Saguache Solar Energy Project

Third Supplemental Information to Final 1041 Permit Application Saguache County, Colorado

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Introduction

This supplemental information is being submitted by Saguache Solar Energy, LLC (SSE) in reference to SSE's 1041 Permit document, per the Guidelines and Regulations for Areas and Activities of State Interest of the County of Saguache, submitted in October 2011. It has been prepared in response to feedback from the Board of County Commissioners (BOCC) received at the public hearing on February 2, 2012 as well as at the BOCC meeting held on February 7, 2012.

Economic Development and Reclamation Bond

On February 6, 2012, SSE submitted a proposal providing for local training, making a financial commitment to hire a local workforce for operational needs, supporting the development of a Visitor Information Center (VIC), and offering to provide a reclamation bond. That proposal is attached hereto as Exhibit A and remains effective.

In addition, in order to support local eco-tourism, SSE will allow the VIC to conduct tours of the Saguache Solar Energy Project on property owned by SSE, so long as those tours follow any reasonable constraints required by SSE (e.g., for safety or insurance reasons.) Such constraints may limit the hours of operation, the location accessible, or the frequency of the tours. SSE will not impose any such constraints unnecessarily. It is anticipated that these site tours will draw visitors specifically to Saguache County, generating economic activity from the tours themselves as well as indirectly from consumer spending on other goods and services.

Home Value Preservation Plan

SSE recognizes that there is concern over the impact that the project may have on nearby home values. As discussed in the original 1041 document, it is difficult to assess whether any change in property value is due to one cause versus another because home values change for many reasons. The strength of Saguache County's economy would likely be a significant driver of residential property values; SSE believes that the Project will strengthen the County's economy, and that the local economy would otherwise decline in the coming years due to the impact on agriculture from water constraints. Nevertheless, in response to feedback from the County, SSE is willing to offer a Home Value Preservation Plan (HVPP).

The proposed HVPP would be as follows:

- Eligible homes would be those within three miles of a tower location that existed at the time of the 1041 hearing.

- Eligible homeowners may contact SSE anytime between the start of construction and one year after the completion of construction; in response, at SSE's cost, SSE would commission an appraisal of the home, to be conducted by a qualified appraiser of the County's choice.
- Within ten years of the appraisal, if the homeowner sells the home in an arm's length transaction for less than the appraisal's value, SSE will pay the homeowner the difference. The homeowner must list the home with an experienced broker familiar with the area. SSE reserves a right of first refusal to purchase the home at any price agreed upon with a buyer.

This HVPP would protect any affected homeowner by guaranteeing that their property would not decline in value. There is no obligation for homeowners to participate. Thus, this optional program offers full protection against harm from declining housing values.

Economic Threshold of Minimum Generation

The County requested that SSE explain whether there is a minimum level of generation that makes the Project feasible.

SSE proposed the Project as two 100 MW facilities because, given the conditions of the San Luis Valley and the state of SolarReserve's technology, 100 MW facilities were found to be an economically viable size. It should be noted that, due to the technology's storage capability, the megawatt rating of the generator could be changed without materially affecting the design of the rest of the plant; the tower height, number of mirrors, amount of salt, etc. would be relatively unchanged if the project were built with a large 200 MW generator or a smaller 50 MW generator. The difference is in how quickly a day's worth of solar energy is utilized. A smaller generator will smooth the output over many hours, while a larger generator will deliver its daily electricity more quickly. The megawatt size is typically influenced by the utility customer's preference for the timing of energy deliveries and by transmission availability.

The project configuration, including the height of the tower, the number and size of the mirrors, and the layout of the solar field, was designed for optimal performance and lowest cost of energy at the time of the Application. Imposing alterations or artificially constraining any aspect of the configuration would likely raise the price of the output, making the project less commercially viable and more expensive for the ratepayer.

There is little risk of underperformance once the facility is built. The technology is guaranteed by manufacturers and the facility performance will be guaranteed and verified by the Engineering, Procurement, and Construction (EPC) provider. Weather risk – from rain, dust, wind, clouds, etc. – is well-understood due to the availability of years of historical data as well as SSE's monitoring station in the San Luis Valley. Typical Power Purchase Agreements (PPAs) contain provisions for a reasonable amount of flexibility in annual output.

As such, there is no "minimum" per se, other than completing the Project as designed.

Elements of the Avian and Bat Protection Plan

The County has expressed an interest in learning more about the Avian and Bat Protection Plan (ABPP) which SSE has committed to produce with the US Fish and Wildlife Service (USFW) and with the Colorado Department of Parks and Wildlife. In order to aid in understanding, the ABPP from the Crescent Dunes project, which was approved by the USFW and Bureau of Land Management (BLM), is attached hereto as Exhibit B.

It should be noted that the ABPP for the Saguache Solar Energy Project will be different from Exhibit B. It will be customized to reflect the unique characteristics of the Project, and will be influenced by the appropriate specific wildlife agencies for the Project. The Crescent Dunes ABPP is already publicly available, and is provided here as an example of the type of plan which will be developed for the Saguache Solar Energy Project.

SSE encourages the County to review Section 6 of Exhibit B in detail, which details the avian and bat protection measures and modifications for the Crescent Dunes project.

As was done for the Crescent Dunes project, and depending upon the requirements from the relevant agencies, the Saguache Solar Energy Project ABPP would likely include the following:

- Delineation of the objectives of the ABPP
- Applicable laws, regulations, policies, and enforcement mechanisms
- Project-specific site description
- Wildlife resources and species of interest at the project site
- Results of biological surveys completed to date
- A threat assessment, detailing anticipated sources of danger to wildlife from the power plant
- Potential avian and bat protection measures addressing the sources of danger, which may include:
    - Perching deterrents / anti-perch devices on power poles and other facilities
    - Inherent features of the technology, e.g., a smooth tower that offers no nesting space
    - Minimizing plant lighting and minimizing attraction of nighttime insects
    - The use of synchronous flashing rather than steady FAA lighting
    - The use of motion-sensitive plant lighting
    - H-frame electrical transmission structures which don't require guy wires and maximize visibility to avian species
    - Transmission wire marking to increase visibility to birds
    - Transmission construction in accordance with raptor-safe design criteria
    - Appropriate slopes of evaporation pond walls and freeboard, and textured liner in the evaporation ponds
    - Management of pond salinity through hydrology adjustments, daily monitoring, and evaporative spray nozzles if necessary
    - Bird deterrents such as:

        - Predator decoys
        - Visual deterrents using bright colors or patterns related to predators
        - A startling gas-fired air cannon
        - Mimicked distress calls
        - Ultrasound emitters
    - Potentially any other techniques or devices developed in the future
- Adaptive management actions including the process for documenting and responding to mortalities that occur
- Construction protocols which minimize impacts
    - Avoiding land-clearing activities during avian breeding season
    - Limiting construction traffic to designated project roads
- Commitment to project personnel training
- Ongoing quality control assessment procedure for avian and bat protection protocols
- An Avian and Bat Reporting System to monitor and record impacts
    - Includes coordination with and reporting to relevant agencies
- Protocols for post-construction mortality surveys

While the following is not an exhaustive list of every difference, we also highlight a few key differences between the Crescent Dunes project and the Saguache project:

- **Site characteristics** – Crescent Dunes was on vacant scrub land, whereas the Saguache project is on center pivot agricultural land
- **Wildlife species** – the two projects have different specific wildlife species present with different behaviors
- **Cooling technology** – Crescent Dunes uses hybrid cooling, which requires more water than the proposed Saguache project's dry cooling system. This also accounts for the different size of the evaporation ponds.

As such, SSE expects that the ABPP for the Project will be similar but not identical to the one for Crescent Dunes. The Crescent Dunes plan was approved by all relevant wildlife agencies for that project.

Steam Blows

The County requested more detail on the nature of the noise from steam blows, which were described in the 1041 Application's Noise Study (Exhibit H.)

Steam blows are the final cleaning process used for the steam piping systems. The purpose is to blow out any loose debris, rust scale particles, etc., so that they do not damage the steam turbine or other boiler components. A steam blow can be as loud as 125 decibels (dB) or more at a distance of 50 feet if

vented directly to atmosphere. However, “silencers” can be used to reduce the sound levels to about 90dB at 50 feet.

This activity will be in the power block, which is about one mile from the Project boundary. Normal sound attenuation over that distance should reduce the noise level of a “silenced” steam blow from 90dB to about 41dB at that distance, which will not be a significant impact on nearby receptors and is within applicable noise regulations.

The steam blow occurs only during the commissioning process, between construction and operations. Steam blows are intermittent events that are repeated until a measure of cleanliness has been achieved – typically over the course of one or two weeks. A single steam blow would likely last for approximately 20 minutes and be separated from the next steam blow by many minutes or even hours.

As stated in the 1041 Permit Application, the Project will utilize steam blow silencers during plant commissioning to reduce the noise impact.

Exhibit A – Economic Development and Reclamation Bond Proposal

SOLARRESERVE®

Saguache Solar Energy Project

Economic Development & Reclamation Bond Proposal

The following issues will be addressed:

- Reclamation bonding
- Local jobs and training
- Eco-tourism support

1. Reclamation bonding

Basis and assumptions:

- Reclamation bonds to remove equipment are typically not required for private landowners. SolarReserve expects that this is not typically required for other activities in Saguache County or Colorado.
- SolarReserve is willing to provide a reclamation bond/guarantee, but wants to minimize the effect on the project economics; keeping the power price of the project competitive helps attract a long-term power contract with the utility and helps protect the ratepayers. The expense from a bond reduces the project's economic competitiveness and makes the project less likely to eventually be built.
- The key issue for reclamation is the visual impact. This is largely limited to the tower.
- Other items, excluding the tower, would have significant salvage value, so the need for a reclamation bond is less justified.

SolarReserve proposal:

- The reclamation bond would be intended to provide necessary funds to remove the tower at the end of the project life.
- SolarReserve would provide evidence at start of construction as to the length of the power contract that the project had obtained.
- SolarReserve would provide a smaller reclamation bond upon the start of construction to insure that a larger reclamation bond is provided later in the project operating period.
- At start of construction, SolarReserve would provide a $1.0 million reclamation bond from a financial entity reasonably acceptable to the county. At year 10, the reclamation bond would be increased to $2.0 million. This is the estimated cost to remove the tower.
- Five years prior to expiration of the power contract (most likely in year 20 or 25), SolarReserve would increase the reclamation bond to $10.0 million.
- In the event that SolarReserve does not increase the reclamation bonds as required, or does not remove the tower after the project operating period, the County shall have the right to cash the reclamation bond.

2. **Local Jobs and training (operational period)**

Basis and assumptions:

- Approximately 50 employees are required per tower for operations, maintenance, and plant management.
- SolarReserve's intent is to maximize the use of local employees for these activities.

SolarReserve proposal:

- SolarReserve will fund a local operator training program, prior to the expected hiring period, with a one-time cash grant of $200,000. SolarReserve will work with local agencies to design a program.
- Operations staff hires will be comprised of at least 40% Saguache County residents. In the event that SolarReserve was short of this local employee content, SolarReserve would pay a one-time penalty to the county of $50,000 for each 10% shortfall (i.e., if only 20% local resident employees is achieved the penalty fee paid by SolarReserve would be $100,000).

3. **Eco-tourism support**

Basis and assumptions:

- Eco-tourism provides a means of economic development for Saguache County.
- SolarReserve can facilitate growth of new eco-tourism opportunities.
- The Town of Center in particular would benefit from increased economic activity.

SolarReserve proposal:

- Six months prior to completion of construction, SolarReserve will provide the County with a grant of $100,000 for the establishment of a new Visitor Information Center (VIC), recommended to be located in the Town of Center. Location, staffing, and management of the VIC will be the responsibility of the County or its designee, not SolarReserve.
- SolarReserve will provide certain materials to the VIC at no cost to the VIC (e.g., samples of mirrors, salt, tubing; photographs of construction and completed facility).
- SolarReserve will provide 40 hours of training to VIC personnel.

Exhibit B – Crescent Dunes Avian and Bat Protection Plan

Avian and Bat Protection Plan
Crescent Dunes
Solar Energy Project

Nye County, Nevada

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List of Acronyms

ABPP	Avian and Bat Protection Plan
APLIC	Edison Electric Institute's Avian Power Line Interaction Committee
APP	Avian Protection Plan
BGEPA	Bald and Golden Eagle Protection Act
BLM	Bureau of Land Management
CDSEP	Crescent Dunes Solar Energy Project
CSP	concentrating solar power
DEIS	Draft Environmental Impact Statement
ESA	Endangered Species Act
FAA	Federal Aviation Administration
HTF	heat transfer fluid
MBTA	Migratory Bird Treaty Act
NAC	Nevada Administrative Code
NDOW	Nevada Department of Wildlife
NMFS	National Marine Fisheries Service
NNHP	Nevada Natural Heritage Program
NRS	Nevada Revised Statutes
REA	Resource Equivalency Analysis
TSE	Tonopah Solar Energy, LLC
USFWS	U.S. Fish and Wildlife Service

Avian and Bat Protection Plan
Crescent Dunes Solar Energy Project
Nye County, Nevada

1.0 Introduction

1.1 SCOPE

An Avian and Bat Protection Plan (ABPP) is a project-specific document that delineates a program designed to reduce the potential risks of avian and bat mortality that may result from the interaction of these animals with project facilities.

