North Sky River Wind Energy Project-Supplemental Information on Avian Studies

Introduction
The purpose of this memorandum is to provide supplemental documentation on avian use of the North Sky River (NSR) project area for use by Kern County in their environmental assessment of the wind energy project proposed by NextEra Energy. Additional data on avian use recently became available from Padoma, a developer who was proposing a project called Hoffman-Summit, in approximately the same location at the NSR project. Padoma’s Hoffman-Summit data was not available to NextEra when the Environmental Impact Report Notebook was submitted to Kern County in December 2010.

General Avian Migration-NEXRAD Study
A study conducted by DeTect (Sapphos, 2006, attached) provided evidence that the NSR project is not within a high passage rate corridor to and from Butterbredt Spring.

DeTect was commissioned to conduct an analysis of the density of bird passage during spring (March 15 to June 1) and fall (August 15 to November 1) migration from January 2003 through December 2005, a period of 3 years for the Hoffman-Summit Project. This study was based on historical NEXRAD data. DeTect’s analysis showed the following:

- Density of migration was lowest (statistically significant) at the Hoffman-Summit site during spring and fall migration when compared with eight other surrounding sites, including Butterbredt Spring.
- Density of migration was five times greater in fall and nine times greater for spring for Butterbredt Spring than the Hoffman-Summit site.
- Migration densities (the highest) at one site, about 120 kilometers (km) southeast of the Hoffman-Summit Project, were 22 times greater in the spring and 24 times greater in the fall than the Hoffman-Summit Project.
• Overall, bird passage rates during spring and fall migration at the Hoffman-Summit Project were relatively low, suggesting the NSR site is not in a primary migratory bird corridor.

**Eagle Migration and Summer/Winter Studies**

Focused eagle migration studies were conducted by Sapphos during 5 weeks in fall 2006 and 5 weeks spring 2007. One location near Cottonwood Creek and one location at Butterbredt Spring were surveyed. The following conclusions may be drawn from the observations made by Sapphos:

- More golden eagles were observed in the fall than in the spring at both locations.
- More golden eagles were observed at Butterbredt Spring than at Cottonwood Creek.

Eagle observations were made by Sapphos during general avian studies in winter (early March) and summer (May) 2007.

- More eagles were observed in March than in May.
- Most eagle observations in March were sub-adults.

Sapphos information indicates that golden eagles have used the NSR site for many years. Sapphos did not record nesting activity within the NSR site, findings that are consistent with surveys conducted by CH2MHILL.

**Ground Raptor Study for Jawbone Wind Project**

Surveys were conducted on 6 days in late November and early December 2010. Two golden eagles were observed, one on each of 2 days, December 9 and 10.

**Aerial Raptor Nest Survey for TRWRA**

Sapphos conducted aerial raptor nest surveys in a 10-mile radius of the Hoffman-Summit Project between May 20 and 31, 2011, near the end of the nesting season for golden eagles. Most of the nest sites within 10 miles of the project area were considered to be “historical” (Sapphos 2011). However, the Sapphos (2011) report did not make a determination if fledging had occurred prior to their surveys at nests classified as “historical.” In general, nest locations in the Sapphos study were consistent with survey findings by CH2MHILL in November 2010 and late February/early March 2011.

**Attachments**

Compiled Golden Eagle Survey Data from the Former Hoffman Summit Wind Energy Project, Sapphos Memorandum, February 11, 2011

Results of Avian Radar Screening Assessment for Proposed Hoffman Summit Wind Energy Project Site, Sapphos Memorandum, June 21, 2006
Compiled Golden Eagle Survey Data from the Former Hoffman Summit Wind Energy Project,
Sapphos Memorandum, February 11, 2011
INTRODUCTION

The golden eagle is protected by the Bald and Golden Eagle Protection Act (BGEPA) of 1940 (16 USC 668-668-668c, as amended), which is administered by the U.S. Fish and Wildlife Service (USFWS). The golden eagle is also a fully protected species in California and a California State Fully Protected Species, which is administered by the California Department of Fish and Game (CDFG). The golden eagle is protected from take pursuant to the BGEPA and the State Fish and Game Code. Consequently, avian surveys were conducted for golden eagles at the former Hoffman Summit Wind Energy Project site (now known as the North Sky River Wind Energy Project) from autumn 2006 through summer 2007 and also in November and December 2010 within the Jawbone Wind Energy Project site; the latter surveys included surrounding buffer areas within the former Hoffman Summit Wind Energy Project site. The small (640-acre) Jawbone Wind Energy Project site is entirely surrounded by the much larger (18,000-acre) former Hoffman Summit Wind Energy Project site in east-central Kern County, California. The autumn raptor surveys were conducted in 2010 to augment and update the results of the former Hoffman Summit Wind Project Biological Resources Technical Report (November 2008) and the Jawbone Wind Energy Project Biological Resources Technical Report in support of the proposed Jawbone Wind Energy Project (proposed project).1,2

METHODS

2006 (Autumn) to 2007 (Summer)

Migration Surveys

Fall and spring avian migration studies were conducted by Sapphos Environmental, Inc. biologists using the area search method while conducting morning flight counts for a ground-based assessment of fall 2006 and spring 2007 migration. The ground-based study assessed traffic rates of avian migrants within a riparian corridor of the former Hoffman Summit Wind Energy Project property along a section of Cottonwood Creek and compared the traffic rates with those at a reference site known to be a migration hotspot.

Two observers located at two stations participated in avian migration studies during autumn 2006 and spring 2007. One station was located within the property at Cottonwood Creek, and the other observation station was located outside the property at Butterbredt Spring. Morning flight ground counts were conducted during the first 4 hours (fall) or 6 hours (spring) after official sunrise at Cottonwood Creek and Butterbredt Spring oasis. It was anticipated that data between the two proximate sites, located 5.6 miles apart, would be positively correlated during synoptic migration.

Morning flight counts were conducted three days a week (two consecutive days plus one day apart from the other two days) for five weeks from September 25 to October 26, 2006, for a total of 15 days, and for five weeks from April 9 to June 1, 2007, for a total of 15 days. All birds including flyovers3 were counted at each station4 for 4 or 6 hours. Data collection began at official sunrise.

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3 Flyovers are birds flying over the survey area.

4 Birds observed flying back in the opposite direction were subtracted.
These migration surveys did not focus on golden eagle, nor were they designed for raptors, but they did collect information on golden eagle (and raptors) at the Hoffman Summit Wind Energy Project site.

**Winter Bird Survey**

The winter season avian surveys study was conducted by Sapphos Environmental, Inc. biologists using a combination of reconnaissance and directed survey methods while conducting a ground-based assessment in early March 2007. The ground-based study assessed winter bird distribution and abundance in two subject habitats within the proposed Hoffman Summit Wind Energy site, oak woodland and cismontane woodland and scrub.

Winter avian surveys were conducted four consecutive days a week for two weeks from March 5–15, 2007, for a total of eight days. All birds including flyovers\(^5\) were counted. The focus of these winter bird surveys was on raptors. Data collection occurred during daytime. To reduce concerns associated with repeat counts, the minimum daily total was used as the estimate of relative abundance for each species. Data collected for residents or winter visitors with large home ranges, such as golden eagle and other raptors, were not assumed to be statistically independent from each other. Special care in all surveys was taken to avoid double counting birds. Age and sex were determined, when possible, to distinguish individuals from one another. Temperature, estimated wind speed, wind direction, and percent cloud cover (Beaufort scale) were recorded at the beginning and end of each observation period.

