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IVANPAH SOLAR ELECTRIC GENERATING SYSTEM
AVIAN & BAT MONITORING PLAN

2014 SPRING REPORT (REVISED)
(23 MARCH 2014 – 22 MAY 2014)

Project # 2802-07

Prepared for:
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15 December 2014

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Prologue to the Revised Spring Report

The Technical Advisory Committee (TAC) for the Ivanpah Solar Electric Generating System facility met on October 10, 2014 to discuss the reporting and analysis for the Spring Report, which was originally prepared August 2014. Modifications were requested by the TAC based upon the discussions at this meeting, and this report has been revised accordingly. Specifically, the original report contained spatial distribution and statistical analyses of impacts indicated by singeing that were requested by the TAC but that were not required by the Plan. However, in light of low sample sizes and confounding factors such as collinearity (e.g., correlation of flux activity and regional bird abundance during the spring migratory period), this analysis was removed.

Additionally, in response to the TAC meeting of October 10, 2014, H. T. Harvey & Associates conducted a thorough QA/QC of the Spring Report to insure accuracy and improve transparency in the reporting and analysis. Three types of revisions were necessary as a result of the TAC requests and the QA/QC effort: 1) clarification of data used (or excluded) in each of the tables/analyses, 2) revisions from transcription/typographical errors, and 3) revisions from clarifying the language used in the data reporting and categorization of observations. The clarification of the data used or excluded was generally provided in the form of footnotes to tables or in explanatory text. For all transcription and typographical errors, corrections involved minor adjustments to data for avian use, large raptor surveys and fatality reporting sections. To provide clarity on data classification and address imprecise descriptions in the reporting, revisions were made to reflect a more transparent method of describing and identifying feather spots versus carcasses (e.g., feather spots exclude feathers with bones attached). These revisions resulted in minor changes to the classifications in Appendix A and reported values throughout the document but will insure transparency and consistency in reporting going forward. All revisions from the previous version are summarized in Appendix C.

Executive Summary

Avian and bat monitoring surveys were conducted from 23 March to 22 May 2014 (the spring season) at the Ivanpah Solar Electric Generating System facility (referred to in this report as "Ivanpah" or "Project") in accordance with the Project's Avian & Bat Monitoring and Management Plan (Plan). Specifically, avian point count surveys, large raptor surveys, facility monitoring for avian detections, searcher efficiency trials, and carcass removal trials were conducted. This report represents the second seasonal report summarizing monitoring methods and results for those surveys based on the procedures and requirements specified in the Plan.

Avian and bat monitoring surveys included avian point counts, raptor and large bird point counts, and fatality searches. Avian point count surveys were conducted using variable-radius point counts at 80 survey points, including 40 points in heliostat arrays and 40 points in desert bajada habitats. A total of 39 bird species were recorded during these avian use surveys. Species richness was highest on the lower desert bajada grid (23 species), slightly lower on the upper desert bajada grid (19 species), and lowest in the heliostat grids (11 species in Unit 1 and four in Unit 3). Avian abundance was the same on the two desert bajada grids, with 181 observations on the lower bajada and 181 on the upper bajada. Abundance was substantially lower in the two heliostat grids, with 49 observations in Unit 1 and 20 observations in Unit 3.

Surveys for raptors and other large birds were conducted at each of eight points (one on the east and west sides of each of the power units and two offsite points). Three to five surveys were conducted at each point (mean of 3.8 surveys/point). During these surveys, six raptor species and two other large bird species (common raven and turkey vulture) were identified. Common ravens comprised 33.8% of all large bird detections. Overall abundance of raptors and other large birds was higher on the eastern points than on the western points.

Avian and bat fatality searches were conducted in 1) the "tower area", consisting of the power block and inner high-density (HD) heliostats surrounding each power block on approximately 154 acres, which was surveyed with 100% coverage; 2) the "heliostat area", consisting of the inner and outer heliostat segments outside of the inner HD heliostats on approximately 720 acres, which was surveyed with 24.1% coverage in randomly selected arc-shaped plots; 3) the "fence line", consisting of the perimeter fences, which was 100% surveyed; 4) the "collector line", consisting of the Unit 3 Collector Line, which was also 100% surveyed; and 5) offsite "control areas." Overall, approximately 29.2% of the facility (not including the offsite control area, which is outside the facility) was searched. Searches were conducted within the spring season at intervals averaging 7.2 days (range 6-14 days, median = 7 days).

All bird and bat fatalities and injuries, including those found incidentally, are referred to as "detections" hereafter. According to the specifications of the Plan, avian detections were input into a fatality estimator equation (model) to provide an estimate of the fatalities for the facility. All fatalities were classified as either

carcasses or as feather spots. Feather spots consisted of groups of feathers composed of at least two or more primary flight feathers, five or more tail feathers, or 10 or more feathers of any type concentrated together in an area 1 m^2 or smaller (feathers with significant skin or flesh, or any bone, attached were considered detections but were not considered feather spots).

During the period 23 March – 22 May 2014, a total of two injured birds, 200 avian fatalities, and four bat fatalities were detected (202 total avian detections). Forty-three avian species and two bat species were positively identified among these detections. A total of 157 avian detections and three bat detections occurred during systematic fatality searches. Forty-five avian detections and one bat detection were made incidentally by workers performing operational duties, in accordance with the reporting protocol of the Ivanpah Wildlife Incident Reporting System. Avian species that are permanent residents in the Ivanpah Valley (i.e., residing there year-round) accounted for 31.2% of the total detections found on the site during the 2014 spring season. Nonbreeding-season residents (those species that breed outside the Ivanpah Valley but winter in the Project vicinity) accounted for 17.3% of total detections; breeding-season residents (species that breed in the Project vicinity but do not winter there) accounted for 11.4% of total detections, and transient species (species that migrate through the Project vicinity but do not regularly breed or winter there) accounted for 29.2% of detections. With respect to foraging guilds, aerial insectivores accounted for 20.3% of detections, followed by terrestrial insectivores (18.8%), granivores/insectivores (17.3%), nectarivore/insectivores (i.e. hummingbirds, 15.3%), and waterbirds (1.5%).

A total of 141 bird detections (69.8%) were recorded within the tower area (the area consisting of the power block and inner HD heliostats). This area, circumscribed by a 260-m radius from the tower and comprising approximately 5% of the facility, was searched with 100% coverage due to proximity to the towers. In addition, these towers were the focus of considerable activity by Ivanpah personnel, who detected and reported fatalities, resulting in high numbers of incidental fatality reports. As discussed below, 97 of 100 avian detections showing evidence of singeing (97.0%), as determined by microscopic examination, were located within the tower area. Given the intensive coverage of the power blocks and our microscopic examination of all detections, we are confident that we were able to detect a large proportion of the singed detections.

In the other survey areas, fifty-four avian detections (26.7%) were recorded for the much larger area composed of the inner and outer heliostats. Three detections were discovered along the fence line (1.5%), three were on Project lands outside the standardized search areas (1.5%), and one was found along the off-site control transects (0.5%). All bat fatalities were observed in the power block: two in the air cooled condenser (ACC) building, and two inside other Project buildings within the power block.

Of the 202 avian injuries and fatalities detected during 2014 spring season, microscopic examination indicated that 99 fatalities and one injured bird (49.5%) showed signs of singed feather damage. Visible evidence of collision (primarily with heliostats) was found in the case of 15 detections (7.4%), including 14 fatalities and one injury. Five additional detections are reported as resulting from "other Project impacts" per Section 3.1 of the Plan (hereafter referred to as "Other Project Causes"); these were found in ACC buildings, but they

showed no signs of singeing or collision effects, and the cause of death is unknown. Obvious evidence of predation was observed in one detection. The cause of injury or mortality for the remaining 81 detections (40.1%) could not be confirmed (i.e., the carcass or feather spot displayed no signs of singeing and no direct collision effects).

Sixty-six (32.7%) of the 202 detections consisted only of feather spots. Because singed feathers are readily observable, fatalities for which the cause of death is unconfirmed are likely to have resulted from predation, collision, or illness. The ratio of feather spots to carcasses varied considerably across the site. Among the power block, inner HD heliostats, and inner/outer heliostats, it was highest in the inner HD heliostats (1:0.6), and lowest in the power block (1:8.3), with the inner and outer segments (1:1.7) intermediate. The number of detections along the fence line, outside survey areas, and in the control plots (totaling a combined seven detections within the three categories) was too low to provide meaningful ratios of feather spots to carcasses. Ongoing carcass removal trials (detailed below) will elucidate both scavenging rates, and persistence rates of carcasses and feather spots, across the study area.

Spring-season carcass removal trials and searcher efficiency trials were conducted to model the fatality estimate. Carcass persistence during the spring season ranged from less than one day, in the case of two carcasses, to 45.8 days, including periods beyond the full six-week trial period in the case of the seven carcasses whose remains persisted throughout the trial. Although all large carcasses were detected and at least partially eaten by scavengers, the scavengers left enough of the carcass in three of the four large-carcass trials that the remains would have been detectable and considered a fatality if detected during the standardized searches. In contrast, small carcasses tended to be more completely removed, with only five of 15 small carcasses (33.3%) leaving remains that persisted for the entire six-week trial. Mean carcass persistence was 18.9 days for small carcasses and 41.6 days for large carcasses. In comparison, the assumptions used in the power analysis in the Plan were 7.4 days for small birds and 21.8 days for large birds. The longer persistence of carcasses (averaging approximately twice that assumed for the Plan's power analysis) increases the statistical power of our sampling approach relative to the power analysis in the Plan.

Human searcher efficiency during the spring season averaged 57.1% for small birds, 71.4% for large birds, and 35.7% for feather spots/partial carcasses. Cumulative searcher efficiency values used in fatality estimates, which included searcher efficiency results from both the winter and spring seasons, were 42.8% for small birds, 52.4% for large birds, and 35.7% for feather spots/partial carcasses. Searcher efficiency rates for small and large bird carcasses in spring were higher than the target rates assumed in the Plan. Detection dog trials occurred in spring in anticipation of integration of detection dogs during summer surveys.

In general, there were no obvious temporal patterns of detections during the spring survey period; however, there were five survey days in which more than 10 fatalities were detected. In each case, the majority of detections were found in the tower area of a single unit. Examination of these records showed that daily detection rates of more than 10 per day at Ivanpah coincided with increases related to pulses in migration. Indeed, the day (22 April) with the greatest number of fatalities (20) appeared to be associated with locally

heavy migration activity throughout the desert southwest of California during the period of 18 – 25 April, according to the Cornell Lab of Ornithology's BirdCast website.[1] Smaller increases in fatalities coincided with weeks of moderate migration activity in the region.

The species composition of fatality detections throughout the solar plant was different than the composition of species observed using the heliostat areas during avian point counts. This suggests that there was a bias in spring fatality detections towards particular avian guilds (transient insectivores and resident granivores), with the most common detections consisting of mourning doves, yellow-rumped warblers, Costa's hummingbirds, and migrating swallows and hummingbirds, and a bias in avian point counts away from ground foraging or smaller species (e.g., mourning dove or warblers), likely because such species are less detectable during distance point counts.

During the period 23 March – 22 May 2014, total estimated numbers of fatalities with direct evidence of singeing, collision, or entrapment was 433 (90% confidence interval estimates 278-774). Of the 433 total estimated, 259 (90% confidence interval estimates 183-439) detections with direct evidence of singeing, collision, or entrapment were estimated for the tower area and 174 (90% confidence interval estimates 95-335) detections with direct evidence of singeing, collision, or entrapment were estimated for the heliostat area. Only three fatalities were found along the fence line, so spring period sample sizes were insufficient to model fatalities for this area. In proportion to unit area, fatality estimates suggest the highest densities of fatalities occur in the tower area, which would be predicted because birds are at risk of collision in the tower area and heliostat area, but singed fatalities are concentrated around the towers.

According to Section 5.3 of the Plan, quarterly reports are required to categorize potential migratory bird mortality issues at Ivanpah as high, medium, or low to provide an appropriate biological basis for TAC review and decision making, based on the following definitions:

1. "High: Estimated avian mortality or injury levels are facility-caused and likely to seriously and negatively affect local, regional, or national avian populations within a particular species or group of species."
2. "Medium: Estimated avian mortality or injury levels are facility-caused and have the potential to negatively affect local, regional, or national populations within a particular avian species or group of species."
3. "Low: Estimated avian mortality or injury levels that have minimal or no potential to negatively affect local, regional, or national populations within a particular species or group of species."

The 2014 spring results indicate that the potential migratory bird mortality during this season would be categorized as low. Total detections of any one species or group represent a small proportion of local, regional, or national populations. The 202 avian detections included 43 different bird species spread among a

[1] http://birdcast.info/forecasts

variety of temporal occurrence groups and foraging guilds. Of these 43 species, 30 were represented by three or fewer detections. All of these 43 species have populations that are great enough locally (either as breeders, wintering birds, or migrants), regionally, and nationally that the loss of the individuals recorded in spring 2014 would have no substantive impact on populations at any of these geographic scales. The cause of injury or mortality for 81 of the 202 detections (40.1%) is not known with certainty.. Section 2.1 of the Plan requires that "If a large portion (i.e., more than 40 percent) of the detections cannot be determined, or presumed without a reasonable doubt to be caused by the facility, potential other causes, such as unrelated avian disease or a lightning event, will be considered and the analysis adjusted as appropriate in the seasonal report." Therefore, we considered potential factors contributing to the fatality of these unknowns. During this spring period, five avian detections without evidence of singeing or collision were found in the ACC buildings. Although the cause of death for these five birds was unknown, these were considered as providing direct evidence of the cause of death because they were found entrapped or within an enclosed space. We found no evidence that the remaining detections of unknown cause were temporally or spatially clumped (which might have suggested that discrete events such as lightning strikes, hard freezes, or disease events had killed multiple birds). We thus concluded that there were no obvious, discrete explanations for these unknown fatalities. As a result, we did not consider it appropriate to adjust the fatality estimates based upon direct evidence to incorporate some or all of the fatalities of unknown cause, but rather, we reported the estimates separately for detections with direct evidence of singeing, collision, or other (entrapped or found within an enclosed space) and detections of unknown cause.

Of the special-status species recorded, three bank swallows (a state-listed species) were detected with singeing. Bank swallows are widespread breeders through the middle and northern latitudes of North America, and throughout the rest of the northern hemisphere. Given the location of the site (so close to the Nevada border) and the expected north-south orientation of migrants of these species in the vicinity, it is likely that some or all of these migrants are breeders from populations outside of California, populations that may not be of special status. Nonetheless, the three bank swallow detections in spring 2014 represented a very small proportion of the bank swallows expected to migrate north through the Ivanpah area in spring, heading to breeding sites as far north as Alaska and Canada. This species' populations are estimated at 13,800,000 birds in North America and 46,000,000 individuals worldwide. The most recent estimate available of the California breeding population numbered approximately 9,590 pairs in 2003, and burrow abundance along the Sacramento River estimated at 15,000 in 2012. Thus, at scales from local/regional (i.e., migrants moving through the Ivanpah area and the surrounding region) to national to global, the three bank swallow detections at Ivanpah during the 2014 spring season do not rise above the "low" category, as their loss would have a minimal effect on populations at any of these geographic scales.

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Section 1.0 Introduction

1.1 Project Background

The Ivanpah Solar Electric Generating System (referred to in this report as "Ivanpah" or "Project") consists of three solar units consisting of power electrical generating facilities (Units 1, 2, and 3) with a combined net capacity of 377 megawatts. Each unit includes a central power tower with an air cooled condenser (ACC) and associated electrical generating equipment, surrounded by a heliostat array that reflects sunlight to a boiler at the top of the tower. Ivanpah is located on approximately 1,457 hectares (3,600 acres) of Bureau of Land Management (BLM) land west of Interstate 15 near Nipton in San Bernardino County, California (Figure 1). Construction was initiated in 2010 and completed in late 2013.

1.2 Monitoring Plan Overview and Goals

An Avian & Bat Monitoring and Management Plan (2013; "Plan") was prepared by the Project proponent in collaboration with the U.S. Fish and Wildlife Service (USFWS), California Department of Fish and Wildlife (CDFW), California Energy Commission (CEC), and Bureau of Land Management (BLM) to guide comprehensive monitoring of impacts to birds and bats associated with the operation of the facility. Final agency acceptance of the Plan occurred in November 2013. The Plan is also intended to: 1) satisfy the BLM Right-of-Way (ROW) Permit requirement that the Ivanpah team develop an avian plan as well as a Migratory Bird Treaty Act (MBTA) Conservation Agreement; 2) satisfy the requirements for an the Avian & Bat Monitoring and Management Plan approved by the CEC for Ivanpah per CEC Condition of Certification BIO-21; and 3) achieve the avian and bat protection objectives of the USFWS in relation to the MBTA, Bald and Golden Eagle Protection Act (Eagle Act), and Federal Endangered Species Act (FESA), including preparing written records of the actions that have been taken to avoid, minimize, and compensate for potential adverse impacts to avian and bat species. By developing a proactive management plan in close consultation with the USFWS and other relevant state and federal agencies, project proponents can effectively comply with the intent of the federal MBTA, Eagle Act, FESA, and relevant state regulations (USFWS 2012).

The Plan details the onsite and offsite surveys to be conducted and the data analysis and reporting processes that will be implemented by Ivanpah in collaboration with the USFWS, CDFW, CEC, and BLM and supports four main goals and associated objectives. As identified in the Plan, they are:

Goal 1. Identify Collision Risks: Risks will be identified by monitoring and identifying avian mortality and injury associated with facility structure collisions.

- Objective 1. Estimate collision-related avian mortality and injury with the following facility structures, using empirical data to calculate facility-wide mortality and injury rates:

- Power towers
- Perimeter fences
- Heliostats
- Project Transmission Line (Unit 3 Collector Line)

Goal 2. Identify Solar Flux Risks: Risks from flux will be assessed by monitoring and identifying avian mortality and injury associated with solar flux generated by the facility.

- Objective 2. Estimate flux-related avian mortality and injury using empirical data to calculate facility-wide mortality and injury rates.

Goal 3. Identify Patterns of Avian Use at the Facility: Patterns of avian use will be assessed by conducting onsite and offsite surveys to document avian species composition onsite and offsite, compare abundance in representative habitats onsite and offsite, and document changes in avian use in these areas over time.

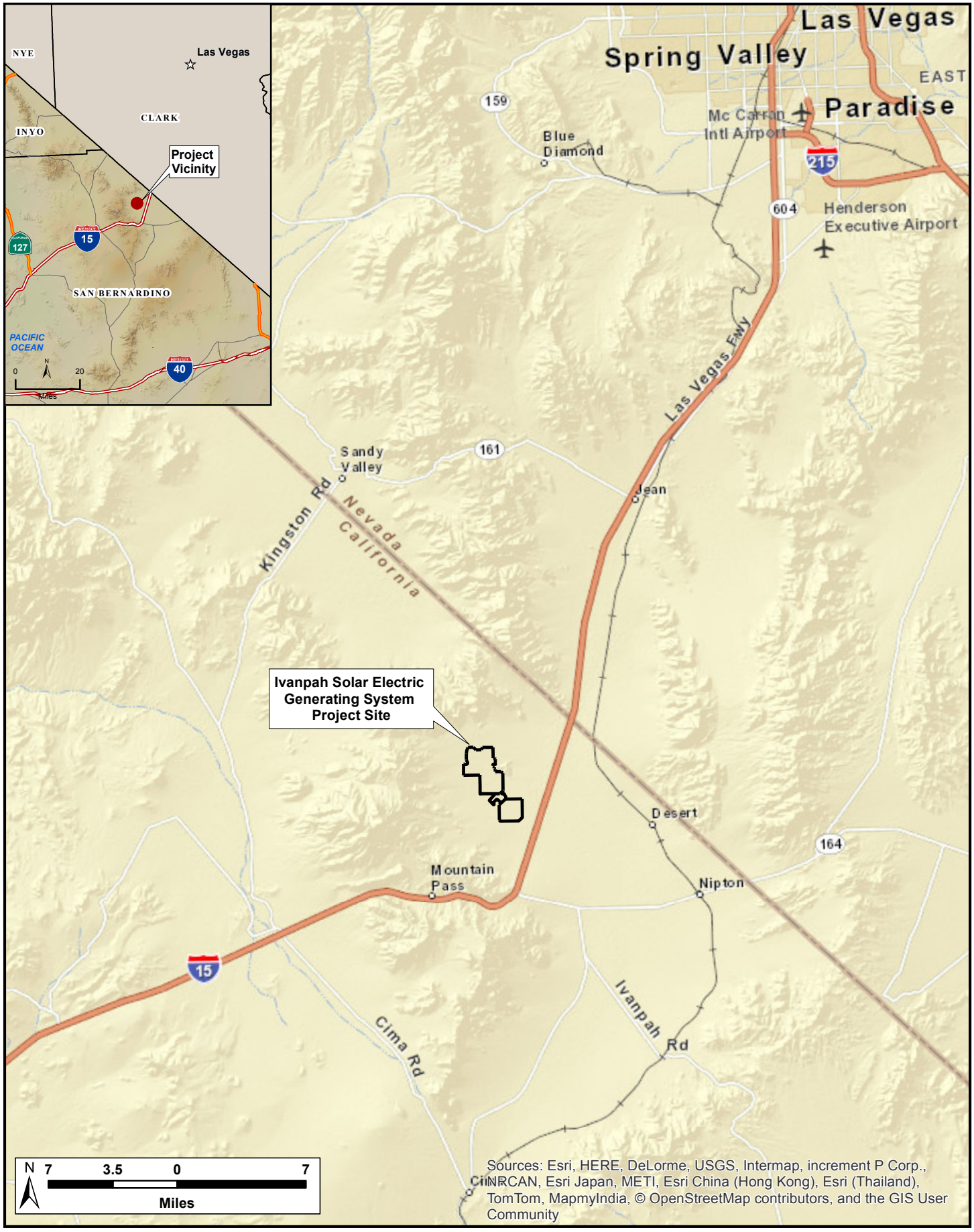
- Objective 3. Document patterns of collision- or flux-related mortality and injury associated with species, age/sex, season, weather, and visibility.
- Objective 4. Document spatial patterns associated with collision- or flux-related mortality and injury.
- Objective 7. Document use patterns of various avian species, including migratory birds, raptors, and golden eagles, particularly the seasonal variation of bird communities through breeding, migratory, and overwintering periods.

Goal 4. Provide a Framework for Management and Response to Risks: The designation and description of the functioning of the Technical Advisory Committee (TAC) provides a management and decision framework for the identification and implementation of potential adaptive management measures.

- Objective 5. Provide quantitative information for developing and implementing adaptive management responses commensurate with identified impacts.
- Objective 6. Provide a framework for the TAC to jointly review, characterize, and recommend responses, based on monitoring results, to the appropriate lead agency representatives.

1.3 Purpose of This Report

This report represents the second "quarterly" (i.e., seasonal) report summarizing monitoring methods and results for avian and bat injuries and fatalities based on the procedures and requirements specified in the USFWS-accepted Plan and as required by CEC Condition of Certification BIO-21. This report covers the 2014 spring season, which includes the period from 23 March through 22 May 2014.



N:\Projects\2802-01\07\Report\Spring 2014 Avian and Bat Monitoring Report\Fig 1 Ivanpah Vicinity Map.mxd

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Figure 1: Ivanpah Vicinity Map
Ivanpah Spring 2014 Avian and Bat Monitoring Report (2802-07)
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Section 2.0 Methods

The Plan describes the methods by which monitoring and certain analyses, such as compiling the overall fatality estimate, will occur. Below, these methods are described only briefly (because they are included in the Plan), with more detailed descriptions of any refinements that were necessary as the Plan was implemented in the field.

2.1 Avian Use Monitoring

This section describes the methods for monitoring avian use of the solar plant and nearby desert areas, as well as the methods for monitoring the occurrence of raptors and other large birds on and around the facility. More than 97 hours of field observation time for avian use surveys and 119 hours of field observation time for raptor/large bird monitoring were performed during the 2014 spring season.

2.1.1 Avian Monitoring Surveys

Avian use surveys were conducted using standard, variable-radius point counts to assess bird use of the vegetated areas within the heliostat fields and nearby offsite areas within desert habitats. The 80 survey points identified in the Plan, and shown on Figure 2, were surveyed a total of four times each during the spring period by a CEC- and BLM-approved avian ecologist.

According to the text of the Plan, these 80 points were to be randomly selected from within the following five study areas:

1. 20 points within an approximately 2.59 square-kilometer (1-square-mile) study area located in Unit 1, within the lower bajada environment of the facility.
2. 20 points within an approximately 2.59 square-kilometer offsite study area located in comparable lower bajada environment as far as practicable from (and south of) the Unit 1 fence line.
3. 10 points within an approximately 1.29 square-kilometer (0.5-square-mile) study area located in Unit 2, within the upper bajada environment.
4. 10 points within an approximately 1.29 square-kilometer located in Unit 3, in the upper bajada portion of the facility.
5. 20 points within an approximately 2.59 square-kilometer offsite study area located in comparable upper bajada environment and as far as practicable from (and southwest of) the Unit 3 fence line.

Our 2014 spring season surveys were conducted consistent with the winter use survey approach and according to Figure 8 on Page 25 of the Plan, which is inconsistent with the text on Page 23 of the Plan because Figure 8 depicts 20 points in Unit 3 and zero in Unit 2. Habitat differences are minor between Units

IVANPAH 3

IVANPAH 2

IVANPAH 1

UPPER DESERT BAJADA

LOWER DESERT BAJADA

LEGEND

- Variable Radius Point Count Location
- Project Site
- Avian Use Survey Plots
- Avian Use Survey Grid

N 2250 1125 0 2250

Feet

N:\Projects\2802-01\07\Report\Spring 2014 Avian and Bat Monitoring Report\Fig 2 Avian Use Monitoring Survey Locations.mxd

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Figure 2: Avian Use Monitoring Survey Locations
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2 and 3, and therefore we believe that the 20 points in Unit 3 are representative of habitat conditions in both Units 2 and 3. Nevertheless, as noted in the Winter Quarterly Report, we will adjust our approach for avian surveys starting in the summer of 2014 to reflect the text on Page 23 of the Plan by randomly selecting 10 of the 20 points in Unit 3 that we surveyed in the 2014 spring season, excluding those from future surveys, and randomly selecting 10 points to survey within a grid in Unit 2.

Each of the survey areas described above was divided into 200-m by 200-m square areas to define distinct sample plots. Within each study area, 20 avian use survey points were randomly selected from the sample plots, resulting in 20 point counts per 2.59 square kilometer for each habitat type in the facility and control areas, with each count location affording a minimum, non-overlapping survey radius of 100 m.

The Plan specifies that avian use surveys are to be conducted once per month during December-February and twice per month during the periods September-November and March-May. In accordance with this schedule, we conducted a total of four surveys (two in April and two in May) for the 2014 spring season.

Using distance-sampling techniques such as variable-radius point count methods, determination of bird densities is not as straightforward as simply calculating the mean number of individuals observed in each survey area (Buckland et al. 1993). Rather, the density distributions of the survey data (i.e., assessing density as a function of distance from each point) have to be considered in determining densities. Determining such density distributions typically requires a fairly large amount of data, especially when using programs such as Distance 6.0 (Thomas et al. 2010) to estimate bird densities. Due to the low number of individuals of any given species recorded during these surveys (owing to the naturally low abundance of spring birds in the habitats surveys), it was not possible to obtain reliable density estimates on a species-by-species basis for the 2014 spring season. Even when data were pooled within a 20-point grid, sample sizes were insufficient to allow for determination of reliable density estimates within a grid (e.g., to allow for comparisons between one 20-point heliostat grid and the other, or between one 20-point desert habitat control grid and the other). However, when data from the 40 heliostat points were pooled, and data from the 40 desert points were pooled, overall sample sizes for the heliostat arrays vs. the offsite desert habitats were large enough to provide reliable density estimates in each of these general habitat types using the program Distance 6.0. These comparisons are appropriate per the Plan, which states that avian use studies will concentrate on species composition and abundance, with a focus on comparison between the on- and offsite areas.

2.1.2 Raptor/Large Bird Monitoring Surveys

Surveys for raptors and other large birds were conducted from each of eight points as identified in the Plan and shown on Figure 3. These surveys were conducted using unlimited-distance point counts to assess use of the facility and offsite study areas. CEC and BLM-approved avian ecologists performed these surveys using binoculars and spotting scopes to identify raptors and other large birds, such as gulls (*Larus* spp.) and common ravens (*Corvus corax*) observed during a 4-hour survey period. The Plan specifies that surveys for raptors and other large birds be conducted twice per month during spring. An effort was made to conduct four surveys at each point; however, some surveys had to be cancelled due to poor weather conditions, or

IVANPAH 3

IVANPAH 2

IVANPAH 1

1

2

3

4

5

6

7

8

LEGEND

Survey Point

800-m Radius Survey Area

Project Site

N 2250 1125 0 2250

Feet

N:\Projects\2802-01\07\Report\Spring 2014 Avian and Bat Monitoring Report\Fig 3 Raptor and Large Bird Use Monitoring Survey Locations.mxd

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Figure 3: Raptor and Large Bird Use Monitoring Survey Locations

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because injured birds were found and needed to be transported to distant rehabilitation facilities. Therefore three points were surveyed three times, while the remaining five points were surveyed four or five times during the spring period.

2.2 Facility Monitoring

This section describes areas surveyed, the timing and frequency of the searches, and the methods by which standardized searches were conducted to identify dead and injured birds and bats at the facility. This section also describes the methods for conducting carcass removal and searcher efficiency trials; how data were reported and analyzed for incidental detections; and the methods for producing fatality estimates for the facility. Not including any data management or analysis, approximately 3,665 person-hours were spent conducting standardized monitoring searches and performing carcass removal and searcher efficiency trials during the 2014 spring season.

2.2.1 Standardized Searches

2.2.1.1 Areas Surveyed

Per the Plan, monitoring searches were conducted in the "tower area", defined as the power block (the area consisting of the tower, the ACC unit, the associated control building, and immediately adjacent areas defined by the ring road and berm/slopes surrounding these facilities) and inner high-density (HD) heliostats surrounding each power block (100% survey coverage); the "heliostat area", defined as the inner and outer heliostat segments outside of the inner HD heliostats (24.1% survey coverage in randomly selected arc-shaped plots); the "fence line" defined as the perimeter fences (100% survey coverage); the "collector line", defined as the Unit 3 Collector Line (100% survey coverage); and offsite control areas. Table 1 provides the acreage searched within each of these areas, as well as the percent of the facility comprised by these search areas. Overall, approximately 29.2% of the facility (not including the offsite control area, which is outside the facility) was searched. All these areas are depicted on Figure 4.

To ensure a balanced distribution of heliostat field survey plots, we divided each unit into inner and outer heliostat fields, and randomly selected approximately 20% of each sub-area. This stratified random sampling design ensures that our survey plots will not be clustered or biased in any distance or direction from the towers.

Table 1. Monitoring Areas, 23 March – 22 May 2014.

Area	Acreage Searched (ac)	Percent of Facility
Tower Area	154	4.8%
Heliostat Area	720	22.4%
Fence line	39	1.2%
Collector Line	26	0.8%
Offsite Control Area	7	NA*
Total Search Area	**939**	**29.2%**

* NA = Not applicable, because the offsite control areas are located outside the facility

2.2.1.2 Search Frequency and Timing

Spring fatality searches began the week of 23 March for all three units. According to the Plan, spring searches of each area were to be conducted at intervals of 7 days. Because some surveys were delayed to address safety concerns related to high winds, the average 2014 spring search interval was 7.2 days (range 6 to 14, median 7 days) for the three solar units. This variation is expected to occur and as indicated in Section 3.1.1 of the Plan the fatality estimator (Huso 2010) is designed to accommodate slight variability in the search interval by incorporating the exact interval for each search to develop an average interval between standardized removal surveys, in days.

The Unit 3 power block, inner HD heliostats, outer segment arc plots, fence, and controls were surveyed seven times during the spring season. One survey of the Unit 3 inner segment arc plots was delayed due to safety concerns related to high winds, so this area was searched six times during the spring season. In order to smoothly transition to the 21-day summer search interval, an additional search was conducted for all areas in Units 1 and 2. These units were searched eight times in all areas except the inner segment arc plots. The inner segment arc plots were searched seven times during the spring period because high winds suspended one of the surveys in these areas.

2.2.1.3 Search Methods

Standardized searches for fatalities were performed by CEC and BLM-approved biologists conducting ambulatory surveys in accordance with the methods outlined in the Plan. We found that searcher efficiency was enhanced when a pair of searchers walked a total of four transects oriented longitudinally along the complete length of each arc-plot, with the ring roads serving as the outer boundaries of each arc plot (Figure 5). Because searcher efficiency was enhanced in accordance with the goals of the Plan, this refinement was implemented throughout the Project site in lieu of the initially proposed pattern in the Plan. While walking each transect, searchers walked a narrow search section approximately 10 meters (m) wide.

N:\Projects\2802-01\07\Report\Spring 2014 Avian and Bat Monitoring Report\Fig 4 Ivanpah Search Areas.mxd

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Figure 4: Ivanpah Search Areas
Ivanpah Spring 2014 Avian and Bat Monitoring Report (2802-07)
December 2014

Previously Proposed Search Pattern

N

Not to scale

LEGEND

Approximate path of observers for 10-meter-wide transects

Search Pattern in Use

N

140 70 0 140

Feet

LEGEND

Roads

Transect Line showing Search Pattern

5-acre Arc Plot

N:\Projects\2802-01\07\Report\Spring 2014 Avian and Bat Monitoring Report\Fig 5 Monitoring Search Pattern for Arc Plots.mxd

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Figure 5: Monitoring Search Pattern for Arc Plots
Ivanpah Spring 2014 Avian and Bat Monitoring Report (2802-07)
December 2014

Otherwise, searches were performed exactly as described in the Plan. Within the heliostat area, 24.1% of each heliostat field was surveyed using randomly distributed 2.02-hectare (5-acre) arc plots. Within the power block, biologists walked through and around the tower and ACC unit looking for dead and injured birds and bats, and walked transects through the gravel surrounding the structures to achieve 100% coverage. Within the inner HD heliostats surrounding each power block, biologists walked transects to ensure 100% coverage. Thus, the tower area, comprising the area within 260 m of each tower, was completely covered during each survey. Along the fence line, a 6-m wide transect was surveyed, centered on the fence itself (i.e., 3 m on either side of the fence). The Unit 3 Collector Line was surveyed using a 30-m wide transect (i.e., 15 m on either side of the center line). Offsite surveys were conducted along two randomly selected 152-m long control areas, separated by approximately 10 m extending outward from the perimeter fence and back to the facility at nine locations, including the north, east, south, and west borders of the facility.

Every carcass and feather spot was examined by a CEC and BLM-approved biologist using an AmScope SE306R-AZ-E2 20X-40X-80X Digital Binocular Stereo Microscope to detect any signs of singeing or collision. When singed detections involving carcasses (as opposed to only feather spots) were found, singeing was assigned a grade according to Kagan et al. (2014), as follows:

- Grade 1 – curling of less than 50% of the flight feathers
- Grade 2 – curling of 50% or more of the flight feathers
- Grade 3 – curling and visible charring of contour feathers

Surveyors also looked for evidence of collision, including obvious physical trauma or detection adjacent to a heliostat with a bird-strike imprint, smudge mark, and/or feathers on or near the surface of the mirror. If there was no evidence of singeing (e.g., charring, curling, or melting of feathers) or collision, as confirmed through microscopic examination, the cause of injury or fatality was listed as "unknown".

