GOLDEN EAGLE CONSERVATION PLAN FOR THE OCOTILLO WIND ENERGY FACILITY

DRAFT
CONFIDENTAL

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1.0 INTRODUCTION

1.1 Project Background

Pattern Energy, through Ocotillo Express LLC (OE LLC), is proposing a wind energy facility known as the Ocotillo Express Wind Energy Facility (OWEF) near Ocotillo, California, in Imperial County (Figure 1). The OWEF will be located primarily on Bureau of Land Management (BLM) land and a small portion of private land. The OWEF will be located on approximately 15,000 acres in the project area and consist of up to 158 turbines (up to 474 megawatts [MW]) and associated infrastructure. The diameter of the circle swept by the blades will be no more than 371 feet (113 meters). The OWEF will connect to the new SDG&E Sunrise Powerlink 500-kilovolt (kV) transmission line scheduled for completion in June 2012 across the middle of the project site. The collection lines connecting one turbine to the next and to the project substation will be buried underground generally adjacent to the interior turbine access roads. The OWEF Plan of Development (POD) was tentatively finalized in February 2011 but may change in response to comments on the preliminary Environmental Impact Report/Environmental Impact Assessment (EIR/EIS).

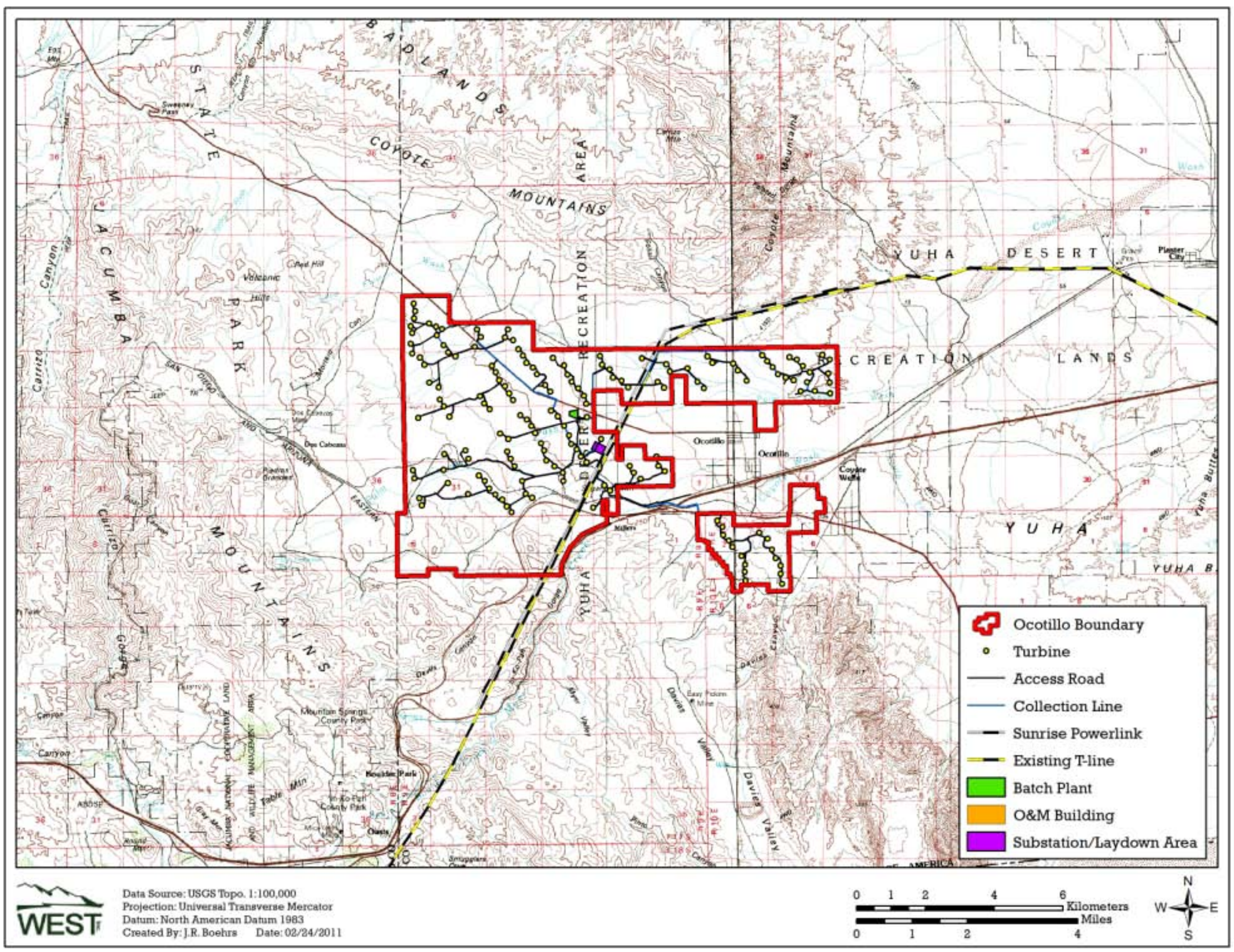

Figure 1. General location of the Ocotillo Wind Energy Facility.

1.2 Environmental Setting

The project site is located within four U.S. Geological Survey 7.5-minute quadrangle maps; Carrizo Mountain, Coyote Wells, In-Ko-Pah Gorge, and Painted Gorge. The northern portion of the site is generally situated north of Interstate 8 (I-8), from the Imperial/San Diego County border on its western edge to approximately 1.5 miles northeast of the town of Ocotillo on its eastern edge. The northern area includes several distinct features, including a portion of the I-8 Island, which is undeveloped rocky and hilly terrain between the eastbound and westbound lanes of I-8, Sugarloaf Mountain, and a portion of the San Diego and Arizona Eastern railroad tracks. County Route (CR) S2 bisects the northern project area, and I-8 passes through the southern portion of the northern project area. The southern area is much smaller than the northern area and the majority is south of State Route (SR) 98.

Vegetation on site consists of a variety of desert scrub habitat types (National Land Cover Database [NLCD] 2001; Figure 2). Several dry desert washes cut through the site, generally from west to east: Palm Canyon Wash cuts through the center of the northern project area; Myer Creek Wash cuts through the southern portion of the northern project area; a portion of Coyote Wash cuts through the northwest portion of the southern project area; and several additional unnamed washes cut through the site.

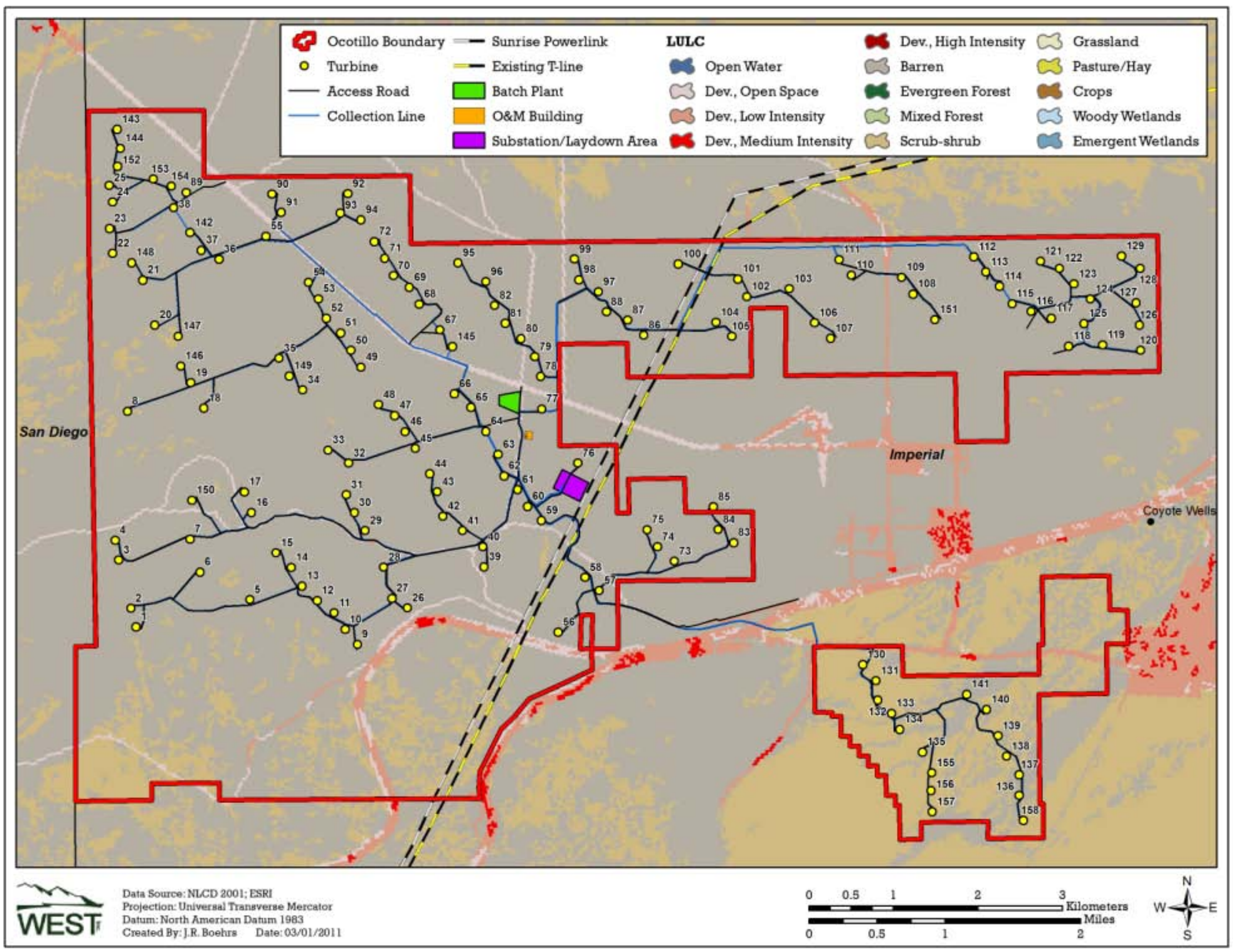

Figure 2. Landuse/Landcover information for the Ocotillo Wind Energy Facility (NLCD 2001).

Elevations on site range from approximately 300 feet above mean sea level (AMSL) in the northeast portion of the site to approximately 1,700 feet AMSL in the southwest portion of the site (Figure 3). The site generally slopes downward from the west to the east, with the Coyote Mountains to the north of the site, and the Jacumba Mountains to the west and south of the site.

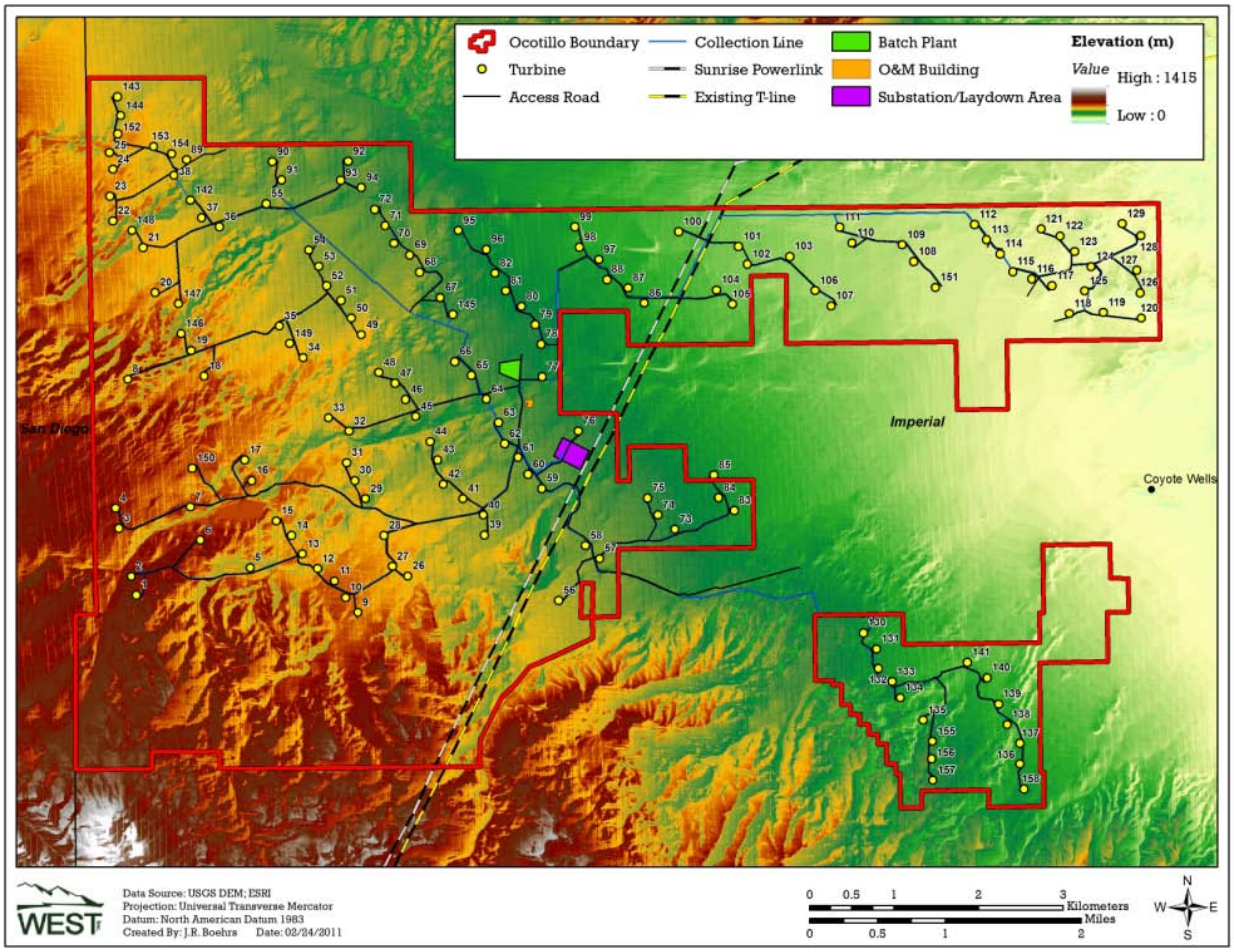

Figure 3. Digital elevation map of the Ocotillo Wind Energy Facility.

1.3 Migratory Bird Treaty Act and Bald and Golden Eagle Protection Act

The federal regulatory framework for protecting eagles includes the Migratory Bird Treaty Act (MBTA) of 1918 and the Bald and Golden Eagle Protection Act (BGEPA) of 1940. The MBTA prohibits the take of migratory birds and does not include provisions for allowing unauthorized take. This project affords substantial design measures to avoid and minimize the likelihood of take, but if take occurs, it will be reported to the U.S. Fish and Wildlife Service (USFWS) for further action. Additionally, this Eagle Conservation Plan (ECP) has been developed to meet BLM and USFWS requirements for addressing BGEPA and the MBTA as it relates to eagles. Both the BGEPA and the MBTA prohibit take as defined as pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, destroy, molest, disturb, or otherwise harm eagles, their nests, or their eggs. Under the BGEPA, "disturb" means to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available: 1) injury to an eagle; 2) decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior; or 3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior. However, on September 11, 2009 (*Federal Register*, 50

Code of Federal Regulations [CFR] 13 and 22), the USFWS set in place rules establishing two new permit types: 1) take of bald and golden eagles that is associated with, but not the purpose of, the activity; and 2) purposeful take of eagle nests that pose a threat to human or eagle safety. As described in the USFWS Draft Eagle Conservation Plan (ECP) Guidance dated January 2011, the USFWS recommends that project proponents prepare an ECP to avoid, minimize, and mitigate project-related impacts to eagles to ensure no-net-loss to the golden eagle population. Pursuant to BLM Instructional Memorandum (IM) 2010-156, the BLM will request "concurrence" from the USFWS that the ECP meets specific requirements.

1.4 Pattern Energy Policy and Commitment to Environmental Protection

Pattern Energy is an independent, fully integrated energy company that develops, constructs, owns, and operates wind power projects across North America and parts of Latin America. Pattern Energy commenced operations in June 2009 as one of the most experienced and best capitalized renewable energy companies in the United States. OE LLC, through Pattern, is dedicated to delivering the highest values for their partners and the communities where they work, while exhibiting a strong commitment to promoting environmental stewardship and corporate responsibility. The OE LLC team has a proven track record of using science and ground-breaking technology to build wind projects that successfully coexist with wildlife and protect the environment. OE LLC is committed to building environmentally responsible renewable energy projects and continues to work closely with environmental agencies to develop appropriate mitigation measures to reduce impacts to wildlife.

2.0 SITE SPECIFIC SURVEYS AND ASSESSMENTS (STAGE 2)

One and a half years of baseline data has been collected on golden eagles in the vicinity of the OWEF beginning in the fall of 2009, and two years will be completed after the spring 2011 surveys. Golden eagle nest surveys, raptor migration surveys, and avian point counts have been conducted (Helix 2010a, 2010b, 2011). Golden eagle nest surveys were conducted by Wildlife Research Institute (WRI), a local firm that has extensive historical information on golden eagles nesting in the vicinity of the OWEF. Migration surveys were conducted by Helix Environmental Planning, Inc (HELIX) in the fall of 2009 and spring and fall of 2010. Avian use point counts were conducted throughout the various seasons from September 2009 to August 2010. The following sections provide more details on the site-specific baseline golden eagle information collected for the OWEF.

2.1 Golden Eagle Nest Surveys

2.1.1 Methods

HELIX contracted with the WRI to conduct surveys of golden eagle (*Aquila chrysaetos*) nest sites in eagle territories that occur within 10 miles of the project site, in accordance with the guidance provided in the U.S. Fish and Wildlife Service (USFWS) Inventory and Monitoring Protocols (Pagel et al. 2010). WRI conducted helicopter surveys in four known territories (referred to as Coyote Mountains West, Coyote Mountains East, Table Mountain, and Carrizo Gorge) in the spring 2010. A hand-held GPS was used to record the helicopter flight path and the location of each nest site. Nest-specific information was documented by two eagle biologists in the helicopter, and each nest site was photographed. In addition to helicopter surveys, WRI conducted ground surveys of an additional suspected golden eagle territory (referred to as Mountain Springs) in the spring 2010. Helicopter surveys were not allowed by USFWS in the Mountain Springs area because of potential disturbance to Peninsular bighorn sheep (*Ovis canadensis nelsoni*).