**Summer Bird Survey**

The summer season avian surveys study was conducted by Sapphos Environmental, Inc. biologists using a combination of reconnaissance and directed survey methods while conducting a ground-based assessment from late May to late June 2007. The ground-based study assessed breeding season bird distribution and abundance in two subject habitats within the proposed Hoffman Summit Wind Energy Project site, oak woodland and cismontane woodland and scrub.

Breeding season avian surveys were conducted from May 24 to June 27, 2007, for a total of eight days. All birds including flyovers\(^6\) were counted. Data collection occurred during daytime and at morning twilight. The minimum daily total was used as the estimate of relative abundance for each species. Data collected for residents or breeding season visitors with large home ranges, such as golden eagles and other raptors, were not assumed to be statistically independent from each other. Special care in all surveys was taken to avoid double counting birds. Age and sex were determined, when possible, to distinguish individuals from one another. Temperature, estimated wind speed, wind direction, and percent cloud cover (Beaufort scale) were recorded at the beginning and end of each observation period.

**2010 Surveys**

**Aerial Surveys**

Based on coordination with the USFWS, golden eagle aerial surveys identified and mapped golden eagle nesting sites and foraging areas located within 10 miles (16 kilometers) of undeveloped areas under potential consideration for wind energy projects within the Tehachapi Pass Wind Resource Area.

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\(^5\) Flyovers are birds flying over the survey area.

\(^6\) Flyovers are birds flying over the survey area.
An aerial survey of all potentially suitable golden eagle habitat was conducted from May 20–31, 2010 (Attachment 1, Golden Eagle Survey Area). Aerial survey methods for the golden eagle survey effort undertaken in May 2010 were undertaken in conformance with the USFWS Interim Golden Eagle Technical Guidance: Inventory and Monitoring Protocols; and Other Recommendations in Support of Golden Eagle Management and Permit Issuance. Sapphos Environmental, Inc. conducted aerial surveys by helicopter from May 20–31, 2010, during the latter part of the golden eagle breeding season in this region of California; Mr. Brad Kygar of Helinet Aviation (Van Nuys, California) was the pilot on these surveys. Aircraft navigation within the survey area and maintenance of appropriate aircraft position in relation to the survey area were facilitated using a pilot-operated and monitored global positioning system (GPS) unit and real-time GPS tracking on an on-board computer.

Complete coverage of the survey area was obtained by systematically traversing the landscape and visually scanning all areas of potential nesting and foraging habitat for golden eagles. Aerial surveys were conducted using a Bell Jet-Ranger 206 helicopter, flying over relatively even terrain mainly in the Antelope Valley at approximately 200 feet (61 meters) above ground level (AGL) and over uneven mountainous terrain at heights varying from 200 to 400 feet (61 to 122 meters) AGL. On average, each of the 10 helicopter flights lasted two hours (range: 110–140 minutes). Helicopter flights lifted off during low to moderate wind conditions <22 miles per hour (mph) (<36 kilometers [km]) and were flown under generally clear skies. Each flight flew a distance of approximately 162 miles (260 km), with an average speed of approximately 80 mph (129 km/h), and included transit time to each target area; however, flight speed sharply decreased to 20–30 mph (32–80 km/h) once the target area of each flight was reached, when searching for golden eagles and their nests on cliffs, rocky outcrops, and in tall trees. When a possible nest site was located, a second fly-over was made to confirm nest type and condition, and to obtain accurate GPS location coordinates using the pilot's GPS unit. Multiple passes at several elevation bands were sometimes necessary to provide complete coverage when surveying potential nesting habitat on large cliff complexes, escarpments, or headwalls. The observers were alert to noting and recording the locations of perched golden eagles in trees as well as golden eagles observed in flight. Some additional montane areas beyond this 10-mile (16-km) buffer were also searched, from the foothills of the Tehachapi Mountains and Southern Sierras to include foothills on both the Central Valley side and desert side.

Individual golden eagles were identified based on plumage characteristics. Age class was estimated with the assumption that young eagles progressed through standard molt patterns, which were divided into three age classes (juvenile 0–1 years of age; subadult 1 and 2 by 2.5 years of age; near-adult and adult by 4.5 years of age). Perched and flying golden eagle sightings were verified by flying closer to obtain a closer view of eagles. GPS locations were recorded based on where the bird was first observed by flying over identified landmarks on the ground.

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Ground Surveys

Autumn avian ground surveys in 2010 were conducted in accordance with guidelines provided by the California Energy Commission (CEC), using a combination of reconnaissance and directed survey methods and were conducted over three active survey sessions (November 8–9, 2010; December 9–10, 2010; December 15–16, 2010). Sapphos Environmental, Inc. biologists conducted avian raptor surveys in and around the proposed Jawbone Wind Energy Project site for a total of 52 staff hours.

RESULTS

Breeding Information

No nesting golden eagles were discovered within or near (1-mile buffer) the former Hoffman Summit Wind Energy Project site or within the Jawbone Wind Energy Project site in 2006–2007 or in 2010. Furthermore, no evidence was observed, such as display flights over the project areas, that suggested any breeding activity within or near the former Hoffman Summit Wind Energy Project site or the Jawbone Wind Energy Project site.

However, older breeding information acquired from the federal Bureau of Land Management (BLM) documents multiple golden eagle nest sites in the Tehachapi Mountains and Southern Sierras over 48 years from 1949 to 1997; the closest of these older nest sites was located approximately 1.6 miles away from the southern boundary of the former Hoffman Summit Wind Energy Project site (Attachment 2, Location of Golden Eagle Nest Sites). In addition, two more recent golden eagle nest sites were discovered and documented during aerial (helicopter) surveys by Sapphos Environmental, Inc., in the Tehachapi Mountains and Southern Sierras during 2004 and 2010; the latter active nest site is located approximately 12 miles from the western boundary of the former Hoffman Summit Wind Energy Project site.

Non-Breeding Information

Autumn 2006 and Spring 2007

The golden eagle was observed foraging over most of the habitats within the Hoffman Summit Wind Energy Project site. Golden eagles are present during spring and autumn migration throughout the Tehachapi Mountains and Southern Sierras. The golden eagle was observed by Sapphos Environmental, Inc., at the Cottonwood Creek riparian station during the avian migration surveys in autumn 2006 (single bird on two dates; two birds on one date; 20 percent of all survey days) and spring 2007 (single birds on two dates; 13 percent of all survey days) (Table 1, Golden Eagle Survey Data in Autumn 2006 and Spring 2007). In addition, golden eagles were also observed nearby at another migration count station at Butterbredt Spring in autumn 2006 (single birds on nine dates plus three birds on October 12, 2006; 67 percent of all survey days) and spring 2007 (single birds on four dates from April 10 to May 1, 2007; 27 percent of all survey days). However, most of these birds appeared to be residents foraging in the area rather than migrants.

