APPENDIX C

AVIAN AND BAT RISK ASSESSMENT

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AVIAN AND BAT RISK ASSESSMENT FOR THE MONTEZUMA II WIND PROJECT, SOLANO COUNTY, CALIFORNIA

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Contents

Acronyms and Abbreviations

AGL	above ground level
APWRA	Altamont Pass Wind Resource Area
BGEPA	Bald and Golden Eagle Protection Act
CEQA	California Environmental Quality Act
CESA	California Endangered Species Act
CFR	Code of Federal Regulations
CMHWRA	Collinsville Montezuma Hills Wind Resource Area
County	Solano County
CUP	conditional use permit
DFG	California Department of Fish and Game
EIR	environmental impact report
ESA	Endangered Species Act
FEIR	final environmental impact report
kV	kilovolt
m/s	meters per second
MBPM-2	Migratory Bird Permit Memorandum
MBTA	Migratory Bird Treaty Act
mph	miles per hour
MW	megawatt
proposed project	NextEra Energy Resources Montezuma II Wind Project
rpm	revolutions per minute
SMUD	Sacramento Municipal Utility District
USC	United States Code
USFWS	U.S. Fish and Wildlife Service
WRA	wind resource area

Chapter 1
Introduction

This report summarizes relevant data to assess the potential operational impacts of the proposed NextEra Energy Resources Montezuma II Wind Project (Montezuma II Wind project or proposed project) on avian and bat species. The primary purpose of this assessment is to provide information to Solano County (County) on expected avian and bat mortality from the proposed project. The County is the lead agency for the proposed project under the California Environmental Quality Act (CEQA) and recently began preparing an environmental impact report (EIR) for the project. Information in this report will be reviewed and used by the County, as appropriate, to evaluate the significance of the project's impacts on avian and bat species relative to CEQA standards.

Through coordination with state and federal resource agencies, counties in California reviewing wind resource development proposals assess the impacts of potential avian and bat mortality and, in some cases, implement mitigation to help offset these impacts. These assessments are undertaken to comply with state and federal laws and regulations designed to protect avian and bat resources, such as CEQA, the federal Migratory Bird Treaty Act, and the Bald and Golden Eagle Protection Act. The assessments generally entail a preconstruction investigation of avian and bat populations in and around the proposed project area, as well as an estimate of the extent of potential collision-based mortality. Estimates of potential avian and bat mortality are typically derived using mortality data collected from surveys at nearby wind energy facilities or from other facilities if local data are not available. Following the approval and construction of a wind project, postconstruction monitoring is generally required to determine the facility's actual collision mortality rate.

Background

While wind energy development is generally considered a source of electrical energy with few associated environmental impacts, the operational effects of wind turbines in some areas have been associated with avian and bat mortality (California Energy Commission 1989; Orloff and Flannery 1992; Erickson et al. 2001). This phenomenon was initially identified in the mid-1980s, and since that time research has been ongoing to determine the causal mechanisms and to identify improvements in design, operational characteristics, and siting of wind turbines to reduce mortality levels. This research has helped identify wind resource areas (WRAs) that are of lower collision risk, such as the Tehachapi WRA (Anderson et al. 2000); higher risk areas, such as the Altamont Pass WRA (Orloff and Flannery 1992; Smallwood and Thelander 2004); and moderate risk areas, such as the Collinsville–Montezuma Hills WRA (Howell and Noone 1992; Kerlinger et al. 2006). Research has resulted in significant design and operational modifications that are thought to reduce collision potential while maximizing energy generating capacity. Research has also led to standardized methods of assessing and monitoring the effects of wind energy development at existing and proposed windfarms (Anderson et al. 1999).

A substantial amount of baseline data on bird use and monitoring data on avian mortality has been collected for various existing and proposed wind projects in the United States and Europe. Avian baseline data on bird use are primarily used to estimate overall project impacts on birds, especially raptors and special-status species. These data have also been used to predict and mitigate impacts on avian species from new wind projects when local mortality data are unavailable.

Bat fatalities were also an unanticipated consequence of wind projects. In the late 1990s biologists began to discover bat carcasses during postconstruction avian mortality monitoring of wind projects. High-profile incidences of bat mortality at windfarms, especially in the Appalachian Mountains of the eastern United States, have led to growing concerns about the impacts of wind projects on bats. Since the early 2000s, researchers have been studying bat mortality resulting from wind projects and have consistently found bat carcasses at wind energy sites, with some sites—primarily in the eastern United States—resulting in unexpectedly high rates of bat mortality.

The Collinsville–Montezuma Hills Wind Resource Area (CMHWRA) was first designated as a WRA by Solano County in its 1987 Wind Turbine Siting Plan. Since that time, a number of wind energy facilities have been constructed, including enXco V, operated by enXco; High Winds, operated by NextEra Energy Resources; Shiloh I & II, operated by Iberdrola Renewables; and Solano Wind Phase I and II, operated by the Sacramento Municipal Utility District (SMUD) (Table 1). In addition to the proposed Montezuma II Wind project, several other wind energy facilities are either under construction or in the planning stages, including Solano Wind Phase III, proposed by SMUD; Montezuma Wind, currently under construction by NextEra Energy Resources; and Shiloh III, operated by enXco (Table 1).

Table 1. Commercial Wind Plants in the Collinsville–Montezuma Hills Wind Resource Area

Entity/ Project Name	Number of Existing Turbines	Number of Proposed Turbines	Turbine Rating	Total Megawatts	Status
Sacramento Municipal Utility District—Solano Wind					
Phase 1	23 Vestas V-47	—	660 kW	15 MW	Constructed in 2004; in operation
Phase 2A	8 Vestas V-90	—	3 MW	24 MW	Constructed in 2006; in operation
Phase 2B	21 Vestas V-90	—	3 MW	63 MW	Constructed in 2007; in operation
Phase 3	—	36–75	—	114 MW	FEIR has been certified; anticipated construction in 2011
High Winds					
FPL Energy	90 Vestas V-80	—	1.8 MW	162 MW	Constructed in 2003; in operation
Montezuma Wind					
Montezuma Wind	—	16 Siemens	2.3 MW	36.8 MW	Under construction; projected date of operation Nov 12, 2010
enXco V (formerly U.S. Windpower)					
enXco	510 U.S. Windpower KCS-56-100	—	100 kW	51.6 MW	Constructed in 1989–1990; in operation
Repowering	6 GE 1.5	—	1.5 MW	9 MW	Constructed in 2006; in operation
Repowering (future)	—	—	—	—	Plans to replace 510 KCS-56-100 turbines with 34 GE 1.5 turbines or equivalent; no application yet submitted

Entity/ Project Name	Number of Existing Turbines	Number of Proposed Turbines	Turbine Rating	Total Megawatts	Status
Shiloh II	75 RePower MM92	—	2.0 MW	176 MW	Constructed in 2008; in operation
Shiloh III		59 RePower MM92	2.0MW	118 MW	FEIR published October 2010; anticipated construction in 2011 if approved.
Shiloh IV*		-65 to -76			Proposed project; owner has not submitted plans to Solano County
Iberdrolla Renewables					
Shiloh I	100 GE 1.5	—	1.5 MW	150 MW	Constructed in 2006; in operation
Phase II of Shiloh I	—	20 GE 1.5	1.5 MW	30 MW	EIR has been certified; owner has no current plans to build

Source: Solano County Department of Resource Management 2010.
Notes:
*Shiloh IV represents the potential removal of approximately 100 existing enXco V wind turbines and installation of 24–35 new wind turbines, for a net decrease of 65–76wind turbines in the WRA.

Each new facility has generated data regarding avian and bat presence in the CMHWRA. Many of the facilities have contributed intensive preconstruction avian use surveys, and all facilities in operation have conducted at least 1 year of postconstruction bird and bat mortality surveys. Combined, these surveys form a robust body of baseline biological data for the area. These studies have documented the occurrence of turbine collision mortality among avian and bat species, including several special-status species. However, overall mortality rates in the area are low to moderate compared to other WRAs in the United States, with most of the fatality burden on species that are common and abundant (Kerlinger et al. 2009a).

Project Description

NextEra Energy Resources Montezuma II Wind, LLC (NextEra), is proposing to construct, own, and operate the Montezuma II Wind project, which will provide energy to the California Independent System Operator power grid. The project will consist of installing and operating 34 wind turbines to achieve a nameplate generation capacity up to 78.2 megawatts (MW) of electricity.

The proposed project area encompasses approximately 2,731 acres in the Collinsville–Montezuma Hills WRA, approximately 5 miles west of Rio Vista and 16 miles southeast of Fairfield (Figure 1), immediately adjacent to the existing High Winds and enXco V wind energy facilities and surrounded by several other operating or proposed wind projects (Figure 2).

The project layout is depicted in Figure 3. Two Siemens 2.3 MW turbine models, each with different blade lengths, are being proposed for the project (Table 2 and Figure 4). Four of the proposed turbines would have 93-meter blades; 30 turbines would have101-meter blades. The proposed turbines would operate automatically in all wind conditions, self-start when winds reach approximately 4 meters per second (m/s), and cut out at a wind speed of 25 m/s to protect the blades and mechanical parts.

A portion of the existing enXco V project with approximately 188 small wind turbines is within the southern portion of the proposed project area. The enXco V wind turbines are Kenetech model 56/100kV turbines and were constructed in approximately 1989–1990 under a conditional use permit (CUP) from Solano County. The CUP for the turbines within the Montezuma II Wind project area expires in 2014. enXco plans to decommission the facility either at the end of 2014, consistent with the terms of its use permit, or in 2011 under a separate agreement with NextEra. Approximately 21 Montezuma II Wind turbines would be installed on a portion of the enXco V project site.

Table 2. Comparison of Proposed Turbine Specifications

Turbine Characteristic	Siemens 2.3 MW (93 m)	Siemens 2.3 MW (101 m)
Number of turbines	4	30
Rotor type	3-blade/horizontal axis	3-blade/horizontal axis
Rotor diameter	93 m	101 m
Rotor swept area	6,793 sq m	8,000 sq m
Rotational speed	Variable: 3.8–15.6 rpm	Variable: 6–16 rpm
Tower type	Tubular	Tubular
Tower (hub) height	80 m	80 m
Rotor height (from ground to lowest tip of blade)	33.5 m	29.5 m
Total height (from ground to top of blade)	126.5 m	130.5 m

The power generated by the Montezuma II Wind turbines would be conveyed to a power substation by an electrical power collection system that would be installed as part of the proposed project. This system would comprise pad-mounted transformers, buried cables, and junction boxes. The pad-mounted transformers would be connected to each turbine by buried power cables. Junction boxes are part of the buried cable system; they house cable splices and allow access to the cable. The cables would be buried between turbines and transformers and between transformers and the substation. The cables would be installed on private land occupied by the proposed project. The project would ultimately connect to an existing PG&E 230-kilovolt (kV) line at the PG&E Birds Landing Switchyard near the proposed substation location (Figure 3).