2.1.2 Results

Twenty-one golden eagle nests were observed in the five territories during nest surveys in 2010 (Figure 4). Two of the five territories were designated as active by WRI in 2010, although no incubating females were observed in 2010. One nest in the Coyote Mountains West territory was considered active. Two additional nests in the Table Mountain territory were considered as inactive/possibly active due to subtle signs of activity that were difficult to confirm. On September 15, 2010, a breeding pair of adult eagles was observed on the Table Mountain territory providing further support for the active designation of this territory in 2010. The remaining three territories were designated inactive in 2010.

Figure Not Included –
Golden Eagle Nesting
Locations Confidential

Figure 4. Location of golden eagle nests and territories within 10 miles of the Ocotillo Wind Energy Facility.

2.1.3 Discussion

Historical nesting information for some of the territories is available to provide further information on golden eagle activity within 10 miles of the OWEF (Helix 2010a, b). Based on this historical information, the Coyote Mountain East territory has been inactive for several years. Table Mountain was successful in producing at least one chick in 2004 and Carrizo Gorge was successful in 2007. Coyote Mountain West is a newly identified territory. Mountain Springs had no sign of activity, although closer monitoring may be warranted in future years. Drought conditions and the timing of the 2010 golden eagle nest surveys limit the utility of one year of golden eagle nest surveys for anticipating impacts to nesting golden eagles from the proposed OWEF. The long-term data help in understanding use of the territories in relation to the OWEF.

Based on the golden eagle nest data from 2010, none of the nests identified in 2010 were within two miles of proposed turbine locations. The one active nest in the Coyote Mountains West territory was located 3.6 miles from proposed turbine locations. No other active nests were confirmed during the 2010 raptor nest surveys conducted within 10 miles of the OWEF.

2.2 Avian Point Counts

2.2.1 Methods

HELIX conducted Avian Point Counts (APC's) approximately weekly over a one-year period (September 1, 2009 – August 31, 2010). The APC's were conducted in accordance with the survey protocols approved by BLM (HELIX 2010a) and generally in accordance with the bird use count methods described in the California Guidelines for Reducing Impacts to Birds and Bats from Wind Energy Development (California Energy Commission [CEC] 2007). The goal of the APC's was to record bird species, abundance, behavior, and flight characteristics from selected sampling locations over a 30-minute period. A total of 50 weeks of point counts were conducted over the one-year period (APC's were not conducted the week of November 29-December 5, 2009, or the week of January 17-23, 2010). Each APC location was visited once per week (the one exception is that Location 13 was not surveyed the week of February 21-27, 2010).

Twenty-one APC locations were established approximately one mile apart throughout the approximately 15,000 acre site (Figure 5). The CEC Guidelines allow for locations to be 5,200 feet apart for large wind resource areas with good viewsheds, which is the case for the proposed Ocotillo site. The APC locations were chosen based on viewsheds, elevation, and habitat types. Each location had good visibility in all directions, with no major impediments impairing the range of view. Locations also covered a wide range of elevations, from approximately 340 ft AMSL (Location 4) to approximately 1,250 ft AMSL (Location 18). Finally, APC's were strategically located to sample different microhabitats. Although each of the locations occurred in desert scrub habitat, several of the locations were within and adjacent to dry desert washes (e.g., Locations 6, 10, 13, 14, and 21) while others were located on or adjacent to hilly topography (e.g., Locations 2, 12, 18, and 19).

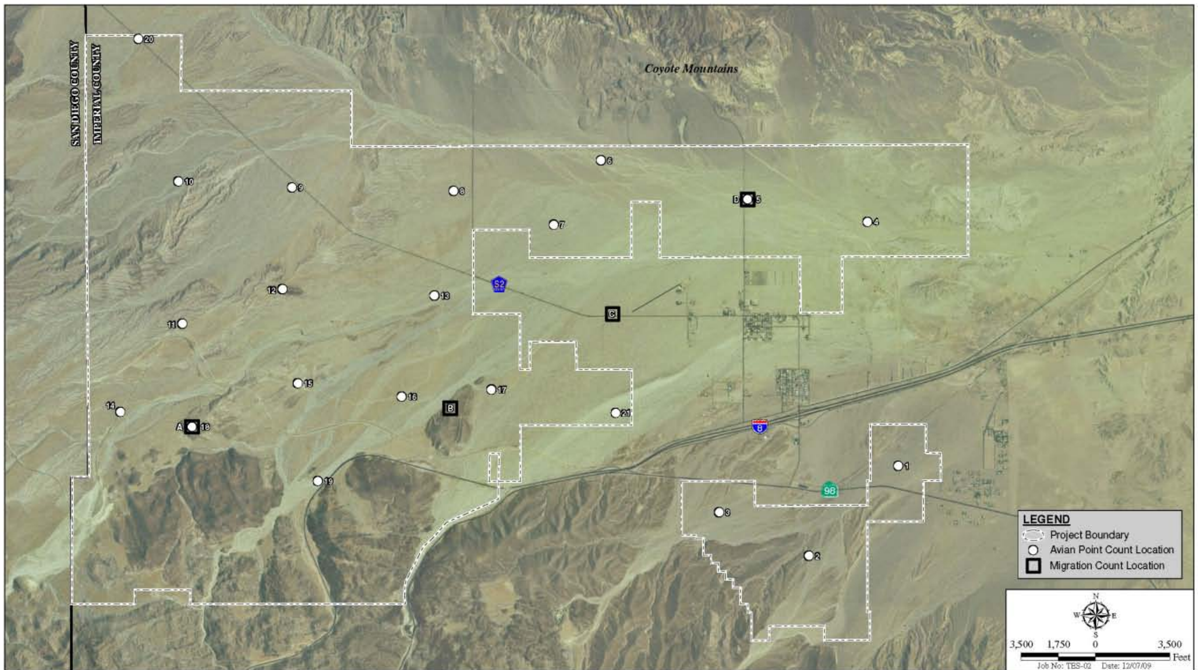

Figure 5. Avian and raptor migration point stations at the Ocotillo Wind Energy Facility.

At each APC location the species, number of individuals, flight height, flight direction, distance from observer, and behavior (e.g., directional flight, perched, flapping flight, soaring, etc.) was recorded over a 30-minute period. Weather conditions (e.g., temperature, wind speed and direction, and cloud cover) were recorded at the start and end of the 30-minute survey period using a hand-held Kestrel anemometer. Species were detected visually with the aid of binoculars and by identifying songs and call notes. All observations were recorded on standardized data sheets. APC's were conducted once per week at each location. Efforts were made to sequence observation times so that locations were surveyed both in the morning and in the afternoon and under varying weather conditions, in accordance with the CEC's Guidelines (CEC 2007).

2.2.2 Golden Eagle Results

Three golden eagles (two adults and one juvenile) were observed flying north over the western portion of the project area during Week One at approximately 1000 feet above ground level (outside the Rotor Swept Area [RSA]; Table 1). No other golden eagles were observed during weekly point counts, but were observed during fall 2009 migration counts (see below; HELIX 2010).

Table 1. Summary of golden eagle observations during avian point counts at the Ocotillo Wind Farm, September 1, 2009 – August 31, 2010.

Date	Time of Observation	# of Individuals	Age	Flight Height (ft above ground)	Distance From Observer (ft)
2-Sep-09	1110 to 1112	3	2 Adults; 1 Juvenile	1,000	600

2.2.3 Discussion

The Ocotillo Wind Energy site does not support large populations of resident golden eagles. The site does not appear to be part of a major migration corridor for golden eagles. Golden eagles were seen only once during the point counts study (September 2, 2009) and were observed flying at a height above the RSA.

2.3 Golden Eagle Migration Surveys

2.3.1 Methods

HELIX conducted migration counts over an eight calendar-week period during the 2009 fall migration period (September 24-November 10, 2009), over a 10 calendar-week period during the 2010 spring migration period (March 22-May 28, 2010), and over a 12 calendar-week period during the 2010 fall migration period (August 23-November 12, 2010). The methods of each survey were developed in coordination with the BLM and were based on the recommendations provided in the California Guidelines for Reducing Impacts to Birds and Bats from Wind Energy Development (CEC 2007). The purpose of the migration study was to document the diurnal raptor activity within the proposed project area in order to provide a risk assessment for these species. HELIX stationed four surveyors throughout the site to scan the sky and record bird migration data. The four migration count locations (Locations A through D; Figure 5) were spaced approximately two miles apart, generally along a southwest-northeast axis across the site. Migration count points were located to maximize the likelihood of detecting potential north-south and east-west migration through the site.

2.3.2 Results

A total of 763 observation hours were logged during the fall of 2009. Nine golden eagle observations were recorded during the fall of 2009 (Table 2). A total of 952 observation hours were logged during the spring of 2010. No golden eagles were observed during spring migration counts; however, a single golden eagle was observed during a burrowing owl survey on the site on June 17, 2010 (Table 3). A total of 577.5 observation hours were logged in the fall of 2010, and 11 golden eagles were observed during the fall migration counts in 2010 (Table 4).

Table 2. Summary of golden eagle observations during Fall 2009 raptor migration surveys at the Ocotillo Wind Farm, September 24 – November 10, 2009.

Date	Time of Observation	# of Individuals	Age	Flight Height (ft above ground)	Distance From Observer (ft)
25-Sep-09	1440 to 1442	1	Juvenile	400	300
25-Sep-09	1545 to 1555	1	Juvenile	400 – 4,000	5,000
2-Oct-09	1315 to 1319	2	n/a*	800 – 1,200	1,000
22-Oct-09	1145 to 1212	2	Undetermined	200 – 500	7,000
30-Oct-09	1325 to 1335	1	Juvenile	200 – 1,000	3,000
10-Nov-09	1230 to 1330	2	1 Adult; 1 Juvenile	0 – 300	1,000 – 10,000

*Individuals observed on October 2 were recorded during additional migration observation hours.

Table 3. Summary of incidental golden eagle observations during Spring 2010 raptor migration surveys at the Ocotillo Wind Farm, March 22 – May 28, 2010. No golden eagles were observed during Spring 2010 raptor migration surveys.

Date	Time of Observation	# of Individuals	Age	Flight Height (ft above ground)	Distance from Observer (ft)
17-Jun-10	0530 to 0532	1†	Adult	0 – 100	20
17-Jun-10	0630 to 0631	1†	Adult	0 – 20	200

† Determined to be the same individual observed separately by two biologists during burrowing owl surveys (Helix 2010b).

Table 4. Summary of golden eagle observations* during Fall 2010 raptor migration surveys at the Ocotillo Wind Farm, August 23 – November 12, 2010.

Date	# of Individuals	Age	Flight Height (ft above ground)	Distance from Observer (ft)
21-Sep-10	1	Undetermined	500	9,000
4-Oct-10	1	Juvenile	400 – 500	6,000
13-Oct-10	1	Adult	35 – 3,000	30 – 3,500
29-Oct-10	1	Adult	100 – 800	3,000 – 7,000
3-Nov-10	1	Undetermined	1,500 – 2,000	3,000 – 9,000
5-Nov-10	1	Undetermined	200 – 400	3,000 – 9,000
5-Nov-10	1	Undetermined	100 – 600	200 – 1,000
10-Nov-10	1	Undetermined	400 – 1,250	400 – 8,000
12-Nov-10	1	Adult	150 – 500	2,000 – 3,000
12-Nov-10	2	1 Adult; 1 Juvenile	150 – 1,000	4,000 – 20,000

*time of observation was not available.

2.3.3 Discussion

The Ocotillo Wind Energy Project site is not located in a known raptor migration corridor (Aspen Environmental Group 2008; pers. comm., Unitt 2007). The majority of the project site supports desert scrub vegetation and dry desert washes. The site does not contain the appropriate topography to funnel migrating birds through the site. With the exception of Sugarloaf Mountain and the rocky terrain in the southwest portion of the site, the project is generally flat and is located east of the Jacumba Mountains and south of the Coyote Mountains. The southwesterly prevailing wind direction would not appear to be conducive to creating updrafts in the project site that are often associated with high raptor migration areas. The site lacks a major ridgeline, water bodies, and large stands of mature trees. The closest major water body is the Salton Sea, which is 30 miles to the northeast of the site, and the irrigated agriculture fields near El Centro are approximately 15 miles to the west of Ocotillo. The results of HELIX's labor-intensive fall 2009 and spring and fall 2010 migration counts indicate that the Ocotillo Wind Energy Project site is not part of a major migratory pathway for golden eagles.

2.4 Golden Eagle Use

A total of 2,817 observation hours were logged and only twenty-two golden eagle observations were recorded resulting in less than 0.01 golden eagle observations per hour (Table 5). These golden eagle use estimates suggest relatively low use of the project site during the study year, especially when compared to other projects in California, such as the High Winds Wind Resource Area (0.3 eagles/30-min survey during pre-construction surveys; Kerlinger et al. 2005, 2006),the Diablo Winds Wind Resource Area (0.3 eagles/30-min survey during the post-construction period; WEST 2008).

Table 5. Summary of golden eagle observations, raptor observations*, sampling effort, and mean use at the Ocotillo Wind Farm during raptor migration surveys and avian point counts, September 1, 2009 – November 10, 2010.

Season	Species Group	Observations	Sampling Effort (hours)	Mean Use (Obs/Hour)
Raptor Migration Surveys				
Fall 2009**	golden eagles	8	763	0.01
	raptors and vultures	165	763	0.22
	Raptors	141	763	0.18
Spring 2010	golden eagles	0	952	0
	raptors and vultures	520	952	0.55
	Raptors	204	952	0.21
Fall 2010	golden eagles	11	577.5	0.02
	raptors and vultures	423	577.5	0.73
	Raptors	340	577.5	0.59
Year One (Fall 2009, Spring 2010)	golden eagles	8	1,715	< 0.01
	raptors and vultures	685	1,715	0.40
	Raptors	345	1,715	0.20
All Seasons	golden eagles	19	2,292.5	0.01
	raptors and vultures	1,108	2,292.5	0.48
	Raptors	685	2,292.5	0.30
Avian Point Counts				
1-Sep-09 through 31-Aug-10	golden eagles	3	524.5	0.01
	raptors and vultures	225	524.5	0.43
	Raptors	143	524.5	0.27
Concurrent Surveys†				
1-Sep-09 through 31-Aug-10	golden eagles	11	2,239.5	< 0.01
	raptors and vultures	910	2,239.5	0.41
	Raptors	488	2,239.5	0.22
All Surveys To Date				
1-Sep-09 through 12-Nov-10	golden eagles	22	2,817	0.01
	raptors and vultures	1,333	2,817	0.47
	Raptors	828	2,817	0.29

*Raptor data reported by HELIX Environmental Planning, Inc. included turkey vultures (Helix 2010a, 2010b, 2011, unpublished data).

**Large numbers of raptors and turkey vultures were not documented during Fall 2009 raptor migration surveys (Helix 2010)

†Includes Fall 2009 and Spring 2010 raptor migration data and all avian point count data.

3.0 ASSESSING GOLDEN EAGLE RISK AND PREDICTING FATALITIES (STAGE 3)

3.1 Assessing Golden Eagle Risk at OWEF

3.1.1 Nesting and Breeding

The 2010 golden eagle nest surveys indicated that two of the five territories (Coyote Mountains West and Table Mountain) were active in 2010, while the remaining three territories were considered to be inactive. However, no active nests were identified. Appendix A shows the history of each of the four territories that have been monitored. It is clear these territories generally have not been consistently active, occupied, or productive for the last decade.

Turbines have been sited greater than two miles from all of the 21 historic golden eagle nests identified within a 10-mile buffer of the project (Table 6). Eleven of the historic nests have at least one turbine within a five-mile buffer. The maximum number of turbines within a five-mile buffer of an eagle nest is 90. The maximum number of turbines that are located within 10 miles of an eagle nest is 141 (Table 6).

The approach in the Draft Eagle Conservation Plan Guidance calls for measuring nearest neighbor distances from active nests (USFWS 2011). Since only one nest was considered active, this is not possible. Instead, the average maximum nest distances between territories closest to one another was calculated for all five territories identified in Helix (2010). The distance to Mountain Springs was approximated, since the actual nest locations were unknown. Table 7 shows the maximum distances between nests in territories closest to one another. The average of these maximum distances is 4.97 miles, so half that distance (2.49 miles) would be the buffer used from nests to determine overlap with the project and characterization of the site. While this approach does not fit exactly to the ECP guidance, it would appear to be a reasonable approach for defining a buffer for initial risk characterization (Figure 6).

Table 6. The number of turbines within various buffers of all known nests in each of the five known territories within 10-miles of the Ocotillo Wind Energy Facility.

	Number of Turbines		
Territory-Nest #	**2-mi.**	**5-mi**	**10-mi**
Corrizo Gorge - Nest1	0	0	113
Corrizo Gorge - Nest2	0	0	113
Corrizo Gorge - Nest3	0	0	111
Corrizo Gorge - Nest4	0	0	111
Coyote Mtns. W - Nest1	0	19	118
Coyote Mtns. W - Nest2	0	19	118
Coyote Mtns. W - Nest3	0	58	100
Coyote Mtns. W - Nest4	0	39	118
Coyote Mtns. W - Nest5	0	70	88
Coyote Mtns. W - Nest6	0	72	86
Coyote Mtns. W - Nest7	0	74	84
Coyote Mtns. W - Nest8	0	90	68
Coyote Mtns. W - Nest9	0	90	68
Coyote Mtns. E - Nest1	0	1	141
Coyote Mtns. E - Nest2	0	41	101
Table Mtn. - Nest1	0	0	130
Table Mtn. - Nest2	0	0	130
Table Mtn. - Nest3	0	0	130
Table Mtn. - Nest4	0	0	127
Table Mtn. - Nest5	0	0	127
Mountain Springs – No nest locations known	0	0	Similar to Table Mountain

Table 7. Calculations of maximum distances between nests of territories closest to one another near the Ocotillo Wind Energy Facility.

