CURRY & KERLINGER, L.L.C.
A PROFESSIONAL CONSULTING GROUP

May 25, 2006

Mr. Ken Solomon
Program Manager
County of Solano
675 Texas Street, Suite 5500
Fairfield, California 94533

Re: Shiloh II Wind Project Phase I Environmental Site Assessment

Dear Mr. Solomon:

This letter addendum to our original report entitled ***Avian Monitoring Study and Risk Assessment for the Shiloh Wind Power Project Solano County, California***, is submitted to address the impacts of pursuing a second turbine layout option, "Option 2," for the Shiloh II wind plant. Our original study assessed the impacts of the first layout option, "Option 1," of this project. This letter assesses the impact of Option 2 on Avian Risk.

The main difference between Option 1 and 2 is the number and type of turbines that will be used. Option 2 will use the REpower MM92, a 2 MW turbine with a rotor diameter of 92.5 meters versus the GE turbine of Option 1, which has a 77 meter rotor diameter and a capacity of 1.5 MW. The tower heights with the REpower turbines would be 67 meters and 80 meters, versus the GE which would be 65 and 80 meters.

Option 2 would have fewer turbines sites than Option 1 although the pad locations would be roughly similar. The site locations in Areas A-D would be the same under both Options. Under Option 2, Area E locations would be eliminated.

We reviewed the data collected in preparation of the ***Avian Monitoring Study and Risk Assessment for the Shiloh Wind Power Project Solano County, California***, and have concluded that there are similar or potentially slightly more opportunities for avian impacts based on a review of Option 2 because the rotor blades are15 meters longer and extending the size of the rotor swept area. Consequently, the tip of the blades in the 6 0'clock position range from 20.75 to

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33.75 meters above ground level (AGL) whereas in Option 1 ground clearance of the blades in the 6 O'clock position ranges from 26.5 to 41.5 meters AGL.

Similarly, the height of the blade tips at the 12 O'clock position extend the rotor swept area upward another 8 meters from 118.5 meters to 126.25 meters on the 80 meter towers of the Repower MM92 model turbines.

Nevertheless, the potential for an increase in impacts that could occur due to these changes is not expected to be substantial enough to cause us to change our original assessment. That is, the potential risk for any avian species from installing turbines in accordance with either Option 1 or Option 2 is not expected to be biologically significant at the local, regional or global population level.

Sincerely,

Richard C. Curry

Richard C. Curry
Curry and Kerlinger, LLC

Avian Monitoring Study and Risk Assessment for the Shiloh Wind Power Project Solano County, California

April 2006

Prepared for:
ENXCO

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EXECUTIVE SUMMARY

This report summarizes information pulled together from several studies conducted over the last several years within the Collinsville Montezuma Hills Wind Resource Area in conjunction with a study of avian abundance and behavior patterns (November 12, 2005 through March 24, 2006) at the Shiloh II Wind Power Project in the Collinsville Montezuma Hills Wind Resource Area (CMHWRA), Solano County, California. This data was compared to data collected in the months of November through March at adjacent project areas. All of the data was examined in the context of the findings of a two year post construction survey of the High Winds Wind Farm where risk has been empirically determined. In addition a raptor nesting survey with a special focus on Golden Eagle nesting was conducted for the developer in 2005.

A total of 26 rounds of point counts, totaling 103.5 hours of observations were conducted. A total of 102,430 observations of 42 avian species including 89,060 unidentified birds were recorded at eight observation points. Of these unidentified birds, 99.7% of were blackbird species. The most common avian species group observed was small songbirds. Red-tailed Hawk, American Kestrel and Northern Harrier constituted 88% of one thousand seventy eight raptors observed. Golden Eagle, a species of special concern at wind plants constituted 0.6% of all raptor species and only 0.05% of all species (excluding blackbirds) observed at the Shiloh II project site, to date. No federally endangered or threatened species observed on or near the site, although a state threatened species, Swainson's Hawk, was observed on 2 occasions.

Raptor nesting surveys revealed nests of 8 species of raptors (including owls). Thirty-seven nests were confirmed and another 23 were rated as probable. An active Golden Eagle nest was confirmed on a property adjacent to the Shiloh project. It is likely that these birds hunt within the Shiloh project area.

Comparisons of abundance and use found for the Shiloh II project were made with data collected during the months of November through March but not contemporaneously using comparable protocols at the adjacent High Winds Wind Power Project and the Shiloh I project, both of which are currently operating. Avian abundance and use patterns of bird use were generally similar between sites, although for particular species some differences were recorded. Abundance of Red-tailed Hawk and Waterfowl was greater at the Shiloh II project, whereas Golden Eagles were observed less frequently.

Overall, for most species, the level of risk on a per-turbine, per-year basis at Shiloh is likely to be similar for most species to risk levels demonstrated at the nearby High Winds project. Those levels were generally rather low. From comparisons with abundance and behavior of birds observed at High Winds and Shiloh I with similar data from Shiloh II, we conclude that fatality rates at the Shiloh II project are likely to approximate those at High Winds. Based on two years of post construction monitoring at High Winds, the levels of fatalities expected at Shiloh II for any species are not expected to be biologically significant at the local, regional or global level.

Biological significance is determined by examining the mortality literature, the literature on hunting harvests of various species, the levels of depredation permits issued by state and federal governments, whether the species is a resident, a migrant or a combination of both and comparing absolute numbers of fatalities to estimates of population size.

INTRODUCTION

Shiloh Wind Partners, LLC is proposing to construct the Shiloh Wind II Power Project (hereafter, the "Project"). The proposed site encompasses approximately 7,800 acres of agricultural land in the Montezuma Hills, near Rio Vista in Solano County, California. The proposed site is within the Collinsville Montezuma Hills Wind Resource Area (CMHWRA) and wraps around the upper sections of the 90 turbine High Winds, LLC project which became operational in 2003 and the 100 turbine Shiloh I project. The wind turbines installed in the High Winds project are the Vestas V80 model capable of generating 1.8 megawatts. The Shiloh I project consists of 100 General Electric 1.5 MW wind turbines. The Shiloh II project developers are proposing 112 turbine locations at which the GE 1.5 MW turbines will be installed to produce 168 MW of energy. The hub height would be 65 and 80 meters and the rotor diameter would be 77 meters (253 feet). A total height for those turbines mounted on 65 meter towers would be ~103.5 meters (339.5 feet) above ground level (AGL) when the rotors are in the 12 o'clock position. At the 6 o'clock position the tip of the rotors will be approximately 26 meters (87 feet) AGL. For turbines mounted on 80 meter towers the total height would be ~ 118.5 meters ((388 feet) above ground level (AGL) when the rotors are in the 12 o'clock position. At the 6 o'clock position the tip of the rotors will be approximately 41.5 meters (136 feet feet) AGL. Currently it is proposed that their will be 29 turbines with 65 meter towers and 85 turbines with 80 meter towers.

The report that follows examines the data generated from the avian abundance and behavior (use) surveys on the Shiloh II site, the raptor nesting surveys studies conducted for the Shiloh Wind Power Project, and comparisons with studies done for the adjacent High Winds and Shiloh I projects. Curry & Kerlinger, LLC conducted and coordinated studies that will provide an inventory of the avian resources on the proposed development and control sites. The inventory will be used to: evaluate the potential risk of project development to avian species; assist, when supported by relevant data, with the micro-siting of the turbines; and, provide a comparative basis for determining the actual impact of the facility upon completion of construction during one or more years of initial operation.

Between 2000 and 2001, Curry & Kerlinger, LLC developed and managed the pre-development Avian Monitoring Study and Risk Assessment for the adjacent High Winds Wind Power and Shiloh projects. These studies were for one year whereas the Shiloh II field data has been collected for the months of November through March. However, by employing similar protocols for collecting data for all of these surveys over an extensive portion of the CMHWRA we are able to demonstrate the comparability of the Shiloh II development area with the adjacent areas. In addition, there are two years worth of post construction data which can be used to empirically assess general risk parameters for the proposed area. The methods used in these studies are based on standard protocols discussed in *Studying Wind Energy/Bird Interactions: A Guidance Document – Metrics and Methods for Determining or monitoring Potential Impacts on Birds at Existing and Proposed Wind Energy Sites* (Anderson et al. 1999).

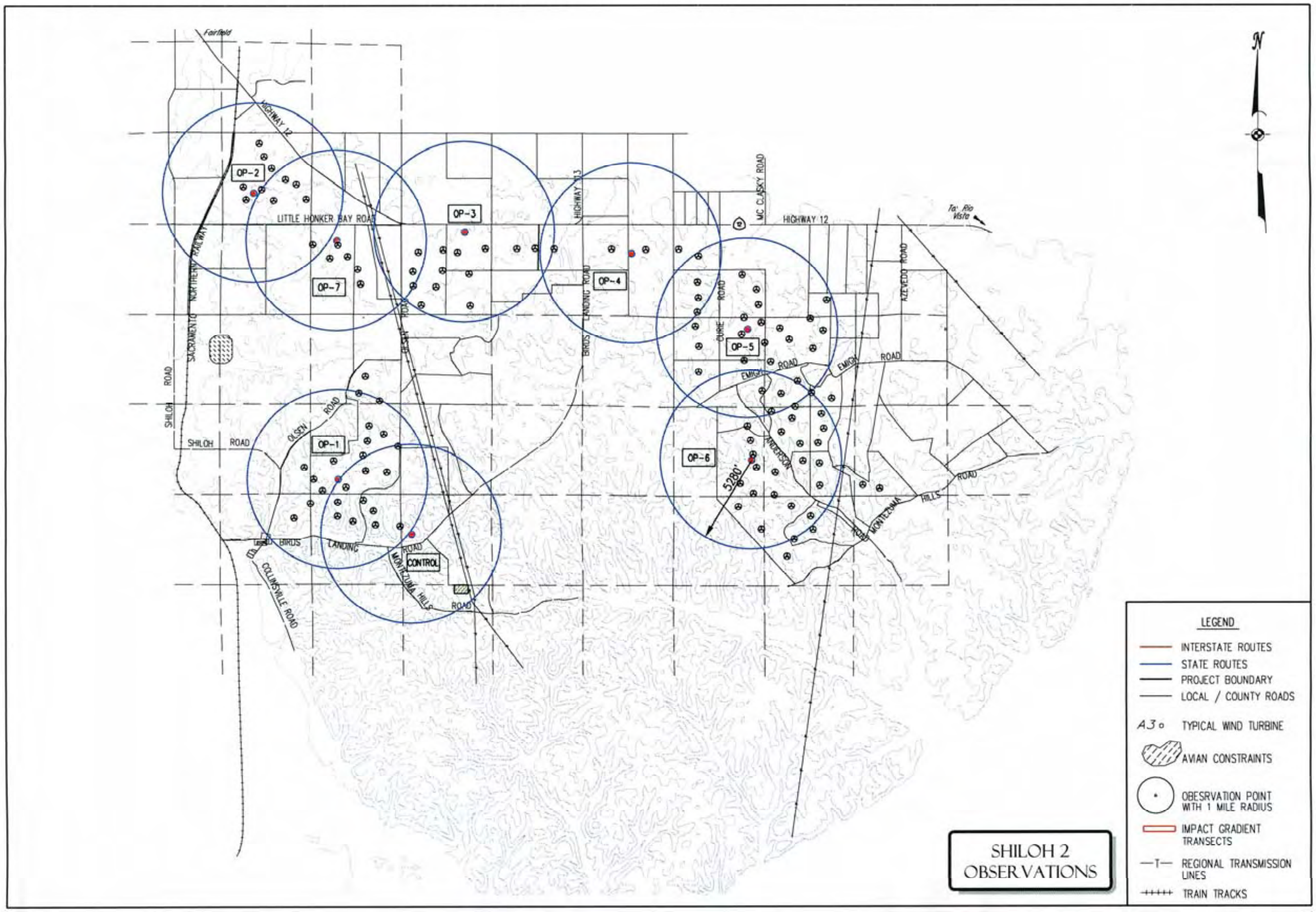
For the High Winds project site, we designed a one-year field study that commenced in mid-August 2000 and ended in mid-August 2001. Data collection for the Shiloh Project pre-construction surveys covered the period from January 1, through December 31, 2004. To meet the schedule of the permitting process, this report includes data collected November, 2005 through March, 2006 and provides a preliminary comparison of avian use between the Shiloh II project and the High Winds and Shiloh I project. Because these currently operating wind farm sites are similar in terrain and topography to the current Project site, and because of their close proximity, it is appropriate to extrapolate from data collected at these sites collected in the same months of the year but not contemporaneously and apply those data to the examination of the Shiloh II project site as part of this report's determination of significance. The primary objective of the study is to document avian species on site, as well as seasonal occurrence, abundance, and behavior while within the project area and from those data, to project the significance of avian impacts from the proposed project. Pre-construction data collection establishes a base which can be compared with observations made following construction of the project.

METHODS

Avian Abundance and Behavior (Use)

The following survey protocols were employed to determine avian abundance (relative number of each avian species present) and behavior (observed activities and seasonal presence) within the Project area. The emphasis is on the bird use of the area and is not designed to provide a population estimate of each species observed in the area. Seven sampling sites and a control site (hereafter referred to as observation points or observations sites) were selected for observing birds. Again the emphasis is on the relative distribution and use of the project area by the various species recorded at the observation points (OPs). An important part of our observations was to observe large raptor use of the area, accordingly, the range of our search radius extended outwards to a mile. In total, these observation points cover 100% of the project area within which the turbines will be installed. From a spatial aspect coverage of the Shiloh II project area was -complete and thereby sufficient to characterize avian abundance and behavior in the development area, and as a result affords a basis for assessing potential risk to those birds. Figure 1 shows the location of the observation points in relation to the proposed turbine locations. The circle represents the area observed from each survey location.

Figure 1. Location of Observation Points



Observation Points:

Control Site:

Observation point Control (OP C) is located on Solano County property along Bird's Landing Road (BLR) west of the Montezuma Hills/Bird's Landing Road junction. The hills in the area run parallel to BLR. The land use in this area has been predominantly agriculture. Sheep are grazing cropland harvested in June 2005. A farm is located on the north side of BLR and consists of small pens and troughs for feeding livestock. There is a large storage of Hay in this area. A large marsh and meandering wetland run along the south side of BLR where sheep are grazed. To the east, there is a residential farm with a large barn that is situated on the southern side of BLR but north of the meandering wetland. The vegetation on the surrounding hills is predominantly harvested wheat crop that has been grazed. Several latticed tower turbines are situated on top of these surrounding hills. This area was chosen because it was located adjacent to the proposed project and offered a wide variety of avian species indicative to the area.

Observation Point 1:

Observation point 1 (OP 1) site is north of BLR, east of Shiloh Road and south of Olsen Road. The land on which OP 1 was located is owned by Russell. The surrounding parcels of land that OP 1 views are owned by Russell, Stewart, Anderson, and Leutholtz. OP 1 was completely surrounded by rolling hills. To the west of OP 1 are a large eucalyptus grove, rolling hills, and Shiloh Road. The land use in these hills are grazing. Further west, the Suisun Marsh Wildlife Management area, Grizzly Island, and Suisun Bay/Honker Bay area were visible. North of OP 1, there exists a manmade pond surrounded by grazed grassland and rolling hills. To the east are more rolling hills covered by wheat. To the south are more rolling hills that surround BLR/MHR intersection. A majority of the hilltops to the north, northeast, east and southeast areas are covered with latticed wind turbines belonging to Enxco. This site was chosen because it was one of the highest hills in the area and offered excellent vantage points in all directions.

Observation Point 2:

Observation point 2 (OP 2) is on the Dexter Mayhood property which is situated north of Little Honker Bay Road, south west of State Route 12 (SR 12), and east of Shiloh Road. OP 2 was located on the tallest hill in the area within a wheat field. To the west, OP 2 overlooks a pond, a large pasture, and Suisun Marsh wildlife Management area. To the north are a meandering wetland, a pasture, and two small groves of eucalyptus trees. To the east are low rolling hills covered with wheat and a commercial/residential area. To the south exists a very large eucalyptus grove, rolling hills of wheat and pasture, and the Shiloh I wind farm project.

Observation Point 3:

Observation point 3 (OP 3) was on the Hatch Investments property which is bordered to the north by SR 12 and between BLR and Olsen Road. The immediate area around the site is pasture. To the west are grazing pastures. To the north of OP 3 and SR 12 are pastures, a large pond, a meandering wetland, and sparse stands of eucalyptus trees. To the east are rolling hills of pasture and wheat, and a meandering wetland. To the south are 5 residences with livestock and farm equipment. Also within this area is a large stand of eucalyptus trees. Further south is the Shiloh I wind farm project.

Observation Point 4:

Observation point 4 (OP 4) is on the Sugawara property which is situated south of SR 12 between BLR and Currie Road. The immediate area around the site is harvested wheat. Adjacent areas consist of wheat fields and pasture. To the west are grazing pastures and harvested wheat. There is also a small stand of eucalyptus trees. To the north are pastures and 1 residence/farm. Small stands of eucalyptus trees are also present. To the east are rolling hills of pasture and wheat, 2 residences, and sparse stands of eucalyptus trees. To the south are wheat fields, horse stables, and 2 stands of eucalyptus trees. Further south is the High Winds wind farm project.

Observation point 5:

Observation point 5 (OP 5) is on the McCormack property which is south of SR 12, north of Emigh Road, east of Currie and west of Azevedo Road. The immediate area around the site consists of rolling hills of pasture. Adjacent areas consist of pastures and wheat fields. To the west are mostly wheat fields. There is also a small stand of eucalyptus trees. To the north are pastures, 2 residence/farms, and small stands of eucalyptus trees. To the east are rolling hills of pasture and wheat, 2 residences, and sparse stands of eucalyptus trees. Further east are eucalyptus stands and residences. To the south are grazed wheat fields, a horse boarding ranch, High Winds wind farm, and 2 stands of eucalyptus trees.

Observation point 6:

Observation point 6 (OP 6) is in a pasture located on the Emigh property which lies south of Emigh Road and west of Anderson Road. The immediate area around the site consists of rolling hills of pasture, a small stand of eucalyptus trees, and a small wetland. Adjacent areas consisted of pastures and wheat fields. To the west are mostly wheat fields and pasture. Further west is the High Winds wind farm project. To the north are pastures and 2 small stands of eucalyptus trees where an historic Golden eagle nest is located. To the east are rolling hills of grazed grassland. To the south are two small stands of eucalyptus trees and a small wetland. Further to the south are rolling hills of wheat, a farm, the Sacramento Municipal Utility District wind farm, Montezuma Hills road and additional eucalyptus stands and residences.

Observation point 7 (OP 7):

Observation point 7 (OP 7) is on the McGraugh property which lies south of Little Honker Bay Road, east of Shiloh Road, and west of Olsen Road. The immediate area around the site consists of low rolling hills of wheat crop. To the west are a pasture , a wetland, the Shiloh I wind farm, and a large grove of eucalyptus trees. Further west is the Suisun Marsh Wildlife Management area. To the north are wheat fields and two stands of eucalyptus trees. To the east are mostly pasture lands and a commercial farm with a pond. To the south are one small stand of eucalyptus trees and a wetland. Further to the south are rolling hills of wheat crop and the Shiloh I wind farm project.

Observation Protocols:

Generally, observations started at 08:00 hours and continued until about 15:30, corresponding to the time raptors are most active. Observation periods were 30 minutes in length at each observation point. All observation points were sampled on the same day or on successive days when weather precluded a complete round of observations. A full survey consisted of 3.5 hours of viewing and data collection and a similar amount of time moving between observation points.

At the beginning of each survey, the starting time and standard weather information were recorded including: wind direction and approximate speed; temperature, percent cloud cover, precipitation and, range of visibility. It was noted whether visibility was sufficient to afford a view of the entire observation area. The following behavioral information was collected for each survey: species identity, number of individuals, estimate of age, the time the observed behavior commenced and ended, flight height of the individual corresponding to the rotor swept height (low = below rotor swept height 0-30 meters, medium = within rotor swept height 31-100 meters, high = above rotor swept height or >100 meters. The individual's direction and their behavior were also recorded.

