DOCKETED

Docket Number:	07-AFC-05C
Project Title:	Ivanpah Solar Electric Generating System (Compliance)
TN #:	201315
Document Title:	ISEGS Avian Monitoring Plan rev 12
Description:	N/A
Filer:	Joe Douglas
Organization:	California Energy Commission
Submitter Role:	Energy Commission
Submission Date:	11/22/2013 4:09:44 PM
Docketed Date:	11/22/2013

Avian & Bat Monitoring and Management Plan

Ivanpah Solar Electric Generating System

Prepared for

Solar Partners I, LLC; Solar Partners II, LLC; and Solar Partners VIII, LLC

November 2013

REV 12

Contents

Tables

Figures

Attachment

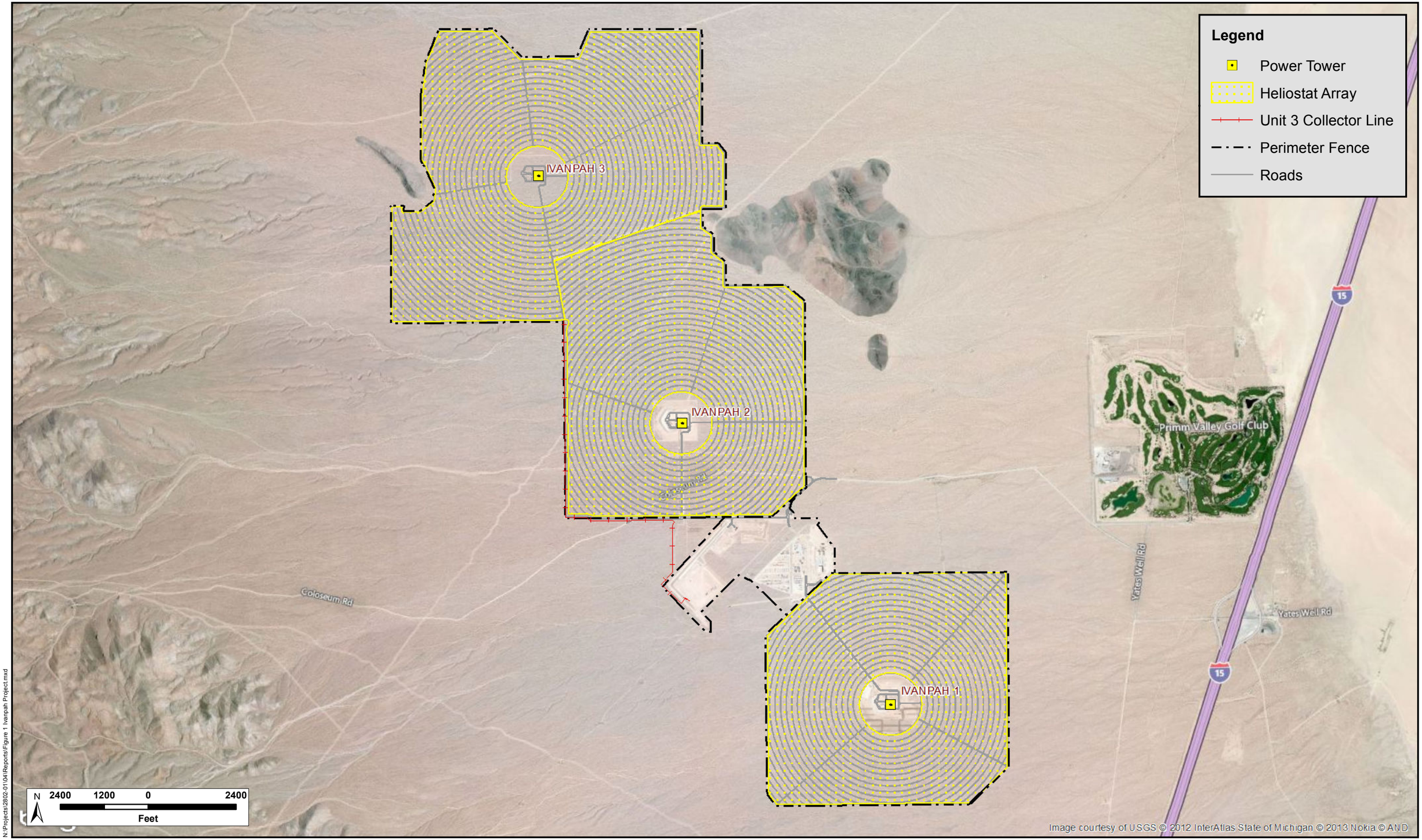
Avian & Bat Monitoring and Management Plan

1.0 Introduction

The Ivanpah Solar Electric Generating System (ISEGS) consists of three solar power electrical generating facilities with a combined net capacity of 377 megawatts. Each facility includes a central power tower, with associated electrical generating equipment, surrounded by a heliostat array that reflects sunlight to a receiver at the top of the tower (Figure 1). ISEGS is located on approximately 3,600 acres of federal land and was approved by the Bureau of Land Management (BLM) and the California Energy Commission (CEC) in 2010. Construction was initiated in 2010, and the first unit of the solar generating facility is expected to become operational in October 2013.

The purpose of this Avian & Bat Monitoring and Management Plan is to comprehensively monitor and identify potential avian impacts that may be associated with the facility, in collaboration with the U.S. Fish and Wildlife Service (USFWS), California Department of Fish and Wildlife (CDFW), CEC, and BLM. This plan is also intended to: 1) satisfy the BLM Right-of-Way (ROW) Permit requirement that the ISEGS team develop a Migratory Bird Treaty Act (MBTA) Conservation Agreement; 2) satisfy the requirements of the Avian and Bat Protection Plan approved by the CEC for ISEGS; 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 Endangered Species Act (ESA), 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 USFWS and other relevant state and federal agencies, project proponents can effectively minimize the potential for prosecutable offenses under the federal MBTA, Eagle Act, ESA, and relevant state regulations (USFWS, 2012).

This plan details the on-site and off-site surveys to be conducted and the data analysis and reporting processes that will be implemented by ISEGS in collaboration with the USFWS, CDFW, CEC, and BLM (collectively, the Technical Advisory Committee or "TAC"; see Section 5.0). The monitoring proposed in this plan is adaptive and will be guided by the TAC in response to the results of the initial surveys conducted. The TAC may recommend modifications to the BLM Authorized Officer (AO) and CEC Compliance Project Manager (CPM) for the survey protocols and to recommend adaptive management responses, if necessary, based on analysis of the survey data. Although impacts to bats are not expected to result from project construction or operation, all bat mortalities detected ancillary to study objectives will be recorded by field survey personnel and operations staff and reported to the TAC as described in this plan.



N:\Projects\2802-01\04\Reports\Figure 1 Ivanpah Project.mxd

H. T. HARVEY & ASSOCIATES
ECOLOGICAL CONSULTANTS

Figure 1: Ivanpah Project Site

ISEGS - Avian & Bat Monitoring and Management Plan (2802-04)

November 2013

ISEGS incorporates practical design, construction, and operational measures to avoid or minimize potential avian impacts, including the mitigation measures identified by the CEC in the *Ivanpah Solar Electric Generating System Commission Decision* (CEC, 2010) and by BLM in the final environmental impact statement (BLM, 2010) and Right-of-Way grants for the facility. Substantial resources have been committed toward the development and implementation of avoidance, minimization, and mitigation actions to benefit the conservation of avian resources, including the development of this plan.

1.1 Plan Goals

The Avian & Bat Monitoring and Management Plan has the following goals:

1. **Identify Collision Risks:** Risks will be identified by monitoring and identifying avian mortality and injury associated with facility structure collisions.
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.
3. **Identify Patterns of Avian Use at the Facility:** Patterns of avian use will be assessed by conducting on-site and off-site surveys to document avian species composition on-site and off-site, compare abundance in representative habitats on-site and off-site, and document changes in avian use in these areas over time.
4. **Provide a Framework for Management and Response to Risks:** The designation and description of the functioning of the TAC provides a management and decision framework for the identification and implementation of potential adaptive management measures.

1.2 Plan Objectives

This plan has the following specific objectives:

1. Estimate collision-related avian mortality and injury with the following facility structures (Figure 1), using empirical data to calculate facility-wide mortality and injury rates:
    a. Power towers
    b. Perimeter fences
    c. Heliostats
    d. Project Transmission Line (Unit 3 Collector Line)
2. Estimate flux-related avian mortality and injury using empirical data to calculate facility-wide mortality and injury rates.
3. Document patterns of collision- or flux-related mortality and injury associated with species, age/sex, season, weather, and visibility.
4. Document spatial patterns associated with collision- or flux-related mortality and injury.
5. Provide quantitative information for developing and implementing adaptive management responses commensurate with identified impacts.
6. Provide a framework for the TAC to jointly review, characterize, and recommend responses, based on monitoring results, to the appropriate lead agency representatives.
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.

2.0 Adaptive Monitoring Plan

This monitoring plan includes two investigations to determine the effects of the ISEGS project on avian species: a mortality and injury investigation and an avian use investigation.

The mortality and injury investigation will focus on the potential for collision and flux effects to occur during normal facility operation and during weather-related events. Survey protocols are detailed in Sections 2.1 and 2.2. The avian use investigation will focus on the use of habitat near and within the facility site by avian species. Avian use survey protocols are described in Sections 2.3, 2.4, and 2.5. All investigations will examine the effects of the ISEGS facility on use by resident and migratory birds, including golden eagles. This monitoring plan is adaptive, and modifications may be recommended by the TAC in response to the results obtained from the initial surveys.

2.1 Collision- and Flux-related Monitoring

This section describes the monitoring studies that will be implemented to assess avian mortality and injury risks potentially associated with facility power tower, perimeter fence, heliostat, and Unit 3 Collector Line collisions (Figure 1) and sunlight (solar flux) reflected from the heliostat field toward the solar tower receiver. The primary objectives of the monitoring study are to estimate levels of avian mortality or injury and to understand the temporal and spatial distribution of these occurrences within the facility area (for example, uniform, concentrated, etc.) that may be associated with tower, perimeter fence, heliostat, and Unit 3 Collector Line collisions or exposure to solar flux. All avian casualties detected within the study areas will be recorded and, based on a field inspection of each casualty, a cause of death or injury will be determined, if possible. The total number of avian casualties will be estimated by adjusting for search frequency, removal bias (length of carcass persistence in the field), and searcher efficiency bias (percent found).

The number and proportion of detections related to unknown causes will be reported. 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. All bat mortalities detected ancillary to other study objectives will be recorded by field survey personnel and operations staff, and reported in the quarterly reports described in this plan.

Causes of injury or mortality will be categorized according to the following criteria:

1. **Collision effects:** Birds with broken bones, chipped beaks, or other evidence of collision trauma, or birds found at the base of heliostats with bird-strike imprints in the dust on the heliostat.
2. **Flux effects:** Birds with any signs of singed feathers or tissues or visible ocular damage (per field evaluation with handheld magnifying glasses or if detected during subsequent necropsy analysis). Without a reasonable amount of fatality data from flux effects, specific categories are best developed after data are collected. At present, relatively little is known about the potential for, let alone the various categories of, flux fatalities.
3. **Flux and collision:** Birds with evidence of both collision and flux effects (evidence that flux impacts could have affected a bird's ability to avoid facility structures).
4. **Other:** Known cause, but not 1, 2, or 3 above (for example, lightning struck, avian disease, etc.).
5. **Unknown:** No known or presumed cause.

2.1.1 Study Components and Field Methodology

This section describes a standardized field-survey approach based on USFWS and other guidance pertinent to renewable energy projects (e.g., CEC and California Department of Fish and Game [CDFG],

2007; Nicolai et al., 2011; Strickland et al., 2011; USFWS, 2010, 2012). The approach primarily involves systematically walking transects in 144 (42 in Unit 1, 48 in Unit 2, and 54 in Unit 3) randomly selected, 5-acre plots inside the facility and randomly selected plots outside of the facility to detect avian casualties and injuries; it also considers detection biases in estimation of impacts. Observers trained in proper search techniques will conduct the field surveys. Trained search dogs may be used if determined to be appropriate by the TAC and approved by the USFWS.

2.1.2 Carcass Removal Trials

The carcass removal trials will be conducted simultaneously with mortality surveys, which will help ensure that both studies are conducted under similar conditions. Carcass removal trials will be conducted for each of four seasons, because mesopredator and aerial scavenger pressure varies by season (Smallwood, 2013). The test species selected will be based on availability and their similarity to expected small and large birds on-site. To the extent authorized in the final USFWS Special Purpose – Utility (SPUT) permit, carcasses of native songbirds and larger birds that are analogous to those occurring on the site and that are found incidentally by biologists involved in the project (e.g., road-killed birds), or otherwise made available by the USFWS or others, will be used. Small bird carcasses may also include house sparrows (*Passer domesticus*) or European starlings (*Sturnus vulgaris)*, but commercially raised ducks, quail, and hens will not be used, consistent with all applicable laws and regulations. Field evidence suggests that carcasses of the latter species are scavenged and removed more quickly than the native species they are used to represent (Smallwood, 2013). The trial carcasses will be dropped from 5 feet or higher and allowed to land in a random posture. Global Positioning System (GPS) locations of each trial carcass will be recorded, and each carcass will be discreetly marked with tape or thread prior to placement so that it can be identified as a trial carcass if detected by facility personnel or moved by a scavenger.

The trial carcasses will typically be placed every other week during each season to incorporate the potential effects of varying weather conditions and scavenger types and densities. Each trial carcass will be monitored with the use of a Bushnell Trophy Camera (Model 119436) or equivalent remote camera at randomly chosen locations within the areas surveyed for fatalities (See Attachment A, Example of Remote Camera Settings and Data). At most, five carcasses will be placed in a survey area at one time to limit scavenger swamping. Each carcass will be checked at least two times per week until it is scavenged or 6 weeks has passed since placement. If the carcass has been scavenged, all remaining feathers and parts of the carcass and the camera will be removed. The final disposition of the carcass will be classified as "Removed" if the carcass cannot be located and there are fewer than 10 feathers of any type or fewer than two primary feathers remaining. The final disposition will be classified as "Not Removed" if there are ≥ 10 feathers of any type, ≥ two primary feathers, or any flesh or bone remaining. Methods for incorporating carcass removal trial data into facility fatality estimates are described in detail in Section 3.1.

Additional scavenging trials will occur during the main fatality monitoring studies using the same methodology as described above. They will be conducted concurrently with the standardized surveys throughout the monitoring period. During these trials, 60 carcasses of small birds and 40 carcasses of large birds will be randomly placed within the on- and off-site survey areas, for a total of approximately 100 trial carcasses throughout the first year of monitoring study. Modeling of carcass removal trials should consist of at least 10 carcasses per group per season (Huso et al., 2012). Carcass removal trials will be conducted during the first year of monitoring and will only be continued for subsequent years if warranted (see Adaptive Monitoring/TAC section).

2.1.3 Searcher Efficiency Trials

The objective of the searcher efficiency trials is to estimate the percentage of casualties found by individual or teams of searchers. Trials will be conducted during each season in which vegetation differs from the prior season, because changes in cover may affect detection of carcasses. Smallwood (2013)

found that searcher efficiency did not change over different seasons when controlled for cover type, which often becomes a co-variant. Such similarities in cover may occur in desert regions between two seasons (e.g., summer and fall), when precipitation is very scarce and changes in vegetation cover are minimal. Searcher efficiency will be estimated by size of bird (small and large, as defined in Section 2.1.2). Estimates of searcher efficiency will be used to adjust the total number of birds found by observers to correct for detection bias.