Territory	**Nearest Territory**	**Maximum Distance**
Coyote Springs West	Coyote Springs East	6.77 miles
Carizo Gorge	Table Mountain	4.16 miles
Mountain Springs	Table Mountain	3.02 miles
Table Mountain	Carizo Gorge	4.16 miles
Coyote Springs East	Coyote Springs West	6.77 miles
	Average	**4.97 miles**
	Buffer (1/2 average)	**2.49 miles**

Figure Not Included – Golden Eagle Nesting Locations Confidential

Figure 6. Nest buffers for the eagle territories within 10 miles of the Ocotillo Wind Energy Facility. Buffer distance of 2.49 miles was used based in average maximum distances between nests of territories closest to one another.

3.1.2 Concentration Areas (Communal roosts, foraging areas, migration corridors, and migration stopovers)

The golden eagle data collected to date suggests that golden eagles use the OWEF on a limited basis for foraging and during the migration season. The data suggest that there are no high golden eagle use areas or golden eagle concentration areas, including communal roosts or concentrated foraging areas, within the OWEF. The migration counts conducted to date suggest that the OWEF is not an important migration corridor or migration stopover for golden eagles.

3.1.3 Eagle Risk Factors

An assessment of the factors known or thought to be associated with increased probability of collisions between eagles and other raptors and wind turbines (from the USFWS draft eagle conservation plan guidance) for the OWEF is provided in Table 8 (located at the end of this section). The risk factors and the science behind the risk factors have been adopted from the USFWS draft eagle conservation plan guidance (USFWS 2011). The three main risk factors identified in the USFWS draft eagle conservation plan guidance are 1) the interaction of topographic features, season, and wind currents to create favorable conditions for slope soaring or kiting (stationary or near-stationary hovering) in the vicinity of turbines; 2) behavior that distracts eagles and presumably makes them less vigilant (e.g., active foraging or inter- and intra-specific interactions); and 3) residence status, with resident adults and young less vulnerable and dispersers and migrants (especially sub-adults and floating adults) more vulnerable.

TOPOGRAPHY AND WIND

The topography of the OWEF at a landscape scale is provided in Figure 3. The topography of the site is highest in the southwest corner and falls away towards the northeast. A rose diagram depicting the prominent wind direction at the OWEF is provided in Figure 7. The prominent wind direction at the OWEF is strongly oriented in a northeast direction. The orientation of the overall topography at a landscape scale and the prominent wind direction in relation to the OWEF suggest that the OWEF should be less risky to golden eagles since the OWEF is sited on the downwind side of the Jacumba Mountains and would be less likely to have conditions suitable for strong updrafts of wind.

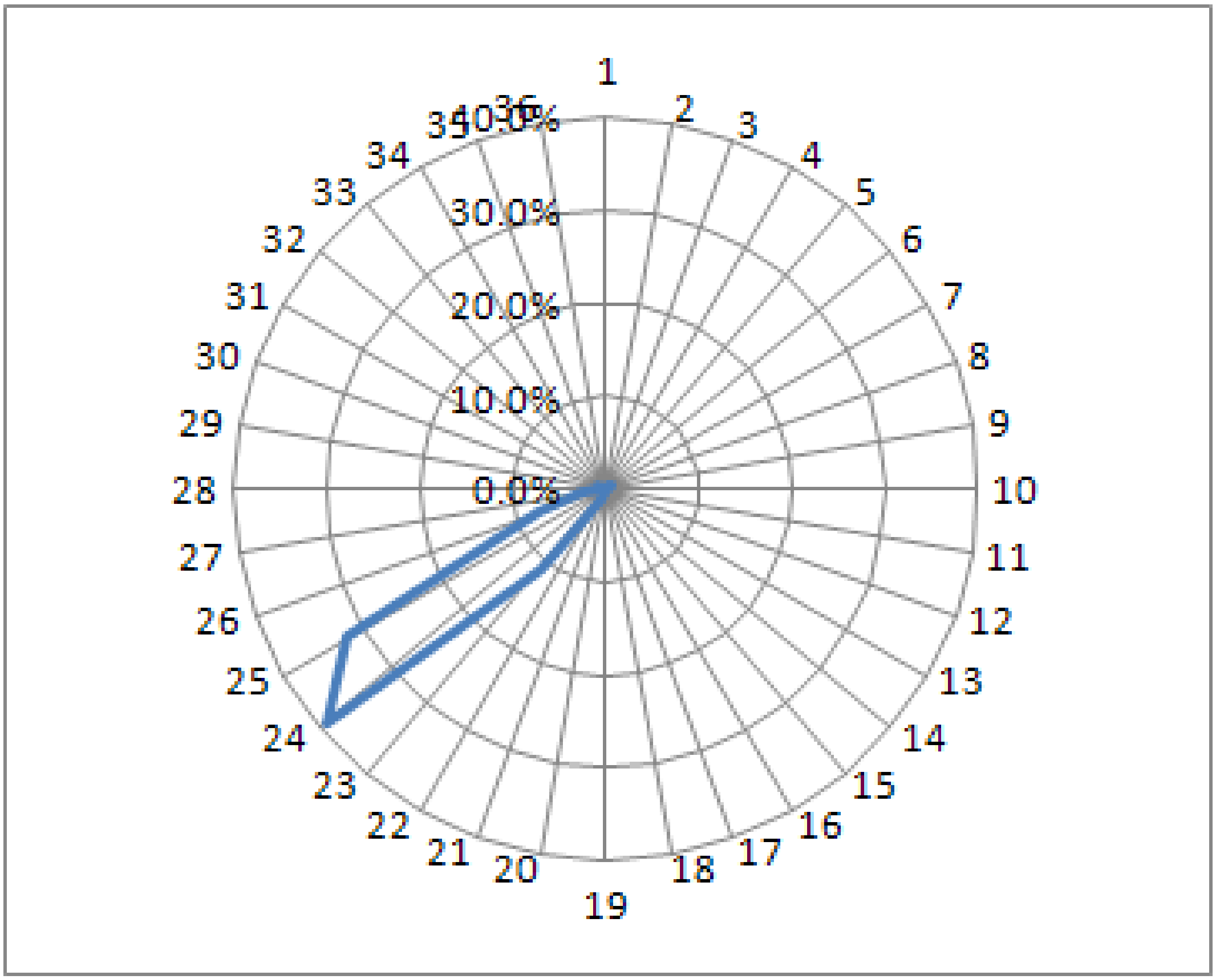

Figure 7. Rose diagram of prominent wind at the Ocotillo Wind Energy Facility.

The slope and aspect of individual turbines were reviewed and assessed on an individual turbine basis within the OWEF. Some research has suggested turbines in saddles or canyons or on the upwind side of ridges may potentially be of more risk to golden eagles. Figures 8 and 9 show the current layout relative to slope and aspect. Based on limited scientific study, it is assumed turbines on steeper slopes, especially on upwind sides of ridges and turbines in saddles or low-lying areas, may be more risky. Generally, none of the turbines are located in low-lying areas, steep slopes, saddles, or on upwind slopes (southwest and westerly aspects). Appendix B contains a list of turbines and the estimated slope, aspect, and elevation of the turbines. Only one turbine is estimated to occur on a slope greater than eight percent (turbine 2), and it is on a northwest aspect (336 degrees). There are only two additional turbines that have greater than a 5% slope on a northwest to south aspect (Turbines 32 and 146). Numerous turbine locations were eliminated from these types of areas or moved to avoid these areas. For example, no turbines were placed in the saddles/drainages between turbines 7 and 6, 16 and 15, 32 and 31, 45 and 44, 64 and 63, 38 and 142, 135 and 155. Very little of the project has westerly, southwesterly, and south aspects where turbines are located. Only one turbine is located near steep slopes with complex topography (146), but the turbine is located on top of the ridge. Based on the information provided above, turbines have been sited in areas that would not be considered high risk locations within the project.

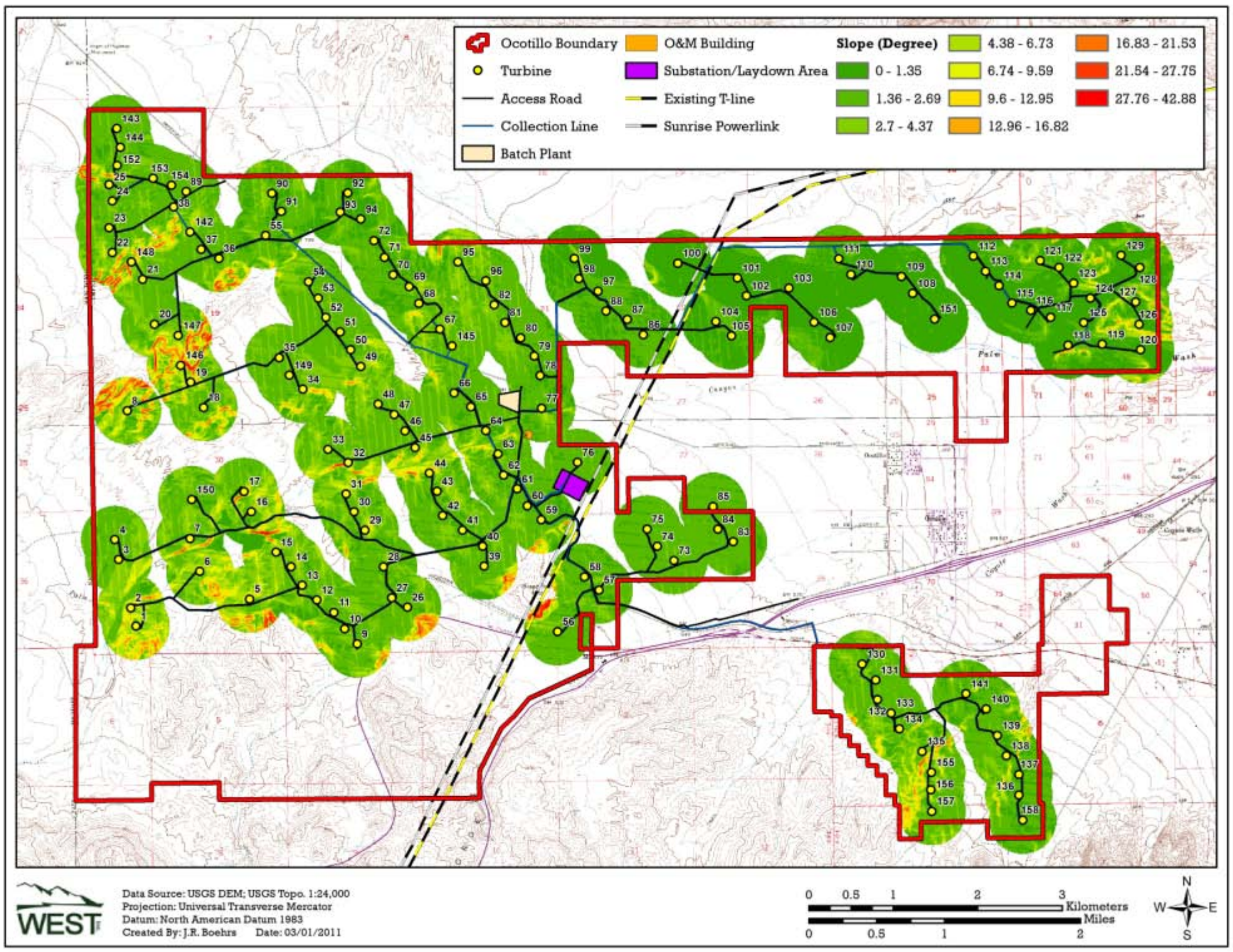

Figure 8. Slope calculations for the Ocotillo Wind Energy Facility.

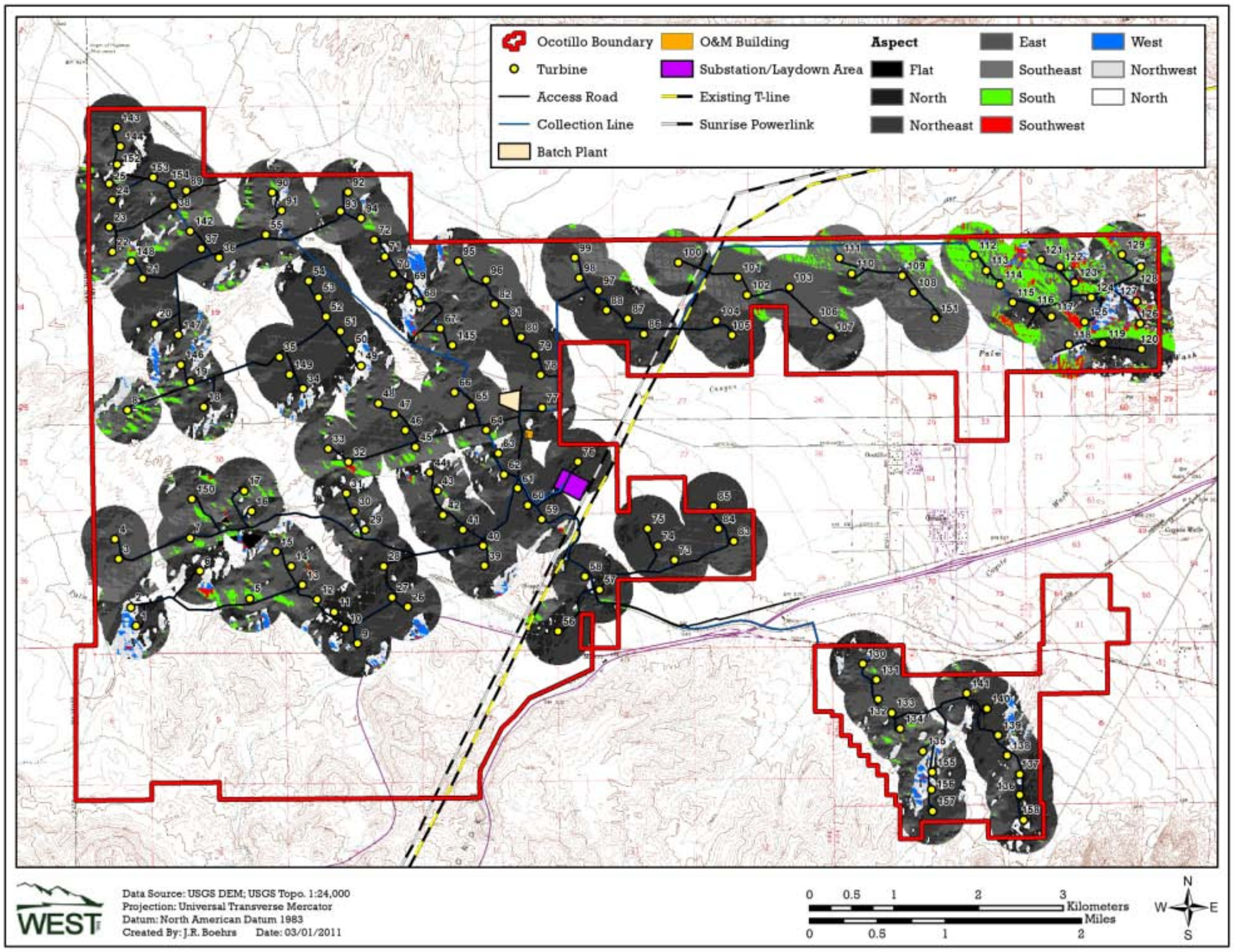

Figure 9. Aspect of the Octoillo Wind Energy Facility.

The results of the landscape-scale assessment of topography and wind as well as the individual turbine assessment suggest that topography and wind conditions at the OWEF are a low risk to golden eagles overall in relation to facility and individual turbine siting.

INTRA-SPECIFIC AND INTER-SPECIFIC INTERACTIONS

Assuming that intra-specific competition and territorial defense increases collision risk, the project area has some potential for having these behaviors occur on the project between the territories to the north of the project and south of the project. We are not aware of any studies that have documented this as a risk factor.

ADULT VS. JUVENILLE AND RESIDENT VS. FLOATER/MIGRANT

Of the 22 golden eagles observations during site-specific surveys to date, nine of the observations were of adult eagles, seven were of juvenile eagles, and six were undetermined. Overall, the age structure of eagle observations within the OWEF is fairly even between adults and juveniles with no major differences between the two age categories. The data collected to date do not allow a determination of whether the site is used more frequently by resident or floater/migrant birds and the associated level of risk is unknown.

Table 8. Risk factors listed in the Draft Golden Eagle Conservation Plan Guidance and a discussion of these factors for this project.