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TABLE 1
GOLDEN EAGLE SURVEY DATA IN AUTUMN 2006 AND SPRING 2007

<table>
<thead>
<tr>
<th>Common Name</th>
<th>Survey Type</th>
<th>Date(s) in 2006–2007</th>
<th>Number</th>
<th>Additional Remarks</th>
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</thead>
<tbody>
<tr>
<td>Golden eagle</td>
<td>Migration count</td>
<td>October 12</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Golden eagle</td>
<td>Migration count</td>
<td>October 19</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Golden eagle</td>
<td>Migration count</td>
<td>October 25</td>
<td>1</td>
<td></td>
</tr>
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</table>

**Autumn 2006 Survey**

**Spring 2007 Survey**

<table>
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<th>Common Name</th>
<th>Survey Type</th>
<th>Date(s) in 2006–2007</th>
<th>Number</th>
<th>Additional Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Golden eagle</td>
<td>Migration count</td>
<td>April 12</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Golden eagle</td>
<td>Migration count</td>
<td>May 3</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

**Winter 2007 and Summer 2007**

Golden eagles were observed foraging within the former Hoffman Summit Wind Energy project site during the winter bird survey and breeding bird survey conducted in 2007. In winter (March 2007), golden eagles were observed on all eight survey days (100 percent), primarily in oak woodland and cismontane woodland but also in all other habitat types. Most golden eagles observed were immature birds in their first or second year. In oak and cismontane woodlands, an adult and immature were repeatedly observed. In desert scrub, grasslands, and ridgeline juniper plant communities, single immature birds were seen repeatedly at many sites. This includes areas along surveyed ridgelines, particularly within the north-central region of the proposed project site. A total of approximately 3 to 5 immature golden eagles were present within the proposed project site in three plant communities (desert scrub, grasslands, and ridgeline juniper). Golden eagles were also observed in Kelso Valley and other areas outside but near the proposed project site boundary, such as at Butterbredt Spring.

In summer 2007 (late May to late June), the single golden eagle observed was an adult flying over oak woodland (12 percent of all survey days). Golden eagles were also observed during this period in Kelso Valley and other areas outside but near the proposed project site boundary, such as at Butterbredt Spring.

**2010**

Golden eagles were observed within the proposed Jawbone Wind Energy Project and in the buffer area within the former Hoffman Summit Wind Energy Project on two of the six survey days (33 percent) in November and December 2010 (Table 2, *Golden Eagle Survey Data in 2010*). One adult golden eagle was observed foraging (soaring, occasionally flapping) at heights above ground level ranging from 300–500 feet over the ridges of both project sites on December 9, 2010. In addition, a first-year immature golden eagle was observed foraging at heights above ground level ranging from 50–800 feet above ground level over the highest ridges of both project sites on December 10, 2010.

TABLE 2
GOLDEN EAGLE SURVEY DATA IN 2010

<table>
<thead>
<tr>
<th>Common Name</th>
<th>Survey Type</th>
<th>Date(s) in 2010</th>
<th>Number</th>
<th>Additional Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Golden eagle</td>
<td>Transect</td>
<td>December 9</td>
<td>1</td>
<td>Adult</td>
</tr>
<tr>
<td>Golden eagle</td>
<td>Reconnaissance</td>
<td>December 10</td>
<td>1</td>
<td>First-year immature</td>
</tr>
</tbody>
</table>
DISCUSSION

Adult and immature golden eagles are present year-round within and near both project sites,\(^\text{12,13}\) and aside from resident and migratory red-tailed hawks (Buteo jamaicensis), are considered to be the species most vulnerable to collisions with wind turbines at both sites because they are susceptible to collisions with wind turbines under certain conditions.\(^\text{14,15}\) In the Tehachapi Mountains, no golden eagles were killed during a 19-month avian mortality study of the TPWRA study,\(^\text{16}\) although three golden eagles have been recently killed in the TPWRA subsequently.\(^\text{17}\) Two of these three golden eagles were killed at the Pine Tree Wind Energy Project property,\(^\text{18}\) whose northern boundary is located approximately 1 mile south of the former Hoffman Summit Wind Energy Project site and 2 miles south of the proposed Jawbone Wind Energy Project site. In general, there are rich cismontane habitats within both project sites on a series of rolling ridges. These sites have superior foraging habitat compared to the Pine Tree Wind Energy Project property; however, golden eagles also forage within desert habitats at the former Hoffman Summit Wind Energy Project site, where they occur regularly. The ferruginous hawk, a locally important raptor, also occurs at both project sites, which are located adjacent to (former Hoffman Summit Wind Energy Project) and approximately 5 miles south (Jawbone Wind Energy Project) of Kelso Valley, a featured wintering site for ferruginous hawks in Southern California.\(^\text{19}\) In addition, golden eagles forage regularly in the Kelso Valley. Furthermore, the higher ridges of both proposed project sites attract a variety of other migratory and resident raptors.

The golden eagle was not found nesting within either of the two project sites; therefore, construction, operation, and maintenance of the proposed projects would be unlikely to affect breeding habitat for the golden eagle. However, adult golden eagles present within or near both project sites could possibly represent breeding individuals at nearby nest sites located in the Tehachapi Mountains and Southern Sierras, since golden eagles have large home ranges.

Direct impacts to golden eagles (and other raptors) at both project sites could occur through the loss of or disruption of foraging habitat, noise, construction activities, and human disturbance or collision with project infrastructure, including turbines and transmission lines. The development of both proposed project sites would likely result in a loss of foraging habitat for golden eagle, and a number of other raptor species. Although it is possible that golden eagles may forage between project structures, it is more likely

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\(^{17}\) Oviatt, Lorelei H., Kern County Planning Department, Bakersfield, CA. E-mail correspondence to Annie Mudge, Cox, Castle & Nicholson LLP, San Francisco, CA. Subject: Notification of CDFG and USFWS of Golden Eagle Mortalities at the Pine Tree Wind Farm Project.


that foraging activities in the generally rich habitats present within both project sites will also include areas where turbines and new transmission lines are located; foraging behaviors of golden eagle are likely to lead to increased collision\textsuperscript{20} or electrocution risk.

Should there be any questions regarding the information contained in this MFR, please contact Mr. Brad Norling at (626) 683-3547.

LEGEND
- Golden Eagle Survey Boundary
- Hoffman Summit Project Boundary

SOURCE: SEI, enXco, ESRI

ATTACHMENT 1
Golden Eagle Survey Area
LEGEND

- **2010 Golden Eagle Observations**
- **Historical Golden Eagle Observations / Nest Locations**
- **2010 Golden Eagle Active Nest**
- **Inferred Golden Eagle Nest Location (2006)**
- **Golden Eagle Survey Boundary**
- **Hoffman Summit Project Boundary**

SOURCE: SEI, enXco, ESRI

ATTACHMENT 2
Location of Golden Eagle Nest Sites
Results of Avian Radar Screening Assessment for Proposed Hoffman Summit Wind Energy Project Site, Sapphos Memorandum, June 21, 2006
MEMORANDUM FOR THE RECORD
2.6 1472-001.M2

TO: Padoma Windpower
(Mr. Jerry Fuchs)

FROM: Sapphos Environmental, Inc.
(Dr. Irena Mendez and Ms. Kara Donohue)

SUBJECT: Results of Avian Radar Screening Assessment for Proposed
Hoffman Summit Wind Energy Project Site


EXECUTIVE SUMMARY

This Memorandum for the Record (MFR) documents the results of a risk assessment conducted for avian species located within the Hoffman Summit Wind Energy Project (proposed project) site located in the southernmost part of the Sierra Nevada Mountain range, approximately 20 miles north of the City of Mojave, Kern County, California. The proposed project site is located on the U.S. Geological Survey (USGS) 7.5-minute series Cross Mountain topographic quadrangle, and portions of the Cinco, Cache Peak, and Mojave NE topographic quadrangles.1,2,3,4

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DeTect, Inc. was contracted by Sapphos Environmental, Inc. to utilize radar remote sensing data for this avian risk assessment. The proposed project area was compared with eight additional sites, including a site located in the Butterbredt Springs resource area, to examine the potential impact of the proposed project to nocturnal migrants. In addition, this data was supplemented with regional visibility information to assess the frequency of low visibility conditions at the proposed project site. Sapphos Environmental, Inc. also conducted a literature review of migrant flight altitude.