Searcher efficiency trials will begin when standardized monitoring surveys begin. Observers conducting surveys will not know when these trials are conducted or the location of the detection trial carcasses. A minimum of two trials will occur during each season, with at least 10 small birds and 10 large birds, to spread the trials over time and varying site conditions. More or fewer searcher efficiency carcasses may be used, depending on site conditions and the number of observers at the facility.

All searcher efficiency trials will be coordinated with the Designated Biologist and placed at random locations within areas being searched prior to the monitoring survey on the given day. Trial carcasses will be dropped from 5 feet or higher and allowed to land in a random posture. The GPS coordinates of each efficiency trial carcass will be recorded and used to retrieve carcasses not found during the survey. To prevent a trial carcass from being confused with actual study detections, trial carcasses will be marked unobtrusively with dark tape or thread on the leg of the bird. Immediately following the trial, the person responsible for distributing the trial carcasses will determine the number of trial carcasses found by observers. Searcher efficiency trials are planned for completion for the first year of monitoring and will only be continued for subsequent years if warranted under conditions that had previously not been tested (e.g., a substantially different amount of cover because of an unusually high amount of rain or the addition of new observers to the project). After the first year of operation the TAC may recommend additional searcher efficiency trials if on-site conditions are different enough from those during previously conducted searcher efficiency trials.

2.1.4 On-site Monitoring

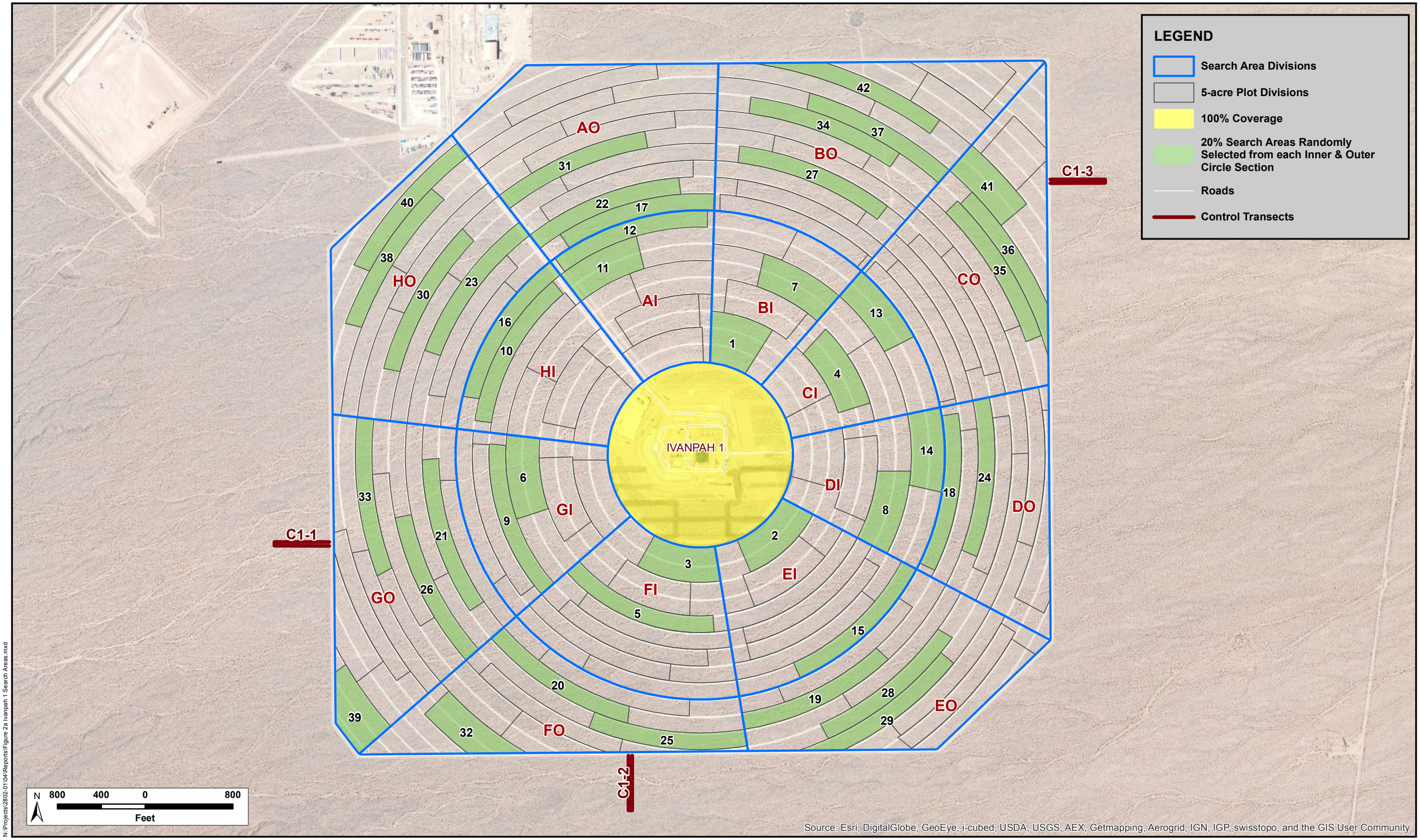
Collision with ISEGS facility structures (towers, perimeter fence, and heliostats) will be evaluated by systematic sampling in each of the three ISEGS units (Ivanpah 1, 2, and 3). Potential flux effects (associated with the concentration of sunlight near the top of the tower) will also be investigated within each of the units in accordance with the following methodology. All (100 percent) of the inner circle area (Figure 2), comprising bare ground with and without high-density heliostats, roads, and buildings immediately around the towers, will be surveyed with 10-meter transects. However, for the tops of some buildings and for other inaccessible areas, fatalities will be modeled based on the assumption that some of the strikes may be due to tower strikes or the effects of the flux and fatalities will be evenly distributed out from the tower. For these inaccessible areas, a fatality density profile will be generated based on the distance from the tower and the distribution of known fatalities, such as is modeled for fatalities at wind energy areas in inaccessible areas (Huso 2012). An estimate of fatalities occurring in inaccessible areas will be modeled based on the distribution and densities of the known fatalities.

Search Timing

During the spring (late March to early May) and fall (late August to early October) migrations, monitoring will occur each week in order to identify potential pulses of fatalities. Fatalities occurring during the winter and summer months outside of these periods are expected to be lower and relatively homogeneous temporally; therefore, surveys during these periods will be 25 days apart, starting 25 days after the last fall or spring survey. Surveys will be conducted according to the schedule in Table 1.

TABLE 1. Fatality Monitoring Search Periods and Intervals

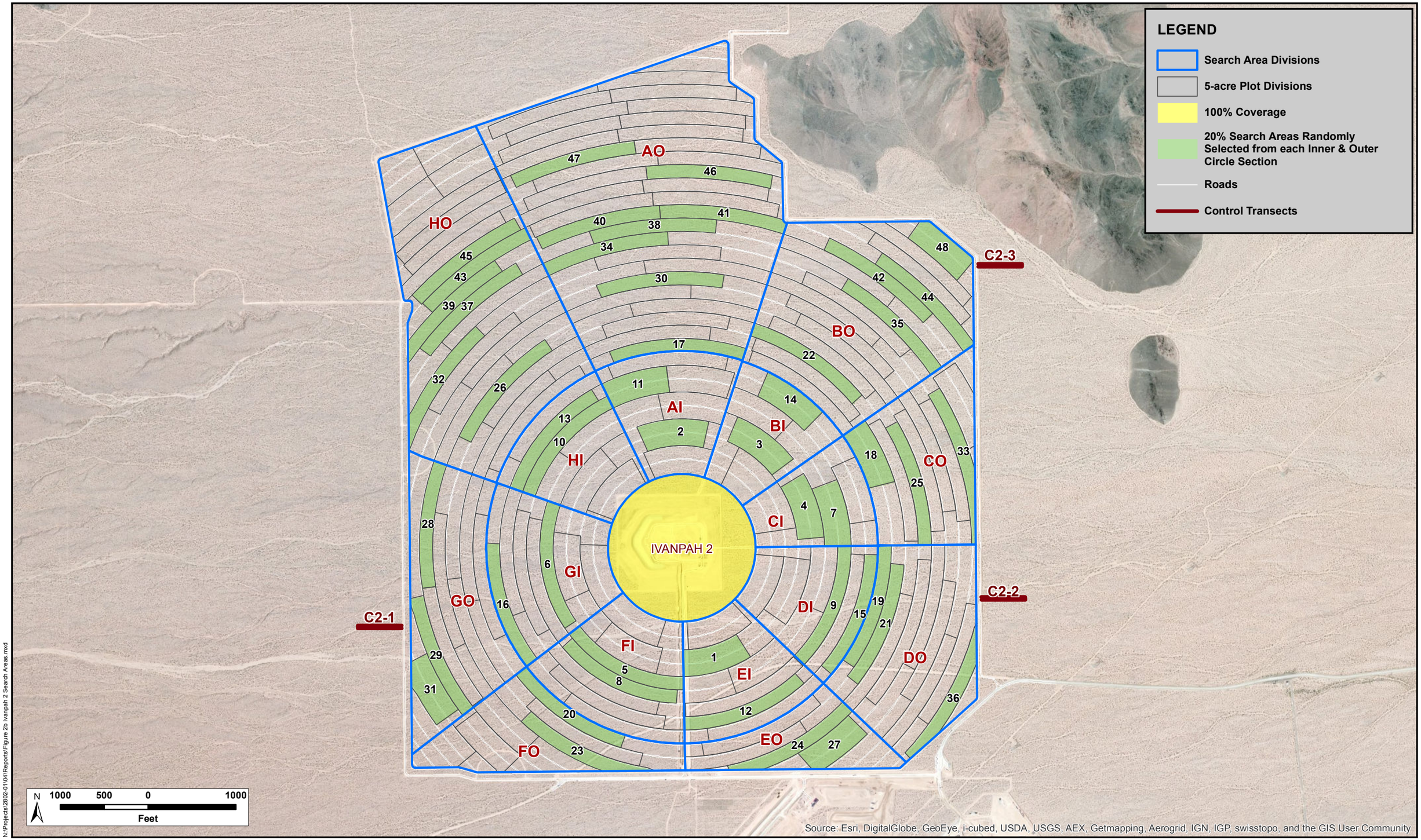
	Fall Migratory Period (late-August to early-October)	**Winter (late-October through early-March)**	**Spring Migratory Period (late-March to early-May)**	**Summer (early-June through mid-August)**
Search interval	7 days	25 days	7 days	25 days
No. of searches	7	6	7	4
Example dates	8/22, 8/29, 9/5, 9/12, 9/19, 9/26, 10/3	10/28, 11/22, 12/17, 1/10, 2/4, 3/1	3/26, 4/2, 4/9, 4/16, 4/23, 4/30, 5/7	6/1, 6/26, 7/21, 8/15



N:\Projects\2802-01\04\Reports\Figure 2a Ivanpah 1 Search Areas.mxd

H. T. HARVEY & ASSOCIATES
ECOLOGICAL CONSULTANTS

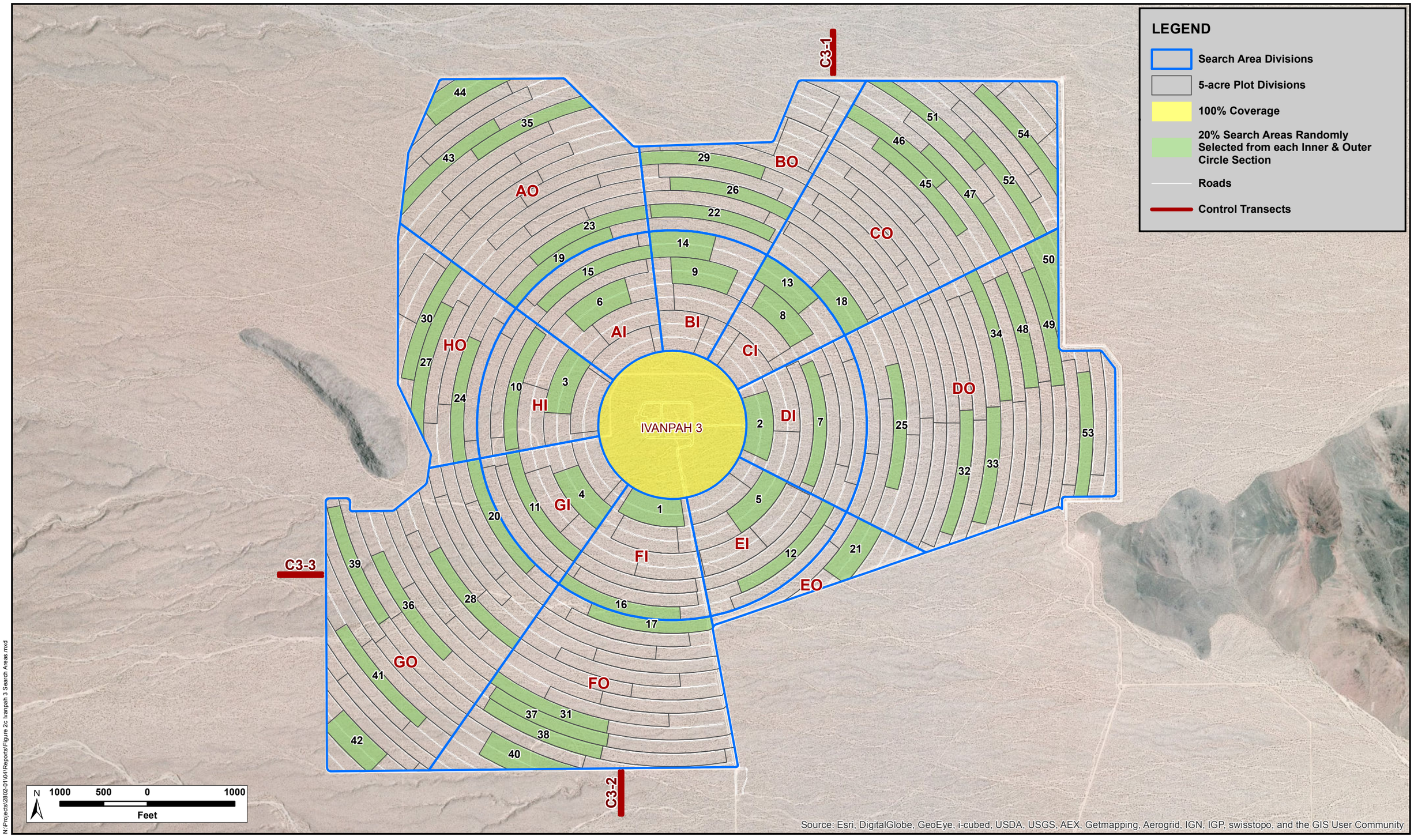
Figure 2a: Ivanpah 1 Search Areas
ISEGS - Avian & Bat Monitoring and Management Plan (2802-04)
November 2013



N:\Projects\2802-01104\Reports\Figure 2b Ivanpah 2 Search Areas.mxd

H. T. HARVEY & ASSOCIATES
ECOLOGICAL CONSULTANTS

Figure 2b: Ivanpah 2 Search Areas
ISEGS - Avian & Bat Monitoring and Management Plan (2802-04)
November 2013



N:\Projects\2802-01\04\Reports\Figure 2c Ivanpah 3 Search Areas.mxd

H. T. HARVEY & ASSOCIATES
ECOLOGICAL CONSULTANTS

Figure 2c: Ivanpah 3 Search Areas
ISEGS - Avian & Bat Monitoring and Management Plan (2802-04)
November 2013

Search Areas/ Methodology

This section describes the robust nature by which avian fatalities and injuries will be evaluated through systematic sampling of the ISEGS towers, Unit 3 collector line, perimeter fence, and heliostats. Because the nature of avian risk varies by these project elements, search area methodologies also vary by project element, as described below. More than 25 percent of the total area comprising Ivanpah 1, 2, and 3 (Figure 1) will be systematically sampled through these methods. In addition to this sampling effort, 100 percent of the facility surface will be examined by workers three to five times a year through the Wildlife Incident Reporting System (WIRS; refer to Section 3.4).