Risk Factor	Scientific Evidence/Support	Citations	OWEF Situation	Qualitative Assessment
Bird Density	Mixed findings; likely some relationship but other factors have overriding influence across a range of species	Barrios and Rodriguez (2004), De Lucas et al. (2007), Hunt (2002), Smallwood and Karas (2009)	Golden eagle use (abundance) of the OWEF has been determined to be less than 0.01 eagle obs./hr based on site specific data collection to date	Low
Bird Age	Higher risk to sub-adult and adult golden eagles	Hunt (2002)	Data collected to date suggest a fairly even mix of adult and juvenile eagle use at the OWEF. Low production and few eagles using the area in recent years suggest likely few sub-adults around	Low
Bird Residency Status	Higher risk to sub-adults and floating adults and lower risk to resident adults and juveniles in golden eagles	Barrios and Rodriguez (2004), Hunt (2002)	Data collected to date is insufficient to address this potential risk factor. However, the low use numbers in general suggest few floating birds around	Low
Season	Mixed findings, with general consensus that risk is higher in seasons with greater propensity to use slope soaring (fewer thermals) or kiting flight (windy weather) while hunting across a range of species	Barrios and Rodriguez (2004), De Lucas et al. (2007), Hoover and Morrison (2005), Smallwood and Karas (2009)	Golden eagles appear to be most abundant in the fall due to slightly higher use based on site-specific data collection.	Unknown
Interaction with Other Birds	Higher risk when interactive behavior is occurring, across a range of species	Smallwood and Karas (2009)	Based on the average nearest-neighbor distance of all nests in the two territories identified as occupied in 2010, there is the potential for territorial defense to occur where turbines are sited.	Moderate, needs further study to determine actual influence to risk
Prey Availability	High risk when hunting close to turbines, across a range of species	Barrios and Rodriguez (2004), De Lucas et al. (2007), Hoover and Morrison (2005), Hunt (2002), Smallwood et al. (2009)	Overall prey availability within the OWEF is considered low throughout the majority of the year due to the harsh arid conditions. Exception would be a few months in the spring following the raining season. However, spring use of the sight by eagles is very low based on site specific data collection.	Low
Turbine Height	Mixed, contradictory findings across a range of species	Barclay et al. (2007), De Lucas et al. (2007)	15 of 22 eagle observations within RSH but overall numbers still very low	Low

Table 8. Risk factors listed in the Draft Golden Eagle Conservation Plan Guidance and a discussion of these factors for this project.

Risk Factor	Scientific Evidence/Support	Citations	OWEF Situation	Qualitative Assessment
Turbine Type	Higher risk associated with lattice turbines for golden eagles, higher risk with tubular towers for burrowing owls (*Athene cunicularia*)	Hunt (2002), Smallwood and Karas. (2009)	Modern, tubular towers will minimize risk to golden eagles compared to older lattice turbines. However, results from other studies from the Altamont facility and not likely relevant to this project	Low
Rotor Speed	Higher risk associated with higher blade-tip speed for golden eagles	Chamberlain et al. (2006)	State of the art technology, low RPM's, more space between rotor sweeps, however tip speeds generally the same	Low
Perch Availability	Possible higher risk with higher perch availability in the general project area for golden eagles	Chamberlain et al. (2006)	Suitable perching substrates are present in within the OWEF primarily in the form of rock outcrops and man-made features such as telephone poles and the existing and proposed T-lines through the project. The new transmission line proposed through the OWEF may increase perch availability within the OWEF for golden eagles.	Moderate
Rotor-swept Area	Mixed findings; higher mortality associated with larger rotor-swept area in one study for non-raptors, meta-analysis found no effect	Barclay et al. (2007), Chamberlain et al. (2006)	15 of 22 eagle observations within the RSA. However larger rotors generally have more space and time between sweeps	unknown
Topography	Several studies show higher risk of collisions with turbines on ridge lines and on slopes where declivity currents facilitate slope soaring and kiting flight of soaring raptors. Also a higher risk in saddles that present low-energy ridge crossing points. Higher risk for burrowing owls in canyons.	Barrios and Rodriguez (2004), De Lucas et al. (2007), Hoover and Morrison (2005), Smallwood and Thelander (2004), Smallwood (2007)	Based on the prevailing wind direction in relation to topography including slope, aspect, and elevation.	Low
Wind Speed	Mixed findings; general pattern of higher risk in situations that favor slope soaring or kiting (high winds in some locales, low winds in other, likely depending on degree of slope and aspect)	Barrios and Rodriguez (2004), Hoover and Morrison (2005), Smallwood and Karas (2009)	Based on the prevailing wind direction in relation to topography including slope, aspect, and elevation.	Low

3.2 Fatality Predictions

In this report, we present two different approaches for predicting the expected level of mortality for the Ocotillo facility. The first approach is similar to the approach presented in the WEST (2010) that looks at the level of mortality observed at wind projects in the western U.S. in comparison to the level of golden eagle use. As previously described, Table 4 summarizes all the observations during the large effort that occurred during the 2009 and 2010 surveys. These observations result in a golden eagle use estimate of less than 0.01 golden eagles per observation hour. Overall mean golden eagle use at the OWEF, adjusted for 20-min surveys in 2009 and 2010 is low compared with other wind-energy facilities that implemented similar protocols (Table 9).

Table 9. List of project areas that have either had direct measures of golden eagle use or mortality studies. The Relative Risk of the project was estimated based on what is known about the region, nearby studies, etc. and was developed by WEST. NA refers to not available. It could mean that studies were not conducted, studies were not available (not public, not completed) or for the case of golden eagle fatalities, it could also mean no wind project has been built.

Facility	Relative Risk based on Expected Use	Approximate Golden Eagle Use Estimate	Golden Eagle Fatalities	Turbine Size (MW)
Diablo Winds CA	High	0.27	2	0.66
Foote Creek Rim, WY	High	0.26	1	0.6
High Winds, CA	High	0.3	2	1.8
SMUD Solano, CA	High	NA	0	0.65
Top of the World, WY	High	0.54	NA	1.5
Glenrock, WY	High	0.49	NA	1.5
Campbell Hill, WY	High	0.36	NA	1.5
Dunlap Ranch, WY	High	0.28	NA	1.5
Elkhorn Valley, OR	High	0.27	NA	1.65
Seven Mile Hill, WY	High	0.26	NA	1.5
Judith Gap, MT	Moderate	NA	0	1.5
Antelope Ridge, OR	Moderate	0.11	NA	NA
Morton Pass Reference, WY	Moderate	0.11	NA	NA
Simpson Ridge (1995-1999), WY	Moderate	0.1	NA	NA
Windy Point, WA	Moderate	0.08	NA	NA
Cotterel Mountain, ID	Moderate	0.07	NA	NA
High Plains, WY	Moderate	0.05	NA	NA
Wild Horse (2002-2003), WA	Moderate	0.05	0	NA
CARES, WA	Moderate	0.03	NA	NA
Klickitat County, WA	Moderate	0.03	NA	NA
Lower Linden, WA	Moderate	0.03	NA	2
Lower Snake River, WA	Moderate	0.03	NA	2.3
Combine Hills, WA	Moderate	0.03	0	NA
Leaning Juniper, OR	Low	0.02	0	1.5
Alta-Oak Creek Mojave, CA (Proper)	Low	0.02	NA	1.5
Hopkins Ridge, WA	Low	0.01	0	1.8
Stateline, OR/WA	Low	0.01	0	0.66
Vansycle, OR	Low	0.01	0	0.66

Table 9. List of project areas that have either had direct measures of golden eagle use or mortality studies. The Relative Risk of the project was estimated based on what is known about the region, nearby studies, etc. and was developed by WEST. NA refers to not available. It could mean that studies were not conducted, studies were not available (not public, not completed) or for the case of golden eagle fatalities, it could also mean no wind project has been built.

Facility	Relative Risk based on Expected Use	Approximate Golden Eagle Use Estimate	Golden Eagle Fatalities	Turbine Size (MW)
Alta-Oak Creek Mojave, CA (East)	Low	0.01	NA	1.5
Dry Lake, AZ[1]	Low	0.01	NA	2.1
Golden Hills, WA	Low	0.01	NA	NA
Hatchet Ridge, CA	Low	0.01	NA	2.3
Homestead 2005-2006, CA	Low	0.01	NA	NA
Maiden, WA[1]	Low	0.01	NA	NA
Reardan, WA[1]	Low	0.01	NA	NA
Stateline Reference, OR [5]	Low	0.01	NA	0.66
Sunshine, AZ[1]	Low	0.01	NA	NA
Vantage, WA	Low	0.01	NA	NA
Windy Flats, WA	Low	0.01	NA	NA
Ocotillo, CA	**Low**	**<0.01**	**NA**	
Klondike, OR	Low	< 0.01	0	NA
Nine Canyon, WA	Low	< 0.01	0	1.3
Desert Claim, WA[1]	Low	< 0.01	NA	2
Roosevelt 2002-2003, WA	Low	< 0.01	NA	NA
White Creek, WA	Low	< 0.01	NA	NA
Klondike 2001-2002, OR[1]	Low	0	NA	1.5
Zintel Canyon, WA[1]	Low	0	NA	NA
Biglow, OR	Low	0	NA	1.65
Dillon, CA	Low	NA	0	NA
Big Horn, WA	Low	NA	0	1.5
Biglow Canyon I, WA (2008)	Low	NA	0	1.65
Klondike II, WA	Low	NA	0	1.5
Klondike III, WA	Low	NA	0	1.5, 2.3
Marengo I, WA	Low	NA	0	NA
Marengo II, WA	Low	NA	0	1.8
McBride, Alb.	Low	NA	0	NA
Ripley, Ont.	Low	NA	0	2
Summerview, Alb.	Low	NA	0	1.8
Grand Ridge, IL	Very Low	0	0	1.5
Buffalo Gap, TX	Very Low	NA	0	2
Buffalo Mountain, TN (2006)	Very Low	NA	0	1.8
Buffalo Ridge I, MN	Very Low	NA	0	2.1
Casselman, PA	Very Low	NA	0	NA
Cedar Ridge, WI	Very Low	NA	0	1.65
Crescent Ridge, IL	Very Low	NA	0	1.5
Maple Ridge, NY	Very Low	NA	0	1.65
Mars Hill, ME	Very Low	NA	0	1.5
Mount Storm, WV (2008)	Very Low	NA	0	NA
Mountaineer, WV	Very Low	NA	0	1.5
Munnsville, NY (2008)	Very Low	NA	0	1.5

Table 9. List of project areas that have either had direct measures of golden eagle use or mortality studies. The Relative Risk of the project was estimated based on what is known about the region, nearby studies, etc. and was developed by WEST. NA refers to not available. It could mean that studies were not conducted, studies were not available (not public, not completed) or for the case of golden eagle fatalities, it could also mean no wind project has been built.

Facility	Relative Risk based on Expected Use	Approximate Golden Eagle Use Estimate	Golden Eagle Fatalities	Turbine Size (MW)
Noble Bliss, NY	Very Low	NA	0	1.5
Noble Clinton, NY	Very Low	NA	0	1.5
Noble Ellensburg, NY	Very Low	NA	0	1.5
NPPD Ainsworth, NE	Very Low	NA	0	1.65
Top of Iowa, IA	Very Low	NA	0	0.9
Stetson Mountain, ME (Year 1)	Very Low	NA	0	1.5

[1]Adjusted from 30-min surveys
[2]Adjusted from 40-min surveys
[3] Non-weighted averages of seasonal use estimates.
[4]Average of spring and fall surveys.
[5]Adjusted from 10-min surveys
[†]Average overall use adjusted to the number of golden eagles/20-min survey

Data from the following sources:

Wind-Energy Facility	Use Estimate	Fatality Estimate	Wind-Energy Facility	Use Estimate	Fatality Estimate
Diablo Winds CA	WEST 2006	WEST 2006, 2008	Windy Flats, WA	Johnson et al. 2007c	
Foote Creek Rim, WY	Johnson et al. 2000b	Young et al. 2003c	Klondike, OR	Johnson et al. 2002	Johnson et al. 2003
High Winds, CA	Kerlinger et al. 2005	Kerlinger et al. 2006	Nine Canyon, WA	Erickson et al. 2001	Erickson et al. 2003b
SMUD Solano, CA		Erickson and Sharp 2005	Desert Claim, WA	Young et al. 2003b	
Wolfe Island, Ont. (July-Dec. 09)		Stantec, Ltd. 2010	Roosevelt, WA (02-03)	NWC and WEST 2004	
Top of the World, WY	Rintz and Bay 2009		White Creek, WA	NWC and WEST 2005	
Glenrock, WY	Johnson et al. 2008a		Klondike, OR (01-02)	Johnsonet al. 2002	
Campbell Hill, WY	Taylor et al. 2008		Zintel Canyon, WA	Erickson et al. 2002a	
Dunlap Ranch, WY	Johnson et al. 2009a		Biglow, OR	WEST 2005c	
Elkhorn Valley, OR	WEST 2005b		Dillon, CA		Chatfield et al. 2009
Seven Mile Hill, WY	Johnson et al. 2008b		Big Horn, WA		Kronner et al. 2008
Judith Gap, MT		TRC 2008	Biglow Canyon I, WA (08)	Jeffrey et al. 2009	
Antelope Ridge, OR	WEST 2009		Combine Hills, OR		Young et al. 2006
Morton Pass Reference, WY	Johnsonet al. 2000b		Klondike II, WA		NWC and WEST 2007
Simpson Ridge, WY(95-99)	Johnsonet al. 2000b		Klondike III, WA		Gritski et al. 2009
Windy Point, WA	Johnson et al. 2006		Marengo I, WA		URS Corporation 2010a
Cotterel Mountain, ID	BLM 2006		Marengo II, WA		URS Corporation 2010b
High Plains, WY	Johnson et al. 2009b		McBride, Alb.		Brown and Hamilton 2004
Wild Horse, WA (02-03)	Erickson et al. 2003a		Ripley, Ont.		Jacques Whitford 2009
CARES, WA	Erickson et al. 1999		Summerview, Alb.		Brown and Hamilton 2006
Klickitat County, WA	WEST and NWC 2003		Grand Ridge, IL	Derby et al. 2009	Derby et al. 2010
Lower Linden, WA	Johnson et al. 2007a		Buffalo Gap, TX		Tierney 2007
Lower Snake River, WA	Young et al. 2009b		Buffalo Mountain, TN (06)		Fiedler et al. 2007
Combine Hills, WA (01-03)	Young et al. 2003d		Buffalo Ridge I, MN		Usgaard et al. 1997, Johnson et al. 2000a
Leaning Juniper, OR	Kronner at al. 2005	Kronner et al. 2007, Gritski et al. 2008	Casselman, PA		Arnett et al. 2009
Alta-Oak Creek Mojave, CA (Proper)	Erickson et al. 2009		Cedar Ridge, WI		BHE Environmental 2010
Hopkins Ridge, WA	Young et al. 2003a	Young et al. 2007a	Crescent Ridge, IL		Kerlinger et al. 2007
Stateline, OR/WA	Erickson et al. 2002b	Erickson et al. 2004	Maple Ridge, NY		Jain et al. 2007, 2008, 2009c
Vansycle, OR	Erickson et al. 2002b	Erickson et al. 2000	Mars Hill, ME		Stantec 2008a
Alta-Oak Creek Mojave, CA (East)	Ericksonet al. 2009		Mount Storm, WV (08)		Young et al. 2009a
Dry Lake, AZ	Young et al. 2007c		Mountaineer, WV		Kerns and Kerlinger 2004
Golden Hills, WA	Jeffrey et al. 2008		Munnsville, NY (08)		Stantec 2008b
Hatchet Ridge, CA	Young et al. 2007b		Noble Bliss, NY		Jain et al. 2009d, 2010a
Homestead, CA (05-06)	Johnson et al. 2007b		Noble Clinton, NY		Jain et al. 2009b, 2010b
Maiden, WA	Young et al. 2002		Noble Ellensburg, NY		Jain et al. 2009a, 2010c
Reardan, WA	WEST 2005a		NPPD Ainsworth, NE		Derby et al. 2007
Stateline Reference, OR	Ericksonet al. 2002b		Top of Iowa, IA		Jain 2005
Sunshine, AZ	WEST and the CPRS 2006		Stetson Mountain, ME (Year 1)		Stantec 2009
Vantage, WA	WEST 2007				

The information in Table 9 suggests that we would expect low golden eagle mortality in any given year at the OWEF. A conservative prediction would be an average of less than one eagle fatality per year assuming the level of use observed during the pre-construction studies continued. The likelihood of mortality in a given year would appear to be influenced by whether the territories near the project are occupied and are successful. Based on the recent past, these territories are often unoccupied and production has been very low.

Another approach to estimating annual eagle fatalities at this project is to look at mortality predictions for all raptors, and then look at the percentage of raptors observed on the site that are eagles. Based on raptor use at the project (approximately 0.4/20-min survey), the estimated raptor mortality rate can be expected to be around 0.10 raptors/MW/yr. Golden eagle use comprises approximately 1/40th of the observed raptor use, so eagle mortality is expected to be 0.0025 eagles/MW/yr or approximately one per year. This last approach is likely conservative because golden eagles are likely more detectable than other raptors and so the raptor use estimates of non-eagles are likely an overestimate of use relative to eagle use.

The final approach attempts to apply the modeling approach prescribed in the USFWS draft eagle conservation plan guidance (USFWS 2011). Table 10 and 11 contain parameters used to calculate a model of collision risk. An avoidance rate of 99% was used in the model following Whitfield (2009), since it doesn't appear that the site (on an overall basis) has risk factors that would lead to increases in fatality (e.g., high prey base, topography, etc.).

Table 10. Values of parameters used to generate an eagle fatality estimate for the Ocotillo Wind Energy Facility.

Parameter	Value
Eagle Use (20 min survey/2.01 km^2)	0.01
Eagle Use/min/km^2	0.00025
# minutes/observation - estimated	5
Eagle minutes/km^2	0.00124
# minutes daylight hours	262800
Area of project km^2	60.7
Exposure minutes in study area	19612
# turbines	158
risk area around turbine - km^2	4.96
danger area as a proportion of study area	0.082
Probability of collision/min flight in danger zone	0.012
non-avoidance rate	0.010
fatality rate for project - eagles per year	0.187

Table 11. Input values and calculations for the probability of collision/min flight in danger zone.

Probability of Collision if in Danger Area	Value
rsa - m2	10,207
area of 2-d plane (200 m x 175 m)	35,000
risk area (rsa/area of rectangle)	0.29
Approximate prob. of collision in RSA - Tucker Model	0.04
collision risk probability (product of latter two)	0.012

Using this approach, we estimate approximately one golden eagle fatality per five years (0.187 eagles per year).

All three approaches lead to a predicted mortality estimate of less than one eagle per year. All three models are predicated on several assumptions, including eagle use continuing to be low as measured during the two years of pre-construction work. If nesting/territory occupancy and production were much higher than observed during the past three years in this region, then actual mortality of eagles may be higher.

3.3 Categorizing Site according to Risk

Based on the USFWS draft eagle conservation plan guidance, the site specific data collected to date and the risk assessments, the OWEF appears to meet a Category 2 designation.

4.0 AVOIDANCE AND MINIMIZATION OF RISK USING ADVANCED CONSERVATION PRACTICE'S AND COMPENSATORY MITIGATION (STAGE 4)

The site-specific golden eagle data collected for the OWEF suggests the site should receive a Category 2 designation according to the USFWS draft eagle conservation plan guidance. However, OE LLC plans to implement a variety of Advanced Conservation Practice's (ACP's) to reduce the risk to golden eagles from the project. The following ACP's have been implemented or are planned for the OWEF during the pre-construction, construction, and operation phase of the project.

4.1 ACP's Pre-Construction

OE LLC collected available site-specific information on golden eagle use to guide project siting to avoid and minimize impacts to golden eagles. The golden eagle data collected to date does not provide strong evidence for modifying any of the preliminary turbine locations to avoid/minimize potential impacts to golden eagles. Other ACP's implemented during the pre-construction phase of the OWEF include:

- The area and intensity of disturbances was minimized during pre-construction monitoring and testing activities.
- Existing roads and transmission corridors have been used to the extent possible while developing site plans.
- Structures are sited away from high avian use areas and the flight zones between them.
- The Avian Power Line Interaction Committee (APLIC) guidance on power line siting (APLIC 1994) was followed while planning.
- Site plans minimized the extent of the road network needed for the OWEF.
- No lattice or structures that are attractive to birds for perching are including in facility designs.
- No guy wires will be included on permanent MET towers.
- Lighting plans for the facility are the minimum according to requirements.
- All security lighting will be motion or heat activated, instead of being left on throughout the night.
- All security lighting will be down-shield and related to infrastructure lights.
- Turbines will not be sited in areas where eagle prey species are abundant.
- The facility was not sited in any areas containing high concentrations of ponds, streams, or wetlands.

4.2 ACP's during Construction

The following ACP's will be implemented at the OWEF during construction:

- The area and intensity of disturbance will be minimized to the extent possible during construction.
- Existing roads will be used for access during construction to the extent possible.
- Non-operational MET towers will be dismantled during construction.
- Powerlines will be buried to the extent possible to reduce avian collision and electrocution.
- The Avian Power Line Interaction Committee (APLIC) guidance on power line construction (APLIC 2006) will be followed.
- A transportation plan will be implemented during construction that includes road design, locations and speed limits to minimize habitat fragmentation and wildlife collisions, and minimize noise effects. This will help to minimize carrion availability for golden eagles.
- Spatial and seasonal buffers will be implemented to protect individual nest sites/territories and/or roost sites during construction, such as maintaining a buffer between activities and nests/communal roost sites and keeping natural areas between the project footprint and the nest site or communal roost by avoiding disturbance to natural landscapes.
- Human activity will be prohibited within line of site of nesting eagles to minimize disturbance.

4.3 ACP's during Operation

OE LLC plans to implement an intensive operational golden eagle monitoring and research program for the OWEF. The golden eagle monitoring and research program includes implementation of a state of the art Merlin avian radar system, radar controlled video tracking system, telemetry on any eagles nesting within four miles of the OWEF (assuming successful capture), and a full time golden eagle biological monitor to observe any golden eagles flying within the OWEF and to curtail turbines when eagles are at risk of collision. OE LLC plans to keep a staff biologist on site during the day year-round to monitor the movements of eagles and other wildlife through the site for the first five years of operations. After the completion of the first five years of monitoring operations, a decision will be made in consultation with the Technical Advisory Committee (TAC) as to whether the system will be manned seasonally and what the dates and times of operation will be to ensure a manned presence on the site when eagles could potentially be active on the site. It is the goal of OE LLC to implement a monitoring system and a compensatory mitigation package that results in no net loss of golden eagles from the OWEF over the life of its operations. Details of the intensive operational golden eagle monitoring and research program that will be implemented at OWEF are provided in Appendix C. This monitoring program is unlike anything implemented to date at a wind energy facility anywhere in the world and will not only provide a test of state of the art technological solutions and their ability to eliminate golden eagle collisions, but will also provide a unique opportunity to gain a better understanding of the interaction of golden eagles and wind energy facilities. These ACP's and this research are likely not feasible or practical at all facilities, but given the size of this facility and other factors, there are opportunities to learn and test hypotheses regarding the effectiveness of such equipment in reducing mortality.

In addition to the intensive monitoring and research program, the following ACP's will be implemented during operation of the OWEF:

- Management activities such as seeding forbs or maintaining rock piles that attract potential prey will be avoided.
- Parts and equipment which may be used as cover by prey will not be stored in the vicinity of wind turbines.

- Any carcasses (with the exception carcasses being used for post-construction bias trials) found within the OWEF will be removed immediately assuming the appropriate permits/authorizations have been granted to OE LLC.
- Responsible livestock husbandry will be practiced (e.g. removal of carcasses, fencing, calving/lambing operations will not occur in the vicinity of the wind turbines).
- Low level speed limits (< 25 mph) will be maintained on all roads within the OWEF.
- Personnel will be trained to be alert for wildlife at all times, especially during low visibility conditions.
- Personnel, contractors, and visitors will be instructed to avoid disturbing wildlife, especially during the breeding seasons and seasonal periods of stress.
- Fire hazards will be reduced from vehicles and human activities (e.g., use spark arrestors on power equipment, avoid driving vehicles off roads, and allow smoking in designated areas only).
- Federal and state measures for handling toxic substances will be followed.
- Effects to wetlands and water resources will be minimized by following provisions of the Clean Water Act (1972).

4.4 Additional ACP's

The following is a list of possible ACP's that may be considered for implementation depending on the results of the post-construction monitoring programs (both the intensive golden eagle monitoring and research program and the general post construction monitoring studies) and discussions with the Technical Advisory Committee (TAC). The post-construction monitoring program and the role of the TAC are described in further detail in Section 5 below.

- Development of a long-term (greater than three years) eagle monitoring program for the facility.
- Modification and implementation of the curtailment strategies developed during the three years of post-construction monitoring, including consideration of possibly other technologies (telemetry of eagles, cellular fence, and possible curtailment of turbines if an eagle breaches the cellular boundary.
- Seasonal or daily curtailment based on data collected on site.
- Placement of visual and/or auditory bird flight diverters in critical locations.
- If fossorial mammals are found burrowing near turbines, burrows may be filled and the turbine pad may be surrounded within gravel at least two inches deep.
- Installing perch guards on overhead electric lines in the vicinity of the OWEF if eagles are shown to regularly use the lines.
- Wildlife rehabilitation - Contribute funding to one or more regional raptor rehabilitation centers. Golden eagles face threats from a variety of sources (disease, natural causes, poisoning, electrocution, power line collision, and other anthropomorphic causes), and supporting a rehabilitation center can save eagles.
- Identify highly disturbed nest sites in the region and promote and find ways to protect those nests from disturbance, which should lead to an increase in reproduction potential.
- Contribute funding for regional eagle population studies.

4.5 Re-evaluation of Risk Considering ACP's

Assuming the goal of no eagle "take" for the facility is achieved through the intensive monitoring and research program and curtailment of wind turbines anytime an eagle is flying in the vicinity of turbines, it is anticipated that the OWEF will be downgraded to a Category 3 site following the first five years of operation. The initial risk assessment is currently being used for the purposes of determining compensatory mitigation.

4.6 Compensatory Mitigation

Due to the experimental nature of the radar and biological monitoring system, and some uncertainties in the likelihood of golden eagle mortality, some compensatory mitigation for retrofitting of lethal power poles will be provided. An initial commitment of funds necessary to retrofit lethal power poles to compensate for one golden eagle fatality a year for the first five years of operation will be provided using the formulas provided in the Draft Eagle Conservation Plan Guidance. Assuming $1,500 cost per pole, OEC LLC will provide $30,000 for the purpose of retrofitting lethal power poles in the region for the first five years of operation. Based on the eagle fatality estimates from the first three years of monitoring, the compensatory mitigation for the life of the project will be determined.

4.7 Cumulative Impacts

4.7.1 Population Status

The population estimate for golden eagles in California, according to Blancher et al. (2007), is approximately 2,000 birds using the Breeding Bird Survey (BBS) data and the Partners in Flight (PIF) population modeling. In the western US, not including California, the population estimate was 20,722 golden eagles (90% confidence interval: 16,317 – 25,948; excluding military lands, elevations above 10,000 ft [3,048m], large water bodies, and large urban areas; Nielson et al. 2010). Based on the ratio of golden eagles aged as juveniles to the total number of golden eagles observed, it was estimated that a total of 1,962 (90% confidence interval; 1,120 – 2,930) juvenile golden eagles were present in the western US (Nielson et al. 2010).

We are not aware of golden eagle population data from Imperial County, but have gathered some public data from the adjacent San Diego County. From 1997 – 2001, approximately 50-55 pairs nested in San Diego County, with approximately 20 pairs fledging young each year, and an average of 1.5 young per successful nest (Bittner 2007). The golden eagle population appears to be declining, primarily due to urban sprawl, but other factors affecting the eagles are human disturbance, especially from rock climbing, shooting, and agriculture. Powerline electrocutions are determined to be the biggest source of mortality from 1988 -2003; approximately 67% of the dead eagles picked up in and near San Diego were reported as electrocutions. Other significant factors affecting golden eagles and other raptors throughout the US include secondary poisoning and prolonged drought.

Given the anticipated low level of potential eagle mortality at this site, and the ACP’s and compensatory mitigation that is being proposed, we anticipate the project to result in no net loss of golden eagles within a regional population level.

5.0 POST-CONSTRUCTION MONITORING (STAGE 5)

A post-construction monitoring program will be implemented at the OWEF. The observations made during post-construction monitoring will be reported to a Technical Advisory Committee (TAC), which will respond with appropriate management decisions depending on the results of the monitoring program.

Notwithstanding the foregoing, the Parties acknowledge that fatality reduction or other measures may be required pursuant to applicable law inc1uding but not limited to the federal Endangered Species Act (1973), Bald and Golden Eagle Protection. Act (1940), Migratory Bird Treaty Act (1918) or the California Endangered Species Act (California Fish and Game Code, §§ 2050, *et seqJ*)

Since post-construction monitoring methods are constantly improving as researchers develop new and more accurate methods of survey, the TAC should consider recommendations to adopt new survey techniques and protocols as they become available. Post-construction monitoring shall include collecting field data on behavior, utilization, and distribution patterns of affected avian and bat species, in addition to fatalities.

5.1 Radar and Biological Monitoring

To advance the state of knowledge in use of radar and biological monitors for risk reduction to eagles, OWEF has committed to developing, evaluating, and refining a potential system for real-time turbine curtailment at this site. These ACP's and this research are not practical at most facilities, but given the size of this facility and other factors, there are opportunities to learn and test hypotheses regarding the effectiveness of such equipment in reducing mortality.

Pattern Energy proposes having a biologist on site to monitor eagle activity in real time during the first three years of operation, and potentially up to an additional two years of operation, depending on the success of the methodologies. The air-conditioned central monitoring control room on the observation tower will be equipped with radar monitors, video monitors and controls, and radio telemetry data monitors to provide the most comprehensive site monitoring system for avian activity deployed anywhere in the world. The concept is to have multiple data sources available in real time and recorded for post event (i.e., an eagle collision with a turbine) analysis, each sensor providing important details and playing to its specific strengths and also providing redundancy.

The biologist will operate during daylight hours from a central monitoring control room, mounted on a tower and affording a 360 degree panoramic view of the site. The tower, illustrated in Figure 10, will be approximately 50 feet tall. The radar used for this application will be a with an Ultra High Resolution Solid State X Band Doppler radar. The radar has a five-m Slotted Waveguide antenna with about 0.4 degrees azimuth resolution. The vertical beam width is about 24 degrees. The transmitter is a solid state with a 200-watt peak power output. The receiver uses enhanced pulse compression that produces 15-m range resolution. It is the about 0.4 degrees azimuth resolution and the 15-m range resolution that make the radar Ultra High Resolution by comparison to ANY other bird radar. The radar uses a Doppler processor with 32 Doppler filters (16 inbound and 16 outbound).

The Merlin Avian Radar System uses radar tracking software which has been optimized specifically for bird tracking. This tracking software will pass off candidate eagle detections to a video monitoring system and to the biological monitor. The video cameras will be pointed in the direction of a target and then the biologist can refine the position in elevation until the target is visually acquired. Once visually acquired, the biologist can identify the target to species using very high powered binoculars and can employ video tracking software to maintain a lock on the eagle until it moves away from the site and is lost from view. The biologist will also provide a curtailment command to the operations center for the turbines if the target is projected to intersect a turbine string within the wind project. Testing will occur to determine how quickly the operations center will need to be alerted before turbine rotors can reach a low enough rpm. In addition, the biologists will investigate any observed potential turbine strikes for eagles and other raptors on the day of the observed interaction (see next section).

In addition to real-time curtailment of turbines, a large amount of data will be collected to help understand golden eagle and raptor behavior and risks in an operating wind energy facility, to help validate and possibly refine the radar, video, and curtailment technologies being tested, and to provide assessments of the efficacies of these technologies for more wide spread use. Flight paths of raptors from the radar and biological monitoring will be mapped and analyzed.

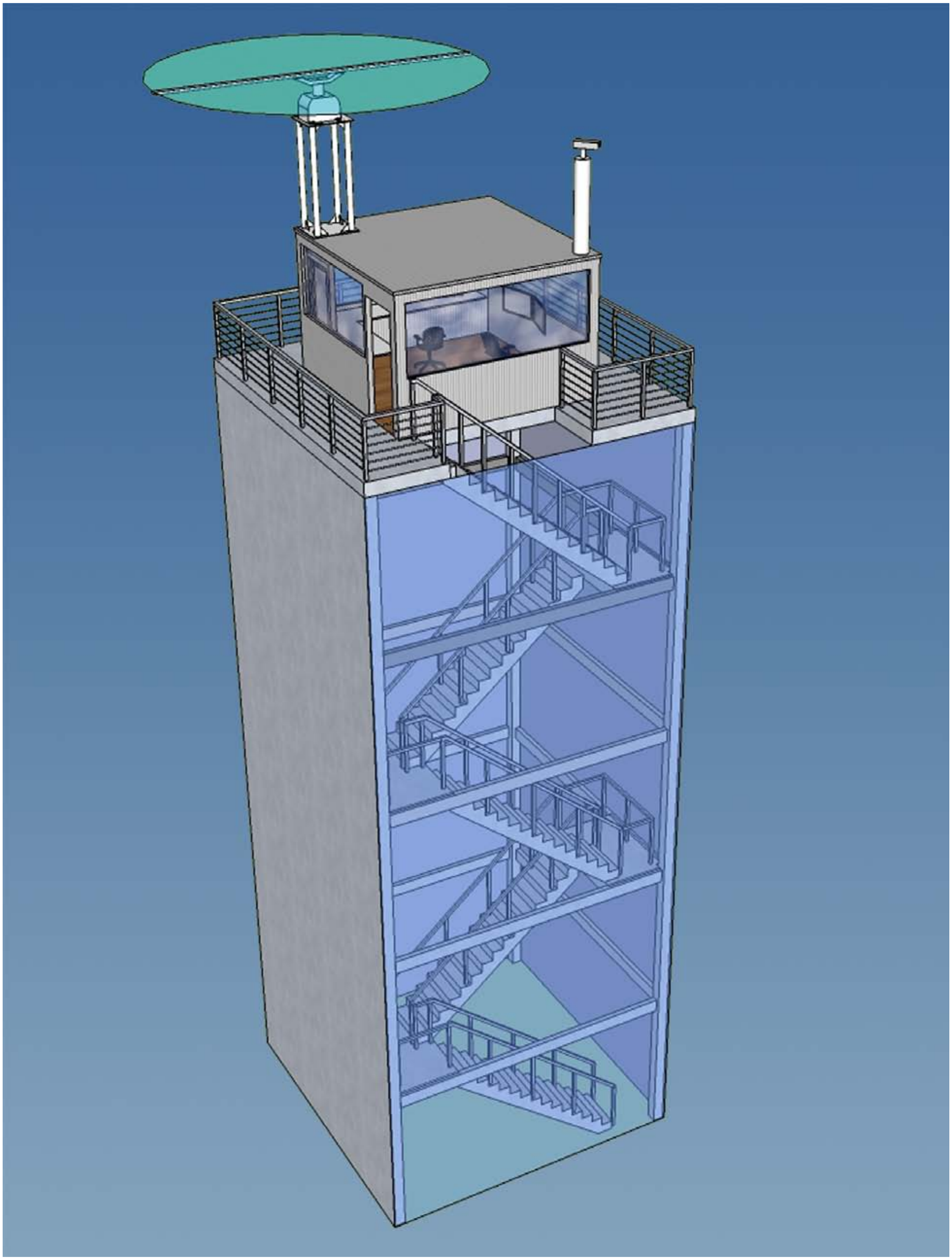

Figure 10. The observation tower proposed for the Ocotillo Wind Energy Facility.

5.2 Fatality Monitoring

OWEF will be subject to three years of post-construction monitoring unless additional monitoring is recommended and agreed upon by OE LLC. Post-construction monitoring shall begin no later than three (3) months after the beginning of operations. Any golden eagle mortalities will be identified through the post-construction monitoring effort. These surveys will be completed regularly to document the number and species of bird and bat fatalities attributable to the OWEF. The methods for estimating mortality at the OWEF will conform with industry standards in the U.S. As part of these mortality surveys, the searcher efficiency rate (i.e., the ability of a surveyor to locate a mortality) and carcass removal rate (i.e., the average time that a carcass persists before a scavenger removes it) will be determined for bats and small and large bird size classes. OWEF will monitor a subset of 30% of the turbines at least twice per month for the first two years of operation to quantify bird and bat mortality. During the third year of monitoring, the focus will be strictly on quantifying eagle and raptor mortality. Monthly searches will be conducted at the sample of turbines during this third year, focusing on quantifying raptor mortality.