For the purpose of these surveys, feather spots were considered detections when they consisted of at least two or more primary flight feathers, five or more tail feathers, or 10 or more feathers of any type concentrated together in an area 1 m^2 or smaller (Smallwood 2007) (feathers with significant skin or flesh, or any bone, attached were considered detections but were not considered feather spots). In some cases, an individual detection was broken up into aggregations of feathers that would meet the criteria for a feather spot, but with pieces of the carcass that contained bone or significant amounts of flesh or skin also present. In these cases, the detection is categorized as a partial carcass (rather than a feather spot), per the "feather spot" definition above. However, when partial carcasses are initially identified as feather spots to the observer in the field they are modeled (in the fatality estimates) as a feather spot. In other words, the primary means of identification of the detection (feather spot or carcass) is the appropriate classification to utilize in the modeled estimates. The primary identification approach is appropriate since different searcher efficiency rates are estimated for feather spots as opposed to carcasses. Such rates differ due to differences in detectability of carcasses vs. feather spots, and because searcher efficiency is an important component of the fatality

estimator, what the surveyors detect first (i.e., feathers meeting the definition of a feather spot or an obvious complete or partial carcass) influences how that detection should be included in the model. Such detections are noted in Appendix A as "partial carcass + feather spot" in the "Description of Carcass/Injury" column.

2.2.2 Carcass Removal Trials

In accordance with the Plan, we set out carcasses approximately bi-weekly (i.e., every other week) for carcass removal trials. For both carcass removal trials and searcher efficiency trials (discussed below) and as per the terms of the USFWS Special Purpose Utility (SPUT) permit, during the spring quarter we were authorized to use only non-native species. Therefore, we used four species of non-native birds: European starlings (*Sturnus vulgaris*), house sparrows (*Passer domesticus*), rock pigeons (*Columbia livia*), and ring-necked pheasants (*Phasianus colchicus*). We classified bird size as follows: ≤100 grams (g) were classified as small, and >100 g were classified as large. As a result, European starlings and house sparrows, which average <100 g, were used to represent small birds, while rock pigeons and ring-necked pheasants, which are >100 g, were used to represent large birds. We conducted 19 carcass removal trials during the 2014 spring season, using four large carcasses and 15 small carcasses. Because carcass removal rates on the power block likely differ from removal rates elsewhere on the Project facilities we initiated carcass removal trials on the power block during the spring survey period. Three carcasses, one large and two small, were placed on the power block. Thirteen carcasses (three large and ten small) were placed in surveyed areas of the facility. The remaining three small carcasses were placed along the off-site control transects.

We conducted carcass removal trials in accordance with the Plan and applicable permits; however, we also added monitoring for any feather spots resulting from those placed carcasses that were left behind after scavenging. Because feather spots often persist for searchers to find long after scavenging, monitoring both feather spots and carcasses provides a more accurate measure of persistence.

2.2.3 Searcher Efficiency Trials

In accordance with the searcher efficiency trials described in the Plan, we placed 17 carcasses during the spring season using nine small carcasses and eight large carcasses in various vegetation heights and with various contrast to soil and vegetation to represent the range of conditions under which searches occur. Two of the small carcasses and one of the large carcasses disappeared (e.g., they may have been scavenged) before the searcher efficiency trial, leaving a sample size of seven small and seven large carcasses included in the trials. Because a number of the fatalities detected during searches were feather spots and partial carcasses, and these fatalities may differ from carcasses in detectability, we also placed 14 feather spots/partial carcasses in a range of field conditions. Each feather spot/partial carcass contained one wing and eight to 14 feathers.

2.2.4 Incidental Reporting

Some detections (defined as a dead or injured bat or bird) were outside standardized search areas, or were within search areas but not during standardized searches. Such detections were found by H. T. Harvey & Associates staff, the Project's designated biologists, or operational personnel. These detections, which were

reported in accordance with the facility's Wildlife Incident Reporting System described in Section 3.4 of the Plan, were considered "incidental" detections. Thus, an "incidental detection" is a bird or bat found dead or injured in a time or place other than the standardized searches that are conducted according to the Plan. Data on such birds and bats were collected separately and reported in the SPUT permit database. As described in Section 2.2.6, incidental data were included in the fatality estimates when they were found in areas covered during standardized surveys (e.g., in the tower area and along the fence line), during time periods in which those areas were being searched. Incidental detections from outside the survey areas are not included in the fatality estimates.

2.2.5 Fatality Estimator

Animals die at an unknown rate which must be inferred from regular searches of a site. Carcasses also persist for varying amounts of time and are imperfectly detected by searchers. For these reasons, it is often inappropriate to draw conclusions based on the raw number of fatalities in an open system. The desire to estimate fatalities given these variables has driven the development of several statistical methods for estimating fatalities (e.g., see Johnson et al. 2003, Smallwood 2007, and Huso 2010). All of these fatality estimation methods share a similar underlying model. Generally, the fatality estimation for a given site may be written as:

$$F=C/rp,$$

where the number of fatalities, F, is the quotient of the number of carcasses detected, C, over the product of carcasses left unscavenged, r, and the proportion that an observer sees, p (Huso 2010).

The inputs for r and p are estimated in subgroups of covariates that will influence the detectability and persistence of each carcass, such as carcass size, vegetation height, and stage of decay or scavenging (i.e., feather spot/partial carcass versus carcass). Given the tendency for many fatality models to underestimate site-wide fatalities, we chose to use a fatality estimator written by M. Huso (2010), which was shown to outperform previous fatality estimation models by more accurately accounting for imperfect detectability. This model, *The Fatality Estimator*, was developed to estimate fatalities primarily for wind energy projects; however, it can be applied to other sources of fatalities including power lines and solar projects (Huso 2010). The estimator uses this conceptual framework of fatalities, combined with bootstrapping from models of r and p to calculate variances and confidence intervals for the estimates of fatalities. Bootstrapping is a statistical method used to create a distribution to assign measures of variance to estimates for data where the underlying distribution is either unknown or cannot be represented algebraically (Efron and Tibshirani 1986). Bootstrapping resamples the data with replacement, several thousand times, to create a distribution that may be used to infer information about the sample mean.

Estimating Carcass Removal Times. Measurements of carcass removal rates typically include one or more censoring values. A censoring value is used in statistics when a value is only partially known. For example, if a carcass was checked on day 7 and was present, and was checked again on day 10, but was found to be

missing, then the date of scavenging is unknown, and an interval censor would be used. Because we used camera traps, the majority of scavenging times were known precisely, and the data was not censored. However, when cameras failed to record the moment of scavenging, we applied interval censoring.

There are four commonly used distributions of survival models that can be used in the fatality estimator for a value of *r*: exponential, Weibull, loglogistic, and lognormal. These four distributions have different rates and shapes of decay curves that attempt to model the survival of carcasses over a given search interval. We used Akaike's Information Criterion adjusted for sample size (AICc; Akaike 1973) to rank the fit of each survival model to our carcass removal trial data. Because the exact time of death for detected fatalities is usually unknown, the probability of persistence cannot be calculated exactly for each carcass, but it can be estimated from the selected survival model and bootstrapped to obtain a range of estimates of *r* for each carcass.

Estimating Searcher Efficiency. Searcher efficiency, or the proportion of fatalities that an observer sees, p, is represented most simply by the following equation:

$$p = \frac{NumberObserved}{NumberAvailable}$$

Because the 2014 spring season was the second season in which searcher efficiency trials were performed at Ivanpah, the sample size is not yet large enough to allow us to fully investigate the effects of variables such as bird size and vegetation cover, but these variables will be examined in future seasons as the sample size increases.

Fatality Estimates. Per Section 3.1 of the Plan, we report estimates for the tower area components (i.e., the power block and inner HD heliostats) together, because 100% of this area was searched; however, these estimates were calculated separately for the power block and inner HD heliostats due to the inclusion of incidental observations from the power block. We ran a separate estimate for the heliostat area (the inner and outer heliostat segments combined), in which 24.1% of the total area was searched.

The ACC units are only marginally accessible to scavengers from the outside; therefore, they act primarily as a closed system with a scavenging rate that approaches zero. Because of this, we did not use the fatality estimator equation to determine the numbers of fatalities at the ACC units; rather, we added the raw numbers from the ACC units, which we believe are representative of the fatality population within the ACC units, to the results of the fatality estimator to produce the total fatality estimates for the tower area. All detections within the ACC buildings were assigned as having a known cause of fatality, whether or not they showed evidence of singeing or collision.

Within the power block, a large percentage of the detections were found incidentally. Incidentals are typically not included in fatality estimates due to the sporadic, unpredictable nature of such reports and unaccounted-for search effort. However, because these detections accounted for such a large proportion of the detections

recorded during the 2014 spring season, we included them in our estimate for the power block and fence line. We adjusted the search interval for incidental detections on the power block to one day to reflect the high human use in these areas and thus the high probability that monitoring or operational personnel would see and report any highly visible fatality in these areas. Because of the carcass removal policies within the power block, no carcass removal trials were conducted in that area during the winter or early spring period. A change in this policy allowed carcasses to be placed on the power block for carcass removal trials late in the spring season. Because the sampling period was short, only three carcasses were placed, which is insufficient to calculate removal rates. Thus, for the spring season, carcass removal values for all Project areas were pooled and averaged and the mean carcass removal rates were used.

Because the fatality estimator is not appropriate for estimating rare events, we only present estimates for Project elements or groupings of more than five detections. The fatality estimator accounts for imperfect searcher efficiency, so fatalities that are not detected during a given search are still represented statistically. However, because of this, if a previously missed fatality is detected on a subsequent search, it will essentially be double-counted, and cause the overall fatality estimate to be falsely inflated. Therefore, any detections determined to be older than the search interval were removed from the estimator (Huso 2010). Because of uncertainty in estimating the ages of detections (i.e., the length of time between a bird's death and when the detection was discovered), all detections that were entered into the SPUT database as being <1 week old for 7-day search intervals, and <1 month old when the search interval exceeded 7 days, were considered to be within the search interval for 2014 spring surveys. We took both the previous search interval (more than one week for the first surveys of the quarter, then roughly weekly thereafter) and the estimated age of individual carcasses into account in determining which detections to exclude on the basis of being older than the search interval. In addition, we exclude detections found outside of our survey plots, as the fatality estimates focus on areas that are covered during standardized surveys.

Section 3.0 Avian Use and Raptor/Large Bird Monitoring Surveys

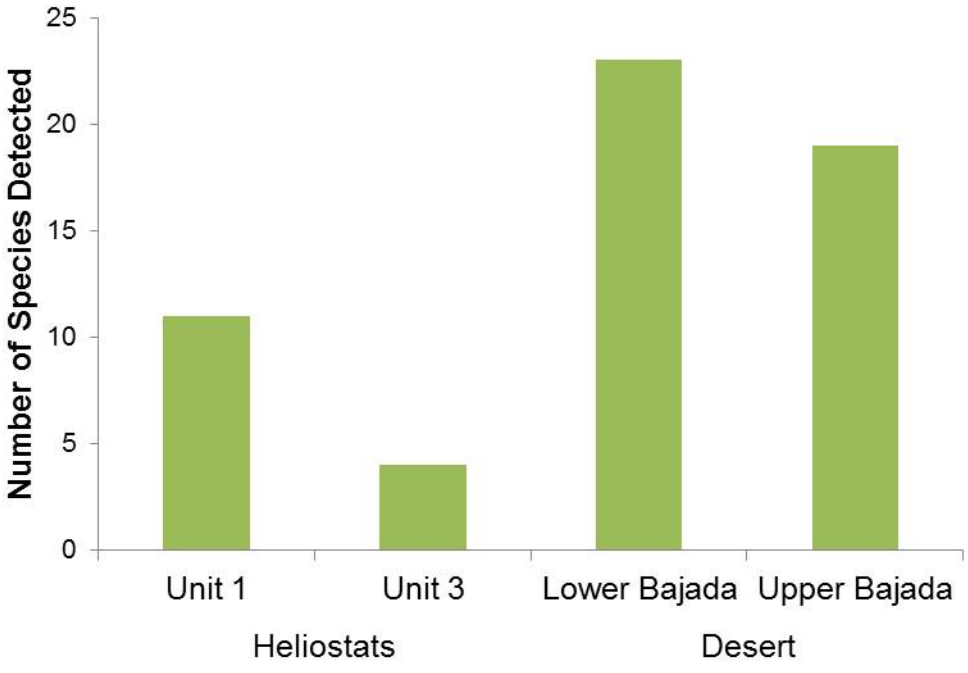
3.1 Avian Use Monitoring

This section provides the results of monitoring of avian use of the heliostat arrays and offsite desert bajada plots, including species composition and abundance. Species composition is compared between these avian use survey results and detections during standardized monitoring surveys. More than 110 hours of field observation time was spent conducting avian use surveys during the 2014 spring season.

3.1.1 Species Composition

A total of 39 bird species were recorded during avian use surveys during the 2014 spring season. Table 2 lists these species, their temporal occurrence status and foraging guild, and the frequency of occurrences (i.e., number of individuals detected) within the four survey grids. As indicated by Figure 6, species richness was highest in the lower bajada desert (23 species), followed closely by the upper bajada desert (19 species). Species richness was much lower in the heliostat grids, with 11 species observed in Unit 1, and only 4 species observed in Unit 3. Statistical tests were not attempted because of the high number of zero values in the samples.

Figure 6. Number of Bird Species Recorded at Avian Survey Points on Four Survey Areas.



Although all birds observed during surveys were recorded, only individual birds using the survey plots were included in these analyses. These included birds that were perched on a plot or aerial foragers (such as raptors) that appeared to be foraging on the plot. Birds that were only observed flying over or through the plot were not included in the analysis, both because these birds' occurrence did not signify use of a particular area and because inclusion of birds transiting over a plot would result in substantial problems associated with spatial autocorrelation of results (e.g., as birds are observed flying through multiple plots).

3.1.2 Avian Abundance

Although species richness was slightly higher on the lower desert bajada, avian abundance was identical on the two desert bajada grids (181 observations on the lower bajada, 181 observations on the upper bajada). The two heliostat arrays had substantially lower avian abundance, with only 49 observations in Unit 1 and 20 observations in Unit 3 during the spring period (Figure 7).

Figure 7. Number of Bird Observations Recorded at Avian Survey Points on Four Survey Areas.

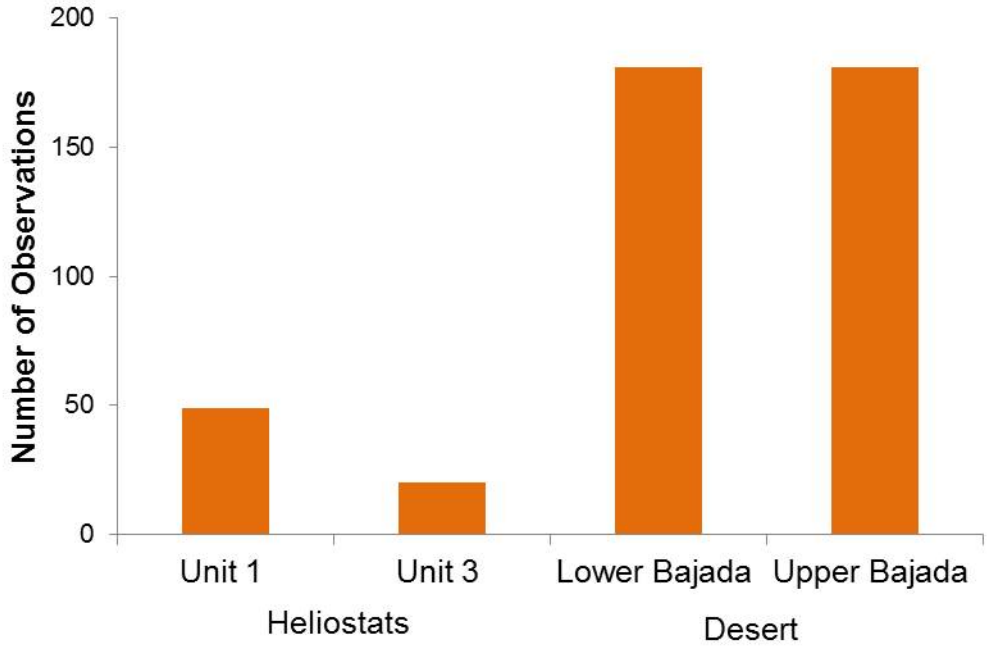


Table 2. Avian Use Survey Results - Frequency of Occurrence by Species and Survey Grid.

Common Name	Scientific Name	Foraging Guild*	Temporal Occurrence Group	Unit 1	Unit 3	Lower Bajada	Upper Bajada
American Kestrel	*Falco sparverius*	Carnivore/Insectivore	Permanent resident	1	0	0	0
American Pipit	*Anthus rubescens*	Granivore (winter)/ Insectivore (summer)	Non-breeding season resident	2	0	0	0
Ash-throated Flycatcher	*Myiarchus cinerascens*	Insectivore (terrestrial)	Breeding-season resident	0	0	6	12
Barn Swallow	*Hirundo rustica*	Insectivore (aerial)	Transient	0	0	1	3
Bewick's Wren	*Thryomanes bewickii*	Insectivore (terrestrial)	Permanent resident	0	0	6	0
Black Phoebe	*Sayornis nigricans*	Insectivore (terrestrial)	Permanent resident	0	0	1	0
Black-tailed Gnatcatcher	*Polioptila melanura*	Insectivore (terrestrial)	Permanent resident	0	0	1	0
Black-throated Sparrow	*Amphispiza bilineata*	Granivore (winter)/ Insectivore (summer)	Permanent resident	7	0	67	67
Blue-gray Gnatcatcher	*Polioptila caerulea*	Insectivore (terrestrial)	Permanent resident	0	0	1	0
Brewer's Blackbird	*Euphagus cyanocephalus*	Granivore	Permanent resident	0	0	2	0
Brewer's Sparrow	*Spizella breweri*	Granivore (winter)/ Insectivore (summer)	Permanent resident	0	0	49	17
Bullock's Oriole	*Icterus bullockii*	Insectivore (terrestrial)	Breeding-season resident	0	0	1	4
Cactus Wren	*Campylorhynchus brunneicapillus*	Insectivore (terrestrial)	Permanent resident	2	0	10	32
Chipping Sparrow	*Spizella passerina*	Granivore	Transient	0	0	0	1
Cliff Swallow	*Petrochelidon pyrrhonota*	Insectivore (aerial)	Breeding-season resident	0	0	2	0
Common Raven	*Corvus corax*	Omnivore	Permanent resident	5	0	1	0
Crissal Thrasher	*Toxostoma crissale*	Insectivore (terrestrial)	Permanent resident	0	0	1	0
Gambel's Quail	*Callipepla gambelii*	Granivore	Permanent resident	0	0	0	2
Horned Lark	*Eremophila alpestris*	Granivore (winter)/ Insectivore (summer)	Permanent resident	15	13	0	0
House Finch	*Carpodacus mexicanus*	Granivore	Permanent resident	8	0	0	1

Common Name	Scientific Name	Foraging Guild*	Temporal Occurrence Group	Unit 1	Unit 3	Lower Bajada	Upper Bajada
Ladder-backed Woodpecker	*Picoides scalaris*	Insectivore (terrestrial)	Permanent resident	0	0	0	1
Lark Sparrow	*Chondestes grammacus*	Granivore	Transient	0	1	0	0
Le Conte's Thrasher	*Toxostoma lecontei*	Insectivore (terrestrial)	Permanent resident	0	0	3	0
Lesser Goldfinch	*Spinus psaltria*	Granivore	Permanent resident	1	0	0	0
Lesser Nighthawk	*Chordeiles acutipennis*	Insectivore (aerial)	Breeding-season resident	1	1	0	1
Loggerhead Shrike	*Lanius ludovicianus*	Carnivore/Insectivore	Permanent resident	0	0	3	13
Northern Mockingbird	*Mimus polyglottos*	Omnivore	Permanent resident	0	0	0	2
Orange-crowned Warbler	*Oreothlypis celata*	Insectivore (terrestrial)	Non-breeding season resident	0	0	0	1
Say's Phoebe	*Sayornis saya*	Insectivore (terrestrial)	Permanent resident	0	0	0	2
Unknown		Unknown	Unknown	3	3	14	14
Unknown Flycatcher		Insectivore (terrestrial)	Unknown	0	0	1	0
Unknown Hummingbird		Nectivore/Insectivore	Unknown	1	0	2	0
Unknown Passerine		Unknown	Unknown	1	0	0	0
Unknown Sparrow		Unknown	Unknown	1	0	0	0
Unknown Swallow		Insectivore (aerial)	Unknown	0	0	1	0
Unknown Wren		Insectivore (terrestrial)	Unknown	0	0	1	0
Vaux's Swift	*Chaetura vauxi*	Insectivore (aerial)	Transient	0	0	0	4
Verdin	*Auriparus flaviceps*	Insectivore (terrestrial)	Permanent resident	0	0	0	1
Warbling Vireo	*Vireo gilvus*	Insectivore (terrestrial)	Transient	0	0	1	0
Western Kingbird	*Tyrannus verticalis*	Insectivore (aerial)	Breeding-season resident	0	0	1	0
Western Meadowlark	*Sturnella neglecta*	Granivore (winter)/ Insectivore (summer)	Permanent resident	1	2	0	0
White-crowned Sparrow	*Zonotrichia leucophrys*	Granivore	Non-breeding season resident	0	0	1	1
Wilson's Warbler	*Cardellina pusilla*	Insectivore (terrestrial)	Transient	0	0	1	2

Common Name	Scientific Name	Foraging Guild*	Temporal Occurrence Group	Unit 1	Unit 3	Lower Bajada	Upper Bajada
Yellow Warbler	*Setophaga petechia*	Insectivore (terrestrial)	Transient	0	0	2	0
Yellow-rumped Warbler	*Setophaga coronata*	Insectivore (terrestrial)	Non-breeding season resident	0	0	1	0
Totals				**49**	**20**	**181**	**181**

* Indicates primary diet in spring.

Avian abundance by temporal occurrence group is depicted in Figure 8. Permanent residents predominated in all areas. These birds were particularly conspicuous in spring since many sang or gave alarm calls from prominent perches as part of their breeding activities in the area. Breeding black-throated sparrows and cactus wrens were numerous in both desert bajada areas, while breeding horned larks were more common in the heliostat arrays.

Figure 8. Number of Bird Observations Recorded at Avian Survey Points on Four Survey Areas by Temporal Occurrence Group.

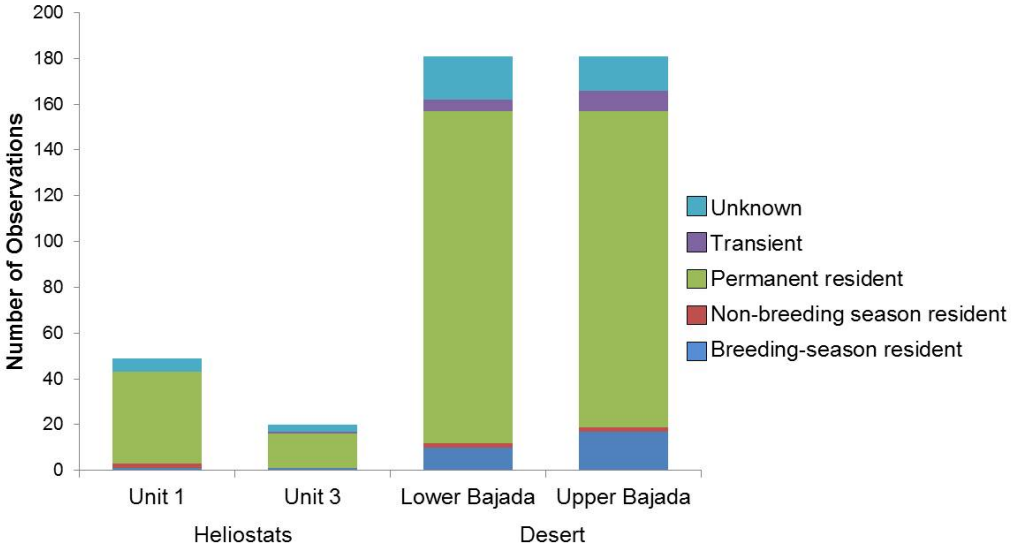
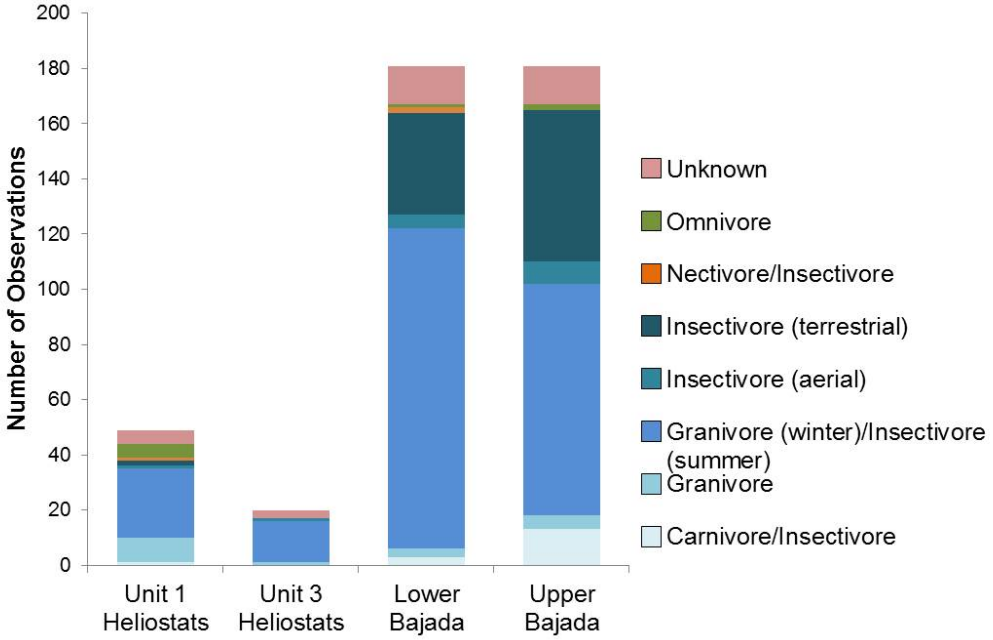


Figure 9 depicts bird abundance by foraging guild. Birds that are primarily granivores in winter and insectivores in spring and summer (when breeding and feeding young) dominated the foraging guilds in all areas. This is as expected given the predominantly insectivorous diet of the nestlings of many locally breeding species. Carnivores/insectivores were also more abundant on the upper desert bajada grid than on other grids; this pattern reflects the greater number of loggerhead shrikes observed in this area. The habitat in the upper desert bajada grid may be more suitable for nesting loggerhead shrikes. The upper desert bajada grid had larger numbers of all shrub and cavity nesting resident species than the lower bajada grid.

Figure 9. Number of Bird Observations Recorded at Avian Survey Points on Four Survey Areas by Foraging Guild.



Because the survey areas (e.g., 20 points in each grid) were identical for each of the four grids, comparison of general avian abundance metrics such as total observations, as was done above, is appropriate for elucidating relative abundance, both overall and by species and species group (e.g., temporal occurrence group and foraging guild). However, because the relative abundance of various species differed among grids, and bird detectability may vary among species, assessing relative abundance using raw numbers may result in inaccurate conclusions. As a result, we used the program Distance 6.0 (Thomas et al. 2010) to evaluate avian densities. As discussed in Section 2.1.1, distance sampling analysis requires a fairly large amount of data, and due to the low number of individuals of most species recorded during these surveys (owing to the naturally low abundance of spring birds in the habitat surveys), it was not possible to obtain reliable density estimates on a species-by-species basis. Even when data were pooled within a 20-point grid, sample sizes were insufficient to allow for determination of reliable density estimates within a grid (e.g., to allow for comparisons between the two 20-point heliostat grids or the two 20-point desert habitat control grids). However, under the assumption that the two heliostat grids were more similar to each other (in terms of habitat and spring bird communities) than to either of the desert bajada grids, and making the inverse assumption with respect to the two desert bajada grids, we pooled data from the 40 heliostat points and compared bird densities to data from the 40 pooled desert bajada points. The 95% confidence intervals around density estimates for each habitat type did not overlap, thus providing strong statistical evidence that bird density in the Desert Bajada was higher than bird density in the Heliostat Units (Table 3). However, this result should be interpreted with caution because the low number of avian observations resulted in high coefficients of variation within the heliostat arrays.

Table 3. Avian Density Estimates for Heliostat vs. Desert Bajada Grids (Derived Using DISTANCE).

		95% Confidence Interval		
Habitat Type	**Density Estimate (Birds/Hectare)**	**Low Estimate (Birds/Hectare)**	**High Estimate (Birds/Hectare)**	**Percent Coefficient Of Variation**
Heliostat Units	0.8	0.3	2.5	60.7
Desert Bajada	5.8	3.9	8.6	20.2

3.1.3 Comparison of Avian Use Survey Results to Fatality Detections

Whereas 39 bird species were recorded during avian use surveys, 43 species were recorded as detections during standardized fatality monitoring. Comparison of the most abundant bird species that were recorded on the avian use surveys to the species most frequently recorded as detections reveals no more similarity between detections and birds using the heliostat grids (as identified during avian use surveys) than between detections and birds using the desert bajada habitats (Table 4). Of the 10 species most frequently recorded as detections, only one species (horned lark) was among the most abundant species on the heliostat survey grids, while a single species (barn swallow) was among the most abundant species on the desert bajada survey grids. Horned larks were the most frequently observed species in the heliostat grids. These birds were also frequently recorded as detections, with three showing evidence of collision, and one showing evidence of singeing. Cause of death could not be determined for the remaining six horned lark detections, but all were found in the heliostat arrays, so collision, predation, or illness is possible. Mourning doves, which were the most frequent fatality detection (69.6% as feather spots), were not recorded during use surveys; however, this species was observed incidentally as surveyors traveled among survey points. Yellow-rumped warblers were frequently recorded as detections, but rarely observed during avian surveys. Hummingbirds were also rarely observed during point counts. The remaining commonly detected species were composed of departing winter residents and migrating species. Due to their transitory status, these birds are unlikely to be observed during point counts, which are designed to assess resident species utilizing the habitat.

Table 4. Comparison of the Most Abundant Bird Species Recorded as Detections and Recorded on Heliostat and Desert Bajada Survey Grids (in Descending Order of Abundance).

Detections[1]	Heliostat Survey Grids	Desert Bajada Survey Grids
Mourning Dove	Horned Lark	Black-throated Sparrow
Yellow-rumped Warbler	House Finch	Brewer's Sparrow
Costa's Hummingbird	Black-throated Sparrow	Cactus Wren
Horned Lark	Common Raven	Ash-throated Flycatcher
Rufous Hummingbird	Western Meadowlark	Loggerhead Shrike
Tree Swallow	American Pipit	Bewick's Wren
White-crowned Sparrow	Lesser Nighthawk	Bullock's Oriole
Barn Swallow	Cactus Wren	Barn Swallow
Cliff Swallow	American Kestrel	Vaux's Swift
Violet-green Swallow	Lark Sparrow	LeConte's Thrasher

[1] Bird and bat fatalities and injuries found during the scheduled fatality searches are called detections

3.2 Raptor and Large Bird Use Monitoring

This section discusses the results of surveys for use of the site and surrounding areas by raptors and other large birds, including a summary of species composition, abundance, and habitat use, as observed from points around the edges of and outside the facility. In addition, this section provides information on the number of individuals of these species observed perched vs. those in flight, as well as the heights at which flying birds were recorded. A total of 119 hours of field observation time was spent conducting raptor/large bird surveys during the 2014 spring season.

3.2.1 General Species Composition, Abundance, and Habitat Use

Three to five 4-hour surveys for raptors and other large birds were conducted from each of eight points as shown on Figure 3. Four surveys were conducted at points 1, 2, 5, and 8. Five surveys were conducted at point 6. Weather delayed two surveys, and in one case a survey was cancelled in order to transport an injured American kestrel to a wildlife rehabilitation center. Thus, three surveys were conducted at points 3, 4, and 7. During these surveys, six raptor species and two other large bird species (common raven and turkey vulture) were observed and identifiable. Table 5 summarizes the total number of detections of each of these species during all surveys combined. Due to the long duration of each survey and the mobility of these birds, it was not always possible to track individuals throughout a survey to avoid counting the same individuals multiple times. Consequently, results of large bird use monitoring surveys are reported in terms of observation rather than individuals.

Table 5. Raptor/Large Bird Point Count Results Summary (Number of Observations).

Common Name	Scientific Name	Ivanpah Facilities	Desert	Mountains	Total
American Kestrel	*Falco sparverius*	3	1	0	4
Cooper's Hawk	*Accipiter cooperii*	0	2	0	2
Common Raven	*Corvus corax*	16	28	0	44
Golden Eagle	*Aquila chrysaetos*	0	4	1	5
Red-tailed Hawk	*Buteo jamaicensis*	5	15	0	20
Sharp-shinned Hawk	*Accipiter striatus*	0	1	0	1
Swainson's Hawk	*Buteo swainsoni*	0	2	0	2
Turkey Vulture	*Cathartes aura*	1	35	9	45
Unknown *Buteo*	*Buteo* species	0	2	0	2
Unknown Raptor		1	2	2	5
Total		**26**	**92**	**12**	**130**

Common ravens comprised 33.8% of all large bird observations. The preponderance of raven observations resulted less from the abundance of ravens on the site (with counts of up to six birds at a time, though more frequently singles or pairs) than from the persistent nature of the species (frequently present) and widespread occurrence. Ravens observations were most common in the desert adjacent to the Ivanpah facilities, with somewhat fewer observations at the Ivanpah facilities themselves and none observed toward the mountains. Nesting ravens were documented in Unit 1, and both individuals and pairs were observed in other units in the vicinity of the tower and flying within and close to the heliostat arrays. American kestrels were more commonly observed in the heliostat array than in the desert. None were observed in the mountains, although this falcon's small size makes very distant observations difficult. Most other raptors were most commonly observed over the desert, with few or no observations within the Ivanpah facilities. Most golden eagle observations were of birds in the desert. Few were observed in the mountains and none were observed at the Ivanpah facilities during formal surveys; however, on 25 April, our biologist noted a transmitter or data-logger backpack on a golden eagle flying over the desert during a raptor survey. Golden eagles were observed incidentally by biologists on two different days. A golden eagle was observed incidentally at the Ivanpah facilities by biologists on 22 March 2014, when an adult was observed perched on a transmission pole, then flying west away from the facility and over the desert. On 2 May 2014, H. T. Harvey biologist Stephen Peterson twice observed golden eagles flying over the Unit 3 heliostat array. He first noted a pair of adult golden eagles flying east across the northern end of Unit 3 at height category 1 (i.e. between 100 and 200 m agl). Later that day, he observed one golden eagle of unknown age flying west over the southwest corner of Unit 3 at height category 2 (i.e., greater than 200 m agl). In addition, two incidental observations of prairie falcons were made, one over the Unit 1 heliostats and one over the Unit 2 heliostats. There were relatively few incidental observations of other raptors at or over the Ivanpah facilities during the 2014 spring season. These involved occasional red-tailed hawk, common raven, American kestrel, and Swainson's hawk.

Because the survey effort was not the same at all points, the relative abundance of these species differs slightly from the raw observations presented in Table 5. Observations converted to number/survey hour are

presented in Table 6. Because differences in survey effort were small, there is little difference between the two measures of raptor abundance.

Table 6. Raptor/Large Bird Point Count Results Summary (Number of Observations/Survey Hour).