A total of 217 hours observing on 62 different visits were conducted at the seven observation points between January, 2004 and December, 2004; equal to 31 hours of observing per observation point.

Incidental observations were recorded while walking/driving between observation points. These observations were recorded on separate data sheets and were not used for statistical analysis. Instead the data were collected and analyzed to provide additional information about avian activity at the proposed site. Incidental observations were recorded on 113 different days with a total of 396 hours of viewing.

In addition to recording avian activity, the presence (observations of animals or their sign) and activities of prey species specifically ground squirrels, pocket gophers and jackrabbits were recorded at each observation point. Prey information was recorded on the incidental data sheets, with a reference noted as to location. The relative numbers of prey species present at a specific site are a good indicator of the attractiveness of that location to Golden Eagles and other raptor species. A summary of the survey rounds used in this report are presented below in Table One.

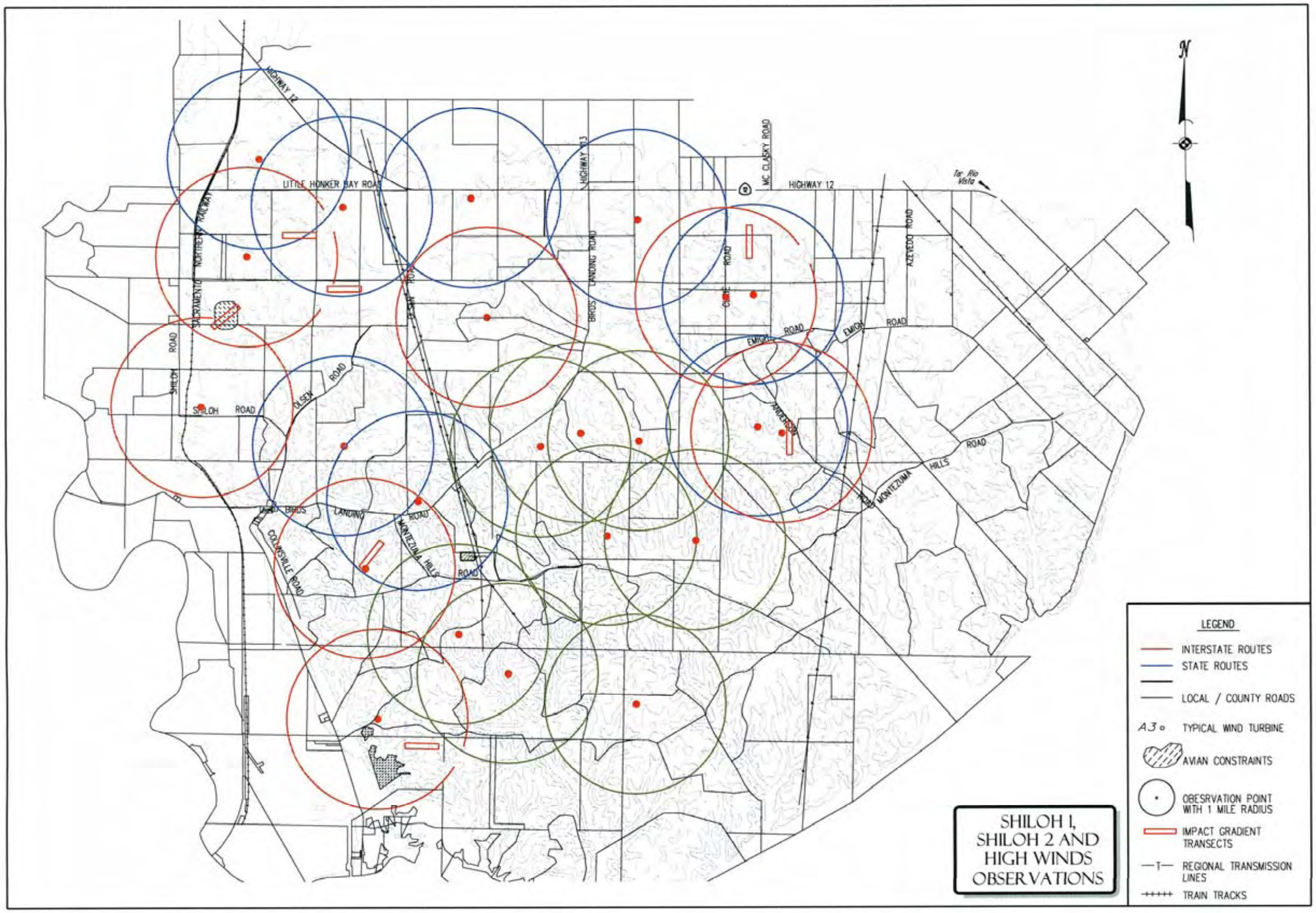
Table 1. Summary of Rounds of Avian Abundance and Behavior Surveys conducted at the Shiloh II Wind Power Project, November 12, 2005 through March 24, 2006

Year	Round	Date Completed
2005	Round 1	November 12 (did not include Site 7 surveys)
	Round 2	November 13
	Round 3	November 19
	Round 4	November 20
	Round 5	November 24
	Round 6	November 27
	Round 7	December 3
	Round 8	December 4
	Round 9	December 11
	Round 10	December 19
	Round 11	December 29
	Round 12	December 31
2006	Round 13	January 8
	Round 14	January 15
	Round 15	January 21
	Round 16	January 26
	Round 17	February 5
	Round 18	February 12
	Round 19	February 19
	Round 20	February 25
	Round 21	March 4
	Round 22	March 6
	Round 23	March 13
	Round 24	March 19
	Round 25	March 23
	Round 26	March 24

8 sites, half hour surveys
26 rounds (minus one site on first day)
208 = 26 * 8 sites
207 site rounds because day one was missing site 7
207 site rounds * 0.5 hours = 103.5 hours

Comparison of Avian Abundance Patterns at the Shiloh II Project with Adjacent Wind Project Sites. To provide a context for the abundance patterns of birds found at the Shiloh II project site, comparisons are made to abundance patterns found at Shiloh I and High Winds a previously constructed wind power facility that is adjacent to the Project. The High Winds Wind Power Project was constructed nearly two years ago on adjacent lands within the Collinsville Montezuma Hills Wind Resource Area (CMHWRA). Methods used to determine avian abundance and behavior at the Shiloh and High Winds project were nearly identical to those used at the Shiloh project, making it possible to make direct comparisons. The observation points utilized in all of the surveys conducted on the Shiloh I and II and the High Winds projects within the Collinsville Montezuma Hills Wind Resource Area (CMHWRA) are shown below (Figure.2).

Figure 2. Observation Points for High Winds, Hamilton Ranch, Shiloh I and II Project Areas



Golden Eagle Nesting Surveys

In the spring of 2005, the developers commissioned a survey of Golden Eagle nesting in and around the Collinsville Montezuma Hills Wind Resource Area Surveys commenced February 2, 2005 and ended June 2, 2005. Golden Eagle surveys consisted of an observer located on top of an optimal vantage point and visually scanning 360 degrees in and adjacent to the CMHWRA. The observer was looking for Golden Eagle territorial and courtship display behaviors. If a Golden Eagle displayed courtship/territorial behaviors, the observer documented and recorded the location and time at which the activity took place. Golden Eagles perform undulating flight behaviors to attract mates and defend their territories. This display is readily visible and is an indicator that a Golden Eagle is trying to establish a territory and attract a mate in that general area.

Five observation points were established (see Appendix One) to observe Golden Eagle activity within and adjacent to the CMHWRA. If an active nest was located, follow up surveys were conducted to determine if the nest was a success or a failure. Observation point One was located one-eighth of a mile west of Currie Road and one and a half miles south of Highway 12, at high point marked at 217 feet above sea level (ASL). Observation point Two was located one mile west of the Toland/Montezuma Hills road intersection and one-half mile north of Montezuma Hills road at a high point marked at 224 feet ASL. Observation point three was located three-quarters of a mile east of Collinsville Road and one-quarter of a mile south of Clank Hollow at a high point marked at 243 feet ASL. Observation point four was located one-half mile west of Birds Landing Road and one-quarter mile south of Birds Landing Road (southwest of the Olsen/Birds Landing Road intersection) at a high point marked at 165 feet ASL. Observation point five was located three-quarters of a mile southeast of the Olsen Road 90 degree corner, at a high point marked at 245 feet ASL.

If an active territory was observed, the observer would locate themselves in the general vicinity and document eagle activity to determine if there was an active nest nearby. If an active nest was located, the observer would find a vantage point nearby and observe the nest from a distance as not to disturb the nesting eagles. Repeat visits were conducted to determine success or failure of each nest and are discussed later.

Surveys were conducted in February, March, April, May and June. Beginning in April, surveys were limited to observations of established nests. A total of 259 hours over the course of 40 days were spent surveying for Golden Eagles (Appendix One).

RESULTS

Avian Abundance and Behavior (Use)

A total of 102,430 observations of 42 avian species were recorded at eight observation points (Table 2). The most common avian species group observed were small songbirds (passerines not including corvid species), which accounted for 94% of all observed birds (n=96,411). Of these small songbirds, blackbird species (mostly Red-winged Blackbirds and Brewer's

Blackbirds) comprised 94.5% (n=91,082), and made up 88.9% of the total number of avian observations. Removing blackbird observations from the total, small songbirds then comprised 47.0%; ducks and geese, 10.2% (n=1160); raptors, 9.5% (n=1078); waterfowl other water birds (plovers, egrets, pelicans, [n=461]) 4.1%; corvids (n=459) 4.0%; and, other birds 25.2% (vultures, doves/pigeons, shrikes, mockingbirds, flickers, etc.,[n=2861]).

Of one thousand seventy eight raptor sightings, Red-tailed Hawks constituted 56.6% (n=610); followed by: American Kestrels, 20.2% (n=218); Northern Harriers, 11.2% (n=121); White-tailed Kites, 2.2% (n=24); Ferruginous Hawks, 1.8% (n=19); Prairie Falcons 1.0% (n=11); Golden Eagles, 0.6% (n=6); Swainson's Hawks, 0.2% (n=2); and, the Cooper's Hawk, 0.1% (n=1). In addition to identified raptors, there were a total of 64 raptors identified to the genus *Buteo*, comprising 5.6% of all raptors observed. Golden Eagle, a species of special concern at wind plants constituted 0.6% of all raptor species and only 0.05% of all species (excluding blackbirds) observed at the Shiloh II project site, to date.

Table 2. Avian Species observed at the Shiloh II Wind Power Project, CA.

Species Name	Number of Observations	Percentage Species Composition
American Crow	2	0.002
American Kestrel	218	0.213
American Pipit	244	0.238
American Robin	1	0.001
American White Pelican	24	0.023
Barn Swallow	3	0.003
Brewer's Blackbird	208	0.203
Canada Goose	498	0.486
Cattle Egret	10	0.010
Common Raven	448	0.437
Cooper's Hawk	1	0.001
European Starling	918	0.896
Ferruginous Hawk	19	0.019
Golden Eagle	6	0.006
Great Egret	3	0.003
Horned Lark	1249	1.219
House Finch	33	0.032
Killdeer	278	0.271
Loggerhead Shrike	76	0.074
Long-billed Curlew	145	0.142
Mallard	296	0.289
Merlin	2	0.002
Mourning Dove	83	0.081
Northern Flicker	14	0.014
Northern Harrier	121	0.118
Northern Mockingbird	3	0.003
Northern Shoveler	6	0.006
Prairie Falcon	11	0.011
Red-tailed Hawk	610	0.596
Red-winged Blackbird	2094	2.044
Rock Pigeon	2479	2.420

Species Name	Number of Observations	Percentage Species Composition
Savannah Sparrow	1871	1.827
Say's Phoebe	11	0.011
Scrub Jay	9	0.009
Snowy Egret	1	0.001
Swainson's Hawk	2	0.002
Tree Swallow	1	0.001
Tundra Swan	172	0.168
Turkey Vulture	181	0.177
Western Meadowlark	994	0.970
White-tailed Kite	24	0.023
Yellow-rumped Warbler	1	0.001
Unidentified Gull spp.	25	0.024
Unidentified Duck spp.	183	0.179
Unidentified Waterfowl spp.	5	0.005
Unidentified Buteo spp.	64	0.062
Unidentified Sparrow spp.	3	0.003
Mixed Blackbirds	88780	86.674
Total Avian Species	**102430**	**100.000**

Two hundred sixty-six (266) observations were made of California threatened species and species of special concern. Northern Harriers (n=121) were the most observed California listed species of concern with 45% of all observations, followed by Loggerhead Shrike (n=76) with 28.5% and American White Pelican N=24) with 9%. One California threatened species was observed, White-tailed Kite (n=24) 9% and one fully protected species, Swainson's Hawk (n=2) constituting 0.007% . No federally listed endangered or threatened species were observed during the study period (Table 3).

Table 3. Number of Observations for California Threatened Species, California Species of Special Concern and Fully Protected Species at the Shiloh II Wind Power Project, CA

Species Name	Number of Observations	Listing Status
American White Pelican	24	CSC
Cooper's Hawk	1	CSC
Ferruginous Hawk	19	CSC
Golden Eagle	6	CSC*
Long-billed Curlew	145	CSC
Loggerhead Shrike	76	CSC
Merlin	2	CSC
Northern Harrier	121	CSC
Prairie Falcon	11	CSC
Swainson's Hawk	2	CA-Threatened
White-tailed Kite	24	Fully Protected
Total Listed Species	**266**	

*Golden Eagle is also protected under the Bald and Golden Eagle Protection Act.

Spatial Distribution of Species in the Shiloh Project Site. The relative number of each species observed during the standardized surveys at the various observation points are presented in Table 4. When the flocks of mixed black birds are removed and large numbers of a single species at four of the eight observation points are subtracted from the total observations recorded at each OP, avian activity was rather evenly dispersed across the proposed project site (Table 5). Most of the observations were registered at the OP Control Site (n=42,551), but 92% of these observations (n=38,966) were flocks of mixed species of Blackbirds. In addition, there was a high concentration of sightings of Rock Pigeons (n=2,440) which constituted 5% of all observations made at the Control OP and that number represented 98% of all rock pigeon sightings made during the course of the study. The other high concentrations of a single species at the other three OPs were recorded as follows: OP #2, Red-winged Blackbird, (n=1,249), 60% of the observations project wide; OP #3, Horned Lark (n=408), 33% of the observations of that species; and, OP #4, Savannah Sparrow (n=679).

There were other heavy concentrations of species and bird groups. All of the White-tailed Kite activity was observed at OP #2 (100%, n=24). Nearly every one (97.9%) of Long-billed Curlew observations (142 of 147) were made at OP #4. Ninety-four (94) per cent of the Tundra Swan observations were made at OP #2 (43%, n=74) and OP #5 (51%, n=87). Mallard observations were concentrated (94%) were made at OP #2 (59%, n=176) and OP #3 (35%, n=105).

As a group, waterfowl and water bird activity was observed ninety-nine (99) per cent of the time at the following OPs: #3 (33%, n=432); #2 (29%, n=388); #4 (23%, n=300); and, #5 (14%, n=179). Twenty-four American Pelican were observed from OP #1. The viewshed of each of these OPs included landscapes that featured either an extensive wetland or a large pond or were close to Suisun Marsh.

The highest amount of raptor activity was registered at OP #2, seventeen (17%) of all Red-tailed Hawk and 20% of all American Kestrel observations were recorded at this location. However, as these low percentages suggest, as a group the raptors were broadly distributed among the observation points ranging from a low of 7% and 9% at the control site and OP #3 to the high of 20% at OP #2. The other five sites were all within the 11% to 16% range. Observation point (OP #7) had 19 Swainson's Hawk observations (70%) The higher number of observations made at this site can be attributed to the close proximity of the Swainson's Hawk nest along Shiloh road. Golden Eagles were observed at five of eight observation points, except OP# 7. The six Golden Eagle observations were made at five different OPs. Single Golden Eagle observations were made at observation points 2, 4, 6, and 7 and two were made at OP# 5.

Table 4. Avian species observed by observation point at the Shiloh II Wind Power Project, CA

	Observation Point								
Species Name	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**C**	**Total**
American Crow					2				2
American Kestrel	14	44	26	36	42	15	30	11	218
American Pipit	60		20	19	46	70	29		244
American Robin					1				1
American White Pelican	24								24
Barn Swallow				1	1	1			3
Brewer's Blackbird	10	9	52	7	2	40		88	208

Species Name	Observation Point 1	2	3	4	5	6	7	C	Total
Canada Goose		107	230	66	92	3			498
Cattle Egret			10						10
Common Raven	77	25	30	107	39	43	98	29	448
Cooper's Hawk			1						1
European Starling	91	12	57	110	250	114	284		918
Ferruginous Hawk	2	5	2	2	2		6		19
Golden Eagle		1		1	2	1	1		6
Great Egret		2						1	3
Horned Lark	169	58	408	204	237	142	31		1249
House Finch	2			17		2	2	10	33
Killdeer	14	92	10	6	38	3	72	43	278
Loggerhead Shrike	5	12	1	12	6	8	12	20	76
Long-billed Curlew		1	1	142		1			145
Mallard		176	105	3		6	4	2	296
Merlin						2			2
Mourning Dove		23	2	29	23		6		83
Northern Flicker		3		1	9	1			14
Northern Harrier	4	9	20	20	19	31	9	9	121
Northern Mockingbird		2			1				3
Northern Shoveler		6							6
Prairie Falcon			7			2		2	11
Red-tailed Hawk	131	102	43	58	57	85	86	48	610
Red-winged Blackbird	48	1249	4		34	50	33	676	2094
Rock Pigeon	2		4	29	4			2440	2479
Savannah Sparrow	307	75	305	679	172	190	76	67	1871
Say's Phoebe	1		3	1	1	2	1	2	11
Scrub Jay								9	9
Snowy Egret				1					1
Swainson's Hawk				1	1				2
Tree Swallow					1				1
Tundra Swan		74		11	87				172
Turkey Vulture	41	28	26	12	11	4	21	38	181
Western Meadowlark	47	20	172	90	248	211	124	82	994
White-tailed Kite		24							24
Yellow-rumped Warbler		1							1
Unidentified Gull spp.					14	1	5	5	25
Unidentified Duck spp.		22	81	80					183
Unidentified Waterfowl spp.			5						5
Unidentified Buteo spp.	7	17	18	3	5	2	9	3	64
Unidentified Sparrow spp.		1				2			3
Mixed Blackbirds	13472	3270	8917	4762	830	12499	6064	38966	88780
Total Avian Species	14528	5470	10560	6510	2277	13531	7003	42551	**102430**

Avian Species by month at the Shiloh II Project Site. Table 5 displays the monthly observations of species made at the site of the proposed Shiloh II Wind Project during the period November 12, 2005 through March 24, 2006. In order to put these numbers in an annual context these data were compared to data collected during the months of November through March at adjacent sites over the last couple of years beginning in 2003. In Appendix 3, the monthly composition of avian species at the Shiloh Wind I and the High Winds Project sites are presented. These data are presented to put the number of observations made at Shiloh II in context. The nature of the data do not permit one to make specific projections of the number of observations to be made on an annual basis for selected species at the Shiloh II project site. However such an analysis of the data does permit us to conclude that with a few exceptions, that Shiloh II species diversity and abundance is similar to Shiloh 1.