In addition to the standardized monitoring, all observations of likely collision of raptors with wind turbines documented through the radar and biological monitoring will be investigated. During the same day the interaction was documented, a technician will search the turbines where the interaction occurred.

5.3 Golden Eagle Nest Surveys

Golden eagle nest surveys will be conducted prior to the nesting season and once each month during the nesting season during the first three years of operations. Aerial or ground based golden eagle nest surveys will be conducted within a 10-mile buffer of the project area focused on suitable nesting habitat, based on current USFWS guidance. The complete 10-mile search area will be limited to once at the beginning of the golden eagle nesting season, with monthly follow-up surveys only being completed for identified golden eagle or potential golden eagle nests. Nest locations found during surveys will be documented by noting the species, dates of activity, Universal Transverse Mercator (UTM) NAD 83 coordinates, nest contents (when possible), and behavior. The data will be presented to the TAC to determine whether mitigation should be recommended to reduce impacts to nesting activities. Active golden eagle nests will be monitored to track the breeding success of resident golden eagles and to evaluate the effectiveness of the mitigation measures that have been applied.

5.4 Reporting

The Monitor shall prepare interim, annual monitoring reports within three months of completing each year of post-construction monitoring, and shall prepare a final three year Monitoring Report within six months of completing three years of post-construction monitoring.

All monitoring reports, including all raw monitoring data upon which the reports are based, shall be made available to members of the TAC. All monitoring reports shall report adjusted and unadjusted annual fatalities for bats and all other bird species on a per-turbine and per-megawatt basis. The monitoring reports shall also summarize the results of the bird and bat behavior and use studies for the preceding one or three years, as applicable. The Monitor shall supplement the final three year Monitoring Report with subsequent monitoring data collected.

6.0 ADAPTIVE MANAGEMENT

The adaptive management techniques described in this section have been developed to ensure that potentially significant levels of mortality from operation of the OWEF are effectively mitigated. This section describes the adaptive management process that will be applied for avian and bat species. Changes in federal, state, and/or BLM status for wildlife species occurring within the project area may result in the addition of, or changes to, adaptive management strategies, as determined by the BLM through TAC recommendations.

6.1 Adaptive Management Process

The TAC Lead will be provided a running mortality count every two weeks for review. The TAC will meet to discuss mitigation needs if the TAC Lead determines that a unique or significant event has occurred. At a minimum, the TAC will meet annually to review data and determine whether mitigation is necessary. If the TAC determines mitigation is necessary, the TAC will be responsible for identifying and recommending suitable mitigation(s). One or more mitigation measures may be applied for birds or bats if a unique or significant event occurs. Measures to consider are found in section 4.4.

6.2 Agency Interaction

The development of an effective and successful ECP for the OWEF will depend on frequent coordination between agency biologists and OE LLC. Many of the ACP's implemented at OWEF will be tested for the first time and will need to be reviewed and evaluated for effectiveness. As the OWEF will likely be one of the first projects that implements the USFWS draft ECP guidance (2011), it is anticipated that the process will evolve and that modifications to the process may need to be made while ensuring that the goal of stable or increasing breeding populations of eagles is achieved. As suggested in the USFWS draft ECP guidance, OC LLC, plans to allow service personnel access to the site to monitor the effects and effectiveness of the ACP's and mitigation measures that have been implemented.

7.0 PUBLIC OUTREACH

OWEF will coordinate with key interest groups within the community to determine how capital contributions from the project can go toward local scholarship funds and/or worthwhile community projects. In addition, a project fact sheet describing the project and measures that have been put in place to address avian and bat issues will be prepared and made available at the local BLM El Centro District Office.

8.0 CONCLUSION

This document was written to provide guidance for all required wildlife mitigation and monitoring prior to, during, and after construction of the OWEF. The measures described in this document are intended to help protect and reduce impacts to wildlife, as well as to monitor potential impacts to wildlife following implementation of the OWEF. It is anticipated that this Avian and Bat Protection Plan (ABPP) will adaptively manage the OWEF based on findings following construction.

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Appendix A: History of golden eagle territories within 10 miles of the OcotilloWind Energy Facility.

Appendix A. History of golden eagle territories within 10 miles of the Ocotillo Wind Energy Facility.

Carrizo Gorge

Dates/Earliest Record	Name on Record	Egg Collection/ Number of Young	Nest Location/ Nest Number	Young Banded/Type of Transmitter
1995	Mike Graham	?	Adult GEs seen on a regular basis; YNG seen	N
1996	P. Jorgenson	?	Adult GEs seen hunting 1 mi South of the mouth of Carrizo Canyon	N
1997	R West/JO	?	Walked the RR tracks from the south near I-8 and saw GE's and Randy reported seeing a nest	N
1998	R West	1 YNG	Walked the RR tracks and found a nest and saw a young in the nest	N
1999	JDB/ J Muench	0 YNG	Flew in Park Plane to find the nests	N
2000	JDB/ J Muench	0 YNG	Flew in Park Plane to find the nests	N
2001	JDB/ J Muench	0 YNG	From Park Plane we found nests but no young	N
2002	JDB/ R. West	0 YNG	Aerial survey found 5 nests; nest located above RR trestle (R. West, ground)	N
2003			Not surveyed	N
2004			Not surveyed	N
2005	JDB	1 YNG	3 wks old in nest on South face	N
6-Apr-2006	JD Bittner	1 YNG + Egg	aerial survey; 1 2wk old YNG and 1 egg; banding attempted, but failed due to hiking difficulty	N
11-May-2007	JDB/JH	1 YNG + Egg	used higher of the two nests; 1 egg and 1 YNG	Y - VHF
9-Apr-2008	JDB	0 YNG	5 nests; all empty. Bighorn sheep herd by nests	N
28-Apr-2009	JDB/JW/CM	0 YNG	5 inactive nests	N
6-Apr-2010	JDB	0 YNG	5 nests; red-collared Bighorn ewe near nests	N

Coyote Mountain

Dates/Earliest Record	Name on Record	Egg Collection/ Number of Young	Nest Location/ Nest Number	Young Banded/ Type of Transmitter
1970s	Culver	?	T15 S., R8 E., SE.35, SE.1/4 on side of mountain	
1992	JD Bittner/Culver	0 YNG	report adult GEs on territory	
2001	JDB/J. Oakley	0 YNG	Aerial Survey found 6 nests-none active; nests on all sides of the mtn.	
2002	JDB/J. Oakley	0 YNG	1 Nest RTH	
2003	JDB/J. Oakley	0 YNG	Aerial survey found nest activity but no young	
2004		?	Not surveyed	
2005		?	Not surveyed	
2006		?	Not surveyed	
11-May-2007	JDB/JH	0 YNG	1 nest, two raven nests on Mtns	
2008		?	Not surveyed	
28-Apr-2009	JD Bittner	0 YNG	1 GE nest; 2 Prairie Falcons in pothole; additional GE territory found to the West (Coyote Mtn West)	
30-Mar-2010	JDB/CM/RR	0 YNG	aerial (heli) survey: 2 nests	

Coyote Mountain - West

Dates/Earliest Record	Name on Record	Egg Collection/ Number of Young	Nest Location/ Nest Number	Young Banded/ Type of Transmitter
28-Apr-2009	JDB	0 YNG	Discovered by helicopter survey; unknown in the past	
30-Mar-2010	JDB/CM/RR	0 YNG	aerial (heli) survey: 9 nests, one active (new material); Bighorn Sheep and 2 pairs of Prairie Falcons on territory	

Table Mountain

Dates/ Earliest Record	Name on Record	Egg Collection/ Number of Young	Nest Location/ Nest Number	Young Banded/Type of Transmitter
1920s	Bittner/West/J. Oakley	?		
1991	JD Bittner/J. Oakley	1 YNG	3 nests on cliffs	
1992	JDB/JO	2 YNG		
1993	JBD/JO	1 YNG		
1994	JBD/JO	0 YNG		
1995	JBD/JO	2 YNG		
1996	JBD/JO	1 YNG	Adults seen early in nesting season; shooters at cliff during nesting season; chick died.	
1997	JBD/JO	0 YNG		
1998	JBD/JO	0 YNG		
1999	JBD/JO	1 YNG		Y- no transmitter
2000	JBD/JO	0 YNG		
2001	JBD/JO	1 YNG		Y- no transmitter
2002	JDB/JH	2 YNG	1 YNG shot on nest	
2003	JDB	1 YNG	Nest with 1 young located by fixed wing aerial survey-Anza Borrego St. Pk	N
14-Mar-2004	JH/ B Erickson	1-2 YNG	RTH nesting in southernmost GE nest	
13-Feb-2005	JH	0 YNG	3 new nests discovered 3/4 mile SW of old nests; extensive whitewash is evidence of 2004 nesting; RTH courting around old GE nest sites	
6-Apr-2006	JD Bittner	0 YNG	6 nests checked	N
13-Mar2007	JH	0 YNG	2 new nests southwest of old nest sites; 3 nests checked	N
9-Apr-2008	JDB	0 YNG	Nests present at old nest site; RTH on one; 6 nests checked	N
28-Apr-2009	JDB/JW/CM	0 YNG	7 nests; RT Hawk nesting on north set of nests	N
6-Apr-2010	JDB	0 YNG	6 nests; GHO w/ yng on old GE nest	

Appendix B: Elevation, slope, and aspect characteristics of proposed turbines at Ocotillo.

Appendix B. Elevation, slope, and aspect characteristics of proposed turbines at Ocotillo.

Turbine	Elevation (m)	Slope (Degrees)	Aspect (Degrees)	Aspect (Direction)
2	397.95	11.15	336.34	Northwest
32	289.65	7.67	165.07	South
8	372.08	6.42	97.49	East
146	330.84	5.50	331.09	Northwest
5	343.24	5.38	153.55	Southeast
147	308.17	4.68	36.03	Northeast
63	228.25	4.38	43.26	Northeast
19	332.59	4.30	21.45	North
1	416.17	4.02	267.33	West
6	363.12	4.02	26.93	Northeast
82	199.21	3.84	77.71	East
33	295.63	3.83	76.86	East
38	288.83	3.66	79.73	East
67	231.34	3.65	80.59	East
9	325.46	3.63	72.95	East
123	102.33	3.47	177.07	South
34	287.16	3.31	23.67	Northeast
134	183.44	3.27	77.09	East
28	292.33	3.22	9.15	North
14	327.25	3.22	78.56	East
27	300.74	3.15	44.13	Northeast
10	323.36	3.13	27.38	Northeast
49	263.64	3.12	334.81	Northwest
24	308.03	3.00	91.94	East
142	276.23	2.95	77.58	East
3	399.79	2.94	72.64	East
81	196.30	2.81	76.53	East
30	291.06	2.77	90.94	East
130	186.99	2.75	31.94	Northeast
149	284.33	2.75	46.56	Northeast
77	200.78	2.74	62.86	Northeast
143	287.19	2.74	72.42	East
21	301.52	2.68	33.96	Northeast
48	267.70	2.61	89.72	East
154	286.26	2.61	58.60	Northeast
4	398.81	2.60	73.84	East
157	203.12	2.56	37.46	Northeast
56	255.88	2.54	18.58	North
15	337.09	2.51	89.39	East
70	223.25	2.46	57.00	Northeast
144	287.75	2.43	82.39	East
95	214.47	2.42	100.72	East
36	270.85	2.41	75.84	East
72	219.74	2.40	52.62	Northeast
145	225.31	2.40	94.75	East
37	274.88	2.38	41.80	Northeast
59	230.66	2.34	67.87	East
41	257.46	2.33	18.69	North
139	158.55	2.29	35.52	Northeast
76	204.30	2.28	34.21	Northeast
23	318.56	2.27	57.88	Northeast
47	260.32	2.26	75.67	East
54	247.97	2.26	46.65	Northeast

Appendix B. Elevation, slope, and aspect characteristics of proposed turbines at Ocotillo.

Turbine	Elevation (m)	Slope (Degrees)	Aspect (Degrees)	Aspect (Direction)
66	230.51	2.25	74.74	East
153	292.78	2.24	79.99	East
126	105.23	2.23	172.76	South
35	283.55	2.22	48.18	Northeast
132	185.91	2.22	77.42	East
75	204.49	2.22	35.35	Northeast
61	229.46	2.19	68.43	East
46	258.35	2.19	66.13	Northeast
52	253.63	2.15	38.76	Northeast
13	323.04	2.12	73.76	East
74	207.38	2.09	36.90	Northeast
62	232.18	2.08	62.49	Northeast
148	302.16	2.03	51.30	Northeast
53	249.94	2.02	52.38	Northeast
58	231.73	2.01	43.93	Northeast
51	253.31	2.01	52.62	Northeast
87	167.11	2.00	65.60	Northeast
55	249.47	1.98	74.81	East
44	257.14	1.97	337.45	Northwest
128	97.57	1.97	181.29	South
131	184.01	1.96	39.53	Northeast
156	197.49	1.96	12.74	North
45	258.13	1.96	89.62	East
31	293.44	1.94	182.99	South
135	170.54	1.93	122.76	Southeast
16	332.12	1.93	13.41	North
96	199.91	1.93	86.76	East
140	152.53	1.92	15.94	North
65	226.65	1.91	69.25	East
158	169.91	1.91	9.67	North
155	190.42	1.90	21.81	North
20	309.87	1.89	63.27	Northeast
90	245.74	1.87	78.16	East
18	327.00	1.87	63.92	Northeast
89	282.42	1.86	49.48	Northeast
152	291.45	1.85	54.56	Northeast
39	260.66	1.84	46.72	Northeast
42	258.54	1.82	31.73	Northeast
73	204.74	1.82	75.57	East
68	230.62	1.81	352.54	Northwest
98	169.90	1.81	75.07	East
26	297.96	1.81	51.97	Northeast
97	166.73	1.78	38.69	Northeast
83	181.49	1.76	64.92	Northeast
85	179.50	1.75	46.41	Northeast
50	254.56	1.72	27.18	Northeast
88	170.97	1.71	44.10	Northeast
71	221.91	1.69	329.26	Northwest
69	223.39	1.67	12.85	North
43	257.16	1.66	343.68	Northwest
138	162.21	1.65	56.85	Northeast
11	317.41	1.64	13.27	North
136	163.85	1.63	18.83	North

Appendix B. Elevation, slope, and aspect characteristics of proposed turbines at Ocotillo.

Turbine	Elevation (m)	Slope (Degrees)	Aspect (Degrees)	Aspect (Direction)
7	358.95	1.63	104.09	East
22	318.06	1.62	81.11	East
84	183.77	1.61	41.16	Northeast
60	230.10	1.60	40.54	Northeast
57	233.75	1.58	47.79	Northeast
64	223.22	1.57	93.61	East
79	195.45	1.56	23.56	Northeast
80	194.12	1.55	46.01	Northeast
91	246.23	1.53	84.81	East
104	146.10	1.47	58.00	Northeast
86	165.61	1.45	78.11	East
29	293.39	1.43	171.83	South
133	181.13	1.29	83.07	East
150	361.11	1.26	82.18	East
78	198.84	1.26	70.84	East
25	308.24	1.25	69.17	East
112	113.67	1.24	174.74	South
121	109.79	1.24	141.46	Southeast
93	226.42	1.23	58.36	Northeast
119	95.77	1.23	18.91	North
101	138.97	1.18	95.58	East
141	153.61	1.15	120.74	Southeast
111	125.74	1.13	146.55	Southeast
92	223.60	1.13	100.77	East
108	115.17	1.12	112.01	East
100	150.45	1.11	111.04	East
107	124.35	1.09	44.53	Northeast
105	143.49	1.05	71.33	East
102	136.81	1.02	100.00	East
137	157.74	0.99	23.78	Northeast
113	109.83	0.98	154.95	Southeast
114	106.28	0.96	161.02	South
99	172.16	0.92	62.81	Northeast
110	121.60	0.88	147.17	Southeast
40	258.69	0.88	125.60	Southeast
12	318.91	0.87	106.02	East
116	102.65	0.83	50.84	Northeast
103	130.57	0.75	107.59	East
129	98.13	0.74	120.86	Southeast
94	222.00	0.69	121.55	Southeast
122	104.39	0.69	156.41	Southeast
17	342.32	0.67	103.02	East
106	125.95	0.65	99.55	East
120	92.03	0.64	54.68	Northeast
125	98.61	0.52	92.41	East
115	103.96	0.52	90.59	East
151	110.63	0.51	91.56	East
117	99.96	0.47	61.62	Northeast
118	97.10	0.46	103.15	East
109	117.57	0.40	79.88	East
124	97.75	0.38	169.42	South
127	104.34	0.00	33.04	Northeast

Appendix C: Radar and Video Tracking, Radio Telemetry and Real Time Collision Risk Assessment for Golden Eagles

APPENDIX C

Radar and Video Tracking, Radio Telemetry and Real Time Collision Risk Assessment for Golden Eagles

Purpose

This document outlines the technology proposed to monitor the movement of large soaring birds such as the Golden Eagle (*Aquila chrysaetos*) over Pattern Energy's planned Ocotillo wind farm site to provide for real-time curtailment capability of the turbines when necessary to minimize the potential for a Golden Eagle collision.

Background

The wind energy development proposed for Ocotillo occurs in the distribution range of Golden Eagles. However, Golden Eagle occurrence on the site, based upon preconstruction surveys, is limited and when it does occur is of short duration (2 – 30 minutes with an average of approximately 12 minutes). All activity noted at the site is confined to daylight hours generally between 1130 and 1600 at flight heights generally between 100 – 1,500 ft AGL (flight height ranged from 0 to 4,000 ft AGL). The project is in proximity to 5 nesting territories (2 of the 5 territories were determined to be active during the 2010 Golden Eagle nest surveys). The closest active nest is approximately 3.2 miles to the north of the project, in the Coyote Mountains.

Generally there has been no eagle mortality at sites with golden eagle use estimates similar to that observed at the Ocotillo site in 2009 and 2010. Projects that have documented golden eagle mortality (mortality reported in the cited reports) have golden eagle use estimates from pre-construction surveys that are much higher than the use observed at the Ocotillo project site.