Tower area: An area defined by a radius of approximately 850 feet (260 meters) around each tower (the "tower area") is generally cleared of vegetation for operational purposes. Each tower area is located beneath the portions of the solar field that would have the highest flux intensity and surrounds the tallest structure within the facility. Each tower area will be sampled according to the schedule in Table 1 by walking transects and visually inspecting the area for evidence of avian and bat mortality and injury (e.g., carcasses, feathers, injured birds). Because the tower area is generally clear of vegetation, searcher efficiency is expected to be high. Each survey will result in a complete (100-percent-coverage) assessment of the tower area. The tower area survey is primarily intended to examine the potential for birds and bats to be affected by acute flux exposure or tower-related collisions.

Perimeter fence: The perimeter fence is approximately 16.2 miles long; a 6-meter-wide transect along the fence thus comprises 38.56 acres (15.64 hectares). An unpaved road parallels the interior perimeter of the fence, providing 100-percent access to the fence from inside the project boundary. Outside the project fence, an unpaved road provides access to approximately 44 percent (7.1 miles) of the fence. These unpaved interior and exterior roads will be visually inspected for evidence of avian mortality and injury from a slow-moving vehicle, according to the schedule in Table 1. The search area will include a 6-meter-wide corridor, 3 meters extending from each side of the fence. This area will be searched by a two-person team (one primary searcher and the driver, who will provide search support) traveling in a vehicle at a speed of no more than 4 miles per hour and at an appropriate distance from the fence to search the 6-meter-wide transect. Visibility on these roads is excellent, so observers should be able to reliably locate evidence of affected birds (for example, carcasses, feathers, injured birds) from vehicles. Approximately 9.1 miles of the exterior fence area is undeveloped, vegetated land that is accessible by pedestrians only. This fence will be visually inspected for evidence of avian mortality and injury, according to the schedule in Table 1, by walking the inner edge of a 6-meter-wide transect, with the fence positioned in the middle of the transect.

Project transmission lines: The Unit 3 Collector Line totals approximately 11,327 feet (3,452 meters) in length. This project component will be surveyed according to the schedule described in Table 1. For much of its length, the Unit 3 Collector Line is located along the perimeter fence; as a result, this section can be surveyed simultaneously with surveys of the fence. However, because the Unit 3 Collector Line is considerably higher and because transmission lines are known high-risk sites for bird collisions, a 15-meter-wide search area on each side of the center line, for a total search width of 30 meters, will be searched.

Heliostat field: Twenty (20) percent of each heliostat field will be visually inspected for evidence of avian mortality or injury, according to the schedule in Table 1. Sampling units will consist of 5-acre arc plots distributed throughout the heliostat fields, as shown in Figure 2. Each region of the project area will be sampled to account for potential tendencies for bird fatalities based on the direction of approach and variation in the density of the heliostat arrays, resulting in a spatially balanced design, as suggested by Manuela Huso (pers. comm.). The heliostat arrays surrounding the three towers are divided into 24 segments that are each divided again by 2, resulting in inner and outer halves totaling 48 areas. Twenty percent of each of these 48 areas will be sampled.

The decision to sample 20 percent of each heliostat field was made based on an in-depth analysis that relied on conservative scenarios for potential avian mortality at the site and subjecting these scenarios to a sensitivity analysis to determine the coefficient of variation (WEST, Inc., 2013). This analysis was undertaken to ensure that the outcome of the heliostat field surveys are effective for supporting the adaptive management goals of this plan and to allow accurate extrapolation of results to facility-wide estimates. The scenarios were evaluated with power analysis by simulating three hypothetical levels of fatality (based on per-megawatt mortality reported for other renewable energy projects) under conservatively assumed conditions. Details regarding the assumptions used in this analysis are presented in Tables 2 and 3.

The conditions assumed for each of the scenarios included a carcass removal rate, searcher efficiencies, and an even distribution of fatalities across the site. The initial assumptions for the carcass removal rates and searcher efficiencies were derived from publicly available fatality studies from other renewable technologies conducted in similar vegetation and topography. For the purposes of this analysis, the searcher efficiencies were decreased by 25 percent and the scavenger removal rates were increased by 25 percent to provide a conservative bias for the scenarios.

At the simulated levels of mortality, the 90-percent confidence interval for the facility-wide estimate narrows as the survey area increases, reaching a nearly asymptotic relationship at the 20-percent sample area in all cases (Figure 3). Additionally, for all levels modeled, the coefficient of variation (the standard deviation/estimate) reaches a level of less than 25 percent in all cases at a 20-percent sample area (Figure 4). At the assumed moderate and higher mortality levels, the coefficient of variation is less than 13 percent with a sample area of 20 percent.

The analysis demonstrates that, as the level of mortality increases, the sampling area can be decreased and still maintain lower coefficients of variation. Furthermore, at higher levels of mortality, the decrease in the coefficient of variation is small, particularly when considering the values associated with 10, 20, and 30 percent of the heliostat field being sampled. Thus, unless a very low mortality rate is encountered at the site, a sampling area of 20 percent of the field should be sufficient to establish the overall site mortality. Should a low mortality rate be established through this monitoring program, the precision of the estimate may be lower than desired; however, the concerns associated with the site will be confirmed as minimal.

As a result of this power analysis, sampling 20 percent of the heliostat field area with representative sampling is statistically and logically supported as sufficient to identify risk and impact areas in accordance with the goals of this plan. It will allow accurate extrapolation of sample results to facility-wide estimates of fatality. The increases in precision resulting from sampling more than 20 percent of the heliostat field are minor and are not likely to generate findings that would improve detection of issues of management concern. However, if monitoring identifies apparent mortality rates that are very low (i.e., less than 50/year), so that the precision of the mortality estimates and their applicability to the entire site are questionable, then the TAC will consider whether to recommend an additional sampling area.

TABLE 2
Assumptions Used in Analysis of the Effect of Sample Area on Fatality Estimates and Confidence Limits (i.e., Power Analysis) for ISEGS Monitoring Study

Topic	Details	Comments
Area searched	Range from 1 percent to 30 percent	Range used for assessment of statistically valid search area.
Scavenging rate	Mean removal time of 7.4 days for small birds, 21.8 days for large birds	Based on wind project fatality studies conducted in similar vegetation and topography, reduced by 25 percent to be conservative.[a]
Searcher efficiency	0.55 for small birds; 0.69 for large birds	Based on wind project fatality studies conducted in similar vegetation and topography, reduced by 25 percent to be conservative.[a]
Distribution	Assumed evenly distributed throughout facility area	Because it is unknown what the distribution of fatalities might be, no attempt was made to account for potential unequal distribution. Due to the wedge-shaped design, the influence of carcass density, should it decrease as distance from tower increases, would not likely substantially change estimates.
Fatality rates[b]	A: 1 bird per MW/year B: 5 per MW/yr C: 10 per MW/yr	Assumed 13 percent of fatalities would be large birds based on percentage of large birds out of all birds at wind projects with similar vegetation and topography.[a]

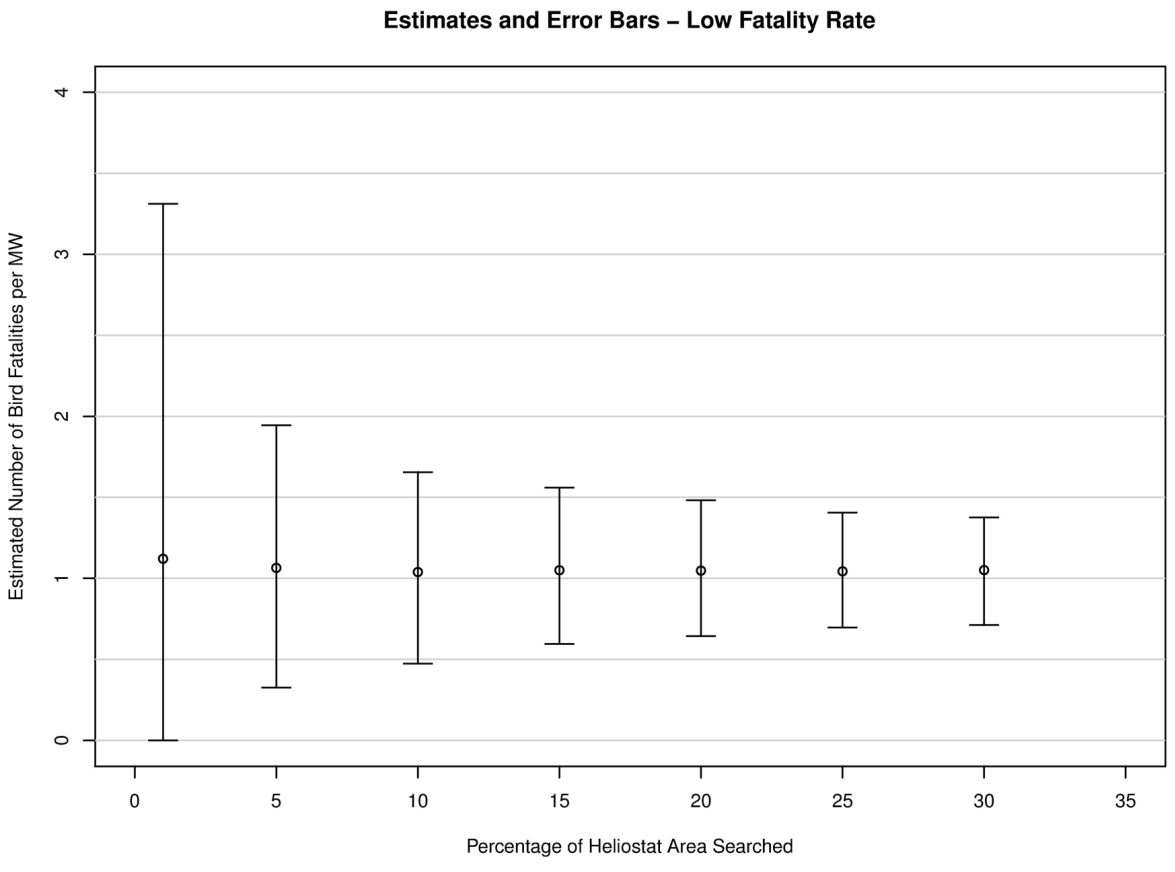
[a]See Table 3 for details and references.

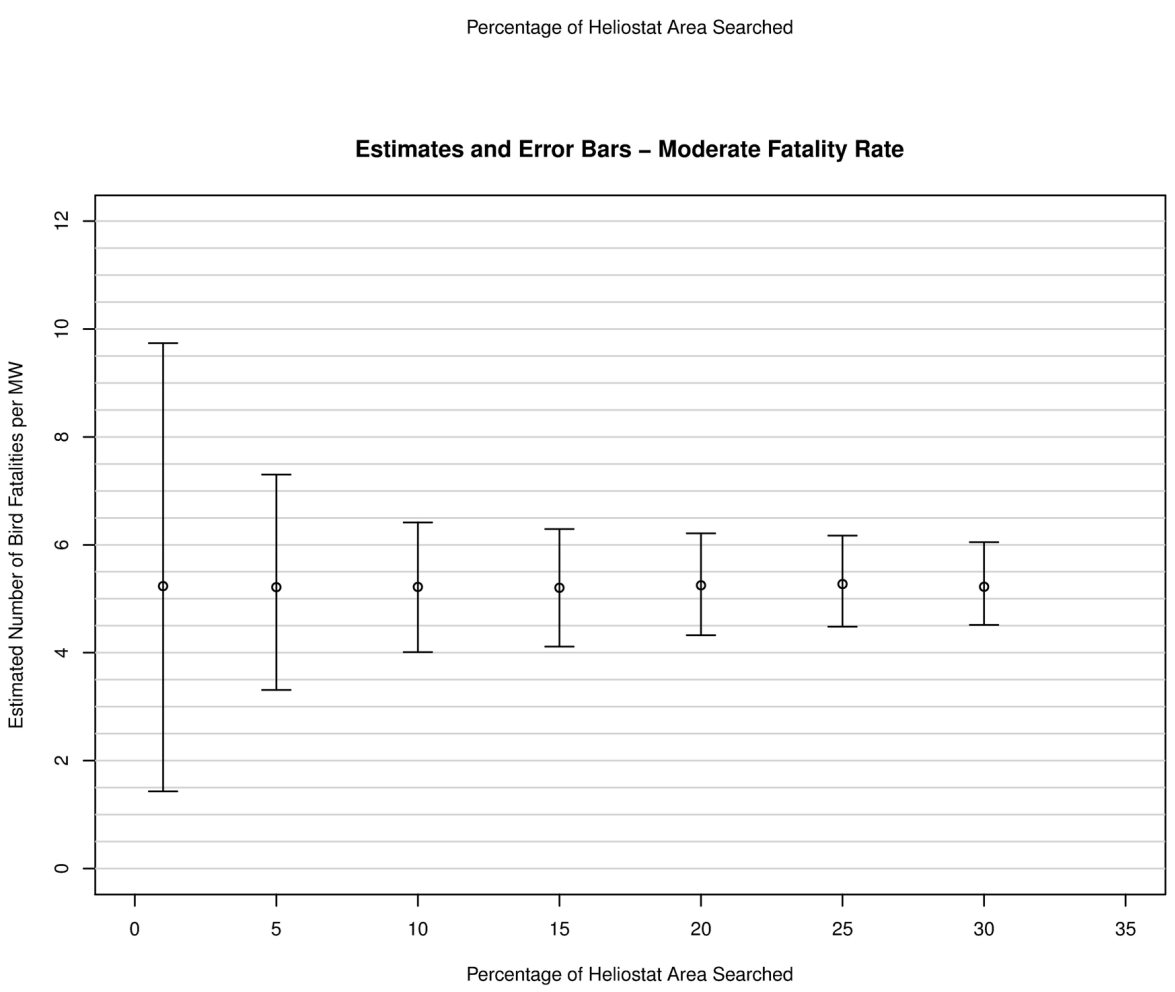
[b]Ranges are hypothetical, for analysis purposes only, and are not intended to indicate the potential range of annual ISEGS avian impacts per megawatt. Avian mortality per megawatt year at wind energy facilities has been documented to range from approximately 14 to less than 1 at wind installations in the United States (see, for example, NWCC, 2010.)

TABLE 3
Mean Removal Times, Searcher Efficiency, and Percent Detected for Large Birds and Small Birds at Projects with Publically Available Reports in Similar Vegetation and Topography Conditions to ISEGS

Project Name	Vegetation	Mean Removal Time: Large Birds (days)	Mean Removal Time: Small Birds (days)	Searcher Efficiency: Large Birds	Searcher Efficiency: Small Birds	Percent Large and Small Birds Detected
Alite, CA[a]	Shrub/scrub ; grassland	17.5	5.85	0.85	0.57	57/43
Dillon, CA[b]	Desert	46.78	17.39	0.96	0.72	10/90
Dry Lake I, AZ[c]	Desert grassland/ forested	Not reported	Not reported	0.91	0.75	4/96
Dry Lake II, AZ[d]	Desert grassland/ forested	22.60	6.50	0.96	0.86	17/83
Average		**29.0**	**9.9**	**0.92**	**0.73**	**22/78**
Number used		**21.8**	**7.4**	**0.69**	**0.55**	**22/78**

[a] Chatfield et al., 2010;[b] Chatfield et al., 2009;[c] Thompson et al., 2011;[d] Thompson et al., 2012.