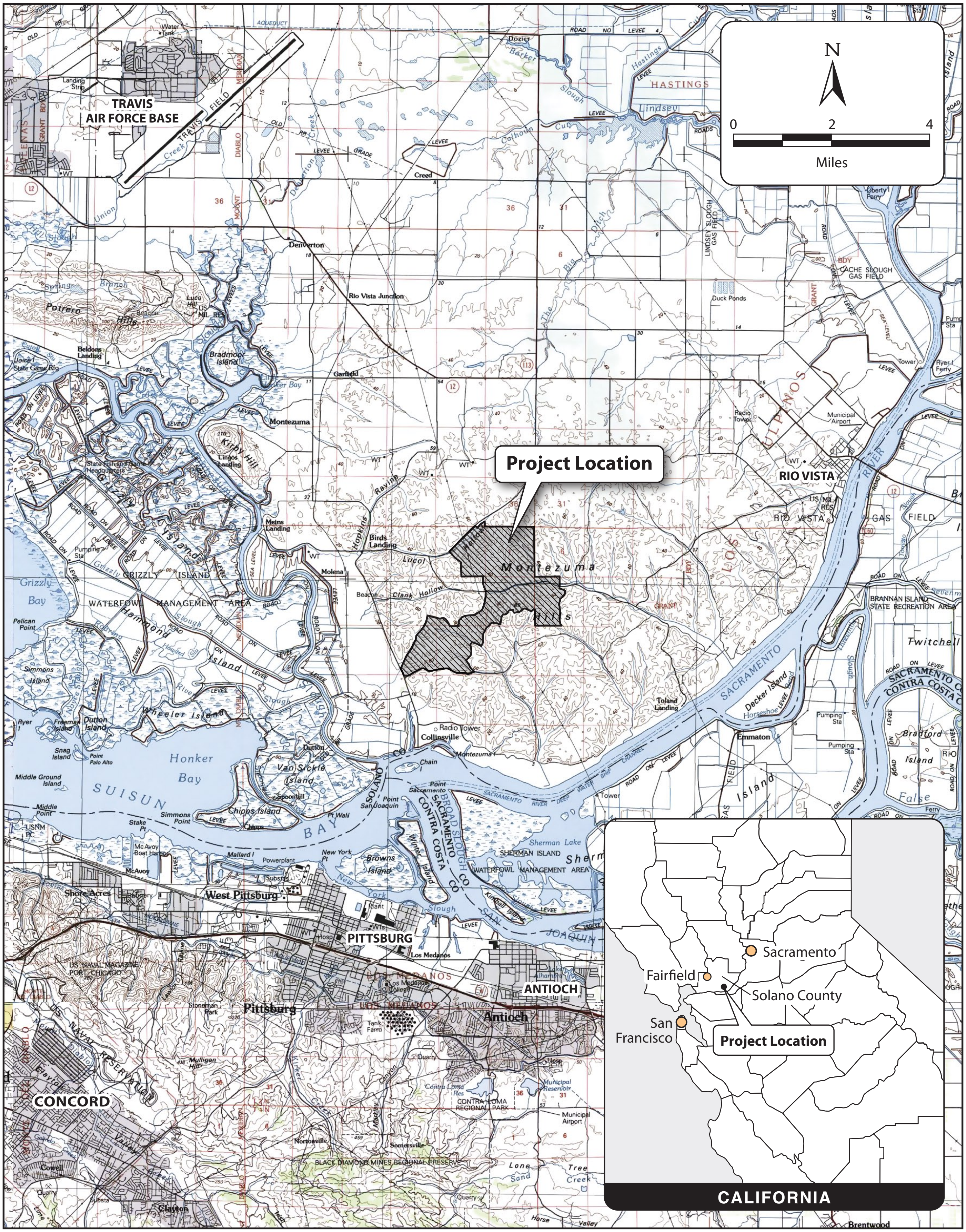

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Figure 1
Montezuma II Wind Project Location

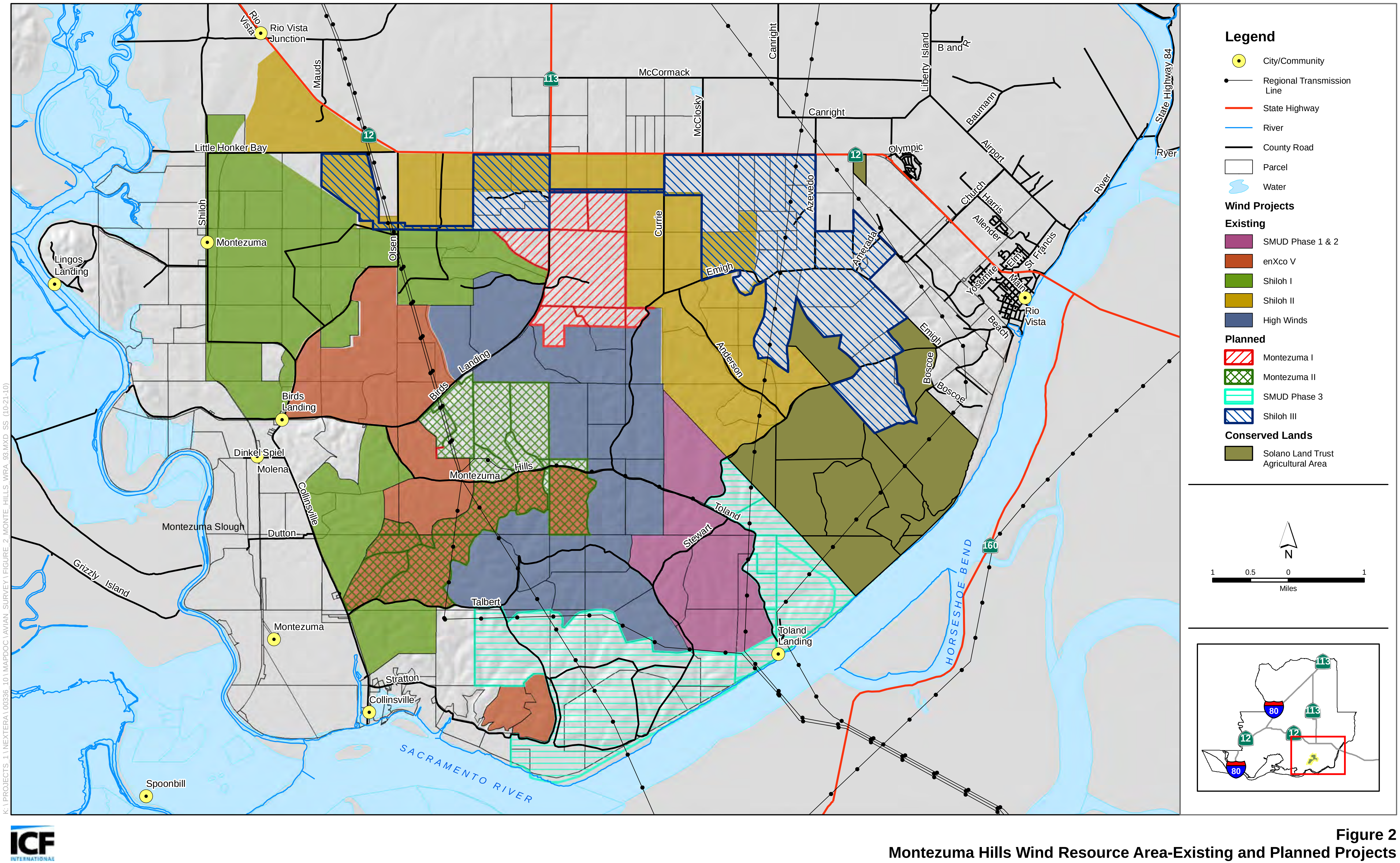

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Figure 2
Montezuma Hills Wind Resource Area-Existing and Planned Projects