Collision Prevention Technology Overview

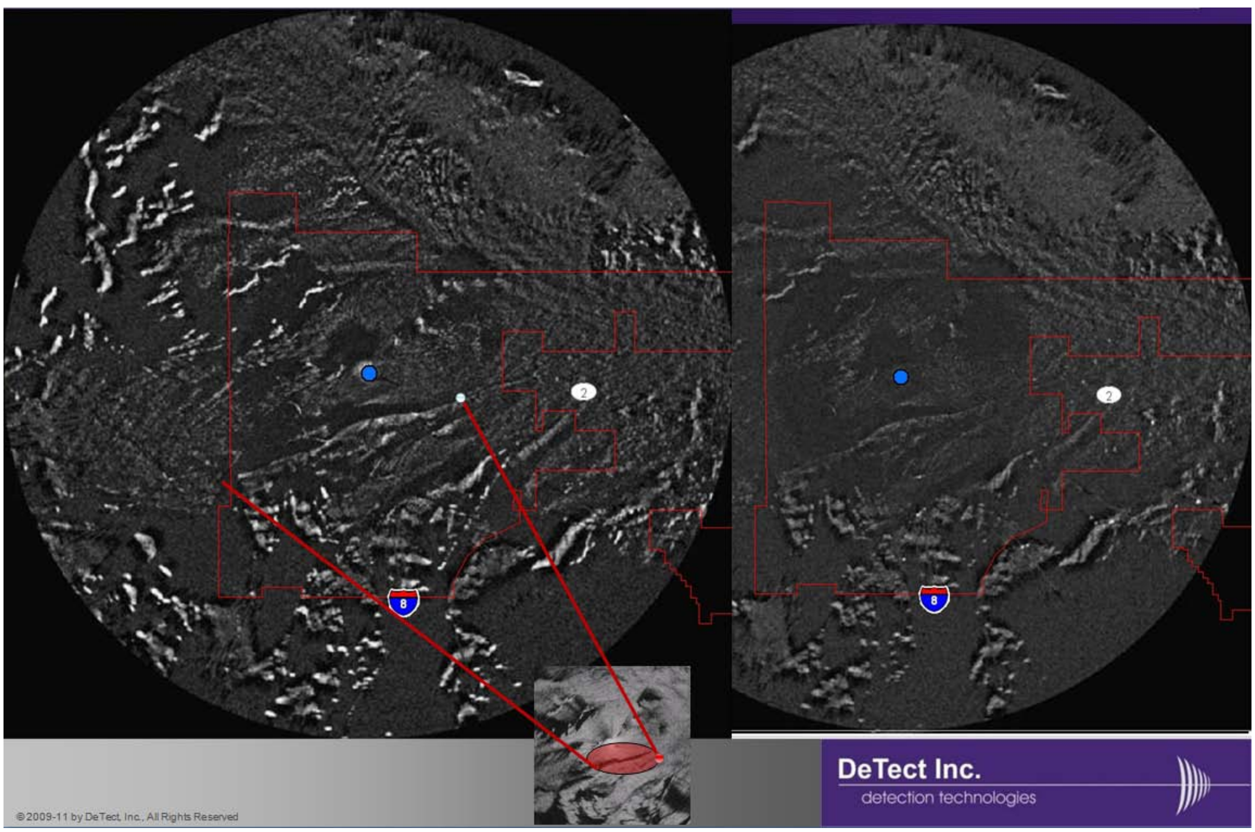
As outlined above, the occurrence of eagles on the site is low, but to further minimize collision risk to a very low rate, Pattern Energy proposes having a biologist on site to monitor eagle activity in real time and to curtail turbine operations when eagles are present on or over the site. The biologist will operate during daylight hours from a central monitoring control room, mounted on a tower and affording a 360 degree panoramic view of the site. (See Exhibit A illustrating visibility coverage at hub height).

The air conditioned central monitoring control room on the observation tower will be equipped with radar monitors, video monitors and controls and radio telemetry data monitors to provide the most comprehensive site monitoring system for avian activity deployed anywhere in the world. The concept is to have multiple data sources available in real time and recorded for post event analysis, each sensor providing important details and playing to its specific strengths and also providing redundancy. The radio telemetry would involve radio tagging of any Golden Eagles nesting within four miles of the turbines, and monitoring of tagged birds.

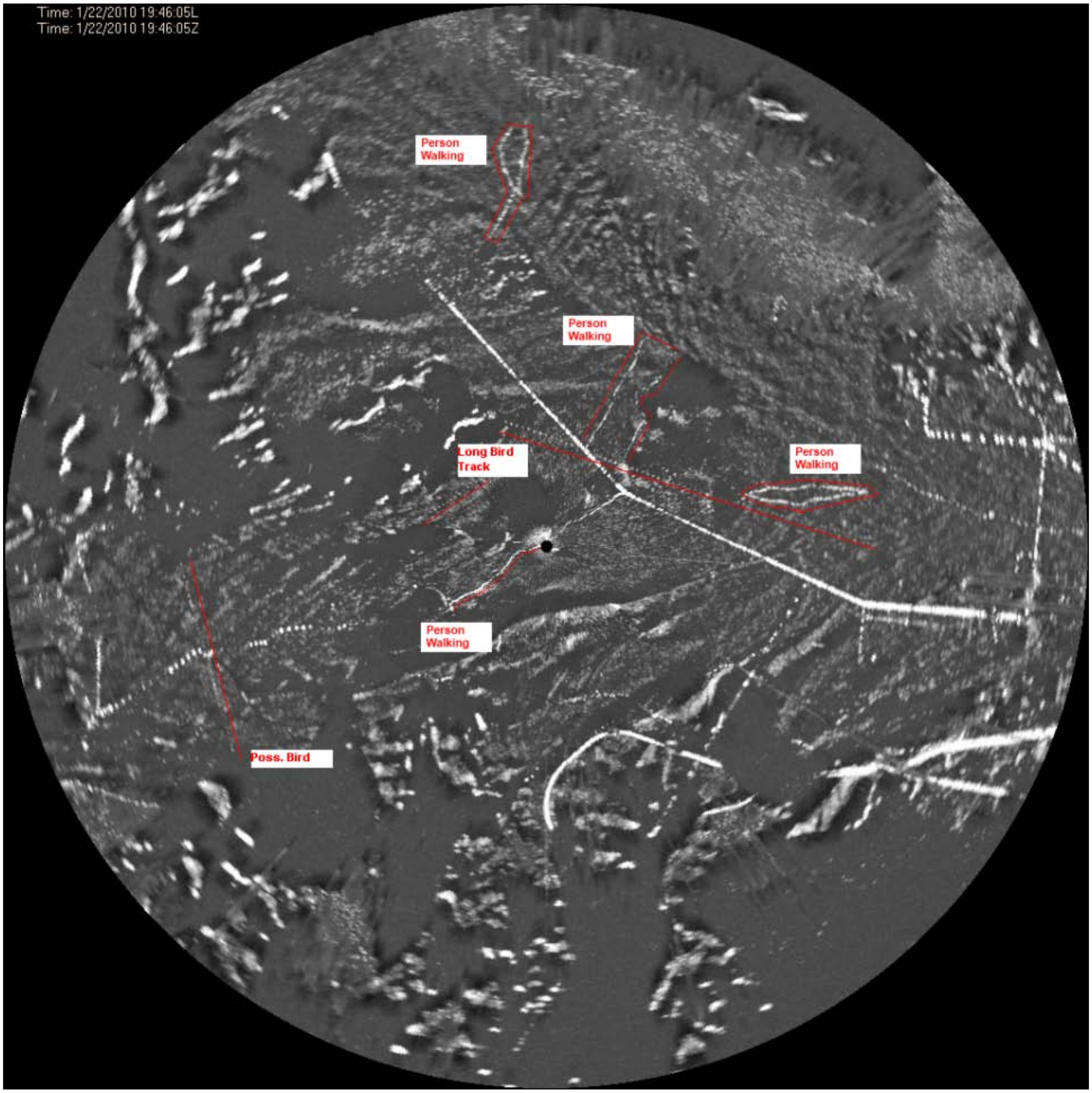
The system will be furnished by DeTect-Inc of Panama City, FL. DeTect-Inc provided the Avian Radar System used by NASA to monitor the air space before each Space Shuttle launch and which was successfully used on the past 17 launches at the Kennedy Space Center in FL. Detect-Inc also provides avian monitoring systems to the United States Air Force, the New International Airport in Durban South Africa as well as many wind energy sites worldwide including Pattern Energy's Texas Gulf Wind facility in Kenedy County, TX.

Pre-construction Phase

In the pre-construction phase of the project a Merlin mobile avian radar system has been deployed to the site. This is a unique system that not only is equipped with S and X band radars but also a state of the art night vision video system to document activity of ground mammals such as Bighorn Sheep on the site. (Note that this radar and video system is focused primarily on Bighorn Sheep during the pre-construction and construction phases, and will be shifted to focus primarily on eagle activity during the operational phase of the project. The solid state radar system being employed is unique in that it can be reprogrammed to optimize detection for different types of target; currently it is optimized for very slow moving sheep through soaring eagles, but refinements could be made to optimize specifically for eagles if the sheep monitoring function is no longer required). The original radars were magnetron based systems, but to overcome issues with strong ground clutter at the site generated by the vegetation and to gain experience for eagle monitoring the site radar is being upgraded to replace the horizontal magnetron S band radar with an Ultra High Resolution Solid State X Band Doppler radar. This decision was made after initial tests at the site showed that a substantial performance increase was possible with this cutting edge technology. The horizontal radar provides the coordinates of slow moving targets and slews the video system to record and document surface movements in the project site. This will be the first deployment of this type of radar equipment for wildlife detection in the world.



In the image above the left hand image shows the ground clutter visible to the ultra high resolution X band Doppler radar with no filtering applied. The brighter the shade of gray, the stronger the ground clutter at that location. The small inset image in the center shows the substantial ground clutter visible to the older technology magnetron S band radar system; such strong clutter precludes observing birds over much of the site. The image to the right shows the ground clutter visible when the ultra high resolution X band Doppler radar is filtered to remove all returns with zero radial velocity. The Doppler capability provides a substantial increase in the amount of area in which birds and other targets are visible on the site.



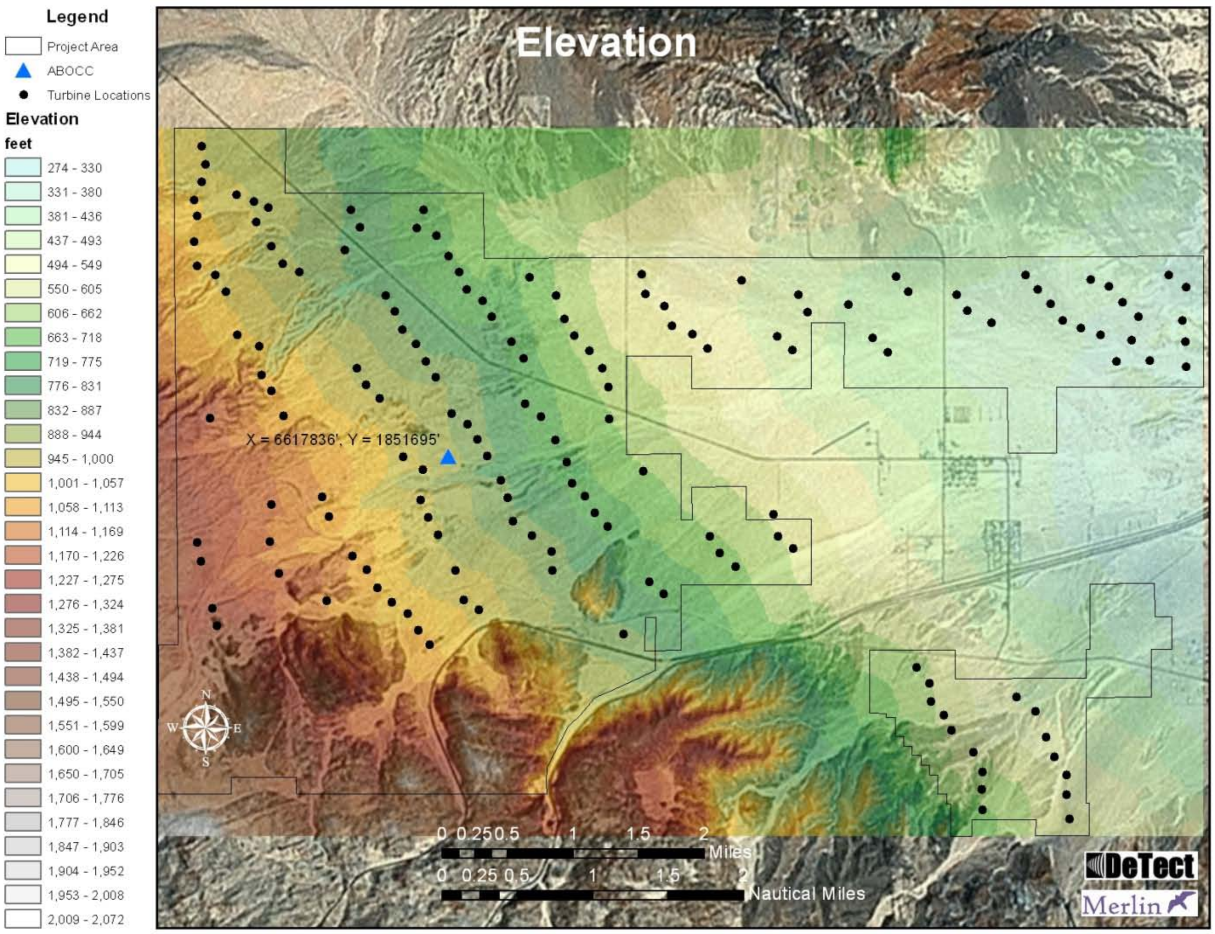
This image above shows the capability of the new radar to detect small targets even on the ground and walking through the vegetation that is the cause of the strong ground clutter returns in the lower resolution, magnetron radar systems. This is a composite image from a long period of time (~ 1 hour) showing target detections within 4nm of the radar. During that time several individual human targets were detected walking on the ground; in addition one bird (unknown species) and one suspected bird movement were also detected.

The High resolution Doppler radar capability shown above opens up the potential for monitoring Eagles in a way not previously possible. Previously 20-30% of the site would be visible and now with the new Doppler radar only a small percentage of the site, in the field of view, has ground clutter returns strong enough to prevent the detection of large soaring birds (bright white areas in the above image not associated with moving targets). As this technology has been tested and achieved this capability on the site we have a very high confidence that this type of eagle monitoring is technically possible.

Post Construction

The mobile radar system will be replaced by a multi radar system to provide a comprehensive site radar monitoring system permanently mounted on a tower. The radars will be state of the art with Doppler processing and Solid State Transmitters as previously used on the upgraded mobile radar system. Each radar will be tower mounted to ensure it has optimal visibility of the site.

GIS Software was used in the planning phase to minimize beam blockage and ensure selection of a site that will give us a high percentage of visibility (over 96%), and thus high probability of target detection of eagles approaching the site.



The map above shows the proposed turbine locations and symbols for the selected site modeled for viewshed analysis.

The map of the view sheds for the selected location is shown in the ***appendix below***. High resolution LIDAR elevation data was utilized in this analysis to maximize accuracy.

The state of the art solid state radars, unlike magnetron radar systems used in other bird studies, provide for the use of Doppler clutter filters and tailoring of the transmitted waveforms to provide optimal eagle target detection even in the presence of heavy ground clutter. The degree of refinement of the radar system for eagle detection that can be made with just a firmware update is unprecedented in the field of radar ornithology. Previously such optimizations would have required a new hardware design. With this reprogrammable system the radar can see a constant evolution in capability during the course of a project as the strengths and weakness of the radar configuration are determined on the site. When future upgrades, such as range azimuth gating (RAG Map), become available for the system these can also be deployed as simple firmware updates. A reprogrammable radar system is cutting edge technology the day it is delivered and can remain that way through progressive firmware updates.

The Merlin Avian Radar System uses radar tracking software which has been optimized specifically for bird tracking. This tracking software will pass off candidate Eagle detections to the video monitoring system in the same way that the night vision system is employed to detect Bighorn Sheep on the current mobile radar system. The video cameras will be pointed in the direction of a target and then the biologist can refine the position in elevation until the target is visually acquired. Once visually acquired the biologist can employ video tracking software to maintain a lock on the eagle until it moves away from the site and is lost from view.

Radar Controlled Video Tracker- existing technology, but state of the art video camera technology exists that is currently being used to track aircraft, where the video camera is automatically steered by an algorithm to keep the designated target close to the center of the video image, until the target is lost from view. This technology can track high speed aircraft in flight so acquiring and tracking slower moving eagles will be easier by comparison.

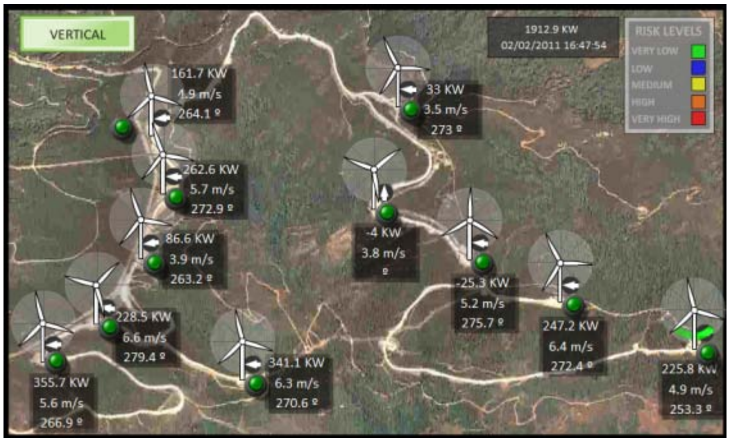
The technology employed to keep the video camera on the eagle is Real-Time Video Tracking software, which automatically controls Pan-Tilt-Zoom video cameras to keep the eagle near the center of the video frame and can be used to record avi video files of the eagles as it moves about the site allowing for avoidance behavior to be studied in detail.