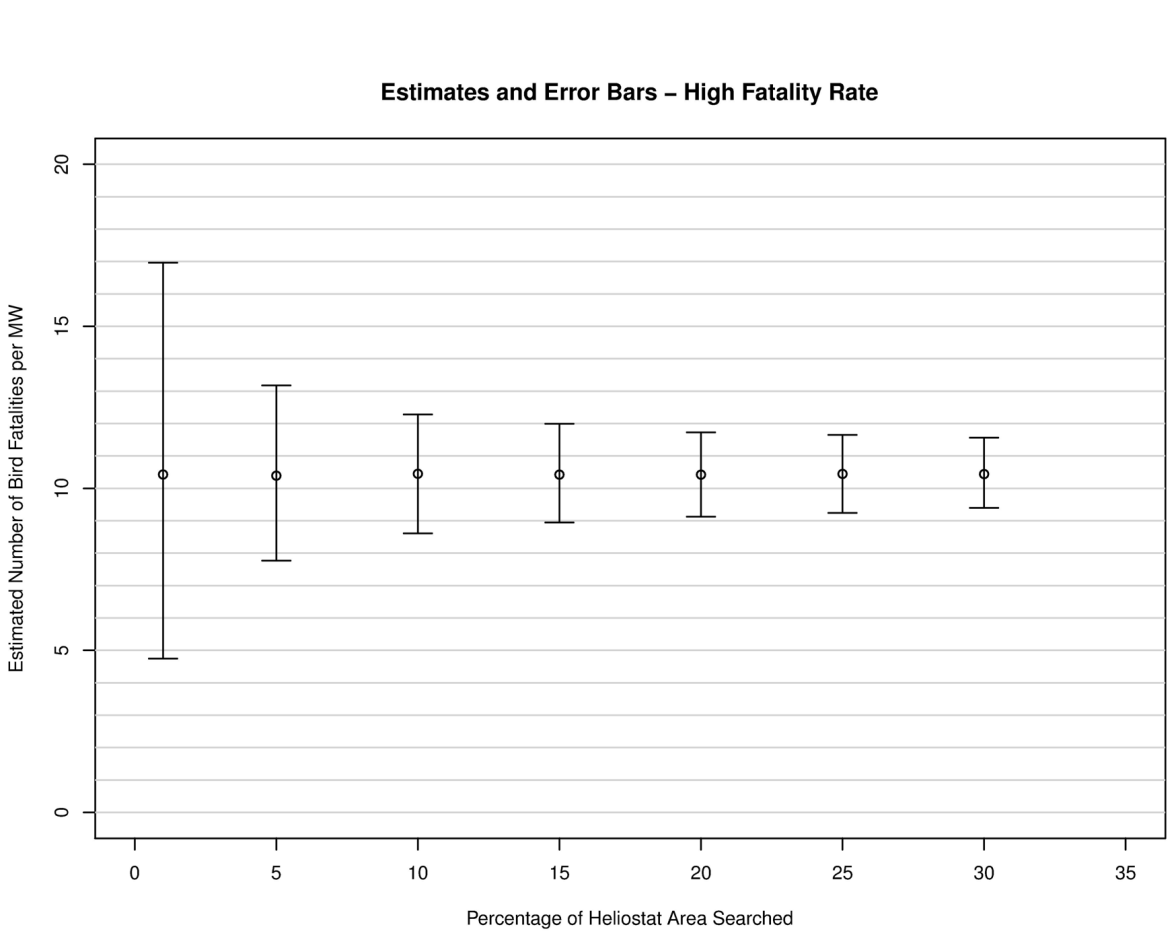


Figure 3: Fatality Estimates and 90-Percent Confidence Intervals for Low, Moderate, and High Fatality Simulations

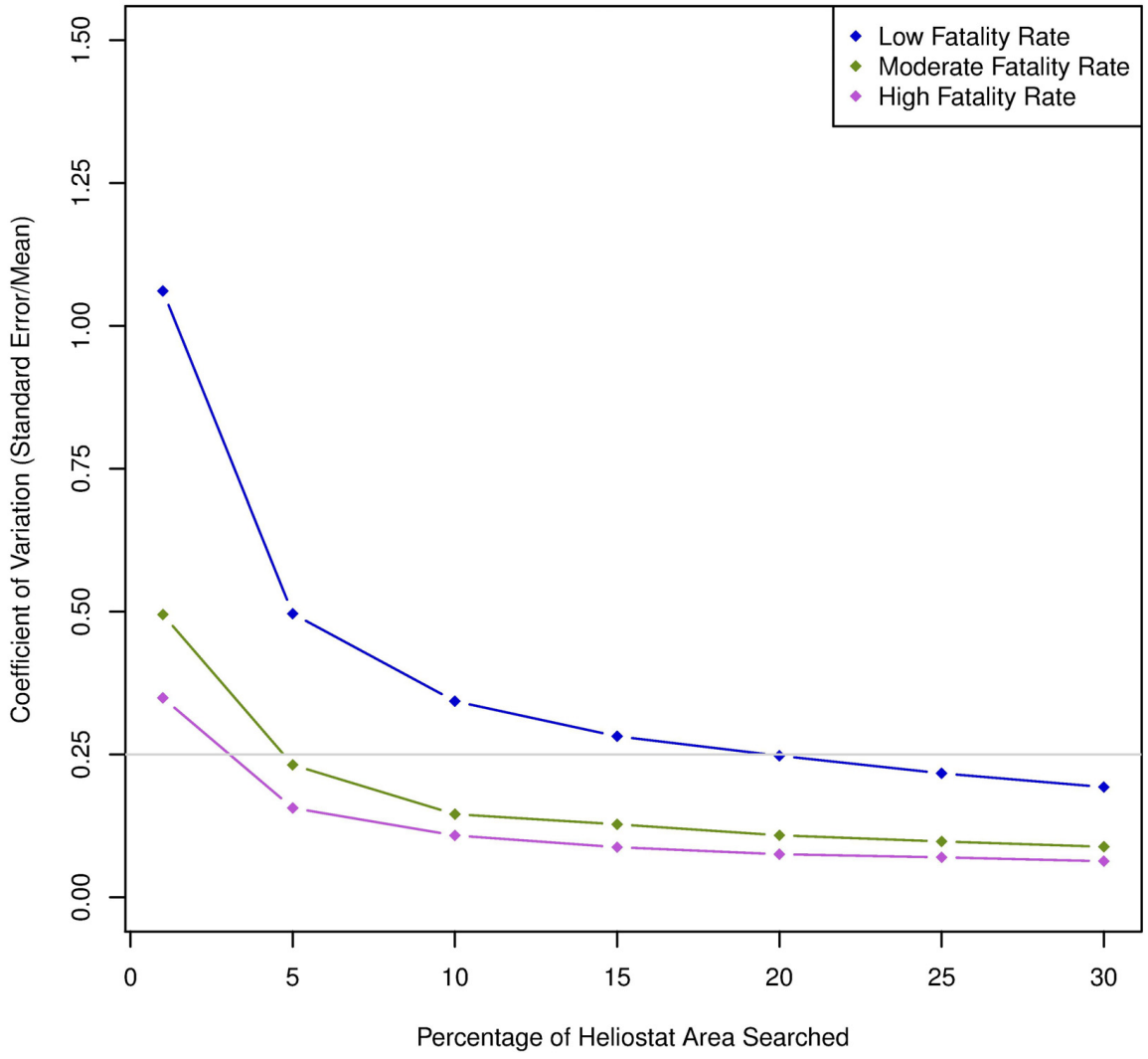


Figure 4: Coefficients of Variation for High, Medium and Low Fatality Simulations

ISEGS - Avian & Bat Monitoring and Management Plan (2802-04)

November 2013

In addition to the planned systematic site surveys, workers will be present in the tower areas on a daily basis, and mirror washing is currently scheduled to take place throughout the entire facility three to five times per year. Therefore, 100 percent of the facility surface will be examined by workers three to five times a year through the Wildlife Incident Reporting System (WIRS; (refer to Section 3.4). In addition, fatality monitoring personnel moving between search areas may encounter carcasses incidentally; these will be tallied and reported separately from the standardized fatality monitoring results, following the same incidental reporting procedure used by operational personnel.

Collectively, the standardized searches and the incidental observations by operational staff and by search personnel will allow for adequate detection of fatalities of rarer species, such as golden eagles, that might not be detected adequately during standardized searches alone. In addition, carcasses of larger species such as eagles have a very long persistence time (usually over a year), which increases the probability of detection.

2.1.5 Off-site Monitoring

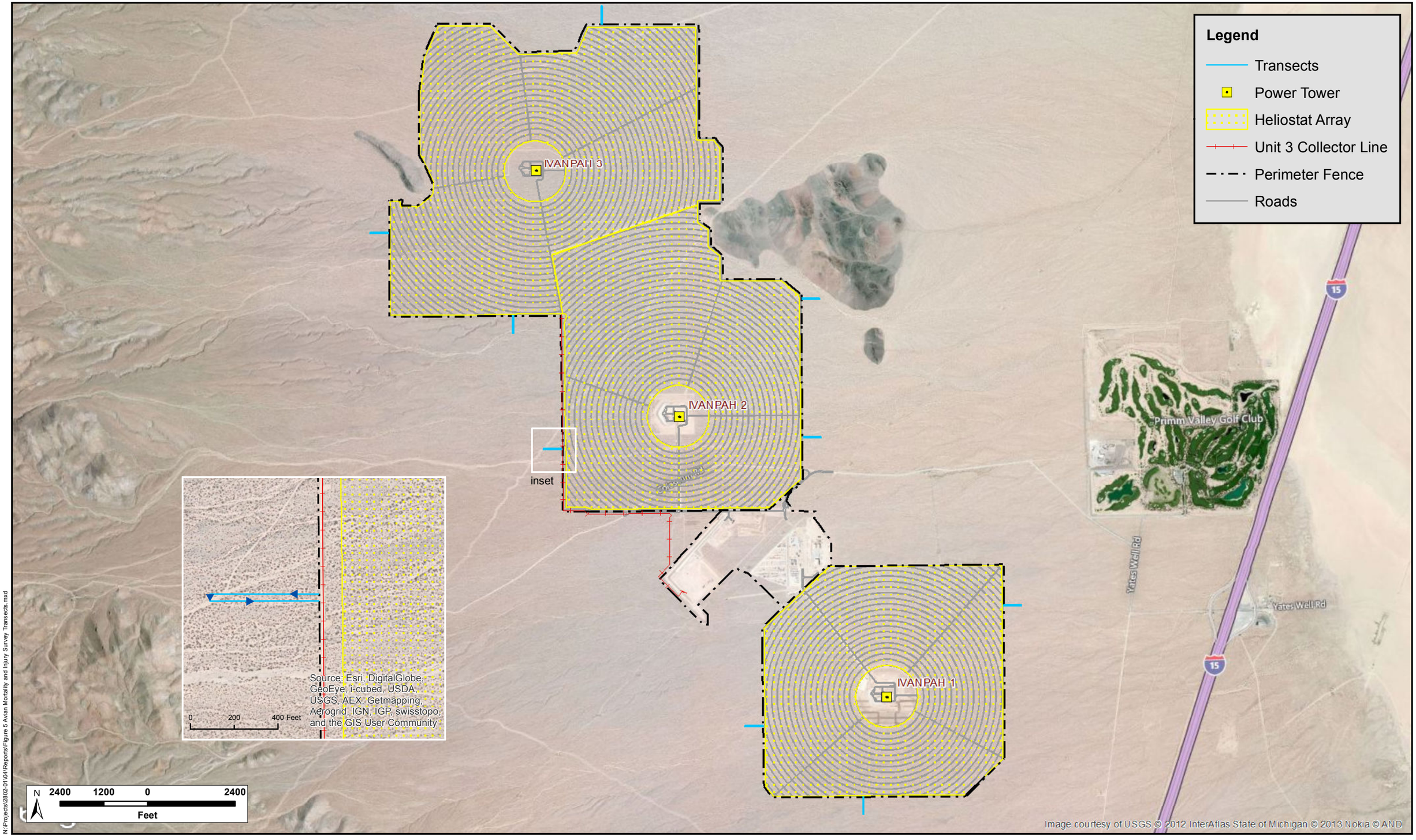
Off-site studies will be conducted by visually inspecting for evidence of avian and bat mortality and injury along two randomly selected 500-foot-long transects, separated by approximately 10 meters extending outward from the perimeter fence and back to the facility at nine locations, including the north, east, south, and west borders of facility (Figure 5). Each transect will be surveyed according to the schedule in Table 1. The transect surveyors will walk each transect from the fence line and then return along the next adjacent transect. Searcher efficiency rates and carcass removal rates will be determined using the same methodology as that used for on-site surveys. However, as a result of the decreased survey area, a reduced number of trial carcasses will be required as compared to the on-site survey effort. Separate mortality rate estimates for the off-site survey results will be generated from the field data and incorporated into estimates of off-site fatality.

Table 4 summarizes the search parameters applicable to the monitoring studies of each tower area, each heliostat field, the facility's perimeter internal and external fence line, and the off-site transect locations. Figures 6 and 7 depict examples of fatality monitoring search patterns for outer and inner arc plots within the heliostat arrays.

TABLE 4
Basic Search Parameters for ISEGS On-site and Off-site Mortality and Injury Monitoring Study

Topic	Details	Comments
Survey coverage in Heliostat field	20 percent	Subject to TAC recommendations in response to mortality rates identified from searches
Survey interval	See Table 1	Subject to TAC recommendations in response to scavenger trials
Rate of travel	1.7 to 2.2 miles/hour	Slow pace to allow careful visual inspection on each side of transect
Transect spacing	Tower area: Standardized at approximately 10 meters apart Perimeter fence: Within 3 meters of the outside of the fence in pedestrian-only-access external areas Heliostat field: Standardized at approximately 10 meters* apart, except in high-density heliostat fields in the inner arc plots where transects will be approximately 8 meters apart Off-site: Outbound and inbound transects separated by approximately 10 meters	Heliostat field transect timing (early morning, mid-day or afternoon) and spacing may vary for searchers to maximize visibility considering vegetation density and/or logistical issues associated with mirror height and position
Transect length	On-site sample areas: Standard within each randomly selected sample area Perimeter fence: Full (100-percent linear coverage) external and internal survey Off-site sample areas: 500-foot outbound and inbound transects	Parallel to ring roads and perimeter fence
Surveyor breaks	Approximately once per hour for humans Approximately once per hour for dogs and only four hours per day during hot seasons; eight hours per day is acceptable for some dogs during mild weather	Short breaks at one-hour intervals to hydrate, snack, and stay alert; approx. 30 minutes for lunch Short breaks at about one-hour intervals for water and also depending upon the rate of finding carcasses (i.e., finding rewards)
Surveyor continuity	Emphasized	Same staff used for each survey (as is practical given staffing constraints) to maximize consistency

*Transect spacing of 10 meters is selected based on experience surveying for avian fatalities in low-growing desert vegetation and flat topography, comparable to conditions present on and off the facility area. The vegetated area between ring roads is 39.6 meters (130 feet); therefore, surveying with four transects spaced at approximately 10-meter spacing (offset 5, 15, 25, and 35 meters from the outside edge of each ring road, and at 10-meter intervals in the cleared area surrounding the towers) allows thorough visual inspection of the sample areas. Six to 10 meters is a generally accepted standard for fatality monitoring at other renewable projects in similar vegetation and topography, and the California guidelines recommend 6-meter spacing with adjustments based on vegetation and topographic conditions (CEC and CDFG, 2007). Additionally, the USFWS (2012) guidelines recommend spacing at 4- to 10-meter intervals based on vegetation and topography.