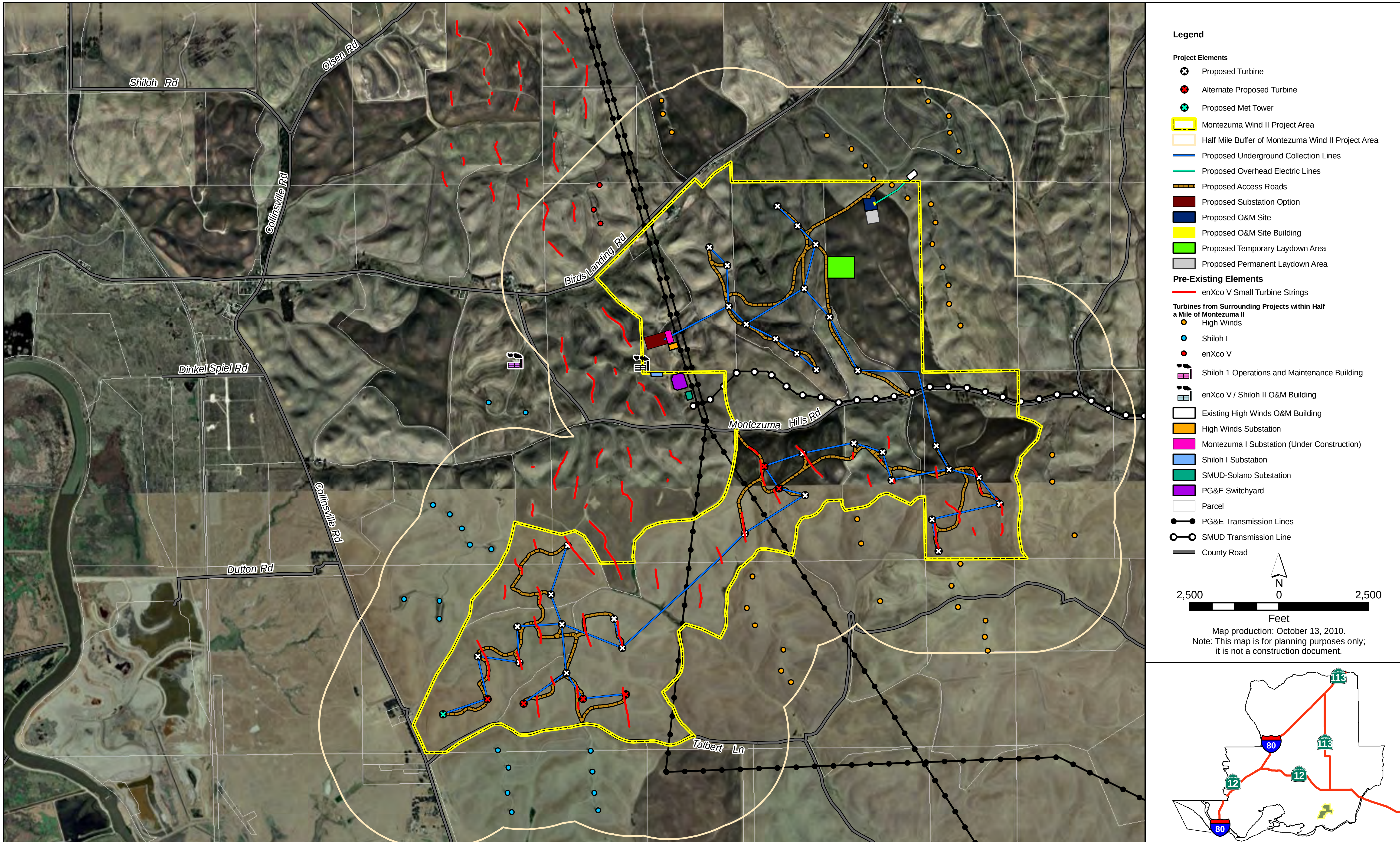

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Figure 3
Project Layout

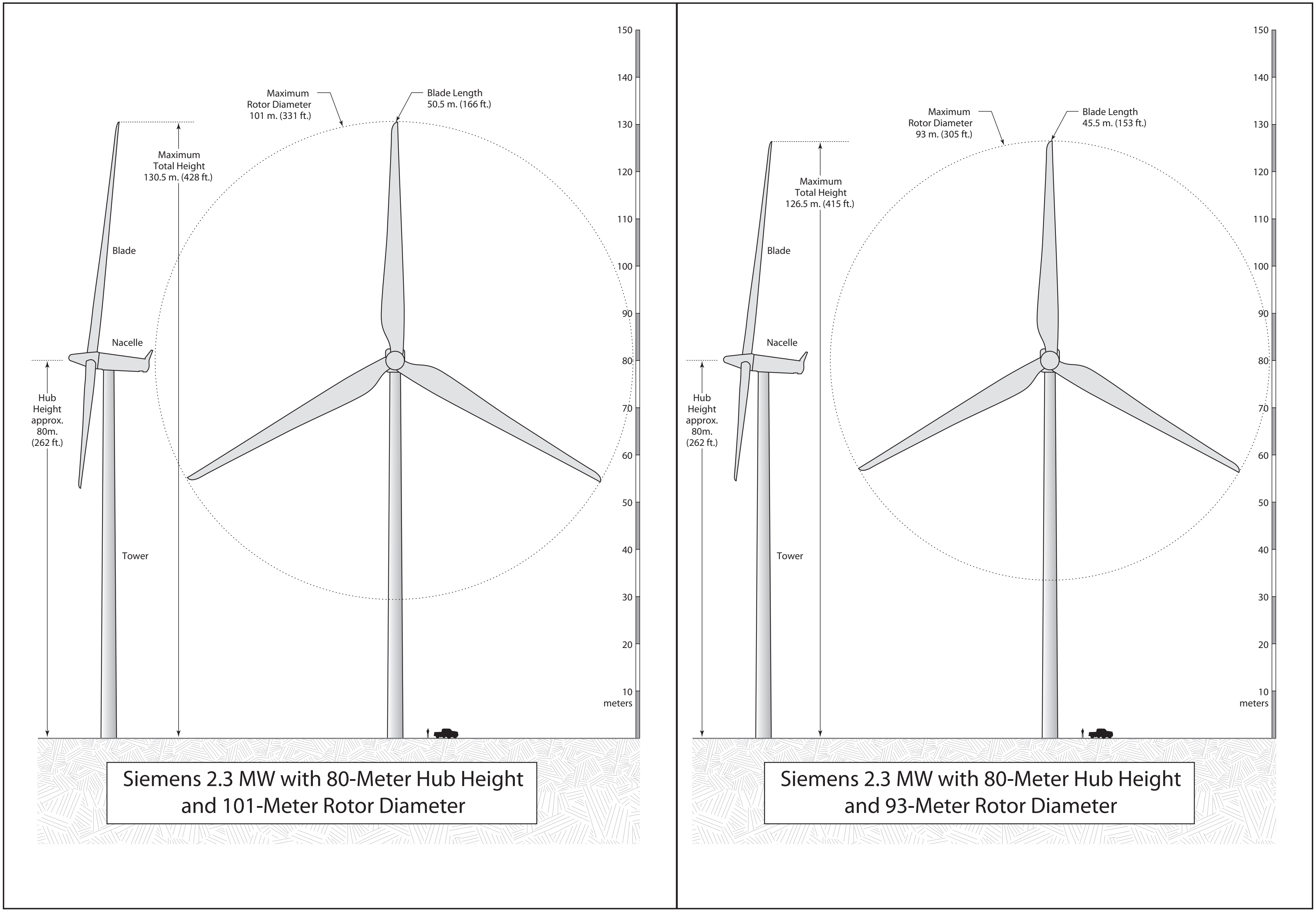

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Figure 4
Montezuma II Wind Project:
Turbine Options 1 and 2

Chapter 2
Regulatory Overview

A number of state and federal laws protect birds and their young, and several laws protect selected wildlife species of conservation concern. Additionally, state and federal agencies have drafted guidance to address avian and bat impacts from wind energy projects.

Migratory Bird Treaty Act

The Migratory Bird Treaty Act (MBTA) (Title 16, United States Code [USC], Part 703) enacts the provisions of treaties between the United States, Great Britain, Mexico, Japan, and the Soviet Union and authorizes the U.S. Secretary of the Interior to protect and regulate the taking of migratory birds. It protects migratory birds, their occupied nests, and their eggs (16 USC 703, 50 Code of Federal Regulations [CFR] 21, 50 CFR 10). Most actions that result in taking of or the permanent or temporary possession of a protected species constitute violations of the MBTA. The MBTA also prohibits destruction of occupied nests. The Migratory Bird Permit Memorandum (MBPM-2) dated April 15, 2003, clarifies that destruction of most unoccupied bird nests is permissible under the MBTA; exceptions include nests of federally listed threatened or endangered migratory birds, bald eagles, and golden eagles. The U.S. Fish and Wildlife Service (USFWS) is responsible for overseeing compliance with the MBTA. Most bird species and their occupied nests that occur in the project area are protected under the MBTA.

Bald and Golden Eagle Protection Act

The Bald and Golden Eagle Protection Act (16 U.S.C. 668-668c) (BGEPA) prohibits the taking or possession of and commerce in bald and golden eagles, with limited exceptions. The BGEPA makes it unlawful for anyone without a permit issued by the Secretary of the Interior from *taking* bald eagles (or any golden eagle), including their parts, nests, or eggs. The BGEPA defines *take* as "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest, or disturb." For the purposes of the BGEPA, *disturb* means: "to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available, 1) injury to an eagle, 2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or 3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior."

In addition to immediate impacts, the BGEPA also covers impacts that result from human-induced alterations initiated around a previously used nest site during a time when eagles are not present if, upon the eagles' return, such alterations agitate or bother an eagle to a degree that interferes with or interrupts normal breeding, feeding, or sheltering habits, and causes injury, death, or nest abandonment.

Federal Endangered Species Act

USFWS has jurisdiction over species listed as threatened or endangered under Section 9 of the federal Endangered Species Act (ESA). ESA protects listed species from *take*, which is broadly defined as "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct." For any project involving a federal agency (e.g., U.S. Army Corps of Engineers) in which a listed species could be affected, the federal agency must consult with USFWS in accordance with Section 7 of the ESA. USFWS issues a biological opinion and, if the project does not jeopardize the continued existence of the listed species, issues an incidental take permit. When no federal context is present, proponents of a project affecting a listed species may consult with the USFWS and apply for an incidental take permit under Section 10 of the ESA. Section 10 requires an applicant to submit a conservation plan that specifies project impacts and mitigation measures.

California Endangered Species Act

The California Endangered Species Act (CESA) prohibits the take of endangered and threatened species; however, removal of habitat is not included in the state's definition of *take*. Section 2090 of CESA requires state agencies to comply with endangered species protection and recovery and to promote conservation of these species. The California Department of Fish and Game (DFG) administers CESA and authorizes take through Section 2081 agreements (except for species designated as fully protected).

California Fish and Game Code

Fully Protected Species

Various sections of the California Fish and Game Code provide for the protection of fully protected species. Section 5050 lists fully protected amphibians and reptiles, Section 3515 lists fully protected fish, Section 3511 lists fully protected birds, and Section 4700 lists fully protected mammals. The California Fish and Game Code defines *take* as "hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, catch, capture, or kill." Except for take related to scientific research, all take of fully protected species is prohibited.

Sections 3503 and 3503.5

Section 3503 of the California Fish and Game Code prohibits the killing of birds and/or the destruction of bird nests. Section 3503.5 prohibits the killing of raptor species and/or the destruction of raptor nests.

California Environmental Quality Act

CEQA is the regulatory framework by which California public agencies identify and mitigate significant environmental impacts on the environment. Although threatened and endangered species are protected by specific federal and state laws, the State CEQA Guidelines Section 15380(b) provides that a species not listed under ESA or CESA may be considered rare or endangered if it can be shown that the species meets specific criteria. These criteria have been modeled after the definitions of ESA and sections of the California Fish and Game Code discussing rare and endangered wildlife.

During the CEQA review process, environmental impacts are assessed and their significance determined on the basis of established thresholds of significance. Thresholds are established using guidance from CEQA, particularly Appendix G of the State CEQA guidelines and CEQA Section 15065 (Mandatory Findings of Significance). CEQA guidance is then refined or defined based on further direction from the lead agency.

A biological resource impact is considered significant (before considering offsetting mitigation measures) if the lead agency determines that project implementation would result in one or more of the following conditions.

- Substantial adverse effects, either directly or through habitat modifications, on any species identified as being a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by DFG or USFWS.
    - A substantial adverse effect on a special-status wildlife species is typically defined as one that would result in at least one of the following conditions.
        - Reducing the known distribution of a species.
        - Reducing the local or regional population of a species.
        - Increasing predation of a species leading to population reduction.
        - Reducing habitat availability sufficient to affect potential reproduction.
        - Reducing habitat availability sufficiently to constrain the distribution of a species and not allow for natural changes in distributional patterns over time.
- Substantial interference with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or interference with the use of native wildlife nursery sites.
    - Substantial interference with resident wildlife movement is typically defined as obstructions that prevent or limit wildlife access to key habitats, such as water sources or foraging habitats, or obstructions that prohibit access through key movement corridors considered important for wildlife to meet needs for food, water, reproduction, and local dispersal.
    - Substantial interference with migratory wildlife movement is typically defined as obstructions that prevent or limit regional wildlife movement through the project area to meet requirements for migration, dispersal, and gene flow that exceed the defined baseline condition.

Consistent with CEQA Section 15065 (Mandatory Findings of Significance), a biological resource impact is considered significant if the project has the potential to achieve at least one of the following effects.

- Substantially degrading the quality of the environment.
- Substantially reducing the habitat of a fish or wildlife species.
- Causing a fish or wildlife population to drop below self-sustaining levels.

- Threatening to eliminate a plant or animal community.
- Substantially reducing the number or restricting the range of an endangered, rare, or threatened species.

California Energy Commission Guidelines

Published by the California Energy Commission (CEC) and DFG, the *California Guidelines for Reducing Impacts to Birds and Bats from Wind Energy Development* (CEC Guidelines) (2007) outline the generally accepted procedures for the permitting and study of potential wind energy development projects. The CEC Guidelines are intended to provide a strategy to reduce impacts on birds and bats from new wind energy developments or repowering of existing wind energy projects in California. The CEC Guidelines include recommendations on screening of proposed sites, study design, and impact assessment, as well as recommendations for the development of avoidance, minimization, and mitigation measures.

In general, the CEC Guidelines recognize and describe four categories of projects for the purpose of determining the level of pre-project study.