Common Name	Ivanpah Facilities	Desert	Mountains	Total
American Kestrel	0.025	0.008	0	0.034
Cooper's Hawk	0	0.017	0	0.017
Common Raven	0.135	0.236	0	0.371
Golden Eagle	0	0.034	0.008	0.042
Red-tailed Hawk	0.042	0.127	0	0.169
Sharp-shinned Hawk	0	0.008	0	0.008
Swainson's Hawk	0	0.017	0	0.017
Turkey Vulture	0.008	0.295	0.076	0.380
Unknown *Buteo*	0	0.017	0	0.017
Unknown Raptor	0.008	0.017	0.017	0.042
Total	**0.219**	**0.776**	**0.101**	**1.097**

As shown by Table 6, the frequency of occurrence of large birds, in terms of the number/survey hour, was relatively low. An average of approximately 1.1 birds/hour was recorded during the 119 hours of raptor/large bird surveys.

Common ravens and red-tailed hawks were observed perched, primarily on offsite electrical transmission towers, moderately frequently. A raven was observed perched within Ivanpah facilities on one occasion (on a trailer) during these raptor surveys. One red-tailed hawk was observed perched on the perimeter fence of Unit 1. At no time during the 2014 spring season were raptors observed perched on the Ivanpah power towers.

The majority of observations of raptors and other large birds involved individuals seen in flight. Per Section 2.3 of the Plan, the height of flight above ground level (agl) was recorded in one of the following categories:

- 0 = < 10 m agl, (within the heliostat collision-risk zone)
- 1 = 10–100 m agl, (between the height of the heliostat collision-risk zone and the height of the elevated solar flux risk zone in areas closer to the power towers)
- 2 = 100–200 m agl (within the elevated solar flux risk zone (primary boiler area at 120–140 m agl)
- 3 = > 200 m agl (above the elevated solar flux risk zone)

Table 7 provides the number of observations of each species that were perched or that were flying in each height category; this information is provided separately for birds seen over Ivanpah facilities and over other habitats such as desert and mountains.

Within the Ivanpah facility, the majority of birds (most of which were ravens) were observed in the three lower height categories (i.e., below 200 m agl). In surrounding areas, the highest numbers were observed flying in the highest category, possibly as they approached the adjacent mountains.

Table 7. Flight Heights of Raptors and Other Large Birds Over Ivanpah Facilities and Other Habitats/Areas (Data are the Number of Observations at Each Flight Height).

	Above Ivanpah Facilities					Above Other Habitats/Areas				
Species	**Perched**	**0**	**1**	**2**	**3**	**Perched**	**0**	**1**	**2**	**3**
American Kestrel	0	0	0	3	0	0	1	0	0	0
Cooper's Hawk	0	0	0	0	0	0	0	2	0	0
Common Raven	1	0	5	4	6	3	2	7	14	2
Golden Eagle	0	0	0	0	0	0	0	0	0	5
Red-tailed Hawk	0	1	0	2	2	6	2	2	1	4
Sharp-shinned Hawk	0	0	0	0	0	0	0	1	0	0
Swainson's Hawk	0	0	0	0	0	0	0	1	0	1
Turkey Vulture	0	0	0	0	1	0	1	2	7	34
Unknown Buteo	0	0	0	0	0	0	0	0	0	2
Unknown Raptor	0	0	0	1	0	2	0	0	2	0
Total	**1**	**1**	**5**	**10**	**9**	**11**	**6**	**15**	**24**	**48**

3.2.2 Raptor and Large Bird Distribution

Table 8 provides the number of observations of each raptor and large bird species from each of the eight survey points (Figures 10-17).

Table 8. Raptor/Large Bird Point Count Results By Survey Point.

Species	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
American Kestrel	0	0	1	0	0	0	1	2
Cooper's Hawk	0	1	0	0	0	0	1	0
Common Raven	5	9	5	1	5	8	9	2
Golden Eagle	0	1	2	2	0	0	0	0
Red-tailed Hawk	0	4	0	0	3	8	2	3
Sharp-shinned Hawk	0	0	0	0	1	0	0	0
Swainson's Hawk	0	0	0	0	0	1	1	0
Turkey Vulture	8	1	2	1	0	7	25	1
Unknown Buteo	0	1	0	0	0	1	0	0
Unknown Raptor	1	0	0	0	0	2	1	1
Total	**14**	**17**	**10**	**4**	**9**	**27**	**40**	**9**

Points 1 and 2, 5 and 3, and 6 and 8 represent paired points on the eastern and western sides of Units 3, 2, and 1, respectively. At Units 1 and 2, overall abundance was higher on the eastern points than on the western. This difference appears to have resulted primarily from higher common raven abundance on the eastern points. Higher raven abundance on the eastern side of the site was expected because ravens move between

the Ivanpah site and areas in Primm with anthropogenic food sources and the relatively low abundance of ravens in areas toward the mountains west of the Project site. Red-tailed hawks showed a similar pattern at Units 1 and 2, with much higher numbers of observations on the eastern side than the western side. Swainson's hawks and turkey vultures were also more numerous on the eastern side of the facility. However, these migratory raptors were seen in such low numbers that their relative location may not be particularly meaningful. Other raptors were slightly more abundant on the west side than the east side of the three power units, but again, in low numbers.

Figures 10 through 17 depict the results of raptor surveys in terms of the locations of birds observed; number of individuals; whether the birds were flying or perched; and flight direction (for flying birds). All observations for the entire season are shown on a single figure for each of the eight survey points to document locations and concentrations, if any, of activity of raptors and other large birds.

LEGEND

Number of Birds

Flight Direction

Raptor/Large Bird Survey Observations

Common Raven, Flying

Turkey Vulture, Flying

Unknown Raptor/Bird, Flying

Survey Point

800-m Radius Survey Area

Project Site

N 2200 1100 0 2200

Feet

8

1

1

1

1

1

1

IVANPAH 3

IVANPAH 2

IVANPAH 1

OVERVIEW

Fig 10

Fig 11

Fig 12

Fig 13

Fig 14

Fig 15

Fig 16

Fig 17

1

2

3

4

5

6

7

8

Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

N:\Projects\2802-01\07\Report\Spring 2014 Avian and Bat Monitoring Report\Fig 10 Raptor Large Bird Survey Observations from Survey Point 1 Spring 2014.mxd

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Figure 10: Raptor/Large Bird Survey Observations from Survey Point 1, Spring 2014

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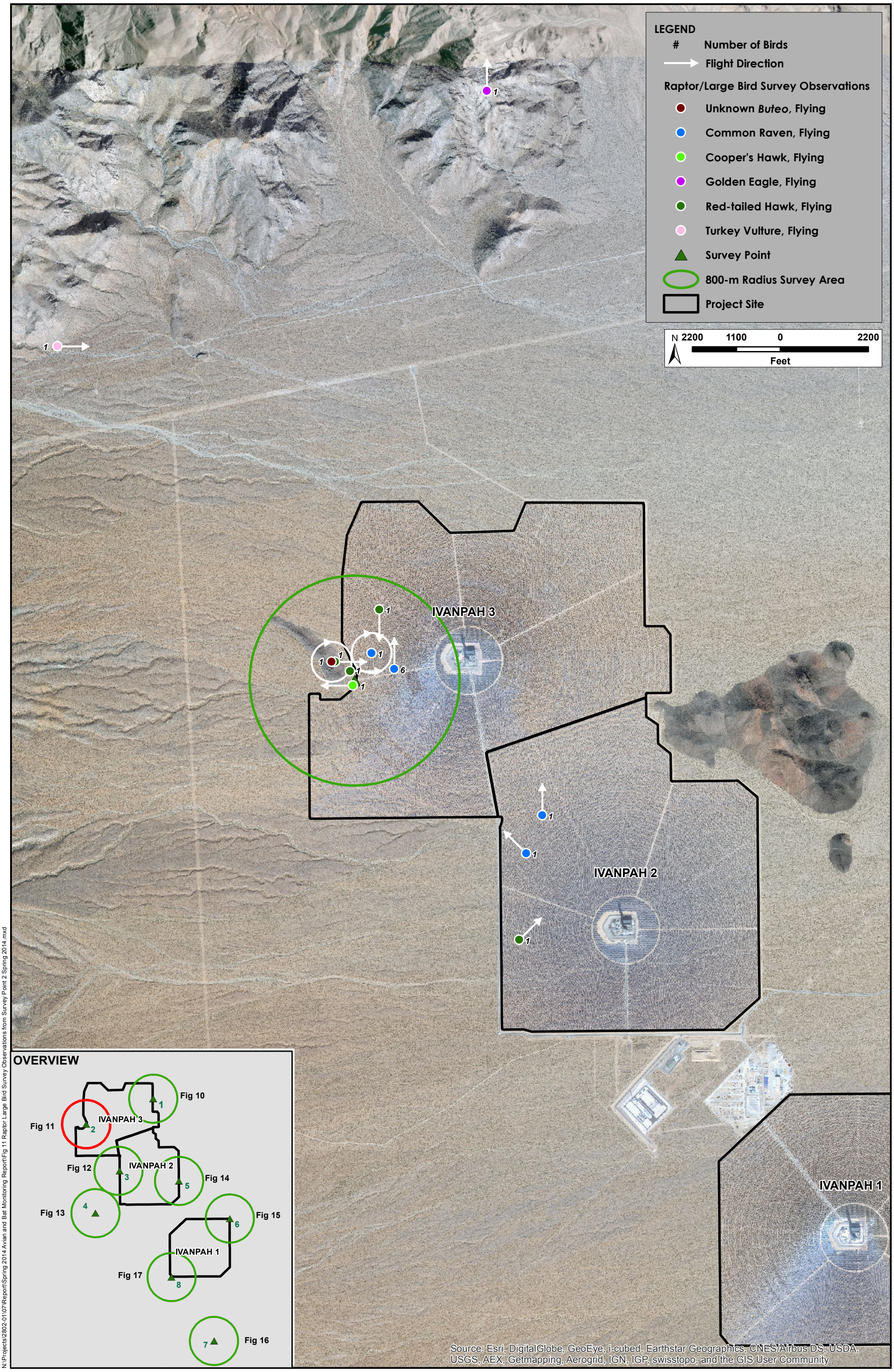

N:\Projects\2802-01\07\Report\Spring 2014 Avian and Bat Monitoring Report\Fig 11 Raptor Large Bird Survey Observations from Survey Point 2 Spring 2014.mxd

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Figure 11: Raptor/Large Bird Survey Observations from Survey Point 2, Spring 2014

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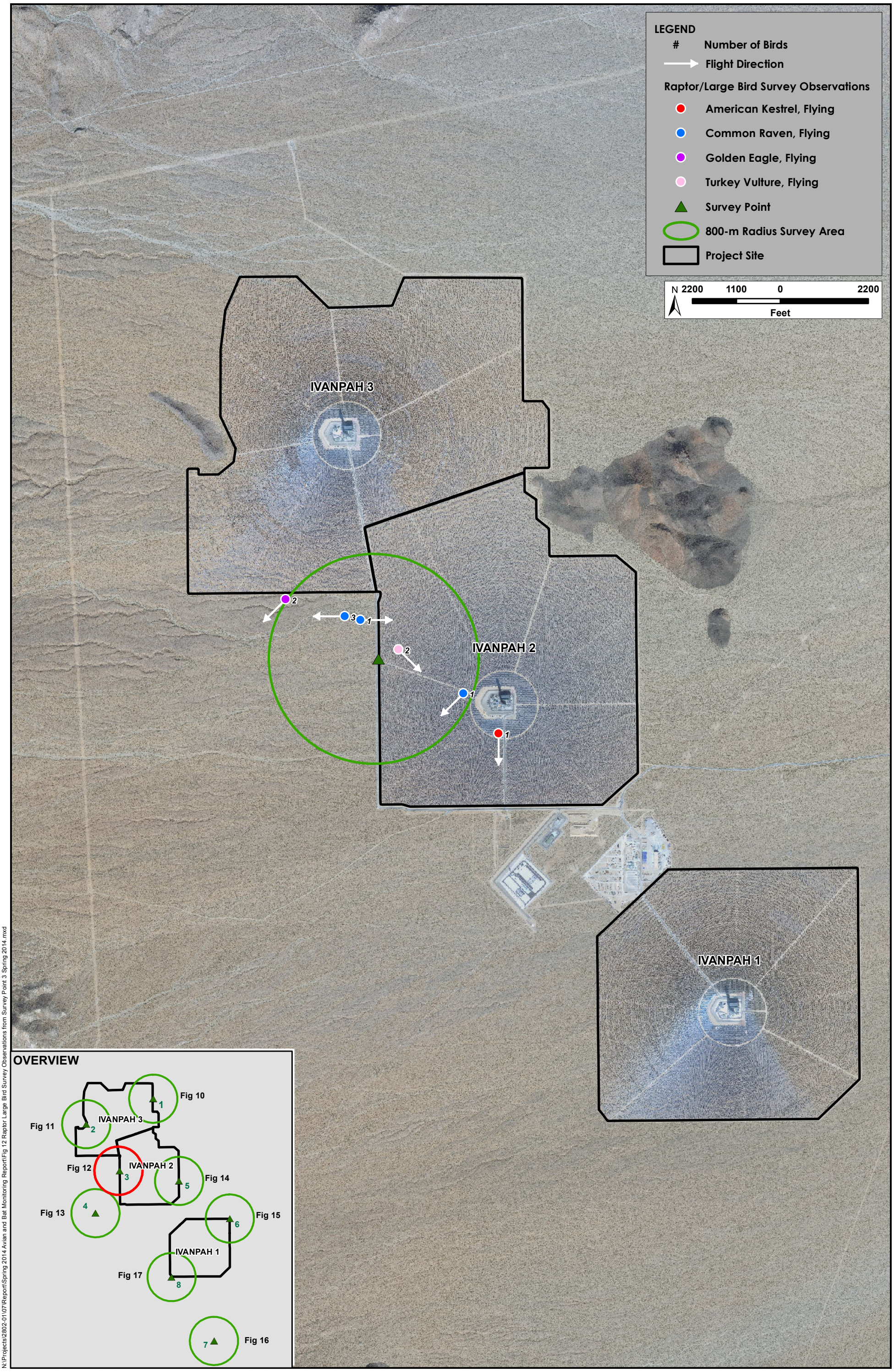

N:\Projects\2802-01\07\Report\Spring 2014 Avian and Bat Monitoring Report\Fig 12 Raptor Large Bird Survey Observations from Survey Point 3 Spring 2014.mxd

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Figure 12: Raptor/Large Bird Survey Observations from Survey Point 3, Spring 2014

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LEGEND

Number of Birds

Flight Direction

Raptor/Large Bird Survey Observations

Common Raven, Flying

Golden Eagle, Flying

Turkey Vulture, Flying

Survey Point

800-m Radius Survey Area

Project Site

N 2200 1100 0 2200

Feet

IVANPAH 3

IVANPAH 2

IVANPAH 1

OVERVIEW

Fig 10

Fig 11

Fig 12

Fig 13

Fig 14

Fig 15

Fig 16

Fig 17

N:\Projects\2802-01\07\Report\Spring 2014 Avian and Bat Monitoring Report\Fig 13 Raptor Large Bird Survey Observations from Survey Point 4 Spring 2014.mxd

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Figure 13: Raptor/Large Bird Survey Observations from Survey Point 4, Spring 2014

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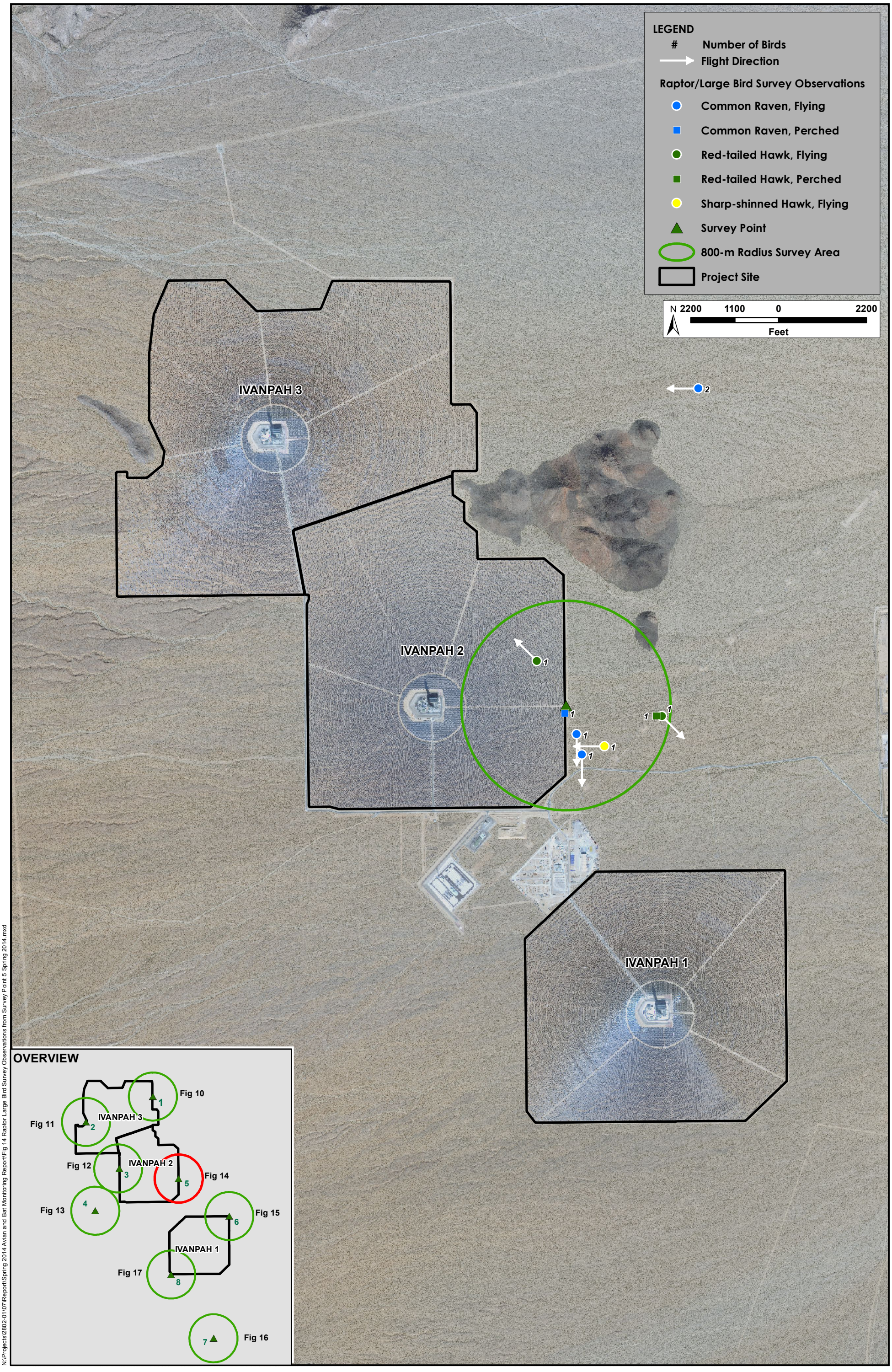

N:\Projects\2802-01\07\Report\Spring 2014 Avian and Bat Monitoring Report\Fig 14 Raptor Large Bird Survey Observations from Survey Point 5 Spring 2014.mxd

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Figure 14: Raptor/Large Bird Survey Observations from Survey Point 5, Spring 2014

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LEGEND

Number of Birds

Flight Direction

Raptor/Large Bird Survey Observations

- Unknown *Buteo*, Flying
- Common Raven, Flying
- Common Raven, Perched
- Red-tailed Hawk, Flying
- Red-tailed Hawk, Perched
- Swainson's Hawk, Flying
- Turkey Vulture, Flying
- Unknown Raptor/Bird, Perched
- Survey Point
- 800-m Radius Survey Area
- Project Site

N 2200 1100 0 2200

Feet

IVANPAH 3

IVANPAH 2

IVANPAH 1

OVERVIEW

Fig 10

Fig 11

Fig 12

Fig 13

Fig 14

Fig 15

Fig 16

Fig 17

N:\Projects\2802-01\07\Report\Spring 2014 Avian and Bat Monitoring Report\Fig 15 Raptor Large Bird Survey Observations from Survey Point 6 Spring 2014.mxd

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Figure 15: Raptor/Large Bird Survey Observations from Survey Point 6, Spring 2014

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IVANPAH 2

IVANPAH 1

Observed
5.3 miles
to west

LEGEND

Number of Birds

Flight Direction

Raptor/Large Bird Survey Observations

American Kestrel, Flying

Common Raven, Flying

Common Raven, Perched

Cooper's Hawk, Flying

Red-tailed Hawk, Flying

Swainson's Hawk, Flying

Turkey Vulture, Flying

Unknown Raptor/Bird, Flying

Survey Point

800-m Radius Survey Area

Project Site

Note:
* For observations of flying birds without a directional arrow, the flight direction was not recorded.

N 2200 1100 0 2200
Feet

1
1
1
1
1
1
1
1
22
1
1
1
3
1
1

OVERVIEW

Fig 10
Fig 11
Fig 12
Fig 13
Fig 14
Fig 15
Fig 16
Fig 17
IVANPAH 3
IVANPAH 2
IVANPAH 1
1
2
3
4
5
6
7
8

Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

N:\Projects\2802-01\07\Report\Spring 2014 Avian and Bat Monitoring Report\Fig 16 Raptor Large Bird Survey Observations from Survey Point 7 Spring 2014.mxd

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Figure 16: Raptor/Large Bird Survey Observations from Survey Point 7, Spring 2014

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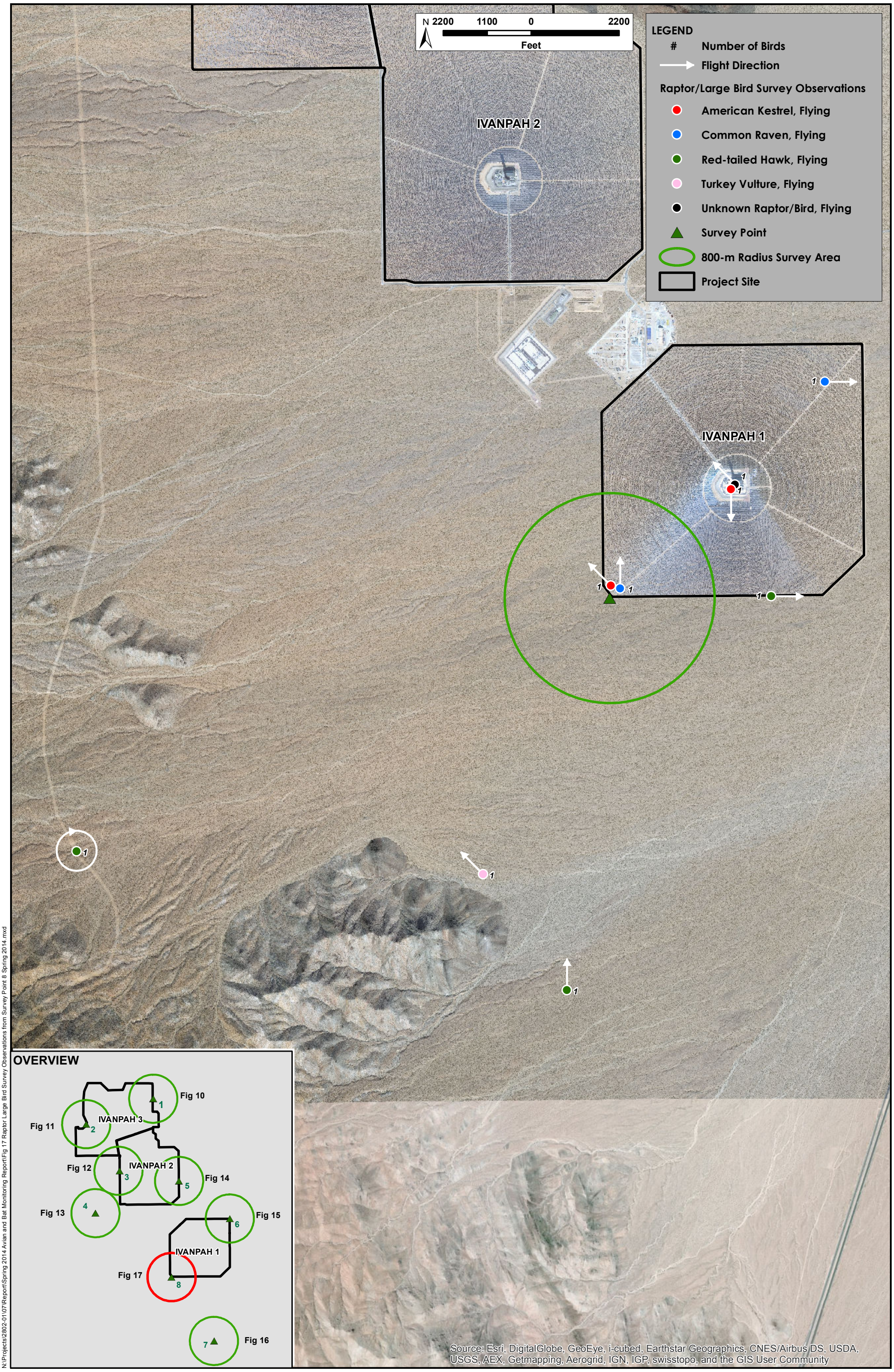

N:\Projects\2802-01\07\Report\Spring 2014 Avian and Bat Monitoring Report\Fig 17 Raptor Large Bird Survey Observations from Survey Point 8 Spring 2014.mxd

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Figure 17: Raptor/Large Bird Survey Observations from Survey Point 8, Spring 2014

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Section 4.0 Monitoring Results

4.1 Avian and Bat Detections

The following section describes the basic descriptions and distributions of the detection data. The summary provides the numbers and species list of these detections. Bird and bat detections are also described by their temporal distribution, their migratory or residency status, and by foraging guild.

4.1.1 Summary of Avian and Bat Detections

During the period 23 March – 22 May 2014, a total of two injured birds, and four bat fatalities and 200 avian fatalities, were detected. Ten of the avian fatalities were initially found injured but succumbed to their injuries soon after capture. These birds are considered fatalities in this report. Of the two injured birds, a Brewer's sparrow (collision) found injured escaped during processing and flew away, while an American kestrel (singed) was taken to a rehabilitation facility, where it was still alive as of 23 October 2014. In total, spring detections included 43 avian species and two bat species. The total number of avian detections is listed by species in Table 9 below; the total of 43 avian species includes an unknown heron, because no herons identified to species were recorded, but the other unknown species are not added to this total because each represents a category (such as "hummingbird" or "swallow") that is also represented by identified species. Bat detections are also listed by species in Table 11. Appendices A and B include additional data on these birds and bats. Figures 18, 19, 20, and 21 depict the locations of the bird detections in Units 1, 2, and 3, and outside the units, respectively.

Table 9. Number of Individual Bird Detections, by Species, 23 March – 22 May 2014.

Common Name*	Scientific Name	Species Code**	Injuries	Fatalities
Mourning Dove[2]	*Zenaida macroura*	MODO		23
Yellow-rumped Warbler[1]	*Setophaga coronata*	YRWA		22
Unknown Passerine[1]				14
Costa's Hummingbird[1]	*Calypte costae*	COHU		12
Horned Lark[1]	*Eremophila alpestris*	HOLA		10
Rufous Hummingbird[1]	*Selasphorus rufus*	RUHU		7
Tree Swallow[1]	*Tachycineta bicolor*	TRES		7
White-crowned Sparrow[1]	*Zonotrichia leucophrys*	WCSP		7
Barn Swallow[1]	*Hirundo rustica*	BARS		6
Cliff Swallow[1]	*Petrochelidon pyrrhonota*	CLSW		6
Violet-green Swallow[1]	*Tachycineta thalassina*	VGSW		6
Unknown Swallow[1]				5

Common Name*	Scientific Name	Species Code**	Injuries	Fatalities
Unknown Hummingbird[1]				5
American Kestrel[2,3]	*Falco sparverius*	AMKE	1	4
Brewer's Blackbird[1]	*Euphagus cyanocephalus*	BRBL		4
Western Meadowlark[1]	*Sturnella neglecta*	WEME		4
Anna's Hummingbird[1]	*Calypte anna*	ANHU		3
Bank Swallow[1]	*Riparia*	BANS		3
Black-throated Sparrow[1]	*Amphispiza bilineata*	BTSP		3
Calliope Hummingbird[1]	*Selasphorus calliope*	CAHU		3
Loggerhead Shrike[1]	*Lanius ludovicianus*	LOSH		3
Nashville Warbler[1]	*Vermivora ruficapilla*	NAWA		3
House Finch[1]	*Carpodacus mexicanus*	HOFI		3
Wilson's Warbler[1]	*Cardellina pusilla*	WIWA		3
Brewer's Sparrow[1]	*Spizella breweri*	BRSP	1	2
Hermit Warbler[1]	*Setophaga occidentalis*	HEWA		2
Lazuli Bunting[1]	*Passerina amoena*	LAZB		2
Lesser Nighthawk[1]	*Chordeiles acutipennis*	LENI		2
Lincoln's Sparrow[1]	*Melospiza lincolnii*	LISP		2
Northern Rough-winged Swallow[1]	*Stelgidopteryx serripennis*	NRWS		2
Townsend's Warbler[1]	*Dendroica townsendi*	TOWA		2
White-throated Swift[1]	*Aeronautes saxatalis*	WTSW		2
American Coot[2]	*Fulica americana*	AMCO		1
Ash-throated Flycatcher[1]	*Myiarchus cinerascens*	ATFL		1
Black-headed Grosbeak[1]	*Pheucticus melanocephalus*	BHGR		1
Broad-tailed Hummingbird[1]	*Selasphorus platycercus*	BTAH		1
Eared Grebe[2]	*Podiceps nigricollis*	EAGR		1
Eurasian Collared-Dove[2]	*Streptopelia decaocto*	EUCD		1
Lesser Goldfinch[1]	*Spinus psaltria*	LEGO		1
Olive-sided Flycatcher[1]	*Contopus cooperi*	OSFL		1
Rock Pigeon[2]	*Columba livia*	ROPI		1
Unknown Bird[4]				1
Unknown Heron[2]				1
Unknown Passerine or Swift[1]				1
Unknown Swift[1]				1
Unknown Warbler[1]				1
Vaux's Swift[1]	*Chaetura vauxi*	VASW		1
Western Kingbird[1]	*Tyrannus verticalis*	WEKI		1

Common Name*	Scientific Name	Species Code**	Injuries	Fatalities
Yellow Warbler[1]	*Setophaga petechia*	YEWA		1
Yellow-breasted Chat[1]	*Icteria virens*	YBCH		1
Bats				
California Myotis	*Myotis californicus*	MYCA		2
Brazilian Free-tailed Bat	*Tadarida brasiliensis*	TABR		2

* For each species, the size of the detection, as well as a notation if it is a raptor, is provided to indicate how each species was considered in the fatality estimates (i.e., as a small bird, large bird, and/or raptor), as follows: [1] Small bird; [2] Large bird; [3] Raptor; [4] For the purpose of fatality estimation, each detection of unknown species group is given a size based on an assessment of feather size.

** Species code refers to the code (usually a four-letter designation) by which the species are referred on Figures 18-21.

4.1.2 Avian Detections by Temporal Occurrence Group and Foraging Guild

To provide information on how birds recorded as detections might use the Ivanpah site, both temporally (i.e., during which seasons and for what duration) and in terms of potential resource use on the site, we categorized all bird detections by temporal occurrence group and foraging guild.

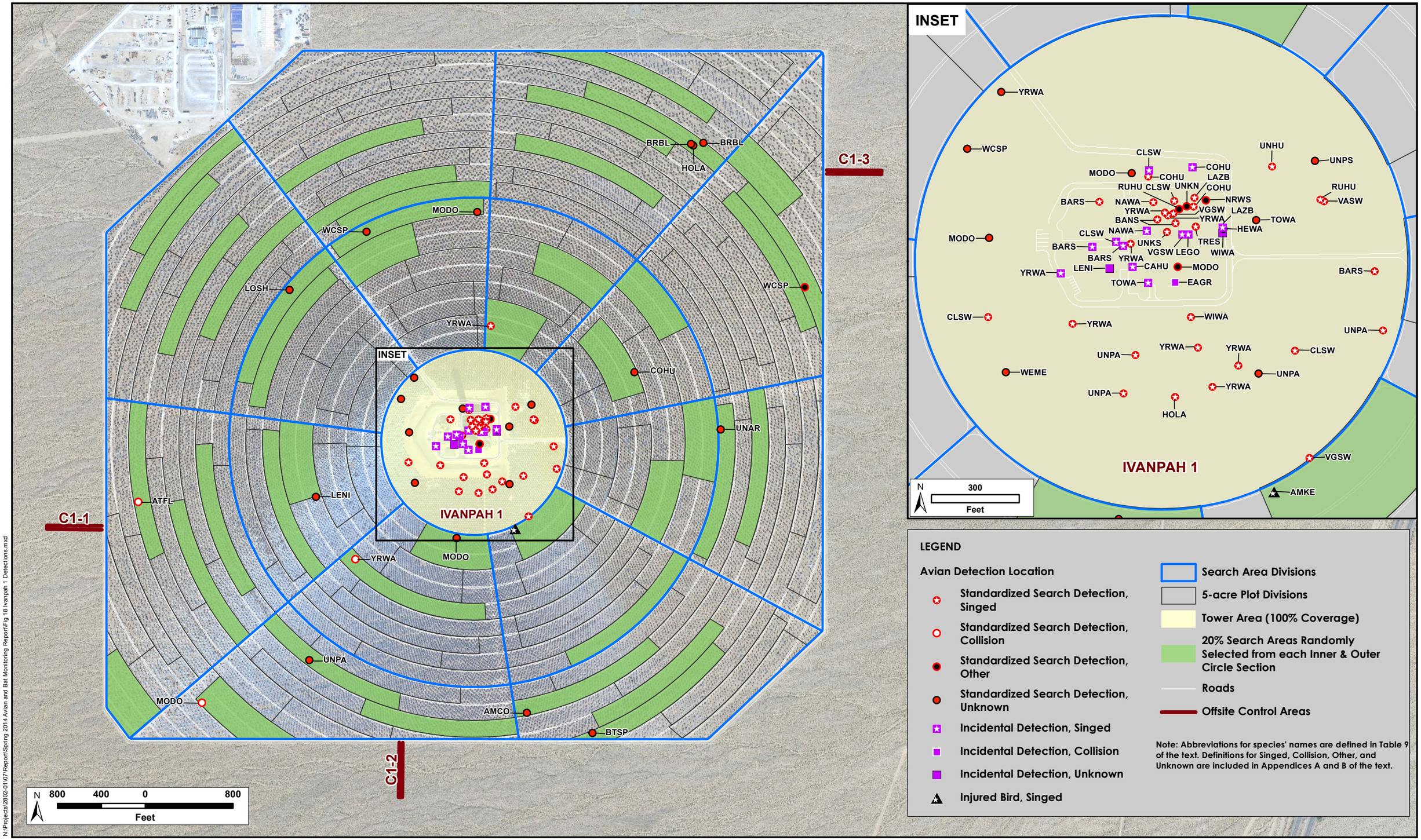
4.1.2.1 Avian Detections by Temporal Occurrence Group

Avian detections were categorized as representing one of four temporal occurrence groups, as follows:

- Permanent residents – species that are present in the Ivanpah Valley year-round
- Breeding-season residents – species that are present in the Ivanpah Valley only during the breeding season and during migration between breeding and wintering areas but which generally do not winter here (or are very rare in winter)
- Nonbreeding-season residents – species that are present in the Ivanpah Valley only during the nonbreeding season and during migration between breeding and wintering areas but which do not occur here during the breeding season
- Transients – species that are present in the Ivanpah Valley only during migration between breeding and wintering areas

Bird species were categorized according to these groups based on published and Internet information regarding their breeding and wintering ranges, and our knowledge of their breeding and wintering ranges.