The analysis of radar remote sensing and supplemental data for the proposed project site and the additional eight sites indicate that bird densities at the proposed project site ranked first (ninth being highest, first being lowest) during both fall migration (August 15 to November 1) and spring migration (March 15 to June 1). Data indicates a minor difference between spring and fall migration densities. Based on analysis of 2003 through 2005 visibility data for the proposed project area, mortality risk due to low visibility at night is not a significant avian risk factor for the proposed project site. Based on the literature review, mean flight altitudes range from 410 to 2,000 meters, which is well above the maximum 410-foot height of the proposed turbines at the proposed project site.

**INTRODUCTION**

Sapphos Environmental, Inc. contracted DeTect, Inc. to conduct a preliminary avian risk assessment of the proposed project site using current and archived radar remote sensing data. The purpose of this assessment was to determine current and historic levels of bird activity, distribution, and seasonal variation in the vicinity of the proposed project site. Data sources include current and historic data from the National Weather Service’s NEXRAD WSR-88D, a national weather radar operations system at Edwards Air Force Base, which is located approximately 59 kilometers from the proposed project site, and regional National Weather Service Surface Area Observations (SAO) visibility databases.

In addition, Sapphos Environmental, Inc. conducted a literature review focusing on nocturnal migrant flight altitude to examine the relationship between avian flight altitudes during nocturnal migration and the height of wind turbines at the proposed project site.

**PROJECT DESCRIPTION**

**Location**

The proposed project site consists of approximately 8,000 acres located approximately 4 miles northwest of the California City limit in the unincorporated territory of Kern County, California. The proposed project site is located in a remote area primarily used for cattle ranching. The proposed project site is surrounded on the north by the Sierra Nevada Mountains, Highway 14 approximately 9 miles to the east, the City of Mojave approximately 17 miles to the south, and the Piute Mountains and Tehachapi Mountains to the west.

The proposed project site is located on the USGS 7.5-minute series Cross Mountain topographic quadrangle (Township 29 S, Range 35 E, Sections 35 and 36; Township 30 S, Range 35 E, Sections 1, 2, 10, 11, 12, 13, 14, 15, 16, 21, 23, 25, 26, 27, 28, 29, 33, 34, and 35 and Range 36E, Sections 6, 7, 8, 17, 29, 30, 31, and 32; Township 31S, Range 35E, Sections 2 and 3), and on portions of USGS 7.5-minute series topographic quadrangles for Cinco (Township 30 S, Range 36E, Sections 15, 21, 22, 23, 24, 26, 27, 28, 34, 35, and 36, and Range 37E, Sections 19, 20, 21, 28, 29, 31, 32, and 33; Township 31S, Range 36E, Section 1 and Range 37E, Sections 5 and 6), Cache Peak (Township 31S, Range 35E, Sections 11 and 12), and Mojave NE (Township 31S, Range 36E, ...
Sections 12 and 13, and Range 37E, Sections 7, 8, 17, and 18). The elevation of the proposed project site ranges from 3,000 feet to 5,000 above mean sea level (MSL). Primary access to the proposed project site is from the east via Highway 14 to Jawbone Canyon Road. There is no developed roadway system within the proposed project site; however, there is an existing network of two-track dirt roads that have been historically used to support ranch operations.

Project Elements

Wind Turbines

The proposed project would consist of a wind energy installation of 100 to 150 wind turbines. The below ground portion of the tower foundation would measure approximately 50 feet by 50 feet. The 55 feet by 40 feet area surrounding the turbine and step-up transformer would be a cleared, compacted, and topped with caliche. Turbine tower heights would be between 213 and 262 feet. The total structure height, including turbine, tower, and blade for each turbine, would be approximately 340 to 410 feet tall. In accordance with the Kern County Military Impact Ordinance,9 turbine height in most portions of the proposed project site would be less than 400 feet in some portions of the site, and up to 600 feet tall in permitted areas. Final turbine placement would be dependent upon the final results of the environmental report documenting the results of field investigations, including topography and any other site-specific details to be incorporated into the final design.

Access and Maintenance Roads

The proposed project would utilize approximately 400 acres of the proposed project site boundary area for roads and turbine pads. There currently exists a network of unpaved roads throughout the proposed project area. Although the existing roads would be used to the extent possible, new unpaved roads would be constructed to serve as access roads from the existing road network to the turbines. Caliche access roads would be 15 feet wide with 10-foot wide shoulders on both sides of the road, cleared and compacted for crane travel. Final service road alignments would be dependent upon the final results of the environmental report documenting the results of field investigations, including topography and any other site-specific details to be incorporated into the final design. Where access roads are required to cross the California Department of Fish and Game (CDFG) jurisdictional areas, appropriate crossings would be installed in order to minimize impacts to jurisdictional areas.

**Power Collection and Transmission**

The proposed project entails construction of 34.5 kilovolt (kV) underground cables for the purpose of power collection and transmission to the substation(s). Corridors for underground power collection circuits, generally located adjacent to the roads, would disturb an area about 15 feet wide when installed. A temporary construction compound would be necessary, requiring approximately 2 acres. Additionally, two staging areas of 1 to 2 acres would likely be needed. A substation(s) is necessary to convert the power from the 34.5 kV cables to 230 kV for transmission over the transmission lines. The substation site(s) and the permanent operations and maintenance building site would both be approximately 1 acre in size. A 230 kV transmission line would be constructed for transmission of power from the substation(s) to a switching station or connection with the Pine Tree Wind Development. The 230 kV transmission line would have a maximum 150-foot wide corridor and transmission line towers would range in height from 70 to 100 feet tall.

**Security**

Fencing would be installed in accordance with Kern County requirements. Based on current Kern County ordinances, the proposed project may fence the exterior boundary or choose to fence each row independently. It has not been determined which of these options would best accommodate the needs of the project stakeholders. All project fencing requirements will be evaluated and the best fit scenario will be incorporated into the project based on final determination by Kern County.