- Category 1—Project sites with available wind-wildlife data.
- Category 2—Project sites with little existing information and no indicators of high wildlife impacts.
- Category 3—Project sites with high or uncertain potential for wildlife impacts.
- Category 4—Project sites inappropriate for wind development.

Although following the CEC Guidelines is voluntary, in general these guidelines represent the current state of knowledge on wind-wildlife interactions and are generally accepted by industry and agencies as the best available resource and framework for assessing potential impacts on birds and bats from wind energy projects.

Wind Turbine Guidelines Advisory Committee

The scope and objective of the Wind Turbine Guidelines Advisory Committee, as outlined in its charter, is to provide advice and recommendations to the Secretary of the Interior on developing effective measures to avoid or minimize impacts on wildlife and their habitats related to land-based wind energy facilities. The Wind Turbine Guidelines Advisory Committee's recommendations for federal guidelines (Wind Turbine Guidelines Advisory Committee 2010) (Committee Guidelines) recognize repowering and infill projects as areas that would conceivably have sufficient preconstruction information to forgo preconstruction monitoring. These suggested voluntary guidelines recommend at least 1 year of postconstruction monitoring for all projects, including repowered projects. They further recommend consultation with regulatory agencies and the use of a tiered adaptive management and monitoring program to determine the need for monitoring after the first year.

Chapter 3
Bird and Bat Use of the Montezuma Hills

The Collinsville–Montezuma Hills WRA is characterized by relatively uniform treeless rolling hills with a relatively constant crest elevation between 150 and 280 feet above mean sea level. The Montezuma Hills are separated by narrow valleys and drainages; the valleys transition to sloped hillsides with relatively flat ridgelines. The Sacramento and San Joaquin Rivers converge to the south and flow west into the Suisun Bay. The topographic and meteorological conditions of the Montezuma Hills area and its location adjacent to the Carquinez Strait consistently produce strong, steady winds ideal for windfarm development.

Current land uses in the Montezuma Hills include wind turbine operations, grazing, dryland farming, and rural residential use. Farmers in the Montezuma Hills typically use a crop rotation cycle, where grazing and fallow years follow planting and harvesting. Virtually all land within the Montezuma Hills is zoned A-160 (Exclusive Agriculture, 160-acre minimum new parcel size) according to the Code of Solano County, Zoning Regulations. Windfarms are allowed as conditional uses in Exclusive Agricultural zone designations.

The proposed project site lies in the approximate center of the WRA. Ridgeline elevations in the project area range from approximately 150 to 280 feet above mean sea level. The rolling topography is similar to most other locations in the Montezuma Hills, with the majority of the landscape currently under intensive agricultural practices. Other habitats found at the project site include bulrush-cattail wetlands, a few small seasonal wetlands, and small areas of nonnative annual grassland. Limited trees and shrubs are present, most of which are nonnative. There is a mature olive orchard northeast of the project site.

Resident and Migratory Birds

The abundance, diversity, and distribution of resident and migratory birds in and around the project area have been well documented since the beginning of wind energy development in the Montezuma Hills in the mid-1980s. Together these studies provide a thorough description of the distribution and abundance of bird species in the Montezuma Hills and surrounding areas.

Howell et al. (1988) conducted the first avian use monitoring study related to wind turbine siting in the Montezuma Hills. During this study, which was conducted between1987 and 1988, the researchers systematically surveyed portions of the Montezuma Hills that were part of the U.S. Windpower Montezuma Hills Windfarm project, currently owned and operated by enXco and referred to henceforth in this document as the enXco V project. Data were collected on species diversity, species abundance, migratory use, nesting, and behavioral characteristics (e.g., flight patterns, altitudes, and perching).

From 1990 to 1991, Howell and Noone (1992) conducted additional avian surveys as part of the postconstruction monitoring of the enXco V project.

Additional ongoing monitoring efforts have continued in the Montezuma Hills since the development of the enXco V project. Such efforts include several recent larger-scale avian surveys conducted in association with the development of the High Winds project; the Shiloh I, Shiloh II, and

Shiloh III projects; and the Montezuma Wind project. Each of these survey efforts employed a similar method of establishing fixed observation points across the landscape that incorporate the entire project area in accordance with guidance from the National Wind Coordinating Committee (Erickson et al. 2001). The surveys were designed to assess avian abundance, diversity, distribution, habitat use, and behavior. In addition to observational surveys, each survey effort also entailed a survey of breeding raptors in and around each project area.

Postconstruction mortality monitoring also yields invaluable information about bird and bat presence. Figure 5 depicts the location of each of the projects as well as the survey and monitoring efforts that have occurred at each. Preconstruction and postconstruction survey efforts conducted in the CMHWRA are briefly described below and are summarized in Table 3.

High Winds Project

Systematic preconstruction avian surveys were conducted for the High Winds project between August 2000 and August 2001 and are summarized in Kerlinger et al. (2001). The survey included seven observation points with visibility radius to 1 mile. Data were collected over 98 survey days during the 1-year survey period. More than 90% of the proposed Montezuma II Wind project area was covered by two of the seven observation points, accounting for a total of 94 hours of survey time within the proposed project area.

Two full years of postconstruction avian monitoring conducted for the High Winds project between August 2003 and July 2005 is reported in Kerlinger et al. (2006). These surveys were conducted over a total of 48 survey days throughout the 2-year survey period. Each of 89 turbines was searched at an interval of 15 days. This monitoring included onsite scavenger removal and searcher efficiency trials and an additional 18 survey hours at the two observation points that overlap with the proposed project area.

Solano Wind Project Phases I and II

No preconstruction surveys were conducted for the Solano Wind project. All live birds observed incidentally during mortality monitoring were counted and recorded.

A total of 14 months (non-consecutive) of postconstruction mortality monitoring was conducted at the Solano Wind project between 2008 and 2010. Approximately 30% of the turbines (16 out of 52) were searched at an interval of 14 days, and searches were conducted out to 63 meters from the turbine base (Burleson Consulting 2010). No in situ scavenger removal and searcher efficiency trials were conducted, and correction factors were averaged from other studies.

Shiloh I Wind Project

Preconstruction avian surveys for the Shiloh I project were conducted between January 2004 and December 2005 and are summarized in Kerlinger et al. (2005). The survey included seven observation points with visibility radius to 1 mile. Data were collected over 62 survey days during the 1-year survey period. Approximately 70% of the proposed Montezuma II Wind project area was covered by one of the seven observation points, accounting for a total of 31 hours of survey time within the proposed project area.

Three years of postconstruction mortality monitoring were conducted at Shiloh I. A total of 50 turbines were searched in the first 18 months, with the remaining 50 searched in the next 18

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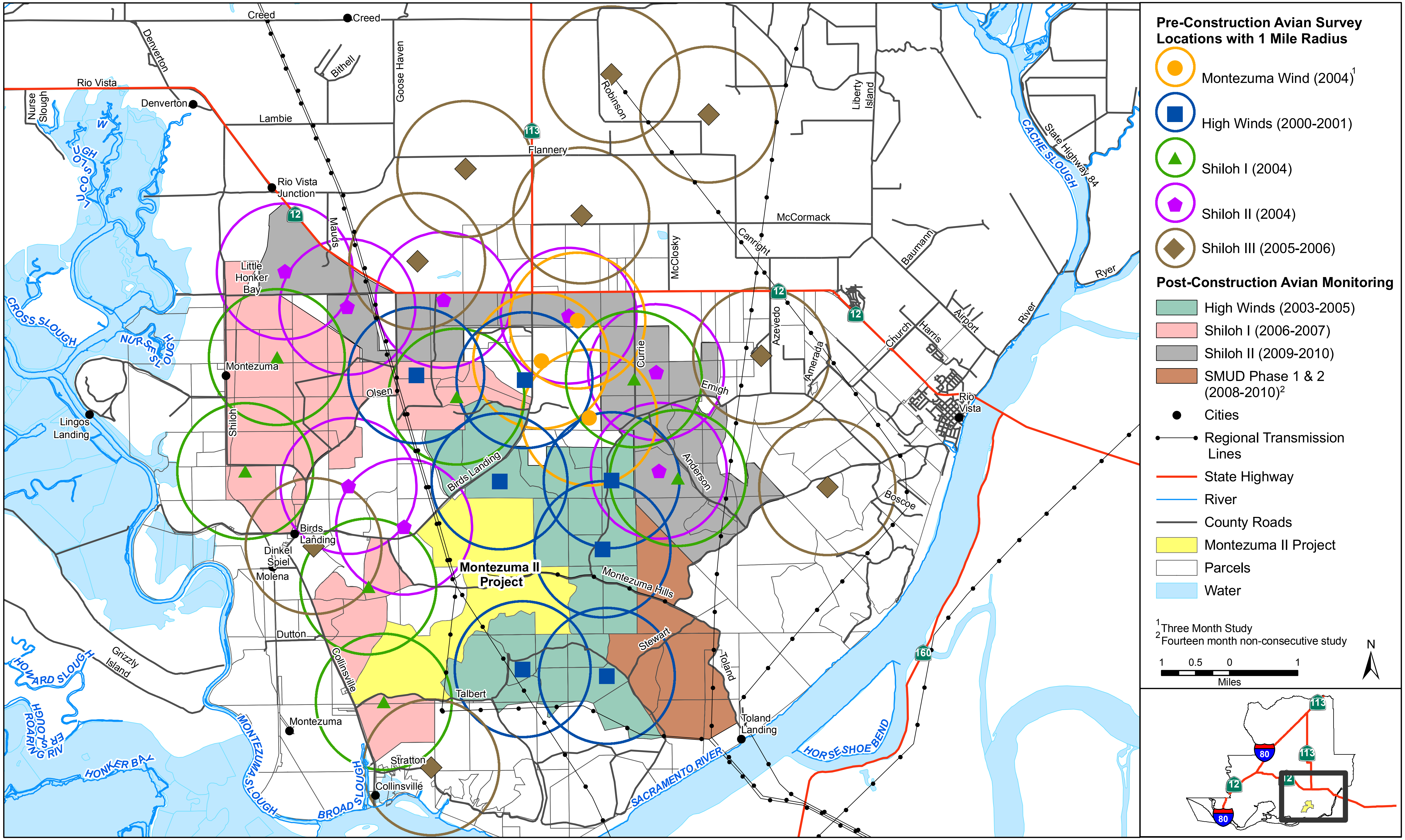

Figure 5
Regional Avian Surveys — Montezuma Hills Wind Resource Area

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months, yielding more than 1 year of mortality data for every turbine in operation. The search interval was 7 days and the search area covered 105 meters from the turbine base. These surveys included in situ scavenger removal and searcher efficiency trials (Kerlinger et al. 2009a).

Shiloh II Wind Project

Preconstruction avian abundance and behavior surveys were conducted for the Shiloh II project over a 4-month period from November 2005 through March 2006, as described by Kerlinger et al. (2006). Surveys consisted of 26 rounds of point counts at eight stations, each with a 1-mile search radius. Observation time totaled 103.5 hours and covered 100% of the proposed turbine-affected area. A raptor nesting survey with a focus on identifying golden eagle nest sites was conducted in 2005 as part of the same study.