Species that are permanent residents in the Ivanpah Valley accounted for 31.2% of the total detections on the site during the 2014 spring season (Figure 22), with nonbreeding-season residents accounting for 17.3% of total detections. The breeding-season resident species represented 11.4% of all detections. The remaining detections represented transient species (29.2%) and remains (often limited feather spots) that could not be identified to species (10.9%).



LEGEND

Avian Detection Location

- Standardized Search Detection, Singed
- Standardized Search Detection, Collision
- Standardized Search Detection, Other
- Standardized Search Detection, Unknown
- Incidental Detection, Singed
- Incidental Detection, Collision
- Incidental Detection, Unknown
- Injured Bird, Singed

- Search Area Divisions
- 5-acre Plot Divisions
- Tower Area (100% Coverage)
- 20% Search Areas Randomly Selected from each Inner & Outer Circle Section
- Roads
- Offsite Control Areas

Note: Abbreviations for species' names are defined in Table 9 of the text. Definitions for Singed, Collision, Other, and Unknown are included in Appendices A and B of the text.

N:\Projects\2802-01\07\Report\Spring 2014 Avian and Bat Monitoring Report\Fig 18 Ivanpah 1 Detections.mxd

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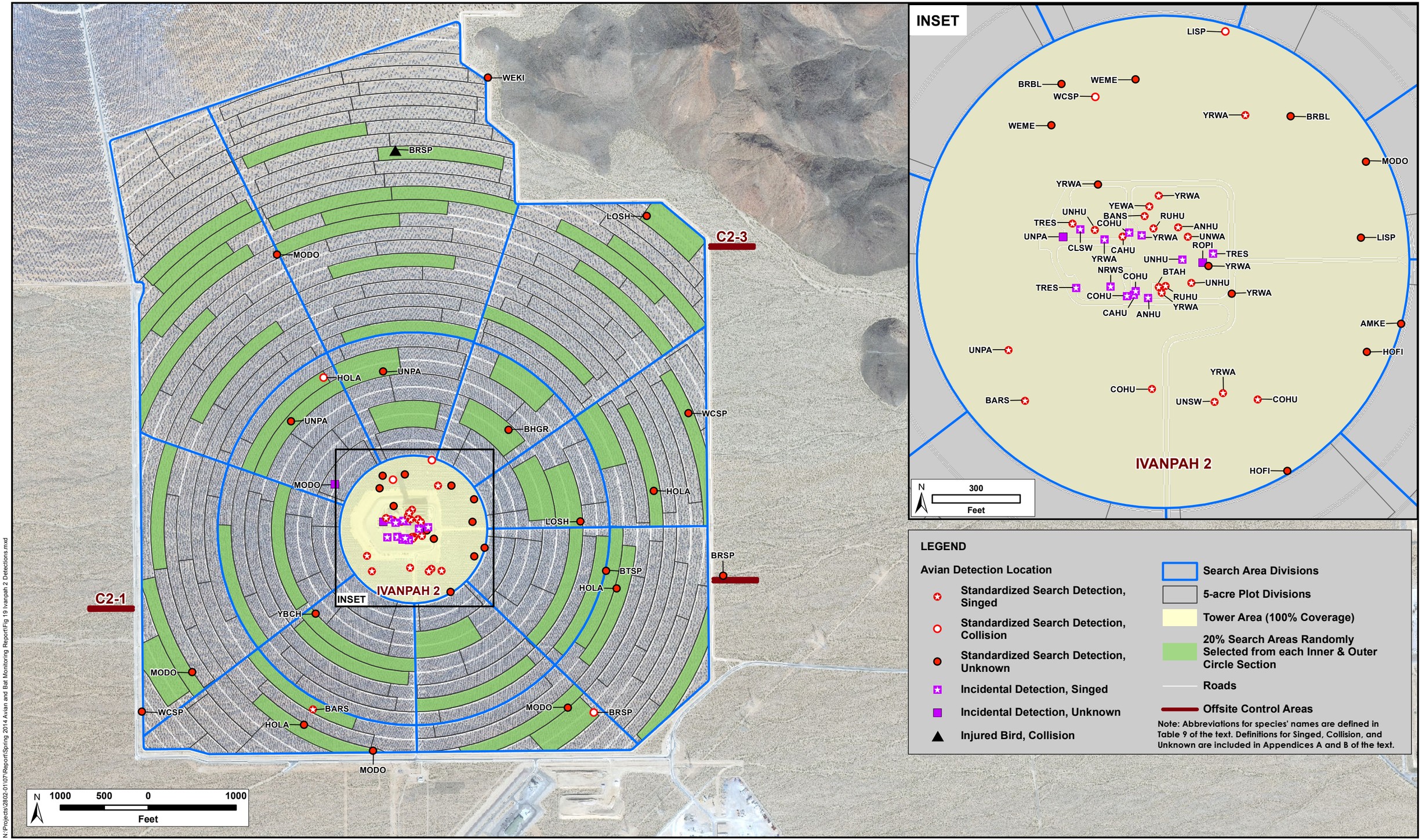
Figure 18: Ivanpah 1 Avian Detections
Ivanpah Spring 2014 Avian and Bat Monitoring Report (2802-07)
December 2014



N:\Projects\2802-01\07\Report\Spring 2014 Avian and Bat Monitoring Report\Fig 19 Ivanpah 2 Detections.mxd

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Figure 19: Ivanpah 2 Avian Detections
Ivanpah Spring 2014 Avian and Bat Monitoring Report (2802-07)
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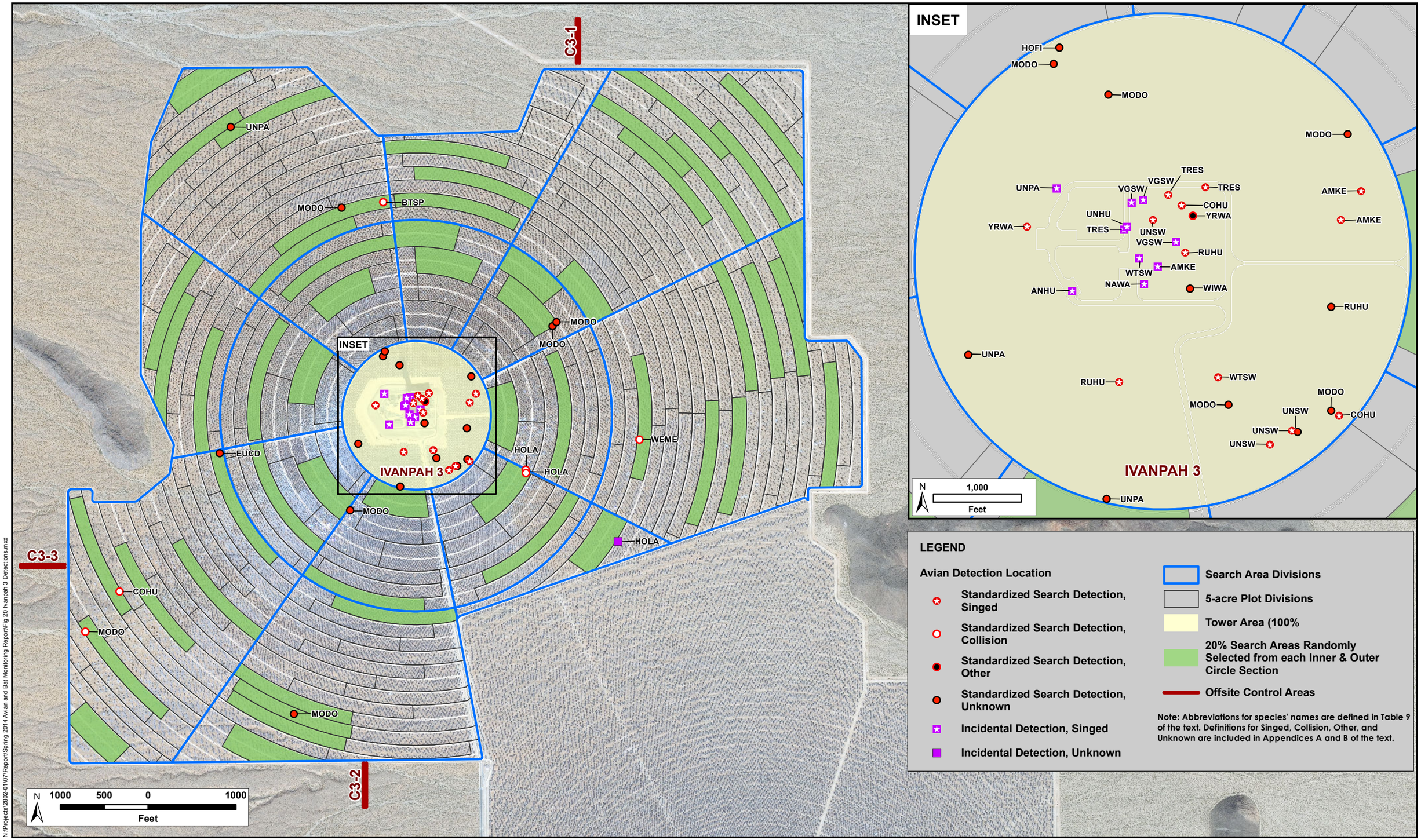

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Figure 20: Ivanpah 3 Avian Detections
Ivanpah Spring 2014 Avian and Bat Monitoring Report (2802-07)
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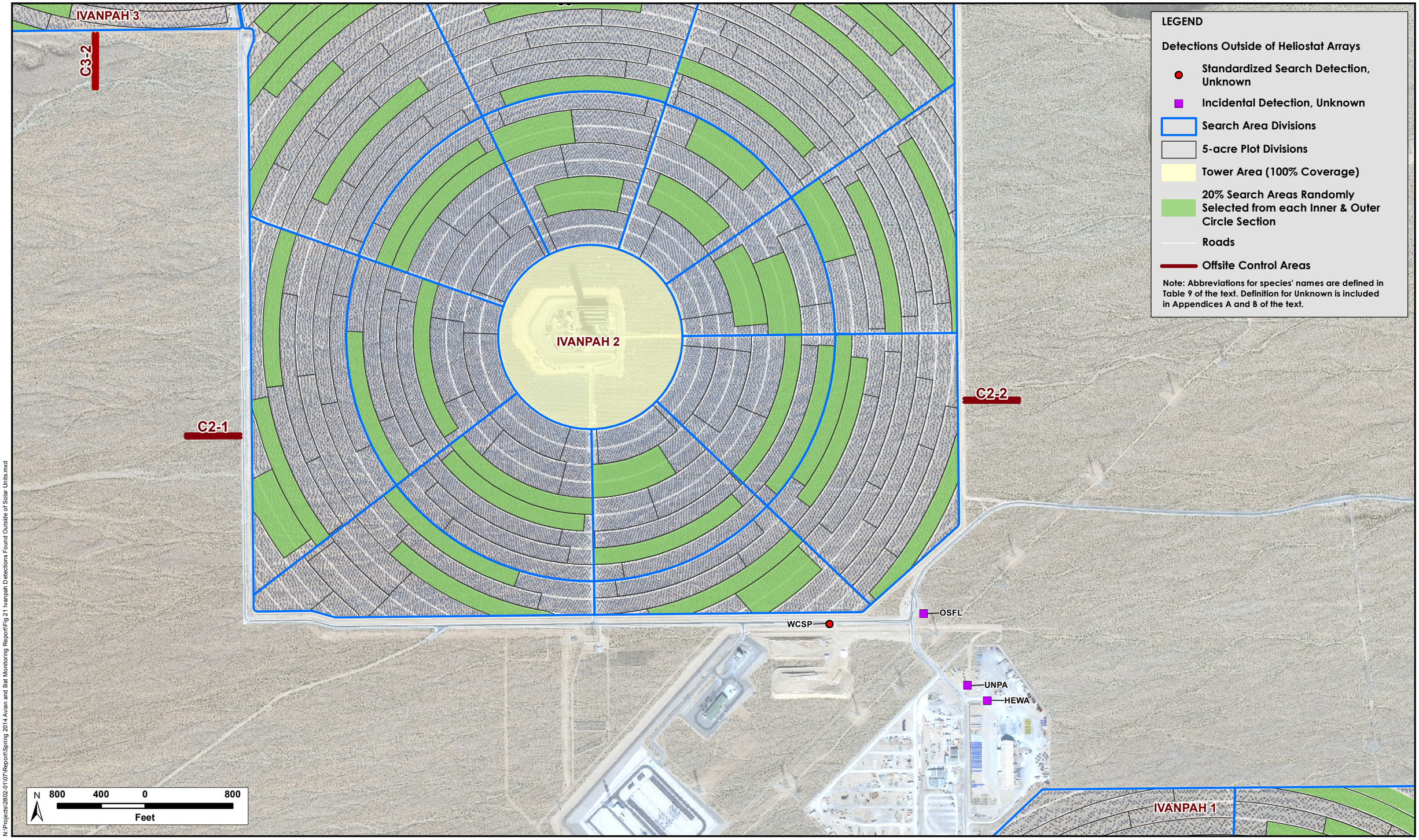

N:\Projects\2802-01\07\Report\Spring 2014 Avian and Bat Monitoring Report\Fig 21 Ivanpah Detections Found Outside of Solar Units.mxd

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Figure 21: Ivanpah Avian Detections Found Outside of Solar Units
Ivanpah Spring 2014 Avian and Bat Monitoring Report (2802-07)
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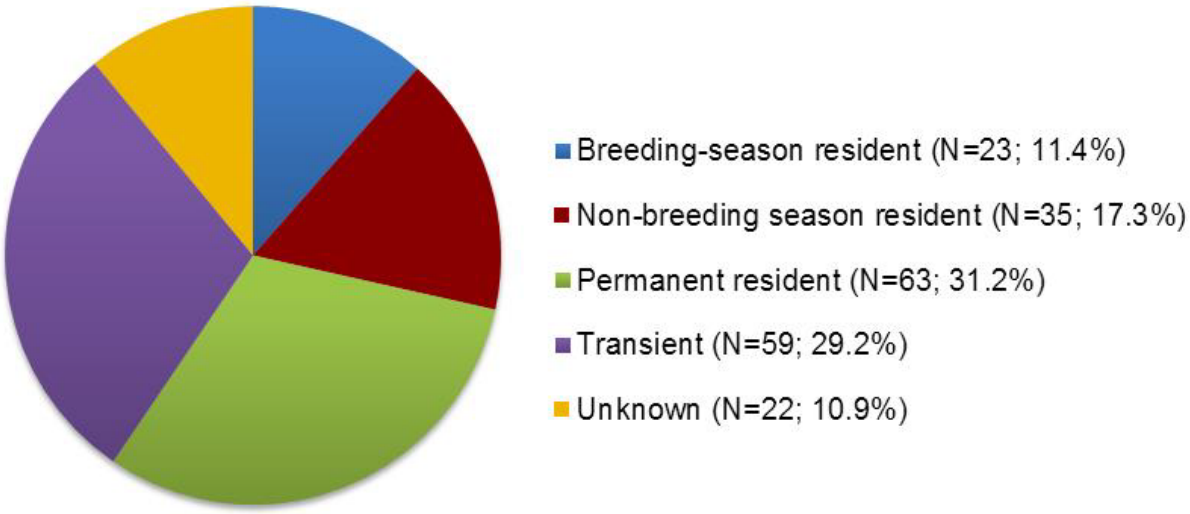
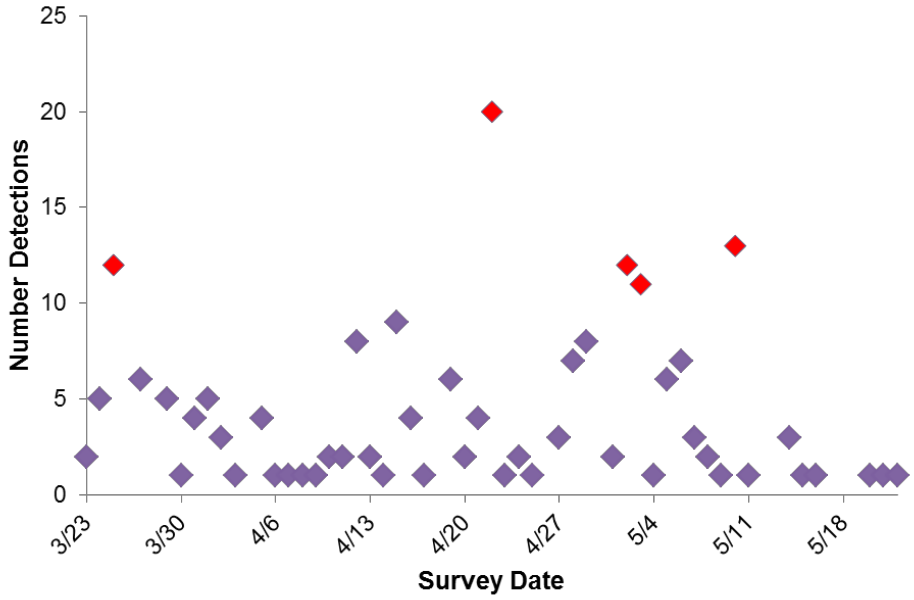
Figure 22. Percent of Detections in Each of Five Temporal Occurrence Groups.



There was no obvious temporal clumping of detections recorded during the spring season; however, five survey days resulted in more than 10 fatalities each (Figure 23). In each case, the majority of detections were in the tower area (power block and inner HD heliostats) of a single unit, and these detections were distributed among singed, collision, and unknown detections (rather than just one mortality cause). It is not yet clear why such increases in detections occurred, but they appear be related to increased migratory activity in the region. Some may have been associated with the passage of weak weather fronts, though no events meeting the criteria for "low-visibility weather events" per Section 2.2 of the Plan occurred during the 2014 spring monitoring period. The Cornell Lab of Ornithology, in cooperation with the National Oceanic and Atmospheric Association (NOAA), Oregon State University, and University of Massachusetts Amherst, releases a weekly analysis of migration activity across the United States on its "BirdCast" website.[2] Examination of these records showed that daily detection rates of more than 10 per day at Ivanpah coincided with increases in migration activity within the desert southwest. Two periods of heavy migration activity were documented by BirdCast: 18-25 April and 2-3 May. On 22 April, 20 detections were recorded, including 17 fatalities in the Unit 2 tower area. On 2 May, 12 detections were noted, including eight fatalities were collected incidentally on the Unit 1 power block; an additional 11 were found in the Unit 1 tower area during the standardized survey the following day. Moderate migration activity was documented by BirdCast around 21-25 March. On 25 March, 10 fatalities were found in the Unit 3 tower area. The 10 May survey of the Unit 1 tower area, which detected 13 fatalities, was preceded by moderate migration activity (as documented by BirdCast) from approximately 7-9 May. Fatalities detected during these surges were almost exclusively migratory species, with hummingbirds, swallows, and warblers representing the majority of species found.

[2] http://birdcast.info/forecasts

Figure 23. Number of Detections on Each Survey Date, 23 March – 22 May 2014.

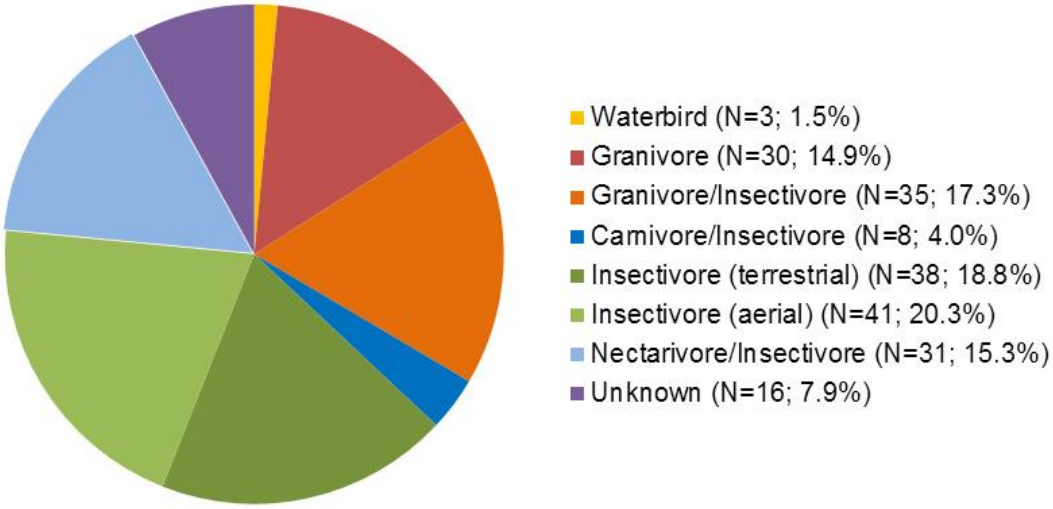


*Red points denote surveys where more than 10 fatalities were detected.

4.1.2.2 Avian Detections by Foraging Guild

We also categorized all detections within the search area by foraging guild, with all waterbirds included in one "waterbird" category. As indicated in Figure 24, aerial insectivores accounted for the largest percentage of detections (20.3%), followed by terrestrial insectivores (18.8%), granivores/insectivores (17.3%), and nectarivore/insectivores (i.e. hummingbirds, 15.3%). Waterbirds accounted for the smallest percentage of detections, with just three individuals detected during the 2014 spring season; of these, an eared grebe was found as a collision-related detection in the power block, while the cause of mortality of an American coot and an unknown heron/egret in the outer heliostat segments was unknown.

Figure 24. Percent of Total Detections in Each of Seven Foraging Guilds.



4.1.3 Injured Birds

Twelve injured birds were detected during this reporting period (Table 10). All but two of these injured birds (a Brewer's sparrow and an American kestrel) eventually succumbed to their injuries, and are included in this report as fatalities. Injured birds were transported to a wildlife rehabilitation center the same day they were detected. Two birds were not taken to a rehabilitator: a Costa's hummingbird died on site before it could be taken to a rehabilitator, and the aforementioned Brewer's sparrow escaped alive after colliding with a heliostat. With the exception of the American kestrel, all other injured birds died either en route to or at a wildlife rehabilitation center. As of 23 October 2014, the kestrel was still alive. It is not yet clear whether the kestrel will be releasable, as this will depend on whether it can recover from being singed and molt in normal feathers this autumn. All 10 birds with singe injuries were close to the towers; eight were found in a power block (within 100 m of a tower), and the other two were 274 m and 277 m, respectively, from the nearest tower.

Table 10. Avian Injuries Detected 23 March – 22 May 2014.

Date	Species	Cause of Injury	Burn Grade	Fate
3/24/2014	Tree Swallow	Singed	2	Died en route to rehab
4/5/2014	Yellow-rumped Warbler	Singed	2, 3	Died en route to rehab
4/5/2014	American Kestrel	Singed	2, 3	Alive, rehab center
4/12/2014	Violet-green Swallow	Singed	2, 3	Died 4/15 at rehab
4/24/2014	White-throated Swift	Singed	2, 3	Died 5/2 at rehab
4/25/2014	Brewer's Sparrow	Collision, heliostat	N/A	Escaped alive
4/28/2014	Costa's Hummingbird	Singed	2, 3	Died on site
4/28/2014	Rufous Hummingbird	Singed	2, 3	Died at rehab 4/29
4/28/2014	Tree Swallow	Singed	2, 3	Died en route to rehab
5/3/2014	Lazuli Bunting	Singed	2, 3	Died en route to rehab
5/3/2014	Barn Swallow	Singed	2, 3	Died en route to rehab
5/6/2014	Western Kingbird	Unknown	N/A	Died at rehab 5/14

4.1.4 Foraging Guilds and Spatial and Temporal Distribution of Bats

Four bat detections representing two species (California myotis [*Myotis californicus*] and Brazilian free-tailed bat [*Tadarida brasiliensis*]) were detected during this reporting period (Table 11). All bat detections were within or immediately adjacent to the ACC buildings. The California myotis is a high-frequency emitting bat that typically forages aerially in close proximity to cluttered habitats (i.e., near shrubs, trees, and other objects). The California myotis is a year-round resident. Although the Brazilian free-tailed bat may occasionally occur on the site during winter and summer months, higher numbers are expected when this species is migrating through the area during spring and fall months.

Table 11. Summary of Bat Detections, 23 March – 22 May 2014.

Species	Date	Location
California Myotis	3/25/14	Unit 3 ACC
Brazilian Free-tailed Bat	3/31/14	Unit 3 ACC
Brazilian Free-tailed Bat	5/3/14	Unit 1 Power Block building
California Myotis	5/4/14	Unit 3 Common Area Standby Generator Room

4.1.5 Incidental Detections

A total of 45 incidental avian detections and one incidental bat detection were recorded during this quarter. Forty-two of these avian detections and the bat detection were within the solar units (Figures 18, 19, and 20). The other three detections were in areas of the Project site outside of the solar units, including the former location of the vehicle washing station, and within the Common Logistic Area (CLA) (Figure 21).

4.1.6 Fatalities Found During Standardized Searches

During the course of 2014 spring season standardized searches, searchers found 157 bird detections and three bat detections (Figures 18, 19, and 20).

4.2 Locations of Avian Detections

As indicated in Table 12, 141 detections (69.8%) were within 260 m of the tower, an area that was searched with 100% coverage. Fifty-four detections (26.7%) were made over the much larger area composed of the inner and outer heliostats. Otherwise, three detections were along the fence line (1.5%), three were on Project lands outside the standardized search areas (1.5%), and one (0.5%) was found along an off-site control transect east of Unit 2 (Figure 19). No detections were noted within the survey areas associated with the Unit 3 Collector Line. Of the 198 avian detections within the solar units, 77 (38.9%) were detected in Unit 1, 71 (35.9%) in Unit 2, and 50 (25.3%) in Unit 3. The three units operated with roughly the same number of days in flux during the spring period.

Table 12. Locations of Bird Detections, 23 March – 22 May 2014.

Location	Injuries	Fatalities
Power Block	0	84[1]
Inner HD Heliostats	0	57
Inner Segment Heliostats	1	20
Outer Segment Heliostats	1	32
Unit Perimeter Fences	0	2
CLA Fence	0	1
Unit 3 Collector Line	0	0
Offsite Control Transects	0	1
Other Project Lands	0	3

[1] 23 were in ACC units

4.3 Cause of Injury or Fatality

The following section describes the number of detections with evidence of singeing or collision effects; the number from "other Project causes", which in spring 2014 included five detections in the ACC units without signs of singeing or collision effects; the number for which cause of injury or fatality is unknown; and the spatial distributions of detections with these causes relative to the towers. Methods for identifying the cause of injury or fatality were provided in Section 2.2.1.3. Table 13 indicates the total number of detections with evidence of singeing or collision effects, from other Project causes, or for which cause of injury or fatality is unknown. Detections with an "unknown" cause of injury or death refer to those for which there was no evidence of singeing (e.g., charring, curling, or melting of feathers) or collision (e.g., obvious physical trauma

or detection adjacent to a heliostat with a bird-strike imprint and/or feathers on the heliostat), as confirmed through microscopic examination.

Table 13. Number of Detections from Singeing, Collision, Other Project Causes, and Unknown Causes, 23 March – 22 May 2014.

Cause	Number of Detections
Singeing	100
Collision	15
Other	5*
Unknown	82**
Total	202

* Includes five detections in ACC units without evidence of singeing or collision effects.

** Includes one detection with obvious evidence of predation.

4.3.1 Solar Flux Effects

Of the 202 avian detections during the 2014 spring season, 99 fatalities and one injured bird (49.5%) showed signs of singed feather damage. Four, all American kestrels, were raptors, and were also considered large birds (> 100 g); of the remaining 96, all that were identifiable to species or species group, or whose feather sizes were indicative of the birds' size, were considered small birds (≤ 100 g). Table 14 indicates the number of detections in various parts of the Project site with and without evidence of singeing as determined through microscopic examination.

Table 14. Locations of Singed and Non-singed Bird Detections, 23 March – 22 May 2014.

Location	Singed	Non-Singed
Power Block	69	15
Inner HD Heliostats	28	29
Inner Segment Heliostats	2	19
Outer Segment Heliostats	1	32
Unit Perimeter Fences	0	2
CLA Fence	0	1
Unit 3 Collector Line	0	0
Offsite Control Transects	0	1
Other Project Lands	0	3
Total	100	102

Figure 25 depicts the total number of detections involving evidence of singeing, evidence of confirmed collision, from other Project causes, and with unknown cause of injury or death by distance from the power towers. The three incidental detections outside the solar units (none of which were singed) are not shown so

that Figure 25 focuses on the solar units themselves. Figure 26 provides an overview of the spatial location of each singed and non-singed detection within the solar units.

As indicated by these data, the vast majority of detections showing evidence of singeing were discovered close to the towers. Ninety-seven (97%) of the 100 singed detections were within the tower area. The other three singed detections included two birds (an American kestrel found injured, and still alive at a rehabilitation facility as of 23 October 2014, and a yellow-rumped warbler that was found injured but that died en route to a rehabilitation facility) in the inner heliostat segments not far outside the inner HD heliostats and one partial carcass of a barn swallow detected in the outer segment (possibly relocated to this area by a scavenger; Figure 26). These results suggest that singeing and mortality resulting in singed detections primarily occurs in the immediate vicinity of the high-density flux fields around the towers.

4.3.2 Collisions

Of the 202 detections, evidence of collisions was observed in the case of 15 (7.4%). As described in Section 2.2.1.3, the evidence that was used to classify these detections as collisions was proximity to heliostats that had smudge marks, body imprints, and/or feathers on or near the surface of the mirror. However, birds that collide with structures do not always leave visible evidence. Of the collisions, 14 were with heliostats, and one was apparently with a structure on the power block.

4.3.3 Other Project Causes

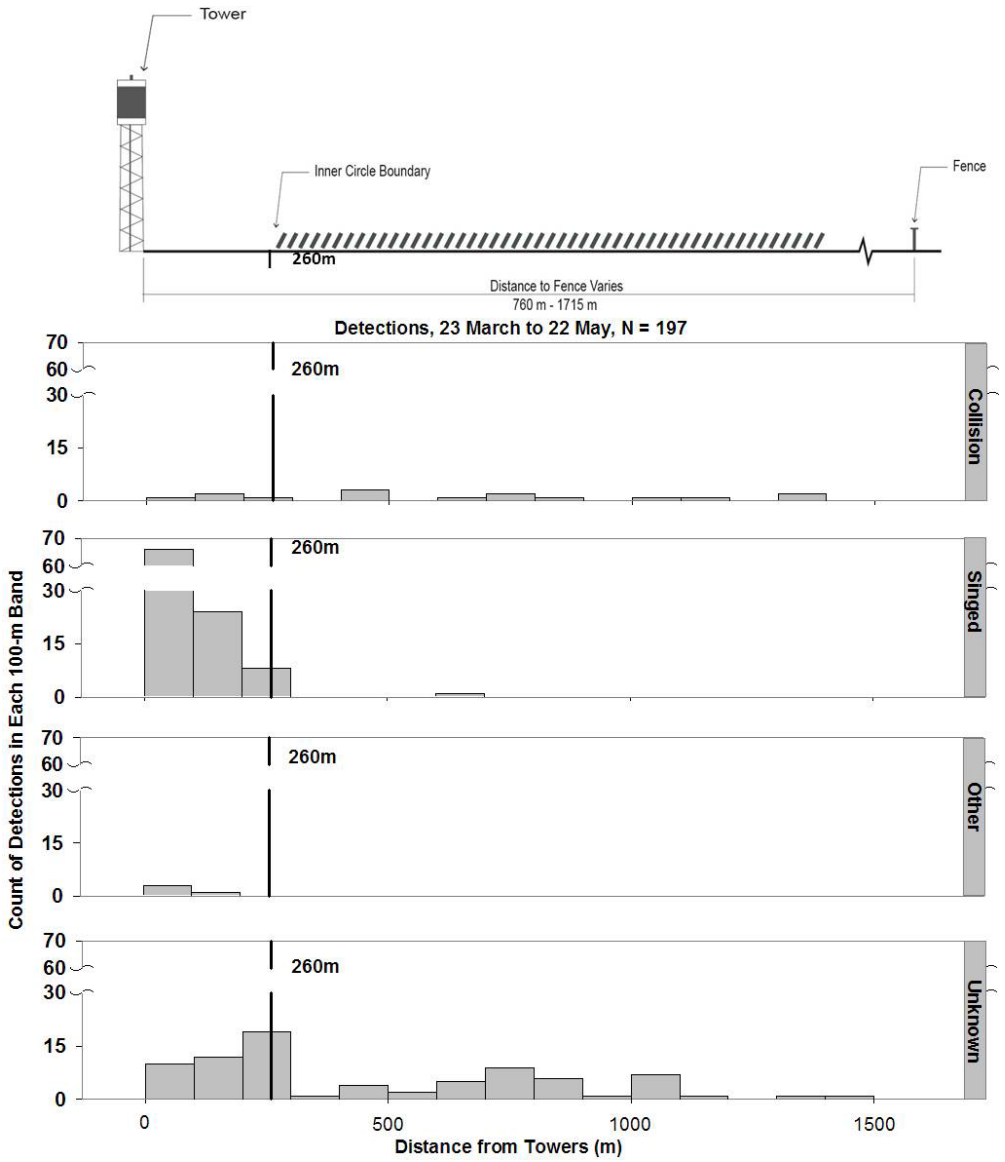
Five avian detections (2.5% of all detections) without evidence of singeing or collision effects were found in the external alleys of the ACC buildings. Although the cause of death for these five birds was unknown, these were considered as providing direct evidence of the cause of death because they were found entrapped or within an enclosed space, the ACC buildings. Section 3.1 of the Plan indicates that fatality estimates should include estimates for "other Project impacts" to accommodate such effects, and therefore these five detections are categorized being of "other Project causes".

None of the bat detections showed evidence of singeing; this result is expected because bats have a low exposure rate to flux due to their crepuscular and nocturnal foraging habits. All of the bat detections were in or near Project buildings on the power block, especially the ACC building. Although the cause of death for these bats remains unknown, their association with the ACC building (with many of them found within the building) provides direct evidence of the cause of death.

4.3.4 Detections of Unknown Cause

One detection, that of a white-crowned sparrow with partially eaten remains stuck to a heliostat, was predated, likely by a raptor. Aside from this detection, the 15 detections where evidence of collision was noted, the 100 detections with evidence of singeing, and the five detections of other Project causes, the cause of injury or mortality for the remaining 81 detections (40.1%) is not known with certainty, and no obvious evidence of the cause of mortality was observed for these detections. These 81 detections showed no

Figure 25. Number of Avian Detections[1] Associated with Singeing, Collisions, Other Project Causes, and Unknown Injury/Fatality Sources by Distance from Towers.



[1] Only raw data are presented, so this graph does not take into account the increase in survey area as distance away from the tower increases. This figure excludes five avian detections (all of unknown causes) found outside the unit fence line. The detections in the "Other" category were detections found in the ACC buildings without evidence of singeing or collision effects. One detection with strong evidence of predation was included in the "unknown" category in this graph.

IVANPAH 3

IVANPAH 2

IVANPAH 1

LEGEND

Detections (23 March - 22 May)

- Singed
- Unsinged
- Roads
- Project Site
- Search Area Divisions
- Tower Area (100% Coverage)

N 2000 1000 0 2000

Feet

N:\Projects\2802-01\07\Report\Spring 2014 Avian and Bat Monitoring Report\Fig 26 Locations of SInged and Unsinged Detections.mxd

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Figure 26: Locations of Singed and Unsinged Detections
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evidence of collision effects, and microscopic analysis does not support that these mortalities were the result of singeing. Of these unknown detections, 42 were feather spots, and 1/3 of these (14) were mourning doves.

