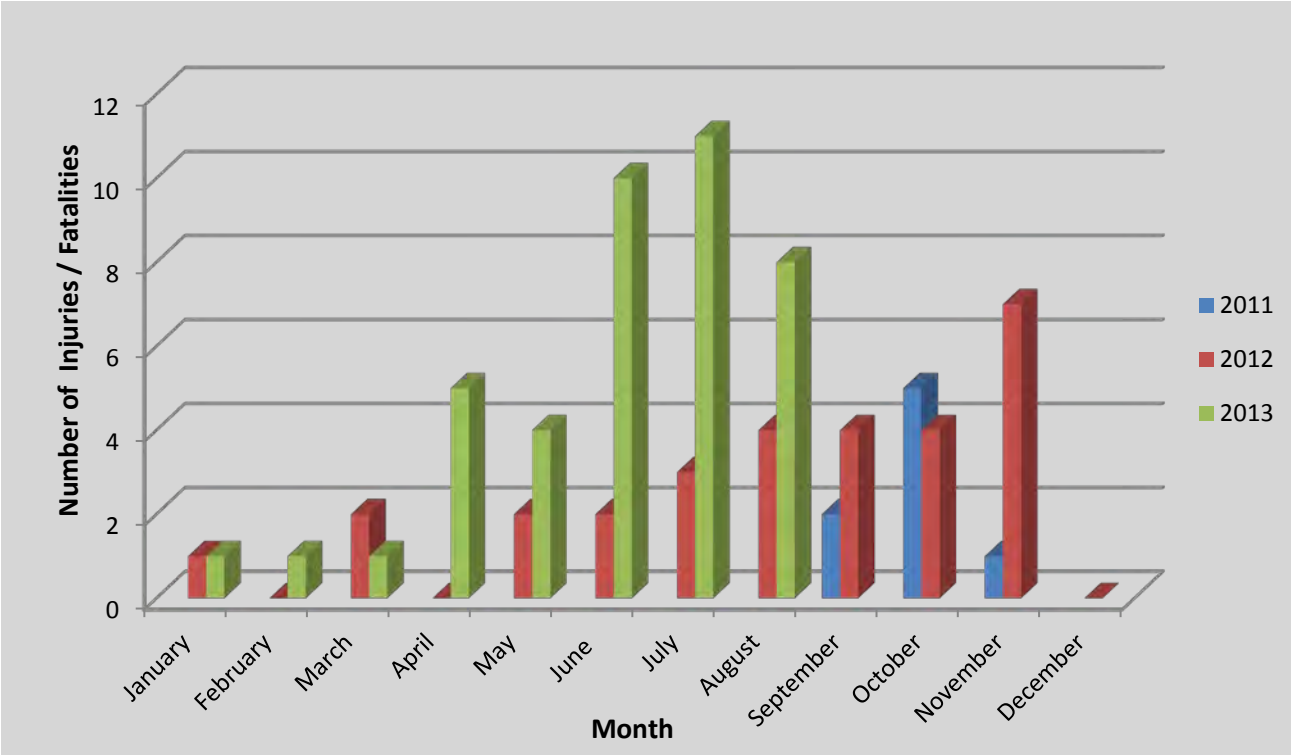
Carcass Disposition ☐ BLM investigations ☐ Buried onsite ☐ CDFW lab San Bernadino ☐ CDFW Law Enforcement ☐ CFWO lab ☐ Freezer on site ☐ Incinerated ☐ Left in place ☐ Nest relocated ☐ Other ☐ SDMNH ☐ Sent to National Eagle Repository ☐ Transferred to other permittee (enter permit # in comments) ☐ USFWS Law Enforcement ☐ Used in Research Trials (searcher efficiency and carcass removal)

Disposition Comments_____

Date and Time of Agency Notification _____

Shipped To: Institution Name_____ **Date Shipped**_____ **Time Shipped**_____

Official Cause of Death_____ **Who Determined Cause of Death?** _____

Necropsy Performed? ☐ Yes ☐ No ☐ Unknown

Appendix 2. Avian Fatalities by Month at Desert Sunlight Solar Farm