**METHODS**

Data from a national weather radar operations system at Edwards Air Force Base, which is located approximately 59 kilometers from the proposed project site, was used for this assessment. Seven additional regional samples were selected from sites located equidistant from Edwards Air Force Base with the center point of each site located every 45 degrees from the center of the sample site at the proposed project site. In addition, a site located in the Butterbredt Springs resource area that is known to experience a significant spring migration of birds using the area during the daytime was used in this assessment. Archived NEXRAD data covered the period of January 2003 through December 2005. Since nocturnal spring and fall migrations are the primary issues of concern for passerines, data were reduced to include only records from March 15 to June 1 for spring and August 15 to November 1 for fall; additionally, data were examined for nighttime hours from approximately 1800 to 0600 hours Pacific Standard Time. Relative bird densities were calculated at each of the nine sites, including the proposed project site.

Low visibility conditions can increase the risk of bird strike mortality. Thus, visibility data was assessed through Automated Surface Observing System (ASOS) and Automated Weather Observing System (AWOS) databases to assess the frequency of occurrence of low visibility conditions that could increase risk to birds from the proposed project. Data included the time period of January 1, 2003 through October 1, 2005. Bird avoidance of obstacles during low visibility conditions combined with darkness is not well studied; therefore, no avoidance under conditions of low visibility at night was assumed.

In addition, Sapphos Environmental, Inc. conducted a literature review focusing on nocturnal migrant flight altitude to examine the relationship between avian flight altitudes during nocturnal migration and the height of wind turbines at the proposed project site.
RESULTS

One site (Site 6), located south-southeast of Edwards Air Force Base and southeast of the proposed project site, was ranked ninth as having the highest density per kilometer squared during both fall and spring (ninth being highest, first being lowest). Butterbredt Springs ranked fifth in spring and sixth in fall, while the proposed project site ranked first in both spring and fall (Attachment 1, DeTect, Inc. Avian Radar Screening Assessment Report, Table 2, Reflectivity Values and Ranking). Little difference was found between the seasons in total densities, but a gradual increase was seen in the total movements from 2003 to 2005 (Attachment 1, Figure 3, Total Density by Season). Migration density for the region was highest in April during spring migration and highest in October during fall migration. Further statistical analyses showed a significant difference in mean density values among sites for both night fall migration (p < 0.0001) and night spring migration (p < 0.0001). The proposed project site was grouped among the lowest total densities, while the Butterbredt site was grouped among those in the middle [Attachment 1, Table 5, Fall-Multiple Range Test (Method: 95.0 percent LSD) and Table 6, Spring-Multiple Range Test (Method: 95.0 percent LSD)].

Less than 0.008 percent of the accessed time periods (dawn, day, dusk, and night) represented periods with low visibility according to the historical visibility information accessed through ASOS and AWOS databases. This suggests visibility conditions are not a factor at the proposed project site.

Studies have found mean nocturnal migration altitudes ranging from 410 meters to 2,000 meters. In a study conducted at the Mount Storm Wind Power Project in West Virginia, the mean flight altitude for all nights sampled was 410 meters, with a nightly mean flight altitude ranging from 214 to 769 meters.10 In a study conducted in New York for a proposed wind farm, the mean fall nocturnal altitude was 532 meters and the mean spring nocturnal altitude was 528 meters, with only 4 percent of targets falling under 125 meters in fall, and only 3.8 percent of targets falling under 125 meters in spring.11 Mean nocturnal migration altitude at a site in northeastern Oregon was found to be 506 meters during spring and 647 meters during fall; mean nocturnal migration altitude at a site in southeastern Washington was found to be 579 meters in spring and 606 meters in fall.12 A bird migration study at the Northwest Passage in Canada found mean flight altitude to be 790 meters.13 A similar study conducted in the Northeast Passage of Canada found mean flight altitude to be 1,330 meters.14 The highest mean flight altitude reported was 2,000 meters for shorebirds over Nova Scotia and New Brunswick during fall.15

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CONCLUSIONS

Results of the analysis of the radar remote sensing and supplemental data do not suggest a significant bird population risk for the proposed project site. The proposed project site does not support higher bird activity levels than the surrounding areas, according to the results of the analysis of radar remote sensing data. NEXRAD data indicates that highest avian activity levels during migration generally occur in fall for the region, with the proposed project site showing slightly higher migration activity during the spring.

The visibility data supports the NEXRAD data, specifically with respect to passerines, waterfowl, and other migratory species, showing the proposed project site does not pose a significant threat to nocturnal migrants due to frequent low visibility conditions.

The maximum height of wind turbines at the proposed project site will not exceed 410 feet or 125 meters. Based on the literature review of studies focused on migrant flight altitude, the proposed project is not likely to significantly impact nocturnal migrants due to mean migration flight altitudes ranging from 410 to 2,000 meters, well above the maximum turbine height of 410 feet.

Because the NEXRAD data does not provide information on flight altitude of migrants at the proposed project site, the use of a site-specific survey radar system may be warranted to further examine migratory species use of the proposed project site.

Should there be any questions regarding the information contained in this MFR, please contact Ms. Kara Donohue or Dr. Irena Mendez at (626) 683-3547.
Avian Radar Screening Assessment
for
Hoffman Summit Wind Project
Kern County, California

Prepared for:

Sapphos Environmental, Inc.
Pasadena, California

Prepared by:

Detect, Inc.
3160 Airport Road
Panama City, Florida 32405

June 20, 2006
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Executive Summary.

An assessment of migratory bird activity at the proposed Hoffman Summit Wind Project site was conducted using archived data from the Next Generation Weather Radar or NEXRAD (WSR 88-D). Fall (Aug 15 through Nov 1) and spring (March 15 through Jun 1) were queried for returns during night time periods to determine if the proposed location was a hot spot of bird activity when compared to surrounding areas. The proposed Hoffman Summit Wind Project site is located approximately 59 km from the NEXRAD unit at Edwards AFB and sample were taken from eight areas each located equal distance from the radar. Results suggest that the proposed site is among the least active in terms of bird activity and ranks 1st (1 being the lowest and 9 being the highest) during spring migration and 1st during fall migration. Visibility analysis further suggests that there are few nights during night migration when low visibility would increase the potential for birds impacting wind turbines.
Introduction.

DeTect Inc. (DeTect) was contracted by Sapphos Environmental, Inc. of Pasadena, California to conduct an Avian Radar Prescreening Assessment (the assessment) of the Hoffman Summit Wind Project (the "Project") site in the Mojave desert of California. The Project site consists of approximately 8,000 acres located approximately 4 miles northwest of the corporate boundary of California City in unincorporated territory of Kern County, California. The proposed Project site is surrounded on the north by the Sierra Nevada Mountains, Highway 14 approximately 9 miles to the east, the City of Mojave approximately 17 miles to the south, and the Piute Mountains and Tehachapi Mountains to the west. The proposed Project would consist of a wind energy installation of 100 to 150 wind turbines. The below ground portion of the tower foundation would measure approximately 50 feet by 50 feet. Turbine tower heights would be between 213 and 262 feet. The total structure height, including turbine, tower, and blade for each turbine, would be approximately 340 to 410 feet tall.

The purpose of this assessment was to develop a preliminary determination of historic levels of nocturnal migratory bird activity in the area during the fall and spring using archived radar data. This assessment did not include a site visit and was limited to assessment of only the data sources identified in this report. Further the remote sensing and data sources utilized in this assessment provide
only broad altitude distribution information and do not present bird distribution data by specific altitude levels.