Table 5. Avian Species Composition by Month at the Shiloh II Wind Power Project, CA

Species	Number of Observations	Number of OPs	November	December	January	February	March
American Crow	2	1		2			
American Kestrel	218	8	41	64	32	26	55
American Pipit	244	6	74	49	1	60	60
American Robin	1	1		1			
American White Pelican	24	1					24
Barn Swallow	3	3					3
Brewer's Blackbird	208	7	8	173	8	8	11
Canada Goose	498	5	200	126	113	16	43
Cattle Egret	10	1		10			
Common Raven	448	8	48	182	89	39	90
Cooper's Hawk	1	1	1				
European Starling	918	7	172	147	475	124	
Ferruginous Hawk	19	6	14	1	1	2	1
Golden Eagle	6	5	2				4
Great Egret	3	2					3
Horned Lark	1249	7	171	204	393	246	235
House Finch	33	5	2	19	10		2
Killdeer	278	8	48	117	85	10	18
Loggerhead Shrike	76	8	10	18	19	11	18
Long-billed Curlew	145	4	2			101	42
Mallard	296	6				98	198
Merlin	2	1		1	1		
Mourning Dove	83	5	20	15	24	4	20
Northern Flicker	14	4	1	3	4		6
Northern Harrier	121	8	15	19	21	32	34
Northern Mockingbird	3	2		1		2	
Northern Shoveler	6	1					6
Prairie Falcon	11	3	1	3	2	5	
Red-tailed Hawk	610	8	167	182	96	72	93
Red-winged Blackbird	2094	7	1046	775		208	65
Rock Pigeon	2479	5	579	966	484	296	154
Savannah Sparrow	1871	8	474	903	202	163	129
Say's Phoebe	11	7	4	2	1	2	2
Scrub Jay	9	1	2		1	2	4
Snowy Egret	1	1			1		
Swainson's Hawk	2	2					2

Species	Number of Observations	Number of OPs	November	December	January	February	March
Tree Swallow	1	1					1
Tundra Swan	172	3		121	47	4	
Turkey Vulture	181	8	56	41	6	21	57
Western Meadowlark	994	8	137	172	163	356	166
White-tailed Kite	24	1	7	8	5	2	2
Yellow-rumped Warbler	1	1			1		
Unidentified Gull spp.	25	4		13	5	7	
Unidentified Duck spp.	183	3			80	8	95
Unidentified Waterfowl spp.	5	1				5	
Unidentified Buteo spp.	64	8	30	15	6	6	7
Unidentified Sparrow	3	2	2			1	
Mixed Blackbirds	88780	8	30489	17474	20663	17020	3134
Grand Total	**102430**	8	33823	21827	23039	18957	4784

Between November 12, 2005 through March 24, 2006, two hundred –eighteen (218) American Kestrel observations were made. In that same period the 164 observations made at Shiloh one during the same set of months (November – March). This number was 48% of annual observations (n=340). We anticipate that the annual relative number of American Kestrel on Shiloh II will be close to those observed annually at Shiloh I. Six hundred-ten (610) Red-tailed Hawk observations were made on Shiloh II. The four month total of four hundred – eleven (411) Red-tail hawk observations registered at Shiloh I, was 60% of the annual number (n=689). We would expect that the annual range of observations for Red-tailed Hawk at Shiloh II to be less than at Shiloh I. It is also reasonable to expect that of the 24 White-tailed Kite observations made at Shiloh II during the four month period will be pretty close to what we might expect on a yearly basis. The White-tailed Kite observations made during the same months at the other three surveys were: eighty-one (81) of (91) annual observations (89%); sixteen (16) of (17) or 94% at HW 1; and 79 out of 128 or 79% at HW 2. The three full year observational data sets strongly indicate that these species observed in most of the CMHWRA were wintering in this area. For the Shiloh II project area we can expect the numbers of these species to also decline precipitously once the breeding season approaches as they have done on the adjacent areas.

For Northern Harriers, the 121 observations made could represent 100% of the expected annual observations for this site. The percentage of the annual count of Northern Harriers observed during this time frame on adjacent properties was 100% (Sh I), 48% (HW1), and 59% (HW2), respectively. Given the range of the species it would be more difficult to anticipate what the annual observations of Golden Eagle would be and whether the six (6) Golden Eagle observations made at Shiloh II would be fairly representative of the annual total. The 8 of “x” Shiloh II Golden Eagle observations compare to 9 of 30 (annual) Shiloh I Golden Eagle, 8 of 14 (annual) and 10 of 14 (annual) observations made each year (1 and 2) during the High Winds study. These two species have been observed throughout the year on these adjacent sites and we anticipate the same pattern to follow on this site.

Northern Harriers would not be expected during the breeding season because Montezuma Hills support very little potential marsh or seasonal wetland breeding habitat. White-tailed Kites would also not be expected during the breeding season, because there is very limited nesting habitat for this species; while Golden Eagles, Red-tailed Hawks, and Great-horned Owls will nest in eucalyptus trees, which is the most common tree type in this area.

While moving from one observation point to another wildlife observations are recorded but not included or analyzed with the data gathered in the standardized surveys (Table 6).

Table 6: Incidental observations made within the Shiloh II Wind Project

Species	Number of Observations
Burrowing Owl	4
Ferruginous Hawk	2
Golden Eagle	2
Great Horned Owl	1
Merlin	1
Swainson's Hawk	1
White-tailed Kite	51
Total	**2,001**

Raptor Flight Activities and Related Behavior(s)

The following avian flight and perching behaviors were recorded: types of flight activity and perching locations. Flight behaviors were categorized as: soaring and/or gliding; coursing/low hunting flight; kiting or hovering usually associated with hunting; flapping flight through the area; and, courtship or territorial behavior. Perching behavior was categorized by the location and/or type of the perching, such as: on the ground or rock outcrop; on a tree; a fence post; and a power line or pole.

Raptor Perching Observations. Perch behaviors were categorized by perch location/structure, such as the ground, a fence, tree, electrical wire, transmission tower, wind turbine, meteorological tower, sign post, or wood pile. A total of 503 raptor perching observations were recorded (Table 7). Of these, the most common perch structure of raptors observed were trees, which accounted for 33% (n=167) of all raptor perching observations. Other perch structures frequently used by raptors during surveys included: fences (27%); the ground (13%), poles (12%) and lattice tower structures (old Kenetech model turbines [n=18] and old farm type windmills [n=15]) (7%). All other perch structures, including guyed meteorological towers, wires, transmission towers and sign posts, almost 9% of all raptor perching observations. Red-tailed Hawks were observed perching more often than all other raptor species combined. Red-tailed Hawks perched in trees most frequently, comprising 67% (n=112) of all raptor perching observations on this type of perch structure, 34% of all Red-tailed Hawk perching observations, and 22% of all raptor perch observations. They perched on the ground (16% of all Red-tailed Hawk perching observations). These three perch sites accounted for (76%) of all Red-tailed Hawk perches and (50%) of all observed raptor perching. Trees were also the most common perch site for American Kestrels and 20 unidentified Buteo observations. Kestrels and Red-tailed Hawks accounted for (84%) of the perching on meteorological towers. Kestrel perching was also observed on fences, wire and poles. Red-tail Hawk and American Kestrel perching accounted for 84% of all raptor perching observations.

Table 7. Perching Behavior of Raptors at the Shiloh II Wind Power Project, CA

	Perch Structure										
Species	Ground	Fence	Tree	Pole	Wire	Transmission Tower	Wind Turbine*	Met Tower	Sign	Other**	Total
Golden Eagle		1	1								2
Red-tailed Hawk	53	88	112	41		3	16	6	2	12	333
Ferruginous Hawk	5	2									7
Unid.Buteo spp.	2	6	20	7	1	4	1	3			44
Prairie Falcon	1	4									5
Merlin		1									1
American Kestrel		19	34	8	14		1	10	1	3	90
Northern Harrier	2	2									4
White-tailed Kite		15		2							17
Grand Total	63	138	167	58	15	7	18	19	3	15	503

* Wind Turbine = enXco wind turbine

** Other = 14 perch observations on old (non-enXco) windmills and 1 on a barn roof (Red-tailed Hawk).

Flight Behaviors. Flight observations were categorized as: direct flight (uninterrupted directional flight across the viewing area), general flight (gliding, flapping, soaring); territorial flight (chasing, diving); and hunting flight (general hunting, diving, low/contour hunting, kiting, hovering, and slope soaring).

A total of 571 observations of raptor flight behaviors were recorded (Table 8). Of these, 67% were hunting flights (n=384), 32% were general flights (n=181), and 1% were territorial flights (n=6). Besides the large number of observations made of general hunting (n=224), a term to categorize hunting behaviors that did not fit into other more descriptive categories, the most common general flight behavior observed in raptors was soaring (n=124). This behavior was evident in 22% of all raptor flight behaviors observed. The most frequently observed soaring activity was by the Red-tailed Hawk, with 92 recorded soaring flights. These constituted 74% of the total 124 soaring flights recorded. The next most common flight behavior exhibited was low level hunting, constituting 16% of all recorded flights. All of these observations were made of Northern Harrier hunting activity. Kiting and Hovering constituted the next most frequently observed specific flight activities. Red-tailed Hawks (24) accounted for 63% of all of the kiting observations and American Kestrel accounted for (26%) of this hunting activity. Ninety-seven (97%) of observations of hovering (n=28) were of American Kestrel. Observations of Golden Eagle flight activity were de minimus.

Table 8. Flight Behavior of Raptors at the Shiloh II Wind Power Project, CA

	General Flights					Territorial	Hunting					
Species	Direct Flight	Glide	Soar	Dive	General Flight	Dive/ Chase	General Hunt	Low Hunt	Kite	Hover	Prey Capture	**Grand Total**
Golden Eagle			1		2		1					4
Red-tailed Hawk	1	1	92	9	24	2	122		24	1		276
Swainson's Hawk			2									2
Unidentified Buteo spp.			3		5		8		4			20
Ferruginous Hawk			5	1	1		5					12
Cooper's Hawk			1									1
Prairie Falcon					3		2				1	6
Merlin											1	1
American Kestrel			6	2	6	3	70		10	28		125
Northern Harrier			14	2		1	9	90			1	117
White-tailed Kite							7					7
Grand Total	1	1	124	14	41	6	224	90	38	29	3	571

Flight Height – Raptors. A common metric that is used to describe flight activity is the relationship of the flight to the ground and how it corresponds to the rotor swept area of the turbines were they to be in place at the points of observation. Estimates of this type of flight activity are made in four segments. The first is flight activity between ground level and less than 10 meters. If one imagines the rotor sweep area as the face of a clock this roughly corresponds to the lowest point of rotation of the rotors or the 6 o'clock position. The second segment is the area between 10 and 29 meters above the ground, the third area is from 30 to 100 meters, the spatial equivalency of the rotor sweep area if turbines were to be in place at that location. The fourth area is flight activity that occurs more than 100 meters off the ground. Twenty-nine (29) of the proposed turbines for this site will be on 65 meter towers and the rotor swept diameter will be 77 meters. This means that the lowest arc of the rotor swept area will be 26.5 meters above ground level (AGL) and the top of the arc is 103.5 meters. This means that the turbine blades on the 65 meter towers will penetrate 3.5 meters into the 1 –30 meter AGL zone and 3.5 meters into the 100 + meters AGL zone. On the other hand for the eighty-nine (89) meter towers the range of the rotor swept area will not begin until 41.5 meters AGL at the 6 o'clock position providing 136 feet of clearance from the bottom of the rotors to the ground. The top of the arc will be 388 feet above the ground but still 112 feet below 500 feet AGL.

Of the 4 Golden Eagles flights observed in the surveys, 75% (n=3of the time these birds were active in a zone 1-30 meters above ground and the balance of Golden Eagle flight activity 25%, occurred 100 meters or more (AGL; Table 9). The 126 Red-tailed Hawk flights were observed at the following AGL elevations: 53% of the time in the 1-9 meter zone; 31% in the 10-29 meter zone, (16%) in the 30 – 100 meter zone and, 0.7% above 100 meters. The Merlin flight and 7 White-tailed Kite flights were less than 10 meters AGL. Ninety-nine (99%) percent of American Kestrel, (86%) of Northern Harrier and (83%) of Ferruginous Hawk flights were in the 30 meter or less zone. The lone Cooper's Hawk and both of the Swainson's Hawk observed flights were between 30 – 100 meters, the rotor swept area equivalency.

Table 9. Flight Heights of Raptors observed at the Shiloh II Wind Power Project, CA

Raptor Species	Number of Flights Observed	% 0 to <10 m	% 10 to < 30 m	% 30 to 100 m	% > 100 m
Golden Eagle	4	75.0	0.0	0.0	25.0
Red-tailed Hawk	276	52.5	30.8	15.9	0.7
Ferruginous Hawk	12	41.7	41.7	16.7	0.0
Swainson's Hawk	2	0.0	0.0	100.0	0.0
Unidentified Buteo spp.	20	25.0	60.0	10.0	5.0
Cooper's Hawk	1	0.0	0.0	100.0	0.0
Prairie Falcon	6	83.3	16.7	0.0	0.0
Merlin	1	100.0	0.0	0.0	0.0
American Kestrel	125	82.4	16.8	0.8	0.0
Northern Harrier	117	86.3	6.8	6.0	0.9
White-tailed Kite	7	100.0	0.0	0.0	0.0
Total	**571**	65.7	23.1	10.3	0.9

Flight Height – Non Raptors. A total of 35,472 flights of 32 species were observed between November 12, 2005 and March 24, 2006. A preponderance of these flights were under 30 meters AGL (98%). Of those flights that did occur within the projected rotor swept area, five of the seven species involved were waterfowl/ waterbirds group. The species and number of flight observations made for each are as follows: American White Pelican, (n=24); Long-billed Curlew (n=43); Tundra Swan (n=168); Canada Goose (n=450) and, unidentified Duck spp. (n= 161).

There were multiple flights of non-raptor species that were observed completely below 30 meter AGL (Table 10). The species and numbers of flights observed include the following: American Pipit (n=121); Horned lark (n=767); Rock Pigeon (n=245); Savannah sparrow (n=624); Western Meadowlark (n=438); and Unidentified Blackbird spp. (n=30,827).

Table 10. Flight Heights of Non-Raptors observed at the Shiloh II Wind Power Project, CA

Non-Raptor Species	Number of Flights Observed	% 0 to <10 m	% 10 to < 30 m	% 30 to 100 m	% > 100 m
American Crow	2	0.0	100.0	0.0	0.0
American Pipit	121	100.0	0.0	0.0	0.0
American White Pelican	24	0.0	0.0	100.0	0.0
Barn Swallow	3	100.0	0.0	0.0	0.0
Brewer's Blackbird	31	96.8	3.2	0.0	0.0
Canada Goose	450	16.2	36.4	47.3	0.0
Common Raven	310	75.5	18.4	6.1	0.0
European Starling	815	90.1	9.9	0.0	0.0
Great Egret	2	100.0	0.0	0.0	0.0
Horned Lark	767	100.0	0.0	0.0	0.0
House Finch	2	100.0	0.0	0.0	0.0
Killdeer	73	75.3	24.7	0.0	0.0
Loggerhead Shrike	10	100.0	0.0	0.0	0.0
Long-billed Curlew	43	4.7	2.3	93.0	0.0
Mallard	17	41.2	58.8	0.0	0.0
Mourning Dove	70	100.0	0.0	0.0	0.0
Northern Flicker	9	100.0	0.0	0.0	0.0
Northern Mockingbird	1	100.0	0.0	0.0	0.0
Red-winged Blackbird	50	90.0	10.0	0.0	0.0
Rock Pigeon	245	96.3	3.7	0.0	0.0
Savannah Sparrow	624	99.7	0.3	0.0	0.0
Say's Phoebe	3	100.0	0.0	0.0	0.0
Scrub Jay	1	100.0	0.0	0.0	0.0
Snowy Egret	1	100.0	0.0	0.0	0.0
Tree Swallow	1	100.0	0.0	0.0	0.0
Tundra Swan	168	23.8	10.7	65.5	0.0
Turkey Vulture	177	29.4	44.6	18.6	7.3
Western Meadowlark	438	100.0	0.0	0.0	0.0
Unidentified Gull spp.	25	20.0	80.0	0.0	0.0
Unidentified Duck spp.	161	0.0	0.0	100.0	0.0
Unidentified Sparrow	1	100.0	0.0	0.0	0.0
Unidentified Blackbird spp.	30827	96.1	3.9	0.0	0.0
Grand Total	**35472**	93.5	4.7	1.7	0.0

Observations of Non-Avian Species. A total of 61 observations were made of non-avian and potential prey species (Table 11). Black-tailed Jackrabbit observations at Shiloh II were 5 whereas during the same months in each of the two years of the High Winds Study, the number of observations were 18 in year one and 38 in year two, respectively. The number of ground squirrel observations, on the other hand, were reversed between the High Winds and Shiloh II Surveys. Only one California Ground Squirrel was recorded between the months of November through the end March 2003-2004 and 2004-2005. From November, 2005 through March, 2006 there were 50 observations of California ground squirrel. Most of the ground squirrel observations were made at the Control site which is along Bird's Landing Road near the intersection of Montezuma Hills Road. Most of the ground squirrel activity is along fence lines and road edges. Many of the observations were made in transit between OPs since road edges and fence lines are not in the direct sight lines of the OPs.

Table 11. Non-Avian Species observed at the Shiloh II Wind Power Project, CA

Species Name	Number of Observations	Percentage Species Composition
Black-tailed Jackrabbit	5	8.197
California Ground Squirrel	50	81.967
Domestic Cat	5	8.197
Pacific Treefrog	1	1.639
Total Non-Avian Species	**61**	**100.000**

Comparison with Shiloh I and High Winds Abundance and Behavior Studies

Adjacent to the Shiloh Project is the newly operational Shiloh I wind project with 100 turbines and the 90 turbine High Winds project which has been in operation for two years. Curry and Kerlinger used similar protocols to determine abundance and behavior (use) for both of these areas beginning in August, 2000. The terrain and habitat at the High Winds site is generally similar to that both of the Shiloh sites (I and II). In preparation of this report, we used data collected from pre construction surveys from both the High Winds and Shiloh I projects and two years of post construction surveys from High Winds. Table 12 summarizes the number of observations per hour per species for the months of November through March in the respective years.