The postconstruction mortality surveys conducted in the first year are described by Kerlinger et al. (2010). Fifty- two rounds of surveys covered a third of the 75 turbines in operation. The surveys used a 7-day search interval, and each turbine was searched to a distance of 105 meters from the tower base. These surveys included in situ scavenger removal and searcher efficiency trials conducted in 2009 and 2010.

Shiloh III Wind Project

Preconstruction avian abundance and behavior surveys for the Shiloh III project were conducted from April 2007 through April 2008, as described in Kerlinger et al. (2009). These surveys consisted of 74 rounds of point counts at nine stations, each with a 1-mile search radius. Observation time totaled 333 hours and covered 100% of the proposed turbine-affected area. A raptor nesting survey with a focus on golden eagle nest sites up to 5 miles outside the project area was conducted in 2007.

This wind energy facility is currently under environmental review and has not yet been constructed. The final EIR for the project requires 3 years of postconstruction mortality monitoring.

Montezuma Wind Project

Preconstruction surveys were conducted in the Montezuma Wind project area between March and July 2004 and are presented in Curry and Kerlinger (2004). The survey entailed three observation points with visibility radius to 1 mile. Data were collected over 36 survey days during the 4-month survey period, for a total of 54 hours of survey time within the project area.

This wind energy facility is currently under construction and is expected to be operational in late 2010. The final EIR for the project requires 3 years of postconstruction mortality monitoring. Monitoring is expected to start in 2011.

Montezuma II Wind Project (Proposed Project)

Avian abundance data from within the proposed project area is derived from surveys conducted for the High Winds project and the Shiloh I project. Together these surveys include five observation points covering majority of the proposed project area.

Surveys for nesting birds, particularly raptors, have been conducted throughout the Montezuma Hills area (Howell et al. 1988; Howell and Noone 1992; Kerlinger et al. 2001; Curry and Kerlinger 2004; Kerlinger et al. 2005; Kerlinger et al. 2006; Kerlinger et al. 2009b). Raptor nesting habitat is limited in the Montezuma Hills by the general lack of trees. However, much of the suitable nesting habitat is occupied, and ground-nesting northern harriers, known to breed in the area, are not limited by tree scarcity.

Kerlinger et al. (2005) confirmed a total of 37 raptor nests (and 23 additional possible nests) within the Shiloh I survey area. The majority of these (33 of 37 confirmed nests) were of three species: red-tailed hawk (*Buteo jamaicensis*), American kestrel (*Falco sparverius*), and great horned owl (*Bubo virginianus*). These results are consistent with the results of other studies (Howell et al. 1988; Howell and Noone 1992). The other four nests comprised two historic golden eagle (*Aquila chrysaetos*) nests and two Swainson's hawk (*Buteo swainsonii*) nests found near the northern edge of the Montezuma Hills.

In 2007, Hunt and Kerlinger et al. (Kerlinger et al. 2009b) conducted nesting raptor surveys encompassing the entire CMHWRA, including a 5-mile buffer zone, to the extent visible from aerial surveys and public roads. These surveys identified nesting activity for 137 raptor pairs of 8 different species. Most abundant were red-tailed hawk, American kestrel, and great horned owl. In addition, there were 11 confirmed Swainson's hawk nests, 10 northern harrier (*Circus cyaneus*) nests, 7 barn owl (*Tyto alba*) nests, 3 white-tailed kite (*Elanus leucurus*) nests, and 2 golden eagle nests. Five raptor species were found nesting within or adjacent to the proposed Montezuma II Wind project area: golden eagle, American kestrel, great horned owl, Swainson's hawk, and red-tailed hawk.

Preconstruction nesting raptor surveys were conducted by ICF biologists in 2010 for the proposed Montezuma Wind Project, some of which overlapped with the proposed project area. Surveys were also conducted in the Montezuma II Wind project area by ICF biologists in 2010. ICF biologists visited the historic eagle nest twice in 2010 during the breeding season. A subadult golden eagle was observed during the first visit and none were observed during the second visit, suggesting that nesting was not successful in 2010. Additionally, surveys for both the Montezuma Wind and Montezuma II Wind projects confirmed several nesting raptors and other nesting birds in the area, including Swainson's hawk, American kestrel, great-horned owl, loggerhead shrike, and northern harrier.

In general, the data derived from these recent monitoring studies are consistent with regard to species distribution, relative abundance, nesting, habitat use, and flight patterns, and they confirm the results of the earlier Howell et al. (1988) and Howell and Noone (1992) studies. Differences in actual abundance as shown in the datasets in Table 4 are attributed primarily to the amount of observation time (Kerlinger et al 2006). For some species, such as golden eagle, the differences may also be attributable to the activity of traditional nest sites in any given survey year leading to an increased number of observations of individual birds.

The avian survey data from all six projects indicate that the Montezuma Hills are used for foraging by both resident and migratory birds. The most common nonraptor species are horned lark (*Eremophila alpestris*), western meadowlark (*Sturnella neglecta*), American pipit (*Anthus rubescens*), Brewer's blackbird (*Euphagus cyanocephalus*), and red-winged blackbird (*Aeglaius phoeniceus*). The most common raptors are turkey vulture (*Cathartes aura*), red-tailed hawk, northern harrier, and American kestrel (Howell et al. 1988; Kerlinger et al. 2001; Kerlinger et al. 2005; Kerlinger et al. 2006).

Due to the extensive wetland habitats south and west of the Montezuma Hills, waterfowl are also occasionally observed; however, typical observations are of birds or groups of birds flying above

Table 4. Number of Live Observations of Special-Status and Raptor Species during Surveys of Six Windfarm Projects

Species	Status	High Winds Aug ’00–Aug ’01	High Winds Aug ’03–July ’05	Shiloh I Jan ’04–Dec ’05	Montezuma Wind Mar–July ’04	Shiloh II Nov ’05-Mar ‘06	Shiloh III Apr ’07-Apr ‘08	Solano Wind Jun ’08-Apr ’10 (14 mos.)
American kestrel	---	748	196	340	54	218	318	64
American white pelican	CSC	67	24	120	12	24	117	0
Black swift	CSC	0	0	0	0	0	3	0
Burrowing owl	CSC	1	3	2	0	0	15	5
Cooper’s hawk	---	1	0	0	0	1	0	0
Ferruginous hawk	---	9	2	0	0	19	18	0
Golden eagle	CSC, CFP	283	28	30	7	6	31	4
Great horned owl	---	0	0	4	0	0	12	0
Loggerhead shrike	CSC	141	50	167	7	76	220	93
Merlin	---	1	0	1	0	2	1	1
Northern harrier	CSC	171	84	184	86	121	83	11
Osprey	---	0	0	1	0	0	1	0
Peregrine falcon	CE, CFP, SCD	0	0	0	0	0	1	0
Prairie falcon	---	9	0	11	0	11	16	1
Red-tailed hawk	---	770	518	689	50	610	552	31
Rough-legged hawk	---	95	0	4	0	0	24	0
Short-eared owl	CSC	2	0	0	0	0	0	0
Swainson’s hawk	CT	4	1	27	14	2	33	0
Tricolored blackbird	CSC	18	0	6	0	0	6	0
Unidentified raptor	---	206	39	0	0	64	0	0
White-tailed kite	CFP	3	31	91	0	24	6	0

Note: While the Solano Wind Project reports some avian observation data, these data were generated incidentally while surveyors were conducting carcass searches. There was no observation protocol established, nor are there any indications as to length of observations or focus of the effort. Thus, these data are not directly comparable with other focused studies. They are included here only to ensure that all possible data are reflected in this assessment.

CSC – California Species of Special Concern; CT – California Threatened; CE – California Endangered; CFP – California Fully Protected; SCD – State Candidate for Delisting

and through the area, but not otherwise using it. Note that these typical observations may not reveal microhabitat-level use details.

Initial results from the first year of mortality monitoring at Shiloh II suggest possible small-scale use patterns that could put certain groups of birds at unexpected risk, as evidenced by an elevated level of waterfowl and waterbird fatalities at a group of turbines located near local wetlands and stock ponds (Kerlinger et al. 2009b). These fatalities include California black rail (*Laterallus jamaicensis coturniculus*), a species not previously recorded in avian surveys of the CMHWRA.

Resident and Migratory Bats

The CEC Guidelines (2007) describe the need for pre-permitting acoustic monitoring to determine bat diversity in, and temporal use of, the project area unless there is "defensible, site-specific data" to support that the project is "unlikely to pose a risk to bats." No preconstruction use and abundance surveys for bats have been conducted anywhere in the CMHWRA, and overall understanding of the temporal and spatial behaviors of the four species known to be present is limited. However, postconstruction mortality monitoring data are available for each of the wind energy facilities surrounding the proposed project. Analysis of risk to bats relies on information generated by these studies. Together, these data provide multiple years of site-specific data on bat species present and seasonal patterns of bat presence in the turbine-impacted areas, allowing a defensible estimate to be made of the extent and species diversity of expected bat mortality in the project area.

There are 27 species of bats known to occur in California. During postconstruction avian mortality surveys of the nearby High Winds, SMUD, Shiloh I, and Shiloh II project areas, surveyors observed the remains of bats as well as avian species. Although numerous species of bats may occur in the CMHWRA, to date surveyors have observed the carcasses of only four bat species, all of which are species that tend to migrate to warmer regions for the winter.

- Hoary bat (*Lasiurus cinereus*) (medium priority—Western Bat Working Group).
- Western red bat (*Lasiurus blossevillii*) (California species of special concern; high priority—Western Bat Working Group).
- Silver-haired bat (*Lasionycteris noctivagans*)(medium priority—Western Bat Working Group).
- Mexican free-tailed bat (*Tadariada brasiliensis*) (low priority—Western Bat Working Group).

There are no known sizeable bat colonies on the project site or adjacent areas, and no known caves or large structures such as bridges that would support such a colony. The CMHWRA does provide relatively plentiful small-scale roosting habitat in the form of barns, outbuildings, houses, a mature olive orchard, various stands of eucalyptus trees, ornamental trees, and some isolated native trees. Onsite drainages, cattail wetlands, and stock ponds, in addition to the Sacramento River to the south and Suisun Marsh to the west, are within foraging distance.

There are no data to indicate whether any of the four species known to occur remain in the CMHWRA during the winter, although bat fatalities were found in all other seasons. Mortality data for CMHWRA windfarms indicates an autumn period of intensified activity for all bat species recorded, with a winter time lull.

Special-Status Birds

Several special-status bird species forage and nest in the Montezuma Hills. Kerlinger et al. (2005, 2006, 2007) reported on the activity of two golden eagle (a California species of special concern and fully protected species) nests in their study area—both in the interior of the hills, a setting consistent with historic records. They also detected two Swainson's hawk (listed as threatened under CESA) nests, both along the northern edge of the hills. Historically, there are three documented golden eagle nesting territories within the CMHWRA and one within 5 miles of the CMHWRA (Figure 6). One of these sites is in a eucalyptus grove in the proposed project area. Northern harrier and loggerhead shrike (*Lanius ludovicianus*), both California species of special concern, have documented nesting occurrences within the CMHWRA.