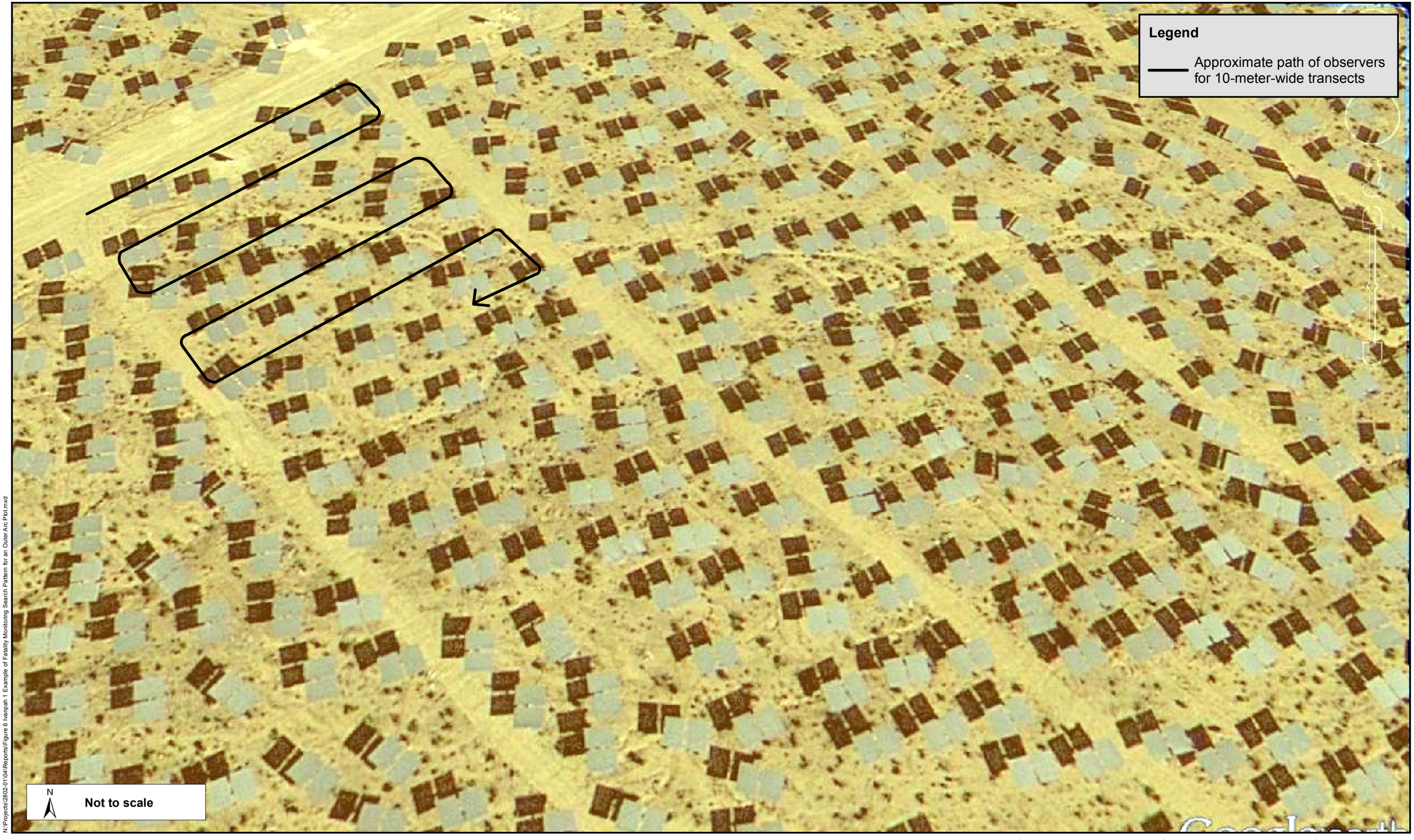
N:\Projects\2802-01\04\Reports\Figure 5 Avian Mortality and Injury Survey Transects.mxd

H. T. HARVEY & ASSOCIATES
ECOLOGICAL CONSULTANTS

Figure 5: Off-site Avian and Bat Mortality and Injury Survey Transects

ISEGS - Avian & Bat Monitoring and Management Plan (2802-04)

November 2013



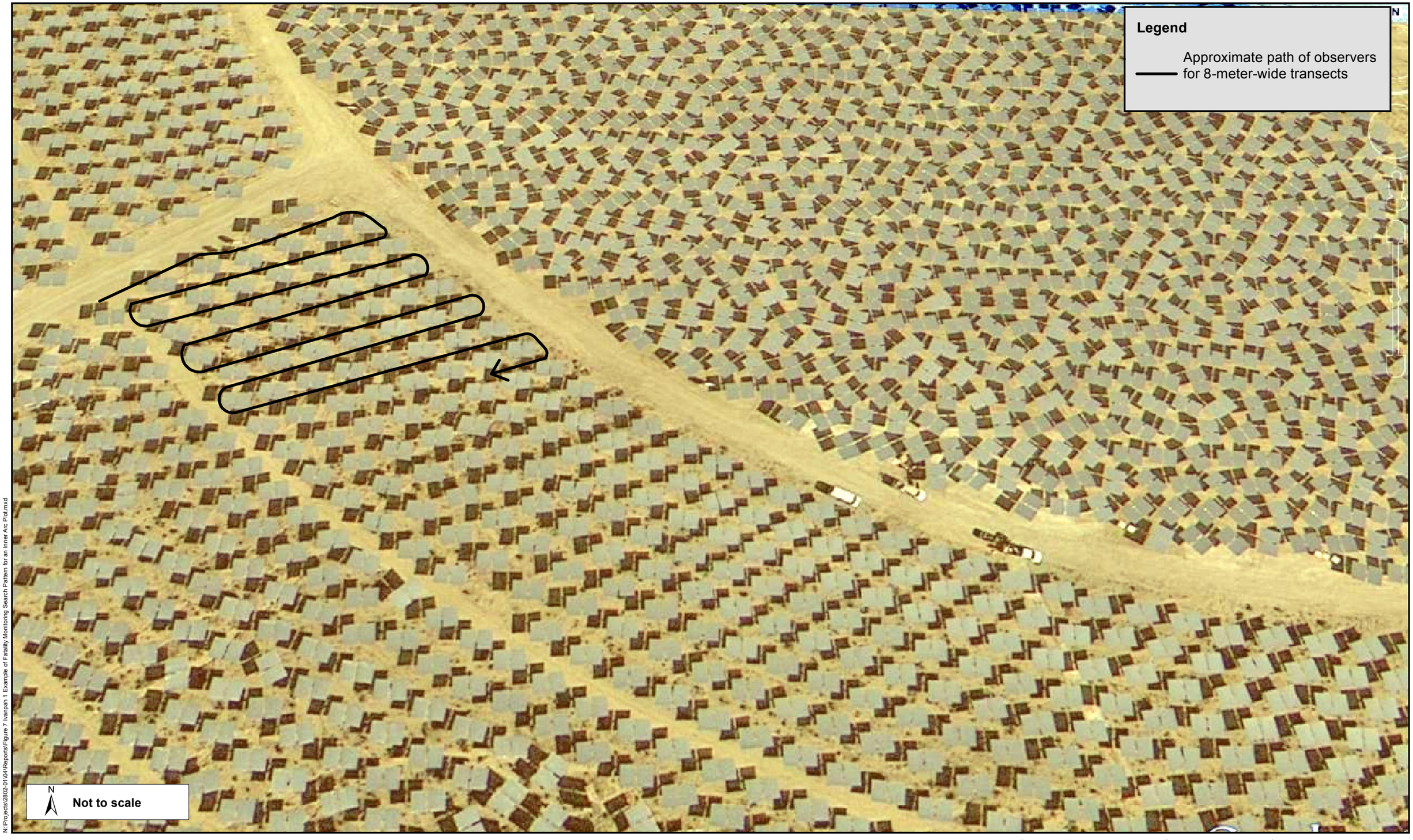
N:\Projects\2802-01\04\Reports\Figure 6 Ivanpah 1 Example of Fatality Monitoring Search Pattern for an Outer Arc Plot.mxd

H. T. HARVEY & ASSOCIATES
ECOLOGICAL CONSULTANTS

Figure 6: Ivanpah 1 Example of Fatality Monitoring Search Pattern for an Outer Arc Plot

ISEGS - Avian & Bat Monitoring and Management Plan (2802-04)

November 2013



N:\Projects\2802-01\04\Reports\Figure 7 Ivanpah 1 Example of Fatality Monitoring Search Pattern for an Inner Arc Plot.mxd

H. T. HARVEY & ASSOCIATES
ECOLOGICAL CONSULTANTS

Figure 7: Ivanpah 1 Example of Fatality Monitoring Search Pattern for an Inner Arc Plot
ISEGS - Avian & Bat Monitoring and Management Plan (2802-04)
November 2013

2.1.6 Data Recordation and Detection Protocols

When a detection is made, information about the type of bird, its condition, and the location will be recorded in a digital data dictionary. The term "detection" is used throughout this document to indicate that observers may find injured birds, intact dead birds, partial birds, and feather spots indicative of avian mortality, as well as injured or dead bats. Field personnel will undertake visual and manual inspection of all carcasses, feathers, and/or body parts discovered in the field. For all detections, data recorded will include species, sex, age, and breeding condition (for example, if a brood patch is present) when possible; distance from observer when detected; date and time collected; GPS location; distance to tower (or structure that caused mortality, if determined); dominant vegetation/ground cover at the location (i.e., within 2 meters of the carcass); condition (fresh, early decomposition, late decomposition, desiccated, scavenged, intact); and any indication of cause of death, such as type of injury, using the criteria outlined in Section 2.1. All detections will be plotted on a detailed map of the study area that shows the location of the surveyed areas, heliostats, tower, roads, and perimeter fence and photographed, using a 12-megapixel digital camera, in situ as well as with full-frame photographs of the dorsal, ventral and head areas of the bird or bat.

Under direction of the TAC and assuming the biologists involved are covered by required federal and state salvage/scientific-collecting permits (discussed further below), detections will be collected, labeled with a unique number, bagged, and frozen for up to one year for future reference and possible necropsy if cause of death cannot be determined upon physical inspection. Carcasses may also be used for scavenger and searcher efficiency trials. The contractors, with TAC approval, or Fish and Wildlife Service Law Enforcement branch will determine whether certain birds detected during the surveys should be removed from the project area so that a third-party wildlife laboratory, under the direction and expense of the USFWS or TAC agencies, may conduct formal necropsy assessments. Copies of all results of any formal necropsy assessment will be provided to the TAC and ISEGS within one week of completion. Detections outside of the surveyed areas, such as those identified while driving through the site or observed outside a survey area boundary during other project-related activities, will also be documented following the above protocol as closely as possible. These detections will be coded as incidental discoveries, and not included in statistically based estimation procedures for the facility because they would not represent systematic survey results.

In the event a dead or injured bald or golden eagle is found, USFWS Office of Law Enforcement (OLE) shall be contacted as soon as possible, but no later than 48 hours after discovery. If a dead eagle is found, the OLE agent will provide instructions on collection and disposition of the eagle carcass. Until then, the carcass will be left in place, unless a project-affiliated biologist has the necessary federal and state permits to authorize handling the carcass in coordination with the OLE.

Any state- or federally listed threatened or endangered species found dead or injured shall also be reported to OLE as soon as possible, but no later than 48 hours after discovery. If a dead animal is found, the OLE agent will provide instructions on collection and disposition of the carcass. A list of federal threatened and endangered species by state may be found in the USFWS's Threatened and Endangered Species System (TESS) database at: http://www.fws.gov/endangered. A list of California threatened and endangered species may be found at http://www.dfg.ca.gov/biogeodata/cnddb/pdfs/TEAnimals.pdf.

Migratory birds, including eagles and threatened or endangered species, that are injured shall be captured, stabilized, and immediately transferred to a licensed veterinarian or federally permitted migratory bird rehabilitator for care. All injured birds observed within a survey area or elsewhere within the facility will be recorded and treated as detections for analytical purposes. The primary avian rehabilitation facility identified to care for injured birds potentially detected during the program is the Ojai Raptor Center, 370 Baldwin Road, Ojai, California (www.ojairaptorcenter.org), with Kim Stroud,

Director (805-798-3600/raptorcenter@roadrunner.com) serving as the primary point of contact. Other avian rehabilitation centers that may also be used are listed in Table 5.

TABLE 5
Avian Rehabilitation Centers

County	City	Name	Phone
Kern	Bakersfield	California Living Museum	661-872-2256
Kern	Bakersfield	Facility for Animal Care and Treatment	661-654-3167
Kern	Tehachapi	Tehachapi Wildlife Rehab & Education	661-822-8993
Kern	Ridgecrest	VCA Crestwood Animal Hospital	760-446-7616
San Bernardino	Big Bear Lake	Moonridge Zoo	909-584-1299
San Bernardino	Chino Hills	All Gods Creatures	909-393-1590

2.1.7 Permitting to Handle Carcasses and Specimens Used in Bias Trials

To ensure accurate documentation of fatalities and probable causes of death, and to enable robust searcher efficiency and carcass removal assessments, biologists involved in mortality monitoring and related bias trials will be covered by federal and state permits that authorize handling and collection of carcasses of birds protected by the MBTA. At the federal level, ISEGS will seek to obtain a USFWS SPUT permit that specifically authorizes collection of bird fatalities associated with commercial energy and utility operations, and use of bird carcasses for related bias trials. If the USFWS processing time for obtaining a SPUT permit extends beyond when fatality monitoring and the associated bias trials must begin, an interim letter of authorization will be obtained from the USFWS to allow for carcass handling under the auspices of a personal USFWS salvage permit, held by either an employee of the ISEGS owner/operators or the biological consultant responsible for managing the monitoring program. If additional bird specimens acquired outside the project are necessary to achieve sufficient sample sizes for the described bias trials, these collections also will be appropriately authorized by the SPUT permit. All such specimens will then be formally transferred to and reported under the ISEGS SPUT permit, once it is in place.

Handling of migratory birds (and bats) is also prohibited under the California Fish and Game Code unless specifically authorized by a CDFW Scientific Collecting Permit. These permits generally are issued only to individuals. Therefore, all biologists involved in handling carcasses for this monitoring program will be authorized by a relevant CDFW Scientific Collecting Permit held by either an employee of the ISEGS owner/operator, or the biological consultant responsible for managing the monitoring program.

2.1.8 Study Duration

Standardized surveys within each of the three ISEGS solar facilities (power towers and heliostats), along the perimeter fences, Unit 3 Collector Line, and off-site study areas, will be conducted for a minimum of two years. Monitoring intervals and survey areas may be adjusted as necessary to incorporate the results of the carcass removal trials and prior seasonal evaluations and conclusions. After each season and year of surveys, the monitoring program will be evaluated by the TAC to determine if modification or continuance is necessary.