Section 2.1 of the Plan requires that "If a large portion (i.e., more than 40 percent) of the detections cannot be determined, or presumed without a reasonable doubt to be caused by the facility, potential other causes, such as unrelated avian disease or a lightning event, will be considered and the analysis adjusted as appropriate in the seasonal report." Therefore, we considered potential factors contributing to the fatality of these unknowns. During this spring period, five avian detections without evidence of singeing or collision were found in the ACC buildings. Although the cause of death for these five birds was unknown, these were considered as providing direct evidence of the cause of death because they were found entrapped or within an enclosed space. We found no evidence that the remaining detections of unknown cause were temporally or spatially clumped (which might have suggested that discrete events such as lightning strikes, hard freezes, or disease events had killed multiple birds). We thus concluded that there were no obvious, discrete explanations for these unknown fatalities.

No detections occurred along the Unit 3 Collector Line, and no evidence of collision or singeing was found on the single fatality detected in the offsite control areas.

4.4 Feather Spot Detections

The following section describes the number of detections that consisted only of feather spots and spatial patterns in the ratio of feather spots to carcass-based detections. Feather spots were considered detections when they consisted of at least two or more primary flight feathers, five or more tail feathers, or 10 or more feathers of any type concentrated together in an area 1 m^2 or smaller (Smallwood 2007); feathers with significant skin or flesh, or any bone, attached were considered detections but were not considered feather spots).

Sixty-six (32.7%) of the 202 detections consisted only of feather spots; 49 of these feather spots were identifiable to species, while 17 were identifiable to order or family. While evidence of singeing through direct and microscopic examination was noted on 20 of these 66 feather spots, and evidence of collision (i.e., feathers and impact smudges on mirrors) was noted in the case of two other feather spots, the cause of the feather spot for the other 44 birds is unknown. The proportions of these 44 feather spots representing fatalities (e.g., collision) that had been scavenged and representing natural predation events associated with desert kit foxes, common ravens, or raptors are not known. For example, mourning doves are a known prey species in the area, and mourning dove feather spots were 15 of the feather spots in the unknown category. Furthermore, in some cases, multiple feather spots may result from one fatality, over-representing the number of fatalities. Nevertheless, all feather spots meeting minimum criteria (i.e., ≥ 10 feathers of any type, ≥ two primary feathers, or five or more tail feathers within an area 1 m^2 or smaller [Smallwood 2007]) were recorded as feather spot detections.

Table 15 indicates the distribution of feather spots vs. other detections (lumped as "carcasses" for the purpose of this table) relative to the Project site components. The ratio of feather spots to carcasses varied considerably across the Project site. Among the power block, inner HD heliostats, and inner/outer heliostats, it was highest in the inner HD heliostats (1:0.6), and lowest in the power block (1:8.3), with the inner and outer segments (1:1.7) intermediate. The number of detections along the fence line, outside survey areas, and in the control plot (totaling seven detections) was too low to provide meaningful ratios of feather spots to carcasses. The change in ratio between the power block and inner HD heliostats could result from the rapidity with which carcasses around the tower are detected by people, so that there is less time for scavenging that would result in feather spots. Feather spots around the relatively open power block may also be removed by the wind more easily than in the rest of the solar field and deposited in the inner HD heliostats.

Table 15. Ratios of Feather Spots to Carcasses Relative to Site Locations.

Location	Total	Feather Spots	Carcasses	Feather Spot: Carcass Ratio
Power Block	84	9	75	1:8.3
Inner HD Heliostats	57	35	22	1:0.6
Inner/Outer Heliostat Segments	54	20	34	1:1.7
Fence line	3	0	3	0:3
Not in Survey Areas	3	2	1	1:0.5
Control	1	0	1	0:1
Total	202	66	136	1:2.1

Section 5.0 Fatality Estimation

This section utilizes the detection data as described in Section 4 to develop an overall fatality estimate in accordance with the Plan. The estimates of carcass removal rates and searcher efficiencies are derived and subsequently utilized in the model with the detection data to provide estimates for the facility areas as required in the Plan. The areas for which estimates are provided include the tower area, heliostats, and fence line. The total estimate for the entire facility is then presented.

5.1 Estimating Model Parameters

5.1.1 Carcass Removal Trials

We conducted 19 carcass removal trials during the 2014 spring season. These trials included four large carcasses and 15 small carcasses. Carcasses were placed in the inner HD heliostats and inner and outer heliostat segments, and along the overhead transmission line and fence line, and a camera was placed at each carcass to record the scavenger species. Three carcasses were placed around the power block after approval was granted late in spring to conduct carcass removal trials around the power block. Scavenger species included common ravens (N=9), desert kit fox (N=1), white-tailed antelope squirrels (*Ammospermophilus leucurus*; N=2), and a turkey vulture (N=1). For the remaining carcasses, the scavenger species was not captured on camera. For two of these carcasses, high winds may have moved the carcass out of the field of view. Twelve feather spots or partial carcasses were created by scavengers consuming carcasses that we placed for carcass removal trials. Seven of these feather spots/partial carcasses were present through a full six-week trial period; these remains, which resulted from five small carcass and two large carcasses, were collected at the end of the period. In one case, a large carcass was scavenged, leaving a partial carcass; however, the carcass had to be removed after 27 days when scavengers moved it to a road. Although all large carcasses were detected and at least partially eaten by scavengers, the scavengers left enough of the carcass in two of four large-carcass trials that the remains would have been detectable and considered a fatality if detected during the standardized searches. In contrast, small carcasses tended to be more completely removed, with only five of 15 small carcasses leaving remains that persisted for the entire six-week trial.

Carcass persistence rates for the spring season ranged from less than one day, in the case of two carcasses, to 45.8 days, including period beyond the full six-week trial period in the case of the seven carcasses whose remains persisted throughout the trial. Figure 27 shows the persistence durations for individual small carcasses, and Figure 28 shows the persistence of large carcasses. Because seven of the carcasses persisted beyond the full six-week trial before being removed by the carcass removal trial team, it is unknown how long they might have persisted if not removed. Mean carcass persistence was 18.9 days for small carcasses and 41.6 days for large carcasses. The average for large carcasses excludes persistence of one large carcass that had to be prematurely removed from the trial. In comparison, the assumptions used in the power analysis in the Plan were 7.4 days for small birds and 21.8 days for large birds. The longer persistence of carcasses (averaging

approximately twice that assumed for the Plan's power analysis) increases the statistical power of our sampling approach relative to the power analysis in the Plan.

Figure 27. Persistence Durations for 15 Small Carcasses Placed for Carcass Removal Trials.

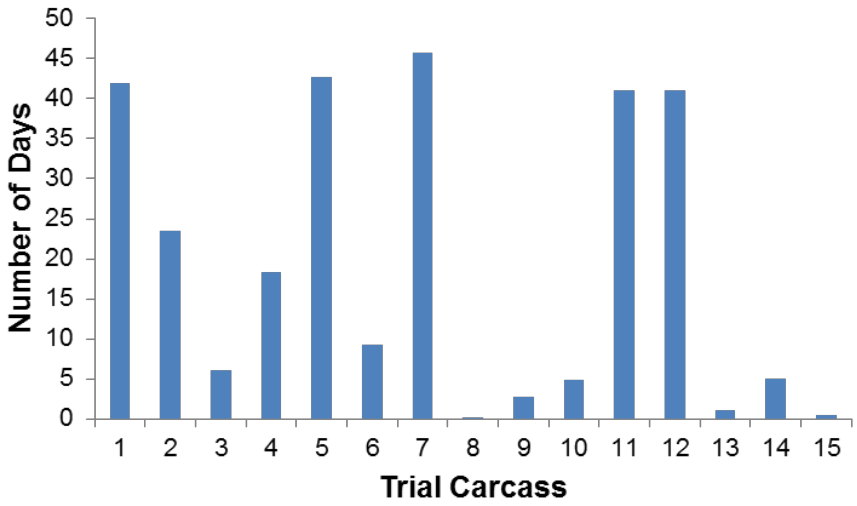
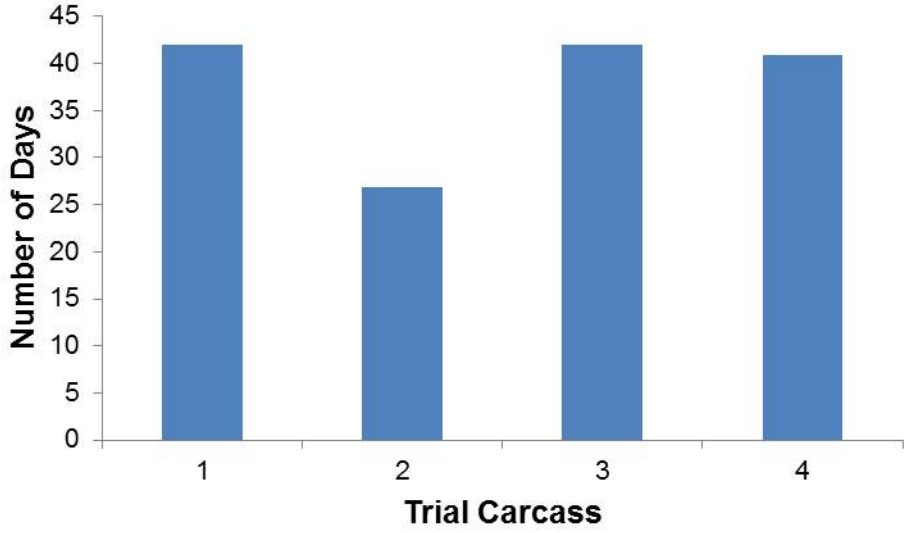


Figure 28. Persistence Durations for Four Large Carcasses Placed for Carcass Removal Trials.



The power block differs from the inner HD heliostats and the heliostat fields both in physical structure and human activity. It is therefore likely that scavenging rates and discovery rates of carcasses and feather spots in the power block are different from those within the heliostat area. Because trials on the power block began late in the spring period, data are available for only three carcasses: two small and one large (these three were included in the 19 mentioned above). All three carcasses were detected and partially scavenged by common

ravens, two within a single day. All three left detectable feather spots, and as a result, carcass persistence on the power block averaged 41.2 days. Carcass removal results on the power block are preliminary, and should be interpreted with caution.

5.1.2 Model Selection for Carcass Removal Decay Curve

Based on the carcass removal data, four selected survival models were compared for relative quality using the Akaike information criterion (AIC) score (Table 16) as suggested in Huso (2010). As a part of the fatality estimator process, Huso (2010) recommends measuring the relative quality of the estimator model for each set of data to determine which model to use. Thus, AIC provides a means for model selection. In other words, although the absolute value of AICc may vary, the difference in AICc values among models provides information about which model is most statistically supported.

Table 16. AICc Values for Each of Four Distribution Models of Carcass Persistence.

Model	AICc	Shape	r
Weibull	98.78	2.05	0.78
Exponential	105.15	1	0.92
Loglog	98.74	1.7	0.77
Lognormal	99.02	3.06	0.76

Although the model with the lowest AICc value is typically held to be the most supported, any model with a change in AICc values of less than two from the "best model" is considered to have strong evidence supporting it (Burnham and Anderson 2004). The loglogistic, lognormal, and Weibull models for carcass persistence had ΔAICc values <2, and we chose to use the Weibull model (a continuous distribution model) because it was equivalent to or better than the other model options and was the same model selected for the 2013-2014 winter-quarter fatality estimates. Due to the small sample size of large carcasses, we were unable to separate carcass persistence by size for this quarter.

5.1.3 Searcher Efficiency Trials

During the 2014 spring season, nine small carcasses, eight large carcasses, and 14 feather spots/partial carcasses were placed in locations with various vegetation heights and with a range of contrast between the soil and vegetation to represent the various conditions under which searches occur. Two of the small carcasses and one large carcass disappeared (e.g., they may have been scavenged) before the searcher efficiency trial, leaving a sample size of seven small carcasses, seven large carcasses, and 14 feather spots/partial carcasses included in the trials. In total, 57.1% of all small carcasses, 71.4% of all large carcasses, and 35.7% of all feather spots/partial carcasses that were planted were successfully discovered by searchers, for a mean searcher efficiency of 50.0%. Due to the low sample size (because this is the second seasonal report), we were not yet able to formally compare searcher efficiency rates among different levels of visual obstruction. Such analyses may be investigated in future seasons. Based on the success of detection dog trials

in spring 2014, the TAC approved the use of detection dogs for searches beginning in summer 2014, which will increase searcher efficiency even further.

The Plan states that searcher efficiency trials will be conducted during each season in which vegetation differs from the prior season, because changes in vegetative cover may affect carcass detectability. We did not make *a priori* decisions regarding whether vegetative cover would differ between winter and spring, but rather, we conducted searcher efficiency trials in spring as we did in winter. Following the completion of spring searcher efficiency trials, we assessed whether the spring searcher efficiency rates differed significantly from those in winter, in which case it might be inappropriate to pool winter and spring searcher efficiency data, or not, in which case pooling of winter and spring data would be useful to obtain a more robust sample.

To evaluate the hypothesis that there is no seasonal difference in carcass detectability, we constructed logistic regression models and used Akaike's Information Criteria, corrected for low sample size (AICc). We compared the null model to a model containing season as an explanatory variable, and found that AICc values for these two models only differed by 0.1517. A difference in AICc values of at least 2 would be required to conclude that season is an important predictor of searcher efficiency; thus, we concluded that season provides no additional predictive power (Burnham and Anderson 2002). In addition to the AICc comparison, we conducted a likelihood ratio test to determine the statistical significance of season as a predictor and found it to be non-significant at the 90% confidence level ($p = 0.125$). As a result of these analyses, we decided to pool searcher efficiency trials for winter and spring. Pooling winter and spring increases sample size for small and large carcass trials, and allows for more accurate estimation of searcher efficiency for these two categories. Cumulative searcher efficiency values used in fatality estimates, which included searcher efficiency results from both the winter and spring seasons, were 42.9% for small birds, 52.4% for large birds, and 35.7% for feather spots/partial carcasses.

Model Selection for Searcher Efficiency Trials. We included trials from both the 2013-2014 winter survey period and the 2014 spring survey period to increase sample size for searcher efficiency values. The null model, with no explanatory variables, had slightly more support than the model with size of carcass plant included as a variable. However, we chose to include size in the final model because we have found it has the potential to account for most of the variation in searcher efficiency.

The final (cumulative) model estimates for searcher efficiency, including 90% confidence intervals obtained from bootstrapping are: 0.36 (0.14-0.57) for feather spots; 0.52 (0.33-0.71) for large carcasses; and 0.43 (0.24-0.62) for small carcasses.

5.2 Fatality Estimates for Known Causes

As per the Plan, facility-wide estimates of potential avian impacts are to be estimated based on the following:

1. Observed number of detections found during standardized searches in the monitoring season for which the cause of death can be determined and is facility-related
2. Non-removal rates, expressed as the estimated average probability that a potential detection is expected to remain in the study area and be available for detection by the observers, based on removal trials
3. Searcher efficiency, expressed as the proportion of placed trial carcasses found by observers during the searcher efficiency trials

After determining the proper model structure for both searcher efficiency and carcass persistence trials, we ran a series of fatality estimates. We only report fatality estimates as per the requirements of the Plan and only for areas and categories with more than five detections because using the fatality estimator with five or fewer detections will produce highly biased values due to the small sample size.

Fatality estimates were calculated separately for specific areas; tower area (power block and inner HD heliostats), heliostat area, and fence line. Estimates are initially provided for fatalities where the cause of death is based upon direct evidence of singeing, collision, or other (entrapped or found within an enclosed space). Following the estimates where the cause of death is based upon these categories of direct evidence, an estimate is provided of total unknown fatalities where the cause cannot be determined.

5.2.1 Total Fatality Estimates for Known Causes

Of the 120 detections where the cause of death or injury could be determined, 88 were included in the fatality estimate models, and 23 detections from the ACC units were added unadjusted to the estimator output to produce the total fatality estimate for the power block (Table 17). All nine of the detections that were outside the ACC units and that were not included in the fatality estimates were excluded because they were older than the search interval. None of the detections along the fences, on the control transects, or in other Project areas (such as the CLA) were of known causes.

Table 17. Number of Detections Based on Known Causes in Each Project Element, and Number Included in Fatality Estimates.

Element	Number Included	Number Excluded	Total Found
Power Block	49	26[1]	75
Inner HD	26	4[2]	30
Inner and Outer Heliostats	13	2[2]	15
Fences	0	0	0
Other Project Areas	0	0	0
Control Transects	0	0	0

[1] Three detections based upon known causes were excluded because they were estimated to be older than the search interval, and 23 were excluded because they were in the ACC buildings.

[2] These detections were excluded because they were estimated to be older than the search interval.

Table 18 provides the total fatality estimates for known causes for the 2014 spring season. These total estimates were calculated by adding the mean estimates and 90% confidence intervals for each Project component, which are discussed in the subsequent sections. Although fatality estimates are not provided in Tables 18 to 20 below when the number of detections for any group (e.g., singeing, collision, singeing + collision, other Project causes, large bird, raptor, or small bird) was less than five, all singeing and collision-related detections, as well as detections from other Project causes, were included in the overall fatality estimates for known causes in Table 18.

Overall, there were an estimated 433 fatalities attributable to known causes (90% confidence interval estimates 278-774). Of these, 259 fatalities (90% confidence interval estimates 183-439) were in the tower area (for all three units combined) and 174 fatalities (90% confidence interval estimates 95-335) were in the inner and outer heliostat segments (for all three units combined), during the period 23 March – 22 May 2014. There were no fatality estimates produced for the fence line because none of the detections provided direct evidence of the cause. Note that estimates from the power block (a sub-area of the tower area) should be interpreted with caution because carcass persistence rates may differ in the power block compared to other Project elements where we have conducted more trials, and due to unaccounted-for search effort from other Project personnel. Incorporating the unaccounted-for search effort by Project personnel responsible for incidental detections may necessitate future revision of these estimates (e.g., in the annual report).

Table 18. Site-Wide Estimates of Total Detections with Known Causes Based on Fatality Searches in all Areas, 23 March – 22 May 2014.

Project Element	Number of Detections Included in Model	Estimate of Site-Wide Detections (with Lower and Upper C.I.)
Tower Area	75[1]	259 (183-439)[2]
Heliostat Area	13	174 (95-335)
Fences	0	NA[3]
Spring Total	**88**[1]	**433 (278-774)**[2]

[1] The 23 detections in the ACC buildings are not included in the number of detections included in the model for the tower area (or the overall model) because they were added to the fatality estimator output unadjusted.

[2] Note that the tower area estimate includes estimates for the power block, which should be interpreted with caution as they may be inaccurate due to the large amount of unaccounted for search effort. The fatality estimates, both overall and for the tower area, include the 23 detections in the ACC units, which were added unadjusted to the fatality estimator results.

[3] NA = not applicable because there were no fence line detections that could be attributed to known causes.

5.2.2 Fatality Estimate for Tower Area

Tables 19 and 20 provide fatality estimates for known causes within the power block and inner HD heliostats for the 2014 spring monitoring period 23 March – 22 May 2014. For the power blocks, including ACC units, 46.7% of the detections with known causes were incidental observations found between standardized surveys. We included incidental detections when they were found in areas covered during standardized surveys, during time periods in which they were being searched. Incidental detections from outside survey areas are not included in these estimates. Because of the high amount of unaccounted-for searching (i.e., resulting in incidental detections) in the power block, we are providing fatality estimates separately for the inner HD heliostats vs. power block in Tables 19 and 20 below. However, results from these two areas are pooled for tower area fatality estimates. Estimates from the power block should be interpreted with caution. Because detections were observed more frequently in the power block (a sub-area of the tower area) than otherwise expected if detections were made only through the fatality monitoring (and not with the addition of incidental detections made by other personnel), the total fatality estimates for the power blocks currently may be inaccurate.

Table 19. Estimates by Cause (a.) and Size Class (b.) of Total Detections with Known Causes Based on Fatality Searches in Power Blocks, 23 March – 22 May 2014.

19a. Estimates by Cause

Type of Estimate	Number of Detections Included in Model	Estimate of Site-Wide Detections (with Lower and Upper C.I.)
Singeing	48[1]	163 (118-263)[2]
Collision	1	NA[3]
Other[4]	0	5 (5-5)[5]
Total	**49**[6]	**170** (125-271)[7]

[1] The 18 singed detections in the ACC buildings are not included in the number of detections included in the model.
[2] The 18 singed detections in the ACC buildings were added unadjusted to the singed fatality estimates.
[3] NA = not applicable because there were fewer than five detections within that group.
[4] Five detections found in the ACC buildings without evidence of singeing or collision effects are considered detections from "other Project causes".
[5] The five detections from "other Project causes" in the ACC buildings are included unadjusted in the fatality estimates for "unknowns".
[6] The 23 detections in the ACC buildings are not included in the number of detections included in the model.
[7] Totals do not reflect the sum of individual estimates because of "NA" values less than five. The total fatality estimate includes the 23 detections in the ACC units, which were added unadjusted to the fatality estimator results.

19b. Estimates by Size Class

Type of Estimate	Number of Detections Included in Model	Estimate of Site-Wide Detections (with Lower and Upper C.I.)
Large Bird	1[1]	NA[2]
Raptor[3]	1	NA[2]
Small Bird	47[4]	164 (118-264)[5]
Unknown Size[6]	0	NA
Total	**49**[7]	**170** (125-271)[8]

[1] The large bird detection in the ACC buildings is not included in the number of detections included in the model.
[2] NA = not applicable because there were fewer than five detections within that group.
[3] All raptors are also considered large birds, but they were considered separately to avoid having redundant data in this table; therefore, the "large bird" and "raptor" detections should be summed to determine the total number of "large bird" detections.
[4] The 21 detections of small birds in the ACC buildings are not included in the number of detections included in the model.
[5] The 21 detections of small birds in the ACC buildings were added unadjusted to the small bird fatality estimates.
[6] Although no birds of unknown size were included as detections in the model, this row is included because one of the detections in the ACC units, which was added to the total fatality estimate unadjusted, was of unknown size.
[7] The 23 detections in the ACC buildings are not included in the number of detections included in the model.
[8] Totals do not reflect the sum of individual estimates because of "NA" values less than five. The fatality estimate includes the 23 detections in the ACC units, which were added unadjusted to the fatality estimator results.

Table 20. Estimates by Cause (a.) and Size Class (b.) of Total Detections with Known Causes Based on Fatality Searches in Inner HD Heliostats, 23 March – 22 May 2014.

20a. Estimates by Cause

Type of Estimate	Number of Detections Included in Model	Estimate of Site-Wide Detections (with Lower and Upper C.I.)
Singeing	24	82 (51-159)
Collision	2	NA[1]
Total Singeing + Collision	**26**	**89** (58-168)[2]

[1] NA = not applicable because there were fewer than five detections within that group.
[2] Totals do not reflect the sum of individual estimates because of "NA" values less than five.

20b. Estimates by Size Class

Type of Estimate	Number of Detections Included in Model	Estimate of Site-Wide Detections (with Lower and Upper C.I.)
Large Bird	0	NA[1]
Raptor[2]	2	NA
Small Bird	24	82 (50-155)
All Detections	**26**	**89** (58-168)[3]

[1] NA = not applicable because there were fewer than five detections within that group.
[2] All raptors are also considered large birds, but they were considered separately to avoid having redundant data in this table; therefore, the "large bird" and "raptor" detections should be summed to determine the total number of "large bird" detections.
[3] Totals do not reflect the sum of individual estimates because of "NA" values less than five.

5.2.3 Fatality Estimate for Heliostat Area

Table 21 provides fatality estimates for known causes within the inner and outer segments of the heliostat area for the 2014 spring season, 23 March – 22 May 2014. These estimates are based on 144 plots are extrapolated to the 598 plots that comprise the total area of the Heliostat Area.

Table 21. Estimates by Cause (a.) and Size Class (b.) of Detections with Known Causes Within the Heliostat Area, 23 March – 22 May 2014.

21a. Estimates by Cause

Type of Estimate	Number of Detections Included in Model	Estimate of Site-Wide Detections (with Lower and Upper C.I.)
Singeing	3	NA[1]
Collision	10	132 (65-264)
Total Singeing + Collision	**13**	**174** (95-335)[2]

[1] NA = not applicable because there were fewer than five detections within that group.
[2] Totals do not reflect the sum of individual estimates because of "NA" values less than five.

21b. Estimates by Size Class

Type of Estimate	Number of Detections Included in Model	Estimate of Site-Wide Detections (with Lower and Upper C.I.)
Large Bird	1	NA[1]
Raptor[2]	1	NA
Small Bird	11	144 (71-270)
All Detections	**13**	**174** (95-335)[3]

[1] NA = not applicable because there were fewer than five detections within that group.
[2] All raptors are also considered large birds, but they were considered separately to avoid having redundant data in this table; therefore, the "large bird" and "raptor" detections should be summed to determine the total number of "large bird" detections.
[3] Totals do not reflect the sum of individual estimates because of "NA" values less than five.

5.2.4 Fatality Estimate for Fence line

The perimeter fence lines for all units, as well as the Common Logistic Area (CLA) fence, were surveyed throughout the full spring period. Two fatalities were detected along the unit perimeter fences. One fatality was detected along the CLA fence during regular surveys. None of these fatalities provided direct evidence of singeing, collision, or other (i.e., cause of death was unknown), so we do not provide a fatality estimate for known causes based on fence line surveys here.

5.3 Fatality Estimates from Unknown Causes

Per Section 3.1 of the Plan, fatality estimates are also to be provided based on detections of birds that were injured or that died of unknown causes. Because no observable evidence of singeing or collision effects was noted in the case of these unknown detections, they cannot be clearly included in an estimate attributed to a specific cause (i.e., singeing or collision). The methods for determining fatality estimates for these unknown detections are the same as those described in Section 5.2 for detections with direct evidence of the cause of the fatality (i.e., singeing, collision, or other).

Of the 82 detections where the cause of death could not be determined, 54 were included in the estimates (Table 22). The 28 unknown detections that were excluded from the estimates included 18 that were estimated to be older than the search interval; three that were from the fence line (for which we did not provide an estimate due to low sample size); three that were within solar units but outside our survey plots; three that were on "other Project lands" outside the solar units; and one that was found on a control transect outside the Project boundary.

Table 22. Number of Detections from Unknown Causes in Each Project Element, and Number Included in Fatality Estimates.

Element	Number Included	Number Excluded[1]	Total Found
Power Block	7	2	9
Inner HD	20	7	27
Inner and Outer Heliostats	27	12	39
Fences	0	3	3
Other Project Areas	0	3	3
Control Transects	0	1	1

[1] Thirty-three unknown detections were excluded because they were estimated to be older than the search interval, found outside survey plots, or found in areas where we did not estimate fatalities due to low sample sizes.

5.3.1 Total Fatality Estimates from Unknown Causes

Total fatality estimates from unknown causes were calculated as described in Section 5.2.1 above. During the period of 23 March – 22 May, estimates of fatalities from unknown causes were 479 (90% confidence interval 313-977). Of these, 97 (90% confidence interval estimates 63-187) were in the tower area and 383 fatalities (90% confidence interval estimates 251-790) were in the heliostat area (Table 23).

Table 23. Site-Wide Fatality Estimates from Unknown Causes, 23 March – 22 May 2014.

Type of Estimate	Number of Detections Included in Model	Estimate of Site-Wide Detections (with Lower and Upper C.I.)
Tower Area	27	93 (59-184)[1]
Heliostat Area	27	383 (251-790)
Total Detections, Unknown Cause	**54**	**479** (313-977)[1,2]

[1] Note that the tower area estimate includes estimates for the power block, which should be interpreted with caution as they may be inaccurate due to the large amount of unaccounted for search effort.
[2] The total fatality estimate includes three fence line fatalities, which were not modeled separately due to low sample size.

5.3.2 Fatality Estimate for Tower Area

Table 24 provides fatality estimates from unknown causes for the power block for the spring period. Table 25 provides fatality estimates from unknown causes for the inner HD area.

Table 24. Power Block Fatality Estimates from Unknown Causes, 23 March – 22 May 2014.

Type of Estimate	Number of Detections Included in Model	Estimate of Site-Wide Detections (with Lower and Upper C.I.)
Large Bird	1	NA[1]
Raptor	0	NA
Small Bird	6	18 (10-35)
Total Detections, Unknown Cause	**7**	**21** (11-39)[2]

[1] NA = not applicable because there were fewer than five detections within that group.
[2] Totals do not reflect the sum of individual estimates because of "NA" values less than five.

Table 25. Inner HD Heliostats Fatality Estimates from Unknown Causes, 23 March – 22 May 2014.

Type of Estimate	Number of Detections Included in Model	Estimate of Site-Wide Detections (with Lower and Upper C.I.)
Large Bird	5	19 (7-45)
Raptor	0	NA
Small Bird	15	54 (34-107)
Total Detections, Unknown Cause	**20**	**72** (48-145)[1]

[1] Totals do not reflect the sum of individual estimates because of "NA" values less than five.

5.3.3 Fatality Estimate for Heliostat Area

Table 26 provides fatality estimates from unknown causes for the heliostat area for the spring period. These estimates are based on 144 plots are extrapolated to the 598 plots that comprise the total area of the Heliostat Area.

Table 26. Heliostat Area Fatality Estimates from Unknown Causes, 23 March – 22 May 2014.

Type of Estimate	Number of Detections Included in Model	Estimate of Site-Wide Detections (with Lower and Upper C.I.)
Large Bird	11	150 (77-323)
Raptor	0	NA
Small Bird	16	234 (131-503)
Total Detections, Unknown Cause	**27**	**383** (251-790)[1]

[1] Totals do not reflect the sum of individual estimates because of "NA" values less than five.

5.3.4 Fatality Estimate for Fence line

Table 27 provides fence line detection data from unknown causes for the 2014 spring monitoring period Because of the low number of detections for this time period (i.e., fewer than the five detections necessary for a fatality estimate), we do not provide a fatality estimate for the fence line.

Table 27. Fence line Fatality Estimates from Unknown Causes, 23 March – 22 May 2014.

Type of Estimate	Number of Detections Included in Model	Estimate of Site-Wide Detections (with Lower and Upper C.I.)
Large Bird	0	NA
Raptor	0	NA
Small Bird	0[1]	NA[2]
Total Detections, Unknown Cause	**0**[1]	**NA**[2]

[1] There were three fence line detections (all small birds) of unknown cause, but because there were fewer than five detections, no formal modeling was conducted for fence lines.
[2] NA = not applicable because there were fewer than five detections within that group.

5.4 Regional Awareness Monitoring

According to the Plan, a communication protocol was implemented to monitor local veterinarians, game wardens, and wildlife rehabilitation facilities during facility operations to determine if significant new incidences of avian injury or fatality are reported to occur in the facility vicinity and region.

The Animal Kingdom Veterinary Hospital is the closest veterinary clinic to the Ivanpah facility and is located in the Las Vegas area about 35 miles northeast of Ivanpah. The closest wildlife rehabilitation facility is the Wild Wing Project located in North Las Vegas 47 miles northeast of Ivanpah. Representatives from each of these facilities were contacted and interviewed as a part of the protocol. Likewise, the local district game warden for the BLM and a field supervisor for CDFW were contacted to determine if they had noticed an increase in avian fatalities in the area or if they had noticed any singed or scorched injured or dead birds. Further, a designated biologist and veterinarian, Dr. Craig Himmelwright, working in the Ivanpah Valley was also interviewed for the same purpose. The following is a summary of results of interviewing these contacts for the purpose of the Regional Awareness Monitoring effort.

A representative from the Animal Kingdom Veterinary Hospital; Lisa Ross representing the Wild Wing Project; Ryan Regnell representing the BLM; Craig Himmelwright, D.V.M. in Ivanpah Valley representing the Designated Biologists for the Project; and Magdalena Rodriquez from CDFW were contacted. Each reported that they were not aware of any increase in avian fatalities for the region or any birds, injured or dead that had been found with singed or scorched feathers since monitoring according to the Plan began at Ivanpah in early winter 2013-2014.

Section 6.0 Discussion

The 2014 spring season represented the first implementation of migration-period monitoring at Ivanpah, which included weekly standardized monitoring of avian and bat detections and avian use of the Ivanpah site per the Avian & Bat Monitoring and Management Plan. Searcher efficiency trials and carcass removal trials were conducted concurrently. Searcher efficiency and carcass removal trials on the power block were started late in the spring season once approval was obtained to place trial carcasses in that location.

Caution is necessary when drawing conclusions from the 2014 spring season monitoring results because of the relatively small number of detections relative to the several Project elements of interest (e.g., heliostat fields, tower, fence line, and power lines) and the variable sampling effort within the power block. Estimates of fatalities from the power block may be inaccurate because of the high number of incidental detections, which resulted in more detections than would be expected if detections were made only through the fatality monitoring. More extensive and robust conclusions will be possible at the end of the first full year of sampling.

6.1 Fatality Estimates

Elevated numbers of detections appear to be associated with increases in migratory activity within the desert southwest region, as anticipated. Species composition of spring detections was composed primarily of obligate and facultative insectivores, many of which were migrating, and so was not similar to the species composition of either the heliostat arrays or the adjacent desert bajadas.

During the period 23 March – 22 May 2014, the total estimated number of fatalities based upon detections with direct evidence of singeing, collision, or entrapment was 433 (90% confidence interval estimates 278-774). Of these, 259 (90% confidence interval estimates 183-439) were estimated in the tower area and 174 (90% confidence interval estimates 95-335) were in the heliostat area. Fewer than five detections were found along the fence lines, so fatalities could not be estimated for this area for the spring period.

As noted above, these estimates (and particularly the magnitude of the estimates) should be considered with caution given the limited dataset for the 2014 spring season. Additionally, the large amount of uncontrolled search effort in the power block complicates fatality estimation in this area. Nevertheless, the relative magnitude of the fatality estimates among the three search areas (tower area, heliostat area, and fence line) matches the pattern of detections observed. In proportion to unit area, fatality estimates suggest the highest densities of detections in the tower area, where heliostat density is highest and the majority of the detections with evidence of singeing were found.

6.2 Carcass Removal and Searcher Efficiency Trials

After conducting the standardized searches in the units during the spring quarter, we believe that future sampling may confirm that the underlying scavenging rates and discovery rates of carcasses and feather spots occurring in the power block differ from those within the rest of the site. As recommended in the winter report, searcher efficiency and carcass persistence trials were initiated on the power block. As the number of trials increases, we will better determine whether or how different scavenging and discovery rates are in the power block compared to other areas within the facility.

For the spring season, searcher efficiency rates averaged 57.1% for small birds, 71.4% for large birds, and 35.7% for feather spots/partial carcasses. Detection rates of carcasses were higher than target rates assumed in the Plan (55% for small birds and 69% for large birds) for spring, though through two survey periods the combined rates for winter and spring were lower than the target rates assumed in the Plan. Detection rates for feather spots/partial carcasses were lower than the Plan's target rates for small or large carcasses. However, all feather spots/partial carcasses placed contained very few feathers (a wing and 8-14 feathers). In contrast, detected feather spots averaged ~50 feathers, with a range of 2 to more than 150 feathers. Therefore, future feather spots used in searcher efficiency trials will be classified as either small or large, with small feather spots containing 20 or fewer feathers and large feather spots containing 50 or more feathers. No partial carcasses will be used in future feather spot searcher efficiency trials. We believe this change will better reflect natural conditions and provide more information on detection rates of feather spots. Based on the success of detection dog trials in spring 2014, the TAC approved the use of detection dogs for searches beginning in summer 2014, which will increase searcher efficiency even further

6.3 Cause and Distribution of Fatalities

The cause of death for 49.5% of the 202 avian detections during the 2014 spring season was attributed to singeing, with 7.4% attributed to collision, and 2.5% to other Project causes; 40.1% were either attributable to predation (in the case of one detection where strong evidence of predation was observed) or could not be confirmed (i.e., the carcass or feather spot displayed no signs of singeing and no direct collision effects as determined by microscopic examination by CEC and BLM approved biologists) mainly because they were limited feather spots (see further discussion of feather spots below). Because singed feathers are readily observable, detections for which the cause of death is unconfirmed are likely to have resulted from predation, collision, or illness.