Nine other species with current special conservation status have been reported during surveys of windfarm projects in the Montezuma Hills: burrowing owl (*Athene cunicularia*), short-eared owl (*Asio flammeus*), peregrine falcon *(Falco peregrinus*), white-tailed kite, tricolored blackbird (*Agelaius tricolor*), American white pelican (*Pelecanus erythrorhynchos*), black swift (*Cypseloides niger*), merlin (*Falco columbarius*), and California black rail (recent mortality observation).

Table 4 lists the number of observations of special-status species during surveys of the High Winds, Shiloh I, Shiloh II, Shiloh III, Montezuma I, and Solano Wind projects.

Special-Status Bats

Western red bat is known to occur in the project area. While the seasonal movements of this species are not well known, all western red bat fatalities reported to date have been found in the fall months. DFG studies document western red bat activity during milder winter days in the Central Valley and San Francisco Bay Area, indicating the potential for this species to occur year-round in the project area, and individuals of the species have been found during migration roosting in tamarisk, a considerably different environment from the usual habitat association with mature riparian forest or orchards (Pierson et al. 2004). Data from Shiloh II's first year of mortality monitoring show three red bat fatalities. In 3 years of survey efforts, Shiloh I reported two western red bat fatalities. High Winds reported four red bat fatalities in 2 years of monitoring, and SMUD reported one red bat fatality in 1 year of monitoring. Each of these numbers reflect actual carcass finds, not adjusted annual mortality estimates.

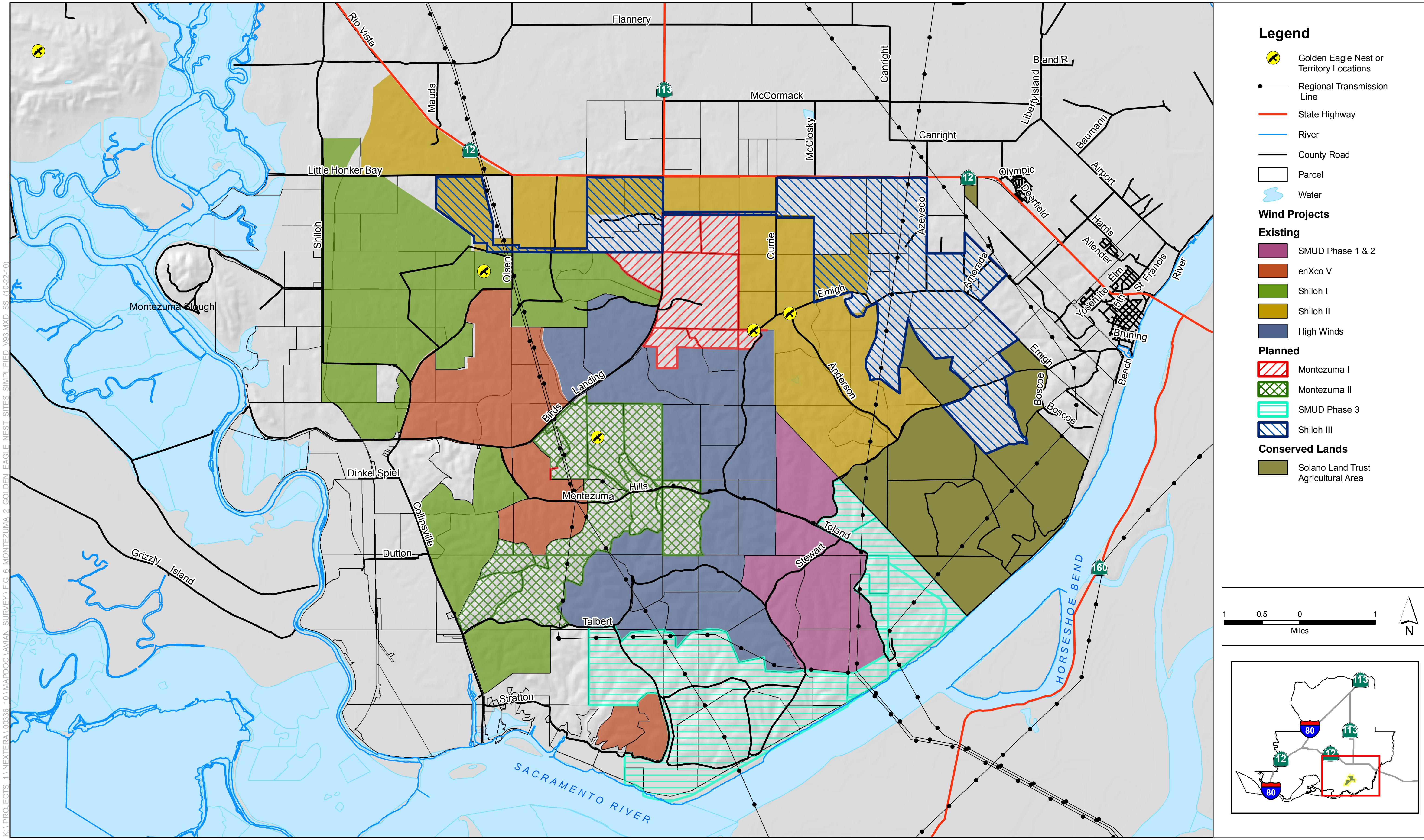

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Figure 6
Golden Eagle Nest Sites and Territory Locations

Chapter 4
Reduction of Risk

Birds

While birds are known to collide with virtually all artificial structures (California Energy Commission 1995), studies have suggested that specific design and siting characteristics contribute to collisions with operating wind turbines in areas where collisions have been identified as a potential problem (Orloff and Flannery 1992, 1996; Kerlinger and Curry 1999; Thelander and Rugge 2001; Smallwood and Thelander 2004). Approaches that have been implemented to reduce bird collisions are discussed below.

Siting Strategies

State and federal guidelines provide some common strategies for micro- and meso-siting of turbines in the project area. First, both recommend the collection of preliminary information to evaluate risk. While risk cannot be eliminated, incorporation of micro- and meso-site conditions into the turbine siting process is likely to provide a considerable benefit relative to the low investment necessitated by such an effort.

Second, federal and state guidelines recommend avoidance actions as a priority in the siting process. The CMHWRA has been shown to support generally moderate to high bird use; it is unlikely that any areas within the Montezuma II Wind project footprint would not pose some risk of avian mortality. However, avoidance of known nest sites, high prey areas (these are limited in the CMHWRA), water sources, and certain topographic configurations can reduce exposure to turbines by foraging raptors or other birds in search of water.

Third, federal and state guidelines recognize the importance of turbine configuration in turbine siting. For example, orienting turbine rows parallel to apparent flyways can reduce the exposure of migrating birds to turbine blades.

Topographical considerations in turbine siting are also thought to influence collision potential (Howell and Noone 1992; Orloff and Flannery 1992, 1996; Kerlinger and Curry 1999; Thelander and Rugge 2001; Smallwood and Thelander 2004). In general, these studies indicate that turbines sited along the edges of steep slopes or within depressions such as swales, saddles, and notches contributed to increased raptor mortality. These types of topographical considerations were taken into account during siting for the Montezuma II Wind project. Although the CMHWRA is not characterized by severe topography such as cliffs, rims, and canyons, and no known major migration routes cross the project area, the proposed turbine layout avoids low-lying valleys and saddles and any ridge edges present. Standard setbacks from biological resources are established, and sensitive environmental areas have been identified.

Design Elements

Perch Availability

Orloff and Flannery (1992, 1996) concluded that bird fatalities were significantly increased at turbines with abundant perches (i.e., horizontal lattice-tower turbines) than at any other type. New wind energy projects typically use tubular towers, in part to reduce perching potential, thereby reducing collision potential. Smallwood and Thelander (2004) did not make this correlation and suggested that perching on wind turbines or their towers is a less important factor contributing to mortality than was previously suspected. The towers proposed for the Montezuma II Wind Project area are of a tubular design.

Rotational Speed

Orloff and Flannery (1996) and Thelander and Rugge (2001) found that rotor velocity and a corresponding increased tip speed are correlated with collision mortality. In other words, more rapidly rotating rotors, such as those of the Kenetech model 56/100 turbine, which rotate at 72 revolutions per minute (rpm), pose a greater likelihood of bird collision than the slower rotational speeds of newer model turbines. The rotors of each of the turbine types being considered for the proposed project typically rotate between 3 and 16 rpm, significantly more slowly than the older 56/100 turbines. The two turbine types being considered for the proposed project have slightly different blade lengths: 93 meters and 101 meters. Accordingly, tip speeds for the two turbine types vary depending on the operational rpm, with ranges of 65–348 mph and 71–379 mph respectively.

Rotor Height

Thelander and Rugge (2001) and Hunt (2002) found that turbines with lower rotor heights (i.e., where the blade-swept area is closer to the ground, as is the case of smaller, older turbines like the 56/100) were correlated with higher mortality of raptors—primarily red-tailed hawks, golden eagles, American kestrels, burrowing owls, and barn owls. Smallwood and Thelander (2004) also examined the relationship of flight height to turbine height and suggested that repowering with turbines with rotor heights more than 29 meters above the ground could substantially reduce raptor mortality. Each of the rotor heights on the turbines considered for the proposed project is significantly higher than that of the older 56/100; one model is 33.5 meters above ground level (AGL) while the other is 29.5 meters AGL.

Percent Time Operating

Newer model turbines are designed to operate for a greater proportion of the year. For example, 56/100 turbines generally operate approximately 49% of the year, while newer model turbines operate up to 75% of the year. This increased time of operation could increase the potential for mortality.

Prey Base Management

Smallwood and Thelander (2004) and Kerlinger et al. (2006) also suggested that prey availability near turbines may be correlated with collision risk by encouraging raptors to hunt in the vicinity of wind turbines. They suggested measures to reduce prey populations near turbines to minimize this risk. Small mammal populations, including California ground squirrels (*Spermophilus beecheyi*), occur in low densities in the project area due to intensive farming and cultivation. Recommended measures to reduce prey populations are not applicable to the project area because prey populations are already highly managed by local farmers.

Assessment Summary

Although the data continue to be somewhat inconclusive and in some cases contradictory, the factors that appear to contribute most significantly to avian collision risk are (1) the number of turbines, (2) the rotational speed of the rotors, (3) rotor height, (4) the availability of perches and possible nesting structures on the turbines and turbine towers, and (5) topographical considerations in siting of turbines. Other factors, however, such as increased prey availability near turbines and turbine location and configuration (e.g., end-row turbines, windwall configuration) have also been demonstrated to be contributing factors in some areas such as the Altamont Pass (Smallwood and Thelander 2004).

One component of the proposed project involves repowering, or replacing older turbines with newer ones. Converting these older, smaller Kenetech 56/100 turbines to modern Siemens turbines should result in a net decrease in avian mortality for that portion of the wind plant. As discussed above, a number of factors have been identified as contributing to increased fatalities at these older generation turbines, including the blades occupying a lower airspace that is more often frequented by foraging birds. Other aspects of older turbines that may have contributed to mortality were the close spacing and the sheer number of turbines required. For example, 782 Kenetech turbines would be required to equal the generational capacity of the 34 Siemens turbines of the proposed project.