2.2 Weather-related Fatality Monitoring

Low-visibility weather conditions have been implicated in most larger-scale avian collision events at communication towers and other tall structures (Longcore et al., 2012; Gauthreaux and Besler, 2006). High wind conditions may also be of concern with regard to collision risk. To document potential weather-related collision risks that may be associated with the three power towers at the facility, additional surveys will be conducted during the peak spring (late-March to early-May) and fall (late-August to early-October) migration periods, within two days of up to two low-visibility or high-wind nocturnal weather events per season. For study purposes, a low-visibility weather event is defined as foggy, highly overcast, or rainy night-time weather typically associated with an advancing frontal system and can occur during the day or night. For the purposes of this monitoring program, high-wind events are defined as winds above 40 miles per hour for a sustained period of greater than four hours. In addition, the online Avian Hazard Avoidance System (AHAS), accessed at http://www.usahas.com/bam/, will be used to identify and monitor potential high-risk weather-related events for birds.

Surveys will be conducted by walking transects, approximately 10 meters apart (see Table 4 for spacing information), throughout an approximately 259-meter (850-foot) -radius circular plot, a distance that is approximately 1.9 times greater than the tower height. The search radius is based on a conservative application of the CEC and CDFG's (2007) California guidelines for wind energy projects, which recommend a search distance extending out one-half the distance of the maximum height of the structures. The search radius also is based on the USFWS (2012) recommendation that avian surveys extend out a distance equal to twice a structure's height in the context of tall wind energy towers. Studies have found that over 80 percent of bat fatalities fall within half the distance of a wind turbine's height (as cited in USFWS, 2012). Consequently, the proposed survey area would also allow identification of potential bat collisions during the weather-related fatality monitoring effort. All avian and bat detections will be documented and collected in a similar manner as described for the year-round standardized surveys.

2.3 Avian Use Studies

Avian use surveys will be implemented using standard, variable-radius point counts to assess bird use of the vegetated areas within the heliostat fields and comparable off-site study areas. The objectives of the study are to document avian species composition on-site and off-site, compare abundance at the areas representative of the lower bajada and upper bajada environments within and in the area near the facility, and document changes in avian use in these areas over time. To achieve these objectives, point counts will be conducted twice per month during the migration seasons and monthly during summer and winter at 80 points randomly selected from within the following five study areas (Figure 8):

1. 20 points within an approximately 1-square-mile study area located in Unit 1, within the lower bajada environment of the facility.
2. 20 points within an approximately 1-square-mile off-site study area located in comparable lower bajada environment as far as practicable from the Unit 1 fence line.
3. 10 points within an approximately 0.5-square-mile study area located in Unit 2, within the upper bajada environment.
4. 10 points within an approximately 0.5-square-mile study area located in Unit 3, in the upper bajada portion of the facility.
5. 20 points within an approximately 1-square-mile off-site study area located in comparable upper bajada environment and as far as practicable from the Unit 3 fence line.

Each of the areas described above was gridded into 200-meter by 200-meter square areas to define distinct sample plots. Within each study area, the 10–20 avian use survey points were randomly selected from the

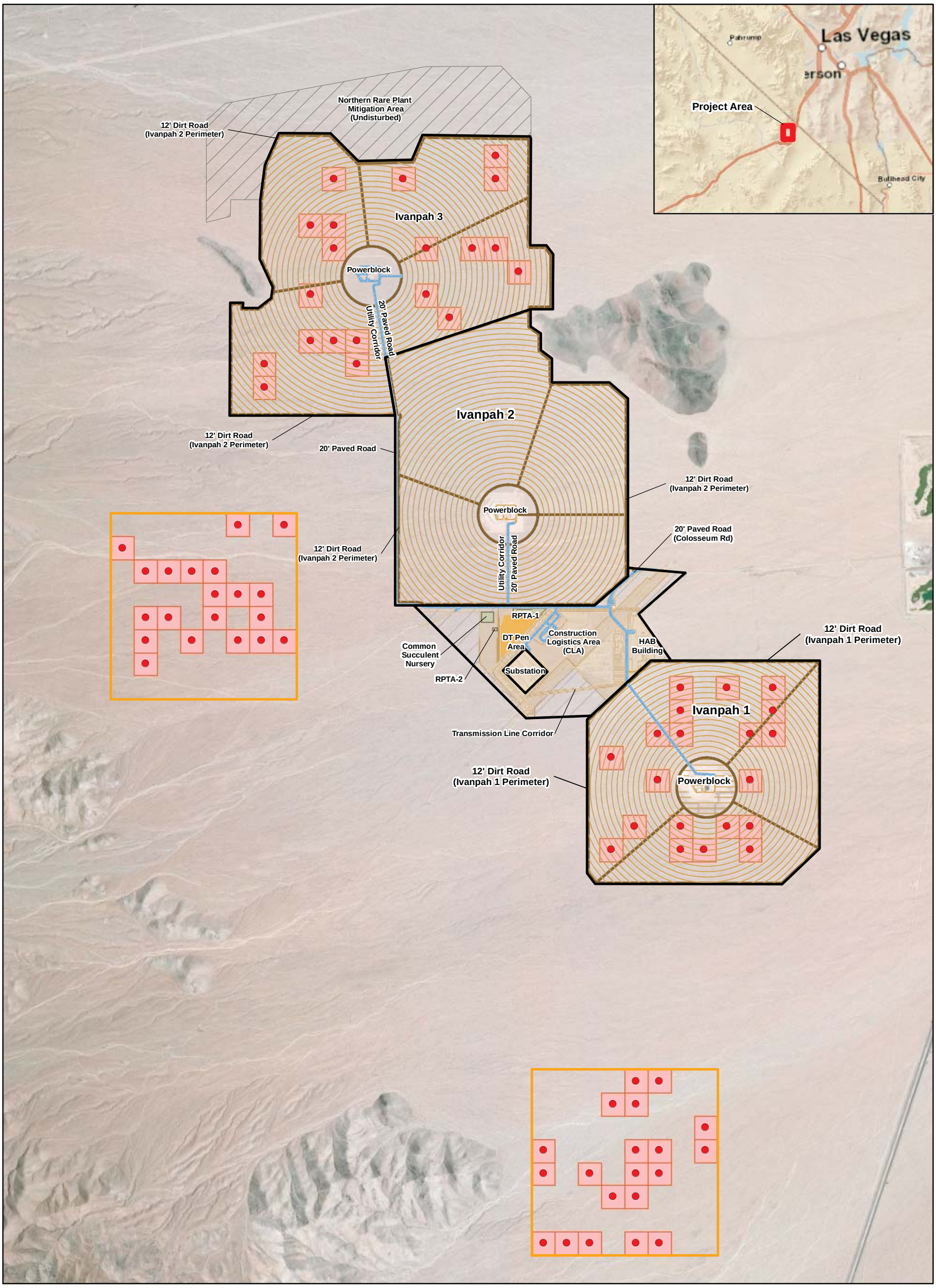
sample plots, resulting in 20 point counts per square mile for each habitat type in the facility and control areas, with each count location affording a minimum, non-overlapping survey radius of 100 meters.

Avian use surveys are planned for completion once per month during summer (June 1 to August 31) and winter (December 1 to February 28), and twice per month during spring (March 1 to May 31) and fall migration periods (September 1 to November 31) at the 80 points distributed across the facility and off-site project area (see Figure 8). The point counts will be conducted for 10 minutes at each avian use study point, with all surveys completed between first light (when birds are visible enough for identification) and three hours after sunrise. The sampling scheme allows for assessment of the wintering and summering bird community, as well as documentation of migrants.

All birds heard or seen at each point up to 100 meters from the observer will be recorded to document species occurrence and estimate abundance. Information about the survey location and time, weather conditions, bird species, number of individuals if in a group, initial detection distance from observer (to nearest 10 meters), location relative to project infrastructure, behaviors, flight direction, flight height, use of facility airspace and infrastructure, and comments will be recorded in a digital data dictionary.

Behavioral categories will be coded as follows:

(P)erched: (r)esting, (p)reening, (f)eeding, (c)ourting/mating
(G)round: (r)esting, (p)reening, (f)oraging/feeding, (c)ourting/mating
(F)lying: (m)igrating, (t)ransit, (s)oaring, (f)oraging, (c)ourtship/territorial, (d)efensive/escape
(N)esting: (b)uilding, (c)opulating, (i)ncubating, (t)ending young, (f)eeding



H. T. HARVEY & ASSOCIATES
ECOLOGICAL CONSULTANTS

Figure 8: Avian Use Monitoring
ISEGS - Avian & Bat Monitoring and Management Plan (2802-04)
November 2013

When relevant, additional details will be recorded concerning the specific nature of interactions with project infrastructure (e.g., hunting beneath heliostats, using heliostats as escape cover, response to elevated solar flux region), specific perch substrates used, and the specifics of any predator-prey interactions observed (e.g., species involved, setting, and outcome).

Flight heights will be estimated as follows:

0 = < 10 meters above ground level (agl); i.e., within the heliostat collision-risk zone
1 = 10–100 meters agl; i.e., between the heliostat collision-risk zone and the elevated solar flux risk zone near the power towers
2 = 100–200 meters agl; i.e., within the elevated solar flux risk zone (primary boiler area at 120–140 meters agl)
3 = > 200 meters agl; i.e., above the elevated solar flux risk zone

Flight direction will be recorded for birds detected moving through the facility or control plot survey area (as opposed to those undertaking localized movements within the facility or control plot survey area) as: N, NW, E, SE, S, SW, W, or NW.

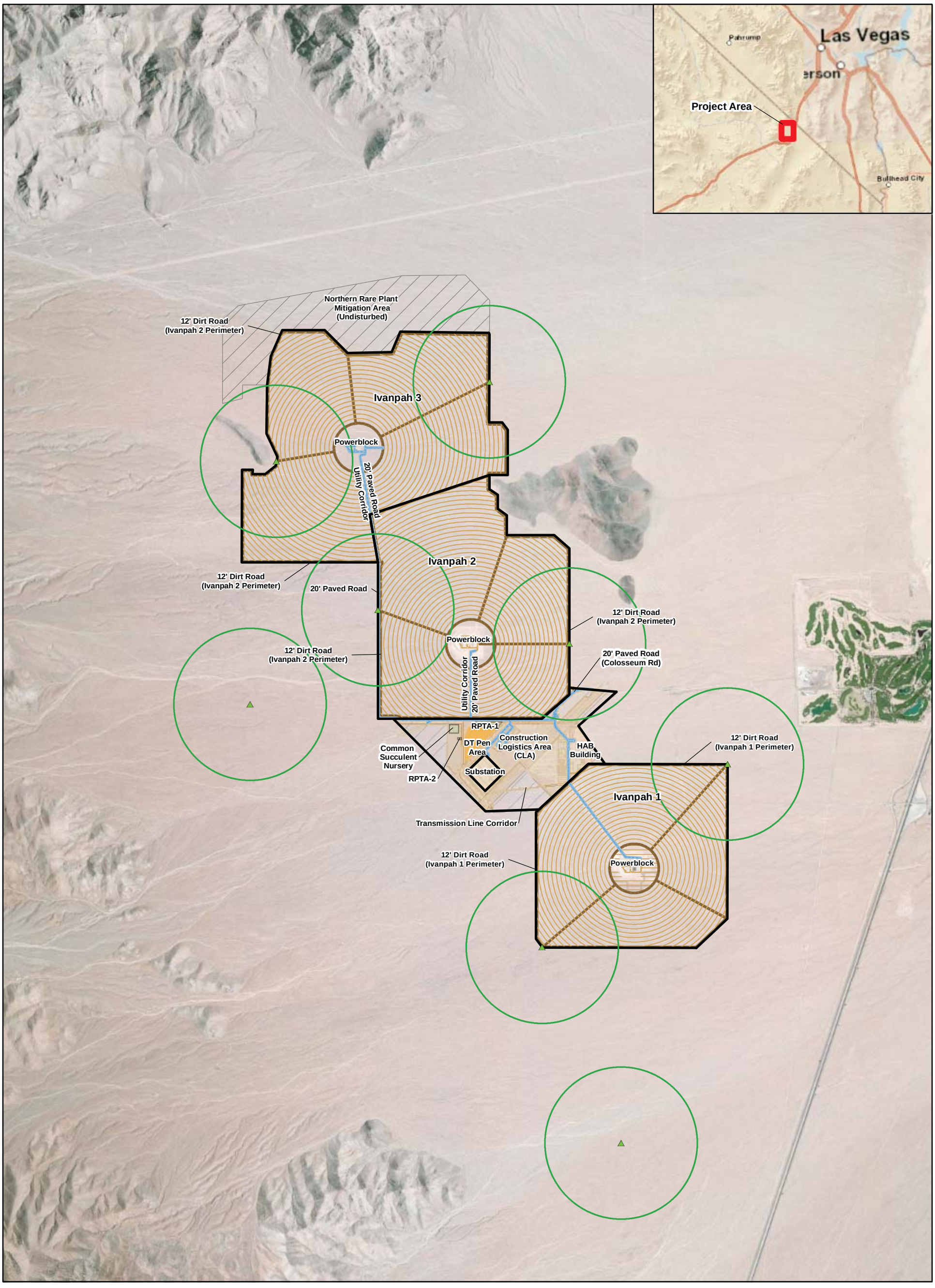
Weather data will be recorded on an hourly basis throughout each survey morning with the aid of a handheld weather-tracker (e.g., Kestrel 4000) and compass, including information on cloud cover, precipitation, visibility, ambient temperature, wind speed, and wind direction.

Species abundance will be estimated using standard distance-sampling data analysis techniques for variable-radius point counts, using programs such as DISTANCE (Buckland et al., 1993). Avian use study results will be prepared and submitted on a quarterly basis with the mortality and injury monitoring reports, described in Section 3.3. Surveys will be completed for a minimum of two years, after which the avian use study will be evaluated by the TAC to determine if modification or continuance is necessary.

The survey will be temporarily halted if any birds are observed exhibiting signs of injury, and immediate efforts will be made to capture, stabilize, and transfer injured birds to a licensed veterinarian or federally permitted migratory bird rehabilitator for care. Incidental mortalities will be handled as described in Section 2.1.6.

2.4 Raptor and Large-Bird Use Monitoring

Raptor and large-bird use surveys will be implemented using unlimited-distance point counts to assess use of the facility and off-site study areas. The objectives of the study are to compare seasonal and annual raptor and large-bird species composition and rates of use between the facility and the off-site study areas, and to document changes in use over time. Surveys are planned for completion once per month during summer (June 1 to August 31) and twice monthly the rest of the year at eight points distributed across the facility and off-site study areas (Figure 9).



H. T. HARVEY & ASSOCIATES
ECOLOGICAL CONSULTANTS

Figure 9: Raptor and Large Bird Use Monitoring
ISEGS - Avian & Bat Monitoring and Management Plan (2802-04)
November 2013

The protocols for these point counts will be identical to those for the general avian use studies, with five exceptions:

1. Only raptors and other large birds (e.g., waterbirds and gulls) will be tallied.
2. Relevant birds will be recorded regardless of distance from the observer.
3. The initial detection distance from observer will be estimated to the nearest 100 meters.
4. The activity locations, perches used, and flight paths of all observed individuals will be immediately mapped using a GPS-equipped iPad with the GIS Kit application, appropriate aerial imagery, and maps of the facility, count locations, and any known raptor nesting areas.
5. Additional data recording will include time-on-plot estimates to quantify the temporal presence of individuals in each study area.

The sampling scheme allows for assessment of the wintering and summering bird community as well as documentation of diurnal migrants. Six of the survey points are positioned to allow evaluation of both on- and off-site use of the project, and two points are located entirely off-site. The towers are in view from each facility-oriented survey point, allowing observation of birds potentially using the area around each tower. Survey points will be evaluated for four-hour sample periods randomly distributed through the middle portion of the day (approximately 9:00 a.m. to 5:00 p.m., depending on time of year) when diurnal raptors are generally considered most active, and sampling will be rotated so that every four months, all points are evaluated throughout the diel sample period. Regardless of the sampling period, all incidental observations of raptors and large birds by the observers should be recorded as incidental observations when observing outside the sampling period.