In September 2010, the Bureau of Land Management (BLM) prepared the *Tonopah Solar Energy, LLC, Crescent Dunes Solar Energy Project, Draft Environmental Impact Statement* (DEIS). The DEIS provides a project-specific analysis of the potential impacts to bats and birds resulting from the proposed Crescent Dunes Solar Energy Project (CDSEP). Tonopah Solar Energy, LLC (TSE) has voluntarily prepared this ABPP in compliance with federal regulations to outline project-specific practices and measures for reducing avian and bat impacts potentially resulting from the project.

This ABPP has been developed based on recommendations from the Avian Protection Plan (APP) Guidelines prepared by the Edison Electric Institute's Avian Power Line Interaction Committee (APLIC) and the U.S. Fish and Wildlife Service (USFWS) in 2005. The APP Guidelines provide guiding principles to utilize in the development of an ABPP and thus reduce avian mortality. The following principles are outlined in the APP Guidelines:

- Corporate Policy
- Training
- Permit Compliance
- Construction Design Standards
- Nest Management
- Avian Reporting System
- Risk Assessment Methodology
- Mortality Reduction Measures
- Avian Enhancement Options
- Quality Control
- Public Awareness
- Key Resources

1.2 GOALS OF THE AVIAN AND BAT PROTECTION PLAN

The voluntary implementation of this ABPP will fulfill several goals simultaneously, and fulfillment of each of these goals will contribute to the satisfaction of the ultimate goal of all ABPPs: to reduce avian and bat mortality. The goals specific to this ABPP are to:

- reduce the potential for avian and bat mortality by implementing specific mortality reduction actions;
- identify and isolate where avian and bat mortality has occurred or has the potential to occur to minimize future incidents;
- establish an avian and bat reporting system to document incidents of mortality caused by electrocution, heat, collision, and other plant-related features;
- assist TSE in compliance with state and federal laws regarding avian and bat species to avoid the threat of penalties and fines; and,
- improve TSE's reliability and services by reducing power outages due to avian and bat interactions and by reducing repair costs due to electrocution of the animals.

1.3 IMPLEMENTATION OF THE AVIAN AND BAT PROTECTION PLAN

TSE would do the following to implement the ABPP and thus accomplish the identified goals. These actions would also be performed routinely after implementation of the ABPP to ensure goals are not only met but also maintained. Specifically, TSE would:

- verify avian and bat mortalities, update mapped data, and develop additional data on concentrations of avian and bat species which may be impacted by the project facility;
- identify the environmental and behavioral factors that lead to areas of high avian or bat use and potentially higher numbers of electrocutions, collisions, and outages;
- assist in refining criteria and protocols to further avian and bat conservation; and,
- ensure the accuracy and detail of incident reporting.

1.4 BENEFITS OF AN AVIAN AND BAT PROTECTION PLAN

As the foremost goal central to any ABPP is reduced avian and bat mortality, avian and bat species are perhaps the most obvious to benefit when the goals of the ABPP are accomplished. While this is true, the practical effect of such a plan may also translate to advantages for TSE. Because the ABPP would reduce avian and bat mortality resulting from bird and bat interactions with TSE facilities, costs associated with avian- and bat-related outages could be avoided or held to a minimum. These costs may include monetary losses such as lost revenue during avian- and bat-caused power outages, repair costs for equipment damaged by avian and bat interaction, or administration and managerial time directed toward avian and bat conflicts. The ABPP would reduce other costs that extend beyond monetary value, such as those attributed to negative public perception.

The voluntary implementation of an ABPP would also support compliance with the state and federal regulations as described in the following section.

1.5 FEDERAL AND STATE AVIAN AND BAT PROTECTION LAWS, REGULATIONS, AND POLICY

1.5.1 Migratory Bird Treaty Act (MBTA)

The Migratory Bird Treaty Act (MBTA) (16 U.S.C. 703-712), which is administered by USFWS, is the cornerstone of migratory bird conservation and protection in the United States. It implements four treaties that provide for international protection of migratory birds. The MBTA states: "it shall be

unlawful at any time, by any means or in any manner, to pursue, hunt, take, capture, kill…possess, offer for sale, sell…purchase…ship, export, import…transport or cause to be transported…any migratory bird, any part, nest, or egg of any such bird, or any product, whether or not manufactured, which consists, or is composed in whole or part, of any such bird or any part, nest, or egg thereof." The word "take" is defined as "to pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to pursue, hunt, shoot, wound, kill, trap, capture, or collect." In 1972, an amendment to the MBTA resulted in bald eagles (*Haliaeetus leucocephalus*) and other birds of prey being included in the definition of a migratory bird. The MBTA currently protects more than 800 migratory bird species, including waterfowl, shorebirds, seabirds, wading birds, raptors, and songbirds (USFWS 2008).

1.5.2 Bald and Golden Eagle Protection Act (BGEPA)

Under the authority of the Bald and Golden Eagle Protection Act (BGEPA) (16 U.S.C. 668-668d), bald eagles and golden eagles (*Aquila chrysaetos*) are provided additional legal protection. The BGEPA makes it unlawful to import, export, sell, purchase, barter, or take any bald eagle or golden eagle, their parts, products, nests, or eggs. As used in the BGEPA, "take" includes pursuing, shooting, poisoning, wounding, killing, capturing, trapping, collecting, molesting, or disturbing an eagle.

1.5.3 Endangered Species Act (ESA)

The ESA (16 U.S.C. 1531-1544) is administered by USFWS and the Commerce Department's National Marine Fisheries Service (NMFS). USFWS has primary responsibility for terrestrial and freshwater organisms, while NMFS has responsibility for marine species. These two agencies work with other agencies to plan or modify federal projects so that they will have minimal impact on listed species and their habitats. Protection of species is also achieved through partnerships with the states, with federal financial assistance and a system of incentives available to encourage state participation.

Section 9 of the ESA makes it unlawful for a person to "take" a listed species. Under the ESA "take" is defined as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect or attempt to engage in any such conduct." Through regulation, the word "harm" has been defined by the Secretary of the Interior as "an act which actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering." However, permits for "incidental take" can be obtained from USFWS for take of endangered species which would occur as a result of an otherwise legal activity.

1.5.4 BLM Policy

BLM has implemented policies for special status species found on BLM-managed lands. BLM's list of special status species includes species that are listed or proposed for listing under the ESA and species requiring special management consideration to promote their conservation and reduce the likelihood and need for future listing under the ESA. Additionally, all federal candidate species, proposed species, and delisted species (for five years after delisting) will be conserved as BLM sensitive species (BLM 2008).

1.5.5 Nevada Regulations

The state of Nevada has identified wildlife species that are declining in their range throughout Nevada or are otherwise rare and at risk of extinction. Sensitive and protected animal species are protected in Title 45 of Nevada Revised Statutes (NRS) (NRS 501.100 through 503.104). Classification of wildlife species and related regulations are detailed in Chapter 503 of Nevada Administrative Code (NAC). Taking of these species is allowed only after obtaining necessary permits or authorizations from Nevada Department of Wildlife (NDOW).

1.5.6 Nevada State Protection and Propagation of Native Fauna

NRS 503.584 through 503.589 provide for the protection and propagation of native fauna, including migratory birds. The Board of Wildlife Commissioners determines which species will be fully protected under this statute (i.e., state of Nevada protected species).

1.6 ENFORCEMENT OF THE MBTA, BGEPA, AND ESA

The MBTA is a strict liability statute wherein proof of intent is not an element of a violation. Wording is clear in that most actions that result in a "take" or possession (permanent or temporary) of a protected species can be a violation. A violation of the MBTA by an individual can result in a fine of up to $15,000 and/or imprisonment for up to six months for a misdemeanor, and up to $250,000 and/or imprisonment for up to two years for a felony. Fines may be doubled for organizations. Penalties increase greatly for offenses involving commercialization or the sale of migratory birds or their parts. Violators of the BGEPA may be fined up to $100,000 or imprisoned for up to one year, or both. The BGEPA has additional provisions where in the case of a second or subsequent conviction of the BGEPA, penalties may be imposed of up to a $250,000 fine or two years imprisonment, or both. Felony violations of the ESA may result in fines up to $50,000 and/or one year imprisonment (for crimes involving endangered species) and $25,000 and/or six months imprisonment (for crimes involving threatened species). Misdemeanor violations of the ESA may result in fines up to $25,000 for endangered species and $12,000 for threatened species (USFWS 1998).

While these acts have no provisions for allowing an unauthorized take, and while the USFWS generally does not authorize incidental takes under these acts, the USFWS recognizes that some birds may be killed even after all reasonable measures to avoid a "take" are implemented. The USFWS Office of Law Enforcement carries out its mission to protect migratory birds not only through investigations and enforcement but also through fostering relationships with individuals and industries that proactively seek to eliminate impacts to migratory birds. While it is not possible under the act to absolve individuals, companies, or agencies from liability if they follow these recommended guidelines, the Office of Law Enforcement and the Department of Justice have used enforcement and prosecutorial discretion in the past regarding individuals, companies, or agencies who have made good faith efforts to avoid the "take" of migratory birds. The voluntary implementation of this ABPP is intended to proactively seek to eliminate impacts to migratory birds at the CDSEP.

2.0 Study Area

2.1 Description of Project Area

According to the DEIS prepared for the project, the project area is located about 13 miles northwest of Tonopah, Nye County, Nevada (BLM 2010a). The DEIS states that the project area encompasses approximately 2,950 acres, consisting entirely of BLM-administered public lands within the Tonopah Resource Management Plan planning area (BLM 1997). The CDSEP would occupy only approximately 1,600 acres within the 2,950-acre area. The 1,600 acres would be within a perimeter security fence, and only limited, temporary disturbance would occur outside the perimeter fence.

The topography of the project area is generally flat with elevations ranging from approximately 5,000 to 5,060 feet above mean sea level (BLM 2010a). Six vegetation communities or land cover types were mapped and observed in the project area and include Inter-Mountain Basins Mixed Salt Desert Scrub, Inter-Mountain Basins Semi-Desert Shrub-Steppe, Inter-Mountain Basins Active and Stabilized Dune, Inter-Mountain Basins Greasewood Flat, Intermountain Basins Playa, and Barren Lands (BLM 2010a). The Inter-Mountain Basins Mixed Salt Desert Scrub cover type accounts for approximately 2,408 acres of the total 2,950-acre project area. The next abundant cover types within the project area are Inter-Mountain Basins Semi-Desert Shrub-Steppe and Inter-Mountain Basins Greasewood Flat, occurring on approximately 176 and 120 acres, respectively. According to the DEIS, there are no wetlands, riparian zones, or waters of the U.S. within or near the project area.

2.2 Description of Proposed Project

The proposed project includes the construction and operation of a 110-megawatt (nominal) solar power generating facility and supporting components. The proposed solar power facility would use concentrating solar power (CSP) technology to generate electricity. This specific technology uses heliostats/reflecting mirrors to redirect sunlight on a receiver erected in the center of the solar field (referred to as the central receiver). The central receiver consists of a series of tubes through which a heat transfer fluid (HTF) passes and would be constructed to a height of about 653 feet above ground surface. The HTF used for the proposed project would be a salt in liquid form, which has the viscosity and appearance of water when heated. When solar energy is to be collected, the liquid salt would be routed through the receiver tubes. As the liquid salt passes through the receiver it would be heated by the concentrated solar energy, and then would be routed to a large insulated tank where it could be stored with minimal heat loss. When electricity is to be generated, the heated salt would be circulated through a series of heat exchangers to generate high-pressure superheated steam which in turn would be used to power a conventional Rankine cycle steam turbine/generator. Powering of the turbine/generator would produce the actual electricity product. The exhaust steam from the turbine would be condensed and returned via feed-water pumps to the heat exchangers, where it would be converted to high-pressure superheated steam in a closed cycle. The energy in the heated salt would be depleted after generating steam and would be routed to the cold salt tank for reuse the next day. Hybrid cooling processes would be used for this project to reduce water used for cooling while maintaining efficient power generation.

Major construction and operational components of the project include:

- Central receiver tower –The concrete tower would be approximately 538 feet tall and would house a 100-foot-tall cylindrical solar receiver and a 15-foot maintenance crane. The total height would be approximately 653 feet above ground surface, and the tower would have appropriate lighting for aviation safety.
- Heliostat array –The solar array would consist of a circular field encompassing an area with a radius of 4,300 feet (approximately 1,330 acres) where the heliostats (or mirrors) would be located.
- Power block –The power block would be contained to a circular area with a radius of about 400 feet and would house the central receiver tower, storage tanks, a conventional steam turbine, an air-cooled condenser, a cooling tower, transformers, heat exchangers, power block buildings, and other ancillary equipment. NOTE: The power block is located near the center of the heliostat array and is the location of all power generation equipment.
- Reverse osmosis water treatment system and evaporation ponds –These facilities would purify the groundwater to be used in the production of electricity and provide a means for wastewater disposal.
- Hybrid cooling system –An air-cooled condenser with a wet cooling augmentation system would reduce water consumption used for cooling by use only during times of high electricity demand or to maximize system efficiency.
- Thermal storage system –The storage system would include two large, insulated storage tanks and associated piping for the liquefied salt, one "hot" tank for the storage of the materials prior to use in generating the steam, and a "cool" tank for storing salt prior to resending it to the central tower for heating.
- Transmission line –The outgoing transmission line would follow the proposed project site access road and head northwest to where the existing Millers to Anaconda 120-kilovolt transmission line (owned and operated by NV Energy) is located. The outgoing transmission would then be routed to NV Energy's existing Anaconda Moly Substation along a path parallel to the Millers to Anaconda transmission line for a total distance of approximately 7.5 miles. A temporary 55-kilovolt transmission line would be constructed in the permanent project ROW for supply of construction power.
- Interconnections –The project would interconnect to the Anaconda Moly Substation located approximately 6 miles due north of the generating facility location.
- Access roads –A paved, two-lane access road would extend approximately 1,500 feet from Pole Line Road to the facility. An existing access road that follows the Millers to Anaconda transmission line would be used for access during construction and for maintenance of the transmission line. Pole Line Road would also be used for access to the transmission line where the line would follow Pole Line Road.
- Building and enclosures –A control building, warehouse, and other buildings would be developed within the project area to support operations of the facility.
- Storage tanks –Tanks would be constructed to store de-mineralized water, water that is not de-mineralized, liquid salt or HTF, lube oil, and other materials for the power block.