More than two-thirds of all detections, and 97 of 100 detections showing evidence of singeing, were detected in the relatively limited tower area. This 260-m radius area consisted of the area that was searched with 100% coverage due to proximity to the towers and is coincidental with the areas with the highest concentrations of solar flux. In addition, these towers were the focus of considerable activity by Ivanpah personnel, who found and reported detections, resulting in high numbers of incidental fatality reports.

6.4 Feather Spots

Sixty-six (32.7%) of the 202 detections consisted only of feather spots. While evidence of singeing was noted on 20 of these 66 feather spots, and evidence of collision was apparent in two feather spots, the cause of mortality for the other 44 birds is unknown. Some of these feather spots may have represented detections resulting from collisions or singeing that had been scavenged, leaving no direct evidence of the cause of the fatality. Other feather spots may represent natural predation events and multiple feather spots may be generated by these events. The large proportion of feather spots among the detections for the site as a whole may inflate the fatality estimate as a result of the potential for multiple feather spots resulting from one fatality, feather spots resulting from predation, or other causes. The ratio of feather spots to carcasses varied widely across the site, with a high ratio in the inner HD heliostats and a low ratio on the power block.

6.5 Incidental Detections

A total of 45 incidental avian detections and one incidental bat detection were found during this quarter. Thus, incidental detections represented a large percentage (22.3% for birds and 25% for bats) of the detections. This demonstrates that the Ivanpah Wildlife Incident Reporting System, described in Section 3.4 of the Plan, is functioning well. However, a number of these incidental detections were retrieved from the power block, and the retrieval of incidental detections from the power block can confound accurate fatality estimates for this area because the search effort involved in the detection of incidental detections is not quantifiable and is subject to considerable spatial and temporal variability. Because incidental detections are retrieved at random intervals, we cannot properly assess the search interval of detected carcasses, or searcher efficiency of personnel finding detections in these areas, which are both critical model parameters when estimating fatalities. Nevertheless, incidental detections from the power block were included with an assumed one day search interval in the fatality estimates because such a large proportion of detections in this area were incidental.

Because a high proportion of detections on the site are found in and around the power block and the current estimation protocol relies on a lower searcher efficiency than is likely reflected in the power block, we proposed a change in the proposed protocol for estimating searcher efficiency and accounting for detections in the power block area was approved by the TAC during the September meeting.

Section 7.0 Framework for Management and Risk Response

According to the Plan, quarterly reports are expected to categorize potential migratory bird mortality issues at Ivanpah as high, medium, or low to provide an appropriate biological basis for TAC review and decision making, based on the following definitions in Section 5.3 of the Plan:

1. "High: Estimated avian mortality or injury levels are facility-caused and likely to seriously and negatively affect local, regional, or national avian populations within a particular species or group of species."
2. "Medium: Estimated avian mortality or injury levels are facility-caused and have the potential to negatively affect local, regional, or national populations within a particular avian species or group of species."
3. "Low: Estimated avian mortality or injury levels that have minimal or no potential to negatively affect local, regional, or national populations within a particular species or group of species."

As noted in Section 5.1, only limited conclusions can be drawn from the spring 2014 season fatality data owing to the low numbers of detections within "a particular species or group of species"; however, the results indicate that the potential migratory bird mortality would be categorized as low. The 202 avian detections included 43 different bird species spread among a variety of temporal occurrence groups and foraging guilds. Of these 43 species, 30 were represented by three or fewer detections (injury or fatality; see Table 9). While special-status species are discussed further below, all of the species represented by three or fewer detections have populations that are great enough locally (either as breeders, wintering birds, or migrants), regionally, and nationally that the loss of three individuals would have no substantive impact on populations at any of these geographic scales.

None of the 13 species represented by more than three detections is particularly rare locally, regionally, or nationally. Ten of these 13 species, including the mourning dove, yellow-rumped warbler, horned lark, white-crowned sparrow, tree swallow, barn swallow, cliff swallow, violet-green swallow, Brewer's blackbird, and western meadowlark, are abundant and widespread species. Two others, the rufous hummingbird and Costa's hummingbird, have more limited breeding distributions but are still very numerous within their breeding ranges and occur in large numbers (as a migrant in the case of rufous hummingbird and as a breeder in the case of Costa's hummingbird) in southeastern California. Populations of the 13th species, American kestrel (of which there were five recorded detections), are somewhat more limited, consistent with the larger territory sizes of raptors (as compared to the other 12 species, which were non-raptors). However, the American kestrel is a common and widespread species on local, regional, and national scales, and the magnitude of kestrel detections at Ivanpah during the 2014 spring season does not rise above the "low" category.

The special-status species recorded as detections were three bank swallows (a state-listed species), three loggerhead shrikes (a California species of special concern), and single individuals of Vaux's swift, olive-sided

flycatcher, yellow warbler, and yellow-breasted chat, which are also California species of special concern. Loggerhead shrikes breed in the vicinity of the site, but all the other special-status species recorded as detections were transients that breed elsewhere. Given the location of the site (so close to the Nevada border) and the expected north-south orientation of migrants of these species in the vicinity, it is likely that some or all of these migrants are breeders from populations outside of California, populations that may not be of special status.

The cause of injury or mortality for 81 of the 202 detections (40.1%) is not known with certainty, and thus these detections cannot be accurately assigned to a known cause (i.e., singeing or collision). Of the special-status species recorded, three bank swallows, the Vaux's swift, and the yellow warbler showed signs of singeing, but the cause of death of the three loggerhead shrikes, the olive-sided flycatcher, and the yellow-breasted chat were unknown.

Bank swallows are widespread breeders throughout the middle and northern latitudes of North America (Garrison 1999). These birds completely vacate North America in winter, and as a result, large numbers migrate through southern North America (including southeastern California) in spring and fall en route between breeding and wintering areas. The three bank swallow detections in spring 2014 represented a very small proportion of the bank swallows expected to migrate north through the Ivanpah area in spring, heading to breeding sites as far north as Alaska and Canada. The North American population of this species is estimated at 13,800,000 birds (http://birds.audubon.org/species/banswa), and the species is found throughout most of Europe and Asia as well, with a global population estimate of 46,000,000 individuals (http://birds.audubon.org/species/banswa). The most recent estimate available of the California breeding population numbered approximately 9,590 pairs in 2003 (bird species accounts at http://www.dfg.ca.gov/wildlife/nongame/t_e_spp/); numbers of burrows, which can be used to identify trends in abundance when monitored over time but which over-represent the actual numbers of breeding pairs, were estimated at 15,000 along the Sacramento River in 2012 (Bank Swallow Technical Advisory Committee 2013). Thus, at scales from local/regional (i.e., migrants moving through the Ivanpah area and the surrounding region) to national to global, the three bank swallow detections at Ivanpah during the 2014 spring season do not rise above the "low" category, as their loss would have a minimal effect on populations at any of these geographic scales.

The loggerhead shrike is declining over much of its range (Sauer et al. 2014), primarily due to habitat loss, but it remains a common and widespread bird throughout much of the western and southeastern United States where habitat remains. In California, this species is common in desert habitats. The southeastern deserts represent one of the areas of highest abundance in the state (Humple 2008), and Breeding Bird Survey data indicate no significant population trends, or perhaps even a slight increase, in the Mojave Desert since the mid-1960s (Sauer et al. 2014). The North American population of this species is estimated at 2,900,000 birds (http://birds.audubon.org/species/logshr). Even if the three individual detections at Ivanpah in spring 2014 could be attributed to a known cause, such a low number would not substantially affect local, regional, or national populations of the species. However, as noted above, the cause of death of these individuals was

unknown, and their mortality thus could not be assigned to a known cause such as collision or singeing. For all these reasons, the three loggerhead shrike detections in spring 2014 do not rise above the "low" category.

Vaux's swift, olive-sided flycatcher, yellow warbler, and yellow-breasted chat are sufficiently abundant at all geographic scales that the loss of single individuals would have a minimal impact on local, regional, and national populations. Further, the cause of mortality of the olive-sided flycatcher and yellow-breasted chat could not be determined. For these reasons, the single detections of these four California species of special concern do not rise above the "low" category.

Section 8.0 Literature Cited

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Appendix A. Individual Avian Detections

USFWS #	Common Name	Species Code	Number Individuals	How Detected	Collection Date	Bird/Carcass Condition[1]	Time Since Death/Injury	Description of Carcass/Injury	Cause of Injury or Mortality[2]	Burn Grade	Unit	UTM Coordinates[3]	Nearest Project Feature	SPUT Revisions[4]
2014_61_ISEGS	Horned Lark	HOLA	2	Incidental	3/23/2014	Broken up	7 days	partial carcass + feather spot: L wing segment, 3 legs, right wing attached to dorsal body segment, partial head, 16 retrices, partial keel, 100+ body feathers	Unknown	NA	3	11 S 638171 3937468	Heliostat	Reclassified: Changed condition of bird/carcass from feather spot to broken up 10/17/2014 (S. Peterson)
2014_62_ISEGS	Violet Green Swallow	VGSW	1	Incidental	3/24/2014	Dead, fresh (eyes moist)	0-8 hours	Fresh, whole carcass. Singeing on right chest and underside of neck, wings and tail feathers curled.	Scorched or singed	2, 3	3	11 S 637489 3937932	Solar Concentrating Tower	
2014_63_ISEGS	Tree Swallow	TRES	1	Incidental	3/24/2014	Alive, injured‡	0-8 hours	Live bird, feather singeing on wings and tail	Scorched or singed	2	3	11 S 637435 3937945	Other: steel support southwest of ACC.	
2014_64_ISEGS	Violet Green Swallow	VGSW	1	Incidental	3/24/2014	Dead, fresh (eyes moist)	0-8 hours	Fresh, whole carcass. Singeing on head, wings and tail feathers, and back side (ventral) side of body.	Scorched or singed	2, 3	3	11 S 637443 3937976	ACC Building°	
2014_65_ISEGS	Unknown Passerine	UNKN	1	Carcass Survey	3/24/2014	Feather spot	1 month +	small grayish brown feathers; 7 primaries, 2 coverts	Unknown	NA	3	11 S 636841 3938918	Heliostat	
2014_66_ISEGS	Costa's Hummingbird	COHU	1	Carcass Survey	3/24/2014	Dead, fresh (eyes moist)	3-6 days	eyes sunken, feathers fresh looking	Collision with solar panel/heliostat	NA	3	11 S 636440 3937309	Heliostat	
2014_67_ISEGS	Costa's Hummingbird	COHU	1	Carcass Survey	3/25/2014	Dead, semi-fresh (eyes desiccated, rigor mortis)	3 weeks	right flank, side of head, retrices, and back singed. Eyes dessicated.	Scorched or singed	1, 3	3	11 S 637495 3937970	ACC Building°	UTM coordinates corrected 10/27/2014 (B. Sousa).
2014_68_ISEGS	Yellow-rumped Warbler	YRWA	1	Carcass Survey	3/25/2014	Dead, fresh (eyes moist)	0-8 hours	Singed tail, head, back, breast, and wings	Scorched or singed	2, 3	3	11 S 637334 3937948	Rip Rap berm	
2014_69_ISEGS	Costa's Hummingbird	COHU	1	Carcass Survey	3/25/2014	Dead, semi-fresh (eyes desiccated, rigor mortis)	7 days	Left head, flank, retrices, and belly singed. Eyes dessicated.	Scorched or singed	1, 3	2	11 S 638640 3935717	Heliostat	
2014_70_ISEGS	Mourning Dove	MODO	1	Carcass Survey	3/25/2014	Broken up	7 days	Partial wing - primaries and coverts and an additional 4 primaries, 2 retrices, and body feathers	Unknown	NA	3	11 S 637419 3938085	Heliostat	Reclassified: Changed condition of bird/carcass from feather spot to broken up 10/17/2014 (S. Peterson)
2014_71_ISEGS	Mourning Dove	MODO	1	Carcass Survey	3/25/2014	Feather spot	1 month +	5 flight and 35 body feathers	Unknown	NA	3	11 S 637362 3938117	Heliostat	
2014_72_ISEGS	Tree Swallow	TRES	1	Carcass Survey	3/25/2014	Feather spot	0-8 hours	~25 flight feathers, curled and singed. 100+ body feathers, many with singeing	Scorched or singed	2, 3	3	11 S 637520 3937989	k-rail around powerblock road	
2014_73_ISEGS	Brewer's Blackbird	BRBL	1	Carcass Survey	3/25/2014	Feather spot	3 weeks	2 central retrices, attached to each other	Unknown	NA	2	11 S 638549 3936035	Heliostat	
2014_74_ISEGS	House Finch	HOFI	1	Carcass Survey	3/25/2014	Broken up	3 weeks	L wing	Unknown	NA	3	11 S 637368 3938134	Heliostat	Reclassified: Changed condition of bird/carcass from feather spot to broken up 10/17/2014 (S. Peterson)
2014_75_ISEGS	Mourning Dove	MODO	1	Carcass Survey	3/25/2014	Feather spot	3 weeks	3 tail feathers attached to each other; 6 wing feathers	Unknown	NA	3	11 S 637668 3938044	Heliostat	

USFWS #	Common Name	Species Code	Number Individuals	How Detected	Collection Date	Bird/Carcass Condition[1]	Time Since Death/Injury	Description of Carcass/Injury	Cause of Injury or Mortality[2]	Burn Grade	Unit	UTM Coordinates[3]	Nearest Project Feature	SPUT Revisions[4]
2014_76_ISEGS	Yellow-rumped Warbler	YRWA	1	Carcass Survey	3/25/2014	Feather spot	2 weeks	12 flank feathers in a clump	Other	NA	3	11 S 637507 3937959	ACC fan deck wall°	
2014_77_ISEGS	Unknown Swallow	UNKN	1	Carcass Survey	3/25/2014	Feather spot	7 days	2 primaries, one of which is singed. one additional wing feather	Scorched or singed	Unknown	3	11 S 637614 3937734	Heliostat	
2014_78_ISEGS	Unknown Swallow	UNKN	1	Carcass Survey	3/25/2014	Feather spot	1 month +	6 primaries, 4 coverts	Unknown	NA	3	11 S 637614 3937734	Heliostat	
2014_79_ISEGS	Mourning Dove	MODO	1	Carcass Survey	3/27/2014	Broken up	3 weeks	head, part of wing	Unknown	NA	2	11 S 638506 3935082	Heliostat	
2014_80_ISEGS	Mourning Dove	MODO	1	Carcass Survey	3/27/2014	Broken up	3 weeks	feathers of entire tail; intact tail with bones	Unknown	NA	2	11 S 639183 3935225	Heliostat	Reclassified: Changed condition of bird/carcass from feather spot to broken up and added "intact tail with bones" 10/17/2014 (S. Peterson)
2014_81_ISEGS	White-Crowned Sparrow	WCSP	1	Carcass Survey	3/27/2014	Mummified	3 weeks	entire carcass; eyes sunken	Unknown	NA	2	11 S 639611 3936242	Heliostat	
2014_82_ISEGS	Black-Throated Sparrow	BTSP	1	Carcass Survey	3/27/2014	Feather spot	3 weeks	200+ body feathers; 20+ flight feathers	Unknown	NA	2	11 S 639320 3935698	Heliostat	
2014_83_ISEGS	Horned Lark	HOLA	1	Carcass Survey	3/27/2014	Mummified	3 weeks	partial carcass	Unknown	NA	2	11 S 639356 3935637	Heliostat	
2014_84_ISEGS	Horned Lark	HOLA	1	Carcass Survey	3/27/2014	Feather spot	3-6 days	~50 body feathers, 4 flight feathers	Unknown	NA	2	11 S 639488 3935974	Heliostat	
2014_85_ISEGS	Yellow-rumped Warbler	YRWA	1	Carcass Survey	3/29/2014	Feather spot	3 weeks	1 retrix with minor singeing; 13 primaries (no singeing); 1 covert	Scorched or singed	Unknown	1	11 S 640451 3933383	Heliostat	
2014_86_ISEGS	Yellow-rumped Warbler	YRWA	1	Carcass Survey	3/29/2014	Feather spot	3 weeks	2 secondaries, 1 covert, ~20 contour feathers, nearly all with singeing	Scorched or singed	3	1	11 S 640409 3933402	Heliostat	
2014_87_ISEGS	Unknown small passerine	UNKN	1	Carcass Survey	3/29/2014	Feather spot	3 weeks	3 primaries attached	Unknown	NA	1	11 S 640472 3933374	Heliostat	
2014_88_ISEGS	White-Crowned Sparrow	WCSP	1	Carcass Survey	3/29/2014	Broken up	3-6 days	partial wing	Unknown	NA	1	11 S 640171 3933611	Heliostat	
2014_89_ISEGS	Mourning Dove	MODO	1	Carcass Survey	3/29/2014	Feather spot	3 weeks	1 flight and 14 body feathers	Other	NA	1	11 S 640389 3933486	ACC Building°	
2014_90_ISEGS	Eared Grebe	EAGR	1	Incidental	3/30/2014	Dead, semi-fresh (eyes desiccated, rigor mortis)	8-24 hours	Entire carcass with missing head from scavenging	Collision (other)	NA	1	11 S 640386 3933470	Solar Concentrating Tower	
2014_91_ISEGS	Northern Rough-winged Swallow	NRWS	1	Incidental	3/31/2014	Dead, semi-fresh (eyes desiccated, rigor mortis)	2 weeks	Entire carcass, singed on both wings and tail feathers	Scorched or singed	2	2	11 S 638598 3935824	Other: PSB parking lot	
2014_92_ISEGS	Unknown small passerine	UNKN	1	Carcass Survey	3/31/2014	Feather spot	3-6 days	partial wing: 3 primaries, alula attached; has no bones attached	Unknown	NA	3	11 S 637273 3937814	Heliostat	Added "has no bones attached " in description of condition of bird/carcass; 10/17/2014 (S. Peterson)

USFWS #	Common Name	Species Code	Number Individuals	How Detected	Collection Date	Bird/Carcass Condition[1]	Time Since Death/Injury	Description of Carcass/Injury	Cause of Injury or Mortality[2]	Burn Grade	Unit	UTM Coordinates[3]	Nearest Project Feature	SPUT Revisions[4]
2014_93_ISEGS	American Kestrel	AMKE	1	Carcass Survey	3/31/2014	Feather spot	3-6 days	2 primaries and 1 covert attached at base. Found another primary with 2 coverts attached on 4/21/14 in same area	Scorched or singed	Unknown	3	11 S 637682 3937985	Heliostat	
2014_94_ISEGS	Tree Swallow	TRES	1	Carcass Survey	3/31/2014	Dead, fresh (eyes moist)	8-24 hours	Whole carcass; singeing on tail, wing, nape, face	Scorched or singed	1, 3	3	11 S 637481 3937981	ACC Building°	
2014_95_ISEGS	House Finch	HOFI	1	Carcass Survey	4/1/2014	Feather spot	7 days	~20 contour feathers	Unknown	NA	2	11 S 638780 3935630	Heliostat	
2014_96_ISEGS	Western Meadowlark	WEME	1	Carcass Survey	4/1/2014	Broken up	2 weeks	head, no clear injuries	Unknown	NA	2	11 S 638538 3935992	Heliostat	
2014_97_ISEGS	House Finch	HOFI	1	Carcass Survey	4/1/2014	Broken up	2 weeks	Wing segment	Unknown	NA	2	11 S 638864 3935753	Heliostat	
2014_98_ISEGS	Mourning Dove	MODO	1	Carcass Survey	4/1/2014	Feather spot	2 weeks	100+ body feathers, 15+ flight feathers	Unknown	NA	3	11 S 637243 3937583	Heliostat	
2014_99_ISEGS	Anna's Hummingbird	ANHU	1	Carcass Survey	4/15/2014	Dead, semi-fresh (eyes desiccated, rigor mortis)	Unknown	Carcass	Scorched or singed	1, 3	2	11 S 638669 3935885	Project Building°	
2014_100_ISEGS	Mourning Dove	MODO	1	Carcass Survey	4/2/2014	Feather spot	3 weeks	30+ body; 5 flight feathers	Unknown	NA	3	11 S 637223 3938634	Heliostat	
2014_101_ISEGS	Black-Throated Sparrow	BTSP	1	Carcass Survey	4/2/2014	Broken up	3 weeks	partial carcass + feather spot: ~50 body, 1 tail feather, partial wing; top of bill	Collision with solar panel/heliostat	NA	3	11 S 637368 3938652	Heliostat	Reclassified: Changed condition of bird/carcass from feather spot to broken up 10/17/2014 (S. Peterson)
2014_102_ISEGS	Mourning Dove	MODO	1	Carcass Survey	4/2/2014	Mummified	1 month +	skeletal/mummified remains; no flesh	Collision with solar panel/heliostat	NA	3	11 S 636320 3937171	Heliostat	
2014_103_ISEGS	Western Meadowlark	WEME	1	Carcass Survey	4/3/2014	Mummified	3 weeks	Dessicated carcass; insects ate flesh; feathers intact	Collision with solar panel/heliostat	NA	3	11 S 638249 3937819	Heliostat	
2014_104_ISEGS	Yellow-rumped Warbler	YRWA	1	Carcass Survey	4/5/2014	Alive, injured‡	8-24 hours	Extensive singeing and curling of wing and tail feathers; left eye damaged and left face singed. Additional singeing on crown and left flank. Extent of singeing on ventral side not assessed.	Scorched or singed	2, 3	1	11 S 640340 3933511	Solar Concentrating Tower	
2014_105_ISEGS	American Kestrel	AMKE	1	Carcass Survey	4/5/2014	Alive, injured	0-8 hours	Extensive singeing and curling of all flight feathers, including coverts. Entire dorsal plumage singed. Singeing on face and under wings. Eyes intact, ventral area largely intact with little visible singeing.	Scorched or singed	2, 3	1	11 S 640487 3933251	Heliostat	
2014_106_ISEGS	Mourning Dove	MODO	1	Carcass Survey	4/5/2014	Feather spot	1 month +	3 flight feathers, two of which area attached to each other at base.	Unknown	NA	1	11 S 640342 3933584	Project Building	
2014_107_ISEGS	Unknown passerine or swift	UNKN	1	Carcass Survey	4/5/2014	Broken up	3 weeks	Partial Left wing. No noticeable injuries	Unknown	NA	1	11 S 640533 3933595	Heliostat	Reclassified: Changed condition of bird/carcass from feather spot to broken up 10/16/14 (B. Sousa).
2014_108_ISEGS	Mourning Dove	MODO	1	Carcass Survey	4/6/2014	Feather spot	1 month +	~20 body feathers in a clump	Unknown	NA	1	11 S 640382 3934130	Heliostat	

USFWS #	Common Name	Species Code	Number Individuals	How Detected	Collection Date	Bird/Carcass Condition[1]	Time Since Death/Injury	Description of Carcass/Injury	Cause of Injury or Mortality[2]	Burn Grade	Unit	UTM Coordinates[3]	Nearest Project Feature	SPUT Revisions[4]
2014_109_ISEGS	American Kestrel	AMKE	1	Carcass Survey	4/7/2014	Feather spot	7 days	1 tail feather, singed and curled.	Scorched or singed	Unknown	3	11 S 637661 3937955	Heliostat	
2014_110_ISEGS	Mourning Dove	MODO	1	Carcass Survey	4/8/2014	Feather spot	7 days	2 secondaries and 1 covert	Unknown	NA	3	11 S 637951 3938216	Heliostat	
2014_111_ISEGS	Loggerhead Shrike	LOSH	1	Carcass Survey	4/9/2014	Feather spot	3-6 days	10+ primaries; coverts; body feathers	Unknown	NA	2	11 S 639233 3935870	Heliostat	
2014_112_ISEGS	Tree Swallow	TRES	1	Incidental	4/10/2014	Dead, fresh (eyes moist)	0-8 hours	Whole carcass; singeing on tail, wings, right side and breast just in front of wing.	Scorched or singed	2, 3	2	11 S 638562 3935823	PSB Building	
2014_113_ISEGS	Yellow-rumped Warbler	YRWA	1	Incidental	4/10/2014	Dead, fresh (eyes moist)	0-8 hours	Extensive melting of all flight feathers. Entire dorsal and ventral plumage charred. Singeing on face. Eyes intact.	Scorched or singed	3	2	11 S 638631 3935877	Steam Pipe	
2014_114_ISEGS	White-Crowned Sparrow	WCSP	1	Carcass Survey	4/11/2014	Dead, fresh (eyes moist)	8-24 hours	Whole carcass, no obvious signs of injury	Unknown	NA	NA	11 S 639311 3935044	Fencing	
2014_115_ISEGS	Brewer's Sparrow	BRSP	1	Carcass Survey	4/11/2014	Dead, semi-fresh (eyes desiccated, rigor mortis)	2 days	Whole carcass	Collision with solar panel/heliostat	NA	2	11 S 639273 3935207	Heliostat	
2014_116_ISEGS	Yellow-rumped Warbler	YRWA	1	Carcass Survey	4/12/2014	Dead, semi-fresh (eyes desiccated, rigor mortis)	3-6 days	Whole carcass, singeing on tail, breast, right wing, back, and right side of face.	Scorched or singed	1, 3	1	11 S 640279 3933428	Solar Concentrating Tower	
2014_117_ISEGS	Costa's Hummingbird	COHU	1	Carcass Survey	4/12/2014	Dead, semi-fresh (eyes desiccated, rigor mortis)	3-6 days	Whole carcass, singeing and curling of all retrices and most right remiges. Singeing on right flank and under wing.	Scorched or singed	2, 3	1	11 S 640359 3933581	ACC Building	
2014_118_ISEGS	Unknown Passerine	UNKN	1	Carcass Survey	4/12/2014	Feather spot	7 days	1 singed flight feather, 9 contour feathers	Scorched or singed	Unknown	1	11 S 640344 3933395	Heliostat	
2014_119_ISEGS	Western Meadowlark	WEME	1	Carcass Survey	4/12/2014	Feather spot	3-6 days	Unknown	Unknown	NA	1	11 S 640209 3933378	Heliostat	
2014_120_ISEGS	Yellow-rumped Warbler	YRWA	1	Carcass Survey	4/12/2014	Feather spot	3-6 days	6 flight feathers with singeing and curling	Scorched or singed	Unknown	1	11 S 640424 3933361	Heliostat	
2014_121_ISEGS	Violet Green Swallow	VGSW	1	Carcass Survey	4/12/2014	Alive, injured¥	0-8 hours	Singed wing and tail feathers. Dorsal rump singed. Capable of short flights.	Scorched or singed	2, 3	1	11 S 640524 3933286	Heliostat	
2014_122_ISEGS	Rock Pigeon	ROPI	1	Incidental	4/12/2014	Dead, fresh (eyes moist)	0-8 hours	Found alive but injured. Died app. 1 hour later. Possible internal injury or heat stress.	Unknown	NA	2	11 S 638694 3935848	Tower	
2014_123_ISEGS	Calliope Hummingbird	CAHU	1	Incidental	4/12/2014	Dead, fresh (eyes moist)	8-24 hours	Singed wing feathers and possibly impacted by a vehicle post mortem.	Scorched or singed	2, 3	2	11 S 638622 3935815	Tower	
2014_124_ISEGS	Loggerhead Shrike	LOSH	1	Carcass Survey	4/13/2014	Broken up	7 days	partial carcass + feather spot: 7 retrices, partial right wing, ~6 contour feathers	Unknown	NA	1	11 S 639861 3933914	Heliostat	Reclassified: Changed condition of bird/carcass from feather spot to broken up 10/17/2014 (S. Peterson)

USFWS #	Common Name	Species Code	Number Individuals	How Detected	Collection Date	Bird/Carcass Condition[1]	Time Since Death/Injury	Description of Carcass/Injury	Cause of Injury or Mortality[2]	Burn Grade	Unit	UTM Coordinates[3]	Nearest Project Feature	SPUT Revisions[4]
2014_125_ISEGS	Yellow-rumped Warbler	YRWA	1	Carcass Survey	4/13/2014	Dead, fresh (eyes moist)	0-8 hours	Found alive but injured. Extensive singeing and curling of L wing, left side, and left side of back. Curling of central retrices. Minor singeing on head. Left leg not gripping or pushing back properly. Capable of short flights. Died during the evening.	Scorched or singed	2, 3	1	11 S 640420 3933815	Heliostat	
2014_126_ISEGS	Mourning Dove	MODO	1	Carcass Survey	4/14/2014	Feather spot	1 month +	1 flight and 20 body feathers	Unknown	NA	3	11 S 637651 3937756	Heliostat	
2014_127_ISEGS	Yellow-rumped Warbler	YRWA	1	Carcass Survey	4/15/2014	Feather spot	3-6 days	18 body feathers and 1 flight feather. Flight feather curled. Singeing on several contour feathers	Scorched or singed	Unknown	2	11 S 638714 3935712	Heliostat	
2014_128_ISEGS	Brewer's Sparrow	BRSP	1	Carcass Survey	4/15/2014	Dead, semi-fresh (eyes desiccated, rigor mortis)	3-6 days	Full carcass, no obvious cause of death.	Unknown	NA	2	11 S 639726 3935677	NA	
2014_129_ISEGS	Yellow-rumped Warbler	YRWA	1	Carcass Survey	4/15/2014	Dead, semi-fresh (eyes desiccated, rigor mortis)	3-6 days	Full carcass. Tail feathers, Left side of face, L wing, L flank, and rump singed and curled.	Scorched or singed	2, 3	2	11 S 638740 3936001	Heliostat	Changed UTM from 368740 to 638740 on 10/21/14 (B. Sousa).
2014_130_ISEGS	Brewer's Blackbird	BRBL	1	Carcass Survey	4/15/2014	Feather spot	3 weeks	10 body, 14 flight feathers	Unknown	NA	1	11 S 641010 3934322	Heliostat	
2014_131_ISEGS	Lincoln's Sparrow	LISP	1	Carcass Survey	4/15/2014	Feather spot	8-24 hours	25+ flight, 50+ body feathers	Collision with solar panel/heliostat	NA	2	11 S 638720 3936088	Heliostat	
2014_132_ISEGS	Unknown Ardeidae species	UNKN	1	Carcass Survey	4/15/2014	Feather spot	3-6 days	ball of filoplume/down feathers - 150+	Unknown	NA	1	11 S 641058 3933526	Heliostat	
2014_133_ISEGS	American Coot	AMCO	1	Carcass Survey	4/15/2014	Broken up	3-6 days	single right wing	Unknown	NA	1	11 S 640520 3932739	Heliostat	
2014_134_ISEGS	Mourning Dove	MODO	1	Carcass Survey	4/15/2014	Feather spot	3-6 days	20 flight, 30 body feathers	Unknown	NA	3	11 S 637965 3938230	Heliostat	
2014_135_ISEGS	White-Crowned Sparrow	WCSP	1	Carcass Survey	4/15/2014	Dead, semi-fresh (eyes desiccated, rigor mortis)	3-6 days	Carcass dried	Unknown	NA	2	11 S 637706 3935225	Fence	
2014_136_ISEGS	Unknown Passerine	UNKN	1	Incidental	4/16/2014	Broken up	8-24 hours	partial carcass + feather spot: >20 contour feathers, several rectrices and remigest, flesh pieces, no evidence of curling or charring. Probable CORA scavenging.	Unknown	NA	2	11 S 638549 3935876	Other	Reclassified: Changed condition of bird/carcass from feather spot to broken up 10/17/2014 (S. Peterson)
2014_137_ISEGS	Eurasian Collared-Dove	EUCD	1	Carcass Survey	4/16/2014	Feather spot	3-6 days	150+ body feathers; 50 flight feathers	Unknown	NA	3	11 S 636792 3937786	Heliostat	
2014_138_ISEGS	Unknown Passerine	UNKN	1	Carcass Survey	4/16/2014	Broken up	3 weeks	partial bottom of carcass	Unknown	NA	2	11 S 638554 3936397	Heliostat	
2014_139_ISEGS	Unknown Passerine	UNKN	1	Carcass Survey	4/16/2014	Mummified	1 month +	mummified carcass. No head	Unknown	NA	2	11 S 638233 3936227	Heliostat	

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2014_140_ISEGS	American Kestrel	AMKE	1	Incidental	4/17/2014	Dead, semi-fresh (eyes desiccated, rigor mortis)	3-6 days	Full carcass; breast, wings, and tail feathers curled, melted, and charred	Scorched or singed	2, 3	3	11 S 637470 3937906	Tower	
2014_141_ISEGS	Yellow-rumped Warbler	YRWA	1	Carcass Survey	4/19/2014	Dead, semi-fresh (eyes desiccated, rigor mortis)	3-6 days	Full carcass, curling and singeing of all flight feathers. Nearly every feather singed save a few on the belly, flank, and rump.	Scorched or singed	2, 3	1	11 S 640363 3933540	ACC Building°	UTM coordinates corrected 10/27/2014 (B. Sousa).
2014_142_ISEGS	Violet Green Swallow	VGSW	1	Carcass Survey	4/19/2014	Dead, semi-fresh (eyes desiccated, rigor mortis)	3-6 days	Full carcass, curling and singeing of all flight feathers, upper back, back of head, and upper chest.	Scorched or singed	2, 3	1	11 S 640385 3933542	ACC Building°	
2014_143_ISEGS	Tree Swallow	TRES	1	Carcass Survey	4/19/2014	Dead, fresh (eyes moist)	8-24 hours	Full carcass. 50% of tail feathers, and more than 50% wing feathers curled and singed. Singeing on back.	Scorched or singed	2, 3	1	11 S 640408 3933528	ACC Building°	
2014_144_ISEGS	Cliff Swallow	CLSW	1	Carcass Survey	4/19/2014	Feather spot	3-6 days	~15 flight and 50 body feathers. All flight feathers singed and curled. Several body feathers singed.	Scorched or singed	3, Unknown	1	11 S 640510 3933398	Heliostat	
2014_145_ISEGS	Unknown Passerine	UNKN	1	Carcass Survey	4/19/2014	Feather spot	1 month +	4 flight feathers, singed.	Scorched or singed	Unknown	1	11 S 640602 3933418	Heliostat	Changed UTM coordinates from 6640696, 3933232 to 640602, 3933418 on 10/21/14 (B. Sousa).
2014_146_ISEGS	Unknown Passerine	UNKN	1	Carcass Survey	4/19/2014	Feather spot	3 weeks	1 singed flight feather	Scorched or singed	Unknown	1	11 S 640331 3933355	Heliostat	
2014_147_ISEGS	White-Crowned Sparrow	WCSP	1	Carcass Survey	4/20/2014	Dead, semi-fresh (eyes desiccated, rigor mortis)	3-6 days	Whole carcass. No singeing or clear sign of injury. Tail feathers and left wing disarticulated and located within inches of body.	Unknown	NA	1	11 S 640075 3934075	Heliostat	
2014_148_ISEGS	Mourning Dove	MODO	1	Carcass Survey	4/20/2014	Mummified	3 weeks	Whole carcass. Dried out, wing disarticulated next to carcass. Could not check mirrors for imprint.	Unknown	NA	1	11 S 640325 3933224	Heliostat	
2014_149_ISEGS	Costa's Hummingbird	COHU	1	Carcass Survey	4/21/2014	Dead, fresh (eyes moist)	8-24 hours	Whole carcass. Missing all tail feathers, entire rump singed.	Scorched or singed	1, 3	3	11 S 637659 3937751	Heliostat	
2014_150_ISEGS	White-Throated Swift	WTSW	1	Carcass Survey	4/21/2014	Feather spot	8-24 hours	21+ singed flight feathers, 40+ singed contour feathers	Scorched or singed	Unknown	3	11 S 637533 3937791	Heliostat	
2014_151_ISEGS	Unknown Swallow	UNKN	1	Carcass Survey	4/21/2014	Feather spot	3-6 days	Two singed flight feathers	Scorched or singed	Unknown	3	11 S 637587 3937721	Heliostat	
2014_152_ISEGS	Nashville Warbler	NAWA	1	Incidental	4/21/2014	Dead, fresh (eyes moist)	8-24 hours	Head and sides charred, flight feathers melted and curled	Scorched or singed	2, 3	1	11 S 640357 3933524	Tower	
2014_153_ISEGS	Horned Lark	HOLA	1	Carcass Survey	4/22/2014	Feather spot	3-6 days	2 retrices, 70+ contour feathers.	Unknown	NA	1	11 S 640982 3934315	Heliostat	
2014_154_ISEGS	Brewer's Blackbird	BRBL	1	Carcass Survey	4/22/2014	Feather spot	3-6 days	6 retrices, 10 contour feathers.	Unknown	NA	1	11 S 640976 3934319	Heliostat	
2014_155_ISEGS	Yellow-rumped Warbler	YRWA	1	Carcass Survey	4/22/2014	Feather spot	3-6 days	1 retrix, 2 clumps of attached contour feathers, total of ~20 contour feathers. No singeing.	Unknown	NA	2	11 S 638724 3935815	Light Pole	
2014_156_ISEGS	Yellow-rumped Warbler	YRWA	1	Carcass Survey	4/22/2014	Feather spot	3-6 days	2 retrices	Scorched or singed	Unknown	2	11 S 638651 3935817	Project Building	