All raptors and large birds will be recorded to unlimited distance to document species occurrence and characterize use of the project and off-site area, but a survey-area radius of 800 meters will be used for standardized assessment and comparison of mean use for raptors and large birds. Species-specific mean use will be estimated for on- and off-site portions of the study area, allowing comparisons of the raptor and other large-bird community between areas, seasons, and years. Surveys will be completed for a minimum of two years, after which the avian use study will be evaluated by ISEGS and the TAC to determine if modification or continuance is necessary.

The survey will be temporarily halted if any birds are observed exhibiting signs of injury, and immediate efforts will be made to capture, stabilize, and transfer injured birds to a licensed veterinarian or federally permitted migratory bird rehabilitator for care. Incidental mortalities will be handled as described in Section 2.1.6.

2.5 Golden Eagle Monitoring

The ISEGS project team is aware that a number of entities have been and are currently conducting studies of golden eagles in the Ivanpah Valley. The USFWS has requested that the ISEGS team summarize and incorporate the data related to territory occupancy and reproductive success into the ISEGS avian monitoring reports. These data will be collected (subject to public or other authorized availability) and incorporated into the ISEGS avian monitoring reports. Golden eagle reporting will be undertaken for a minimum of two years, after which the data will be evaluated by the TAC to determine if modification or continuance is necessary. Golden eagle and raptor monitoring reports will be submitted to the TAC quarterly and distributed to the Renewable Energy Action Team (REAT) agencies (CEC, CDFW, USFWS, and BLM).

3.0 Data Analysis and Reporting

Data analysis and reporting will consist of assessing the two principle investigations: (1) collision- and flux-related mortality and injury, and (2) avian use. The collision- and flux-related data analysis procedures are detailed in Section 3.1, along with the methodology for the assessment of weather-related events. The avian use analyses approaches are discussed in Section 3.2.

3.1 Statistical Methods for Collision- and Flux-related Investigations

Statistical methods will be used to generate facility-wide estimates of potential avian impacts 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

Fatality estimates will be reported as collision, flux, flux and collision, other project impacts, or unknown (as described in Section 2.1) for a minimum of four categories: (1) all birds, (2) small birds, (3) large birds, and (4) raptors specifically. The total number of avian fatality detections identified during the surveys will be adjusted for removal and searcher efficiency biases to generate estimates of facility-wide mortality, as well as project-caused avian impacts. All survey area or incidental detections, regardless of species, will be reported; however, separate estimates will be prepared for the 100-percent tower area survey, the heliostat field, the perimeter fence, and the off-site transect survey areas.

3.1.1 Definition of Variables

The following variables are used in the equations below:

C the total number of detections per monitoring season

c_i the number of detections at plot *i* for the study period of interest (for example, one season, one monitoring year) for which the cause of death is either unknown or is attributable to the facility

k the number of areas searched (including the ground beneath the tower within each search plot)

s the number of trial carcasses used in removal trials

s_c the number of trial carcasses in removal trials that remain in the study area after 30 days

se standard error (square of the sample variance of the mean)

t_i the time (in days) a trial carcass remains in the study area before it is removed, as determined by the removal trials

$\bar{t}$ the average time (in days) a trial carcass remains in the study area before it is removed, as determined by the removal trials

d the total number of trial carcasses placed in searcher efficiency trials

p the estimated proportion of detectable trial carcasses found by observers, as determined by the searcher efficiency trials

I the average interval between standardized removal surveys, in days

$\hat{\pi}$ the estimated probability that a trial carcass is both available to be found during a survey and is found, as determined by the removal trials and the searcher efficiency trials

m the estimated annual average number of detections at the facility per season, adjusted for removal and searcher efficiency biases

3.1.2 Observed Number of Detections

The estimated number of detections (C) observed per monitoring season is:

$$C = \sum_{i=1}^{k} c_i$$

This is the total number of detections found, which is the sum of the carcasses found in each of the *k* plots searched.

3.1.3 Estimation of Bird Non-removal Rates

Estimates of bird non-removal rates are used to adjust detection counts for removal bias. Mean bird removal time ($\bar{t}$) is the average length of time a bird remains in the study area before it is removed:

$$\bar{t} = \frac{\sum_{i=1}^{s} t_i}{s - s_c}$$

This is a standard formula from survival analysis for determining the average of a set of values with right censored observations. In the case of carcass removal trials, a right censored observation is one in which the carcass persists until the end of the removal trial, and is picked up at the end, effectively removing it from study before it is removed by scavenging or other means.

3.1.4 Estimation of Searcher Efficiency Rates

Searcher efficiency rates are expressed as *p*, the proportion of trial carcasses that are detected by searchers in the searcher efficiency trials. These rates will be estimated by subject size and season.

3.1.5 Estimation of Facility-related Fatality Rates

The estimated seasonal fatality rate for the facility (*m*) is calculated by:

$$m = \frac{C}{\hat{\pi}}$$

where $\hat{\pi}$ includes adjustments for both bird removal (from scavenging and other means) and searcher efficiency bias. When data do not test statistically significantly different between seasons at the alpha = 0.10 level (using a chi-squared test of proportions for searcher efficiency and a nonparametric Monte Carlo test for scavenger removal rates), data for trial carcass removal and searcher efficiency biases will be pooled across the study to estimate $\hat{\pi}$. Otherwise, separate estimates will be made for each season.

$\hat{\pi}$ is calculated as follows:

$$\hat{\pi} = \frac{\bar{t} \cdot p}{I} \cdot \left[\frac{\exp\left(I / \bar{t} \right) - 1}{\exp\left(I / \bar{t} \right) - 1 + p} \right]$$

This formula has been independently verified by Shoenfeld (2004).

The associated standard errors and 90-percent confidence intervals for *m* and each of the parameters used to calculate fatality estimates for the facility will be calculated using bootstrapping (see Manly, 1997). Bootstrapping is a computer simulation technique that is useful for calculating point estimates, variances, and confidence intervals for complicated test statistics. For each bootstrap sample, C, $\bar{t}$, p, $\hat{\pi}$, and *m* are calculated. A total of 1,000 bootstrap samples will be used. The standard deviation of the bootstrap estimates is the estimated standard error. The lower 5th and upper 95th percentiles of the 1,000 bootstrap estimates are estimates of the lower limit and upper limit of 90-percent confidence intervals for the reported estimates. Confidence limits found through bootstrapping can be interpreted in the same way as exact confidence limits calculated by formulae, in essence presenting a very likely range for the actual value to occur within.

3.2 Methods for Assessments of Avian Use

Methods for assessing avian use studies will focus on species composition and abundance to provide descriptive statistics. For species composition and abundance, the focus will be on comparison between the on- and off-site areas. For raptor and large-bird studies, the data will generate descriptive statistics. The details of each of these methods are presented below.

3.2.1 Avian Use Survey Assessment Methods

Each variable-radius point-count survey grid will be analyzed separately to allow comparison of species composition and species abundance between areas. Species lists will be prepared for each survey grid

area, and species abundance will be estimated using standard distance-sampling data analysis techniques for variable-radius point-count data and using programs such as DISTANCE (Buckland et al., 1993). Avian use study results will be prepared and submitted on a quarterly basis with the mortality and injury monitoring reports, described in Section 3.3. Avian use surveys will be completed for a minimum of two years, after which the avian use study will be evaluated by the TAC to determine if modification or continuance is necessary.

3.2.2 Raptor and Large-Bird Surveys Assessment Methods

Separate species lists of all raptors and large birds detected on- and off-site, regardless of distance from observer (i.e., including those observed beyond 800 meters and those recorded incidentally/outside standardized raptor and large-bird surveys), will be prepared for each season of monitoring. Data will be analyzed to generate descriptive statistics that will be presented in text, tables, and figures that summarize the number of observations of each species, the locations of species observed, and the relative frequency of observation (i.e., the mean number of birds observed per hour of observation) on- and off-site and between seasons and years. Flight paths of all raptors and large birds will be reported in figures, flight heights will be reported in tables, and any areas of concentrated use will be identified if present. In addition, behavioral responses to the facility will be summarized if detected. Surveys will be completed for a minimum of two years, after which the avian use study will be evaluated by ISEGS and the TAC to determine if modification or continuance is necessary.

3.3 Reporting

All detections will be recorded in the USFWS Special Purpose – Utility (SPUT) permit report and submitted to the TAC monthly. A seasonal monitoring report will be prepared within three months of completion of each seasonal monitoring period (once per quarter) by the contractor responsible for field studies and data analysis. The report will include the results of the studies, as well as a discussion of the data collection and analytical methods. The report will also include an appendix that lists each individual detection observed, identification number, species, date of find, GPS location, condition, type of injury and other evidence of cause of death, and additional notes or comments. This list will include all documented injuries and fatalities, even if the detection is not believed to have been caused by the solar energy facility, and will include all detections found during both standard surveys and incidentally. The report will include results of the carcass removal and searcher efficiency trials, including estimates of removal rates and searcher efficiency by size and season from both on- and off-site study areas. Observed and adjusted fatality rates[1] (and associated standard error and 90-percent confidence intervals) resulting from collision, exposure to solar flux, both, unknown, and all causes will be estimated for all birds, small birds, large birds, and raptors for both on- and off-site areas. Maps will be provided showing the location of each detection relative to the facility. Subjective and potentially quantitative statistical evaluation will be made of locations to consider the spatial arrangement in relation to facility features to aid in future study design. These analyses will carefully consider the ramifications of including (or not) incidental finds discovered outside of the standard fatality surveys; in the case of rare species and events, consideration of incidental finds may be imperative to yield appropriate insight. Photographs of all detections will be separately provided. In addition, avian use, raptor and large-bird, and golden eagle monitoring results will be included in the quarterly reports. The quarterly reports will be provided to the TAC as described in Section 5.2.

3.3.1 Regional Awareness Effort and Assessment

In addition to direct monitoring of the off-site area, a communication protocol will be 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

1 Adjusted for carcass removal and searcher efficiency biases.

vicinity and region. Facility biologists will communicate with these entities on a quarterly basis to evaluate potential increases in frequency of injured birds in the project vicinity in response to project operations. Findings will be reported to the TAC in quarterly reports.

3.4 Wildlife Incident Reporting System

In addition to the post-construction fatality monitoring study described above, ISEGS will implement a Wildlife Incident Reporting System (WIRS) into the WEAP training at the start of operations, and it will remain active for the life of the ISEGS facility. The purpose of the WIRS is to standardize the actions taken by site personnel in response to wildlife incidents encountered in the ISEGS and to fulfill the obligations for reporting wildlife incidents. In addition, this system is also intended to complement the standard searches as detailed in the mortality monitoring. However, employees will be instructed only to report incidences to the Designated Biologist and not to disturb any evidence of mortality within the 5-acre plots, to avoid interfering with the standardized searches and total fatality estimates. All observed fatalities will be reported in monthly, quarterly, and annual reports.The WIRS will be utilized by site operations and maintenance personnel who encounter dead or injured wildlife incidentally while conducting general facility maintenance activities, such as mirror washing. The WIRS is designed to provide a means of recording and collecting fatalities at the ISEGS project to increase the understanding of power tower solar facilities and wildlife interactions. In addition, this system will specifically train personnel to identify evidence of mortality of rare species, particularly large birds such as eagles.

Any native bird found injured within the ISEGS facility will be taken to the nearest appropriate wildlife rehabilitation facility, as directed in the WIRS. Any incident involving a state- or federally listed threatened or endangered species or a bald or golden eagle must be reported to the USFWS and CDFW within 24 hours of identification. ISEGS maintains an ongoing commitment to investigate wildlife incidents involving company facilities and to work cooperatively with federal and state agencies in an effort to prevent and mitigate future wildlife fatalities. It is the responsibility of ISEGS employees and subcontractors to report all wildlife incidents to their immediate supervisor and to the on-site Designated Biologist as per CEC Conditions of Certification (COCs).

4.0 Monitoring Schedule

All studies proposed in this plan will be reported to and evaluated by the TAC. All surveys described in this plan will be completed for a minimum of two years, after which each component will be evaluated by the TAC to recommend to the lead agencies if modification or continuance is necessary. Depending on the findings, the monitoring program is adaptive and may be expanded, reduced, discontinued, or otherwise modified as appropriate to address specific questions that may arise from the results. Changes to the monitoring program from year to year, or additional monitoring during future years, will be recommended by the TAC in accordance with the decision framework described in Section 5.0, Adaptive Monitoring and Management. The monitoring program may be expanded to evaluate specific concerns, or to gather more refined information to focus management response or define appropriate responses. Conversely, all or portions of the program may be discontinued if the TAC recommends that such changes to the monitoring plan are appropriate.

5.0 Adaptive Monitoring and Management

The adaptive monitoring and management plan presented in this section provides for the formation of a Technical Advisory Committee (TAC) to advise the BLM AO and the CEC CPM in the implementation of changes in monitoring or adaptive management measures to protect avian and bat species, and an analytical framework within which to recommend measures related to migratory birds and a process by which to develop a step-wise table of advanced conservation practices and apply for an eagle permit, should take occur.

ISEGS operates under the terms and conditions of the federal Right-of-Way grants, which delegate the authority to modify the terms and conditions of the grants to the BLM's AO. ISEGS also operates under the CEC's Conditions of Certification, under which the decision making authority regarding the facility, this monitoring plan, and any adaptive mitigation measures resides with the CPM. Therefore, with the concurrence of the BLM and CEC, a TAC will be formed to provide adaptive monitoring and management recommendations. The BLM's AO and CEC's CPM will evaluate any recommendations of the TAC and decide what measure(s), if any, are necessary for modifying the monitoring or for implementing adaptive management of the facility, as per the terms and conditions of the right-of-way grants and CEC conditions of certification.

The adaptive monitoring and management plan presented in this section provides a process to form the TAC and an objective analysis framework for the TAC to use, so that the TAC can objectively assess monitoring data and recommend future actions, including actions related to modifying the scope of studies and determining management or mitigation responses that are commensurate with the extent of impacts that may be identified in the monitoring studies.

5.1 TAC Membership, Objectives, and Meetings

The TAC will consist of one member from each of the regulatory agencies—BLM, CEC, USFWS, and CDFW—that oversee compliance activities, with respect to BLM and CEC, or that have issue area expertise, with respect to the USFWS and CDFW. Each agency will provide a member completely at its own discretion. The BLM and CEC TAC members will serve as the designated TAC co-chairs for the duration of the project. TAC members will be available for an initial meeting at the site to confirm the specifics of this plan and to assess site conditions. The members of the TAC will also be available for quarterly conference calls or meetings to review the data and analysis provided in the quarterly reports from the facility. More frequent meetings may be needed, particularly during the early monitoring periods, and can be called by one or both of the co-chairs. In addition, the TAC, through the TAC co-chairs, may invite an avian expert to sit on the committee, and invite specialists involved in the monitoring effort to specific meetings to discuss results and potential adaptive management responses. Only the four regulatory agencies on the TAC will have voting authority for making changes and determinations.

Two additional members will be provided by the ISEGS facility. One member will be nominated from the Environmental Compliance department and a second from the Operations department. The level of experience with the operation of large-scale concentrating solar power tower technologies is limited; therefore, the Operations member is necessary to provide guidance with respect to facility operations. The Environmental Compliance member will be the main point of contact for the agencies.