- Wastewater –Two types of wastewater would be generated, industrial and domestic. The industrial wastewater would be generated from the cooling tower blow down and from the reverse osmosis water treatment system. The wastewater from this process would be piped to three lined evaporation ponds. Each pond would be up to 10 acres in size. Domestic wastewater would be generated from toilets, showers, kitchens, and sinks and would be directed to an on-site sanitary septic system and on-site leach field.
- Construction facilities – Facilities would include an office trailer, material lay down areas, rock processing equipment, a portable concrete batch plant, a temporary aboveground storage tank for diesel fuel, portable sanitary toilets, and a temporary septic system.
- Borrow site –A material borrow site would be required for extracting aggregate for the construction of the access road and the base of the proposed facility. This material would come from a borrow site located next to an existing pit used by Nye County Public Works. This site would be used only during facility construction.
- Lighting Systems – The lighting system for the facility would be limited to areas required for safe operation of the facility. Where lighting is required, it would be designed and installed to minimize visual impacts in the region.

3.0 Wildlife Resources

3.1 MAMMALS

The main components of vegetation in the project area include greasewood, blackbrush, four-wing saltbush, and Indian ricegrass. This vegetation provides food, water, and cover for many small mammals such as black-tailed jackrabbits (*Lepus californicus*), kit foxes (*Vulpes macrotis*), ground squirrels (*Spermophilus* spp.), desert woodrats (*Neotoma lepida*), pocket mice (*Perognathus* spp.), deer mice (*Peromyscus maniculatus*), grasshopper mice (*Onychomys* spp.), and kangaroo rats (*Dipodomys* spp.) (BLM 2010a).

3.2 GAME SPECIES

According to NDOW, the project area falls within designated pronghorn antelope (*Antilocapra americana*) habitat. Pronghorn antelope tracks were observed in the project area during field surveys, and it is likely that they utilize this area. Mule deer (*Odocoileus hemionus*) likely use this area for foraging; however, the area has not been designated as important or unique habitat for this species by the NDOW. It is unlikely that bighorn sheep (*Ovis canadensis*) utilize the area because they prefer the steep cliffs of the surrounding mountain ranges; however, bighorn sheep may migrate through the area (BLM 2010a).

3.3 BIRDS

Most birds that utilize the project area are protected by the MBTA; however, some birds may utilize the project area year round. For example, ravens (*Corvus corax*) may prey on reptiles, insects, and small mammals that are present throughout the project area. Horned larks (*Eremophila alpestris*), sage sparrows (*Amphispiza belli*), and song sparrows (*Melospiza melodia*) may forage on seeds and insects in the project area and were observed in the project area during surveys. Singing black-throated sparrows (*Amphispiza bilineata*) were observed in the project area and would be considered migrants. Both common ravens and horned larks were observed during field surveys within the proposed area (BLM 2010a).

3.4 REPTILES

A wide variety of reptiles may be present in the project area, including western whiptail (*Cnemidophorus tigris*), leopard lizard (*Gambelia wislizenii*), Great Basin gopher snake (*Pituophis catenifer*), and desert horned lizard (*Phrynosoma platyrhinos*). These species as well as others are present in a wide variety of valley habitats and most likely utilize the project area (BLM 2010a).

4.0 Species of Interest

4.1 Protected Species Criteria and Utilization of Project Area

In this ABPP, the term "protected species" encompasses all avian and bat species that are protected by any one or more of the laws, policies, or regulations described in Section 1.5 of this document. Specifically, this includes:

- all avian and bat species that are listed as threatened or endangered species or are proposed or candidates for listing under the ESA of 1973 as amended;
- all avian species extended protection under the MBTA;
- bald and golden eagles extended protection under the BGEPA;
- all avian or bat species that the state of Nevada extends protection to through NRS 501.100–503.104, NRS 527.050, and/or NRS 527.60–527.300; and,
- all species identified as BLM sensitive species in Nevada.

Regardless of whether a bat or bird species is protected by regulation, law, or agency directive, the ultimate goal of this ABPP is to provide protection to all avian and bat species that may interact with the project facilities.

4.2 Protected Species Potentially Occurring within the Project Area

According to the DEIS prepared for the project (BLM 2010a), a concise list of potentially occurring protected wildlife species was compiled from data from the USFWS; the BLM Sensitive Species list for Nevada; the Nevada State Protected, Threatened, and Sensitive Species lists in NAC 503.030, NAC 503.050, NAC 503.075, and NAC 503.080; and the Nevada Natural Heritage Program (NNHP) database. Biologists from the USFWS, BLM, and NDOW were consulted on several occasions to provide additional input regarding protected species. The DEIS also lists the potential likelihood of each identified species to occur within the project area. According to the DEIS, the following protected species have been observed in the project area or have potential to occur in the project area:

Bat Species:

Brazilian free-tailed bat (*Tadarida brasiliensis*)
California myotis (*Myotis californicus*)
fringed myotis (*Myotis thysanodes*)
little brown bat (*Myotis lucifugus*)
long-eared myotis (*Myotis evotis*)
western pipistrelle (*Pipistrellus hesperus*)
western small-footed myotis (*Myotis ciliolabrum*)

Avian Species:

Brewer's sparrow (*Spizella breweri*)
burrowing owl (*Athene cunicularia*)
golden eagle (*Aquila chrysaetos*)
greater sage-grouse (*Centrocercus urophasianus*)

loggerhead shrike (*Lanius ludovicianus*)
long-billed curlew (*Numenius americanus*)
prairie falcon (*Falco mexicanus*)
sage sparrow (*Amphispiza belli*)
short-eared owl (*Asio flammeus*)
Swainson's hawk (*Buteo swainsoni*)
vesper sparrow (*Pooecetes gramineus*)

The DEIS indicates that is unlikely that the little brown bat or the long-eared myotis occur in the project area with the exception of when either species is migrating. All other bats listed above are described in the DEIS as potentially foraging within the project area. The DEIS indicates that the presence of greater sage-grouse in the project area is unlikely, due to the general lack of suitable sagebrush habitat preferred by the bird.

Although 11 avian species were identified in the DEIS, most species that could potentially occur within the project area would be considered protected species. The MBTA alone would render most of these observed or potentially occurring species as protected, as the act protects all native birds commonly found within the Tonopah Field Office district, with the exception of gallinaceous species (upland game birds) and introduced, non-native species. Many species, such as the golden eagle or burrowing owl, are protected by the MBTA in addition to other regulations or listings, such as the BGEPA or listing on Nevada BLM Sensitive Species lists.

Both ground surveys and aerial surveys for nesting golden eagles were conducted by the BLM in June 2010 (BLM 2010b). The survey area included a 10-mile buffer around the project area. Prior to performing surveys, background research was conducted to determine the location of known golden eagle nests in the area. Then the area within the 10-mile buffer was evaluated for potential golden eagle nesting habitat. In the first ground survey area, one golden eagle nest was found occupied at one of the previously known nest sites approximately 8 miles southeast of Crescent Dunes. The BLM determined occupancy at this nest based on the presence of one nestling and one adult visible in the nest.

The other previously known golden eagle nest was determined to be unoccupied. No evidence of nesting material or nest site were found at or near the known location previously used. No nests were found in the second ground survey area. Potential habitat exists; however, it would be considered marginal based on the relatively small extent of cliff-like features and rock outcrops (BLM 2010b).

Two incidental sightings of golden eagles were made during the ground surveys: one of a soaring adult in T4N, 42E, Section 14, and the second of an immature in T5N, R42E, Section 28.

No additional active golden eagle nests were found during the aerial survey. One inactive golden eagle nest was found approximately 4 miles east of the project area. Old whitewash and a significant amount of nesting material were present. Some maintenance of the nest would need to occur to make in order for it to be utilized, although the nest condition would be considered fair to good.

Two additional incidental sightings of golden eagles were noted. One sighting was an immature golden eagle 9 miles southwest of the project area. The other sighting was likely a recently fledged juvenile golden eagle approximately 11 miles northeast of the project area (BLM 2010b).

Based on the findings from the ground and aerial surveys, one confirmed active nest is located within the 10-mile buffer of the project area. The nearest potential project disturbance to this nest is approximately 7 miles away. Because of the location and direction the nest faces on the cliff, the nest would be shielded from the disturbance by topography (BLM 2010b).

Sufficient evidence of suitable nesting habitat was found in the San Antonio Mountains, and one other previously used golden eagle nest was found. Based on the extent of habitat, it is likely this area could support two active golden eagle nests in one nesting season. Overall, the potential golden eagle cliff nesting habitat within 10 miles of the project area is limited (BLM 2010b).

Other protected bird species that could potentially utilize the project area may include the black-throated sparrow, red-tailed hawk (*Buteo jamaicensis*), common raven, horned lark, barn swallow (*Hirundo rustica*), rock wren (*Salpinctes obsoletus*), Say's phoebe (*Sayornis saya*), and white-crowned sparrow (*Zonotrichia leucophrys*). Big Smoky Valley, where the project area is located, contains playas that may be seasonally inundated and could provide temporary habitat for migrating birds such as American avocet (*Recurvirostra americana*) or northern harrier (*Circus cyaneus*) (Great Basin Bird Observatory 2009). Many other protected species of birds may potentially utilize the project area in addition to the species listed here. Avian species composition and density in the project area would vary with season and available habitat type. Avian species diversity would be highest during the spring and summer months, when Neotropical migrant species are present in the area.

5.0 Threat Assessment

5.1 AVIAN AND BAT USE OF CRESCENT DUNES PROJECT COMPONENTS

5.1.1 Central Receiving Tower

Avian species potentially utilizing the central receiving tower may include raptors and corvids (ravens and crows), which may find the height and prominence of the tower appealing for roosting and nesting. The tower may also provide a perch location from which raptors can hunt prey below. The tower, however, is located near the center of the heliostat field and a minimum of 3,800 feet from native foraging habitat. It is anticipated that the high temperatures in and around the central receiver when in operation would deter avian species from being attracted to the tower. As required by the Federal Aviation Administration (FAA; see below), the tower would be lighted during the day (with white blinking lights) and at night (with red blinking lights). The tower lighting is likely to attract insects, which may in turn attract bats.

5.1.2 Heliostat Solar Field

It is not anticipated that bats or avian species would intentionally or deliberately utilize heliostats for any nesting, roosting, or perching purposes since the mirrors would not be stationary and would rotate continuously during the day to track the sun during operations. However, avian species may mistake the mirrored surfaces of the heliostats for open water, which is generally a source of foraging habitat.

5.1.3 Transmission Lines and Power Poles

Transmission lines and poles may potentially be utilized as perching and roosting habitat for many bird species. Regardless of whether they are foraging or nesting, birds on or near the ground surface may feel susceptible to predators or other threats that could be hidden in the surrounding vegetation. Since the transmission lines and poles would be located well above the tallest vegetation in the project area, birds perched or roosting on these structures have a more open and distant view of their surroundings. The awareness of their surroundings, combined with the protection of perching or roosting at heights well above terrestrial predators, would appeal to many species.

Raptors are opportunistic and may use power poles for a number of purposes, including nest sites, high points from which to defend territories, and perches from which to hunt prey. Hunting from a perched position is energetically efficient for a bird, provided the bird has a view of quality prey habitat. Generally, the power poles would place raptors at a considerable elevation above the surrounding terrain, offering an ideal hunting position and high point for defending territory. Nesting on power poles would allow a raptor a high point from which to defend the nest and diminishes the threat of nest predation from reptiles and mammals.

5.1.4 Evaporation Ponds

The project would include three evaporation ponds that would receive piped industrial wastewater generated by the cooling tower blow down and occasionally from the first pass reverse osmosis system (used for pre-treatment of groundwater supply) and the steam cycle blow down. Steam from the steam cycle blow down may also be diverted into the cooling tower and evaporated in these ponds (Worley

Parsons 2010). Since existing water sources are relatively scarce in the region surrounding the project area, the water in the evaporation ponds would tend to attract bats and various avian species. This wastewater would actually be a brine solution, however, which is water that contains large amounts of sodium. A study at a solar-energy facility near Harper Dry Lake in the Mojave Desert of California revealed that invertebrates utilize evaporation ponds during larvae and pupae stages and can successfully emerge as adult insects (Herbst 2006). It is expected that aquatic insects would be present in the three evaporation ponds at the project site because the ponds would be similar to the evaporation ponds at the project site near Harper Dry Lake. As a potential forage source, these aquatic insects would attract avian and bat species to the ponds. This forage source combined with the consistent availability of water may encourage some avian species to nest or roost at the ponds, or on other components of the solar utility system.

5.2 CAUSES OF AVIAN AND BAT MORTALITY

5.2.1 Collision

5.2.1.1 Central Receiving Tower

The potential for avian and bat species to collide with the central receiving tower would be present when avian species are in flight during adverse environmental conditions, such as rain, fog, strong winds, or other similar periods of low visibility. Avian and bat species are also subject to collision with the tower when flying while distracted. Potential distractions could include foraging, territorial chases, escape from predators, nearby human activity, or other such action that results in aggressive and swift flight, or erratic and fear-driven flight. The potential for collision with the central receiving tower would also be present if avian species were flying to or from a nesting or roosting site on the tower.