Bats

Based on preliminary findings, bat collisions with wind turbines seem to be more frequent than collisions with other artificial structures (Cryan 2008). Few specific causes of risk to bats at wind turbines are known. For example, studies at CMHWRA do not indicate that bats are attracted to FAA-required lighting, and increased fatalities at turbines with certain types of ground cover may indicate an overlooked biological link, or they may simply highlight the role of vegetation, ground color, and visibility in searchers' variable abilities to find carcasses. Data relating bat mortality risk to rotor height and rotation speed are inconclusive.

Aspects of bat biology that might influence susceptibility to wind turbine collisions remain unknown. Some data suggest that hoary bats may actually be attracted to turbines, particularly during the fall mating and migration season, when hoary bats congregate at prominent snags to breed (Western EcoSystems Technology 2002; Szewczak 2010). Hypotheses are being tested, but the current body of knowledge is not sufficient to provide many practical, field-worthy solutions. Several promising lines of inquiry involve localized noise deterrents (Szewczak and Arnett 2008) and whether, and how, wind turbines could be attracting bats, particularly migratory tree roosting species (Cryan 2008).

In addition to aspects of bat biology that might influence susceptibility to wind turbine collisions, barotrauma (i.e., physical damage to body tissues caused by a difference in pressure between an air space inside or beside the body and the surrounding fluid) has also been implicated as a cause of mortality from wind turbines (Baerwald et al. 2008). Bat collisions with turbine blades are thought by some to occur in the wake of the injuries sustained from a pressure drop, though barotrauma on its own is sufficient to cause mortality.

Two consistent findings of increased risk have surfaced; these are discussed below.

Wind Speed

Modern wind turbines such as those proposed for the proposed project are able to operate at lower wind speeds. It is hypothesized that because these lower wind speeds coincide with periods of greatest bat activity, these newer turbines may also pose an increased risk to bats. In cases where significant impacts on bats are anticipated, there are indications that curtailment of operations may result in a reduction of mortality; however research is ongoing with respect to curtailment options.

Seasonal Movement

Several bat species exhibit wide variations in movement patterns between the sexes and between spring and fall migration periods. Many bats typically regarded as solitary congregate for mating and migrating in the fall but move in more scattered, isolated patterns in the spring (Cryan 2008). All four postconstruction mortality studies in the CMHWRA (High Winds, Shiloh I, Shiloh II, and Solano Wind) have shown dramatically elevated bat mortality rates during the fall. Several other studies, as summarized in Erickson et al. (2002), have documented similar spikes in bat fatalities during the fall migration period.

Chapter 5
Conclusions

California Energy Commission Guidelines

The Montezuma II Wind project is an infill project in a developed WRA that has been studied intensively for avian use and avian and bat mortality. As such, it is a CEC Guidelines Category 1 project, defined as projects for which there is existing information sufficient to predict the project's potential impacts on birds and bats with a reasonable degree of accuracy. During initial meetings conducted in 2008, DFG concurred that the proposed project qualifies under Category 1, as multiple years of defensible, empirical mortality data exist for neighboring wind facilities in addition to at least 5 years of avian use and abundance data collected from a significant portion of the proposed project area. There are no outlying habitat elements, topographical features, or land use practices that would set the project area apart from neighboring windfarms or provide cause for presuming a significant difference in avian use and abundance or mortality risk for birds or bats. Surveys to document bird use and abundance are not required or necessary for the proposed project because the level of impact can be predicted with greater accuracy by using existing mortality data from adjacent wind projects.

Avian and Bat Mortality Estimates

Mortality data in the Collinsville-Montezuma Hills WRA have been collected since the early 1990s. Howell and Noone (1992) conducted a study to determine mortality rates over time on the enXco V project. The Wildlife Response and Reporting System, a long-running (more than 12 years), industry-regulated program of reporting and cataloging bird collisions, provides data based on incidentally observed occurrences. Current postconstruction data are available from four facilities' reports: a 1-year mortality study at the Solano Wind site (SMUD 2010), a 1-year study at the Shiloh II site (Kerlinger et al. 2010), a 3-year study at the Shiloh I site (Kerlinger et al. 2009a), and a 2-year study at the High Winds site (Kerlinger et al. 2006). Together, these studies provide mulitiple years of empirical mortality data for the area surrounding the proposed project.

The proposed project includes a single monopole meteorological tower approximately 213 feet (65 meters) tall. As outlined in the CEC Guidelines (2007), guyed meteorological towers are known to pose a hazard to birds. The use of monopole meteorological towers, such as those proposed for the Montezuma II project, is thought to reduce risks to avian species, and the CEC recommends their use.

Mortality search efforts by the windfarms in operation at CMHWRA have been relatively consistent between facilities and for the most part have generated datasets that can be compared with a degree of confidence. Mortality estimates for the proposed project were based on the methodologies, results, and range of mortality rates developed in these earlier studies (Table 5).

While all the studies met CEC Guidelines and are generally comparable, there are differences in study methodologies that could translate into differences in reported mortality rates. Some of these issues are discussed below.

The SMUD mortality surveys entailed a significantly smaller search area around each turbine (out to 62.5 meters as opposed to 105 meters), a longer search interval (14 days as opposed to 7), a greater distance between search transects, and the smallest percentage (approximately 30%, or 16 out of 52) of total turbines searched. Moreover, the SMUD surveys used searcher efficiency and scavenger removal adjustment rates from neighboring studies that may or may not be accurate when applied to the SMUD site's topography and search methodology.

The High Winds survey covered nearly 100% of operational turbines, but surveyors searched approximately half the ground area at each turbine as that covered at Shiloh I and used a 14-day search interval.

Shiloh II mortality surveys will cover 100% of its 75 operational turbines over the course of 3 years of study, but only 25 will be covered in any given year. This methodology leaves room for the dilution of mortality effects of turbine groupings near microhabitats (e.g., wetlands and mortality of waterbirds including California black rail) if data are compiled into a multi-year average.

The Shiloh I surveys provide the longest term dataset, used the shortest search interval (7-day), and searched the most ground (to 105 meters from the turbine base, equivalent to twice the area searched for the High Winds mortality surveys) with the narrowest transect spacing (particularly when transect spacing was reduced in the third year). Moreover, this mortality study conducted onsite searcher efficiency and scavenger removal trials, and is thus most likely to have site-accurate adjustment factors. Years 2 and 3 may provide the most accurate estimates from which to derive an average estimated mortality per MW, as the search effort was augmented, and the adjustment factors for scavenger removal and searcher efficiency were made more robust. In addition, an elevated level of small-bird use of the project area was observed in the first year of the mortality surveys and may account for the significantly higher mortality rate reported for that year (Kerlinger et al. 2009a).

Year-to-year variation in wildlife presence based on prey fluctuations, weather patterns, agricultural rotations, and other unknown factors can affect mortality in any given area, making long-term datasets invaluable to accurate mortality predictions. Differences in microhabitats and groundcover at each windfarm can also make applying mortality rates from one site to another an inexact science. Given these uncertainties, the most responsible approach would be to apply to the proposed project the highest mortality rates observed in the CMHWRA to date. Accordingly, Table 5 provides overall avian and bat mortality estimates for the proposed project, standardized per MW per year, and a breakdown of mortality estimates for those special-status species that have been found in carcass searches to date at the CMHWRA. The two California black rail incidents are the only known occurrence of this species in the CMHWRA, and habitat for California black rail is not known to occur in the project area. Consequently, and absent information indicating that this species occurs in or flies through the project area, California black rail is not included in the special-status species mortality estimates for the proposed project.

Table 5 shows the estimated annual per MW mortality (adjusted using scavenger removal and searcher efficiency correction factors) and the estimated avian and bat mortality for the proposed project based on the number and type of turbines, and it shows mortality estimates calculated from mortality surveys throughout the CMHWRA. It is assumed for purposes of this assessment that changes in mortality as a result of differences in output or individual turbine characteristics would be negligible. Several species were reported at only one site. In these cases, that fatality rate was adopted, even though there is potential for those species never to be found, or seldom to be found, in

Table 5. Adjusted Mortality Estimates for Selected Species at CMHWRA Wind Projects

Species/Group	High Winds (2-year average)	Shiloh I (3-year average)	Shiloh II (1 year)	Solano Wind (1 year)	Average Mortality among Four Studies	Highest Mortality among Four Studies	Proposed Project: Estimated Fatalities/Yr with 34 Siemens 2.3 MW Turbines[a]
Overall avian	1.36	6.96	1.51	0.34	2.54	6.96	199–544
American kestrel	0.21	0.28	0.03	0.06	0.145	0.28	11.34–21.90
Red-tailed hawk	0.14	0.07	0.09	0.15	0.1125	0.14	8.80–10.95
Northern harrier	—	0.01	—	—	0.0025	0.01	0.20–0.78
Golden eagle	0.01	0.005	—	—	0.01	0.01	0.29–0.78
White-tailed kite	0.023	—	—	—	0.00575	0.023	0.45–1.80
Peregrine falcon	—	0.005	—	—	0.00125	0.005	0.10–0.39
Ferruginous hawk	0.01	0.01	—	—	0.005	0.01	0.39–0.78
Rough-legged hawk	0.01	—	—	—	0.0025	0.01	0.20–0.78
Large birds	0.22	0.21	0.70[b]	0.15	0.19[c]	0.22[c]	15.6–17.2
Medium birds	0.24	1.89	(included with large birds)	0.19	0.84[c]	1.89[c]	65.69–147.80
Small birds	0.89	4.86	0.81	—	1.64	4.86	128.25–380.05
Overall bat	2.02	3.92	2.72	1.65	2.58	3.92	201.56–306.68
Western red bat	0.07	0.06	0.26	0.25	0.16	0.26	12.5–20.3

Sources: High Winds: Kerlinger et al. 2006; Shiloh I: Kerlinger et al. 2009; Shiloh II: Kerlinger et al. 2010; Solano Wind: SMUD 2010

Note: all mortality rates except the estimated fatalities per year shown for the proposed project reflect fatalities per megawatt (MW) per year.

[a] Estimates presented are a range based on the average mortality observed during all four studies, up to the highest mortality observed during any one study.

[b] Includes medium and large birds

[c] Medium and large birds were combined in the Shiloh II study and are excluded from this calculation.

the Montezuma II Wind project area. By employing the worst-case scenario estimates for the upper range and including rare species such as peregrine falcon, these mortality calculations reflect the highest expected mortality rates for the full range of species that could occur. Earlier studies have reported a range of mortality rates, and using the lowest reported mortality rates to extrapolate rates for the proposed project would not be realistic. A more realistic estimate can be obtained by averaging the rates reported in the earlier studies. While this estimate is likely to be more realistic, it may not account for differences in year-to-year variation or microhabitat conditions. Accordingly, the authors of this report present a range of mortality estimates based on an average of the earlier studies, as well as a mortality estimate based on the highest mortality rates reported in the earlier studies. Estimates for the Montezuma II project were calculated by multiplying the number of turbines (N=34) times 2.3 MW/turbine times the average per MW mortality rates (lower range), and highest mortality rates (upper range). This range of estimated mortality rates is shown in Table 5.