Table 12. Summary and Comparison of Number of Birds observed Per Hour during the Months of November through March during Pre-Construction Surveys conducted at the Shiloh II (2005 - 06) and Shiloh I (2004) Project Sites, and two years of Post-Construction Surveys at the High Winds Project Site (2003 - 05)

Species	**Shiloh II** **Pre-Construction** Nov 05 - Mar 06	**Shiloh I** **Pre-Construction** Jan - Mar, Nov – Dec 04	**High Winds Year1** **Post-Construction** Nov 03 - Mar 04	**High Winds Year2** **Post-Construction** Nov 04 - Mar 05	**Grand Total**
American Crow	0.019	0.308	0.063	0.156	0.546
American Kestrel	2.106	1.802	1.078	0.641	5.627
American Pipit	2.357	2.198	6.422	1.547	12.524
American Robin	0.010				0.010
American White Pelican	0.232	0.220	0.047		0.499
Barn Swallow	0.029		0.031	0.141	0.201

Species	Shiloh II Pre-Construction Nov 05 - Mar 06	Shiloh I Pre-Construction Jan - Mar, Nov – Dec 04	High Winds Year1 Post-Construction Nov 03 - Mar 04	High Winds Year2 Post-Construction Nov 04 - Mar 05	Grand Total
Brewer's Blackbird	2.010	2.912	4.438	0.109	9.469
Burrowing Owl		0.022	0.016		0.038
Canada Goose	4.812	0.033	1.141	0.313	6.298
Cattle Egret	0.097				0.097
Cliff Swallow		0.901		0.141	1.042
Common Raven	4.329	1.571	1.797	1.688	9.384
Cooper's Hawk	0.010				0.010
Dark-eyed Junco		0.154			0.154
European Starling	8.870		2.141	0.484	11.495
Ferruginous Hawk	0.184				0.184
Golden Eagle	0.058	0.154	0.125	0.156	0.493
Great Blue Heron			0.016		0.016
Great Egret	0.029				0.029
Horned Lark	12.068	2.725	0.719	0.891	16.402
House Finch	0.319				0.319
Killdeer	2.686	1.253	0.313	0.078	4.329
Loggerhead Shrike	0.734	0.857	0.250	0.109	1.951
Long-billed Curlew	1.401				1.401
Mallard	2.860	0.253	0.016	0.063	3.191
Merlin	0.019	0.011			0.030
Mourning Dove	0.802	0.154	0.188	0.016	1.159
Northern Flicker	0.135	0.165			0.300
Northern Harrier	1.169	1.176	0.438	0.297	3.079
Northern Mockingbird	0.029	0.011	0.016		0.056
Northern Shoveler	0.058				0.058
Osprey		0.011			0.011
Prairie Falcon	0.106	0.121			0.227
Red-shouldered Hawk		0.022			0.022
Red-tailed Hawk	5.894	4.516	4.906	1.234	16.551
Red-winged Blackbird	20.232	9.011	18.375	5.547	53.165
Ring-necked Pheasant		0.022			0.022
Rock Dove		0.462	2.094	2.266	4.821
Rock Pigeon	23.952				23.952
Rough-legged Hawk		0.033			0.033
Savannah Sparrow	18.077	0.220	0.313	0.109	18.719
Say's Phoebe	0.106	0.099		0.063	0.268
Scrub Jay	0.087				0.087
Snow Goose		1.099			1.099
Snowy Egret	0.010				0.010
Song Sparrow			0.656		0.656
Swainson's Hawk	0.019	0.066			0.085
Tree Swallow	0.010	0.110		0.375	0.495
Tundra Swan	1.662				1.662
Turkey Vulture	1.749	2.626	1.188	0.719	6.281
Western Meadowlark	9.604	2.802	1.672	1.016	15.094
White-tailed Kite	0.232	0.890	0.250	0.172	1.544
Yellow-rumped Warbler	0.010				0.010
Unidentified Hawk	0.618	0.011	0.375	0.031	1.036
Unidentified Gull	0.242	0.011	0.016	0.031	0.299

Species	Shiloh II Pre-Construction Nov 05 - Mar 06	Shiloh I Pre-Construction Jan - Mar, Nov – Dec 04	High Winds Year1 Post-Construction Nov 03 - Mar 04	High Winds Year2 Post-Construction Nov 04 - Mar 05	Grand Total
Unidentified Waterfowl	1.816		0.406		2.223
Unidentified Swallow				0.500	0.500
Unidentified Sparrow	0.029		0.016		0.045
Mixed Blackbirds	857.778	90.000	834.484	180.984	1963.247
Grand Total	989.662	129.011	884.000	199.875	2202.548

To compare abundance of species at the two sites during their respective 4 month periods, we transformed the data for each species into the numbers of birds observed per hour of observation. This provided a metric for each species that was comparable. By comparing the rate of observations per hour for each species, comparisons can be made to examine potential risk to each species. This is particularly useful when combined with empirically determined measures of risk (collision fatalities) at the High Winds site. The proximity of the survey points and the circles of observation are shown above in Figure 2.

There is a high degree of similarity of species composition within the four surveys covering three project areas (Table 12). Almost eighty-one percent (80.95) of the species seen at Shiloh II were observed in at least at one of the other surveys and nearly sixty-two percent (61.90%) of the species were observed in at least two of the other surveys. Species found at Shiloh II and not reported at the other sites in the standardized surveys include; American Robin; Cattle Egret; Cooper’s Hawk; Long-billed Curlew; Northern Shoveler; Scrub Jay; Snowy Egret; and, Tundra Swan.

The closer proximity to the Suisun Marsh could account for the additional diversity of waterbird and waterfowl species as well as the substantially increased numbers of Canada Goose and Mallard observations.

A greater percent of the land cover may be in grassland not subject to as much grazing in the Shiloh II project area which may account for the higher number of observations of grassland birds such as Horned Lark, Western Meadow Lark, Red-Winged Blackbird and Savannah Sparrow.

Golden Eagle Nesting

Golden Eagle nesting surveys were conducted to determine whether these birds were nesting within or adjacent to the Collinsville Montezuma Hills Wind Resource Area (CMHWRA) in Solano County, California. The study was also designed to determine how many nests were active and where those nests were located. Eagles have been found nesting within the CMHWRA in past years, although some nests were not active in all years. Surveys commenced February 2, 2005 and ended June 2, 2005.

Two active Golden Eagle nests/territories were determined to be present within the CMHWRA: the Callahan pair and the Emigh Road pair. The Callahan pair consisted of two adult eagles and the Emigh road pair consisted of two sub-adult eagles. Both pairs of eagles actively foraged within and adjacent to the CMHWRA. The Callahan pair was last observed occupying the nest on May 4 and the Emigh Road pair was last observed occupying the nest on May 13. From the time the nests were first considered to be active thirteen visits were made to observe each of the nests. Because of the low level of activity in the CMHWRA in comparison with the Altamont Pass area, foot searches at the base of each of the nesting locations was conducted.

The nests were concluded to be failures for the following reasons. 1) No chicks or juvenile birds were observed at or near the nests; 2) Golden Eagle activity on the nest ceased early in the nesting cycle; 3) eagles were absent in/around their nests; 4) songbirds actively moved in/around the eagle nest; and 5), fresh prey remains and whitewash underneath the nests were absent

Raptor Nesting

Raptor nesting surveys have been conducted periodically in the Collinsville Montezuma Hills Wind Resource area since 2001. The most recent survey was conducted in 2005, and is part of the *Post-Construction Avian and Bat Fatality Monitoring Study for the High Winds Wind Power Project (Kerlinger, P.et al, 2006)* and is excerpted below.

> *<u>2005 Nesting Study</u>. Six different species of raptors were observed in and/or adjacent to the project area (Table 38). A total of 26 raptor nests were designated confirmed, 10 as probable and 3 possible. The most common raptor species nesting were American Kestrels, followed by Red-tailed Hawks, and Great-Horned Owls. One California Threatened Species was observed nesting within the area surveyed, one pair of Swainson's Hawk. This pair successfully fledged one offspring. Figure 17 shows raptor nest locations observed in the vicinity of the High Winds Project.*
>
> *There appeared to be a decline in the number of raptors nesting within/adjacent to the project site when compared to the previous year's data, which had 66 confirmed, probable and possible nests. This could be attributed to the severe weather that occurred in the area in the second year spring. Many of the nests that were active in 2004 had been blown out of the trees in the spring of 2005. There were also fewer raptors observed during avian behavior and abundance surveys in the second year.*

Table 38. Number of Raptor Nesting Sites per Species Observed In and Adjacent to the High Winds Power Project, Solano County, CA. April 18 - June 27, 2005.

Species	*Confirmed**	*Probable***	*Possible****	*Grand Total*
American Kestrel	*12*	*6*	*2*	*20*
Golden Eagle	*2*			*2*
Great Horned Owl	*4*			*4*
Northern Harrier	*1*	*2*		*3*
Red-tailed Hawk	*6*	*1*	*1*	*8*
Swainson's Hawk	*1*	*1*		*2*
Grand Total	*26*	*10*	*3*	*39*

**Confirmed - Observed activity at a nest*
***Probable - Observed nesting or territorial behavior in an area*
****Possible - Observed adult pair using area*

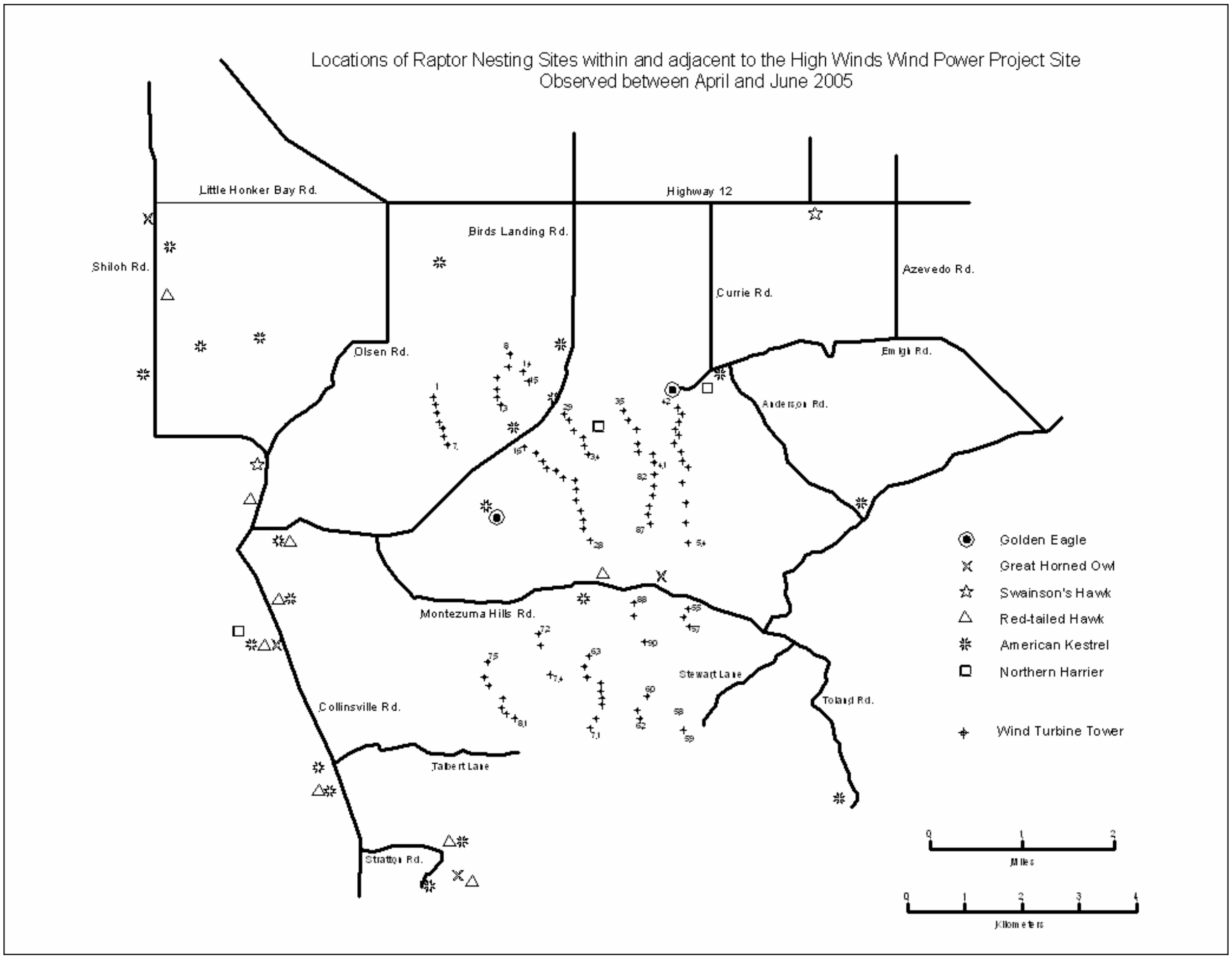
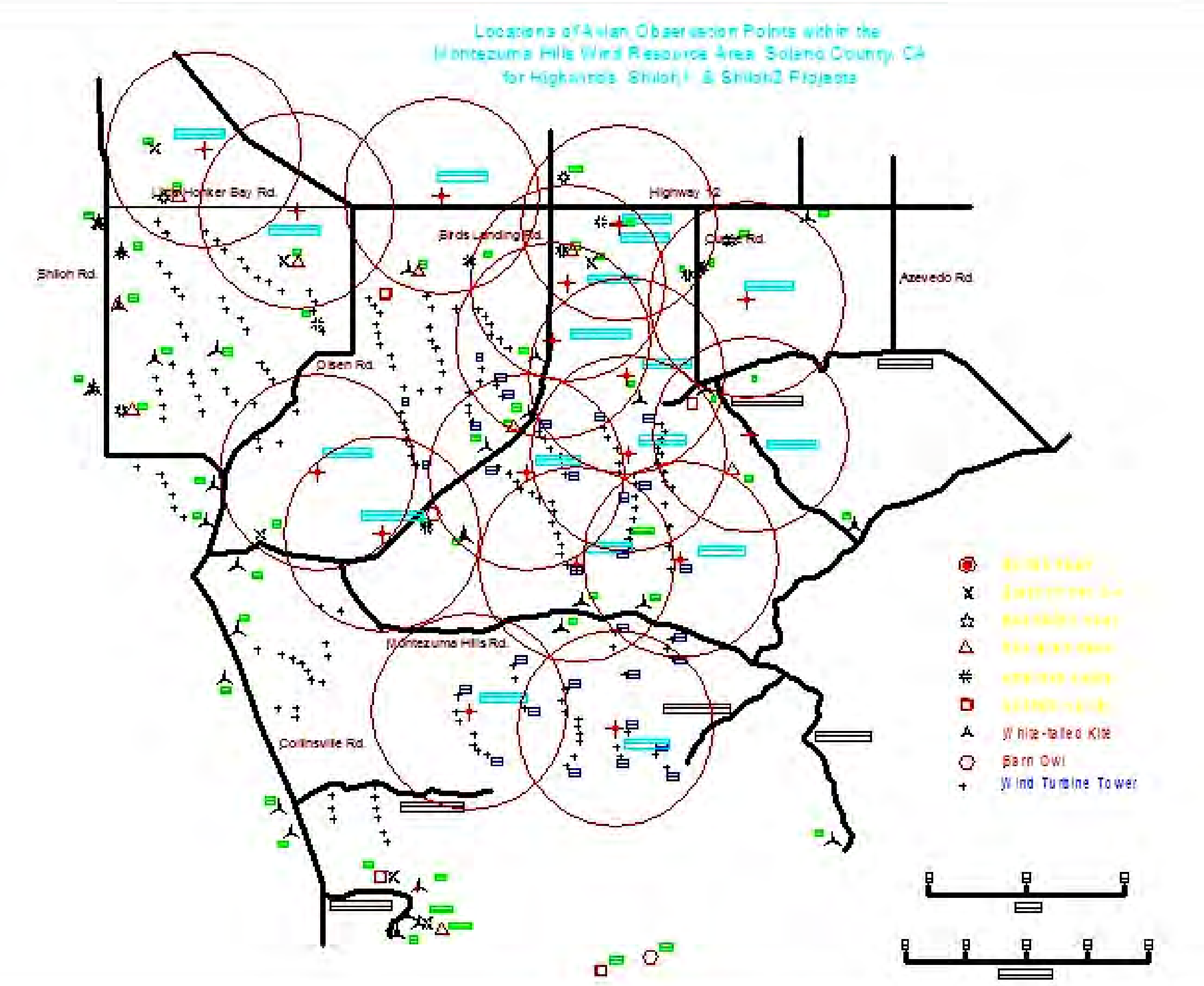


Figure 17. Map of 39 Raptor Nests observed in 2005 in the Vicinity of the High Winds Project

Figure 3 shows the proximity of the nesting sites to the approximate locations of the installed turbines in the High Winds and Shiloh I projects. The circles represent the viewing area of the observation points for the Shiloh II, Shiloh I and High Winds 1 and 2 Avian Abundance and Use Surveys.

Figure 3. Observation Points with High Winds and Shiloh I Wind Turbines and Raptor Nest Sites



DISCUSSION

Review of Avian Impacts and Risk Factors

Two types of negative impacts to birds have been documented at wind power projects:

- Habitat alteration and disturbance resulting from construction and the operation of wind turbines on the landscape may render an area unsuitable for some birds to nest, forage, rest, or use in other ways.
- Direct mortality has resulted from collisions with moving rotors and meteorology tower guy wires, as well as electrocution.

Each of these types of impacts and a discussion of their significance is reviewed below.

Habitat Alteration and Disturbance/Avoidance Impacts.

The presence of new infrastructure – primarily turbines and roads – has been studied at sites in both Europe and the United States to determine whether birds are permanently displaced from a particular area as a result of this new feature on the landscape.

<u>Construction impacts</u>. Habitat impacts include the disturbance resulting from wind plant construction, which is generally ephemeral. Construction activity rarely extends for more than a year and most human activity is reduced after several months of construction. This disturbance cannot be considered significant because after construction is completed, human presence, construction noise, and other activity associated with construction ceases or is greatly reduced. After construction, land use goes back to its previous state, with the exception of the presence of the turbines and maintenance crews. The Shiloh II Wind Project and the other projects in the CHWRA are located in an active agricultural area where the land is almost entirely tilled agriculture with a rotation of fallow and grazing activities.

<u>Operational Impacts</u>. The amount of habitat altered by a wind power project footprint is usually a very small percentage of the area at a particular site and after construction, land use at most sites continues as prior to construction. This impact to habitat from the infrastructure is not generally considered to be significant because the footprint is so small. However, the area impacted by the presence of tall structures with moving rotors is larger than the actual, on the ground, footprint. The impact can extend for many meters out from the turbine base, causing disturbance to nesting and foraging birds as well as displacement of these birds from the area surrounding a wind turbine.

Studies of disturbance type impacts on grassland and open field birds have been conducted in Minnesota, Wyoming and Iowa, as well as in several countries in Europe. A study done in conservation reserve program (CRP) grasslands in southwestern Minnesota at a large wind farm detected reduced nesting activity among Savannah Sparrows, Western Meadowlarks, and some other songbirds close to wind turbines as opposed to farther from those turbines (Leddy et al. 1999). These species were less numerous within 200 m of wind turbines than farther away. At the Foot Creek Rim Wind Power Project in Wyoming use of an area by nesting Mountain Plovers was shown to decline following construction of wind turbines and their productivity was apparently reduced (Johnson et al. 2000). Successful nesting of Mountain Plovers was at times, however, noted within 200 m of operating wind turbines.

A recent study of *Bird and Bat Behavior and Mortality at a Northern Iowa Windfarm, Jain, A, Iowa State University, 2005* that although within 0 to 30 meters of a turbine there was little avian activity, that beyond that there was little impact on avian activity at the site. The site referenced is the 89 turbine Top of Iowa Wind Farm near Joice, IA. Because this project site is near three large Wildlife Management Areas (WMA), there is great potential for bird activity. The study found neither a clear pattern of significant differences in avian activity between tower and non-tower sites within the project, nor a clear pattern of significant differences between wind farm sites and sites in an adjacent area approximately 2 miles to the southwest of the farm.

In Europe, studies have shown that some birds avoided the area immediately beneath wind turbines. Shorebirds may be the most sensitive species. For example, at a site in the Netherlands shorebirds (lapwing and curlew) avoided the area within 250-500 m of wind turbines (Winkelman 1990). In Denmark, some shorebirds (golden plover and lapwings) were displaced by up to 800 m by the presence of turbines (Pederson and Poulsen 1991). Reduced avian use near wind turbines by some waterfowl and songbirds has also been detected (Peterson and Nohr 1989, Winkelman 1990). A study of eiders and scoters at a site off the coast of Denmark demonstrated that these birds avoid flying within 200 m of wind turbines and did not forage within 100 to 200 m of them (Tulp et al. 1999). Other studies have shown that birds do habituate to turbines or are not disturbed by them (Ihde and Vauk-Henzelt 1999, Winkelman 1990). One such study from England reported that shorebirds (Purple Sandpiper and Sanderling), as well as gulls and seaducks (including eiders – see above), habituated to the presence of turbines mounted on a rock jetty at the edge of the ocean (in Lowther 2000). In Denmark, Pink-footed Geese generally will not forage within 100 m of wind turbines in agricultural fields, but closely related Barnacle Geese will feed up to about 25 m from the same turbines (Larsen and Madsen 2000). Pink-footed Geese are known to be particularly sensitive to disturbance and flush at much greater distances than most other species. This suggests that most waterfowl species are less sensitive and will forage closer to turbines than Pink-footed Geese.

From these studies it is clear that some species, including waterfowl and shorebirds, may be disturbed and displaced from small areas. However, because most impacts occur within 100 to 200 m of wind turbines, it is unlikely that waterfowl and other waterbirds that use the Suisun Marsh will be impacted in any way by the construction of wind turbines in the CMHWRA. The nearest proposed turbine location to Suisun Marsh will be .7 of a mile away.