The FAA requires that structures that reach heights greater than 199 feet above ground surface be lighted. Because the central receiving tower would reach a height of approximately 653 feet above ground surface, it would be lit per FAA requirements. This lighting could attract birds to the tower at night, potentially resulting in collisions with the structure. It is reported that birds flying at night are attracted to lights (Manville 2005) or may become disoriented and congregate around the illuminated areas rather than continuing flight toward the birds' original destinations (Towerkill.com n.d.). Studies performed at towers less than 480 feet tall have shown that avian collisions are less likely to occur when flashing lights are utilized rather than steady-burning lights (Gehring, Kerlinger, and Manville 2009). Red lights on towers seem to disorient migrating birds more than white or green lights (Rich and Longcore 2006).

5.2.1.2 Transmission Lines and Power Poles

Bat species and avian species are susceptible to potential collisions with the transmission lines and power poles. Bats are most active in low-light to dark hours. While bats typically navigate and forage by emitting and receiving high-frequency sound (echo-location), bats not actively echo-locating may fail to detect the transmission lines or poles when in flight. Avian species may be susceptible to collisions with transmission lines due to an inability to see or distinguish the lines. If the transmission lines are spotted during flight, heavy-bodied, less agile birds or birds within large flocks may lack the ability to quickly

negotiate the lines, making these birds more susceptible to a potential collision. Adverse weather obscuring sunlight and moonlight could contribute to difficulties bats and birds may have seeing or detecting the transmission lines.

Bats and birds may be distracted when foraging to the extent that awareness of their surroundings is reduced. This level of distraction is also possible during reproductive activities, territorial chases, and when fleeing a predator. Even if awareness of surroundings is retained, distracted bats and birds would be subject to potential collisions with transmission lines and power poles. Raptors that may hunt from perches on the power poles and aerial foraging birds (swifts, swallows) would be the bird species most susceptible to collision while foraging. The potential for collision with the power poles is also present when avian species are flying to or from a nesting or roosting site on the power pole.

Occasional human activity in the project area could potentially distract birds and bats causing them to feel threatened. Such birds may take flight while distracted by human activities, a distraction which could contribute to a potential collision with the transmission lines and power poles.

5.2.1.3 Heliostats

The reflective surfaces of the heliostats (front-side only) may be mistaken as open water or open air space by avian species, which could attract birds and result in potential collisions. An avian mortality study at Solar One, an existing project similar to the proposed project, found that 81 percent of the observed avian mortalities at the Solar One project site were the result of collisions with project components and structures. More than 75 percent of these collision-related mortalities were from collisions with the heliostats at Solar One (McCrary et al. 1986). However, the study found that only a small proportion (less than 1 percent) of the total birds in the area suffered mortality from the Solar One project.

5.2.2 Electrocution

5.2.2.1 Transmission Lines

Avian electrocutions can occur when a bird completes an electric circuit by simultaneously touching two energized parts or an energized part and a grounded part of the electrical equipment. The reason birds may complete an electric circuit can be attributed to two interrelated factors: environmental factors and engineering factors (APLIC 2006).

Environmental factors are naturally occurring factors that affect avian use of power poles. The behavioral and biological characteristics unique to individual avian species determine in part how that species will utilize power poles, and affect their potential to suffer electrocution from such use. Behavioral and biological characteristics include the physical size and shape, foraging characteristics, flight pattern, and territorial traits of the species. Environmental factors also include the natural topography of the area, vegetation in the area, available forage and prey in the area, and weather. These factors affect the behavior of birds. Eagles are the most commonly reported electrocuted avian species, with golden eagles reported to suffer electrocution 2.3 times more frequently than bald eagles (Manville 2005).

Engineering factors include the physical design and construction of the electrical system, including the transmission lines, power poles, transformers, and other components of the system. A bird may potentially come into simultaneous contact with two energized conductors or an energized conductor and grounded hardware if the spacing between any of these two components is inadequate. If such contact were to occur, an electric circuit would be completed and electrocution would result (APLIC 2006).

5.2.2.2 Bird Nesting

Nests on power transmission structures that pose the greatest risk to birds are those that are built in close proximity to energized conductors and hardware. While a nest that is not in close proximity to energized parts may not be an electrocution risk in and of itself, it would tend to cause the parent bird and possibly nest predator birds to routinely land on other parts of the power pole or surrounding poles that may be unsafe (APLIC 2006). In the project area, the species most likely to nest on power poles are ravens and raptors.

5.2.3 Evaporation Ponds

Since existing water sources are relatively scarce in the region surrounding the project area, the evaporation ponds would tend to attract bats and various avian species. Bats could potentially ingest water (brine solution) from the ponds and consequently suffer sodium toxicity which could cause illness or death of the bat (Arizona Game and Fish Department 2010). Bats that forage on insects at the evaporation ponds or near the evaporation ponds could potentially fall into the ponds and drown if no escape route is available or found. Bats and birds that have fallen into ponds may also be identified as ideal prey by raptors since they may become exhausted or distracted while struggling to escape the water.

Waterfowl, shorebirds, and other resident or migratory birds that drink or forage at the ponds might be harmed by hyper-saline conditions of the water or brine solution. Birds using the evaporation ponds could ingest the water and become ill or die from sodium toxicity (USFWS 2009). Like bats, birds (other than aquatic species) could potentially fall into the water while utilizing the ponds and drown if no escape route is available. Additionally, birds that utilize the water may experience a build-up of sodium crystals in their feathers. The sodium crystals would reduce the feathers' thermoregulatory properties, which could potential cause mortality from hypothermia during cold weather (USGS 2009). The accumulation of salt crystals on the feathers of birds may also impede their ability to fly, which could potentially result in mortality.

5.2.4 Burning from Concentrated Solar Energy

During normal operation of a solar tower facility, solar energy is collected by reflecting sunlight from heliostats onto the central receiver, mounted on top of the tower. Thus, the surface temperature of the receiver itself will exceed 1,000 degrees Fahrenheit during operation. The receiver would be turned on and off daily and would not be operated at night. During startup, testing, and maintenance of the CDSEP, the heliostats would temporarily direct solar energy to standby points, which are points on the central receiving tower located just below the receiver. At the site of the previously mentioned avian mortality study at the Solar One project, several birds were found dead at the base of the central

receiving tower; these birds had been severely singed or burned (McCrary et al. 1986). The dead birds were small, fast-flying species (swallows), and the authors speculated that the birds may have been unable to alter course at high speeds to avoid the heat in time to prevent injury. Based on these findings, it is possible that avian species in the project area flying at elevations of the receiver or just below it (approximately 500 feet to 638 feet above ground surface), or birds attracted to the tower as a potential perch or roost site, may be at risk of injury or death from burns. Bats are much more active during night hours when solar energy would not be concentrated, and thus would not likely be subject to burns.

5.3 EFFECTS TO AVIAN AND BAT SPECIES

5.3.1 Effects from Project Construction

5.3.1.1 Central Receiving Tower and Heliostat Solar Field

Direct impacts would occur to golden eagles and migratory birds as a result of the project because project construction would remove approximately 1,500 acres of potential foraging habitat for golden eagles and nesting and foraging habitat for migratory birds. Most of this habitat consists of Inter-mountain Basins Mixed Salt Desert Scrub, which is the dominant habitat in the surrounding area. The project would not restrict bird migration throughout the lower Big Smoky Valley; however, it may remove a small proportion of the available migratory bird habitat and golden eagle foraging habitat in the area.

Most birds are highly mobile, and initial construction activities would not occur during nesting periods; therefore, it is unlikely that grading activities associated with project construction would result in bird injury or death because most birds can flee the area. However, a few species such as burrowing owls may be more susceptible to injury or death during grading activities because they may hide in their burrows and not be able to flee in time. Grading activities could destroy nests; however, disturbances to nesting birds would be avoided by avoidance and minimization. Avoidance and minimization would include restricting grading activities during migratory bird breeding season (April 1 – August 31) or having a monitoring biologist on-site during grading activities so that nests can be identified and avoided. Increased noise levels during construction may cause birds to avoid the area temporarily, possibly disrupting normal behavior patterns.

No indirect effects to golden eagles or migratory birds from the construction of the proposed project are likely to occur.

Direct effects to a wide variety of special status bat species would include the removal of approximately 1,673 acres of potential foraging habitat. The Proposed Action would not restrict bat migration throughout the lower Big Smoky Valley.

No indirect effects to bats are likely to occur from the construction of the project (BLM 2010a).

5.3.1.2 Transmission Lines and Power Poles

Direct effects to golden eagles and migratory birds from construction activities would be similar to those associated with construction of the central receiving tower and heliostat solar field in that potential foraging habitat would be lost.

No indirect effects to golden eagles and other migratory birds have been identified from the construction of spur roads and installation of power poles.

Direct effects to bats from transmission line construction activities would be similar to those associated with construction of the central receiving tower and heliostat solar field in that potential foraging habitat would be lost.

No indirect effects to bat species have been identified from construction of spur roads and installation of power poles (BLM 2010a).

5.3.1.3 Evaporation Ponds

Direct effects to golden eagles and migratory birds associated with construction of the evaporation ponds would be the same as those associated with construction of the central receiving tower, heliostat solar field, transmission line, and power poles in that 40 acres of potential foraging habitat would be lost.

No indirect effects to golden eagles and migratory birds associated with construction of the evaporation ponds were identified.

Direct effects from construction of the evaporation ponds to a variety of bat species would include the temporary removal of approximately 40 acres of potential foraging habitat. Construction of the evaporation ponds would not restrict bat migration throughout the lower Big Smoky Valley.

No indirect effects to bat species associated with construction of the evaporation ponds are likely to occur (BLM 2010a).

5.3.2 Effects from Project Operations

5.3.2.1 Central Receiving Tower and Heliostat Solar Field

A potential direct effect of the project operations on golden eagles, migratory birds, and bats is death or injury resulting from collisions with structures associated with the project area. A variety of species of birds have been documented colliding with buildings and other structures, resulting in death or injury. Such collisions probably occur because of the reflection of the sky in the structure. A study on a project similar to the proposed project found that a variety of migratory birds were injured or killed after colliding with various components of the facility. However, the study found that only a small proportion (less than 1 percent) of the birds in the area were affected.

Another potential direct effect on golden eagles, migratory birds, and bats is injury or death associated with the heat generated by the central receiver/tower component of the proposed project. Reflected solar energy would be focused on the central receiver/tower, causing the surface temperature of the receiver to exceed 1,000 degrees Fahrenheit during the day. In the 40-week study at the previously mentioned project site with the central receiver, several birds were found dead at the base of the central tower; they had been severely singed or burned. The dead birds were small, fast-flying species (swallows), and the authors speculated that the birds may have been unable to alter course at high speeds to avoid the heat in time to prevent injury.

Based on these findings, it is possible that other migratory birds that fly at elevations similar to the receiving tower (600 feet) and those attracted to the tower as a potential perch or roost site, including golden eagles, may be at risk of death or injury (BLM 2010a).

5.3.2.2 Transmission Lines and Power Poles

Direct effects on migratory birds resulting from project operation of the transmission line may include injury or mortality from transmission line collisions and/or electrocutions. Birds may collide with transmission lines because transmission lines are not readily visible to them. Recent research has shown that the rate of bird collisions may be closely related to bird size. Larger birds in the project area may be particularly at risk because it is harder for them to change direction quickly. Smaller birds such as passerines are generally much more agile and may be better at avoiding transmission lines. Because the transmission line would be built in a corridor that already contains several transmission lines, the concentration of transmission lines may make them more visible, therefore making it more likely for birds to avoid the area. Bird electrocutions occur when the bird's body bridges the gap between two energized components of the transmission line. Once again, larger birds with greater wingspans may be much more susceptible to electrocution because larger wingspans can increase the potential for two points of contact. This potential effect can be mitigated by spacing the wires appropriately so that it is impossible for the wingspan of the largest birds in the area to contact two wires. Current design standards dictate these specifications (BLM 2010a).

In addition to collisions and electrocutions, electromagnetic fields may affect birds that roost or nest near transmission lines. Electromagnetic fields could affect a number of factors including but not limited to fertility rates, nest success, egg quality, and hatch success. Some studies suggest that effects of electromagnetic fields are species-specific, so the complete range of effects for birds in the area is unknown (BLM 2010a).

Not all direct impacts of the transmission line may be adverse. Recent research shows that raptors and corvids may benefit from the presence of transmission lines because they may provide more roosting or nesting opportunities (Steenhof et al. 1993). This study also found that nest success for golden eagles was higher (10 percent) for nests on transmission lines than for nests in cliffs.

Because habitat for golden eagles and migratory birds would be removed during initial grading and excavation activities, no additional indirect impacts are likely to occur with operation of the transmission line and Anaconda-Moly Substation corridor.

Introduction of a new transmission line throughout the valley may increase perching opportunities for raptors, owls, and other avian predators. These avian species may increase the predation pressures on vulnerable species, such as the bat species in the area.

Because habitat for special status bat species would be removed during initial grading activities associated with installation of the transmission line and completion of spur roads, no additional direct effects from operation of the transmission line are likely to occur.

Because habitat for bats would be removed during initial grading and excavation activities, no additional indirect impacts are likely to occur with operation of the transmission line and Anaconda-Moly Substation corridor (BLM 2010a).