One of the limitations of the radar technology is it cannot tell you it is specifically tracking an eagle, only that it is a large target, moving at speeds and in a way consistent with an eagle. Pattern has committed to having a biologist on-site to confirm species identification. If determined to be needed, a radio telemetry system will provide an additional layer of information on the activity of known individual eagles. By trapping and equipping eagles with a coded radio transmitter we can be sure which individual is active over the wind site, if it is flying or perched and catalog its activity and proximity to the site over extended periods. For example the activity switch on the transmitter can identify when an eagle leaves the nest site and becomes airborne providing an alarm to the biologist to start looking for the bird on the radar and monitor if the activity is closing in on the turbines. The telemetry is performing the function here of a transponder on an aircraft, allowing individual eagles to be identified and associated with a radar track. The radar provides the high spatial resolution tracking and the telemetry provides the confirmation of the target as an eagle down to a specific individual.

Cameras will be used in addition to telemetry for monitoring the eagles to determine if they are active. If an active eagle nest is found within five miles of the project, cameras will be installed at the neighboring nests sites at a safe distance (to avoid disturbance) to indicate the presence of eagles at the nest site and more importantly indicate when they leave so the biologist can be cued to activity and inactivity of the eagles. This will be an important data input to indicate when a juvenile is about to leave the nest to ensure that it is afforded maximum protection as it learns to navigate the environment.

In addition to a state of the art avian radar tracker on the Merlin Radar system, Merlin also has a unique capability to assess the collision risk of all targets in real time with multiple targets. This capability has been developed to reduce the collision risk of vultures with wind turbines in Spain and will shortly become operational but will be relatively mature capability by the time this system is installed at the Ocotillo project. By assessing the collision risk of an eagle or other track with each turbine, alarms can be sounded and curtailment operations automated to reduce the complexity and support the decision making process to the biologist on the site. By assigning each track a risk assessment to every turbine on the site at each update of the radar (every 2-3 seconds) an unprecedented ability to asses and synthesize collision risk is available in real time. Displays can be color coded to show the highest risk birds and the turbines they can potentially collide with to provide the biologist with situational awareness.

The risk assessment looks at both the proximity to a turbine as well as the flight direction. A bird flying away from a turbine is at lower risk than flying towards it even at the same range. This situation is reflected in the pioneering collision risk assessment system being introduced by Detect-Inc.



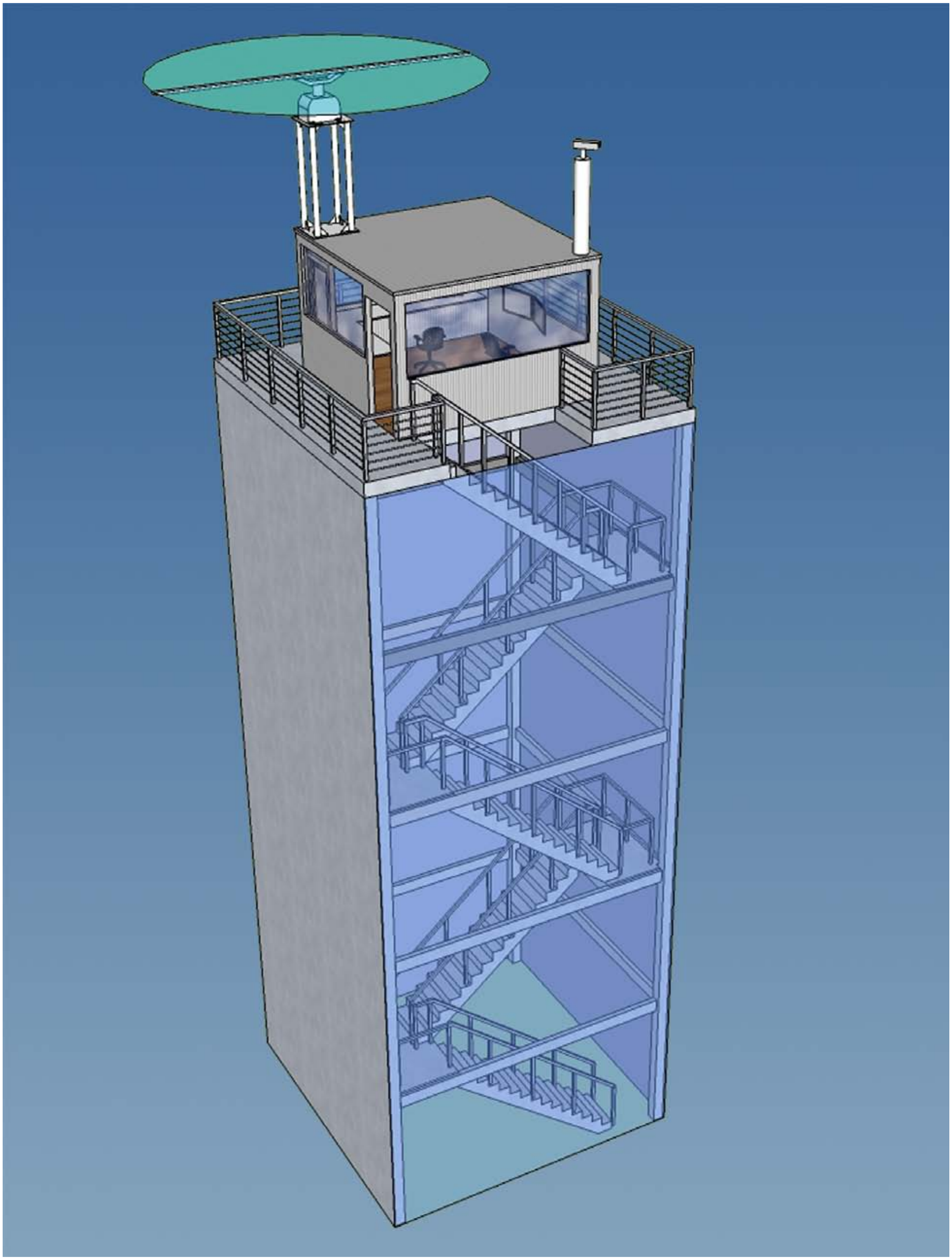
Control interface used in Spain to manually curtail turbines in real time based upon the proximity of a bird to the turbine. Curtailment can be for individual turbines by clicking on them as in the illustration or optionally for a group of clustered turbines in a small region.

The Advanced Biological Operations Command and Control Center ("ABOCC")

Pattern proposes to place an observatory platform on the site to be the control room for the biologists where they can have a commanding view of the entire site with 360 degree vision and be able to monitor the data feeds from the radar, video tracker and radio telemetry feeds in real time while remaining out of the direct sunlight, in an air conditioned environment, to provide ideal working conditions for the on duty biologist.

Long-Range Observation Binocular

In addition to the video tracking system the observer in the ABOCC will be able to conduct independent observations with a pair of Long-Range Observation Binoculars. These binoculars have rotating ocular turrets that allow for wide-angle viewing at 25x magnification, and high-power viewing at 40x magnification. The apparent field of view is a very wide 67° at 25x magnification; overcoming the drinking straw effect of looking for birds at high magnification and long range. Once acquired at wide angle the observer can rotate the ocular turrets and make detailed close up observations without the eye strain of using a spotting scope and closing one eye. A 7x50mm finder-scope can also be used for rapid acquisition of targets without the need to rotate the ocular turrets, depending on the observer's preference for operation and observation of targets. These Long-Range Observation Binoculars provide a flexible approach to acquiring small targets at range but affording detailed observations.


The observation tower proposed for the site.

Concept of Operations

By having the radar system cue the video cameras to a target(s) and automating the subsequent tracking of targets the workload on a single biologist is kept at a minimum so they can focus on the task of curtailing the motion of turbine blades before the eagles approach them. This decision making is further supported by the collision risk assessment available for each radar track and the presence of species of concern, the Golden Eagle can be confirmed for marked individuals by the on-site biologist. The availability of this data will make it possible for the biologist to curtail operations before the eagle gets close to the turbines and keep them curtailed until the eagles have left the area.

For the first five full years of operations it is proposed to keep a staff biologist on site during the day year-round to monitor the movements of Eagles and other wildlife through the site. After the completion of the first five years of monitoring operations then a decision will be made, in consultation with FWS as to whether the system will be manned seasonally and what the dates and times of operation will be to ensure a manned presence on the site when Eagles could potentially be active on the site.

Sensor Strengths and Redundancy

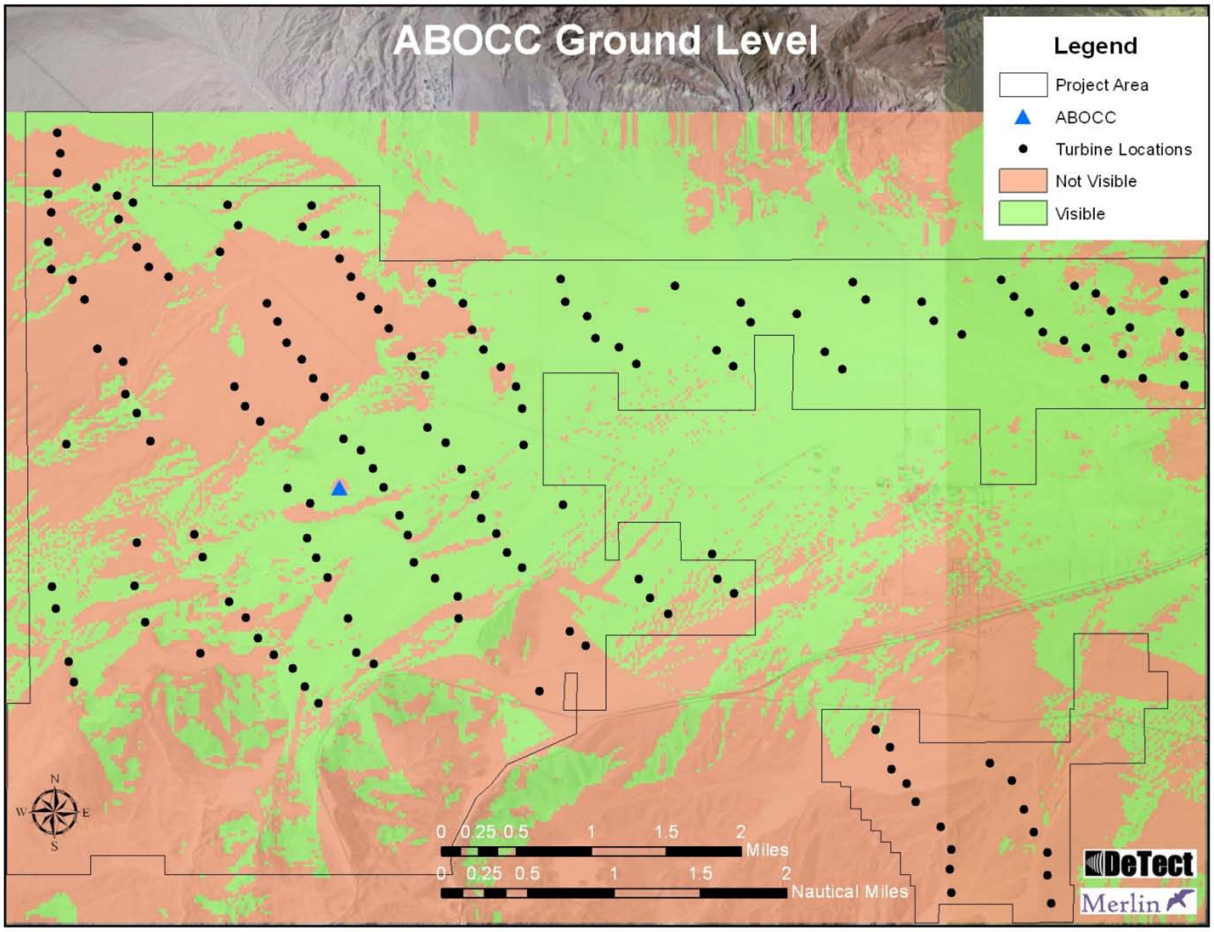
Each of the sensors outlined for this project has strengths and weaknesses. None of the sensors has 100% probability of detection, but the telemetry equipment (if used on resident birds) can provide data on the presence of an Eagle on the site when it is unseen by the radar. The radar has the ability to detect unmarked Eagle-like birds, but not to identify them positively. Radio telemetry can identify a marked individual while video cameras can confirm species. The video camera can follow a specific individual while in line of site in azimuth and elevation, where as the radar can track multiple targets in range and azimuth, line of site. In other words the suite of sensors provides for the fullest information on the presence and activity of Eagles at the site and redundancy if any sensor fails to detect the eagle for any reason.

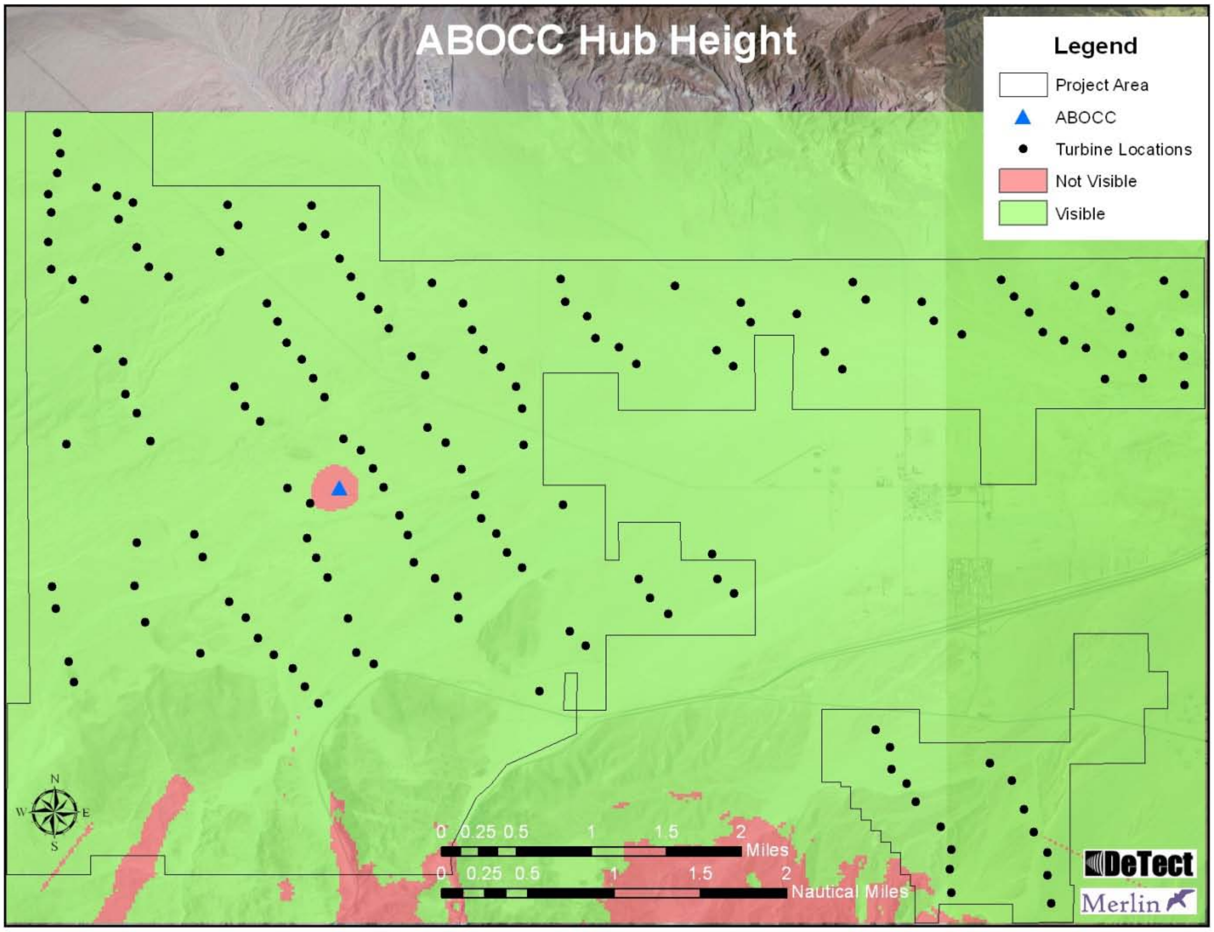
Comprehensive System Design

The system proposed and outlined here is the most comprehensive system built anywhere in the world to monitor birds and is built upon proven technology that has been used elsewhere. The Solid State radars - although new technology - are being used at multiple sites worldwide for bird detection and tracking, including for Vultures in Spain at a wind energy site. The radio telemetry equipment has been used for wildlife studies for decades; the coded transmitters are the latest in that technology, but again have been used in multiple avian studies worldwide. The video tracker technology is proven technology in military and civilian applications. We also have a history of use of video cameras for monitoring vultures with the NASA Launch system at the Kennedy Space Center. The only new part of the system design here is the use of all the data in real time to determine the need to curtail wind energy production when eagles are present on the site. This comes down to training and practice for the biologists with the equipment. The site is known to have intermittent activity by Turkey Vultures which will provide surrogate for the biologist to practice monitoring with the video and radar sensors and simulate the curtailment decision-making process i.e. they will provide as targets of opportunity regular drills in tracking and monitoring so that it is a reflex response when Eagles arrive at the site. The low number of eagles known to use the site and the limited duration they spend at the site (2-30 minutes average 10 minutes) on the limited number of occasions they are present will require this surrogate training. But we feel confident that such a curtailment process for these limited duration events will be effective in minimizing the collision risk potential.

This site will be the most heavily instrumented site in the world for monitoring the activity of large birds and provides an unprecedented opportunity to learn about the activity of large birds on and near a large wind site.

Appendix: Viewshed Analysis




ABOCC Hub Height
Legend
Project Area
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Turbine Locations
Not Visible
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