Disturbance and displacement impacts are not always permanent. At wind power facilities in Colorado and the Altamont region of California several grassland bird species have habituated to wind turbines and do not seem to be significantly disturbed by them. At these grassland sites, Horned Larks, Western Meadowlarks, and Loggerhead Shrikes forage beneath the turbines and even perch on them (observations in the Altamont Pass Wind Resource Area by authors and others). Other birds, including Common Ravens and various species of raptors regularly perch on these same turbines. Some species (ravens and Barn Owls) nest inside the turbine nacelles or on the turbine work platform in the Altamont (Red-tailed Hawk, raven). The turbines in California have been operating for nearly 20 years, so birds seem to have habituated to the turbines, at least after several years. The Altamont turbines are also older model turbines and provide perching and nesting opportunities, unlike modern turbines.

<u>Displacement/Disturbance Risk at the Shiloh Wind Partners Power Project.</u> When the first wind turbines were introduced into the Collinsville Montezuma Hills Wind Resource Area concern was raised about waterfowl impacts. None of the expressed concerns materialized in terms of habitat impact or wind farm related fatalities to waterfowl and/or waterbirds. The Shiloh II project will be closer to the Suisun Marsh and the observations of waterfowl to date have been much greater in OPs 1 and 2 than those observed in the Shiloh I or any year of the High Winds surveys. There is clearly more activity on the western edge of the project area. However, in a study of a wind farm in northern Iowa, which is adjacent to three Wildlife Management Areas that there was no hesitancy of the waterfowl (predominately geese) to forage around and under

the turbines. Moreover, there were no recorded waterfowl fatalities and the birds were observed successfully avoiding the turbines as they continued to use the area among the turbines (Jain, 2005).

With respect to ground nesting species, it is important to keep in mind that the proposed wind farm site is in an active agricultural zone. At any given time, a substantial part of the site will be planted in wheat and/or barley, a portion of the land will remain fallow and the remaining segments will be in pasture. Fallow lands remain this way for only a few months before tilling and replanting, not allowing time for birds to nest successfully. These patterns of use are systematically rotated across most of the area under consideration for wind farm development. Thus, there is already significant disturbance to the landscape from agricultural operations. The wind turbines will not create significant new disturbance.

With respect to disturbance impacts to grassland portions of the Shiloh site (fallow and grazed grassland), the studies from southwestern Minnesota (Leddy et al. 1999) and the Ponnequin Site in Colorado are most instructive. The Leddy study shows that some grassland nesting species are disturbed and displaced from the immediate area surrounding turbines. The species that would be displaced would include small numbers of common grassland nesting species. Displacement from habitat appears to be a species-specific phenomenon. In the Ponnequin WRA six years after commencement of operations, Horned Larks and McCowns Longspurs have returned to nesting distances equivalent to those reported prior to installation of the turbines (personal communication Ron Ryder, 2003). The removal of cattle from one area of the Ponnequin Windplant has had the greatest impact in terms of habitat characteristic and related use. In the areas closest to the turbines where the grasses are shortest the horned larks and McCowns Longspurs remain. Away from the turbines where vegetation is higher, Chestnut-collared Longspurs are now dominant (personal communication Ron Ryder, 2003). The Colorado site has been surveyed annually since 1997 and these species are nesting in close proximity to the towers (personal communication R. Ryder).

With respect to the CMHWRA, there does not appear to be an across the board diminution of use as a result of the introduction of wind turbines based on observations made during the studies of the High Winds Project. The total number of birds observed per hour was approximately 2.5 times greater in the first year of the High Winds post-construction study than in the second year and the pre-construction study (Table 13). A single large mixed flock of blackbird species accounted for the great difference between the years, as the number of observations per hour of “Unidentified Non-Raptors” (which were 99.6% blackbird species) was 2.5 times greater in the post-construction first year than the pre-construction study. The numbers of several species of birds varied between the two study periods. However, there was no clear pattern of increase or decrease, by species. The Golden Eagle, Prairie Falcon, Rough-Legged Hawk were seen in greater numbers during preconstruction surveys, while Red-tailed Hawks, Northern Harriers and White-tailed Kites were seen in greater numbers post-construction. other species with notably different number of observations per hour between studies include the Canada Goose, American Pipit and European Starling, which were observed at a greater rate during the first year of post-construction surveys; and American Crow, Chipping Sparrow, Cliff Swallow, Long-billed Curlew, Horned Lark and Turkey Vulture, which all had notably larger rates of observation in pre-construction surveys than post-construction. When comparing two years of post-construction observations to the pre-construction observations, Red-tailed Hawks were 1.7 times more abundant per hour during the post-construction surveys, and the total numbers of avian observations recorded per hour were 1.7 times greater during the post-construction surveys. Essentially, no strong evidence for decrease of overall avian activity was seen in the first two years after construction. Additional years of surveying should provide a more clear picture, and will also allow for a more accurate assessment of trends by species. Given the proximity of the High Winds project to the Shiloh I and II project areas, and the similar range of species seen at both sites, we expect to see similar mixed trends in bird numbers by species. While some species may react negatively to the presence of turbines, others may well increase. The current data available cannot predict bird numbers in subsequent years, but post-construction surveys will paint a clearer picture.

Table 13. Comparison of the Number of each Species observed per hour during Avian Abundance and Behavior Surveys at the High Winds Project Site between One Year of Pre-Construction Study (Mid-August 2000- Mid-August 2001) and Two Years of the Post-Construction Study (August 2003-July 2005)

	Pre-Construction	Post-Construction		
	2000 - 2001	Year 1	Year 2	Both Years
Species Name	Number per Hour	Number per Hour	Number per Hour	Number per Hour
American Crow	0.61	0.11	0.20	0.16
American Goldfinch	0.05	0	0	0
American Kestrel	2.27	1.81	1.25	1.53
American Pipit	3.77	7.81	2.09	4.95
American Robin	0.02	0	0	0
American White Pelican	0.2	0.11	0.27	0.19
Anna's Hummingbird	0.01	0	0	0
Bank Swallow	0	0	0	0
Barn Swallow	0.89	1.11	1.41	1.26
Black Phoebe	0.02	0	0	0
Brewer's Blackbird	2.06	5.44	0.28	2.86
Burrowing Owl	0	0.02	0.03	0.02
California Quail	0	0	0	0
Canada Goose	0.22	1.17	0.31	0.74
Chipping Sparrow	0.22	0	0	0
Cinnamon Teal	0	0	0	0
Cliff Swallow	1.05	0.09	0.14	0.12
Common Raven	2.31	2.36	2.22	2.29
Cooper's Hawk	0	0	0	0
European Starling	0.39	2.41	0.53	1.47
Ferruginous Hawk	0.03	0.02	0.02	0.02
Golden Eagle	0.86	0.22	0.22	0.22
Golden-crowned Sparrow	0	0.08	0	0.04
Grasshopper Sparrow	0	0	0.03	0.02
Great Blue Heron	0	0.02	0	0.01
Great Egret	0.03	0.03	0	0.02
Horned Lark	8.29	2.25	2.08	2.16
House Finch	0.27	0.05	0.05	0.05
Killdeer	0.72	0.52	0.22	0.37
Lesser Yellowlegs	0.01	0	0	0
Loggerhead Shrike	0.43	0.5	0.28	0.39

Species Name	Pre-Construction 2000 - 2001 Number per Hour	Post-Construction Year 1 Number per Hour	Post-Construction Year 2 Number per Hour	Post-Construction Both Years Number per Hour
Long-billed Curlew	0.42	0	0	0
Mallard	0.05	0.05	0.11	0.08
Merlin	0	0.02	0	0.01
Mourning Dove	0.59	0.84	0.44	0.64
Northern Flicker	0.07	0	0	0
Northern Harrier	0.52	0.81	0.50	0.66
Northern Mockingbird	0.11	0.05	0.03	0.04
Northern Rough-winged Swallow	0	0.02	0	0.01
Nuttall's Woodpecker	0.01	0	0	0
Peacock	0.02	0	0	0
Prairie Falcon	0.03	0	0	0
Red-tailed Hawk	2.34	6.09	2.00	4.05
Red-winged Blackbird	2.37	55.19	11.19	33.19
Ring-necked Pheasant	0.04	0.02	0	0.01
Rock Dove	1.24	3.45	3.86	3.66
Rough-legged Hawk	0.29	0	0	0
Savannah Sparrow	0.05	0.34	0.11	0.23
Say's Phoebe	0.12	0	0.08	0.04
Scrub Jay	0.29	0	0	0
Short-eared Owl	0.01	0	0	0
Snowy Egret	0.03	0	0	0
Song Sparrow	0.07	0	0	0
Swainson's Hawk	0.01	0.02	0	0.01
Tree Swallow	0.04	0.2	0.44	0.32
Tri-colored Blackbird	0.05	0	0	0
Turkey Vulture	5.44	3.95	3.63	3.79
Unidentified Hawk	0.63	0.52	0.09	0.3
Unidentified Non-Raptor*	345.59	859.39	348.98	604.19
Violet-green Swallow	0.16	0.36	0	0.18
Western Kingbird	0.07	0.05	0.11	0.08
Western Meadowlark	3.6	3.06	1.70	2.38
Whimbrel	0.07	0	0	0
White-crowned Sparrow	0.14	0	0.02	0.01
White-tailed Kite	0.01	0.27	0.22	0.24
White-throated Swift	0	0.05	0	0.02
Willet	0	0	0	0
Yellow-billed Magpie	0	0.02	0	0.01
Yellow-rumped Warbler	0	0	0	0
Grand Total	389.23	960.86	385.13	672.99

* Unidentified Non-Raptors were predominantly blackbird species (99.6%)

Collision Fatality Impacts

Avian fatalities are the second type of impact noted at wind power facilities. These fatalities result primarily from collisions with rotors and with guy wires supporting meteorology towers. Electrocutions can also occur where transmission wires within the site are above ground, unlike modern facilities at which such transmission is below ground. Collision impacts have been studied or monitored systematically and intensively at about 15 different wind power project sites in more than a dozen states in the United States and a similar number of sites in Europe (Erickson et al. 2001). The number of fatalities involved at project sites has, generally, been small and population impacts have neither been established nor suspected.

To put collision fatality impacts into perspective, fatalities caused by wind turbines are orders of magnitude smaller than fatalities resulting from collision with transmission lines, windows, motor vehicles, and communication towers (Erickson et al. 2001), as well as non-collision fatalities related to cat predation, hay mowing, oil pits, fishery long lines (see Appendix III). Even livestock watering tanks are also a substantial source of fatalities (Dr. Ronald Ryder personal communication and personal observations of authors at the Ponnequin Wind Farm in Colorado) etc. Turbine collision fatalities are also orders of magnitude smaller than hunting harvests permitted by professional wildlife managers (data from U. S. Fish and Wildlife Service). The harvest of game birds in such great numbers occurs on a regular basis proceeds without biological impact on the populations of a broad range of game species. In comparison, the number of wind turbine related fatalities, especially when examined on a species specific basis is inconsequential in biological terms. A species specific list of fatalities recorded over a two year period at the adjacent High Winds shows that with few exceptions the fatalities on a per species basis are less than double digits (see Table 15 below) . For a general summary of fatalities documented at wind plants in the United States see Erickson et al. (2001).

<u>Abundance and Behavior (Use) as an Indicator of Risk.</u> Behavioral observations and abundance data, when taken together can also be used to assess fatality risk. The abundance and behavioral data being gathered in this study are generally accepted as a measure of “use” by birds and can, with some limitations, be used to assess risk. The method used for assessing risk in this report is to determine existing avian use on the site and compare the species and their behavior to sites with empirically demonstrated levels of risk. In addition, suspected and known risk factors were being examined. By comparing the avifauna on site and their behavior with that of sites with high risk and low risk, an overall assessment of risk to the various species can be made. In many instances, risk is examined at the species level, because risk is believed to be species, site and turbine specific (Anderson 1998).

<u>Abundance and Risk.</u> We compared the observations of all avian species observed in the months of November, December, January, February and March for Shiloh II with observations made in those same months albeit different years at the Shiloh I and the High Wind areas. As discussed above the Shiloh I and Shiloh II project sites are very comparable and for many species they are comparable to the High Winds project area.

With respect to raptors, American Kestrel and White-tailed Kite abundance appear to be comparable across the project areas. Golden Eagle abundance appears to be less than the other areas whereas their appear to be more Northern Harrier and Red-tailed Hawk in Shiloh II

We also compared the observations of raptors at Shiloh and two other wind plants. As Table 14 shows use of the Shiloh I project site by kestrels (small falcon category) and Northern Harriers is greater than the numbers reported from the Altamont and the Foote Creek Rim Project in Wyoming. Use by Red-tailed Hawks and other Buteos is less than the Altamont and the Golden Eagle density is substantially less than was recorded in the Altamont. The Shiloh II project as discussed above is very comparable to the Shiloh I project area and the adjacent High Winds area.

Table 14. Comparative use estimates for three Native Landscape Areas (estimated number observed per 20 minute survey)

Comparative Use (Raptors)				
		Wind Resource Area		
Raptor Group	**Season**	**Shiloh Project**	**Altamont Pass**	**Foote Creek Rim**
Buteos	Spring	0.46	0.636	0.253
Golden Eagle	Spring	0.06	0.438	0.301
Small Falcon	Spring	0.17	0.125	0.085
Northern Harrier	Spring	0.20	0.031	0.022

The recently completed post construction study at the High Winds Project provides empirical data on which we can build better assessments of risk. Orloff and Flannery (1992) noted that for raptors, with the exception of the Turkey Vulture, fatalities could not simply be explained by relative abundance. In the High Winds study (Kerlinger, et al, 2006), the avian species with the largest number of recorded fatality incidents (45), the American Kestrel, was observed 196 times. Whereas, the most abundant species, was the Red-winged Blackbird (counting only those who were observed and identified to species) who were observed 4,248 times. For this species, there were fourteen (14) recorded fatalities during the standardized post construction searches of High Winds project area, indicating this species is not as susceptible to turbine strike as the American Kestrel.

In fact there were fewer observations of Red-winged Blackbirds in the second year than the first, while fatalities of this species were six times greater in the second year. This species nests in wheat fields and was believed to be impacted by either wind turbine blades or harvesting equipment (precise cause of death was not clinically determined, thus when in question, they were recorded as collision incidents) more heavily in the second year because of possibly differences in nesting use of the project site.

Within the High Winds project area there was a marked difference in use for some of the raptor species between pre- and post-construction surveys as noted in Table 13 (in which the observations were recorded per hour). Red-tailed Hawks were 1.7 times more abundant (2.34 [pre] and 4.05 [post]) and White-tailed Kites were many times more abundant (0.01 [pre] to 0.24 [post]) in 2003-2004 compared to 2000-2001. Northern Harrier observations per hour were up just slightly from 0.52 per hour to 0.66. Simply comparing the number of fatalities for the species listed above between the Altamont and High Winds, the total incidents recorded in High Winds was less for following species (listed in Table 39): Red-tailed Hawk (213 Altamont – 18 High Winds); Golden Eagle (54 Altamont – 1 High Winds); American Kestrels (59 Altamont to 45 High Winds); and, Northern Harrier (3 Altamont – 0 High Winds).

To date, risk has not been demonstrated empirically to be related to avian use for all but a very few species. The probable reason is that species appear to differ greatly in their ability to take notice of and avoid colliding with wind turbines during the course of their flight activities. Carrion as the primary food source of vultures and the fact that the hunting activity is primarily locating a stationary food source perhaps accounts for the low fatality rates of vultures in comparison to other raptors who are pursuing live and moving targets. Perhaps the need for many avian species to be aware of potential predation by raptors requires a higher concentration and awareness of surroundings for birds that are prey as opposed to birds of prey.

The Top of Iowa wind project experiences high levels of Canada Geese coming into the fields in which the turbines are arrayed to feed with no fatalities reported in post construction fatality searches. (Jain, 2005).

Pre-construction Flight Patterns: Height and Flight Characteristics. A common metric is to chart the height above ground level of birds flying over the area proposed for development. With respect to using this metric as an indicator of risk, it is important to register the following caveat. The reader should be cautioned that there are limitations to this metric as a predictor of risk since it is very clear that birds avoid objects including wind turbines. Therefore, it is not reasonable to assume that the level of flight activity observed within the projected rotor sweep area will be the same once the turbines are in place and even more specifically when the turbines are operating.

The Kenetech Avian Task Force in the early 1990s photographically tracked different flight behaviors of homing pigeons flying on landscapes in the Altamont both with and without turbines. By using two cameras, they were able to track the bird flight in three dimensions thereby accurately determining where the bird was in space, especially in relation to distance from objects such as wind turbines. Homing pigeons were released in various parts of the Altamont wind plant under a variety of conditions and their flight behavior was recorded as they initiated flights back to their home lofts. Many flight tracks were recorded passing through the projected rotor sweep area over landscapes on which there were no turbines deployed. The birds were released around the turbines under the same set of conditions. Flight patterns recorded on landscapes where turbines were in place reflected the bird's recognition of the presence of objects (turbines) in the air space and exhibited avoidance flight behavior. Evidence of that behavior was even more pronounced when the turbines were operating. Avoidance was typically achieved by flying under or over the rotor swept area when passing through a turbine string. Many flight tracks recorded flight paths that completely avoided passing through the turbine strings by flying around either end of the string. In addition, the birds appeared to be able to distinguish between operating and non operating turbines. They were tracked flying through a turbine string of operating turbines only where one or more of the turbines were not operating.

The authors of the PIER sponsored study of the Altamont (Smallwood and Thelander, 2004, p326) were also clear in stating they observed what appeared to be avoidance behavior by Golden Eagles making an effort to fly under the rotor planes of wind turbines. The authors generally attributed this flight behavior to hunting activities. It was not clear whether the turbines were operational at the time of the observations.

Smallwood and Thelander (2004) also assert that Red-tail hawks and Kestrels recognize turbines as dangerous. They observed flight paths around turbine strings of these species similar to those of homing pigeons documented by the Kenetech Avian Task Force in the early 1990s and described above.

As stated earlier, a total of 35,472 flights of 32 species was observed between November 12, 2005 and March 24, 2006. A preponderance of these flights was under 30 meters AGL (98%). Of those flights that did occur within the projected rotor swept area, five of the seven species involved were waterfowl/ waterbirds group. The species and number of flight observations made for each are as follows: American White Pelican, (n=24); Long-billed Curlew (n=43); Tundra Swan (n=168); Canada Goose (n=450) and, unidentified Duck spp. (n= 161).

There were multiple flights of non-raptor species that were observed completely below 30 meter AGL. The species and numbers of flights observed include the following: American Popit (n=121); Horned lark (n=767); Rock Pigeon (n=245); Savannah sparrow (n=624); Western Meadowlark (n=438); and Unidentified Blackbird spp. (n=30,827).