Overall bird mortality from the proposed project is expected to be approximately 219–544 birds per year. Less than one-tenth of these are expected to be raptors, primarily American kestrel. While this amount of raptor mortality would not be expected to affect local or regional populations, the effect could be further diluted as a result of the possible origins of the individual birds, which can be generally surmised from the time of year in which the fatalities occurred. Kerlinger et al. (2006) reported that approximately one-third of the High Winds fatalities occurred during the breeding season, indicating local birds, and the remaining two-thirds occurred during the migratory and wintering seasons, suggesting birds from outside the local or regional area. Thus, the majority of the raptor fatalities may be birds that originate outside the region and possibly from many different population centers, effectively spreading out the effects of the mortality.

Four special-status raptor species were among the fatalities in the Shiloh I dataset (Kerlinger et al. 2006): golden eagle, ferruginous hawk (California species of special concern at the time of the Shiloh 1 study but subsequently removed from the list), northern harrier, and peregrine falcon. Three special-status raptor species were among the fatalities at High Winds: golden eagle, ferruginous hawk, and white-tailed kite. Mortality estimates for these species are included in Table 5. While the probability of a fatality is low for each of these species, the species occur in relatively low frequencies; consequently, any individual loss could represent a greater percentage of the birds present.

Bat mortality was also detected during mortality monitoring and is accordingly included in Table 5. Western red bat, a California species of special concern and a high conservation priority for the Western Bat Working Group, , was among the fatalities.

In the High Winds project area, 116 bat carcasses were observed, and 90 bat carcasses were observed in the Shiloh I project area. Of these, the majority of the fatalities at both sites were hoary bats and Mexican free-tail bats (110 of the 116 and 86 of the 90 at Shiloh I), and 6 western red bat fatalities and 4 silver-haired bat fatalities were recorded between the two sites. This general pattern of species composition holds true for the Shiloh II and Solano Wind fatalities. One red bat was found in Solano Wind's surveys, and three were found at Shiloh II.

The greatest numbers of bat carcasses were observed during the fall migration and mating period, with 78% of the carcasses found between August and October 2003 and 80% of the carcasses observed between August and October 2004. At Shiloh I, 87% of all bat fatalities recorded in 3 years of surveys were found between August and October, while no bat fatalities were recorded from December through February for each of the 3 years. Data from Shiloh II's first year of mortality monitoring shows 91% of bat fatalities occurring in the fall, a complete absence of bat fatalities from December through March, and another absence of fatalities in June and July. The only bat fatality reported in SMUD's 1-year of postconstruction monitoring was found in October. In 2 years of monitoring at High Winds, silver-haired bats and western red bats were not reported in any months other than August through November.

Using the same extrapolation for estimated mortality, bat mortality is expected to be approximately 202–307 individuals per year, with the majority of bat fatalities occurring from August to November, peaking in September and October. Applying the highest mortality estimate from Solano Wind to the thirty-four 2.3 MW turbines proposed by this project would yield a fatality count of approximately 20 western red bats per year.

Avian and bat fatalities resulting from collisions, whatever the circumstances under which they occur, do not in and of themselves constitute a significant impact. Fatalities attributable to collision with turbines during the operation of wind plants generally—and the Montezuma II Wind project specifically—are no exception. The question of biological significance under CEQA hinges 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. Mortality data have not revealed any clear, spatially concentrated bird or bat movement patterns, nor are there known mass roost locations that would create areas of unusually high risk to bats were a turbine to be placed nearby. With regard to the proposed project, the greatest uncertainty on this front is the question of whether the few golden eagles nesting in the CMHWRA constitute a population; however, data necessary to make this determination are not available.

The primary means of determining an adverse effect on a species is to estimate how many project-induced fatalities a given population can 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 affected by the number of fatalities sustained from a given activity and/or the total of various activities. Wildlife agencies have the responsibility to establish population levels that must be maintained to ensure the continuation of any given species. When those thresholds 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 its food supply, and fatality by collision with structures or some other direct action that causes fatalities to occur. Table 5 presents estimates of the fatalities of the special-status birds and the number of bats associated with the proposed project. It is anticipated that the proposed project would result in similar rates of impacts on avian and bat species as existing projects in the CMHWRA.

Other Considerations

While not discussed extensively in this report, approximately half of the project area is within the existing enXco V project area. The enXco V project was constructed in 1989–1990 using small Kenetech 56/100 wind turbines. The project was constructed prior to the design and widespread implementation of current mortality monitoring standards and data are limited on the project with respect to avian and bat mortality.

Howell and Noone (1992) conducted mortality monitoring at the enXco V project site following construction; however, the methods differ from those used in current studies, making a direct comparison of other, more recent studies in the CMHWRA difficult and inappropriate. In general, early studies on avian mortality, such as the Howell and Noone study, did not employ the same survey methodology standards as the current studies. The survey area was not well defined as in current studies, scavenger trials did not account for small birds or bats, and searcher efficiency studies were not conducted. Each of these differences makes a direct comparison with current studies difficult. Extensive studies on Kenetech 56/100 turbines have also been conducted at the Altamont Pass Wind Resource Area (APWRA), which differs substantially from the CMHWRA, also making comparisons difficult. Recent studies in the APWRA conducted under the supervision of the Alameda County Scientific Review Committee (ICF Jones & Stokes 2009) have included mortality monitoring at repowered projects. To date, there have been two repowering projects in the APWRA, entailing the replacement of older turbines with new generation turbines: the Diablo Winds repowering project and the Buena Vista repowering project. The Diablo Winds repowering project was evaluated by Western EcoSystems Technology (2006), Smallwood and Karas (2009), and ICF Jones & Stokes (2009). The Buena Vista repowering project was evaluated by Insignia Environmental (2009).

In the Diablo Winds repowering project, 169 FloWind vertical axis turbines were replaced with 31 660 kw Vestas V47 turbines in 2005 (Western EcoSystems Technology 2006). Although these Vestas turbines were larger than the FloWind turbines and structurally very different (vertical axis turbines as opposed to horizontal turbines on tubular towers), they are smaller than the modern turbines, rated at 1 MW or more, that have become standard. Mortality rates reported by WEST (2006) for the first year of operation (March 2005–February 2006) were estimated to be approximately 0.32 raptor/MW/year and 1.8 birds/MW/year, excluding incidental finds. These estimates were significantly lower than those reported by Smallwood and Thelander (2004) for the rest of the APWRA, but were not directly comparable because the projects were sampled during different years using different sampling schemes.

Smallwood and Karas (2009) attempted to evaluate the effects of repowering by comparing estimated annual mortality rates for the Diablo Winds project area before and after repowering. Using this approach, the estimates of the number of birds killed during 1998–2002 prior to repowering were lower than the estimates of mortality during 2005–2007 after repowering. However, the sampling scheme and sampling intensity used during the period prior to repowering were substantially different from those used after repowering. Data used to estimate mortality rates prior to repowering were from Smallwood and Thelander (2004), while data used to estimate mortality rates subsequent to repowering were from the ICF fatality study (ICF Jones & Stokes 2009). Given the vast differences between the two study periods in sampling duration and intensity, the lack of precision in estimates produced by the prevailing estimation method, and the known or perceived high level of inter-annual variation in bird use and fatality rates, the appropriateness of this comparison is questionable.

Smallwood and Karas (2009) compared estimated mortality rates from the Diablo Winds project site using data from the ICF fatality study to concurrent estimates of mortality rates from non-repowered turbines in the APWRA. Estimated mortality rates were 1.8 raptors/MW/year and 5.7 birds/MW/year for repowered turbines, compared to 2.2 raptors/MW/year and 7.5 birds/MW/year for concurrently operating old-generation turbines across the rest of the APWRA. These estimates are substantially higher than those reported by WEST, but they nevertheless provide strong evidence for a beneficial effect of repowering. Based on an Analysis of Variance (ANOVA), estimated mortality rates were significantly lower for several species and species groups: red-tailed hawks (64% lower), American kestrel (92% lower), all raptors (54% lower), and all birds (66% lower).

Estimated mortality rates were 84% lower for golden eagle, 24% for burrowing owl, 95% for barn owl, 83% for horned lark, 73% for mourning dove, 44% for loggerhead shrike, and 44% for western meadowlark, though not significantly so. The authors concluded that careful repowering could reduce avian fatalities by up to 54% for raptors and 65% for all birds.

ICF also compared estimated mortality rates at the repowered Diablo Winds project site to concurrent estimates from the rest of the APWRA, using 3 years of data instead of the 2 years presented in Smallwood and Karas (2009). ICF presented mortality rates for only four species: American kestrel, golden eagle, red-tailed hawk, and burrowing owl. For all species, mortality rates were lower for the repowered turbines than for the old-generation turbines, substantially so for American kestrel and golden eagle. Burrowing owl mortality rates, though lower, were similar to APWRA-wide estimates. However, burrowing owls are believed to occur in significant numbers in that part of the APWRA (Western EcoSystems Technology 2006; ICF file data), suggesting that the "treatment effect" of repowering may be greater than the mortality rate estimates would indicate.

The Buena Vista project site was repowered in 2005 and became operational in December 2006. A total of 179 old-generation 150 and 160 kW turbines were replaced with 38 new Mitsubishi 1 MW turbines. Although monitoring is ongoing, the only report available is for the first year, covering the period February 2008–February 2009 (Insignia Environmental 2009). Postconstruction monitoring at Buena Vista uses modern, scientifically defensible, industry standard techniques such as a census of the turbines, a 2- week search interval, and ongoing monitoring of carcass removal and searcher efficiency rates.

Estimated annual mortality rates were 0.44 raptor/MW/year and 1.15 birds/MW/year, substantially lower than estimates for the Diablo Winds project site. Although estimated mortality rates were lower for burrowing owl and red-tailed hawk and slightly higher for American kestrel and golden eagle than those for the Diablo Winds project site (ICF Jones & Stokes 2009), the mortality rates are generally similar in magnitude. Because the Buena Vista project was not part of the current APWRA monitoring program, it is not possible to make direct comparisons between the historic and current fatality rates at the site. However, the preponderance of evidence from the Buena Vista postconstruction monitoring and the current APWRA-wide monitoring program suggests that repowering has reduced fatality rates at the project.

In all studies of the two repowered project sites within the APWRA, repowering with newer generation turbines has resulted in a reduction in the estimated total number of avian fatalities and the overall mortality rate per MW of nameplate capacity, for all species groups and for all individual species. In addition, although the nameplate capacity of the repowered turbines is the same as that of the turbines being replaced, the amount of energy actually produced by new-generation turbines is greater. Therefore, the total number of fatalities per MW is even smaller for repowered project sites.

Overall, the results of monitoring indicate that repowering within the APWRA has resulted in a reduction in overall mortality for those projects. It is reasonable to assume that repowering within the CMHWRA would have a similar effect for most species overall. Although not specifically considered in the mortality estimates for the proposed project, the replacement of the existing enXco V turbines in the proposed project area is likely to reduce avian mortality from the current baseline conditions.

Chapter 6
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