The TAC co-chair duties will include ensuring that project data gets disseminated to the TAC, including data on mortality events, setting up and moderating meetings, reviewing mortality data, inviting participation by outside experts, if warranted; and documenting mitigation recommendations for the facility.

5.2 Data Review Process

Seasonal summary reports will be completed by ISEGS within three months of the end of each monitoring season (spring, summer, fall, and winter) and provided to the TAC members through the TAC co-chairs. A WebEx or in-person meeting will be scheduled through the TAC co-chairs within 30 days of receipt of each seasonal summary report. This meeting will include the TAC members and a representative of the contractor responsible for conducting the field studies. The meeting will focus on ensuring that all TAC members have a consistent understanding of the content and findings of each summary report. The TAC comments on the report and any recommendations regarding implementing adaptive monitoring, management actions, or mitigation measures will be documented by the TAC co-chairs after discussion with TAC members, with any dissenting opinions noted in the decisions and

meeting notes. Recordkeeping responsibility for documenting each meeting's content (issues, decisions, outcomes, and action items) and for ensuring completion of any resulting action items will be the responsibility of the ISEGS Environmental Compliance TAC member, in coordination with the TAC co-chairs. Draft meeting notes will be circulated to the TAC for review and comment, and final notes will be circulated to all members for recordkeeping purposes.

5.3 TAC Review Framework

At a minimum, the TAC will meet annually to review data and recommend whether additional adaptive monitoring or management actions are necessary. The TAC may meet more often to discuss adaptive management needs if the TAC Co-chairs determine that a significant event has occurred. Should the operational monitoring studies indicate significant adverse impacts to avian resources, either to a particular species or group of species at the regional population level (for example, Bird Conservation Region 33), ISEGS is committed to taking appropriate action to address the issue(s). Given the new technology, it is difficult to predict the extent or level of impacts, if any. Therefore, ISEGS is committed to working with the TAC in a collaborative manner to identify and implement measures commensurate in scale with the identified impact.

The TAC shall ensure that management recommendations to mitigate impacts should be directed specifically at identified problems. For example, if heliostats placed in the upright position at night are documented to cause adverse avian impacts, a reasonable action might be to orient the structures horizontally or with varying angles to determine if the observed level of impacts can be reduced, or to assess other strategies that would address the identified problem. If nocturnal migrants are affected by a tower during low-visibility weather events, modifications to the tower lighting scheme could be implemented to evaluate methods for avoiding weather-related issues. Other responses to documented impacts could include conservation or enhancement of certain habitats or habitat modifications in or near the facility to deter affected species from using the facility or adjacent areas. The TAC will assess impacts and identify appropriate responses in a collaborative manner with the Operations and Environmental team at ISEGS for recommendation to the BLM AO and CEC CPM.

The TAC shall consider species impacts according the status of the species. In other words, migratory birds, bald and golden eagles, and endangered species will be considered by the TAC for recommendations as groups, according to their regulatory status. For migratory birds, the TAC shall review the seasonal report, discuss the results of the seasonal monitoring, and undertake collaborative decision making in accordance with the criteria described in Table 6. The seasonal report shall categorize potential migratory bird mortality issues as high, medium, or low to provide an appropriate biological basis for TAC review and decision making, and shall reflect 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.

TABLE 6
Adaptive Management Responses

Issue	Management Response	Study Response
High levels of general or species-specific mortality associated with a particular facility feature (for example, heliostats) or characteristic (for example, flux, weather events)	Immediate management action taken if cause can be addressed*	Studies modified, refined, or expanded to better understand and address impact issue and assess effectiveness of management response
Medium levels of general or species-specific mortality associated with a facility feature or characteristic	Management action taken to address impact issue if deemed necessary*	Studies modified, refined, or expanded to better understand and address impact issue and assess effectiveness of response
Low mortality rates at or near background rate	No management responses taken	Studies completed according to plan, or stopped earlier than planned if appropriate

* Management actions must be feasible and commensurate with the impact. Some examples of measures include placement of visual and/or auditory bird flight diverters in critical locations, retrofitting power lines to APLIC standards, installing perch guards on overhead electric lines in the vicinity, modification of mirror resting angles, modifications to tower or other facility lighting.

For bald or golden eagles, should such a species be taken by the facility, then ISEGS will report within 24 hours, prepare an Eagle Conservation Plan (ECP), and consult with the USFWS to determine the need for an eagle permit. The ECP and/or permit application, if required, shall be prepared in accordance with the current USFWS Eagle Conservation Plan guidance, as relevant to Solar Power Tower Technology. The modified ECP would contain a step-wise table with proposed advanced conservation practices appropriate for a solar power tower facility. The eagle permit will account for and credit the habitat conservation associated with other species (i.e., desert tortoise).

The TAC shall, at all times, identify the most appropriate response to a documented avian impact (including operational management actions) in the best professional judgment of the TAC members, and subject to the following decision criteria:

1. Any response shall be based on the causation of the applicable mortality.
2. All responses shall be commensurate (in terms of factors that include geographic scope, costs, and scale of effort) with identified impacts.
3. If the facility causes impacts to migratory bird species considered to be high or medium after ISEGS has undertaken appropriate measures as recommended by the TAC, ISEGS will use its best efforts to identify for TAC review additional measures, including coordination with other local or regional renewable energy or other projects, that would conserve bird species and that are commensurate with the identified impacts.
4. If the facility causes take of a bald or golden eagle, ISEGS will, within 10 days, develop a step-wise table for TAC review and will consult with the USFWS regarding whether an application for an eagle permit is warranted.

5.4 Addressing Resource Impacts

If, based on the analytical framework above, the TAC identifies significant impacts to avian resources that warrant an immediate response to either change the monitoring/reporting procedures or to protect the

resources involved, a recommendation will be developed by the TAC. If the recommendation is adopted and required by the BLM AO and CEC CPM, it will be implemented by ISEGS in a timeframe agreed upon by the parties. If the identified problem cannot be effectively addressed, a follow-up action plan will be developed by ISEGS within 30 days that addresses the resource issue. ISEGS shall be responsible for documenting and implementing the response action or action plan. If no immediate response is needed to address an identified impact, then previously approved and scheduled monitoring and other activities related to this plan will be implemented without change, subject to modification as may be recommended by the TAC.

Based on the annual monitoring results, the TAC will recommend if and to what extent previously implemented studies may be warranted in subsequent seasons or years. If continued study is recommended by the TAC, the scope and objectives of the planned studies will be evaluated for adequacy and modifications (e.g., reduction in search area or number of surveys in a season), and recommended changes will be implemented as appropriate if approved at the discretion of the BLM AO and CEC CPM.

Any recommended expansion of scope for monitoring would be subject to a cost cap developed in consultation with the TAC (USFWS, 2013). These cost caps would be proportional to the risks. Since the risk of the power tower technology is unknown, the cost cap cannot be established until monitoring has identified what, if any, impacts occur. Therefore, the cost cap will be established after two years of monitoring.

6.0 References

Buckland, S. T., D. R. Anderson, K. P. Burnham and J. L. Laake. 1993. *Distance sampling; estimating abundance of biological populations*. Chapman and Hall, NY. 446 pp.

Bureau of Land Management (BLM). 2010. *CDCA Plan Amendment/FEIS.* July. Available online at: http://www.blm.gov/pgdata/etc/medialib/blm/ca/pdf/needles/lands_solar.Par.19048.File.dat/1-CDCA-Ivanpah-Final-EIS.pdf.

California Energy Commission (CEC) and California Department of Fish and Game (CDFG). 2007. *California Guidelines for Reducing Impacts to Birds and Bats from Wind Energy Development.* Commission Final Report. California Energy Commission, Renewables Committee, and Energy Facilities Siting Division, and California Department of Fish and Game, Resources Management and Policy Division. CEC-700-2007-008-CMF. Available online at: http://www.energy.ca.gov/2007publications/CEC-700-2007-008/CEC-700-2007-008-CMF.pdf.

California Energy Commission (CEC). 2010. *Ivanpah Solar Electric Generating System Commission Decision*. CEC-800-2010-004-CMF. Docket Number 07-AFC-5. September. Available online at: http://www.energy.ca.gov/2010publications/CEC-800-2010-004/CEC-800-2010-004-CMF.pdf

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

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

ESRI. 2013. *An Overview of the Create Random Points Tool.* Available online at: http://resources.esri.com/help/9.3/arcgisdesktop/com/gp_toolref/process_simulations_sensitivity_analysis_and_error_analysis_modeling/an_overview_of_the_create_random_points_tool.htm.

Gauthreaux, S. A., Jr., and C. G. Belser. 2006. Effects of Artificial Lighting on Migrating Birds, in *Ecological Consequences of Artificial Night Lighting* (C. Rich and T. Longcore, Eds.). Island Press, Washington, DC. Pages 67-93.

Huso, M., N. Som, and L. Ladd. 2012. *Fatality Estimator Software and User's Guide*. U.S. Geological Survey Data Series 729, 22 pp.

Johnston, D. S., J. A. Howell, S. B. Terrill, N. Thorngate, J. Castle, J. P. Smith, T. J. Mabee, J. H. Plissner, N. A. Schwab, P. M. Sanzenbacher, C. M. Grinnell. 2013. *Bird and Bat Movement Patterns and Mortality at the Montezuma Hills Wind Resource Area.* Final report. CEC-500-2013-015. California Energy Commission, Public Interest Energy Research (PIER), Sacramento, CA. Available online at: http://www.energy.ca.gov/2013publications/CEC-500-2013-015/CEC-500-2013-015.pdf.

Longcore, T., C. Rich, P. Mineau, B. McDonald, D. G. Bert, L. M. Sullivan, E. Mutrie, S A. Gauthreaux Jr., M. L. Avery, R. L. Crawford, A. M. Manville II, E. R. Travis, and D. Drake. 2012. *An Estimation of Avian Mortality at Communication Towers in the United States and Canada*. PLoS ONE 7(4): e34025. doi:10.1371/journal.pone.0034025.

Manly, B. F. J. 1997. *Randomization, Bootstrap, and Monte Carlo Methods in Biology*. 2nd Edition. Chapman and Hall, London.

Nicolai, C., S. Abele, H. Beeler, R. Doster, E. Kershner, and T. McCabe. 2011. *Monitoring Migratory Bird Take at Solar Power Facilities: An Experimental Approach*. U.S. Fish and Wildlife Service. April 26.

NWCC. 2010. *Wind Turbine Interactions with Birds, Bats, and their Habitats. A Summary of Research Results and Priority Questions.* Available online at: https://www.nationalwind.org/assets/publications/Birds_and_Bats_Fact_Sheet_.pdf.

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

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

Strickland, M. D., E. B. Arnett, W. P. Erickson, D. H. Johnson, G. D. Johnson, M. L. Morrison, J. A. Shaffer, and W. Warren-Hicks. 2011. *Comprehensive Guide to Studying Wind Energy/Wildlife Interactions.* Prepared for the National Wind Coordinating Collaborative, Washington, DC.

Thompson, J., D. Solick, and K. Bay. 2011. *Post-Construction Fatality Surveys for the Dry Lake Phase I Wind Project. Iberdrola Renewables: September 2009 - November 2010.* Prepared for Iberdrola Renewables, Portland, OR. Prepared by Western Ecosystems Technology, Inc. (WEST), Cheyenne, WY. February 10.

Thompson, J., and K. Bay. 2012. *Post-Construction Fatality Surveys for the Dry Lake II Wind Project: February 2011 – February 2012.* Prepared for Iberdrola Renewables, LLC, Portland, OR. Prepared by Western Ecosystems Technology, Inc. (WEST), Cheyenne, WY. June 6.

U.S. Fish and Wildlife Service (USFWS). 2010. *Region 8 Interim Guidelines for the Development of a Project-Specific Avian and Bat Protection Plan for Solar Energy Plants and Related Transmission Facilities.* U.S. Fish and Wildlife Service, Region 8, Sacramento, CA.

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

U.S. Fish and Wildlife Service (USFWS). 2013. *Eagle Conservation Plan Guidance: Module 1 – Land-based Wind Energy.* Version 2. April. 103 pp. Available online at: http://www.fws.gov/migratorybirds/PDFs/Eagle20Conservation20Plan20Guidance-Module201.pdf.

WEST, Inc. 2013. *Ivanpah Error Simulations.* Technical memorandum prepared for BrightSource Energy, Inc. March 1.

Attachment A
Example of Remote Camera Settings and Data

A specific protocol for the use of remote cameras will include the GPS location and the direction and distance to the nearest anthropogenic structure (e.g., building structure in the inner circle area) or heliostat number when carcasses are placed in heliostat fields. Photos will be taken to document the position of each carcass when placed. The camera will be placed within 1-1.5 meters of the carcass on a t-post and faced north to avoid sunlight shining directly into the camera lens (see below for camera settings). If the carcass is no longer in front of the camera and is not readily apparent, the surrounding area will be searched using a spiral search pattern. The search will start at the camera's location and spiral out to 100 feet from the camera. If the carcass has been moved to a new location within the search area but is intact, the camera will be repositioned on the carcass in its new location.

The camera batteries and SD card will be checked at least once a week. The batteries will be replaced if there is < ½ charge remaining. The SD card will be exchanged if there are > 2000 pictures (See Attachment A. Example of Remote Camera Settings and Data).

Camera Settings for Bushnell Trophy Camera (Model 119436) or Equivalent

1) Mode: Camera
2) Image size: SM Pixel
3) Capture #: 3 photo
4) Video size: 640x480
5) Video length: 10s
6) Interval: 1s
7) Sensor level: High
8) Format: Execute
9) TV out: NTSC
10) Time stamp: On
11) Field scan: Off
12) Video sound: On
13) Default set: Cancel

Data Collected at Carcass Placement

1) Site name (e.g., Heliostat Field, Section, and Arc Plot #).
2) Date of survey: Use the following format: DayMonthYear.
3) Time carcass and camera trap were placed. Use 24-hour clock.
4) Surveyors: First, middle (if applicable), and last name initials. Indicate initials for all crew members present.
5) Carcass number: Each carcass will be assigned a number that includes year, month, day when it was placed, and the four-letter code for the species (e.g., 20121212-MODO).
6) UTM coordinates: NAD 83 datum, using handheld devise accurate to 3-4m.
7) General location: For the Heliostat Fields, give location of project (e.g., Ivanpah 1) the section number (e.g., Section 7b), and the specific heliostat number.
8) Distance/Direction to nearest structure: (e.g., Distance and direction to nearest tower or distance direction to nearest overhead wires if along Unit 3 Collector Line.)
9) Substrate: Describe substrate where the carcass was placed, using the known habitat types described in environmental documents for the project.
10) Vegetation height: Low, < 25 cm, Medium, 25-50 cm, High, > 50 cm

11) Percent cover: Bare ground, 0-25 percent, 25-50 percent, 50-100 percent
12) Exposure: Describe visibility of carcass as either: Exposed, Hidden, Partially Hidden.
13) Camera serial number: Located inside camera housing.

Data to Note at Carcass Check

1) Date of check.
2) Time of check. Use 24 hour clock
3) Surveyor.
4) Carcass condition: Choose from: **Present-no change** (appears to be in the same location and position), **Present-moved** (still within search area for fatality survey but moved from placed location), **Removed** (carcass gone, no feathers or parts left or < 10 feathers of any type or < 2 primaries), **Not removed** (> 10 feathers of any type, > 2 primary feathers or any flesh or bone).
5) Camera function: Normal, Dead, Frozen
6) Battery charge: Full, ¾, ½, ¼, zero.
7) # of photos.