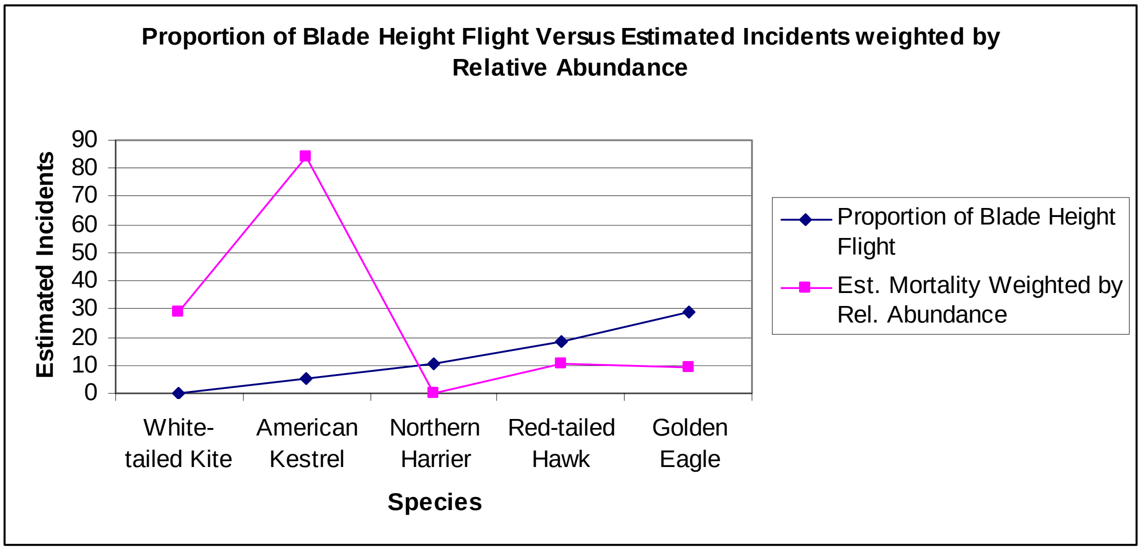
With respect to raptor species, of the 4 Golden Eagles flights observed in the surveys, 75% (n=3of the time these birds were active in a zone 1-30 meters above ground and the balance of Golden Eagle flight activity 25%, occurred 100 meters or more (AGL; Table 7). The 126 Red-tailed Hawk flights were observed at the following AGL elevations: 53% of the time in the 1-9 meter zone; 31% in the 10-29 meter zone, (16%) in the 30 – 100 meter zone and, 0.7% above 100 meters. The Merlin flight and 7 White-tailed Kite flights were less than 10 meters AGL. Ninety-nine (99%) percent of American Kestrel, (86%) of Northern Harrier and (83%) of Ferruginous Hawk flights were in the 30 meter or less zone. The lone Cooper’s Hawk and both of the Swainson’s Hawk observed flights were between 30 – 100 meters, the rotor swept area equivalency.

There may be some weak evidence to suggest a relationship between the proportion of observations (per species) at blade height vs. the estimated number of mortalities after weighting with the relative abundance of species.

We ran a simple ANOVA (SAS Institute Inc, 2001), regressing proportion of blade height versus (estimated mortality)/(relative abundance) for 5 species (White-tailed Kite, American Kestrel, Northern Harrier, Red-tailed Hawk and Golden Eagle. The remaining raptors had insufficient observed flight heights to test. The result of the F-test was ($df = 1$, $F = 7.88$, $p = 0.1069$)

We also arranged the raptor species in ascending order of proportion of flight at blade height, and plotted (estimated mortality/relative abundance) versus the proportion of flight at blade height versus Estimated mortality weighted by relative abundance to illustrate potential sources of this weak evidence. The graphs show that the American Kestrel and White-tailed Kite suffered mortality at rates higher than expected if flight height was the primary factor considered. However, Northern Harriers, Red-tailed Hawks and Golden Eagles seem to follow the expected pattern of greater amount of blade height flight and corresponding greater mortality.

Figure 4. Observations at Blade Height vs. Estimated Incidents



The absence of Northern Harrier from the list of recorded fatalities at High Winds is not unexpected given their hunting flight line which usually well below the 1-30 meter AGL zone.

<u>Distinguishing the Altamont Wind Resource Area and the Solano County Wind Resource Area.</u> The only wind resource area in the United States where risk to birds has even been suspected to be biologically significant is the Altamont Pass Wind Resource Area (APWRA) of California, where raptor fatalities have been reported for more than two decades. Golden Eagles, Red-tailed Hawks, American Kestrels, and some other species collide with turbines in varying numbers in the APWRA. Raptors are believed to be the most collision-susceptible group of birds (Anderson et al. 2000), although nowhere, including the APWRA have such fatalities been documented to have negative impacts on populations of individual raptors species. A long-term study of the Altamont Golden Eagle population by Hunt (2002) concluded that although fatalities of this species occur at a high rate, the population remains stable (no detectable decline). Large numbers of gulls, ravens, vultures, grassland songbirds, and other species fly among the APWRA turbines and rarely collide with the turbines. The situation with respect to raptor impact in the APWRA seems to be an anomaly, where raptors have shown a disproportionately higher risk than other species. Raptor fatalities have not been found to be extensive, however, at other wind plants. Raptors have shown a disproportionately higher risk than other species, based on studies in the APWRA. Specifically, studies at all wind power facilities outside of California, however, have yielded a small number of recorded raptor fatalities, indicating that the APWRA is an anomaly and that overall raptor fatalities are rare events at wind plants. Reported raptor fatalities in California were 488 most of them attributed to the APWRA whereas outside of California the number was 20 (Erickson, et al, 2001.

This information however, has not affected the steadily increasing amount of pre-construction site specific environmental assessments conducted on site at proposed wind projects regardless of the variety of local permitting requirements in place. These studies are not only important in providing information in the permitting process, they have contributed to better site selection and macro siting of turbines in new projects. With respect to the Shiloh project, information gathered in field observations made this year at the proposed development site have been used to make siting adjustments in turbine locations in order to preemptively mitigate avian risk.

Several factors based on the weight of evidence developed in numerous studies over the years are now believed to produce higher than industry average mortality in the APWRA. They are: project size (APWRA one of the world's largest concentrations of operating turbines (N=5,400, reduced from about 7,000 several years ago); project density (closely spaced turbines (<10 m [<30 feet] rotor to rotor distance) that may not permit birds to fly between them safely; prey base (a superabundant population of California ground squirrels (which attract the raptors); Raptor Use (the presence of very large numbers of foraging raptors throughout the year clearly related to the abundance of prey); Complex topography (steep topography with turbines placed in valleys and along steep valley/canyon edges where risk is greater); and, turbines mounted on lattice type towers and/or old style tubular towers (each type enhances perching by providing easily gripped surfaces and shade and cover from the sun and rain); and turbine rotors that revolve at high rotation rates (>40-72 rpm). These factors have been hypothesized to act alone or in concert (Howell and DiDonato 1991, Orloff and Flannery 1992, 1996, Curry and Kerlinger 2000), to produce mortality in the APWRA.

Number of Wind Turbines. The largest numbers of fatalities, especially raptors, at wind plants have generally been at plants with large numbers of wind turbines, although number of turbines alone does not seem to be highly correlated with risk. The APWRA is the best example of this with nearly 5,400 turbines and more documented fatalities than any other wind resource area. Small wind power plants, with fewer than a dozen turbines, have not reported more than a single fatality or two and many report no fatalities. Wind power plants in the mid-range size, more than a 100 to 1,000 turbines, generally report small numbers of fatalities. However, other wind power plants with thousands of turbines, such as those at Tehachapi and San Gorgonio wind resource areas in California, have not demonstrated significant risk to birds (see Erickson et al., 2001 and Erickson, et al., 2002). – The Shiloh II project will have about an order of magnitude fewer turbines than the APWRA. Even maximum build out of the CMHWRA is not expected to exceed 1,000 turbines. Currently a little over 800 turbines are operating in the CMHWRA and that number could increase over the next 2 years to over a 1000. However, with the repowering of the existing 600 older turbines and taking into account possible development of the rest of the WRA, that number will be reduced to about 575 total.[1]

[1] The cumulative impacts analysis for this project includes consideration of full build-out of the Collinsville/Montezuma Hills Wind Resource Area. The WRA currently includes 237 mega watts ("MW") of installed wind turbines or a total of 713 turbines. This Project proposes to add approximately 114 turbines or up to 1168 MW. In addition, by the end of 2006, FPL plans to add approximately 38 MW or 21 turbines and SMUD plans to construct an additional 85 MW or approximately 57 turbines. Over the next two years, therefore, this would result in a total of approximately 1011 turbines in the entire WRA.

EnXco however, also plans to "repower" or replace older, less efficient wind turbines with newer models. These repowering projects result in a net decrease in the number of turbines while still maintaining the same power production. In all, enXco plans to replace 690 existing turbines with 46 new 1.5 MW turbines. Once repowering is completed, these reductions would result in a total of approximately 450 turbines in the WRA.

The Collinsville-Montezuma Hills Wind Resource Area (WRA) consists of approximately 40,300 acres of area. The four (4) current projects that are built and the proposed Shiloh II consist of approximately 17,300 acres. With the proposed development for High Winds III and SMUD, and enXco Shiloh II, it adds another 8000 acres or a total of

To date there have been 90 (56-100 model) older technology turbines removed and replaced by 6 General Electric (GE) 1.5 MW turbines as part of the EnXco repowering program.

If fatality risk does become strongly correlated with numbers of turbines, then risk at the Shiloh II site even when the CMHWRA is fully developed, is anticipated to be less than significant based on the adjusted per turbine and per MW per year fatality rates that are being recorded in the wind resource area.

Spacing of Turbines. Modern wind turbines are larger and more widely spaced in the field than were older turbines. For example, where adjacent turbines were spaced at only 80 feet (24m) from tower leg to tower leg and about 30 feet (10 m) from rotor to rotor, risk is great and fatalities are high. Modern turbines in the 1+ megawatt size range are usually spaced at 700 feet or more. The wider spacing provides more room for birds to fly between turbines. Smallwood and Thelander document raptor behavior that suggests that Golden Eagles prefer to fly in less densely arrayed turbine areas in the Altamont but in the absence of repowering in the areas they studied, the spacing scales they observed between old turbine arrays in the Altamont and new turbine arrays in CMHWRA and elsewhere do not appear to be comparable. Observations of birds in the APWRA (Kerlinger and Curry 1999) show that raptors and other species that cross turbine rows at elevations below the top of the rotor swept area, come closer to rotors than birds that cross turbine strings that are more widely spaced (Kerlinger and Ryder, personal observations from Ponnequin Wind Energy Project in Colorado, Micon 750 turbines spaced at more than 500 feet [152 m]). The Shiloh turbines will be spaced at distances of at least 400 feet (122 m) thereby presenting lower risk to birds flying between them.

Tower/Turbine Height. The rotor swept area on the taller turbines extends higher than the older turbines. These taller turbines are beginning to approach the 500 feet, AGL. It is too early to determine whether this will increase risk to birds soaring at higher altitudes in the project area. Although no relationship between height and risk has been demonstrated for wind turbines per se, risk has been associated with height at communication towers (especially when coupled with the use of guy wires). Risk to night migrants appears to be one or more orders of magnitude greater for communication towers taller than 500 feet (152 m) than communication towers less than 500 feet. Moreover, communication towers have more extensive lighting and employ guy wires. These factors are important considerations in explaining why the studies at turbine facilities around the United States have demonstrated little risk to night migrants. Avian fatalities have seldom been demonstrated at communication towers in the height range of wind turbine (usually less than 350 feet [107 m]; (Kerlinger 2000, Crawford and Engstrom 2001, Trapp 1998,). This is probably because wind turbines do not reach into the normal height above ground level (AGL) used by nocturnal migrants.

25,300 acres. This represents 62% of the WRA. The Solano Land Trust controls approximately 3700 acres (9%) within this area.

An additional remaining 11,000 acres (27%) in the WRA could be developed in the future to maximize the wind potential of the WRA. The estimated potential output as determined by the maximum transmission capacity is approximately 850 MW. Correlating the 11,000 acres to be developed and assuming a turbine of a 1.5 MW size and additional 125 turbines would be added for a total of approximately 575 turbines in the WRA.

Most importantly, a majority of migrants fly between 300 and 2,500 feet (91-915 m) AGL (Kerlinger 1995, Kerlinger and Moore 1989), with small numbers flying above 5,000 feet (1,524 m) AGL. Except for landing and taking off, relatively fewer migrants fly below about 500-600 feet (152-183 m) AGL. Mean hourly altitudes usually exceed 1,200 to 1,500 feet (366-457 m) AGL. With most migrants flying higher than 300 feet above ground level, they are well above the turbine rotors and even higher above turbine lights (which are generally at about 65-80 m [213-262 feet on modern turbines]). The Shiloh turbines are not likely to pose a risk to night migrating birds.

With respect to birds that hunt flying low to the ground (coursing), such as Northern Harriers, and Golden Eagles, rotors tips that are near the 30 meter AGL in the 6 O'clock position present less risk than do the Kenetech KCS-56 turbines which have rotors that extend to only about 30 feet (10 m) above the ground when mounted on 60 foot (18 m) towers (the most common tower used). However, it appears that the space beneath the rotor swept areas of the new technology reduces the level of risk for species such as the Golden Eagle. Smallwood and Thelander appear to be confirming this in their 2004 study and in fact, recommend that the lowest point of the rotor swept area be around 30 meters AGL.

<u>Rotation Rate</u>. It has been hypothesized that with faster rotation rates and smaller turbine rotors, the rotor – mostly the tip – is less visible and, therefore, more risky to flying birds (Tucker 1996, Howell 1995). The older turbines, including the Kenetech KCS-56 machine, had small rotors (tip about a foot [0.3 m across] wide and 28 feet long) and rotated at about 72 rpm. Tip speeds on these turbines are approximately 212 miles per hour. The more modern turbines, such as those proposed for the Shiloh project, rotate at about 12-24 rpm (depending on turbine and gearing) and have a rotor that is nearly 3 feet (1 m) across at the tip and are approximately 37 meters long. Depending on the machine, rotor tip speed is generally lower than the older machines. The blades appear to be more visible because of the larger size. (Also see below for discussion on KVS-33 fatality rate.) However, this relationship has yet to be fully documented. Another result of slower rotation rate is longer rotors and a larger space between the rotors. The larger, pie-shaped area between the rotors may pose less risk than with shorter rotors that provide a smaller area through which to pass through the plane of operating turbine blades (see Tucker, 1996). – Shiloh turbines are likely to present less risk than older style turbines because of enhanced visibility of the larger blades and wider spaces within the plane of the rotor swept area.

<u>Tower Design and Perching</u>. Perching is an energy conserving opportunity for all birds and for raptors a perch is also a platform from which to hunt. A total of 503 raptor perching observations were recorded (Table 7). Of these, the most common perch structure of raptors observed were trees, which accounted for 33% (n=167) of all raptor perching observations. Other perch structures frequently used by raptors during surveys included: fences (27%); the ground (13%), poles (12%) and lattice tower structures (old Kenetech model turbines [n=18] and old farm type windmills [n=15]) (7%). All other perch structures, including guyed meteorological towers, wires, transmission towers and sign posts, accounted for almost 9% of all raptor perching observations. Red-tailed Hawks were observed perching more often than all other raptor species combined. Seventy-six percent (76%) of all Red-tailed Hawks perching occurred in trees, fences and on the ground Trees were also the most common perch site for American Kestrels and 20 unidentified Buteo observations. Kestrels and Red-tailed Hawks

accounted for (84%) of the perching on meteorological towers. Kestrel perching was also observed on fences, wire and poles. Red-tail Hawk and American Kestrel perching accounted for 84% of all raptor perching observations.

Older turbines mounted on horizontal lattice type towers provide ideal situations for perching by raptors and other birds. Those towers are hypothesized to present a greater risk to birds than the tubular towers, as proposed for this project, for two reasons. First, birds attempting to perch or take off from operating turbines are at risk of collision. Second, birds that perch on turbines, even when they are not operating, habituate to being in close proximity to turbines. If birds become comfortable near turbines, they are more likely to collide with them than if they are not habituated to the turbines. Kenetech KCS-56 turbines on lattice towers have been demonstrated to be favored perch sites as well as presenting greater risk of collision than other turbines (Orloff and Flannery 1992, 1996). Thelander and Rugge (2000) did not find the same relationship, but they frequently pooled data from unrelated species (raptors and non raptors) rather than conducting the analyses at the species or species group level. Small sample sizes may have made such analyses impractical.

Although the level of risk associated with perching on a wind turbine has yet to be determined, it is clear that raptors, especially red-tailed hawk and kestrel will perch on turbines, if the opportunity is provided. The perching platform of choice in the APWRA is the lattice type tower on which most of the turbines are installed. In addition, the older model tubular towers with good perching locations such as partial ladders, railings and other external features not found on modern turbines and towers being installed today are a powerful attractant in the APWRA. The older tubular towers deployed in the Altamont are not comparable to the modern turbine designs currently used by the industry in new projects. Turbine towers with readily accessible perch sites afford the raptors three important elements: an opportunity to rest; a hunting platform (generally accessible only by flying through the plane of the rotor swept area); and, not insignificantly, a vehicle for becoming habituated to and therefore becoming more comfortable and possibly careless around the turbines.

Shiloh turbines are not expected to provide perching opportunities and, therefore, they will be expected to pose little or no risk that will be attributable to perching on turbines at this project site.

<u>Topography</u>. Kenetech KCS-56 turbines in the APWRA that are situated at the end of turbine strings/rows, especially on steep hills, and turbines situated in dips and canyon bottoms experience risk that is double that of turbines not situated in these locations (Kerlinger and Curry 1999, Orloff and Flannery 1992, 1996). Howell and DiDonato (1991) did not find a relationship between fatality rate and position of a turbine in a row in the APWRA, but they did find a relationship between fatalities and topographic conditions in the APWRA. The Alameda County EIR/Biological Resource Management Plan (Alameda County Community Development Agency 1998) for the repowering in the APWRA includes an entire section on avoidance of high risk topographic sites, based on a fatality analysis of more than 12 years of data from 3,400 existing turbines (Curry & Kerlinger, 1998 report to the FWS). A similar conclusion was reached for a site in Wyoming, where potential risk to soaring raptors was believed to occur along a steep escarpment on which wind turbines were situated (Strickland et al. 2000). In pre

development surveys, raptors were observed soaring along the face of this escarpment/ridge, so turbines were set back from the edge to reduce potential risk. To date, the numbers of raptor fatalities at this installation has been demonstrated to be minimal (Appendix III), despite high use of the area by these species. The CMHWRA has more gentle topography than the APWRA , though there is some steep terrain. The Shiloh II wind site has the most gentle topography in the CMHWRA. In addition, the proposed turbines will not be located on steep hillsides or through valleys, so risk is expected to be low. Micro siting decisions regarding turbine locations for both the High Winds project and the Shiloh project utilize data upon which the Alameda and Contra Costa siting guidelines were based.

<u>Tower Lighting</u>. Because collisions of night migrating birds with communication towers have been linked to lighting of those towers, presence and type of lighting is a risk factor on towers. Avery et al. (1980) and others (U.S. Fish & Wildlife Service 2000) have reviewed and made recommendations regarding the relationship between lighting and collisions of nocturnally migrating birds, although there is no consensus about this recommendation among the scientific community. Suggested guidelines proposed by the U.S. Fish & Wildlife Service include white strobes at night (as opposed to red incandescent lights), but there is little to support this recommendation (also see Appendix II).

For both bats and birds, there is no evidence that FAA lighting in the form of L-864 and L-810 flashing red lights attracted birds to towers and that the presence of those lights cause large scale fatality events at wind turbines.

Kerlinger (2004a, 2004b) has recently demonstrated that flashing red, strobe-like lights (L-864) of the type recommended by FAA and used most often on wind turbines do not appear to attract night migrants like the combination of the same lights in combination with L-810 steady burning red lights. These results continue to suggest that wind turbines in the western United States, like communication towers, do not appear to kill large or significant numbers of night migrants. . Determining the exact number of night migrants is difficult, however, as the birds involved may be residents breeders. However, Erickson 2001 attempts to summarize the range of night migrant incidents noted at several wind farm sites in the US.

In the High Winds study (Kerlinger, et al 2006) an examination of the numbers of night migrating bird (songbirds, rails, common moorhen, and coots) and bat fatalities at turbines with FAA lights vs. turbines without such lights did not reveal a significant difference. Of the 31 night migrating birds (22 songbirds and 9 other birds), 32.25% were found dead at turbines with either L-864 or L-810 flashing red lights as opposed to 67.75% being found at turbines that did not have FAA lights. These percentages are roughly equal to the representation of the percentage of towers with and without FAA lights (28.9% had FAA lights and 71.1% did not have lights). A chi-square test revealed that there was not a significant deviation from the expected number of fatalities at lit turbines as opposed to unlit turbines ($\chi^2 = 0.181, df = 1$, $P>0.10$, ns). If the red flashing lights attracted birds to turbines, a disproportionately greater number of these fatalities would have been found at turbines with lights, which was not the case.

A similar examination of the numbers of bat fatalities at turbines with FAA lights vs. turbines without such lights reveals a similar relation. Of all bats found dead, 32.2% were found at turbines with FAA lights and 67.8% were found at turbines without such lights. These proportions do not deviate significantly from those expected if bats collided with towers randomly and irrespective of whether FAA lights were present ($\chi^2 = 0.674$, $df = 1$, P>0.10, ns).

For both bats and birds, there is no evidence that FAA lighting in the form of L-864 and L-810 flashing red lights attracted birds to towers and that the presence of those lights cause large scale fatality events at wind turbines. We do not expect the tower lighting design for the wind turbines to pose a risk to birds.

Avian Fatalities in the CMHWRA. A two year post construction study has been completed at the adjacent High Winds project(Kerlinger, et al, 2006). A total of 163 avian incidents were recorded by searchers during standardized surveys, representing 35 species (including one unidentified species of *Empidonax* flycatcher which was considered a separate species) and 10 unidentified birds (4 of these were songbirds not identified to species, 6 were bird remains not identifiable to a taxonomic group; (Table 15). Of the 35 species, 7 were raptor species including American Kestrel, Red-tailed Hawk, Ferruginous Hawk, Rough-legged Hawk, White-tailed Kite, Golden Eagle, and Barn Owl. Owls were included as “raptors” in our analyses because they are predatory birds in behavior, and therefore may be vulnerable to turbine strikes similarly to hawks and other raptor species. There were a total of 71 raptor incidents found during this two year study. There were 60 incidents of songbirds identified to 17 different species plus unidentified species (3 warblers, 1 blackbird). Other avian species found included a mixed group of vultures, pheasants, doves, rails, flickers, swifts and one cormorant, comprising 11 species and 22 incidents.

Of all 163 (excluding 20 incidental finds) avian incidents registered, 31 were night migrating birds representing species, including 19 passerines (12 species; 1 individual found incidentally), and 11 non-passerines (rails, moorhen, coot and Northern Flicker. Eight specimens were European Starlings and Rock Doves, neither of which is a protected species. In other words, 16.9% of all carcasses located at the High Winds project were night migrants and only 9.4% were night migrating passerines.

Table 15. Number of Incidents per Species per Year and per Total Installed Megawatt Capacity at the *Montezuma Hills WRA* High Winds Company, August 2003 – July 2005, found during Standardized Surveys (Incidental finds are noted separately)

Species Name	YEAR ONE Ave. 86.3 Turbines	YEAR TWO Ave. 89.6 Turbines	Total	# Incidents per Mw/Year	# Incidents per Turbine/Year	Incidental **
Birds (163)						
American Kestrel	29	16	45	0.1422	0.25591	7
Red-tailed Hawk *	10	8	18	0.0569	0.10237	2
White-tailed Kite	2	1	3	0.0095	0.01706	
Ferruginous Hawk ***	1		1	0.0032	0.00569	
Rough-legged Hawk		1	1	0.0032	0.00569	
Golden Eagle ***	1		1	0.0032	0.00569	1
Turkey Vulture	1	1	2	0.0063	0.01137	2
Double-crested Cormorant	1		1	0.0032	0.00569	
Ring-necked Pheasant	2		2	0.0063	0.01137	1
Canada Goose*						1

Snow Goose*						1
Mallard						1
Common Moorhen	1		1	0.0032	0.00569	
American Coot	1	1	2	0.0063	0.01137	1
Virginia Rail	1	2	3	0.0095	0.01706	
Sora	1	2	3	0.0095	0.01706	
Mourning Dove	2		2	0.0063	0.01137	
Rock Dove		2	2	0.0063	0.01137	
Barn Owl *		2	2	0.0063	0.01137	2
White-throated Swift	2		2	0.0063	0.01137	
Northern Flicker	1	1	2	0.0063	0.01137	
Western Wood-Pewee	1		1	0.0032	0.00569	
Empidonax species	1		1	0.0032	0.00569	
Warbling Vireo	1	1	2	0.0063	0.01137	
Horned Lark	10	7	17	0.0537	0.09668	
Tree Swallow		1	1	0.0032	0.00569	
Ruby-crowned Kinglet	2		2	0.0063	0.01137	
European Starling	4	2	6	0.0190	0.03412	
American Pipit		2	2	0.0063	0.01137	
Orange-crowned Warbler	1		1	0.0032	0.00569	
Yellow Warbler ***	1	1	2	0.0063	0.01137	
Townsend's Warbler	2	1	3	0.0095	0.01706	
Wilson's Warbler		1	1	0.0032	0.00569	
Common Yellowthroat ***	1		1	0.0032	0.00569	1
Unidentified Warbler	2	1	3	0.0095	0.01706	
Lincoln's Sparrow	1		1	0.0032	0.00569	
Western Meadowlark	2	1	3	0.0095	0.01706	
Red-winged Blackbird	2	12	14	0.0442	0.07962	
Brewer's Blackbird	2		2	0.0063	0.01137	
Unidentified Blackbird	1		1	0.0032	0.00569	
Unidentified Bird	6		6	0.0190	0.03412	
Total Birds	96	67	163	0.5167	0.9301	20
Bats (116)						
Hoary Bat	45	17	62	0.1959	0.35259	1
Mexican Free-tailed Bat	22	26	48	0.1517	0.27298	1
Western Red Bat	3	1	4	0.0126	0.02275	
Silver-haired Bat		2	2	0.0063	0.01137	
Total Bats	70	46	116	0.3679	0.6623	2
Grand Total	166	113	279	0.8815	1.58667	22

The average number of wind turbines searched per year is given under the date ranges. A total installed megawatt capacity of 158.3 MW was calculated by multiplying individual turbine MW of 1.8 by the average number of wind turbine towers surveyed throughout the two year survey of 87.92

*One or more of the individuals of this species was found on "SITE" and was not associated with a wind turbine tower

**Number of individuals found incidentally and not during standardized surveys. NOT included in the Total for that species

***Denotes California Species of Special Concern (CSC)

It is recognized that the number of carcasses found under the towers is lower than the total number of birds and bats likely to have been killed. There are at least two factors that need to be accounted for. The first is the possibility that the searchers will miss carcasses due to the amount of ground cover or the size and coloration of the species making it difficult to spot them. A second possibility is that the carcasses are removed prior to the time the searchers arrive on location after the collision event occurred. A preliminary scavenger removal and searcher efficiency study has estimated the proportion of carcasses missed by the searchers and the proportion removed by scavengers within the 14 day search cycle.

Tables 16 and 17 are estimates of the number of bird and bat fatalities attributed to collisions with the wind turbines at the High Winds project in each of the two years of the study. They reflect search and scavenge rates for the number of birds/bats found during searches and the subsequent estimate adjustment made using the formula described in the Methods section above.

Table 16. First Year Estimates for Bird and Bat Collision Mortality under 90 Towers of the Solano County High Winds Project (without 22 incidents reported in Appendix E), Corrected for Searcher Efficiency and Scavenger Removal Rate

		Birds				
Year 1	**Correction Factors**	**Small**	**Medium**	**Large**	**Bats**	**Total Carcasses**
	# Found	47	33	15	70	165
	Search Efficiency	50%	100%	100%	50%	
	% Not Scavenged	60%	70%	43%	38%	
	Adjusted Total	**157 (± 16 95% CI)**	**47 (± 1 95% CI)**	**35 (± 3 95% CI)**	**373 (± 47 95% CI)**	612

Table 17. Second Year Estimates for Bird and Bat Collision Mortality under 90 Towers of the Solano County High Winds Project (without 22 incidents reported in Appendix E), corrected for Searcher Efficiency and Scavenger Removal Rate

		Birds				
Year 2	**Correction Factors**	**Small**	**Medium**	**Large**	**Bats**	**Total Carcasses**
	# Found	35	19	14	46	114
	Search Efficiency	50%	100%	100%	50%	
	% Not Scavenged	60%	70%	43%	38%	
	Adjusted Total	**117 (± 12 95% CI)**	**27 (± 1 95% CI)**	**33 (± 3 95% CI)**	**245 (± 31 95% CI)**	422

By dividing the estimated number of birds/bats by the number of turbines searched in each year, a rate of kills/turbine can be calculated, allowing comparisons between wind farms of different sizes (different numbers of towers). The estimates are as follows: 2.92 birds/turbine and 4.52 bats/turbine in the first year, and 1.98 birds/turbine and 2.73 bats/turbine were estimated killed in the second year. The average rate over the two years is 2.45 birds/turbine/year and 3.63 bats/turbine/year. Erickson et al. (2001) described several avian mortality studies with estimated incidents ranging from 0 birds/turbine to 2.83 birds/turbine. However, a more recent study in Minnesota (Johnson et al. 2002) noted a mortality incident rate as high as 4.5 birds/turbine. In comparison, the High Winds Wind Power Project does not differ greatly in mortality, with other studied wind power projects. The range of bat mortality as studied at wind projects across the US, is much greater, from 0.07 bats/tower to 10 bats/tower (Erickson 2002). However, one study (Kerns and Kerlinger 2004) reported 47.5 bats/tower/year, an exceptionally high case of incidents. The High Winds Wind Power Project comes in at the lower part of the range described by Erickson 2002. Finally, when calculated as birds per Megawatt instead of per turbine, the numbers are as follows: 1.62 birds/Mw and 2.51 bats/Mw in the first year, and 1.10 birds/Mw and 1.52 bats/Mw were estimated killed in the second year. The average rate over the two years is 1.36 birds/Mw/year and 2.02 bats/Mw/year.

<u>Assessing the biological significance of turbine related fatalities.</u> Avian fatalities resulting from collisions, whatever the circumstances, under which they occur do not in and of themselves constitute a significant impact. Birds collide with many types of objects some of which are referenced in Appendix III. Fatalities attributable to collision with turbines during the operation of wind plants generally and this project specifically are no exception. The question of biological significance under CEQA turns on whether the project will have a substantial adverse effect on any special status species or will interfere substantially with the movement of any migratory species. The main way of determining "adverse effect on a species" is to estimate how many project-induced fatalities can a given population sustain and still remain viable. To make that determination, it is necessary to establish a threshold at which a local regional or national population will be effected by the number of fatalities sustained from a given activity and/or the total of various activities. For example, wildlife agencies at the national and state level who have a trust responsibility to maintain healthy populations of various species terrestrial, aquatic and avian establish these thresholds whenever they issue bag limits for hunting, predation permits for public health and safety reasons and falconry permits for educational and sport purposes. Similarly these trust agencies have the responsibility to establish population levels that must be maintained to assure the continuation of any given species. When those floors are approached species are designated for extra protection and an effort is made to examine all the potential sources of adverse impacts on the species such as destruction of habitat by development, diminishment of their food supply and fatality by collision with structures or some other direct action that causes fatalities to occur.

In order to provide data for making assessments of significance regarding this specific project in the context of the Collinsville Montezuma Hills Wind Resource Area we looked at several sources of data, including source materials from the California Department of Fish and Game website, and the Christmas Bird Count (CBC) data from the last 10 years at the nearest reporting location, Benecia, CA.. We also looked at bag limits for hunting, and take limits for predation permits. We have tabulated some of that information in Table 19 for ready reference.

In Table 18, we present a species by species estimate of the range of fatalities that have been associated with the operation of the High Winds Project. Because of the similarity of the habitat, the size of the project, generally comparable species composition and use behaviors and close proximity of the projects, we feel comfortable using the fatality data from High Winds to assess the level of risk that can be associated with the development and operation of the Shiloh II project within the context of the CMHWRA.

First, we looked at raptors which as a group tend to be more prone to sustaining fatalities at wind plants than their relative abundance at wind projects might suggest. The raptor species that have sustained fatal injuries believed to be a result of collision with wind turbines on the High Wind project from August 2003 through July 2005 include American Kestrel, Red-tailed Hawk, White-tailed Kite, Ferruginous Hawk, Rough-legged Hawk, Golden Eagle. The Turkey Vulture which we do not generally classify as a raptor due to behavioral differences in hunting is nevertheless grouped with the other species in this discussion.

American Kestrel and Red-tailed Hawk are common residents and breeders throughout the State of California. Earlier studies in the CMHWRA document general migratory activity of these two species moving into the project area in the fall and departing in early spring. The population of these two species is both local and regional. The adjusted number of fatalities for American Kestrel were 42 and 23 in years one and two respectively. To put these annual projected totals into perspective we cite an authorized take of 54 killed via depredation permit on San Clemente Island in 1999. Red-tailed Hawk projected fatalities were 23 and 19 for the two year period. In the same program in 1999, 27 Red-tailed hawks were taken via depredation permit on San Clemente Island. This level of take was presumably based on the local island population of these two species. The winter density of these two species according to Christmas Bird Count (CBC) 1996-2005 Benicia, CA. National Audubon Society, is 0.81 and 1.33 birds/square mile respectively. Therefore, given that an undetermined part of the American Kestrel and Red-tailed Hawk population in the CMHWRA are migrants, the adjusted estimate of fatalities should not be considered significant in terms of a substantial adverse effect on the species.

The White-tailed Kite is a specially protected species in California. Data from the CDF&G website report a noticeable increase in numbers and extension of the species range in recent years. The CDF&G and the Museum of Vertebrate Zoology at the University of California, Berkeley are conducting studies currently centered on Grizzly Island in Solano County among other places. Winter densities of White-Tailed Kite in the Benecia, CA Audubon CBC shows 0.64 birds per square mile. Relative abundance observations in the CMNWRA over the last several years tends to reflect this stability. The impacts are not expected to be significant with respect to this species.

The Ferruginous Hawk, a CSC species, is a migrant that arrives in September and leaves in April. The adjusted number of (2) fatalities for the two year study period does not suggest a significant impact on a migrant species with a U.S. and Canada population of approximately 23,000 according to the Partners in Flight North American Landbird Conservation Plan, 2006. The per mile density of this species is 0.01.

The Rough legged does not breed in California and is a migrant species. The U.S. and Canada population is listed as approximately 265,000. The adjusted number of (2) fatalities for the two year study period does not suggest a significant impact on this migrant species. The per mile density of this species is 0.03.

The Golden Eagle is also a CSC species and is protected under several laws including the Bald and Golden Eagle Protection Act. Until we are able to better define the local population we continue to adopt the default position that although the impact is not likely to be significant, we nevertheless, in the absence of good local population data, agree to declare the impact to be potentially significant.

The Turkey Vulture and the other species listed involve adjusted fatality numbers that are extremely low with the exception of the Horned Lark with an estimate of 33 and 23 fatalities in years one and two respectively. Given the citation to the federally authorized depredation order 50 CFR section 21.44 for California that requires a permit from the Commissioner of Agriculture it is highly unlikely that the wind plant related fatality estimates are biologically significant.

Table 18. Number of Avian Fatality Incidents per Species per Year and per Total Installed Megawatt Capacity at the *Montezuma Hills WRA* High Winds Company, August 2003 – July 2005, found during Standardized Surveys (incidental finds are noted separately)

Species Name	# Avian Fatality Incidents per Turbine/Year	Incidental	Adjusted Estimate (Scavenge and Search Efficiency) YEAR ONE	YEAR TWO	Total	Biological Significance of Impacts at High Winds (see Table 20 for rationale)
American Kestrel	0.25591	7	42	23	65	Not Significant
Red-tailed Hawk	0.10237	2	23	19	42	Not Significant
White-tailed Kite	0.01706		5	2	7	Not Significant
Ferruginous Hawk	0.00569		2	0	2	Not Significant
Rough-legged Hawk	0.00569		0	2	2	Not Significant
Golden Eagle	0.00569	1	2	0	2	Potentially Significant
Turkey Vulture	0.01137	2	2	2	5	Not Significant
Double-crested Cormorant	0.00569		2	0	2	Not Significant
Ring-necked Pheasant	0.01137	1	3	0	3	Not Significant
Canada Goose		1	0	0	0	Not Significant
Snow Goose		1	0	0	0	Not Significant
Mallard		1	0	0	0	Not Significant
Common Moorhen	0.00569		1	0	1	Not Significant
American Coot	0.01137	1	1	1	3	Not Significant
Virginia Rail	0.01706		3	7	10	Not Significant
Sora	0.01706		3	7	10	Not Significant
Mourning Dove	0.01137		7	0	7	Not Significant
Rock Dove	0.01137		0	7	7	Not Significant
Barn Owl	0.01137	2	0	5	5	Not Significant
White-throated Swift	0.01137		7	0	7	Not Significant
Northern Flicker	0.01137		3	3	7	Not Significant
Western Wood-Pewee	0.00569		3	0	3	Not Significant
Warbling Vireo	0.01137		3	3	7	Not Significant
Horned Lark	0.09668		33	23	57	Not Significant
Tree Swallow	0.00569		0	3	3	Not Significant
Ruby-crowned Kinglet	0.01137		7	0	7	Not Significant
European Starling	0.03412		13	7	20	Not Significant
American Pipit	0.01137		0	7	7	Not Significant
Orange-crowned Warbler	0.00569		3	0	3	Not Significant
Yellow Warbler	0.01137		3	3	7	Not Significant

Adjusted Estimate (Scavenge and Search Efficiency)

Species Name	# Avian Fatality Incidents per Turbine/Year	Incidental	YEAR ONE	YEAR TWO	Total	Biological Significance of Impacts at High Winds (see Table 20 for rationale)
Townsend's Warbler	0.01706		7	3	10	Not Significant
Wilson's Warbler	0.00569		0	3	3	Not Significant
Common Yellowthroat	0.00569	1	3	0	3	Not Significant
Lincoln's Sparrow	0.00569		3	0	3	Not Significant
Western Meadowlark	0.01706		7	3	10	Not Significant
Red-winged Blackbird	0.07962		7	40	47	Not Significant
Brewer's Blackbird	0.01137		7	0	7	Not Significant
	Total Birds	20	241	178	**419**	

Table 19. Factors for Determining Biological Significance of Fatalities Registered at the High Winds Project, Solano County, California

Species	U.S. and Canada Population	California Hunting Harvest or Bag Limit/Falconry Permits/Depredation Permits	Migrant/Resident/Vagrant
American Kestrel	4.2 million	54 killed via depredation permits on San Clemente Island – 1999; falconry and depredation take requested from CDFG	Migrant
Red-tailed Hawk *	2 million	27 killed via depredation permits on San Clemente Island – 1999; falconry and depredation take requested from CDFG	Migrant
White-tailed Kite	10,700	--	Migrant?/Vagrant?
Ferruginous Hawk ***	23,000	--	Migrant
Rough-legged Hawk	265,000	--	Migrant
Golden Eagle ***	80,000	--	Migrant/Resident/Vagrant?
Turkey Vulture	4.5 million	Depredation permits granted in many states – example – VA – 4,000 per year	Migrant/Resident/Vagrant?
Double-crested Cormorant	Unknown	Depredation Permits – Max = 47,000 per year in US	Migrant
Ring-necked Pheasant	Unknown	2-3 per day per hunter, 4-6 per hunter in possession	Resident
Canada Goose*		41,946 – 2003; 2-3 per day per hunter, 4-6 per hunter in possession	Migrant and Resident
Snow Goose*		32,851 – 2003; 2-4 per day per hunter; 4-8 per hunter in possession	Migrant
Mallard	13 million	288,094 – 2003; 5 per day per hunter, 10 per hunter in possession	Migrant and Resident
Common Moorhen		25 per day per hunter – same in possession	Migrant and Resident?
American Coot		25 per day per hunter – same as in possession; ~8,000 per year harvested in CA – 2000-2001	Migrant?
Virginia Rail			Migrant and Resident?
Sora			Migrant and Resident?
Mourning Dove	110 million	10 per day per hunter, 20 per hunter in possession; 20+ million per year harvested in US	Resident
Rock Dove	N/A Unprotected	Unlimited Take Permitted	Resident
Barn Owl *	343,000	--	Resident (and Migrant/Vagrant?)
White-throated Swift	283,000	--	Migrant

Species	U.S. and Canada Population	California Hunting Harvest or Bag Limit/Falconry Permits/Depredation Permits	Migrant/Resident/Vagrant
Northern Flicker	14.5 million	--	Migrant
Western Wood-Pewee	9.7 million	--	Migrant
Warbling Vireo	18 million	--	Migrant and Resident
Horned Lark	98 million	50 CFR § 21.44 – depredation order, CA – no permit required other than from Comm. of Dept. of Agric.	Migrant and Resident
Tree Swallow	20 million	--	Migrant and Resident
Ruby-crowned Kinglet	72 million	--	Migrant
European Starling	N/A Unprotected	Unlimited Take Permitted	Resident (and Migrant?)
American Pipit	20 million	--	Migrant(and Resident?)
Orange-crowned Warbler	76 million	--	Migrant
Yellow Warbler ***	33 million	--	Migrant (and Resident?)
Townsend's Warbler	12 million	--	Migrant
Wilson's Warbler	36 million	--	Migrant
Common Yellowthroat ***	32 million	--	Migrant (and Resident?)
Lincoln's Sparrow	39 million	--	Migrant
Western Meadowlark	29 million	--	Migrant and Resident
Red-winged Blackbird	193 million	--	Migrant and Resident
Brewer's Blackbird	34 million	--	Migrant

The weight of evidence suggests that this project may proceed through the permitting process with respect to potential avian impacts because these numbers of collision related fatalities taken on a species by species basis are not significant on either a single project or cumulatively on a CMHWRA wide basis in terms of biological effect. In almost every life history description of species of concern in California, the primary cause of decline is loss of habitat. The wind projects in the CMHWRA and in other WRAs in California and across the nation in areas on lands utilized for agriculture provide a means of maintaining the existing land use against the pressure of development that reduces the availability of habitat.

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*Not all of the above references are cited specifically in the text. In some cases the references were consulted and information (or lack of information) was noted without citing the specific reference.

APPENDIX I. Golden Eagle Nesting Survey – Selected Figures and Tables

Figure 1. Map of Collinsville Montezuma Hills Wind Resource Area indicating Observation Points (OPs) and confirmed Golden Eagle nest locations.

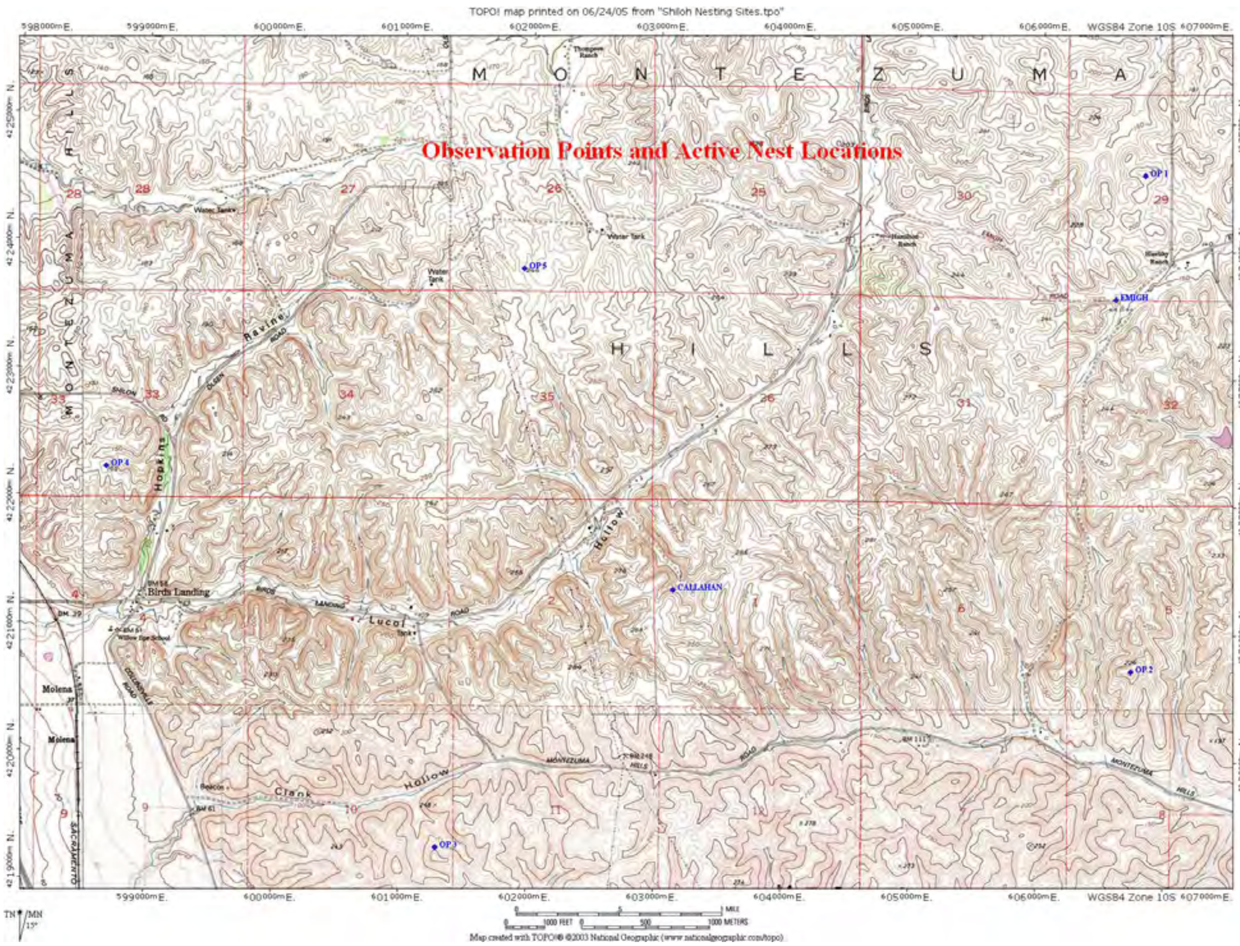


Table 1. Summary of Nesting Surveys conducted February 2 through June 2, 2005.

Survey Dates	Number of Days	Number of Hours
February 2,3,7,9,10,12,13,14,15,21,22,23,26	13	119
March 1,2,3,5,13,15,16,18, 19, 21,23,25,28	13	60
April 4,7,18,28	4	24
May 4,13,14,15,16,17,22,23	8	37
June 1, 2	2	19
Totals	**40**	**259**

APPENDIX II. Avian Species by Month – Shilo I and High Winds Year 1 and 2

Shiloh Wind Power Final Report – Table 4. Avian Species Composition by Month

SPECIES	Number of Observations	Observation Points **	January	February	March	April	May	June
American Crow	8	4	2	2	2	2		
American Kestrel	135	7	39	36	24	12	6	18
American Pipit	18	1				18		
American White Pelican	120	4	16	4			10	90
Barn Swallow	26	2				18	8	
Brewer’s Blackbird	65	2		45	20			
Burrowing Owl	1	1	1					
Canada Goose	3	2		2	1		28	
Cliff Swallow	112	6			50	6	28	28
Common Raven	91	7	27	31	8	12	10	3
Golden Eagle	17	6	1	1	3	5	7	
Great Egret	8	4				2		6
Great Horned Owl	4	1				3		1
Horned Lark	112	2	60		30			22
Killdeer	86	2		82		2	2	
Loggerhead Shrike	81	2	19	9	18	8	12	15
Mallard	30	2		2	21			7
Merlin	1	1		1				
Mourning Dove	17	2	14			1	2	
Northern Flicker	5	2	3	1	1			
Northern Harrier	123	7	27	37	20	22	8	9
Osprey	1	1			1			
Prairie Falcon*	7	3	6	1				
Red-tailed Hawk	355	7	114	111	42	43	19	26
Red-winged Blackbird	1178	6		700	120	188	150	20
Ring-necked Pheasant	3	1	2			1		
Rock Dove	10	1				10		
Rough-legged Hawk*	4	4	1	1	1	1		
Savannah Sparrow	4	1				4		
Swainson’s Hawk	14	4			2	3	4	5
Tree Swallow	10	1		10				
Turkey Vulture	262	7	23	55	51	42	40	51
Western Meadowlark	8	1	8					
White-tailed Kite	48	7	27	19	2			
Unidentified Gull	1	1		1				
Unidentified Buteo	1	1			1			
Unidentified Blackbirds	590	3	440	150				
TOTAL	**3559**		**773**	**1259**	**392**	**371**	**318**	**193**

*Probably does not nest within project area/Solano County
** Observation points refer to the number of observation points in which the species was observed. There was a total of 7 different observation points.

High Winds Report – Table 25. Avian species composition per month at High Winds for the First Year, August 2003 – July 2004.

			2003					2004						
Species	**# Observations**	**# Observation Points**	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL
American Crow	7	2		1		3			1		2			
American Kestrel	116	8	14	13	9	13	22	11	18	5	5	1	1	4
American Pipit	500	8			35	154	84	99	1	73	16		16	22
American White Pelican	7	2								3			4	
Barn Swallow	71	5	10	11						2	8	12	21	7
Brewer's Blackbird	348	7		7	47	178	91		13	2	2			8
Burrowing Owl	1	1							1					
Canada Goose	75	4		2			72		1					
Cliff Swallow	6	1										6		
Common Raven	151	8	1	8	4	18	45	35	12	5	8	8	4	3
European Starling	154	7			7	76	47	1	13		2	8		
Ferruginous Hawk	1	1		1										
Golden Eagle	14	6	1			3	1	1		3	1	2	2	
Golden-crowned Sparrow	5	1			5									
Grasshopper Sparrow		0												
Great Blue Heron	1	1					1							
Great Egret	2	2									1	1		
Horned Lark	144	8	12	7	20	5	24	5	7	5	13	3	41	2
House Finch	3	1									2	1		
Killdeer	33	4	3	2	3		9	3	3	7	3			
Loggerhead Shrike	32	6	1	2	2	2		5	5	4	2	7		2
Mallard	3	2								1	2			
Merlin	1	1											1	
Mourning Dove	54	6	13	2				12			4	3	16	4
Northern Harrier	52	7	2	6	2	8	1	3	13	3	5	1	5	3
Northern Mockingbird	3	2								1			1	1
Northern Rough-winged Swallow	1	1	1											
Red-tailed Hawk	390	8	6	22	27	82	81	74	59	18	12	6		3
Red-winged Blackbird	3532	8					15	5	52	1104	2176	180		
Ring-necked Pheasant	1	1									1			
Rock Dove	221	7	23	17	1	1	29	25	21	58	10	2	12	22
Savannah Sparrow	22	3					7	7	6		2			
Say's Phoebe		0												
Swainson's Hawk	1	1										1		
Tree Swallow	13	4	4	1	2						2		3	1
Turkey Vulture	253	8	12	77	20	35	7	3	26	5	6	14	6	42
Unidentified Hawk	33	8	2			5	2	11	4	2	6		1	
Unidentified Non-Raptor*	55001	8	149	81	1258	35235	6018	5901	5233	1090	0	5	30	1
Violet-green Swallow	23	2	23											
Western Kingbird	3	2										1	2	
Western Meadowlark	196	8	26	9	8	48	8	26	15	14	7	13	15	7

Species	# Observations	# Observation Points	2003 AUG	SEP	OCT	NOV	DEC	2004 JAN	FEB	MAR	APR	MAY	JUN	JUL
White-tailed Kite	17	5			1	1	2	3	8	2				
White-throated Swift	3	1										3		
Yellow-billed Magpie	1	1										1		
Grand Total	61495		303	269	1451	35867	6566	6230	5512	2407	2298	279	181	132

* Unidentified Non-Raptors were predominantly blackbird species (99.6%)

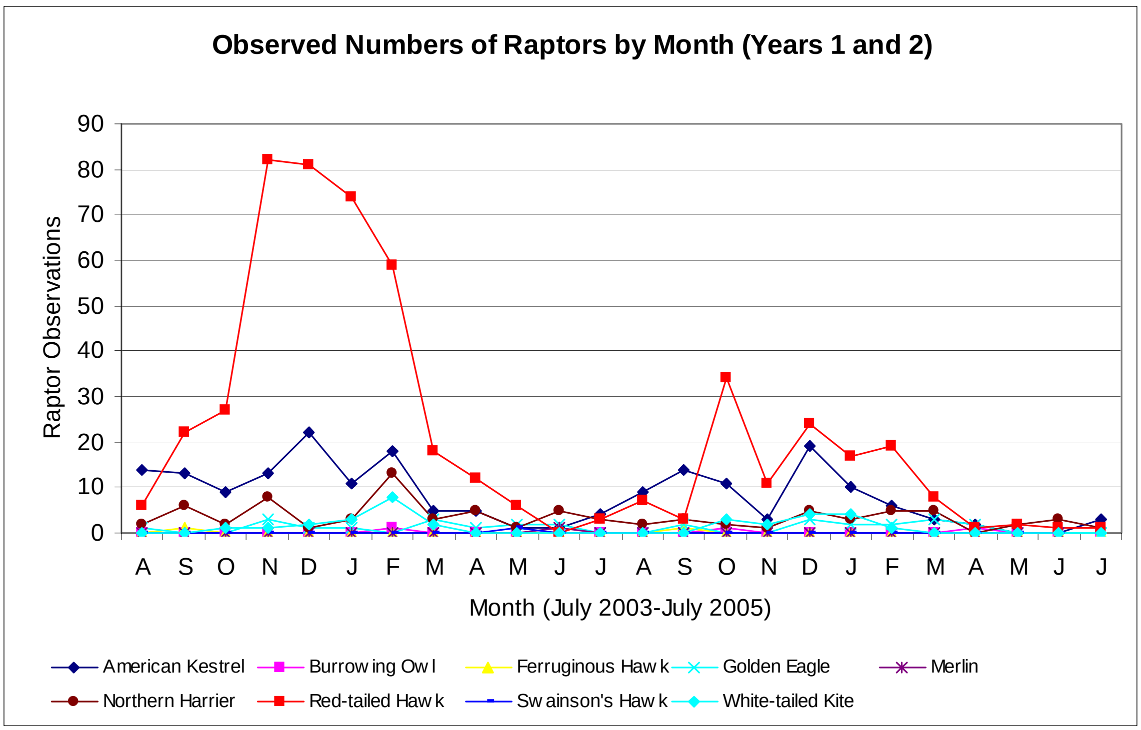
High Winds Report – Table 26: Avian Species Composition per Month at High Winds for the Second Year of this Study, August 2004 – July 2005.

Species	# Observations	# Observation Points	2004 AUG	SEP	OCT	NOV	DEC	2005 JAN	FEB	MAR	APR	MAY	JUN	JUL
American Crow	13	1		1				10			2			
American Kestrel	80	8	9	14	11	3	19	10	6	3	2			3
American Pipit	134	7	24			36	31	19	2	11	11			
American White Pelican	17	1												17
Barn Swallow	90	5	31	3						9	8	8	15	16
Brewer's Blackbird	18	5	1		9	2	1		1	3	1			
Burrowing Owl	2	1			1						1			
Canada Goose	20	4				8		4		8				
Cliff Swallow	9	2								9				
Common Raven	142	8	5	2	12	8	24	23	41	12	5	5		5
European Starling	34	5					4	20	7		3			
Ferruginous Hawk	1	1		1										
Golden Eagle	14	5		2			3	2	2	3	2			
Grasshopper Sparrow	2	1			2									
Horned Lark	133	8	3	20		39			2	16	24	6	4	19
House Finch	3	1											3	
Killdeer	14	4		7		3				2			2	
Loggerhead Shrike	18	7	3	5			4	2	1		1	1	1	
Mallard	7	2								4	3			
Mourning Dove	28	6	7	2						1		6	7	5
Northern Harrier	32	8	2	3	2	1	5	3	5	5		2	3	1
Northern Mockingbird	2	1										1		1
Red-tailed Hawk	128	8	7	3	34	11	24	17	19	8	1	2	1	1
Red-winged Blackbird	716	8		10	2		1	51	196	107	278	6	65	
Rock Dove	247	5	14	16	13	23	90	4	28		12	4	23	20
Savannah Sparrow	7	1				7								
Say's Phoebe	5	4	1				3		1					
Tree Swallow	28	3								24			4	
Turkey Vulture	232	8	32	77	25	8	7	2	26	3	8	6	23	15
Unidentified Hawk	6	5			1	1	1				2			1
Unidentified Non-Raptor*	22335	8	24	63	9940	1214	4380	2011	3428	584	274	133	221	63

Species	# Observations	# Observation Points	AUG	SEP	OCT 2004	NOV	DEC	JAN	FEB	MAR	APR 2005	MAY	JUN	JUL
Western Kingbird	7	4										5	2	
Western Meadowlark	109	8	4	6	9	11	4	31	10	9	7	5	11	2
White-crowned Sparrow	1	1									1			
White-tailed Kite	14	4			3	2	4	4	1					
Total	24648		167	235	10064	1377	4605	2213	3776	821	646	190	385	169

* Unidentified Non-Raptors were predominantly blackbird species (99.6%)

High Winds Report – Figure 15. Raptor Species Composition per Month at High Winds August 2003 – July 2005.



APPENDIX III. Causes of Bird Fatalities

Activity/Agent Causing Fatalities	Number of Fatalities	Information Source
Glass Windows	100 to 900+ million	Dr. Daniel Klem, Muhlenberg College (20 year study)
House Cats	100 million	The National Audubon Society annual estimate
Automobiles/Trucks	50 to 100 million	National Institute for Urban Wildlife and U.S. Fish and Wildlife Service annual report
Electric Transmission Line Collisions	174 million	U.S. Fish and Wildlife Service annual studies
Agriculture - pesticides	67 million	Smithsonian Institute annual studies
Agriculture – hay cutting	1 million	Smithsonian Institute annual studies
Land Development – loss of habitat	Unknown	National Audubon Society annual report (unestimated number of bird fatalities due to urban sprawl)
Communication Towers	4 to 10 million	U.S. Fish and Wildlife Service annual estimates
Stock Tank Drowning	Unknown	U.S. Fish and Wildlife Service annual report (estimated number of bird fatalities due to drownings in livestock water tanks)
Oil and Gas Extraction	1 to 2 million	U.S. Fish and Wildlife Service annual reports.
Logging and Strip Mining – loss of habitat	Unknown	National Audubon Society annual report (unestimated number of bird fatalities due to habitat destruction)
Commercial Fishing	40,000 to Unknown	U.S. Fish and Wildlife Service and the Ornithological Council annual report (for Alaska only).
Electrocutions	1,000+	Biologists and other experts annual reports
Hunting	100+ million	U.S. Fish and Wildlife Service annual reports

APPENDIX IV. Winter Bird Densities in the Region of the Project

Species	Winter Density (birds/sq. mile)
American Kestrel	0.81
Red-tailed Hawk	1.33
White-tailed Kite	0.64
Ferruginous Hawk	0.01
Rough-legged Hawk	0.03
Golden Eagle	0.08
Turkey Vulture	1.02
Double-crested Cormorant	1.57
Ring-necked Pheasant	0.33
Canada Goose	11.09
Snow Goose	-
Mallard	15.59
Common Moorhen	0.11
American Coot	49.88
Virginia Rail	0.86
Sora	0.37
Mourning Dove	2.64
Rock Dove	7.74
Barn Owl	0.11
White-fronted Swift	0.26
Northern Flicker	1.01
Western Wood-Pewee	-
Warbling Vireo	-
Horned Lark	0.21
Tree Swallow	6.53
Ruby-crowned Kinglet	1.08
European Starling	23.10
American Pipit	2.46
Orange-crowned Warbler	-
Yellow Warbler	-
Townsend's Warbler	0.01
Wilson's Warbler	-
Common Yellowthroat	0.38
Lincoln's Sparrow	0.12
Western Meadowlark	8.70
Red-winged Blackbird	43.63
Brewer's Blackbird	18.02

*Based on the recent 10-year average count (1996-2005) at the Benicia CBC (CABE) divided by the 177 square mile count circle.