**Description of Data Sources.**

The radar remote sensing data used for this assessment was from the National Weather Service (NWS) WSR 88-D Next Generation Radar (NEXRAD) weather radar located at Edwards Air Force Base, California (denoted as EYX). Additionally, regional NWS Surface Area Observations (SAO) visibility databases were used to eliminate radar returns that were associated with weather. This assessment did not include site visits and was limited to only review and evaluation of the data sources identified in this report.

**NEXRAD.**

NEXRAD radar data were accessed, processed and analyzed to evaluate the seasonal level of bird activity at the project site. The nationwide NEXRAD network includes 148 Doppler radars arrayed across the lower 48 states that provide near-real time (updated approximately every six minutes) information on weather activity. In the early 1990’s it was determined that these radars also detected biological targets in the atmosphere (such as birds and bats) and by late 1998, techniques were available to collect and process this information to develop regional bird density information. The radar data can be processed to remove weather, identify biological targets, and conduct spatial analyses to determine daily and seasonal trends of biological targets.
NEXRAD reflectivity is recorded by the system in dBZ values, which are logarithmic measurements of the energy returned to the radar. High dBZ values represent high amounts of energy return. When weather is not present, biological targets typically range from less than 1 to approximately 35 dBZ. Higher dBZ values are correlated to higher levels of bird activity for that period.

**Surface Area Observations.**

Historical visibility information was accessed from airport Automated Surface Observing System (ASOS) and Automated Weather Observing System (AWOS) databases available for the project area. ASOS data is available at both towered airports and major non-towered facilities and AWOS is available at most towered airports. Both systems are a collection of electronic sensors providing information to a computer system that creates visibility information for the current period. Data is archived and can be used to develop a visibility history profile for specific areas by time of day. Current reportable ASOS values of visibility in statute miles are: <1/4, 1/4, 1/2, 3/4, 1, 11/4, 11/2, 13/4, 2, 21/2, 3, 4, 5, 6, 7, 8, 9, 10+. For purposes of avian risk assessment, low visibility resulting in bird strike risk is generally defined as visibility of less than 1/3 mile.
Assessment Methodology.

This assessment analyzed current and archived radar data that were processed from the NWS NEXRAD installation located at Edwards Air Force Base (EYX), California.

As illustrated in Figure 1, the EYX is located 59.3 kilometers (km) from the analysis point within the proposed Project site area. The probability of detection of a target by radar has as a major component the distance from the radar to the target. To assess the activity at the Project site relative to other areas in the region, seven additional regional sample sites were selected that were the same distance from the EYX, with the center point of each site located every 45 degrees from the center of the sample site (1) in the proposed Project area.

*Figure 1: Approximate location of the Edwards AFB NEXRAD (EYX) site in relation to the proposed Project site (1) and additional sample sites (2-8).*
The eight sample sites (including the Project site, no. 1) were arranged in a 59.3 km ring around EYX. At each sample site on the ring, a sample survey circle with a radius of 9.26 km (based upon a programmed data extraction of 5 nautical miles) was designated and radar reflectivity values extracted for the area from the archived NEXRAD data. Additionally, data were extracted for a 9th site, the Butterbredt location, an area which has been studied by a variety of individuals and groups for bird activity. This location has partial sampling overlap with the proposed Project site. NEXRAD reflectivity data (dBZ) are archived approximately every six minutes in 1 square kilometer areas. These data were converted to “Z” values and the hourly averages calculated for each survey site. A great deal of work has been done over the past decade in an effort to convert dBZ values to an estimator of bird densities. A wide range of variables may influence these calculations however Black (2000) reported that a simple estimation of density could be determined by converting the logarithmic dBZ value to “Z” values (Z = antilog [dBZ/10.0]). At a given location the value of “Z” should be equal to the average value of the density times the average value of the radar cross-section of the birds in the volume of airspace times a constant of 28.0. However in most cases the average cross-section of the birds in the volume of airspace is unknown. Additionally, the mix of bird species in the airspace volume may include both large and small birds. Black (2000) suggests that an average density can be determined by multiplying the Z value times 3 to
estimate birds/km². The multiplier can range from 2 (landing density), to 3 (beam density at 46km), to 100 (Migration traffic rate). For simple comparison of the proposed site to other site in the area, a multiplier of 3 was selected for his analysis.

**Data Queries.**

Processed NEXRAD data from the nine sample sites in the area of the Project site were extracted from the EYX NEXRAD data archives covering the period from January 2003 through December 2005. The initial data set accessed included over 100,000 radar records in the database. Records that occurred during periods of precipitation (defined by SAO data and NEXRAD precipitation mode) were dropped from the analysis. Since night migration (Spring and Fall) are the primary concern, data were further reduced to include only records from 15 March to Jun 1 (Spring) and from 15 August to 1 November (Fall) and that occurred during hours of dark from approximately 1800 to 0600 hours Pacific Standard Time.

**Radar Coverage.**

Data extracted for the analysis was processed from the lowest tilt of the EYX NEXRAD radar. The NEXRAD system has a one degree beam angle and is aligned to cover from ground level to an altitude that is dependent upon the distance from the radar. At a distance of 59.3 km, this would range from ground level to approximately 3,394 feet (ft) [1,034 meters (m)].
Terrain masking is a concern when comparing reflectivity data between areas. The EYX NEXRAD unit had the best unobstructed view of sample sites in the region when compared to other NEXRAD radar units situated along the California coast. An analysis of each site was conducted using a GIS to determine the percentage of each sample circle that had NEXRAD coverage. All nine sites had at least 90% coverage (see Appendix A).

**Analysis Results.**

Over 43,490 archived radar records met the search criteria (day of the month, time of day, and “clear air”. Records for the fall and spring periods were totaled for each site for Spring (table 1) and Fall (table 2).
Total densities for each season are plotted by year in figure 3. There appears to be little difference between the seasons in total densities, however there was a gradual increase in the total movements from 2003 to 2005. Summary statistics for each site are provided in Appendix B. Heavy migration occurred during both seasons, however the single highest density value \( z \) was recorded at site 2 (270.8) during a fall movement compared to the highest spring density value \( z \) of 183.7 recorded at site 3. However, there are some nights when spring

---

### Table 1. Total Density (per km²) for Spring Night Migrants

<table>
<thead>
<tr>
<th></th>
<th>Site 1</th>
<th>Site 2</th>
<th>Site 3</th>
<th>Site 4</th>
<th>Site 5</th>
<th>Site 6</th>
<th>Site 7</th>
<th>Site 8</th>
<th>Butterbredt</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Density</td>
<td>2056</td>
<td>4734</td>
<td>7611</td>
<td>15883</td>
<td>5942</td>
<td>45309</td>
<td>21355</td>
<td>17482</td>
<td>11048</td>
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<tr>
<td>Ranking</td>
<td>1</td>
<td>2</td>
<td>4</td>
<td>6</td>
<td>3</td>
<td>9</td>
<td>8</td>
<td>7</td>
<td>5</td>
</tr>
</tbody>
</table>

### Table 2. Total Density (per km²) for Fall Night Migrants

<table>
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<tr>
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<th>Site 1</th>
<th>Site 2</th>
<th>Site 3</th>
<th>Site 4</th>
<th>Site 5</th>
<th>Site 6</th>
<th>Site 7</th>
<th>Site 8</th>
<th>Butterbredt</th>
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<tr>
<td>Total Density</td>
<td>1879</td>
<td>5766</td>
<td>6614</td>
<td>18621</td>
<td>5968</td>
<td>44452</td>
<td>19243</td>
<td>16194</td>
<td>17441</td>
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<tr>
<td>Ranking</td>
<td>1</td>
<td>2</td>
<td>4</td>
<td>7</td>
<td>3</td>
<td>9</td>
<td>8</td>
<td>5</td>
<td>6</td>
</tr>
</tbody>
</table>

---

**Figure 3. Total Density by Season**
migration densities can be significant. Figure 4 is an example of heavy migration in the spring.