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2014_157_ISEGS	Mourning Dove	MODO	1	Carcass Survey	4/22/2014	Feather spot	3-6 days	1 primary, 1 scapular, 4 body feathers	Unknown	NA	2	11 S 638865 3935951	Heliostat	
2014_158_ISEGS	Costa's Hummingbird	COHU	1	Carcass Survey	4/22/2014	Dead, semi-fresh (eyes desiccated, rigor mortis)	3-6 days	Whole carcass. Singeing on R side of head and right flank.	Scorched or singed	3	2	11 S 638750 3935705	Heliostat	
2014_159_ISEGS	Unknown Hummingbird	UNKN	1	Carcass Survey	4/22/2014	Broken up	3-6 days	Partial carcass. Entire carcass scorched and singed. Bill missing, right leg disarticulated, a few wing feathers found, but most remiges and all retrices missing.	Scorched or singed	2, 3	2	11 S 638682 3935827	Project Building	
2014_160_ISEGS	Unknown Hummingbird	UNKN	1	Carcass Survey	4/22/2014	Dead, semi-fresh (eyes desiccated, rigor mortis)	3-6 days	Carcass. Tail missing, bill broken, All flight feathers curled and singed, entire dorsal surface singed, ~30-50% of ventral surface singed.	Scorched or singed	2, 3	2	11 S 638582 3935883	Steam Pipe	
2014_161_ISEGS	Yellow-rumped Warbler	YRWA	1	Carcass Survey	4/22/2014	Feather spot	3-6 days	20 flight and 10 body feathers	Unknown	NA	2	11 S 638586 3935930	Project Building	
2014_162_ISEGS	Brewer's Blackbird	BRBL	1	Carcass Survey	4/22/2014	Feather spot	3-6 days	Two primaries with coverts; all attached.	Unknown	NA	2	11 S 638787 3935999	Heliostat	
2014_163_ISEGS	Rufous Hummingbird	RUHU	1	Carcass Survey	4/22/2014	Dead, semi-fresh (eyes desiccated, rigor mortis)	3-6 days	Whole carcass. Singed crown, rump, tail feathers, and breast	Scorched or singed	3	2	11 S 638655 3935824	Project Building	
2014_164_ISEGS	Broad-Tailed Hummingbird	BTAH	1	Carcass Survey	4/22/2014	Dead, semi-fresh (eyes desiccated, rigor mortis)	3-6 days	Whole carcass. Singed back, crown, head, and wings	Scorched or singed	1, 3	2	11 S 638648 3935823	Project Building	
2014_165_ISEGS	Calliope Hummingbird	CAHU	1	Carcass Survey	4/22/2014	Dead, semi-fresh (eyes desiccated, rigor mortis)	3-6 days	Whole carcass. Singeing on head.	Scorched or singed	3	2	11 S 638611 3935876	Project Building	
2014_166_ISEGS	American Kestrel	AMKE	1	Carcass Survey	4/22/2014	Feather spot	3-6 days	1 wing feather with ~5 attached coverts	Unknown	NA	2	11 S 638900 3935782	Heliostat	
2014_167_ISEGS	Unknown Passerine	UNKN	1	Carcass Survey	4/22/2014	Feather spot	2 weeks	2 primaries, singed and curled.	Scorched or singed	Unknown	2	11 S 638491 3935759	Heliostat	
2014_168_ISEGS	Swallow Species	UNKN	1	Carcass Survey	4/22/2014	Feather spot	3-6 days	5 wing feathers, singed and curled; 1 loose, the rest attached at the base	Scorched or singed	Unknown	2	11 S 638705 3935703	Heliostat	
2014_169_ISEGS	Lincoln's Sparrow	LISP	1	Carcass Survey	4/22/2014	Feather spot	3-6 days	Partial right and left wing, 30+ body feathers	Unknown	NA	2	11 S 638859 3935872	Heliostat	
2014_170_ISEGS	Western Meadowlark	WEME	1	Carcass Survey	4/22/2014	Broken up	3-6 days	partial carcass + feather spot: 1 primary, 1 covert, 5 throat feathers, partial trachea	Unknown	NA	2	11 S 638626 3936039	Heliostat	Reclassified: Changed condition of bird/carcass from feather spot to broken up 10/17/2014 (S. Peterson)
2014_171_ISEGS	Anna's Hummingbird	ANHU	1	Incidental	4/22/2014	Dead, semi-fresh (eyes desiccated, rigor mortis)	3-6 days	whole carcass. Singed tail and rump. Missing front part of head and bill.	Scorched or singed	1, 3	2	11 S 638637 3935812	Street Light	Changed “How Found” from carcass survey to incidental 10/21/14 (B. Sousa).

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2014_172_ISEGS	Hermit Warbler	HEWA	1	Incidental	4/22/2014	Dead, semi-fresh (eyes desiccated, rigor mortis)	8-24 hours	Partial carcass, head and torso. Scavenged by raven.	Unknown	NA	NA	11 S 639747 3934827	Road	
2014_173_ISEGS	Horned Lark	HOLA	1	Carcass Survey	4/23/2014	Broken up	3 weeks	headless body impaled on barrel cactus	Collision with solar panel/heliostat	NA	2	11 S 638347 3936378	Heliostat	
2014_174_ISEGS	Costa's Hummingbird	COHU	1	Incidental	4/24/2014	Dead, semi-fresh (eyes desiccated, rigor mortis)	0-8 hours	Whole carcass. Feathers on wings, tail, and throat melted and curled.	Scorched or singed	2, 3	2	11 S 638615 3935814	Parking area	
2014_175_ISEGS	White-Throated Swift	WTSW	1	Incidental	4/24/2014	Alive, injured¥	0-8 hours	Melting and curling of flight feathers and back.	Scorched or singed	2, 3	3	11 S 637451 3937915	Dumpster	
2014_176_ISEGS	Brewer's Sparrow	BRSP	1	Carcass Survey	4/25/2014	Alive, injured*	0-8 hours	Kirk Setser observed bird strike mirror and drop to the base of heliostat, face down. Eyes were closed initially and did not move. Bird came to and eyes opened when picked up. Bird flew from hand	Collision with solar panel/heliostat	NA	2	11 S 638603 3937164	Heliostat	
2014_177_ISEGS	Costa's Hummingbird	COHU	1	Incidental	4/27/2014	Dead, semi-fresh (eyes desiccated, rigor mortis)	3-6 days	Severe charring. Whole carcass.	Scorched or singed	2, 3	2	11 S 638624 3935819	Parking area	
2014_178_ISEGS	Costa's Hummingbird	COHU	1	Carcass Survey	4/27/2014	Dead, semi-fresh (eyes desiccated, rigor mortis)	8-24 hours	Whole carcass. In good condition. Eyes not moist, but not completely sunken.	Unknown	NA	1	11 S 640819 3933685	Heliostat	
2014_179_ISEGS	Townsend's Warbler	TOWA	1	Incidental	4/27/2014	Dead, semi-fresh (eyes desiccated, rigor mortis)	8-24 hours	Severe charring. Whole carcass.	Scorched or singed	2, 3	1	11 S 640358 3933470	Road	
2014_180_ISEGS	Costa's Hummingbird	COHU	1	Incidental	4/28/2014	Alive, injured	0-8 hours	Singed feathers on back and left side of body and on right side along flared throat feathers.	Scorched or singed	2, 3	2	11 S 638618 3935880	Ground	
2014_181_ISEGS	Rufous Hummingbird	RUHU	1	Carcass Survey	4/28/2014	Alive, injured¥	0-8 hours	Singed left flank; underwing, nape, upper coverts, left wing, tail	Scorched or singed	2, 3	3	11 S 637499 3937921	Solar Concentrating Tower	
2014_182_ISEGS	Wilson's Warbler	WIWA	1	Carcass Survey	4/28/2014	Dead, fresh (eyes moist)	0-8 hours	No external trauma present; no singeing	Unknown	NA	3	11 S 637504 3937883	Solar Concentrating Tower	
2014_183_ISEGS	Unknown Swallow	UNKN	1	Carcass Survey	4/28/2014	Feather spot	3 weeks	Single singed flight feather	Scorched or singed	Unknown	3	11 S 637465 3937955	Solar Concentrating Tower	
2014_184_ISEGS	Unknown Passerine	UNKN	1	Carcass Survey	4/28/2014	Feather spot	3-6 days	30 plus body feathers	Unknown	NA	3	11 S 637417 3937664	Heliostat	
2014_185_ISEGS	Rufous Hummingbird	RUHU	1	Carcass Survey	4/28/2014	Broken up	3-6 days	Singed nape, contour feathers	Scorched or singed	1, 3	3	11 S 637430 3937786	Heliostat	
2014_186_ISEGS	Tree Swallow	TRES	1	Incidental	4/28/2014	Alive, injured‡	0-8 hours	singed wing and tail feathers	Scorched or singed	2, 3	2	11 S 638705 3935857	Auxilary Boiler	

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2014_187_ISEGS	Unknown Warbler	UNKN	1	Carcass Survey	4/29/2014	Dead, semi-fresh (eyes desiccated, rigor mortis)	3-6 days	Entire body singed	Scorched or singed	2, 3	2	11 S 638679 3935875	Solar Concentrating Tower	
2014_188_ISEGS	Rufous Hummingbird	RUHU	1	Carcass Survey	4/29/2014	Dead, semi-fresh (eyes desiccated, rigor mortis)	3-6 days	Entire body singed	Scorched or singed	2, 3	2	11 S 638643 3935884	ACC Building°	
2014_189_ISEGS	Yellow-rumped Warbler	YRWA	1	Carcass Survey	4/29/2014	Feather spot	2 weeks	12+ flight; 30+ body feathers	Unknown	NA	2	11 S 638700 3935844	Cement Pond	
2014_190_ISEGS	White-Crowned Sparrow	WCSP	1	Carcass Survey	4/29/2014	Dead, fresh (eyes moist)	8-24 hours	Whole carcass. No singeing. Nondescript smudge on heliostat.	Collision with solar panel/heliostat	NA	2	11 S 638584 3936021	Heliostat	
2014_191_ISEGS	White-Crowned Sparrow	WCSP	1	Carcass Survey	4/29/2014	Broken up	3-6 days	partial carcass + feather spot: Partial wing, guts, and some feathers stuck to heliostat. 9+ retrices and 100+ body feathers under heliostat.	Predated	NA	1	11 S 641292 3933921	Heliostat	Reclassified: Changed condition of bird/carcass from feather spot to broken up 10/17/2014 (S. Peterson)
2014_192_ISEGS	Barn Swallow	BARS	1	Carcass Survey	4/29/2014	Feather spot	3-6 days	5 primaries and 5 secondaries that were singed. 12+ coverts.	Scorched or singed	Unknown	2	11 S 638508 3935706	Heliostat	
2014_193_ISEGS	Horned Lark	HOLA	1	Carcass Survey	4/29/2014	Dead, fresh (eyes moist)	0-8 hours	Whole carcass. Smudge on mirror. Bill bloody; eyes moist, body limber. Next to 2014_194_ISEGS.	Collision with solar panel/heliostat	NA	3	11 S 637854 3937713	Heliostat	
2014_194_ISEGS	Horned Lark	HOLA	1	Carcass Survey	4/29/2014	Dead, fresh (eyes moist)	0-8 hours	Whole carcass. Smudge on heliostat. Next to 2014_193_ISEGS. Eyes moist, body limber.	Collision with solar panel/heliostat	NA	3	11 S 637854 3937712	Heliostat	
2014_195_ISEGS	Mourning Dove	MODO	1	Incidental	5/1/2014	Dead, semi-fresh (eyes desiccated, rigor mortis)	3-6 days	Whole carcass. No external signs of trauma.	Unknown	NA	2	11 S 638382 3936008	Heliostat	
2014_196_ISEGS	Mourning Dove	MODO	1	Carcass Survey	5/1/2014	Feather spot	3 weeks	Feather spot of flight and body feathers	Unknown	NA	2	11 S 637882 3935361	Heliostat	
2014_197_ISEGS	Yellow-rumped Warbler	YRWA	1	Incidental	5/2/2014	Dead, fresh (eyes moist)	0-8 hours	Singed carcass; nape, rump, tail and right wing feathers singed.	Scorched or singed	1, 3	2	11 S 638592 3935873	Solar Concentrating Tower	
2014_198_ISEGS	Cliff Swallow	CLSW	1	Incidental	5/2/2014	Dead, fresh (eyes moist)	8-24 hours	Singed carcass; entire body scorched, flight feathers, back, rump, head	Scorched or singed	2, 3	2	11 S 638567 3935884	Solar Concentrating Tower	
2014_199_ISEGS	Loggerhead Shrike	LOSH	1	Carcass Survey	5/2/2014	Broken up	3-6 days	entire left wing	Unknown	NA	2	11 S 639473 3936928	Heliostat	
2014_200_ISEGS	Violet Green Swallow	VGSW	1	Incidental	5/2/2014	Dead, fresh (eyes moist)	0-8 hours	Singed wings, tail and rump feathers	Scorched or singed	1	3	11 S 637443 3937973	ACC Building	
2014_201_ISEGS	Cliff Swallow	CLSW	1	Incidental	5/2/2014	Dead, fresh (eyes moist)	8-24 hours	Singed tail, wing feathers curled, nape singed	Scorched or singed	2	1	11 S 640360 3933587	Solar Concentrating Tower	
2014_202_ISEGS	Calliope Hummingbird	CAHU	1	Incidental	5/2/2014	Dead, fresh (eyes moist)	0-8 hours	rump, tail feathers singed	Scorched or singed	1	1	11 S 640342 3933487	Project Building	
2014_203_ISEGS	Costa's Hummingbird	COHU	1	Incidental	5/2/2014	Dead, fresh (eyes moist)	0-8 hours	most of tail burnt off; right flank singed	Scorched or singed	1	1	11 S 640405 3933590	ACC Building	
2014_204_ISEGS	Lesser Goldfinch	LEGO	1	Incidental	5/2/2014	Dead, fresh (eyes moist)	0-8 hours	wing and tail feathers singed and curled	Scorched or singed	2	1	11 S 640400 3933520	Solar Concentrating Tower	

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2014_205_ISEGS	Violet Green Swallow	VGSW	1	Incidental	5/2/2014	Dead, fresh (eyes moist)	0-8 hours	wing, tail feather singed and curled	Scorched or singed	2	1	11 S 640394 3933520	ACC Building	
2014_206_ISEGS	Barn Swallow	BARS	1	Incidental	5/2/2014	Dead, fresh (eyes moist)	0-8 hours	Entire body singed; head; flight feathers, body feathers, back	Scorched or singed	2, 3	1	11 S 640332 3933509	ACC Building	
2014_207_ISEGS	Cliff Swallow	CLSW	1	Incidental	5/2/2014	Dead, fresh (eyes moist)	0-8 hours	wing and tail feathers singed and curled	Scorched or singed	1	1	11 S 640325 3933513	Solar Concentrating Tower	
2014_208_ISEGS	Barn Swallow	BARS	1	Incidental	5/2/2014	Dead, fresh (eyes moist)	0-8 hours	wing, tail feathers, nape, rump, head singed	Scorched or singed	2, 3	1	11 S 640300 3933508	Solar Concentrating Tower	
2014_209_ISEGS	Cliff Swallow	CLSW	1	Carcass Survey	5/3/2014	Dead, fresh (eyes moist)	0-8 hours	singed greater coverts, retrices, tips of some primaries. Head, face, breast and armpits also singed.	Scorched or singed	1	1	11 S 640191 3933436	Heliostat	
2014_210_ISEGS	Barn Swallow	BARS	1	Carcass Survey	5/3/2014	Dead, fresh (eyes moist)	0-8 hours	Singed covets, primaries, retrices, rump, cloacal protrubence. Right side of head and right eye singed.	Scorched or singed	2, 3	1	11 S 640594 3933480	Heliostat	
2014_211_ISEGS	Yellow-rumped Warbler	YRWA	1	Carcass Survey	5/3/2014	Dead, semi-fresh (eyes desiccated, rigor mortis)	8-24 hours	All flight feathers singed and curled. Entire face singed. Upper breast, both sides, undertail coverts, and upper back singed.	Scorched or singed	2, 3	1	11 S 640376 3933543	ACC Building°	
2014_212_ISEGS	Bank Swallow	BANS	1	Carcass Survey	5/5/2014	Dead, semi-fresh (eyes desiccated, rigor mortis)	3-6 days	Singeing on body. Wing feathers curled and singed.	Scorched or singed	2, 3	1	11 S 640368 3933536	ACC Building°	
2014_213_ISEGS	Rufous Hummingbird	RUHU	1	Carcass Survey	5/3/2014	Dead, semi-fresh (eyes desiccated, rigor mortis)	3-6 days	Whole carcass. No singeing or clear sign of injury.	Other	NA	1	11 S 640391 3933546	ACC Building°	
2014_214_ISEGS	Cliff Swallow	CLSW	1	Carcass Survey	5/3/2014	Dead, fresh (eyes moist)	8-24 hours	All flight feathers singed and curled. Back and under wings singed,	Scorched or singed	2, 3	1	11 S 640386 3933555	ACC Building°	
2014_215_ISEGS	Nashville Warbler	NAWA	1	Carcass Survey	5/3/2014	Dead, semi-fresh (eyes desiccated, rigor mortis)	2 days	Tail and R wing feathers singed and curled. Singed R ventral side. Singed head and back. All wing coverts singed.	Scorched or singed	2, 3	1	11 S 640364 3933554	ACC Building°	
2014_216_ISEGS	Northern Rough-winged Swallow	NRWS	1	Carcass Survey	5/3/2014	Dead, semi-fresh (eyes desiccated, rigor mortis)	3-6 days	No external trauma present; no singeing	Other	NA	1	11 S 640419 3933555	ACC Building°	
2014_217_ISEGS	Bank Swallow	BANS	1	Carcass Survey	5/5/2014	Dead, semi-fresh (eyes desiccated, rigor mortis)	3-6 days	All flight feathers singed. Most tail feathers missing. Entire dorsal surface singed.	Scorched or singed	2, 3	1	11 S 640387 3933532	ACC Building°	
2014_218_ISEGS	Lazuli Bunting	LAZB	1	Carcass Survey	5/3/2014	Alive, injured‡	0-8 hours	Singed over 90% of back. Tail missing. All flight feathers singed and curled.	Scorched or singed	2, 3	1	11 S 640407 3933558	ACC Building°	
2014_219_ISEGS	Barn Swallow	BARS	1	Carcass Survey	5/3/2014	Alive, injured‡	0-8 hours	All flight feathers singed and curled. ~70% of tail feathers missing. Back singed. Right side of face singed and right eye cloudy and half closed.	Scorched or singed	2, 3	1	11 S 640308 3933555	Project Building	

USFWS #	Common Name	Species Code	Number Individuals	How Detected	Collection Date	Bird/Carcass Condition[1]	Time Since Death/Injury	Description of Carcass/Injury	Cause of Injury or Mortality[2]	Burn Grade	Unit	UTM Coordinates[3]	Nearest Project Feature	SPUT Revisions[4]
2014_220_ISEGS	Yellow-rumped Warbler	YRWA	1	Carcass Survey	5/4/2014	Dead, semi-fresh (eyes desiccated, rigor mortis)	3-6 days	Full carcass, half eaten by ants. skull fully exposed. Indistinct smudge on nearby mirror, but no clear injuries or cause of death.	Collision with solar panel/heliostat	NA	1	11 S 640044 3933166	Heliostat	
2014_221_ISEGS	Mourning Dove	MODO	1	Carcass Survey	5/5/2014	Feather spot	3-6 days	~200 body, ~15 flight feathers	Collision with solar panel/heliostat	NA	1	11 S 639618 3932767	Heliostat	
2014_222_ISEGS	Ash-Throated Flycatcher	ATFL	1	Carcass Survey	5/5/2014	Dead, semi-fresh (eyes desiccated, rigor mortis)	3-6 days	full carcass; ants on carcass; eyes gone	Collision with solar panel/heliostat	NA	1	11 S 639441 3933325	Heliostat	
2014_223_ISEGS	Rufous Hummingbird	RUHU	1	Carcass Survey	5/5/2014	Feather spot	3-6 days	5 flight and 18 body feathers	Unknown	NA	3	11 S 637651 3937864	Heliostat	
2014_224_ISEGS	Mourning Dove	MODO	1	Carcass Survey	5/5/2014	Feather spot	8-24 hours	10-12 flight and 20 body feathers	Unknown	NA	3	11 S 637544 3937762	Heliostat	
2014_225_ISEGS	Lazuli Bunting	LAZB	1	Incidental	5/5/2014	Dead, fresh (eyes moist)	0-8 hours	Singed back, crown, rump. Body feathers, tail feathers curled; Singeing grade 1 and 3	Scorched or singed	1, 3	1	11 S 640436 3933527	Solar Concentrating Tower	
2014_226_ISEGS	Wilson's Warbler	WIWA	1	Incidental	5/5/2014	Dead, fresh (eyes moist)	0-8 hours	No external trauma present; no singeing	Unknown	NA	1	11 S 640436 3933521	Solar Concentrating Tower	
2014_227_ISEGS	Yellow-rumped Warbler	YRWA	1	Carcass Survey	5/6/2014	Dead, semi-fresh (eyes desiccated, rigor mortis)	2 days	Singeing on wings, tail, nape, rump, back and head; Singeing grade 2 and 3	Scorched or singed	2, 3	2	11 S 638649 3935918	Project Building°	
2014_228_ISEGS	Bank Swallow	BANS	1	Carcass Survey	5/6/2014	Dead, semi-fresh (eyes desiccated, rigor mortis)	3-6 days	Tail, wing feathers singed; chest singed nape, top of head	Scorched or singed	2, 3	2	11 S 638634 3935897	Project Building°	
2014_229_ISEGS	Yellow Warbler	YEWA	1	Carcass Survey	5/6/2014	Dead, semi-fresh (eyes desiccated, rigor mortis)	3-6 days	Little singeing on nape, left of neck and small amount on tips of wing feathers	Scorched or singed	1	2	11 S 638639 3935907	Project Building°	
2014_230_ISEGS	Tree Swallow	TRES	1	Carcass Survey	5/6/2014	Dead, fresh (eyes moist)	0-8 hours	Singeing on flight, contour feathers, nape	Scorched or singed	2, 3	2	11 S 638559 3935890	Other	
2014_231_ISEGS	Black-Throated Sparrow	BTSP	1	Carcass Survey	5/6/2014	Dead, semi-fresh (eyes desiccated, rigor mortis)	3-6 days	Intact carcass; feathers in good condition	Unknown	NA	1	11 S 640702 3932683	Heliostat	
2014_232_ISEGS	Western Kingbird	WEKI	1	Carcass Survey	5/6/2014	Alive, injured[¥]	8-24 hours	Injured right wing, no singeing or sign of other external trauma.	Unknown	NA	2	11 S 638927 3937413	Fencing	
2014_233_ISEGS	Unknown Hummingbird	UNKN	1	Incidental	5/6/2014	Mummified	3-6 days	Entire body burned. Missing feathers over most of its body. Skull and keel exposed. Bill broken.	Scorched or singed	2, 3	2	11 S 638673 3935851	Solar Concentrating Tower	
2014_234_ISEGS	Anna's Hummingbird	ANHU	1	Incidental	5/7/2014	Dead, fresh (eyes moist)	0-8 hours	Entire ventral surface singed. Tail, head, nape, and flanks singed.	Scorched or singed	1, 3	3	11 S 637381 3937881	Solar Concentrating Tower	
2014_235_ISEGS	Mourning Dove	MODO	1	Carcass Survey	5/7/2014	Dead, semi-fresh (eyes desiccated, rigor mortis)	3-6 days	Whole carcass. No obvious external injuries	Unknown	NA	3	11 S 637041 3936878	Heliostat	

USFWS #	Common Name	Species Code	Number Individuals	How Detected	Collection Date	Bird/Carcass Condition[1]	Time Since Death/Injury	Description of Carcass/Injury	Cause of Injury or Mortality[2]	Burn Grade	Unit	UTM Coordinates[3]	Nearest Project Feature	SPUT Revisions[4]
2014_236_ISEGS	Olive-Sided Flycatcher	OSFL	1	Incidental	5/7/2014	Feather spot	3-6 days	Feather spot of flight and body feathers	Unknown	NA	NA	11 S 639572 3935071	Transmission Line	
2014_237_ISEGS	Horned Lark	HOLA	1	Carcass Survey	5/8/2014	Feather spot	3 weeks	Feather spot of breast feathers with limited dried skin attached; has no bones attached	Unknown	NA	2	11 S 638268 3935174	Heliostat	Reclassified: Changed condition of bird/carcass from carcass to feather spot because no bones were attached 10/17/2014 (S. Peterson)
2014_238_ISEGS	Yellow-rumped Warbler	YRWA	1	Incidental	5/8/2014	Dead, fresh (eyes moist)	0-8 hours	Head, neck, sides, tail, and wings singed.	Scorched or singed	2, 3	1	11 S 640267 3933481	Other	
2014_239_ISEGS	Mourning Dove	MODO	1	Carcass Survey	5/9/2014	Feather spot	3-6 days	Large amount of flight and body feathers found in a ~20 ft diameter scattered all around a heliostat	Unknown	NA	2	11 S 638190 3936806	Heliostat	
2014_240_ISEGS	Unknown Passerine	UNKN	1	Incidental	5/10/2014	Feather spot	Unknown	Scavenged by raven, only feathers remained	Unknown	NA	NA	11 S 639692 3934871	Ground	Unit changed from "CLA" to "NA" 10/14/2014 (B. Sousa).
2014_241_ISEGS	Costa's Hummingbird	COHU	1	Carcass Survey	5/10/2014	Dead, semi-fresh (eyes desiccated, rigor mortis)	3-6 days	R ventral side, L rump, both dorsal sides and chin singed. L retrices singed/curled.	Scorched or singed	1, 3	1	11 S 640406 3933549	ACC Building°	
2014_242_ISEGS	Unknown bird	UNKN	1	Carcass Survey	5/10/2014	Broken up	3 weeks	partial carcass + feather spot: Foot, some feathers. May be part of a CORA pellet.	Other	NA	1	11 S 640399 3933549	ACC Building°	Reclassified: Changed condition of bird/carcass from feather spot to broken up 10/17/2014 (S. Peterson)
2014_243_ISEGS	Wilson's Warbler	WIWA	1	Carcass Survey	5/10/2014	Dead, fresh (eyes moist)	0-8 hours	Whole carcass. Crown, wing coverts, nape and rump singed. All flight feathers singed and curled.	Scorched or singed	2, 3	1	11 S 640402 3933434	berm	
2014_244_ISEGS	Unknown Hummingbird	UNKN	1	Carcass Survey	5/10/2014	Dead, semi-fresh (eyes desiccated, rigor mortis)	2 days	Whole carcass. Most primaries curled. Tail singed off. All dorsal body feathers singed.	Scorched or singed	2, 3	1	11 S 640488 3933590	Heliostat	
2014_245_ISEGS	Vaux's Swift	VASW	1	Carcass Survey	5/10/2014	Dead, semi-fresh (eyes desiccated, rigor mortis)	3-6 days	Whole carcass. Tail and wings singed and curled.	Scorched or singed	2	1	11 S 640542 3933553	Heliostat	
2014_246_ISEGS	Rufous Hummingbird	RUHU	1	Carcass Survey	5/10/2014	Dead, semi-fresh (eyes desiccated, rigor mortis)	3-6 days	Whole carcass. Most flight feathers curled, back and head and dorsal feathers singed.	Scorched or singed	2, 3	1	11 S 640538 3933555	Heliostat	
2014_247_ISEGS	Townsend's Warbler	TOWA	1	Carcass Survey	5/10/2014	Dead, fresh (eyes moist)	8-24 hours	Whole carcass. No obvious external injuries	Unknown	NA	1	11 S 640471 3933534	Heliostat	
2014_248_ISEGS	Unknown Swift	UNKN	1	Carcass Survey	5/10/2014	Dead, semi-fresh (eyes desiccated, rigor mortis)	2 weeks	Whole carcass. Tail and most flight feathers burned off. Missing most of ventral feathers, rest are singed. L side singed. Back of skull exposed.	Scorched or singed	2, 3	1	11 S 640378 3933523	Solar Concentrating Tower	
2014_249_ISEGS	Hermit Warbler	HEWA	1	Carcass Survey	5/10/2014	Dead, fresh (eyes moist)	0-8 hours	Whole carcass. No obvious external injuries	Unknown	NA	1	11 S 640437 3933525	ACC Building	

USFWS #	Common Name	Species Code	Number Individuals	How Detected	Collection Date	Bird/Carcass Condition[1]	Time Since Death/Injury	Description of Carcass/Injury	Cause of Injury or Mortality[2]	Burn Grade	Unit	UTM Coordinates[3]	Nearest Project Feature	SPUT Revisions[4]
2014_250_ISEGS	Horned Lark	HOLA	1	Carcass Survey	5/10/2014	Broken up	2 weeks	partial carcass + feather spot: 2 retrices, partial wing, 1 breast feather. Some curling and small amount of singeing on partial wing.	Scorched or singed	Unknown	1	11 S 640385 3933351	Heliostat	Reclassified: Changed condition of bird/carcass from feather spot to broken up 10/17/2014 (S. Peterson)
2014_251_ISEGS	Yellow-rumped Warbler	YRWA	1	Carcass Survey	5/10/2014	Dead, fresh (eyes moist)	8-24 hours	Whole carcass. No obvious external injuries	Unknown	NA	1	11 S 640207 3933670	Heliostat	
2014_252_ISEGS	Mourning Dove	MODO	1	Carcass Survey	5/10/2014	Feather spot	8-24 hours	5 primaries, 2 secondaries, 3 retrices, 15+ breast feathers. No sign of damage to feathers.	Unknown	NA	1	11 S 640193 3933518	berm	
2014_253_ISEGS	Lesser Nighthawk	LENI	1	Incidental	5/11/2014	Dead, fresh (eyes moist)	0-8 hours	whole carcass	Unknown	NA	1	11 S 640318 3933485	Solar Concentrating Tower	
2014_254_ISEGS	Black-Headed Grosbeak	BHGR	1	Carcass Survey	5/14/2014	Feather spot	7 days	partial wing consisting of 5 primaries and their associated coverts, attached by skin; 5 additional flight feathers and ~30 contour feathers. No sign of singeing or collision.	Unknown	NA	2	11 S 638987 3936190	Heliostat	Reclassified: Changed condition of bird/carcass to "feather spot", added "attached by skin" in description of carcass 10/17/2014 (S. Peterson).
2014_255_ISEGS	Yellow-Breasted Chat	YBCH	1	Carcass Survey	5/14/2014	Broken up	1 month +	Right wing only; scavenged	Unknown	NA	2	11 S 638312 3935559	Heliostat	
2014_256_ISEGS	Nashville Warbler	NAWA	1	Incidental	5/14/2014	Dead, fresh (eyes moist)	8-24 hours	singed head, side of face, wings, tail feathers singed; Singeing Grade 2 and 3	Scorched or singed	2, 3	3	11 S 637456 3937888	Solar Concentrating Tower	
2014_257_ISEGS	Barn Swallow	BARS	1	Carcass Survey	5/15/2014	Broken up	8-24 hours	Portions of 2 wings; breast, keel present with feathers; fresh blood and organs; singed wing, covert, and body feathers; Singeing grade 1 and 3	Scorched or singed	1, 3	2	11 S 638299 3935229	Heliostat	
2014_258_ISEGS	Unknown Passerine	UNKN	1	Incidental	5/16/2014	Feather spot	0-8 hours	~40 Flight feathers singed and curled; body feathers singed	Scorched or singed	2, 3	3	11 S 637365 3937988	Light Pole	
2014_259_ISEGS	Lesser Nighthawk	LENI	1	Carcass Survey	5/20/2014	Broken up	2 weeks	eyes gone, feathers fluffy, carcass missing guts, muscle	Unknown	NA	1	11 S 639934 3933339	Heliostat	
2014_260_ISEGS	Unknown Passerine	UNKN	1	Carcass Survey	5/21/2014	Feather spot	1 month +	4 flight feathers	Unknown	NA	1	11 S 639916 3932885	Heliostat	
2014_261_ISEGS	Unknown Hummingbird	UNHU	1	Incidental	5/22/2014	Dead, fresh (eyes moist)	0-8 hours	whole carcass. Head and body singed. All flight feathers singed; tail gone.	Scorched or singed	2, 3	3	11 S 637438 3937948	ACC Building	

[1] In the original spring report, partial carcasses that were very small and that contained relatively few (or inconspicuous) bones or pieces of flesh, such as a wing of a small bird or a piece of wing, were considered feather spots. In this revised spring report, the definition of a feather spot has been clarified that they are without significant skin or flesh, or any bone, attached. All detections with significant skin or flesh, or any bone, were considered detections in this revised report but were considered carcasses, not feather spots.

[2] "Unknown" cause of death = no evidence of singeing and no clear evidence of what caused the fatality; "Singed" = evidence of singeing on the carcass or feather spot; "Collision" = evidence of collision was observed, such as a bird-strike imprint and/or feathers on a heliostat above the detection; "Other" = a detection with a known cause without signs of collision or singeing (in spring 2014, all "other" detections were of birds found in the ACC units).

Where sufficient information was available for earlier detections, singed carcass detections were assigned a singeing grade based on Kagan et al. (2014), as follows:

- Grade 1 – curling of less than 50% of the flight feathers
- Grade 2 – curling of 50% or more of the flight feathers
- Grade 3 – curling and visible charring of contour feathers

Grades were not applied in the case of feather spots or partial carcasses.

[3] UTM = Universal Transverse Mercator coordinate system

[4] This column indicates changes that were made after the initial SPUT database entry; the "Additional Information and Notes" column in the SPUT database may contain additional information.

† Still alive at rehabilitation facility as of October 23, 2014.
* Released alive.
‡ Died en route to rehabilitation facility.
¥ Died at rehabilitation facility.
º Found inside ACC building.