5.3.2.3 Evaporation Ponds

Direct effects may include bird injury or mortality during operation because of the presence of evaporation ponds associated with the facility, the presence of additional structures in the area, and the presence of the high-temperature central receiver. The evaporation ponds may attract birds to the project site. The water in the evaporation ponds would be saturated with salt (making a brine solution). Birds using the evaporation pond could ingest the brine and die from sodium toxicity if a freshwater source is not available nearby. Additionally, birds that utilize the water may experience a build-up of sodium crystals in their feathers, resulting in a reduction of the feathers' thermoregulatory properties, causing the birds to die of hypothermia during cold weather. The accumulation of salt crystals on the feathers of birds may also impede their ability to fly.

Migratory bird habitat and golden eagle foraging habitat within the project area would be removed during construction activities. No indirect effects to these species are likely to occur during operation of the facility.

Direct effects to bats may result from the operation of the facility's evaporation ponds. Bats may be attracted to the water in the ponds (and would not be excluded by the fence around the facilities). The water in the evaporation ponds would be saturated with salt (making a brine solution). If bats ingest water from the pond, they may become ill or die from sodium toxicity. Bats could also fall into the ponds and drown if no escape route is available.

Bat foraging habitat within the project area would be removed during construction activities. No indirect effects to these species are likely to occur during operation of the facility. Additionally, project structures may provide roosting opportunities for raptors, owls, and other predatory birds that prey on bat species, thus increasing predation pressure on these sensitive species (BLM 2010a).

5.3.3 Effects from Project Maintenance

5.3.3.1 Central Receiving Tower and Heliostat Solar Field

Direct effects to golden eagles, migratory birds, and bats from maintenance activities at the central receiving tower and heliostat solar field include the potential for individuals to be crushed by vehicles. No indirect effects are expected.

5.3.3.2 Transmission Lines and Power Poles

Direct effects to golden eagles, migratory birds, and bats from maintenance activities at the transmission lines and power poles include the potential for individuals to be crushed by vehicles. No indirect effects are expected.

5.3.3.3 Evaporation Ponds

Direct effects to golden eagles, migratory birds, and bats from maintenance activities at the evaporation ponds include the potential for individuals to be crushed by vehicles. No indirect effects are expected.

6.0 Avian and Bat Protection Measures and Modifications

6.1 COLLISION

6.1.1 Central Receiving Tower

The central receiving tower would be roughly cylindrical in shape and extend upward to more than 650 feet above the ground surface. The diameter of the central receiving tower at ground level would be up to 115 feet, and although it would taper along its length, the tower would still be of a considerable diameter near the top end. Due to the sheer size of the tower most birds and bats are likely to perceive and thereby avoid its presence. The size and design of the tower also eliminates the need for guy wires, which avian and bat species may collide with if present. Additionally, the tower would not be constructed of reflective material that may be mistaken for water or air space by passing birds, and thus would be less likely to attract birds and result in collisions. The tower, along with its size, would be constructed in a manner to minimize nesting or perching opportunities. The tower would be constructed of slip form concrete rather than lattice steel, thus providing a smooth vertical or near vertical surface. Operation of the tower would also require frequent and extensive human presence and activity, which would not be conducive or favorable to nesting. Likewise parts of the tower would be subject to concentrated heat during operations, which would prevent the birds from nesting on the parts of the tower. TSE would monitor any potential perching and nesting locations on the central receiving tower as needed when it is safe to do so. TSE may also add perch deterrents to appropriate places on the tower as needed.

Because the central receiving tower would reach a height of approximately 653 feet above the ground, it would be lit per FAA requirements. The lights could contribute to avian mortality from potential collisions with the tower since lights appear to be a key attractor of night-migrating songbirds (Manville 2005). TSE would use the minimum number of lights at the minimal intensity required per FAA requirements to light the tower, and the lights would flash or blink. The utilization of flashing or blinking lights in place of steady-burning lights has been reported to reduce the likelihood of avian collisions with towers (Gehring, Kerlinger, and Manville 2009). Lights within the facility would be designed to illuminate synchronously. Plant facility lights would be fully shielded and focused downward to reduce skyward illumination. Aerial foraging avian species have been observed to feed on swarms of flying insects attracted to continuously burning artificial light sources at night (Lebbin, Lenz, Andersen, and Ellis 2007). Some bat species would be anticipated to feed on swarms of insects attracted to artificial light sources as well, considering flying insects are primary forage for many bats. Birds and bats could potentially collide with the lighted structures while foraging. Therefore, TSE would equip plant facility lights with motion detectors or power switches so that continuous illumination is avoided, except where continuous illumination is necessary for safe operations.

This would prevent swarms of insects from forming near structures equipped with lights that are not on continuously, and thus reduce potential for avian and bat collisions.

6.1.2 Transmission Lines and Power Poles

The transmission line poles would be constructed as typical three-phase H-frame structures that utilize two upright poles instead of one pole typical of mono-pole structures. The use of H-frame structures may increase the visibility of the structures to birds and bats, since the poles would be grouped in pairs connected with cross-bracing lumber. Guy wires used to add stability to monopole structures are not required as often for H-structures, which reduces the potential for collision with the thin guy wires. Any necessary guy wires would be marked with recommended bird deterrent devices (APLIC 2006 and USFWS 2000). The use of guy wires on meteorological towers would be avoided.

The transmission line poles outside of the project perimeter fence, which separates facilities inside the plant fence from undisturbed foraging habitat, would be constructed with anti-perch devices to prevent raptors from preying on small mammals from perched positions on the poles. The anti-perch devices would reduce avian use of the power poles, which could consequently reduce potential collisions with the poles.

Static transmission lines are the smallest diameter lines and therefore are potentially the most difficult for birds to see and avoid. In order to minimize collisions, all static transmission lines would undergo wire marking. Typical, commonly accepted wire marking methods would be used as needed, including placing crossed bands between the two static wires or hanging material from the static lines. Additionally, the transmission line would be constructed adjacent to two existing overhead transmission lines. This may contribute to the improved visibility of transmission lines since more would present in a concentrated area.

6.2 ELECTROCUTION

The transmission line poles would be typical three-phase H-frame structures constructed of two wood poles embedded upright into the ground without a continuous foundation. A wooden cross-arm would extend between the two poles and support three hanging insulators, each of which would hold a phase conductor (transmission line). Cross bracing made of wood would be used to stabilize the two upright poles and to support the cross-arm. A separate wooden cross-arm would be near the top of the two upright poles to support two static wires.

The use of wood reduces the potential for electrocution because wood is a poor conductor of electricity and there are fewer potential circuits present than when metal poles are used. Additionally, the power poles would be constructed in accordance with the raptor-safe design criteria recommended by the APLIC (2006). The APLIC recommends at least 5 feet of clearance between phases and any electrical ground. Each phase of the three-phase transmission line at the project would be spaced approximately 15.5 feet from each other and between 7 to 9 feet from the nearest potential electric ground. This would prevent birds, including golden eagles, which are expected to be the largest bird in the area, from completing an electrical circuit and suffering electrocution through utilization of the transmission lines.

6.3 EVAPORATION PONDS

In order to maximize the evaporation rate of the wastewater, the evaporation ponds would remain uncovered. Leaving the pond uncovered would also ensure that bats and birds do not get trapped or entangled by any sort of mesh netting or screen. According to *The Revised Nevada Bat Conservation Plan*, preliminary studies have shown artificial water sources with modifications such as wires across the top that impede direct flight patterns are a source of mortality for bats (Bradley, O'Farrell, Williams, & Newmark 2006). To further reduce potential bat and avian mortality at the ponds, TSE would incorporate several protection measures, listed below, into the design and operation of the ponds.

The evaporation ponds would be constructed with interior side slopes of 3:1 (horizontal:vertical) or steeper. This would ensure that there are no shallow areas in the evaporation ponds that would encourage or facilitate avian wading. Additionally, evaporation ponds would be designed and operated so that a minimum freeboard of 3 feet is maintained at all times. The freeboard is essentially the distance from the top of the water surface to the top of the containment berm. The freeboard would also be constructed to slopes of at least 3:1, ensuring that there are no gradual approaches or entry points to the ponds. The steep 3:1 slope approach to the water surface would be difficult for birds to negotiate and would assist in deterring avian use of the water. Anti-perching devices would also be installed around the perimeter of each evaporation pond to assist in preventing birds from having perching locations directly near the ponds. Despite these protection measures, there would still be potential for bat and avian species to accidentally fall into the water. In order to reduce mortality risks associated with drowning from an accidental fall, a textured liner would be installed at each corner of the three evaporation ponds. The corners of the pond represent the best locations to ensure that ramps intercept species swimming along the pond perimeter where most species will naturally swim to escape. The textured liner would allow bats and birds to crawl out of the water.

It is anticipated that waterfowl species capable of landing directly on the surface of the water, such as ducks and geese, would still access the pond even with implementation of the protection measures described above. Although waterfowl are anticipated to be the highest risk category, other avian species, such as shorebird species, may be present even though the ponds have been designed to minimize access. In order to protect these species and minimize mortality risks associated with salt encrustation and/or salt toxicosis from ingestion of water, proper management of the pond hydrology would be practiced (see Appendix C). The water contained in the evaporation ponds would be a brine solution. A solution is a mixture of one or more solutes dispersed in a sufficient quantity of dissolving medium solvent. In a brine solution, salt is the primary solute and water is the primary solvent. The strength of a solution is inversely related to the volume of solvent present in solution. Therefore, the salinity of the brine solution in the evaporation ponds is inversely related to the volume of water present in the ponds. If water levels are allowed to drop in the evaporation ponds, the salinity of the brine solution would increase as the solute (salt) became more present in volume. If more water is introduced to the brine solution in the evaporation ponds, the salinity of the brine solution would be reduced. Based on information provided by GeoTrans, Inc. in the Biological Resources Mitigation Implementation Plan Compliance Reports prepared quarterly from 2002 to 2008 for the Harper Lake Solar Project Inc., salt encrustation and salt toxicosis have been a rare occurrence at evaporation ponds at that project (as cited by ENSR AECOM 2008). The report describes the rare occurrences of mortality

from salt encrustation and salt toxicosis that have been observed at the Harper Dry Lake Solar Facility project as being associated with periods of low water levels in an evaporation pond. Since then, a recurrence of avian mortality has been avoided at that project through increasing the water levels in all evaporation ponds that are active at any given time.

TSE would adopt management and operation practices for evaporation ponds similar to those enacted at the Harper Dry Lake Solar Facility project to prevent avian mortality. TSE would prepare an operational plan detailing the planned operation of the ponds prior to placing the evaporation ponds in service. Such a plan would ensure the operational personnel are familiar with the design features and operation techniques designed to protect avian and bat species. TSE would install a water level gauge and a hydrometer at each active evaporation pond and gather daily water level and salinity measurements. Electrical conductivity would be used as an indicator of salinity. A direct reading thermometer with the capability of recording temperature data at least diurnally would also be installed. Salt crystallization is known to increase in cooler water temperatures, particularly temperatures of 4 degrees Celsius or colder. If the average overnight water temperature in the active evaporation ponds dips to 4 degrees Celsius or colder, a visual survey of the ponds would be conducted immediately on the following morning. If upon inspection of the active ponds the designated representative observes evidence of recent substantive increases in salt crystallization anywhere within the pond (e.g., at or near the waterline), all water would be pumped into one or two ponds to increase the pond volume and lower the subsequent average salinity within the pond(s). At the same time, the remaining pond or ponds would be pumped dry. The pond to which the combined flow is discharged during this time would be rotated each year periodically as needed so that water levels do not rise too high and minimum freeboard requirements are met. Additionally, the evaporation ponds would be designed with provisions for installing evaporative spray nozzles to be used in the event that climatic conditions are such that evaporation rates must be accelerated to maintain the minimum freeboard requirements. Implementation of these devices and operational practices, which are similar to the operations utilized to prevent avian mortality at the Harper Dry Lake Solar Facility project, would be anticipated to prevent impacts to avian and bat species.

To further avert potential impacts to avian species, TSE would install visual deterrents at active evaporation ponds. The use of visual deterrents would be intended to cause birds to feel uncomfortable with or frightened by the area surrounding the evaporation ponds and to prevent them from landing on or otherwise utilizing the ponds. The visual deterrents that TSE may install include various decoys which mimic avian and terrestrial predators, or various objects that scare or confuse birds with bright colors, motion, reflective surfaces, and surface patterns that resemble predatory bird features, such as large reflective eyes. The use of decoys that mimic avian species would be avoided during breeding season. In order to prevent birds from becoming acclimated to the deterrents, TSE would routinely redistribute them to new locations around the ponds and regularly alternate the types of deterrents used.

Implementation of the pond management practices described above would be anticipated to prevent impacts to avian and bat species at the evaporation ponds, and the installation of visual deterrents would minimize avian and bat use of the ponds.

However, TSE may elect to implement other deterrents or measures to discourage avian use of the evaporation ponds. Some of the deterrents that TSE may utilize include the following:

- In the event that climatic conditions are such that evaporation rates must be accelerated to maintain the minimum freeboard requirements at any one or more of the ponds, evaporative spray nozzles would be installed and operated at that specific pond or ponds.

- The use of a gas-fired air cannon, often referred to as a "bird cannon," may be used to haze waterfowl and frighten them away from the ponds. Bird cannons work by igniting a mixture of gas and oxygen to produce a sudden, unexpected noise similar to that of a gunshot. The unexpected noise startles birds, causing them to panic and flee the area. The noise can be projected in general directions by pointing the "barrel" of the cannon toward intended areas. The bird cannon would be stored on-site but would be used only intermittently because birds may become acclimated to the disturbance caused by cannon hazing if used regularly. Other devices may be constructed and utilized that are capable of producing similar sudden and high-decibel noises to scare waterfowl without harm.

- Sonic devices capable of producing sounds that mimic the distress calls of various avian species or the calls of various predator species may be installed around the ponds. The sounds produced by the sonic devices would frighten or alarm avian species to the extent that they avoid the pond area. The sonic devices would be used at infrequent intervals so that avian species do not become acclimated to the sounds. Ultrasound devices capable of emitting high frequency noise that irritates birds but is silent to humans may also be utilized to discourage avian use of the ponds. Ultrasounds have not been proven effective in deterring bats (Ferraro, Hygnstrom, & Vantassel 2007).

This list is only a partial inventory of the avian deterrents that TSE may implement as needed to keep birds from landing on, or otherwise using, the evaporation ponds. The deterrents that TSE implements would largely be dependent on the avian species that the deterrent was intended for and the time of year it is implemented (bird cannon would be used primarily during migration periods when waterfowl would have the greatest potential to be present). The rate at which a deterrent has been utilized would also be considered in order to prevent birds from becoming acclimated to the device. TSE may not necessarily implement each or any of the deterrents identified in the list. Additional deterrents may also be developed as new avian deterrent technology and information become available.

Some impacts resulting from avian use of the evaporation ponds may be better mitigated using the adaptive management approach described in Section 7.0. Whether an impact warrants mitigation requiring implementation of adaptive management actions would be determined collaboratively among TSE and the USFWS, NDOW, and BLM. Several factors would be considered when making the determination, such as the avian or bat species impacted, whether that species is listed as threatened or endangered, the rarity of the species, the effects to the population level of that species, whether previous mortality of the species has been reported at the ponds, and total mortality of all species reported at the evaporation ponds.

Continued post-construction mortality monitoring at the evaporation ponds would reveal if these adaptive management techniques have been successful in minimizing mortality as intended. The success of the techniques shall be determined through consultation among the USFWS, NDOW, and BLM, in collaboration with TSE. Should, through this consultation, after all other adaptive management techniques are exhausted, it be determined that impacts resulting from the evaporation ponds remain unacceptable, netting would be installed on one or more of the ponds. The ponds would be initially designed with adequate spacing for the installation of net support structures and cable tie downs so that netting could be installed while allowing the ponds to function as a means of evaporation. However, this measure would be implemented only as a last and final resort if avian and or bat mortality could not be controlled with other adaptive management techniques.

7.0 Implementation and Adaptive Management Actions

7.1 TONOPAH SOLAR ENERGY POLICY

TSE would voluntarily adopt and implement the avian and bat protection measures as described in this ABPP to reduce the potential for mortality that could result from electrocution, collision, burning from concentrated heat, saline toxicity, and drowning in evaporation pond water.

7.2 AVOIDANCE AND MINIMIZATION

TSE has agreed to several measures to avoid and minimize impacts to avian and bat species during project construction and operation that are discussed in Section 6 of this document. Lighting would be controlled on the central receiving tower to minimize the potential for avian and bat collisions. Transmission lines and power poles would be constructed to APLIC standards which would minimize impacts to avian and bat species in the project area. Evaporation ponds would be constructed in a manner to discourage wading. Anti-perching devices would be installed at evaporation ponds, and visual deterrents would be installed.

In order to minimize impacts to migratory birds during initial construction activities, TSE would avoid land-clearing activities such as vegetation removal during the avian breeding season (April 1 to August 31). These dates may be modified by BLM based on specific site and weather conditions. If land-clearing activities take place during the avian breeding season, a qualified biologist would conduct preconstruction surveys in the affected area to identify nests and breeding birds. If active nests were located, then a protective buffer zone would be delineated around the area (approximately 100 feet) and land-clearing activities would be restricted within this buffer zone (BLM 2010a).

During project operations, vehicles would travel on project roads to minimize destruction of the native habitat in the project area, which would minimize habitat impacts and crushing of avian and bat species during project-related activities.

7.3 ASSESSMENT AND IMPLEMENTATION APPROACHES

7.3.1 Reactive Approach

The reactive approach would include implementation of adaptive management actions after avian or bat mortality has occurred. As incidents occur, TSE would respond appropriately through documentation via the Avian Reporting System (see Section 8.0). The post-construction monitoring procedures described in Section9.0 would also report and record mortality impacts resulting among avian and bat species interacting with the project facilities. These reports would be provided to the USFWS, NDOW, and BLM. The reported mortality impacts would be assessed by the three agencies in collaboration with TSE to determine whether the impact justifies mitigation by implementation of adaptive management actions. This determination would include several factors, including such factors as the avian or bat species impacted, whether that species is listed as threatened or endangered, the rarity of the species, the effects on the population level of that species, and consideration of previous mortality resulting to that species at the project site, or as a result of interaction with that project facility. Adaptive management actions would be developed based on many of these same factors. The development of specific adaptive management actions would occur collaboratively among the USFWS, NDOW, BLM, and TSE, and would be based on scientific data, effective actions implemented at similar projects, new

technology developed during the life of the project, and other similar or related information. Continued post-construction at the evaporation ponds would reveal if these adaptive management techniques have been successful in minimizing mortality as intended. The success of the techniques shall be determined collaboratively as well.

Not all impacts would warrant implementation of adaptive management techniques, such as reducing avian mortality at the evaporation ponds by implementing various avian deterrent devices at the ponds according to species and seasons. Although the mortality of a bat or bird or several bats and birds would occur for a reactive measure to be implemented, the population benefits through minimization or removal of the risk originally causing the mortality.

7.3.2 Preventative Approach

Preventative measures would include all of the initial protection measures described in this document that would be constructed into the project components in order to minimize mortality, such as anti-perching devices around the perimeter of the evaporation ponds or raptor-safe power poles and transmission lines. Preventative measures attempt to avert potential bat and avian mortality before the potential becomes reality. Effective preventative measures can help prevent possible violations of the MBTA, ESA and BGEPA.

Preventative measures also include mitigation measures implemented to minimize or eliminate the potential for avian mortality resulting from non-operational risks associated with the project, such as construction impacts. Appendix B contains several of the mitigation measures that TSE would implement for non-operational impacts.

7.4 PERMIT COMPLIANCE

There may be situations where TSE finds it necessary to obtain additional federal and state permits regarding avian or bat species as it relates to mortality and to avian nest removal and relocation. These could include incidental take permits, collection or salvage permits, and nest removal and relocation permits. In such a situation, TSE would work with the federal and state resource agencies listed in Section 7.10, Key Resources, to determine which permits are necessary and to acquire relevant permit applications. Under no circumstances would TSE perform any activity requiring a permit without first obtaining the proper permit or authorization to do so.

7.5 PERSONNEL TRAINING

In order to effectively implement the ABPP, TSE would ensure that all appropriate personnel (Facilities Maintenance Department, Resident Officer in Charge of Construction, etc.) undergo training on the issues and protocols outlined in the ABPP. This training would ensure that all appropriate personnel have a thorough understanding of the ABPP and their responsibility to avian and bat protection and regulatory compliance.

7.6 AVIAN AND BAT ENHANCEMENT OPTIONS

TSE would continue to protect natural resources and promote actions that benefit local and regional bird and bat populations. TSE would limit project disturbance to the area within the perimeter fence to the extent possible, thus maintaining local vegetation outside of the project perimeter fence that would maintain nearby nesting and foraging habitat for avian and bat species. TSE would avoid construction of new roads, and if necessary, new roads outside of the perimeter fence would be kept to a minimum.

In addition to enhancing habitat, TSE would install anti-perching guards on power poles outside of the project fence perimeter. Anti-perching guards would enhance the overall safety of the immediate habitat area. Based on agency consultation and approval, nesting platforms or nesting boxes could be constructed by TSE at a future date. Such construction would depend on future observations and monitoring data during operation of the facility, and would be coordinated with the USFWS, BLM, and NDOW.

7.7 NOISE EMISSIONS

Anthropogenic noise has generally been found to have negative effects on various avian species. With the exception of occasional motorized travel on existing roads in the area, the existing ambient noise in the vicinity of the project facility is free of anthropogenic noise. Ambient noise would generally be attributed to natural sources, predominantly wind. Wind blowing over grass and brush is reported to generate a noise level of 30 decibels (Kariel 1991).

Operation of the project facility would introduce anthropogenic noise to the area. The project facility would be operated in conformance with the OSHA standards for occupational noise standards (29 CFR 1910.95). Pursuant with the standard, a time-weighted average sound level (TWA) of 85 decibels or less would be maintained at the project facility. The power block would be the only source of consistent and regular anthropogenic noise that approaches the 85 decibel level. The power block is located near the center of the heliostat field and is separated by a distance of 3,800 feet from the project perimeter fence, which is where the nearest avian habitat would be located. Although several factors can alter the rate at which noise attenuates, including atmospheric absorption, scattering, and boundary interference, noise generally attenuates at a rate of 6 decibels each time the distance from the noise source is doubled (Crocker 2007). Applied to the project, the anthropogenic noise of 85 decibels at the power block would be reduced to approximately 25 decibels at 3,800 feet away. Noise of 25 decibels is comparable to a whisper (Olishifski and Harford 1975) and is less than the estimated ambient noise of the existing environment (30 decibels). Other noise sources associated with the project would occur infrequently and would be temporary, including occasional use of vehicles or water pumps at the evaporation ponds. Therefore, anthropogenic noise would not be expected to have negative impacts to avian species.

If operations later require a source of anthropogenic noise to be placed within a distance of avian habitat that would substantially increase the existing ambient noise level at that habitat, the source would be fitted with sound muffling devices or similar mechanisms to reduce noise emissions to the extent practicable.

7.8 QUALITY CONTROL

Periodically, TSE would assess various parameters and protection measures as described in the current ABPP to ensure that it is as efficient and effective as possible. Parameters that TSE would assess periodically include:

- assessing remedial action techniques through follow-up surveys to evaluate their effectiveness in reducing avian and bat mortality;
- assessing avian and bat protection devices to identify products preferred for avian and bat protection as well as ease of application and durability;
- assessing mortality reporting procedures to ensure that discoveries of avian mortalities are properly documented;
- assessing response to avian mortalities to ensure that appropriate actions are taken in a timely manner;
- assessing compliance with company procedures to ensure that personnel are consistently following company methods for avian- and bat-safe construction, mortality reporting, nest management, etc.; and,
- assessing public and agency opinions on system reliability and avian protection.

These parameters would be assessed during each periodic review of the ABPP if necessary or if appropriate for that period. Additional parameters other than those listed above may be assessed during review of the ABPP if determined necessary by TSE. Although it is only practical to periodically revise or update the ABPP, the quality control component would be an ongoing process. Daily observations, internal operating procedures, personnel input, and new technologies would be applied to assessments during the periodic reviews of the ABPP. Revisions and updates to the ABPP would be made in consultation with the USFWS, BLM, and NDOW. Revisions and updates to the ABPP would be addressed with personnel at the project area.

7.9 PUBLIC AWARENESS

A public awareness program can be an integral part of an APP. This program can be used to enhance general public awareness and support for a project's APP. It allows stakeholders such as government agencies, Tribes, non-profit organizations, wildlife rehabilitators, and other interested parties an opportunity to provide input to the decision-making process, enabling all parties to work openly and collaboratively toward recommendations that can be effectively implemented. This collaboration often leads to improved relationships within the community and to more efficient and positive projects. The relationships developed through this process may also encourage the public to report bird and bat mortalities and encourage them to seek assistance for birds and bats that have been injured in power line related accidents (APLIC and USFWS 2005).

TSE would include avian and bat protection in its ongoing public awareness campaign. Ongoing public awareness would include TSE's cooperative and innovative efforts to minimize avian and bat mortality, effectiveness of the ABPP, and ongoing monitoring to detect problem areas. Public awareness may be made available through brochures, websites, advertisements, or other media.

7.10 KEY RESOURCES

TSE will consult with the following key resources to assist in providing expertise in permitting, bird and bat populations and behavior, and avian- and bat-safe design features.

- U.S. Fish and Wildlife Service
- Nevada Department of Wildlife
- The Bureau of Land Management
- Nevada Natural Heritage Program
- Great Basin Bird Observatory
- Western Bat Working Group
- Nevada Bat Working Group
- Edison Electric Institute
- Avian Power Line Interaction Committee

These resources will be utilized as necessary and will further ensure that TSE has a successful and effective ABPP. Resources other than those listed may also be consulted, including consultants, company specialists, and other solar energy facilities with proven effective avian and bat protection programs.

8.0 Avian and Bat Reporting System

8.1 PURPOSE OF THE AVIAN AND BAT REPORTING SYSTEM

In order to assess the effectiveness of the ABPP and prioritize avian and bat protection needs, TSE would report, monitor, and manage all bat and avian injury or mortality in accordance with the methodology below. All appropriate TSE personnel, including managers, supervisors, line crews, and engineers would be provided with instruction on implementing the methodology and properly reporting bat and avian mortality. The reporting of avian and bat mortality would be standard practice by TSE for the duration of the operation of the project. The reporting of avian mortality from electrocution with transmission structures would also allow the development of measures to reduce potential power outages resulting from avian conflicts. Reporting of avian nesting sites would also be performed according to the methodology below.

8.2 AVIAN REPORTING SYSTEM COMPONENTS

8.2.1 Detection

Avian and bat injury or mortality would be detected through investigation of avian- or bat-caused power outages, through monitoring efforts during operation, and through incidental observations by TSE personnel or others. To improve the probability that birds or bats that have suffered injury or death do not go undetected, TSE field staff would be directed to remain alert for birds and bats within the project area and near the project area. The detection of avian nest sites would occur through monitoring efforts during operation and through incidental observations.

8.2.2 Response and Documentation to Injured, Deceased, and Nesting Birds

In the event that an avian or bat injury or mortality is detected through monitoring efforts or incidental observations, TSE personnel would record the circumstances and conditions associated with the death or injury. Among the information recorded would be the date and time that the bird or bat was detected, the location where the bird or bat was detected, the apparent cause of injury or mortality, and if possible, the species of the bird or bat. TSE personnel would be provided with a standardized Avian Incident Form for recording the necessary information when an incident is detected. An example form is provided in Appendix A.

TSE would perform a site assessment in response to any power outage that may occur in order to determine the cause and circumstances resulting in the outage. If it is determined that the power outage is related to avian interaction with the utility system, TSE would record the pertinent avian information using the standardized Avian Incident Form in Appendix A. Assuming the bird causing the outage suffers mortality from the incident, the information recorded would include the species of the bird, the nearest power pole number if applicable, the specific cause of the fatality if possible, and as much other relevant data as possible. Photographs of the bird carcass would be taken to accompany the standard reporting form if possible. It is unlikely that bat species would be capable of causing a power outage due to the lack of system damage that would be sustained from these smaller sized mammals colliding with utility facilities.

In the event that an avian nesting site is observed through monitoring or incidental observations within the project area, TSE personnel would record the circumstances and conditions associated with the nest site and nest. The recorded information would be used to determine if the nest and its locations present risk of injury or mortality to the nesting birds, and if the nest presents risk to the functionality of the solar project.

8.2.3 Remedial Action

While there are no legal provisions for an unauthorized take of protected species, the USFWS recognizes that some avian species may be killed even after all reasonable measures to avoid a take are implemented. Based upon the information gathered from site investigations and reported on Avian Incident Forms, TSE would determine whether implementation of remedial protection measures is substantiated. This determination would be dependent on the frequency of incident occurrences at a particular utility facility, the species that suffered mortality, the likely effectiveness of remedial actions, and agency input and guidance. Likewise, these same factors would determine what types of remedial protection measures and practices TSE would implement if such measures are determined necessary.

8.2.4 Reporting

TSE's Environmental Representative would complete and submit an Avian Incident Form (Appendix A) during, or immediately following the site investigation for future risk assessment. Although this form would be for internal submittal, it would be used for mortality monitoring studies at the site and would be available to regulatory agencies should data be requested. TSE's Environmental Representative would also complete the USFWS's online "Bird Fatality/Injury Report", an online database of voluntarily submitted incidents of bird mortalities and injuries resulting from electrocutions or collisions with utility structures. The intent of the database is to gain information that can be used to prevent future avian mortality.

Mortality of a bald or golden eagle would be immediately reported to the USFWS, BLM, and NDOW. Any other avian nesting or avian and bat mortality data reported in the area by persons not employed by TSE would be recorded by TSE in the USFWS online database as well.

8.2.5 Disposal Procedures for Injured, Deceased, and Nesting Birds

The USFWS issues permits to take, possess, or transport bald and golden eagles under the BGEPA. Considering that mortality of a golden or bald eagle is unlikely to result from the project, especially after implementation of the mitigation measures described in this ABPP, the need for a take permit under the BGEPA is not warranted at this time. TSE personnel are strictly prohibited from handling, transporting, or disposing of a golden or bald eagle carcass without a take permit issued under the BGEPA. As a result, in the unlikely event that such mortality does occur, TSE would contact the USFWS immediately to report the incident and arrange for retrieval and receipt of the carcass. The BLM would also be notified of the mortality. In the event that an eagle mortality occurs, TSE would conduct a Resource Equivalency Analysis (REA) and meet with the agencies to determine appropriate compensatory mitigation and to determine if further avoidance measures should be implemented.

Under the MBTA, it is unlawful to collect, salvage, or otherwise have in possession any raptor or raptor

part, including feathers, without a state and federal permit. Most other avian species with potential to occur in the project area, including those that are not raptors, would be protected under the MBTA as well. There may be occasion however, for TSE or appointed biologists to collect bird carcasses in order to determine the cause of death, for disposal purposes, for temporary collection for onsite inspection, or for extraction from electrical components. If such occasion becomes necessary, TSE would coordinate with the USFWS, BLM, and NDOW to determine the need for a permit and, if necessary, would apply for permits to allow the handling of dead and injured birds. TSE would immediately notify the USFWS and the NDOW regarding any apparent injury or death occurring to an eagle during project activities. TSE would ensure that any injured eagle would be immediately transported to the nearest federally permitted eagle rehabilitator. Dead eagles will be reported to the USFWS Division of Migratory Bird Management and Law Enforcement within 24 hours and shipped to the eagle repository in Colorado. A Migratory Bird Salvage permit maybe required. When Programmatic Eagle Permits (take permits) become available, the salvage and shipment of eagles would be included in the permit and could be handled by TSE or appointed biologists.

The protected bat species with potential to occur in the project area are considered BLM sensitive species in the state of Nevada. Several of the species are also classified as protected by the state of Nevada. In the event that a bat sustains injury or experience death from interaction with utility facilities, TSE or TSE appointed biologists may need to handle, transport, or dispose of protected-bat carcasses. If the need for such actions becomes apparent, TSE would coordinate with the BLM and NDOW to ensure that all necessary permits are obtained and that all activities are in accordance with applicable regulations and laws.

9.0 Mortality and Monitoring Studies and Mitigation

9.1 GOALS AND OBJECTIVES

The primary goal of the post-construction monitoring program is to ensure that the adaptive management approach is as successful as possible at minimizing the potential for avian and bat mortality sustained from interactions with the project facilities during operations. In order to accomplish this goal, it is critical that an estimate of the impacts of the project facility to avian and bat species is obtained regularly. This would ensure that the adaptive management actions that have been implemented are routinely assessed for effectiveness and that avian and bat mortality remain minimized. To facilitate this, the objective of the post-construction monitoring program is to:

- estimate direct impacts to birds and bats in terms of mortality resulting from operation of the project facilities;
- assess avian and bat utilization of the project facilities and areas under or immediately adjacent to the project facilities; and,
- estimate the success of adaptive management actions that have been implemented to minimize avian and bat mortality and, if necessary, identify other actions to implement.

Since solar energy technology is rapidly developing, monitoring methods are constantly improving as researchers develop new and more accurate methods of survey and mitigation techniques. TSE will consider refinement of monitoring methods and mitigation practices described below and adoption of new survey techniques or protocols as they become available. Refinement of the monitoring program may also occur through consultation with the USFWS, BLM, and/or NDOW. The monitoring program may be adjusted to include additional objectives as determined necessary during implementation and practice, or through consultation with the USFWS, BLM, and/or NDOW.

9.2 POST-CONSTRUCTION MONITORING COMPONENTS

Post-construction monitoring protocols follow *Monitoring Migratory Bird Take at Solar Power Facilities: An Experimental Approach*, USFWS, April 26, 2011, and ensure that monitoring includes all aspects of the project including the central receiving tower and heliostat field, the transmission lines and power poles, and the evaporation ponds. Post-construction monitoring protocols for the evaporation ponds also follow the requirements identified in the Industrial Artificial Pond Permit issued by NDOW for the Crescent Dunes Solar Energy Project (NDOW 2011).

9.2.1 Methods

9.2.1.1 Intensity of Mortalities

TSE would provide data from initial studies controlling for detection rate, method of mortality, scavenging rate, and locations of mortality. There is the potential in the future to adapt monitoring protocols for the project based on these initial studies to set forth the monitoring effort (USFWS 2011).

9.2.1.2 Detection Rate

Data from initial studies would include the detection rate as a function of distance from established

transect lines. This would allow TSE to help develop future protocols and set distances from transect lines to monitor mortalities (USFWS 2011).

9.2.1.3 Method of Mortalities

TSE would provide data from initial studies. Descriptions of found mortalities and location within the project area would aid in this assessment. These initial studies would identify where in the solar development mortalities occur and direct future efforts to reduce take resulting from specific causes (USFWS 2011).

9.2.2 Considerations

Capture/recapture would be used to estimate the abundance of dead migratory birds, considering variation in frequency of carcasses that may vary over time and location across and within transects and considering scavenging rates that may vary over time and location across and within transects (USFWS 2011).

9.2.3 Sampling Design

9.2.3.1 Strata

The following three strata are included in this design: (1) within the mirror array and central tower (for power tower developments); (2) ponds; and (3) along transmission lines (USFWS 2011).

9.2.3.2 Transects

Transects are used as replicates within strata. Transects should cover 10 to 30 percent of the stratum area. Coordinates for transect lines should be established. Then sampled areas would be extrapolated to the overall area within each stratum (USFWS 2011).

9.3 TRANSECT LAYOUT

Within the mirror array and central receiving tower (for power tower developments), mirror or photovoltaic cells typically are created in a circular or tetragon shape. Given the difference in these developments, there are two different approaches to laying out transects. Transect design should result in 10 to 30 percent of the total area coverage within the stratum. A minimum of eight transects should occur within this stratum to obtain good replication and enough data to test for effects of distance on mortality events (USFWS 2011).

9.3.1 Central Receiving Tower and Heliostat Solar Field

Transect layout in a power tower array (typically circular) encompasses the 360 degree area surrounding the central tower (Figure 1). Carcasses are considered to be detected randomly throughout the mirror array. Eight transects which originate at the central tower and extend to the edge of the mirror array should be sampled. These transects shall be at every 45 degrees, which should result in 10 to 30 percent coverage (USFWS 2011).

9.3.2 Transmission Lines and Power Poles

The overall length of the sampled transmission line should be determined, and transects should be

randomly assigned to result in 10 to 30 percent coverage. Transects should run down the middle of the transmission lines. A minimum of four transects should be performed in this stratum (USFWS 2011).

9.3.3 Evaporation Ponds

Transect lines should be placed randomly along the immediate edges of ponds (Figure 1) to monitor floating or pulled-out carcasses. One transect should occur for each cardinal direction (i.e., north side, south side, east side, and west side) within this stratum due to the effects of wind or current. If multiple ponds occur, efforts should be made to sample each pond with at least one transect. There should be a minimum of four transects in this stratum (USFWS 2011). In addition to the transect surveys, monitoring of the evaporation ponds would occur not less than weekly and a log of monitoring efforts would be maintained in compliance with the NDOW Industrial Artificial Pond Permit (NDOW 2011). Monitoring would be performed by TSE staff. Also in compliance with the Industrial Artificial Pond Permit, water quality parameters of Total Dissolved Solids (TDS) and pH will be monitored on a quarterly basis at all ponds.

Figure 1. Typical Footprint for a Circular Solar Facility

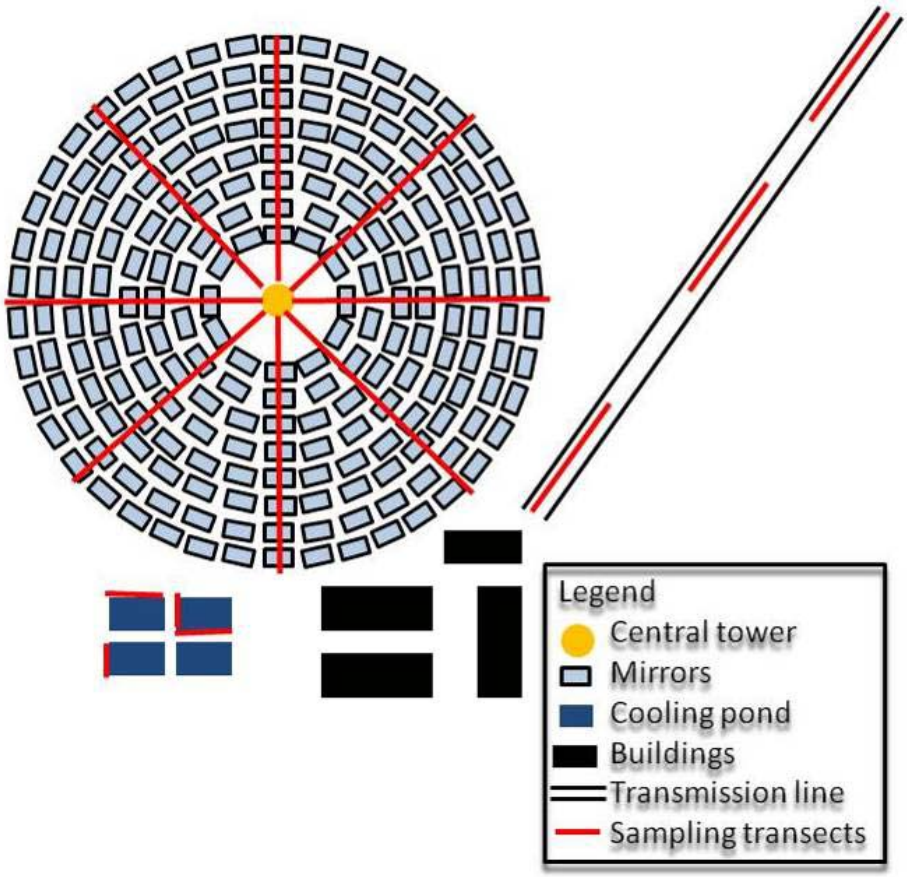

Figure 1 is a general diagram showing a typical footprint for a circular solar facility with a central power tower. Included is an approximation of the layout for transects to estimate migratory bird mortality.

For solar facilities in a tetragon shape, transects should be modified to run in a parallel fashion across the array.

9.4 Sampling Along Transects

Use of a single qualified observer is preferred. The observer would walk along pre-determined transects searching for bird carcasses, scanning away from the transect. When a carcass is observed, the observer should walk the shortest distance to the carcass. At each discovery of a carcass, a GPS location (UTM) would be recorded, the species would be identified, and information regarding carcass condition would be collected. Each carcass (not the location) would be uniquely and inconspicuously marked with tape and permanent marker. By recording UTMs, distances from the transect can be calculated for analysis in Program DISTANCE. All carcasses would be left exactly as found. By marking carcasses, future encounters would be used as recaptures. Once data are collected at a carcass, the observer would return to the pre-determined transect and continue with the survey. All sampling periods would be seven consecutive days. Observers would continue to record the presence, location (UTM), and condition of all observed carcasses. A sample data sheet is included in Appendix A. Carcasses would be

assigned to one of the following four classes at each encounter: (1) fresh (eyes are still wet and not totally sunk into sockets); (2) medium (eyes are totally sunk into sockets and breast muscle and viscera are still present); (3) non-scavenged carcass (a stiff carcass consisting of a dried complete carcass); or (4) remnant (a dried carcass consisting of non-edible parts). Additionally, the presence or absence of evidence of superheating (singed feathers) should be recorded (USFWS 2011).

9.5 DATA TO BE PROVIDED

The USFWS has a definitive interest in the analysis of the data and the results. Shapefiles showing the solar development including each mirror, tower, building, road, transmission line, and cooling pond are to be provided to the USFWS, as well as separate shapefiles showing all transects. Completed data sheets, or copies of them, also should be provided to the USFWS (USFWS 2011).

9.6 ANALYSIS

Two primary analyses would be conducted. The first would use Program DISTANCE to determine the most effective transect width to search for carcasses. The second would use Program MARK to estimate the total number of mortalities controlling for detection rate, scavenging rate, and proximity to the power tower (USFWS 2011).

9.6.1 Program DISTANCE

The preliminary analyses would benefit from the use of Program DISTANCE to determine the distance from established transects and which detection probabilities remain greater than 0.95. ARC GIS can use shapefiles containing the transect routes and separate shapefiles identifying the locations of carcasses to develop distances from the transect in which carcasses were detected. This initial analysis would develop protocols in which to sample along transects and whether a set transect width should be implemented in future surveys (USFWS 2011).

9.6.2 Program MARK

A suggested analysis would use the closed captures design within Program MARK to estimate the number of dead birds in the sampled area (10 to 30 percent of total area). This approach would allow the estimation of the number of dead birds, apparent survival to be the inverse of scavenging rate, and capture probability to be the observer detection rate; therefore, the estimate of the number of carcasses would include variation in scavenger and detection rate. The estimate of number of carcasses would be extrapolated to the full area within each stratum and would be summed to provide an estimate of total number of carcasses for the facility.

Consideration of multiple models would allow determination of source of mortality (e.g., central tower (models including distance from tower is selected); USFWS 2011).

9.7 ADAPTIVE STRUCTURE

Initially, all transects would be sampled for seven consecutive days at the beginning of each month for a year. We suggest that this year-round monitoring program be initiated at the beginning of the most active migratory period for the area. Analyses should be updated seasonally (every three months). At the end of the first year, the extrapolated full-year estimate of number of bird mortalities would be

considered for future refinement of monitoring protocol.

9.8 MITIGATION

Specific mitigation measures for impacts to avian and bat species from the project have not been specified; however, the USFWS would contribute to accessing site-specific mitigation.

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Appendix A

Avian Incident and Nest Assessment Forms

SAMPLE DATA SHEET (Excel file is available)

XXX Solar Facility Migratory Bird Monitoring Project

Date:

(use a different sheet for each day)

Observer:

Transect #	Unique Carcass ID	Species	Carcass Condition	UTM	Cause of Death		Transect #	Unique Carcass ID	Species	Carcass Condition	UTM	Cause of Death

Daily Summary

Transect	Total Number of carcasses (include zeros for transects with no carcasses; put X if not sampled)	Transect	Total Number of carcasses (include zeros for transects with no carcasses; put X if not sampled)
Mirror 1		Pond 1	
Mirror 2		Pond 2	
Mirror 3		Pond 3	
Mirror 4		Pond 4	
Mirror 5		Line 1	
Mirror 6		Line 2	
Mirror 7		Line 3	
Mirror 8		Line 4	

Appendix B

Partial List of Avoidance and Minimization Measures for Non-Operational Impacts

Pre-Construction Migratory Bird Nesting Surveys

- All ground-disturbing activities will be conducted outside the migratory bird nesting season (March 15 – July 31). If ground-disturbing activities cannot be avoided during this time period, pre-construction nest surveys shall be conducted by a BLM-approved biological monitor with the following guidelines:

- For raptors specifically, the holder will use the USFWS Utah Field Office Guidelines for Raptor Protection from Human and Land Use Disturbances (1999) to determine appropriate survey areas and disturbance buffers for active nests.

- For all non-raptor bird species, surveys shall cover all potential nesting habitat in and within 300 feet of the area to be disturbed.

- Surveys must be conducted between sunrise and 3 hours post-sunrise when birds are most active.

- Because there are no standardized disturbance buffers for active non-raptor bird nests, if active nests are detected, a no-disturbance buffer zone (as determined by USFWS, NDOW, and BLM) will be established. Nest locations shall be mapped and submitted to the BLM as needed.

- Active bird nests will not be moved during the breeding season unless the holder is expressly permitted to do so by the USFWS, BLM, and NDOW.

- All active nests and disturbance or harm to active nests will be reported within 24 hours to the USFWS, the BLM, and NDOW upon detection. The biological monitor will halt work if it is determined that active nests are being disturbed by construction activities, until further direction or approval to work is obtained from the appropriate agencies.

Golden Eagle Nest Monitoring

- Nest monitoring will be performed in accordance with the *Interim golden eagle inventory and monitoring protocols; and other recommendations* (Pagel et al 2010).

- Monitoring of the known golden eagle nest will be required during construction and at least five (5) years post-construction.

- Monitoring can and should be done from the main road.

- At least two (2) observation periods per season shall be completed between March and June. Observation periods will last at least four (4) hours, or until nest occupancy can be confirmed. Observation periods will be at least 30 days apart.

- Surveyors need to be experienced with raptor identification and survey techniques. A report of

findings should be submitted to Tonopah Solar Energy, NDOW, and the BLM that includes dates, times, species seen, activity, etc.

Appendix C

Evaporation Pond Operations Discussion

EVAPORATION POND OPERATIONS

INTRODUCTION

An Operations Plan is required for the three evaporation ponds at the Crescent Dunes Solar Energy Project to ensure the operational personnel are aware of the evaporation pond design features and operational techniques required to maximize evaporation and protect avian and bat species. Operational features of the evaporation ponds and potential operational methods that can be implemented to decrease the risks associated with the ponds on avian and bat species are outlined below.

The evaporation ponds are designed to contain 3 feet of evaporative residue, 3 feet of wastewater and a minimum of 3 feet of freeboard. However the depth of evaporative residue and wastewater in each pond is determined by the volume of wastewater pumped into each pond, chemistry of the wastewater discharged into the ponds, chemical and biological processes occurring within the ponds, and the weather (evaporation potential). Generally, the wastewater in the evaporation ponds will be a brine solution with the salt acting as the primary solute and water acting as the primary solvent. As the wastewater levels increase, the concentration of salt decreases due to the dilution, alternatively, as the wastewater levels decrease, the salinity increases.

Avian and bat species may be effected if there are high concentrations of total dissolved solids (TDS) in the wastewater. The ponds are not covered by netting to prevent entanglement or trapping of avian and bat species.

The following components need to be balanced to managing the evaporation ponds:

- Depth of wastewater
- Concentrations of TDS in the wastewater
- Temperature of the wastewater
- Visual monitoring

The following sections outline the operational procedures of each component.

DEPTH OF WASTEWATER

To keep the concentrations of TDS as low as possible, the following operational procedure has been designed on basis that there must be a depth of between 1 to 3 feet of wastewater in each operating evaporation pond:

- At the commencement of operation of the Crescent Dunes Solar Energy Project, only one evaporation pond is to be used (“Pond A”). Wastewater will be discharged into

Pond A only until it contains three feet of wastewater. This may take several months, depending on what time of year operation commences and the monthly evaporation rate. The other two evaporation ponds ("Pond B" and "Pond C") are to remain empty.

- When Pond A reaches capacity (3 feet of wastewater), 1 foot of wastewater will be pumped into Pond B, then Pond B used solely for the discharge of wastewater, and the wastewater in Pond A allowed to evaporate.
- When either Pond B reaches capacity (3 feet of wastewater), or there is less than 1 foot (12 inches) of wastewater remaining in Pond A, one of the following practices must occur:
    - Pond A will receive the ongoing discharge of wastewater from the plant (as long as there is more than 12 inches of wastewater remaining in Pond B);
    - Excess wastewater from Pond B will be pumped into Pond A (as long as there is more than 12 inches of water remaining in Pond B after the transfer of wastewater) and either Pond B or Pond A receives ongoing discharge of wastewater from the plant;
    - ALL of the wastewater from Pond A will be pumped into Pond B and Pond B will continue to receive the ongoing discharge of wastewater from the plant. This operation may be used (dry out a particular pond) if excessive evaporative residue has developed and must be removed.
- If Pond A and Pond B both reach capacity (3 feet of wastewater each), Pond C will be activated, with 1 foot of wastewater pumped into Pond C from either Pond A or Pond B, and then Pond C operated until either Pond A or Pond B evaporates down to only 12 inches of wastewater. At that point, wastewater will be pumped between the ponds to ensure each pond is either dry or contains more than 12 inches of wastewater.

This procedure of routing wastewater between the evaporation ponds to maintain wastewater levels will be up to the discretion of the Facility personnel. Each evaporation pond will be fitted with water level gauge which will be used to record the water level in each pond on a daily basis.

During the initial months of operation, there will be less that 12 inches of wastewater in Pond A, however the concentration of TDS is expected to be low and therefore the wastewater is expected to have minimal impacts on avian and bat species as there will have been no previous salt accumulation occurring in the ponds.

If required, the evaporation ponds can be fitted with evaporative spray nozzles during the life of the Project to accelerate evaporation rates to maintain the minimum freeboard requirements. This task would be undertaken at the discretion of the Facility Manager.

TDS CONCENTRATIONS IN WASTEWATER

The concentration of salt in the wastewater is dynamic, based on the concentration of constituents and chemical and physical processes occurring within the water body. Concentrations of total dissolved solids (TDS) in the wastewater may vary from approximately 11,000 ppm (estimated incoming TDS concentration) up to 250,000 to 300,000 ppm. Therefore a hydrometer will be installed at each active evaporation pond to gather daily data on the salinity. If there are any periods where high concentrations of TDS are recorded, then one of the two following procedures must occur:

- Pump wastewater from another operating pond(s) into the pond with the high TDS concentrations to allow for dilution; or
- Pump ALL the wastewater from the pond with high TDS concentrations into another operating pond(s), and allow the evaporative residue to solidify.

NOTE: The term "high concentrations of TDS" is considered a level of TDS in the wastewater that may cause health issues with birds that use the pond. This will be evaluated through monitoring of the evaporation ponds as outlined in the ABPP.

TEMPERATURE OF THE WASTEWATER

Salt crystallization is known to increase in cooler temperatures, particularly in temperatures of 4 degrees Celsius (39.2 degrees Fahrenheit) or lower. Each evaporation pond will be outfitted with a direct reading thermometer to record temperature data. The operational personal will monitor the temperature gauge, and if the average overnight water temperature in the active evaporation ponds is at or below 4 degrees Celsius, the following procedures will be implemented:

- Conduct a visual survey of the ponds the following morning to observe evidence of recent substantive increases in salt crystallization anywhere within the pond (e.g., at or near the waterline).
- If there are no signs of salt crystallization, then no further actions are required, however if there is evidence of salt crystallization, then one of the two following procedures will be undertaken:
    - Pump wastewater from another operating pond(s) into the pond with the evidence of salt crystallization to allow for dilution; or
    - Pump ALL the wastewater from the pond with evidence of salt crystallization into another operating pond(s), and allow the evaporative residue to solidify.

EVIDENCE OF WILDLIFE USE/MONITORING

The Facility will have an appointed biologist or Environmental Compliance Manager (ECM) to conduct avian monitoring at the evaporation ponds. Avian monitoring would be conducted in

accordance with the ABPP. The data collected (water level, water quality, and water temperature) can be used in conjunction with the monitoring to provide information to help plant personnel determine the best ways to operate the evaporation ponds to minimize impacts to avian and bat species.

The adaptive management technique(s) implemented will be dependent on the avian or bat species mitigation and the time of year mitigation is implemented (bird cannon would be used primarily during migration periods when waterfowl would have the greatest potential be present). The rate at which a particular management technique has been utilized would also be considered in order to prevent birds from becoming acclimated to the mitigation measure.

CONCLUSION

The main objectives of the operation procedures for the evaporation ponds is maintaining 3 feet of freeboard, whilst balancing the TDS concentrations by varying the depth of the wastewater, and monitoring the TDS concentrations and wastewater temperatures. The data from the daily measurements of water levels, salinity concentrations and temperatures will be kept on site and available to the personnel monitoring the evaporation ponds. The operating personnel will be required to assess all three components to ensure that the ponds are managed effectively while protecting avian and bat species.