Figure 4. Nocturnal Spring Migration, May 2006.

Figure 5 is an example of light migration during a fall night.

Figure 5. Fall Night Migration, Sept 27, 2005
Figures 4 and 5 depict activity using the dBZ scale commonly used to show reflectivity values on maps. The conversion of the logarithmic dBZ scale to density was discussed earlier, however, it is often convenient to put the density analysis back into dBZ values. Tables 3 and 4 show the average dBZ values for fall and spring as well as the maximum dbz value recorded for each location.

<table>
<thead>
<tr>
<th>Fall</th>
<th>Average (z)</th>
<th>Average dBZ</th>
<th>Max z</th>
<th>Max dBZ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Butterbredt</td>
<td>2.58734</td>
<td>4.12535027</td>
<td>127.569</td>
<td>21.057452</td>
</tr>
<tr>
<td>Site 1</td>
<td>0.278676</td>
<td>18.9267</td>
<td>270.793</td>
<td>24.326374</td>
</tr>
<tr>
<td>Site 2</td>
<td>0.855336</td>
<td>-0.678632487</td>
<td>57.4176</td>
<td>17.59045</td>
</tr>
<tr>
<td>Site 3</td>
<td>0.981185</td>
<td>-0.082490998</td>
<td>57.4176</td>
<td>17.59045</td>
</tr>
<tr>
<td>Site 4</td>
<td>2.76241</td>
<td>4.12580191</td>
<td>127.569</td>
<td>21.057452</td>
</tr>
<tr>
<td>Site 5</td>
<td>0.885375</td>
<td>-0.528727452</td>
<td>12.241</td>
<td>10.878169</td>
</tr>
<tr>
<td>Site 6</td>
<td>6.59425</td>
<td>8.19165408</td>
<td>91.9085</td>
<td>19.633557</td>
</tr>
<tr>
<td>Site 7</td>
<td>2.85468</td>
<td>4.555574324</td>
<td>107.804</td>
<td>20.326349</td>
</tr>
<tr>
<td>Site 8</td>
<td>2.40238</td>
<td>3.806417037</td>
<td>200.034</td>
<td>23.011038</td>
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</tbody>
</table>

Table 3. Fall dBZ values

<table>
<thead>
<tr>
<th>Spring</th>
<th>Average (z)</th>
<th>Average dBZ</th>
<th>Max z</th>
<th>Max dBZ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Butterbredt</td>
<td>1.42409</td>
<td>1.535374368</td>
<td>119.419</td>
<td>20.770734</td>
</tr>
<tr>
<td>Site 1</td>
<td>0.265077</td>
<td>-5.766279532</td>
<td>92.9259</td>
<td>19.681368</td>
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<tr>
<td>Site 2</td>
<td>0.610211</td>
<td>-2.145199678</td>
<td>179.008</td>
<td>22.528724</td>
</tr>
<tr>
<td>Site 3</td>
<td>0.98111</td>
<td>-0.082822977</td>
<td>183.774</td>
<td>22.642841</td>
</tr>
<tr>
<td>Site 4</td>
<td>2.04724</td>
<td>3.111687584</td>
<td>150.34</td>
<td>21.770745</td>
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<tr>
<td>Site 5</td>
<td>0.765923</td>
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<td>70.1407</td>
<td>18.459701</td>
</tr>
<tr>
<td>Site 6</td>
<td>5.84033</td>
<td>7.66437387</td>
<td>106.473</td>
<td>20.272395</td>
</tr>
<tr>
<td>Site 7</td>
<td>2.7527</td>
<td>4.597588829</td>
<td>88.0056</td>
<td>19.445103</td>
</tr>
<tr>
<td>Site 8</td>
<td>2.25339</td>
<td>3.528363627</td>
<td>42.9177</td>
<td>16.326364</td>
</tr>
</tbody>
</table>

Table 4. Spring dBZ values

**Rankings of Sites by Season**

Rankings of each site from lowest density (1) to highest density (9) are provided in tables 1 and 2 above for each season.
Analysis of variance of the mean density value ($z$) was conducted with
statgraphics (Appendix B). A statistically significant difference in the mean
density values among the sites was found for night fall migration ($F= 359.59,$
$P<0.0001$) and also for night spring migration ($F=414.71, P<0.0001$). A multiple
range test for the fall comparisons grouped the proposed Project site (1) among
the lowest in total densities (table 5). The Butterbredt site was grouped among
those in the middle. A multiple range test for the spring analysis (table 6) again
grouped the proposed Project site (1) among the lowest groups.
Table 5. Fall - Multiple Range Test (Method: 95.0 percent LSD)

<table>
<thead>
<tr>
<th>Site</th>
<th>Count</th>
<th>Mean</th>
<th>Homogeneous Groups</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site 1</td>
<td>2247</td>
<td>0.278676</td>
<td>X</td>
</tr>
<tr>
<td>Site 2</td>
<td>2247</td>
<td>0.855336</td>
<td>X</td>
</tr>
<tr>
<td>Site 5</td>
<td>2247</td>
<td>0.885375</td>
<td>X</td>
</tr>
<tr>
<td>Site 3</td>
<td>2247</td>
<td>0.951185</td>
<td>X</td>
</tr>
<tr>
<td>Site 8</td>
<td>2247</td>
<td>2.40238</td>
<td>X</td>
</tr>
<tr>
<td>Butterbredt</td>
<td>2247</td>
<td>2.58734</td>
<td>XX</td>
</tr>
<tr>
<td>Site 4</td>
<td>2247</td>
<td>2.76241</td>
<td>X</td>
</tr>
<tr>
<td>Site 7</td>
<td>2247</td>
<td>2.85468</td>
<td>X</td>
</tr>
<tr>
<td>Site 6</td>
<td>2247</td>
<td>6.59425</td>
<td>X</td>
</tr>
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</table>

Table 6. Spring - Multiple Range Test (Method: 95.0 percent LSD)

<table>
<thead>
<tr>
<th>Site</th>
<th>Count</th>
<th>Mean</th>
<th>Homogeneous Groups</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site 1</td>
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<tr>
<td>Site 2</td>
<td>2586</td>
<td>0.610211</td>
<td>X</td>
</tr>
<tr>
<td>Site 5</td>
<td>2586</td>
<td>0.765923</td>
<td>XX</td>
</tr>
<tr>
<td>Site 3</td>
<td>2586</td>
<td>0.98111</td>
<td>X</td>
</tr>
<tr>
<td>Site 8</td>
<td>2586</td>
<td>2.04724</td>
<td>X</td>
</tr>
<tr>
<td>Butterbredt</td>
<td>2586</td>
<td>2.58734</td>
<td>XX</td>
</tr>
<tr>
<td>Site 4</td>
<td>2586</td>
<td>2.76241</td>
<td>X</td>
</tr>
<tr>
<td>Site 7</td>
<td>2586</td>
<td>2.85468</td>
<td>X</td>
</tr>
<tr>
<td>Site 6</td>
<td>2586</td>
<td>5.84033</td>
<td>X</td>
</tr>
</tbody>
</table>

**Visibility Data & Analysis**

Historical visibility information within the region of the Project site was accessed through ASOS and AWOS databases to assess the frequency of occurrence of low visibility conditions that could increase risk to birds from the project. Over 28,000 records for a period from January 1, 2003 through October 1, 2005 were accessed covering all time periods (dawn, day, dusk, night). Of these records, less than 0.008% represented periods with low visibility, indicating that mortality risk due to low visibility at night conditions is not a significant risk factor for the Project site.
Conclusions.