Appendix B. Additional Detection Data for Fatality Estimates and Documentation of Fatality Estimates in Which Each Detection Was Included

		Variables for Fatality Estimator						Fatality Estimates in Which Each Detection was Included						
FWS #[1]	Location	Distance from Tower (m)	Size	Model Category[2]	Cause of Death/ Injury[3]	Incidental	Time Since Last Survey (days)[4]	Used in Estimator[5]	Tower Area	Heliostat Area	Power Block	ACC Building	Inner HD	Estimator Notes[6]
2014-61 -ISEGS	Outer Segment‡	820	Small	Feather Spot	Unknown	Yes	NA	No						Outside of survey area
2014-61 -ISEGS	Outer Segment‡	820	Small	Feather Spot	Unknown	Yes	NA	No						Outside of survey area
2014-62 -ISEGS	Power Block	2	Small	Carcass	Singeing	Yes	27	Yes	X		X			
2014-63 -ISEGS	Power Block	24	Small	Carcass	Singeing	Yes	27	Yes	X		X			
2014-64 -ISEGS	Power Block*	37	Small	Carcass	Singeing	Yes	27	No				X		In ACC, added after
2014-65 -ISEGS	Outer Segment	1190	Unknown	Feather Spot	Unknown	No	12	No						Older than search interval
2014-66 -ISEGS	Outer Segment	1190	Small	Carcass	Collision	No	12	Yes		X				
2014-67 -ISEGS	Power Block*	60	Small	Carcass	Singeing	No	28	No				X		In ACC, added after
2014-68 -ISEGS	Power Block	60	Small	Carcass	Singeing	No	28	Yes	X		X			
2014-69 -ISEGS	Inner HD	110	Small	Carcass	Singeing	No	22	Yes	X				X	
2014-70 -ISEGS	Inner HD	190	Large	Carcass	Unknown	No	28	Yes	X				X	
2014-71 -ISEGS	Inner HD	240	Large	Feather Spot	Unknown	No	28	No						Older than search interval
2014-72 -ISEGS	Power Block	100	Small	Feather Spot	Singeing	No	28	Yes	X		X			
2014-73 -ISEGS	Inner HD	230	Small	Feather Spot	Unknown	No	22	Yes	X				X	
2014-74 -ISEGS	Inner HD	253	Small	Carcass	Unknown	No	28	Yes	X				X	
2014-75 -ISEGS	Inner HD	240	Large	Feather Spot	Unknown	No	28	Yes	X				X	
2014-76 -ISEGS	Power Block*	50	Small	Feather Spot	Other	No	28	No				X		In ACC, added after
2014-77 -ISEGS	Inner HD	200	Small	Feather Spot	Singeing	No	28	Yes	X				X	
2014-78 -ISEGS	Inner HD	200	Small	Feather Spot	Unknown	No	28	No						Older than search interval
2014-79 -ISEGS	Outer Segment	760	Large	Carcass	Unknown	No	21	Yes		X				
2014-80 -ISEGS	Outer Segment	830	Large	Carcass	Unknown	No	21	Yes		X				
2014-81 -ISEGS	Outer Segment	1000	Small	Carcass	Unknown	No	22	Yes		X				
2014-82 -ISEGS	Outer Segment	700	Small	Feather Spot	Unknown	No	21	Yes		X				
2014-83 -ISEGS	Outer Segment	750	Small	Carcass	Unknown	No	21	Yes		X				
2014-84 -ISEGS	Outer Segment	860	Small	Feather Spot	Unknown	No	22	Yes		X				
2014-85 -ISEGS	Inner HD	126	Small	Feather Spot	Singeing	No	19	Yes	X				X	
2014-86 -ISEGS	Inner HD	86	Small	Feather Spot	Singeing	No	19	Yes	X				X	
2014-87 -ISEGS	Inner HD	150	Unknown	Feather Spot	Unknown	No	19	Yes	X				X	
2014-88 -ISEGS	Inner HD	250	Small	Carcass	Unknown	No	19	Yes	X				X	
2014-89 -ISEGS	Power Block*	40	Large	Feather Spot	Other	No	19	No				X		In ACC, added after
2014-90-ISEGS	Power Block	14	Large	Carcass	Collision	Yes	1	Yes	X		X			
2014-91 -ISEGS	Power Block	43	Small	Carcass	Singeing	Yes	6	No						Older than search interval
2014-92 -ISEGS	Inner HD	220	Unknown	Feather Spot	Unknown	No	6	Yes	X				X	
2014-93 -ISEGS	Inner HD	240	Raptor	Feather Spot	Singeing	No	6	Yes	X				X	

Variables for Fatality Estimator								Fatality Estimates in Which Each Detection was Included						
FWS #[1]	Location	Distance from Tower (m)	Size	Model Category[2]	Cause of Death/ Injury[3]	Incidental	Time Since Last Survey (days)[4]	Used in Estimator[5]	Tower Area	Heliostat Area	Power Block	ACC Building	Inner HD	Estimator Notes[6]
2014-94 -ISEGS	Power Block*	78	Small	Carcass	Singeing	No	6	No				X		In ACC, added after
2014-95 -ISEGS	Inner HD	243	Small	Feather Spot	Unknown	No	7	Yes	X				X	
2014-96 -ISEGS	Inner HD	180	Small	Carcass	Unknown	No	7	No						Older than search interval
2014-97 -ISEGS	Inner HD	240	Small	Carcass	Unknown	No	7	No						Older than search interval
2014-98 -ISEGS	Inner Segment	390	Large	Feather Spot	Unknown	No	7	No						Older than search interval
2014-99 -ISEGS	Power Block*	61	Small	Carcass	Singeing	No	7	No				X		In ACC, added after
2014-100-ISEGS	Outer Segment	775	Large	Feather Spot	Unknown	No	9	Yes		X				
2014-101-ISEGS	Outer Segment	750	Small	feather spot	Collision	No	9	Yes		X				
2014-102-ISEGS	Outer Segment	1400	Large	Carcass	Collision	No	9	No						Older than search interval
2014-103-ISEGS	Outer Segment	785	Small	Carcass	Collision	No	11	Yes		X				
2014-104-ISEGS	Power Block	0	Small	Carcass	Singeing	No	7	Yes	X		X			
2014-105-ISEGS	Inner Segment	239	Raptor	Carcass	Singeing	No	7	Yes		X				
2014-106-ISEGS	Power Block	60	Large	Feather Spot	Unknown	No	7	No						Older than search interval
2014-107-ISEGS	Inner HD	110	Unknown	Carcass	Unknown	No	7	No						Older than search interval
2014-108-ISEGS	Inner Segment	670	Large	Feather Spot	Unknown	No	26	No						Older than search interval
2014-109-ISEGS	Inner HD	200	Raptor	Feather Spot	Singeing	No	7	Yes	X				X	
2014-110-ISEGS	Inner Segment	780	Large	Feather Spot	Unknown	No	7	Yes		X				
2014-111-ISEGS	Inner Segment	800	Small	Feather Spot	Unknown	No	7	Yes		X				
2014-112-ISEGS	Power Block	55	Small	Carcass	Singeing	Yes	2	Yes	X		X			
2014-113-ISEGS	Power Block	20	Small	Carcass	Singeing	Yes	2	Yes	X		X			
2014-114-ISEGS	Fence	1030	Small	Carcass	Unknown	No	7	No						Sample size insufficient for fence
2014-115-ISEGS	Outer Segment	900	Small	Carcass	Collision	No	8	Yes		X				
2014-116-ISEGS	Power Block	100	Small	Carcass	Singeing	No	7	Yes	X		X			
2014-117-ISEGS	Power Block	130	Small	Carcass	Singeing	No	7	Yes	X		X			
2014-118-ISEGS	Inner HD	77	Small	Feather Spot	Singeing	No	7	Yes	X				X	
2014-119-ISEGS	Inner HD	190	Small	Feather Spot	Unknown	No	7	Yes	X				X	
2014-120-ISEGS	Inner HD	110	Small	Feather Spot	Singeing	No	7	Yes	X				X	
2014-121-ISEGS	Inner HD	200	Small	Carcass	Singeing	No	7	Yes	X				X	
2014-122-ISEGS	Power Block	53	Large	Carcass	Unknown	Yes	4	Yes	X		X			
2014-123-ISEGS	Power Block	30	Small	Carcass	Singeing	Yes	4	Yes	X		X			
2014-124-ISEGS	Inner Segment	690	Small	Feather Spot	Unknown	No	7	Yes		X				
2014-125-ISEGS	Inner Segment	290	Small	Carcass	Singeing	No	7	Yes		X				
2014-126-ISEGS	Inner HD	230	Large	Feather Spot	Unknown	No	7	No						Older than search interval
2014-127-ISEGS	Inner HD	140	Small	Feather Spot	Singeing	No	7	Yes	X				X	
2014-128-ISEGS	Control Transect	1090	Small	Carcass	Unknown	No	7	No						Control Transect
2014-129-ISEGS	Inner HD	180	Small	Carcass	Singeing	No	7	Yes	X				X	

Variables for Fatality Estimator								Fatality Estimates in Which Each Detection was Included						
FWS #[1]	Location	Distance from Tower (m)	Size	Model Category[2]	Cause of Death/ Injury[3]	Incidental	Time Since Last Survey (days)[4]	Used in Estimator[5]	Tower Area	Heliostat Area	Power Block	ACC Building	Inner HD	Estimator Notes[6]
2014-130-ISEGS	Outer Segment	1007	Small	Feather Spot	Unknown	No	8	Yes		X				
2014-131-ISEGS	Inner HD	270	Small	Feather Spot	Collision	No	7	Yes	X				X	
2014-132-ISEGS	Outer Segment	708	Large	Feather Spot	Unknown	No	7	Yes		X				
2014-133-ISEGS	Outer Segment	739	Large	Carcass	Unknown	No	7	Yes		X				
2014-134-ISEGS	Inner Segment	590	Large	Feather Spot	Unknown	No	7	Yes		X				
2014-135-ISEGS	Fence	1010	Small	Carcass	Unknown	No	7	No						Sample size insufficient for fence
2014-136-ISEGS	Power Block	90	Small	Feather Spot	Unknown	Yes	1	Yes	X		X			
2014-137-ISEGS	Outer Segment	690	Large	Feather Spot	Unknown	No	7	Yes		X				
2014-138-ISEGS	Inner Segment	576	Unknown	Carcass	Unknown	No	7	No						Older than search interval
2014-139-ISEGS	Inner Segment	228	Unknown	Carcass	Unknown	No	7	No						Older than search interval
2014-140-ISEGS	Power Block‡	0	Raptor	Carcass	Singeing	Yes	NA	Yes	X		X			
2014-141-ISEGS	Power Block*	80	Small	Carcass	Singeing	No	7	No				X		In ACC, added after
2014-142-ISEGS	Power Block*	82	Small	Carcass	Singeing	No	7	No				X		In ACC, added after
2014-143-ISEGS	Power Block*	75	Small	Carcass	Singeing	No	7	No				X		In ACC, added after
2014-144-ISEGS	Inner HD	250	Small	Feather Spot	Singeing	No	7	Yes	X				X	
2014-145-ISEGS	Inner HD	230	Small	Feather Spot	Singeing	No	7	No						Older than search interval
2014-146-ISEGS	Inner HD	115	Small	Feather Spot	Singeing	No	7	No						Older than search interval
2014-147-ISEGS	Inner Segment	680	Small	Carcass	Unknown	No	7	Yes		X				
2014-148-ISEGS	Inner Segment	250	Large	Carcass	Unknown	No	7	No						Older than search interval
2014-149-ISEGS	Inner HD	250	Small	Carcass	Singeing	No	7	Yes	X				X	
2014-150-ISEGS	Inner HD	130	Small	Feather Spot	Singeing	No	7	Yes	X				X	
2014-151-ISEGS	Inner HD	220	Small	Feather Spot	Singeing	No	7	Yes	X				X	
2014-152-ISEGS	Power Block	2	Small	Carcass	Singeing	Yes	2	Yes	X		X			
2014-153-ISEGS	Outer Segment	1050	Small	Feather Spot	Unknown	No	7	Yes		X				
2014-154-ISEGS	Outer Segment	1050	Small	Feather Spot	Unknown	No	7	Yes		X				
2014-155-ISEGS	Inner HD	78	Small	Feather Spot	Unknown	No	7	Yes	X				X	
2014-156-ISEGS	Power Block	10	Small	Feather Spot	Singeing	No	8	Yes	X		X			
2014-157-ISEGS	Inner HD	250	Large	Feather Spot	Unknown	No	7	Yes	X				X	
2014-158-ISEGS	Inner HD	160	Small	Carcass	Singeing	No	7	Yes	X				X	
2014-159-ISEGS	Power Block	45	Small	Carcass	Singeing	No	7	Yes	X		X			
2014-160-ISEGS	Power Block	83	Small	Carcass	Singeing	No	7	Yes	X		X			
2014-161-ISEGS	Power Block	120	Small	Feather Spot	Unknown	No	7	Yes	X		X			
2014-162-ISEGS	Inner HD	220	Small	Feather Spot	Unknown	No	7	Yes	X				X	
2014-163-ISEGS	Power Block	11	Small	Carcass	Singeing	No	7	Yes	X		X			
2014-164-ISEGS	Power Block	15	Small	Carcass	Singeing	No	7	Yes	X		X			
2014-165-ISEGS	Power Block	71	Small	Carcass	Singeing	No	7	Yes	X		X			

		Variables for Fatality Estimator						Fatality Estimates in Which Each Detection was Included						
FWS #[1]	Location	Distance from Tower (m)	Size	Model Category[2]	Cause of Death/ Injury[3]	Incidental	Time Since Last Survey (days)[4]	Used in Estimator[5]	Tower Area	Heliostat Area	Power Block	ACC Building	Inner HD	Estimator Notes[6]
2014-166-ISEGS	Inner HD	260	Raptor	Feather Spot	Unknown	No	7	No						Older than search interval
2014-167-ISEGS	Inner HD	170	Small	Feather Spot	Singeing	No	7	No						Older than search interval
2014-168-ISEGS	Inner HD	140	Small	Feather Spot	Singeing	No	7	Yes	X				X	
2014-169-ISEGS	Inner HD	220	Small	Feather Spot	Unknown	No	7	Yes	X				X	
2014-170-ISEGS	Inner HD	220	Small	Feather Spot	Unknown	No	7	Yes	X				X	
2014-171-ISEGS	Power Block	22	Small	Carcass	Singeing	Yes	0	Yes	X		X			
2014-172-ISEGS	Other Project Lands	NA	Small	Carcass	Unknown	Yes	4	No						Sample size insufficient for fence
2014-173-ISEGS	Inner Segment	142	Small	Carcass	Collision	No	7	No						Older than search interval
2014-174-ISEGS	Power Block	30	Small	Carcass	Singeing	Yes	2	Yes	X		X			
2014-175-ISEGS	Power Block	30	Small	Carcass	Singeing	Yes	3	Yes	X		X			
2014-176-ISEGS	Outer Segment	1310	Small	Carcass	Collision	No	8	Yes		X				
2014-177-ISEGS	Power Block	30	Small	Carcass	Singeing	Yes	5	Yes	X		X			
2014-178-ISEGS	Inner Segment	500	Small	Carcass	Unknown	No	7	Yes		X				
2014-179-ISEGS	Power Block	35	Small	Carcass	Singeing	Yes	1	Yes	X		X			
2014-180-ISEGS	Power Block	14	Small	Carcass	Singeing	Yes	6	Yes	X		X			
2014-181-ISEGS	Power Block	25	Small	Carcass	Singeing	No	7	Yes	X		X			
2014-182-ISEGS	Power Block	1	Small	Carcass	Unknown	No	7	Yes	X		X			
2014-183-ISEGS	Power Block	20	Small	Feather Spot	Singeing	No	7	No						Older than search interval
2014-184-ISEGS	Inner HD	250	Unknown	Feather Spot	Unknown	No	7	Yes	X				X	
2014-185-ISEGS	Inner HD	130	Small	Carcass	Singeing	No	7	Yes	X				X	
2014-186-ISEGS	Power Block	30	Small	Carcass	Singeing	Yes	6	Yes	X		X			
2014-187-ISEGS	Power Block	10	Small	Carcass	Singeing	No	7	Yes	X		X			
2014-188-ISEGS	Power Block*	50	Small	Carcass	Singeing	No	7	No				X		In ACC, added after
2014-189-ISEGS	Power Block	61	Small	Feather Spot	Unknown	No	7	No						Older than search interval
2014-190-ISEGS	Inner HD	200	Small	Carcass	Collision	No	7	Yes	X				X	
2014-191-ISEGS	Outer Segment	1020	Small	Feather Spot	Other	No	7	Yes		X				
2014-192-ISEGS	Inner HD	180	Small	Feather Spot	Singeing	No	7	Yes	X				X	
2014-193-ISEGS	Inner Segment	425	Small	Carcass	Collision	No	7	Yes		X				
2014-194-ISEGS	Inner Segment	425	Small	Carcass	Collision	No	7	Yes		X				
2014-195-ISEGS	Inner Segment‡	260	Large	Carcass	Unknown	Yes	NA	No						Outside of survey area
2014-196-ISEGS	Outer Segment	890	Large	Feather Spot	Unknown	No	7	Yes		X				
2014-197-ISEGS	Power Block	20	Small	Carcass	Singeing	Yes	3	Yes	X		X			
2014-198-ISEGS	Power Block	50	Small	Carcass	Singeing	Yes	3	Yes	X		X			
2014-199-ISEGS	Outer Segment	1400	Small	Carcass	Unknown	No	7	Yes		X				
2014-200-ISEGS	Power Block	60	Small	Carcass	Singeing	Yes	4	Yes	X		X			
2014-201-ISEGS	Power Block	67	Small	Carcass	Singeing	Yes	6	Yes	X		X			

Variables for Fatality Estimator								Fatality Estimates in Which Each Detection was Included						
FWS #[1]	Location	Distance from Tower (m)	Size	Model Category[2]	Cause of Death/ Injury[3]	Incidental	Time Since Last Survey (days)[4]	Used in Estimator[5]	Tower Area	Heliostat Area	Power Block	ACC Building	Inner HD	Estimator Notes[6]
2014-202-ISEGS	Power Block	41	Small	Carcass	Singeing	Yes	6	Yes	X		X			
2014-203-ISEGS	Power Block	80	Small	Carcass	Singeing	Yes	6	Yes	X		X			
2014-204-ISEGS	Power Block	15	Small	Carcass	Singeing	Yes	6	Yes	X		X			
2014-205-ISEGS	Power Block	30	Small	Carcass	Singeing	Yes	6	Yes	X		X			
2014-206-ISEGS	Power Block	30	Small	Carcass	Singeing	Yes	6	Yes	X		X			
2014-207-ISEGS	Power Block	60	Small	Carcass	Singeing	Yes	6	Yes	X		X			
2014-208-ISEGS	Power Block	80	Small	Carcass	Singeing	Yes	6	Yes	X		X			
2014-209-ISEGS	Inner HD	190	Small	Carcass	Singeing	No	7	Yes	X				X	
2014-210-ISEGS	Inner HD	210	Small	Carcass	Singeing	No	7	Yes	X				X	
2014-211-ISEGS	Power Block*	82	Small	Carcass	Singeing	No	7	No				X		In ACC, added after
2014-212-ISEGS	Power Block*	76	Small	Carcass	Singeing	No	7	No				X		In ACC, added after
2014-213-ISEGS	Power Block*	87	Small	Carcass	Other	No	7	No				X		In ACC, added after
2014-214-ISEGS	Power Block*	95	Small	Carcass	Singeing	No	7	No				X		In ACC, added after
2014-215-ISEGS	Power Block*	94	Small	Carcass	Singeing	No	7	No				X		In ACC, added after
2014-216-ISEGS	Power Block*	104	Small	Carcass	Other	No	7	No				X		In ACC, added after
2014-217-ISEGS	Power Block*	72	Small	Carcass	Singeing	No	7	No				X		In ACC, added after
2014-218-ISEGS	Power Block*	102	Small	Carcass	Singeing	No	7	No				X		In ACC, added after
2014-219-ISEGS	Power Block	120	Small	Carcass	Singeing	No	7	Yes	X		X			
2014-220-ISEGS	Inner Segment	440	Small	Carcass	Collision	No	7	Yes		X				
2014-221-ISEGS	Outer Segment	1030	Large	Feather Spot	Collision	No	7	Yes		X				
2014-222-ISEGS	Outer Segment	640	Small	Carcass	Collision	No	7	Yes		X				
2014-223-ISEGS	Inner HD	180	Small	Feather Spot	Unknown	No	7	Yes	X				X	
2014-224-ISEGS	Inner HD	160	Large	Feather Spot	Unknown	No	7	Yes	X				X	
2014-225-ISEGS	Power Block	31	Small	Carcass	Singeing	Yes	2	Yes	X		X			
2014-226-ISEGS	Power Block	36	Small	Carcass	Unknown	Yes	2	Yes	X		X			
2014-227-ISEGS	Power Block*	90	Small	Carcass	Singeing	No	7	No				X		In ACC, added after
2014-228-ISEGS	Power Block*	86	Small	Carcass	Singeing	No	7	No				X		In ACC, added after
2014-229-ISEGS	Power Block*	80	Small	Carcass	Singeing	No	7	No				X		In ACC, added after
2014-230-ISEGS	Power Block	110	Small	Carcass	Singeing	No	7	Yes	X		X			
2014-231-ISEGS	Outer Segment	870	Small	Carcass	Unknown	No	7	Yes		X				
2014-232-ISEGS	Fence	1500	Small	Carcass	Unknown	No	7	No						Sample size insufficient for fence
2014-233-ISEGS	Power Block	36	Small	Carcass	Singeing	Yes	0	Yes	X		X			
2014-234-ISEGS	Power Block	80	Small	Carcass	Singeing	Yes	2	Yes	X		X			
2014-235-ISEGS	Outer Segment	1100	Large	Carcass	Unknown	No	7	Yes		X				
2014-236-ISEGS	Other Project Lands‡	NA	Small	Feather Spot	Unknown	Yes	NA	No						Outside of survey area
2014-237-ISEGS	Outer Segment	790	Small	Feather Spot	Unknown	No	7	No						Older than search interval

		Variables for Fatality Estimator						Fatality Estimates in Which Each Detection was Included						
FWS #[1]	Location	Distance from Tower (m)	Size	Model Category[2]	Cause of Death/ Injury[3]	Incidental	Time Since Last Survey (days)[4]	Used in Estimator[5]	Tower Area	Heliostat Area	Power Block	ACC Building	Inner HD	Estimator Notes[6]
2014-238-ISEGS	Power Block	76	Small	Carcass	Singeing	Yes	5	Yes	X		X			
2014-239-ISEGS	Outer Segment	1045	Large	Feather Spot	Unknown	No	7	Yes		X				
2014-240-ISEGS	Other Project Lands‡	NA	Unknown	Feather Spot	Unknown	Yes	NA	No						Outside of survey area
2014-241-ISEGS	Power Block*	94	Small	Carcass	Singeing	No	7	No				X		In ACC, added after
2014-242-ISEGS	Power Block*	91	Unknown	Feather Spot	Other	No	7	No				X		In ACC, added after
2014-243-ISEGS	Power Block	40	Small	Carcass	Singeing	No	7	Yes	X		X			
2014-244-ISEGS	Inner HD	170	Small	Carcass	Singeing	No	7	Yes	X				X	
2014-245-ISEGS	Inner HD	190	Small	Carcass	Singeing	No	7	Yes	X				X	
2014-246-ISEGS	Inner HD	190	Small	Carcass	Singeing	No	7	Yes	X				X	
2014-247-ISEGS	Inner HD	120	Small	Carcass	Unknown	No	7	Yes	X				X	
2014-248-ISEGS	Power Block	0	Small	Carcass	Singeing	No	7	No						Older than search interval
2014-249-ISEGS	Power Block	94	Small	Carcass	Unknown	No	7	Yes	X		X			
2014-250-ISEGS	Inner HD	110	Small	Feather Spot	Singeing	No	7	No						Older than search interval
2014-251-ISEGS	Inner HD	270	Small	Carcass	Unknown	No	7	Yes	X				X	
2014-252-ISEGS	Inner HD	190	Large	Feather Spot	Unknown	No	7	Yes	X				X	
2014-253-ISEGS	Power Block	50	Small	Carcass	Unknown	Yes	1	Yes	X		X			
2014-254-ISEGS	Inner Segment	500	Small	Feather Spot	Unknown	No	7	Yes		X				
2014-255-ISEGS	Inner Segment	430	Small	Carcass	Unknown	No	7	No						Older than search interval
2014-256-ISEGS	Power Block	25	Small	Carcass	Singeing	Yes	9	Yes	X		X			
2014-257-ISEGS	Outer Segment	690	Small	Carcass	Singeing	No	7	Yes		X				
2014-258-ISEGS	Power Block	120	Small	Feather Spot	Singeing	Yes	11	Yes	X		X			
2014-259-ISEGS	Inner Segment	460	Small	Carcass	Unknown	No	9	Yes		X				
2014-260-ISEGS	Outer Segment	730	Unknown	Feather Spot	Unknown	No	9	No						Older than search interval
2014-261-ISEGS	Power Block	54	Small	Carcass	Singeing	Yes	17	Yes	X		X			

[1] The FWS # can be used to match each detection in Appendix B with additional information provided in Appendix A.

[2] In the original spring report, partial carcasses that were very small and that contained relatively few (or inconspicuous) bones or pieces of flesh, such as a wing of a small bird or a piece of wing, were considered feather spots. In this revised spring report, the definition of a feather spot has been clarified that they are without significant skin or flesh, or any bone, attached. All detections with significant skin or flesh, or any bone, were considered detections in this revised report but were considered carcasses, not feather spots.

[3] "Unknown" cause of death = no evidence of singeing and no clear evidence of what caused the fatality; "Singeing" = evidence of singeing on the carcass or feather spot; "Collision" = evidence of collision was observed, such as a bird-strike imprint and/or feathers on a heliostat above the detection; "Other" = a detection with known cause without signs of collision or singeing (in spring 2014, all "other" detections were of birds found in the ACC units).

[4] "Time Since Last Survey" indicates the number of days between when the detection was found and the previous standardized survey of the area in which it was found.

[5] "Used in Estimator" indicates whether the detection was used in the fatality estimates. If it was not, the "Estimator Notes" column indicates why not. If it was, an "X" appears under one or more of the subsequent five columns to indicate whether the detection was used in the fatality estimate for the "Tower Area" (consisting of the power block plus inner HD heliostats combined), "Heliostat Area" (consisting of the inner and outer heliostat segments), "Power Block", "ACC", or , "Inner HD" areas. Note that because the ACC building (which is located within the Power Block) is a closed system, being only marginally accessible to scavengers, no fatality estimate per se was made for the ACC buildings; rather, the detections in the ACC buildings were added to the estimates for the Power Block and Tower Area after the fatality estimator was used to produce estimates for those areas.

[6] "Outside of survey area" indicates that the detection was not within the standardized survey areas and thus were not appropriate for inclusion in the fatality estimator. Similarly, detections that were "older than search interval", indicating that the carcasses were deemed to have been present longer than the "time since last survey", are not included in the fatality estimator.

* Found in ACC building.

‡ Found outside of designated standardized survey plots.

Note: Fatalities in ACC building and along fences were not used in the fatality estimator, but were added in to fatality estimates post hoc.

Appendix C. Ivanpah 2014 Spring Monitoring Report: Errata and Explanations for Revisions by Section

Section 2.2 Facility Monitoring

- In Section 2.2.1, clarified that feather spots exclude feathers with bone and significant skin and flesh.
- In Section 2.2.3, clarified that 17 carcasses were placed, including nine small carcasses and eight large carcasses and 14 feather spots.
- Removed Section Relating Detections to Flux Activity per direction of the TAC due to low sample size and collinearity (e.g., correlation of flux activity and regional bird abundance during the spring migratory period).
- In Section 2.2.5, clarified method to exclude carcasses older than the search interval and clarified that all detections within the ACC buildings were considered to of known cause, whether or not they showed evidence of singeing or collision.

Section 3.1 Avian Use Monitoring

- Clarified number of field hours from 97 to 110.
- Corrected species observation numbers based on QA/QC.
- An unidentified hummingbird was added to the total number of species because, although unidentified, it represented a new species (i.e., no other hummingbirds were recorded).
- Avian abundance on the bajada plots, and numbers of species in the lower desert bajada grid and Unit 1 heliostats, were modified slightly due to re-categorization of some flyovers as either excluded from the counts (because the birds were not using the survey plots) or included in the counts, based on review of all the survey data.

Section 3.2 Raptor and Large Bird Use Monitoring

- In the original spring report, Tables 7 and 8 (giving flight heights of raptors and large birds, and counts of raptors and large birds by survey point, respectively) included the number of observations (with some observations consisting of multiple birds) rather than the number of individual birds. In revising the report, we revised Tables 7 and 8 to include the number of individual birds to be consistent with Tables 5 and 6 and to avoid confusion.
- During raptor/large bird surveys, several common ravens, red-tailed hawks, and unknown raptors were seen perched on power poles along Coliseum Road. These were recorded in the original report as being perched above Ivanpah facilities. However, because these birds were more likely utilizing resources over the desert and Primm Valley Golf Course (e.g., hunting from the towers but scanning the adjacent natural areas), we believe it is more appropriate to consider these birds as utilizing other habitats or areas, and Table 7 has been revised accordingly.

Section 4.0 Monitoring Results

- In Section 4.1.1, the total number of species was increased by one (from 42 to 43) with inclusion of an unidentified heron in the species total. This was not included originally because it was

unidentified; however, because no other herons were recorded, we determined that it was more appropriate to add it.

- A note was added to Table 9 to explain which birds were classified as small, large and/or raptor.
- In Section 4.1.2, the percentages of detections in various temporal occurrence groups and foraging guilds were modified based on refinements in how various species were categorized within these groups during the QA/QC process.
- In Section 4.1.2, the summary of the days with more than 10 detections was modified to include all detections on those days (e.g., including incidentals found in other areas outside the standardized survey areas) for the sake of completeness.
- In Section 4.1.3, we made a minor change to indicate that an injured American kestrel was still alive as of this revision (previously, we reported that it was still alive as of 1 July 2014).
- In Section 4.1.4, one detection that had been incorrectly considered a standardized survey detection in the original report was changed to an incidental detection upon further QA/QC of the data.
- In Section 4.3, a table (new Table 13) was added per the TAC's request to tabulate the number of detections from singeing, collision, and unknown causes (these numbers had previously been reported only in the text).
- In Section 4.3, distance of each detection from the towers was double-checked and Figure 25 was revised to include corrected data per the TAC's request, and to separate out as "other Project causes" five detections from the ACC units that showed no evidence of singeing or collision effects.
- In Section 4.3, text and graphs pertaining to the spatial and statistical analysis of flux and unknown fatalities vs. distance from the tower and flux activity were removed, per the discussion with the TAC, so that the report would focus on information required by the Avian & Bat Monitoring and Management Plan.
- In Section 4.3, text was added in several places to clarify that one of the fatalities listed as being of "unknown" cause showed strong evidence of predation.
- In Section 4.3, additional discussion was added regarding unknown detections.
- In Section 4.3, a new group of detections, being from "other Project causes", was identified. This group included five detections from the ACC units that showed no evidence of singeing or collision effects. These five had previously been considered detections of unknown cause, but because they were found in the ACC buildings, we determined that they were more accurately characterized as having a known cause. Section 4.3.3 was added to specifically discuss these detections, and these five detections were removed from the tally of detections of unknown cause.
- In Section 4.4, the number of detections that were categorized as feather spots was revised. First, the number of feather spots originally identified was a typographical error. Additionally, the categorization was revised to reflect a clearer delineation between feather spots and carcasses. Originally, the descriptions of the fatalities were imprecise and some partial carcasses were mis-classified as carcasses. Re-inspection of the data during the revision of this report led to re-categorization of these detections as carcasses due to the presence of body parts (such as bones) other than feathers. In this revised report, we have changed the categorization of these detections from feather spot to carcass, and we have clarified our definition of a feather spot so that biologists

can more precisely enter the data. This revision also resulted in changes in the ratios of feather spots to carcasses in various Project components.

- In Section 4.4, the number of detections found along fence lines was changed from four to three after re-categorization of an incidental detection found in the CLA near, but not at, the fence line; this also resulted in an increase in the number reported as being "not in survey areas" or in "other Project areas".

Section 5.1 Estimating Model Parameters

- In Section 5.1.1, for the carcass removal trials, the end time of a single carcass was increased by 1 day after reviewing camera footage. Instead of reporting that some carcasses had persisted "for the full six-week trial" and assuming 42-day persistence for those carcasses, as we had originally done, we included the entire duration of those carcasses' presence, increasing the carcass persistence rate somewhat, for the sake of accuracy/transparency.
- In Section 5.1.3, for searcher efficiency trials, two trial subjects that had originally been reported as carcasses were changed to feather spots upon further QA/QC of the searcher efficiency data. This resulted in changes in the number of small carcasses, large carcasses, and feather spots reported for searcher efficiency trials, as well as changes in the detection rates of each of these three categories.

Section 5.2 Fatality Estimates For Known Causes

- The five detections from "other Project causes" were added to the fatality estimates for known causes, both overall and for the power blocks and tower areas.
- In Section 5.2, for the fatality estimates, relatively minor changes in several of the variables that were input into the fatality estimates, such as change in one detection from a survey detection to an incidental detection (which changed that detection's search interval), changes of some detections from feather spots to carcasses, and changes in carcass persistence and searcher efficiency rates led to minor changes in fatality estimates.
- In Section 5.2.1, we clarified our exclusion criteria (i.e., the criteria for exclusion of fatalities from the fatality estimator modeling); originally, we based exclusion on the estimated age of the detection and one-week search intervals; using this approach, we included detections that were estimated to be less than one week old, and excluded others. However, there were times when search intervals were longer than one week, mainly for the first survey of the season but also in a few other cases during the spring season when circumstances resulted in 8 or 9-day search intervals. In these cases, we originally tried to decide inclusion or exclusion on a case-by-case basis by examining photos and notes to try to determine whether the detection was older than the interval. Due to uncertainty regarding exactly how old a detection was (i.e., how long since death), this approach led to some ambiguity. To address this in the revised report, we defined more standardized criteria regarding the estimated age of detections for inclusion of detections in the fatality estimate model. Under these revised criteria, when the search interval was longer than one week, we included all detections that were estimated to be less than one month old. This affected several fatalities in the fatality estimate section, thus being responsible for slight changes in the fatality estimates (both overall and for

individual Project components), but it allowed for a more standardized and transparent approach to applying inclusion and exclusion criteria and reduced ambiguity in some decisions.

- New Tables 17 and 22 were added to indicate the number of detections from known and unknown causes in each Project element, and the number included in or excluded from fatality estimates. These tables were made to increase transparency and reader comprehension of the fatality estimates.
- The increase in searcher efficiency with respect to feather spots from 25% to 35% was the primary factor responsible for an overall reduction in fatality estimates. In the fatality estimator, searcher efficiency is in the denominator of the adjustment (the "adjustment" being the factor that extrapolates from an individual detection to the number of modeled fatalities predicted to be represented by that detection). In the original report, before this reclassification of the feather spot searcher efficiency, one feather spot detection predicted approximately four fatalities (1/0.25 = 4). With the corrected feather spot searcher efficiency, one feather spot detection predicts approximately 2.9 fatalities (1/0.35 = 2.86). The bootstrapped confidence intervals around these mean estimates were also reduced by this corrected searcher efficiency adjustment. Because a large proportion of detections in all areas were feather spots, this reduced the overall estimates. This also affected fatality estimates from unknown causes (discussed in Section 5.3).

Section 5.3 Fatality Estimates from Unknown Causes

- The five detections from "other Project causes" that were added to the fatality estimates for known causes were removed from the fatality estimates from unknown causes.
- In Section 5.3.2, for the Power Block estimate, the number of detections from unknown causes was reduced from 10 to 8 by removing two bats, and changes related to exclusion criteria discussed above further reduced it to 7.