Results from the analysis of processed radar data does not indicate that the proposed Project site (site 1) supports bird activities that are greater than the surrounding areas: the proposed Project site ranked lowest (1st) out of the 9 sampled sites in total Spring migration density and in Fall migration density. Site number 5 was ranked the highest (9th) during both fall and spring migrations.

The analyses conducted in this report do not provide information on the altitude distribution of birds in the region. NEXRAD data indicate the greatest activity in the area during the months of April and October. If field observations indicate that birds of concern occur in significant densities during any month of the year, the use of a site-specific survey radar system may be warranted to determine more precisely the number of birds using the area and what the altitude distribution is relative to the areas that will be swept by the wind turbine blades.
Appendix A. Coverage Analysis EYX NEXRAD (59.3 km)

Height Analysis

<table>
<thead>
<tr>
<th>Site</th>
<th>beam angle - degree</th>
<th>Nautical miles</th>
<th>tan angle</th>
<th>Meters</th>
<th>Feet</th>
<th>Height (m)</th>
<th>Height (Feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proposed Site</td>
<td>1</td>
<td>32</td>
<td>0.017455</td>
<td>59264</td>
<td>194432</td>
<td>1034</td>
<td>3394</td>
</tr>
</tbody>
</table>

Terrain Masking Analysis. GIS-based analysis of EYX Radar coverage

<table>
<thead>
<tr>
<th>Site number</th>
<th>total pixels</th>
<th>covered pixels</th>
<th>%cover</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>252</td>
<td>244</td>
<td>96.8</td>
</tr>
<tr>
<td>BB</td>
<td>251</td>
<td>243</td>
<td>96.8</td>
</tr>
<tr>
<td>2</td>
<td>253</td>
<td>228</td>
<td>90.1</td>
</tr>
<tr>
<td>3</td>
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<td>253</td>
<td>100</td>
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<td>252</td>
<td>237</td>
<td>94.0</td>
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<td>5</td>
<td>248</td>
<td>242</td>
<td>97.5</td>
</tr>
<tr>
<td>6</td>
<td>250</td>
<td>245</td>
<td>98</td>
</tr>
<tr>
<td>7</td>
<td>253</td>
<td>253</td>
<td>100</td>
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<tr>
<td>8</td>
<td>248</td>
<td>229</td>
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Appendix B. Summary Statistics

Fall 2003 – 2005
Aug 15 through 1 Nov

Summary Statistics

<table>
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<tr>
<th></th>
<th>Count</th>
<th>Average</th>
<th>Standard deviation</th>
<th>Coeff. of variation</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Range</th>
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<tbody>
<tr>
<td>Butterbredt</td>
<td>2247</td>
<td>2.58734</td>
<td>4.44887</td>
<td>171.947%</td>
<td>0.0241617</td>
<td>127.569</td>
<td>127.544</td>
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<tr>
<td>Site 1</td>
<td>2247</td>
<td>0.278676</td>
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<td>18.9267</td>
<td>18.9267</td>
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<td>0.855336</td>
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<td>0.000125594</td>
<td>270.793</td>
<td>270.792</td>
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<tr>
<td>Site 3</td>
<td>2247</td>
<td>0.981185</td>
<td>2.4911</td>
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<td>0.00323033</td>
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<td>57.4144</td>
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<tr>
<td>Site 4</td>
<td>2247</td>
<td>2.76241</td>
<td>4.47715</td>
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<td>0.163537</td>
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<td>0.885375</td>
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<td>Site 6</td>
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<td>6.59425</td>
<td>5.34397</td>
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<td>0.475417</td>
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<td>Site 7</td>
<td>2247</td>
<td>2.85468</td>
<td>5.37187</td>
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<td>0.0120019</td>
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<tr>
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<td>199.865</td>
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<tr>
<td>Total</td>
<td>20223</td>
<td>2.24462</td>
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<td>226.343%</td>
<td>0.0</td>
<td>270.793</td>
<td>270.793</td>
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</table>

ANOVA Table

<table>
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<tr>
<th>Source</th>
<th>Sum of Squares</th>
<th>Df</th>
<th>Mean Square</th>
<th>F-Ratio</th>
<th>P-Value</th>
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</thead>
<tbody>
<tr>
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<td>65029.8</td>
<td>8</td>
<td>8128.72</td>
<td>359.59</td>
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<td>Within groups</td>
<td>456942.</td>
<td>20214</td>
<td>22.6052</td>
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<tr>
<td>Total (Corr.)</td>
<td>521972.</td>
<td>20222</td>
<td></td>
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</tbody>
</table>

Multiple Range Tests

Method: 95.0 percent LSD

* denotes a statistically significant difference.

Measures and 95.0 Percent LSD Intervals
Spring 03 -05  
March 15 through June 1

Summary Statistics

<table>
<thead>
<tr>
<th></th>
<th>Count</th>
<th>Average</th>
<th>Standard deviation</th>
<th>Coeff. of variation</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Butterbredt</td>
<td>2586</td>
<td>1.42409</td>
<td>4.3182</td>
<td>303.225%</td>
<td>0.0221099</td>
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<td>1.89724</td>
<td>715.731%</td>
<td>0.0</td>
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<td>92.9259</td>
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<tr>
<td>Site 2</td>
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<td>4.75218</td>
<td>778.777%</td>
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<td>179.008</td>
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<td>150.24</td>
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<tr>
<td>Site 5</td>
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<td>318.902%</td>
<td>0.00462205</td>
<td>70.1407</td>
<td>70.1361</td>
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<tr>
<td>Site 6</td>
<td>2586</td>
<td>5.84033</td>
<td>4.88766</td>
<td>76.8391%</td>
<td>0.160599</td>
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<td>2586</td>
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<td>42.9177</td>
<td>42.7837</td>
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<tr>
<td>Total</td>
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<td>1.88223</td>
<td>4.53408</td>
<td>240.888%</td>
<td>0.0</td>
<td>183.774</td>
<td>183.774</td>
</tr>
</tbody>
</table>

ANOVA Table

<table>
<thead>
<tr>
<th>Source</th>
<th>Sum of Squares</th>
<th>Df</th>
<th>Mean Square</th>
<th>F-Ratio</th>
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<tr>
<td>Between groups</td>
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<td>Total (Corr.)</td>
<td>478443.</td>
<td>23273</td>
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</tbody>
</table>

Multiple Range Tests

* denotes a statistically significant difference.
Appendix C. References:
