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Year 1 Avian Use Study Report and Risk Assessment for the Fountain Wind Project

Shasta County, California

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EXECUTIVE SUMMARY

In April 2017, Western EcoSystems Technology, Inc. (WEST) initiated an avian use study at the proposed Fountain Wind Project (Project) in Shasta County, California. The study was conducted following the tiered approach outlined in the US Fish and Wildlife Service (USFWS) Land-Based Wind Energy Guidelines and USFWS Eagle Conservation Plan Guidance (ECPG), and included the following principle objectives: 1) to assess the relative abundance and spatial and temporal distribution of birds throughout the Project area and 2) to evaluate the potential for adverse impacts to avian species, particularly eagles, other diurnal raptors, and species of regulatory or management concern. This report includes methods and results for the Year 1 avian use study at the Project, as well as an assessment of potential risk to avian species resulting from Project development.

Fixed-point avian use surveys were conducted at 39 observation points located throughout the Project area from 19 April 2017 through 22 May 2018. Two separate surveys were conducted at each point every month: a 10-minute (min) small bird survey followed immediately by a 60-min large bird survey. Over the course of the study, 531 large bird surveys were completed and a total of 3,267 large bird observations including 25 species were recorded. Large bird use was highest in winter, largely due to high use by waterfowl. Diurnal raptor use was highest during the fall (0.56 birds/plot/60-min survey) and lowest during summer (0.23). The most common raptor species observed in the Project was red-tailed hawk (148 observations), which composed 69% of overall diurnal raptor observations. This was followed by sharp-shinned hawk (18 observations), bald eagle (16 observations), and Cooper's hawk (nine observations). Diurnal raptors were observed at all 39 points with the highest use occurring at Point 30 (1.92 birds/60-min survey).

Over the course of the 531 small bird surveys conducted during the Year 1 study, a total of 2,408 small bird observations, comprising 71 separate species, were recorded. Six species (dark-eyed junco, mountain chickadee, western bluebird, red-breasted nuthatch, Steller's jay, and yellow-rumped warbler) accounted for nearly half (49.2%) of all small bird observations. The highest small bird use was recorded in fall (5.61 birds/plot/10-min survey), followed by summer (4.23), spring (3.56), and winter (2.79). Small bird use varied among the 39 observation points, with the highest use recorded at points 17 and 7 (8.77 and 7.14 birds/10-min survey, respectively), and the lowest use at points 39 and 15 (2.15 and 2.29).

During surveys or incidentally, 10 bird species considered sensitive at the state and/or federal level were recorded within the Project area. At the state level this included two state fully protected species (bald eagle and golden eagle), and six state species of special concern (American white pelican, northern goshawk, northern harrier, olive-sided flycatcher, Vaux's swift, and yellow warbler). Additionally, sandhill crane was recorded during surveys. Depending on the subspecies of sandhill crane observed, these were either state-threatened or state species of special concern; identification to subspecies level was not possible. Species considered sensitive at the federal level included four bird species of conservation concern in

the Sierra Nevada Bird Conservation Region (bald eagle, Cassin's finch, northern goshawk, and olive-sided flycatcher). Additionally, bald and golden eagles receive protection under the federal Bald and Golden Eagle Protection Act.

To date, overall fatality rates for birds at wind energy facilities in California and the Pacific Northwest have ranged from 0.16 to 17.44 fatalities/MW/year, while diurnal raptor fatality rates at these same facilities have ranged from zero to 1.06 fatalities/MW/year. However, the forested habitats covering the majority of the Project area are unique to wind energy facilities in the western US, which are more typically composed of desert scrub, grassland, and shrub-steppe vegetation communities, potentially limiting the inference from studies conducted at most other facilities. The one exception to this is the Hatchet Ridge Wind Energy Facility (Hatchet Ridge), located adjacent the Project and having similar ecological characteristics. Because of the proximity and similarity of Hatchet Ridge to the Project, Hatchet Ridge represents the most relevant source of information for assessing potential risk to avian species at the Project. The results of pre-construction avian use surveys conducted at Hatchet Ridge were largely consistent with those documented at the Project during this study, and based on post-construction monitoring data collected at Hatchet Ridge, all bird, small bird, and diurnal raptor fatality rates have all been low and within the range of other facilities in California and the Pacific Northwest. Given the similarity in species composition and temporal use patterns reported at Hatchet Ridge and observed at the Project, it is reasonable to expect that fatality rates and species composition of fatalities at the Project would be similar to that documented at Hatchet Ridge. Following recommendations presented in the ECPG, a second year of large bird/eagle use surveys is currently underway at the Project and because field studies were being conducted to gather a second year of large bird/eagle use data, Pacific Wind opted to capitalize on the efficiency of being in the field and is also completing a second year of small bird use surveys. An updated risk assessment will be prepared following the completion of the second year of surveys, in early summer 2019. The updated risk assessment will focus on risk to bald and golden eagles, as well as any inter-annual variations in species composition or use documented during the Year 2 surveys that may influence perceived risk to avian species at the Project.

STUDY PARTICIPANTS

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REPORT REFERENCE

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INTRODUCTION

In 2016, Pacific Wind Development, LLC contracted Western EcoSystems Technology, Inc. (WEST) to conduct an avian use study at the proposed Fountain Wind Project (Project) to evaluate the potential impacts of Project construction and operation on birds. Agency guidelines regarding the study of wildlife and how to assess potential impacts of wind energy on wildlife have evolved over the past 10 years, with the most current guidance from the USFWS provided in the Land-based Wind Energy Guidelines (WEG; USFWS 2012) and Eagle Conservation Plan Guidance (ECPG; USFWS 2013). The study was designed to address the questions posed under Tier 3 of the WEG (USFWS 2012) and Stage 2 of the ECPG (USFWS 2013), while also collecting data comparable to those recommended in the more dated California Wind Energy Guidelines (CEC Guidelines; CEC and CDFG 2007). Similar to the WEG, the CEC Guidelines identify modified point counts surveys (i.e., bird use counts) as the primary survey technique to collect data on bird species composition, relative abundance, and bird behavior that might influence vulnerability to collisions with wind turbines (see top of page 44 of the CEC/CDFG Guidelines). Recommendations in the WEG, ECPG, and CEC Guidelines all result in data sufficient to document species composition, relative abundance, and behavior; therefore, to reconcile the slightly differing protocols as presented in the various guidelines, implementation of the more current ECPG (and WEG) were given precedent over strict interpretation of the CEC Guidelines.

The primary objectives of the study were to: 1) assess the relative abundance and spatial and temporal distribution of birds throughout the Project area and 2) evaluate the potential for adverse impacts to avian species, particularly eagles, other diurnal raptors, and species of regulatory or management concern. This document provides the results of fixed-point avian use surveys conducted at the Project from April 2017 to May 2018, which represents the first 13 months (Year 1) of the two-year study. In addition to a detailed description of survey methodology and results, this document presents an assessment of potential risk to avian species at the Project based on the Year 1 survey results.

STUDY AREA

The Project area includes approximately 32,000 acres (ac; 12,950 hectares [ha]) within Shasta County in northern California, northeast of the community of Redding (Figure 1). The Project is located within the Cascades Ecological Region (ecoregion; Griffith et al. 2016), which is a Level III Ecoregion primarily covering parts of Oregon and Washington but also including a discontinuous land area near Mount Shasta in California. This ecoregion is marked by a generally mesic, temperate climate which supports productive coniferous forests. At higher elevations, subalpine meadows provide habitat for unique flora and fauna. The land cover types within the Project area are predominantly coniferous forest (54.7%) and shrub/scrub (38.3%), with the shrub/scrub mostly comprising recently harvested stands of coniferous forest that have been replanted with conifer trees but also have a high shrub component (Figure 2, Table 1). Small areas of mixed montane chaparral and herbaceous vegetation (i.e., grassland) are scattered throughout the Project area (Figure 2, Table 1). Wetlands occur within the Project area primarily as riverine habitats, with much smaller areas of wet montane meadow and open water (Figure 2, Table 1). Remaining land cover within the Project is composed of very small areas of barren land, mixed forest, developed areas, and cultivated cropland (Table 1, Figure 2).

Table 1. Land cover types within the Fountain Wind Project area according to National Land Cover Data (US Geological Survey [USGS] National Land Cover Database [NLCD] 2011, Homer et al. 2015).

Land Cover	Acres	% Composition
Coniferous Forest	17,786.16	54.7
Shrub/Scrub	12,430.51	38.3
Herbaceous	1,516.25	4.7
Deciduous Forest	344.15	1.1
Barren Land	205.18	0.6
Mixed Forest	95.09	0.3
Developed, Open Space	74.90	0.2
Emergent Herbaceous Wetlands	21.26	0.1
Developed, Low Intensity	8.13	<0.01
Cultivated Crops	5.71	<0.01
Total	**32,487.34**	**100**

Dominant overstory species within the Project area include a combination of white fir (*Abies concolor*), Douglas fir (*Pseudotsuga menziesii*), incense cedar (*Calocedrus decurrens*), ponderosa pine (*Pinus ponderosa*), sugar pine (*P. lambertiana*), and California black oak (*Quercus kelloggii*). A number of permanent and intermittent streams run throughout the Project area, flowing primarily to the west and northwest. The primary drainages in the north are Hatchet Creek and Montgomery Creek (north and south forks), while Cedar Creek and Little Cow Creek drain the southern portions of the Project area. Riparian vegetation along these creeks includes various willow species (*Salix* spp.), thinleaf alder (*Alnus incana* ssp. *tenuifolia*), several species of maple (*Acer* spp.), mountain dogwood (*Cornus nuttallii*), and California hazel (*Corylus cornuta* var. *californica*).

The Project area is entirely privately owned and actively managed for commercial timber production. In 1992 the Fountain Fire burned approximately 64,000 ac (25,900 ha) in and around the Project, including an area encompassing the north-central half of the Project area. Post-fire management included salvage logging, site preparation, and planting in the year following the fire. As of 2018, the burned portion of the Project area comprises mostly contiguous stands of roughly 25-30 year old timber. As a result of the Fountain Fire, merchantable timber is primarily confined to the southern half of the Project area, where ongoing harvest operations are regularly occurring (Figure 3). Given that the Project area is privately owned and managed for timber production, current and future commercial timber operations will continue to alter the landscape within the Project area, with older forests being harvested and replanted with conifer seedlings that eventually transition from a shrub-scrub cover type to densely treed early- seral forests over the following 10-20 years. As timber management changes the landscape within the Project area, bird communities will also change spatially within the Project area.

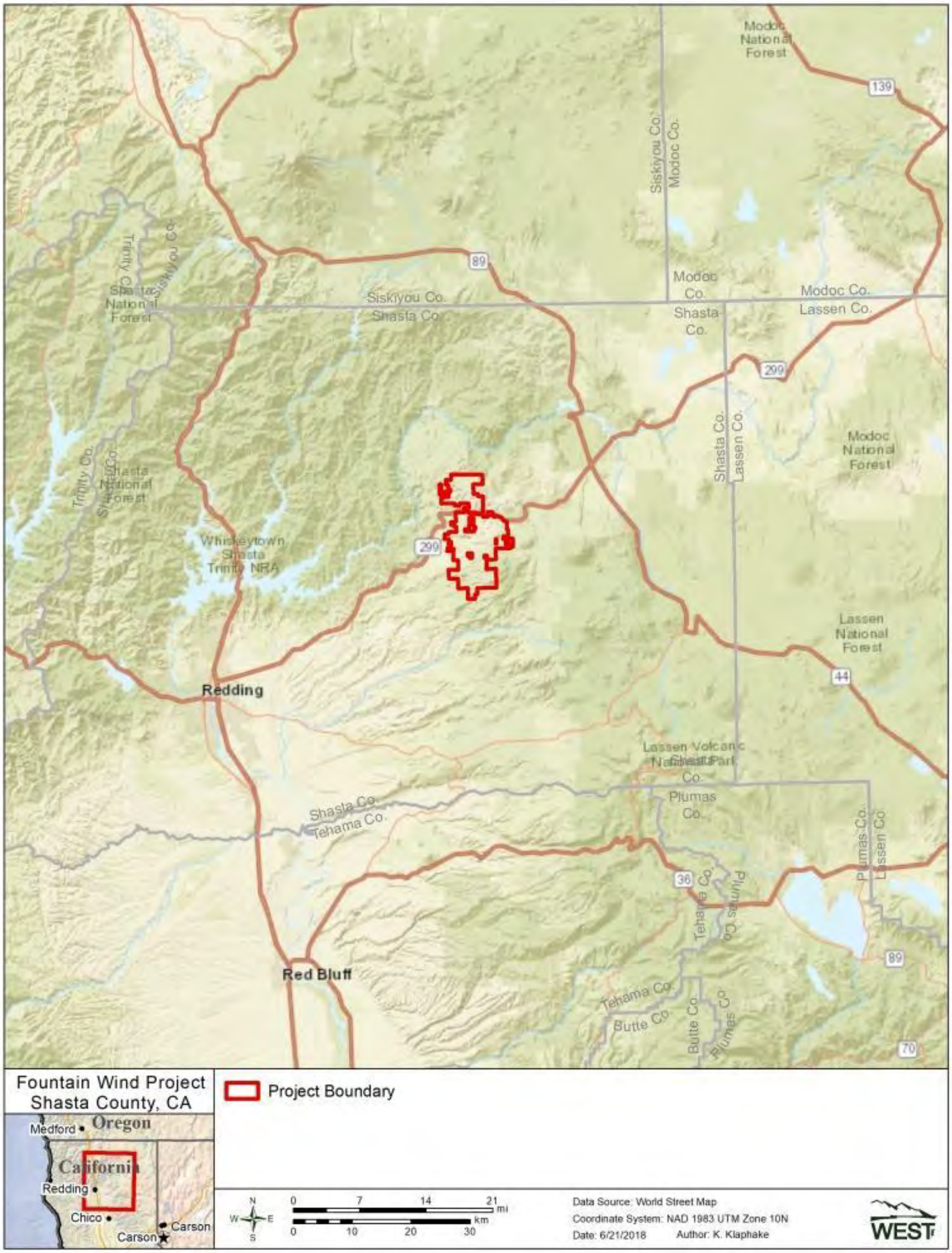


Figure 1. Location of the Fountain Wind Project, Shasta County, California

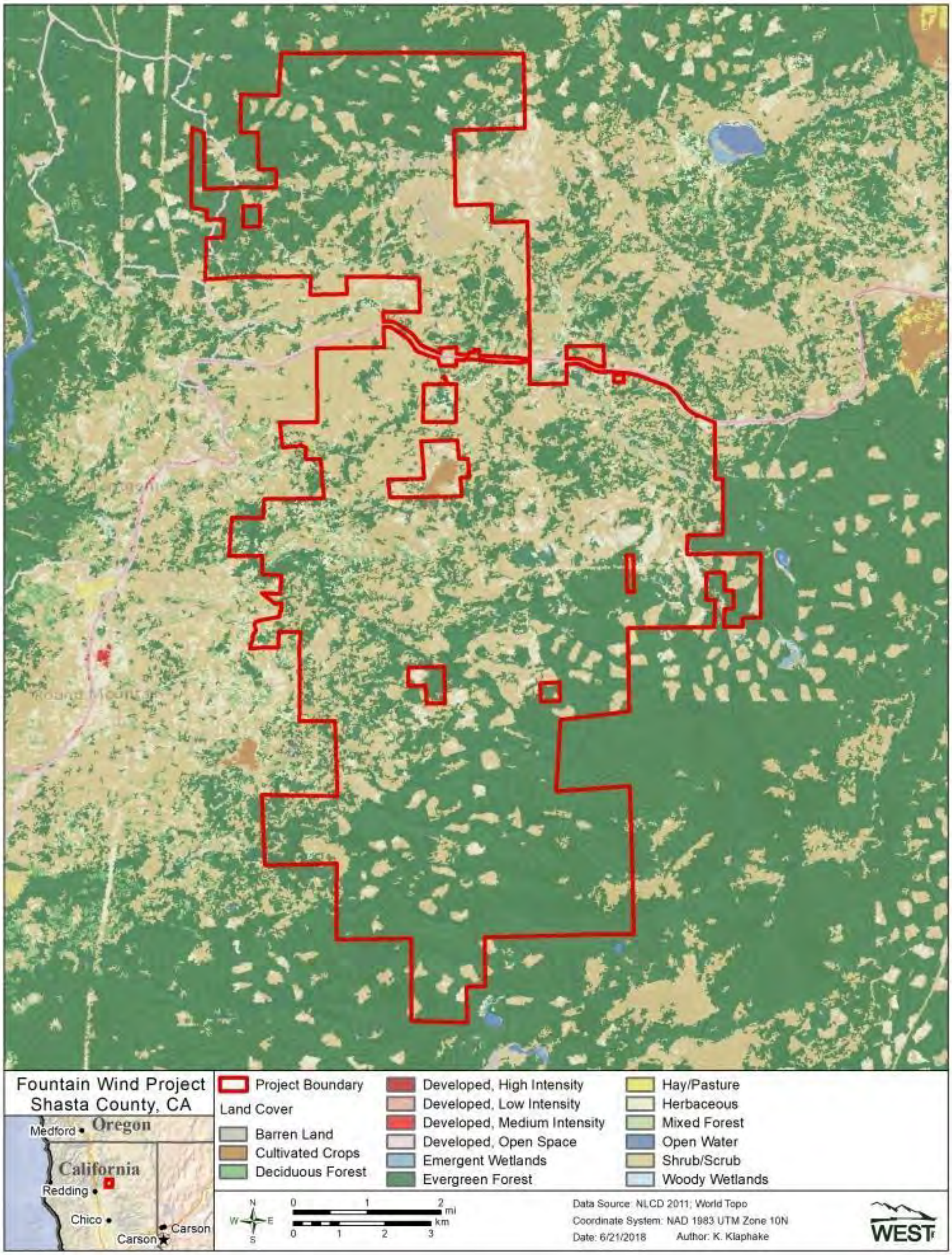


Figure 2. The land cover types and coverages within the Fountain Wind Project, Shasta County, California (US Geological Survey National Land Cover Database 2011, Homer et al. 2015).

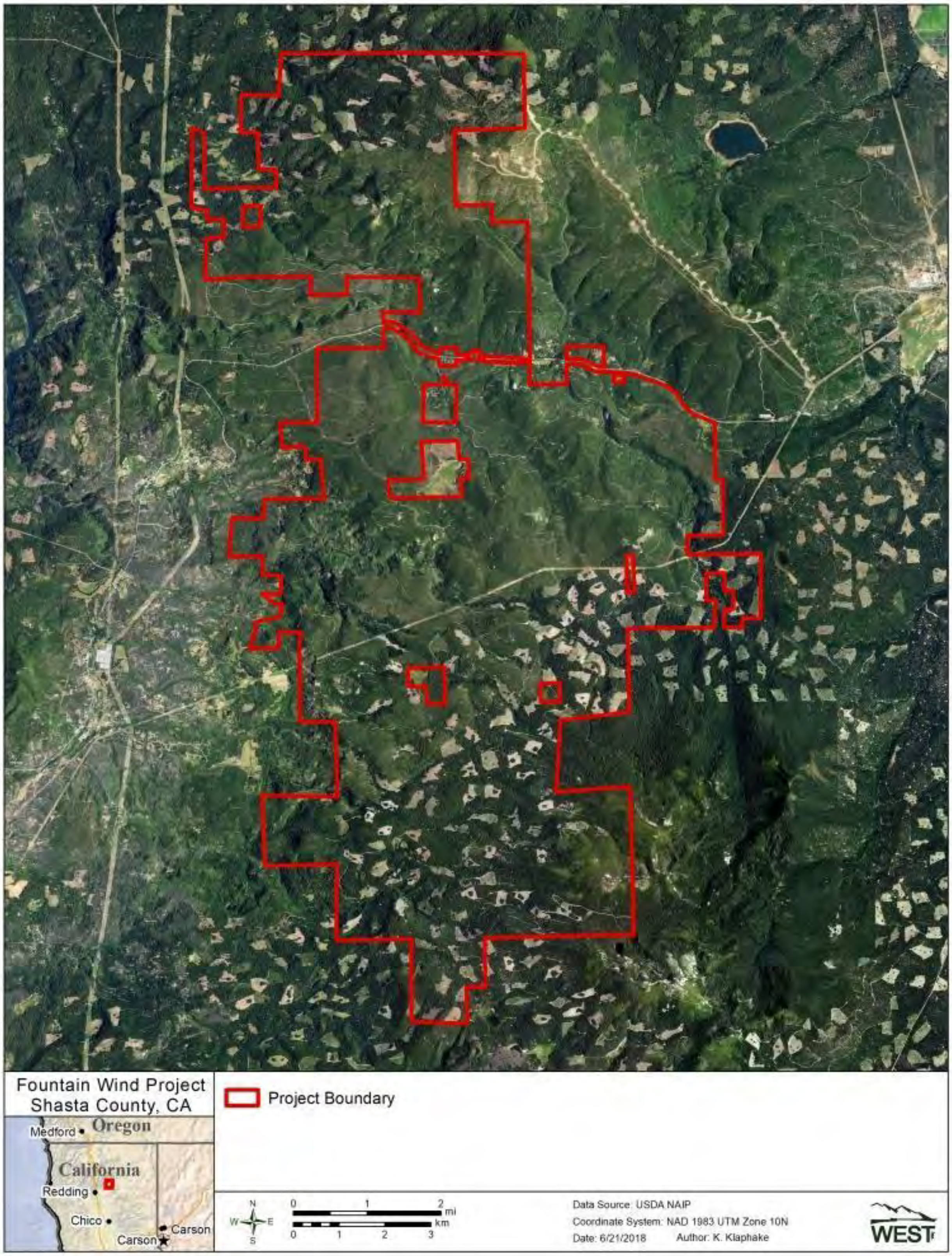


Figure 3. Aerial imagery of the Fountain Wind Project, Shasta County, California.

METHODS

Point-count surveys are the most widely used methodology for pre-construction avian use characterization and risk analyses (e.g., USFWS “Tier 3” studies [USFWS 2012]) because of their effectiveness and efficiency for characterizing use of selected sites by a broad spectrum of diurnally active birds (Ralph et al. 1993, Strickland et al. 2011). Fixed-point avian use surveys for both large and small birds were conducted using the field methods described by Reynolds et al. (1980). Survey methodologies were generally comparable to those used at other wind energy sites in California and the Pacific Northwest and were consistent with methods and survey effort recommended in the WEG and ECPG (USFWS 2012, 2013), as well as the CEC Guidelines (CEC and CDFG 2007). Separate surveys were conducted for large and small birds.

Large Bird Surveys

The primary objective of the large bird surveys was to estimate the seasonal and spatial use of the Project area by large birds, with an emphasis on eagles and other diurnal raptors (e.g., *Accipiter* spp., *Buteo* spp.).

Survey Plots

Thirty-nine observation points were located throughout the Project area with each observation point centered in an 800-meter (m; 2,625-foot [ft]) radius survey plot (Figure 4). Plots were selected for viewshed and to survey representative habitats and topography within the Project area, while meeting ECPG spatial sampling recommendations of at least 30% survey coverage of areas within 1.0 kilometer (km; 1.6 miles [mi]) of proposed turbine locations (USFWS 2013).

Field Methods

The survey duration at each point was 60 minutes (min), during which time only large birds were recorded. Large birds were defined as waterbirds, waterfowl, shorebirds, diurnal raptors, vultures, upland game birds, doves and pigeons, and large corvids (e.g., magpies, crows, and ravens). While all large birds, regardless of distance from the observer, were recorded during each survey, only birds within the 800-m radius plot were used for quantitative analysis and other comparative metrics.

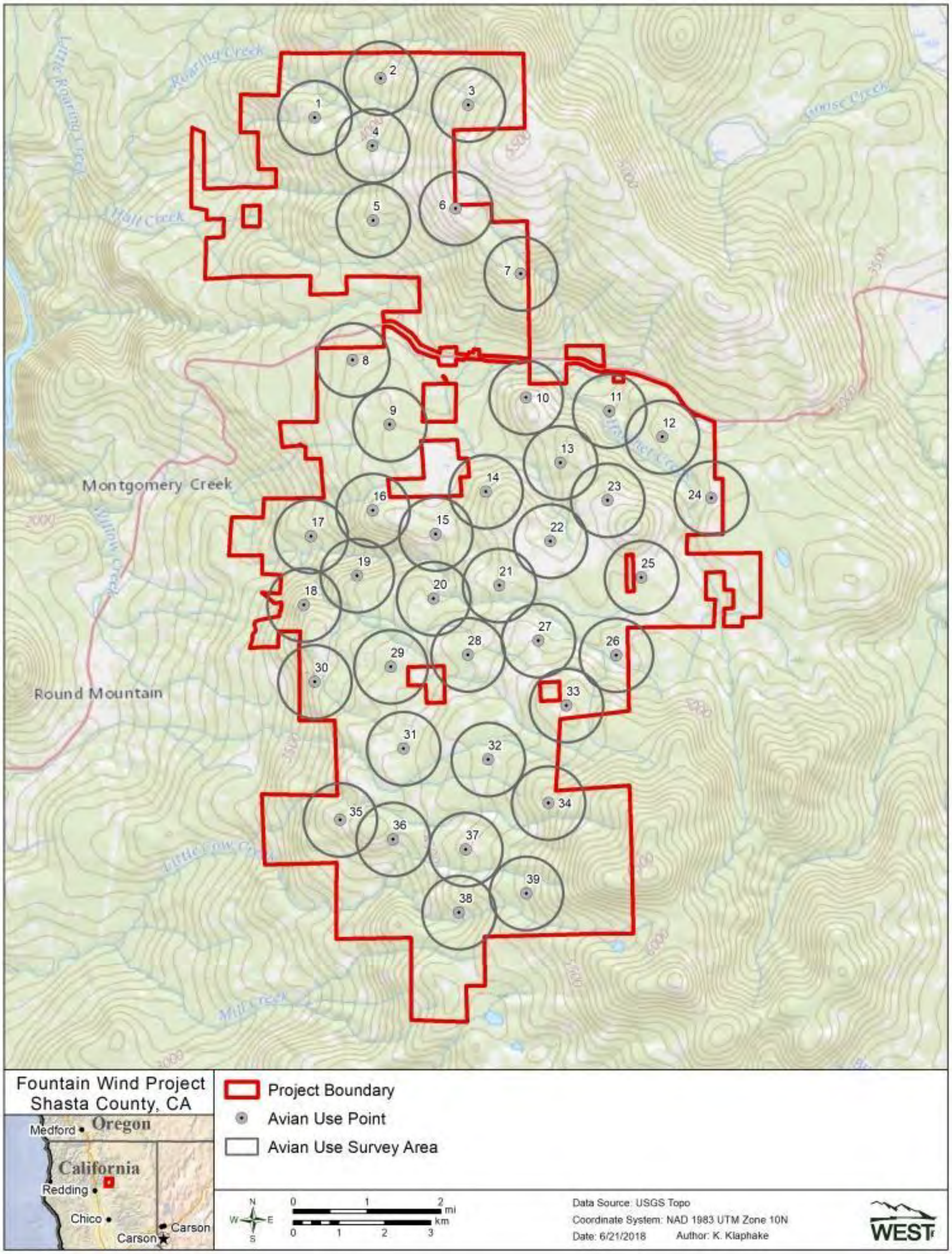


Figure 4. Location of survey plots used during fixed-point avian use surveys at the Fountain Wind Project, Shasta County, California.

Date, start and end time of the survey period, and weather information (e.g., temperature, wind speed and direction, cloud cover) were recorded for each survey. Every bird group observed during a survey was recorded and identified by a unique observation number. Information collected for each observation included: species or best possible identification, number of individuals, sex and age class (if possible), distance from plot center when first observed, closest distance, height above ground level (AGL), activity (behavior), and habitat(s). Bird behavior and habitat type were recorded based on the point of first observation. Approximate flight height AGL and distance from plot center at first observation were recorded to the nearest 5-m (16-ft) interval. Other information collected included whether or not the observation was auditory only, as well as the 10-min interval of the survey during which the detection first occurred. Topographic inset maps centered on each observation point were used to more accurately estimate flight height, distance from observer, and map flight paths during large bird observations. Additionally, data were collected following ECPG methodology to record eagle risk minutes, including minute by minute flight height AGL, distance from observer, and behavioral data for the entirety of each eagle observation (USFWS 2013).

Locations of all diurnal raptors observed during surveys were recorded on field maps. Flight paths and perch locations were digitized using ArcGIS 10.0; comments were recorded in the comments section of the data sheet.

Observation Schedule

Sampling intensity was designed to document large bird use and behavior by habitat and season within the Project area. Large bird surveys were conducted approximately once per month at each of the 39 observation points, with approximately 9-10 points surveyed each week of the study period. Seasons were defined as spring (March 1 – May 16), summer (May 17 – August 31), fall (September 1 – November 30), and winter (December 1 – February 28). Surveys were carried out during daylight hours and survey periods were varied to approximately cover all daylight hours during a season. To the extent practical, each point was surveyed roughly the same number of times. During each survey round, to the extent practicable, the order in which points were surveyed was randomized to ensure surveys occurred during different times of day among visits.

Small Bird Surveys

In addition to the large bird surveys described above, surveys were conducted to document the spatial and temporal use of the Project area by small birds. The ECPG recommends conducting surveys of this sort separately from eagle/large bird use surveys in order to increase detection probability and avoid observer distraction (USFWS 2013). Assessment of small bird use of the Project area is important as it may allow detection of previously unknown occurrence of sensitive species, identification of high use periods (e.g., migration windows, breeding seasons), or specific sites within the larger Project area that may be particularly important to small birds (e.g., reproductive habitats, stopover sites).

Survey Plots

Small bird surveys were conducted at the same 39 observation points used for the large bird surveys described above (Figure 4). Survey plots for small bird surveys consisted of a 100-m (328-ft) radius circle centered on the observation point.

Field Methods

The survey duration at each point was 10 min, during which time only small birds (e.g., cuckoos, hummingbirds, swifts, woodpeckers, and passerines) were recorded. Only small birds observed within the 100-m radius plot were used for quantitative analysis and other comparative metrics.

The date, start and end time of the survey period, and weather information (e.g., temperature, wind speed and direction, and cloud cover) were recorded for each survey. Every bird group (i.e., one or more individuals) recorded during a survey was recorded and identified by a unique observation number. Information collected for each observation included: species or best possible identification, number of individuals, sex and age class (if identifiable), distance from plot center when first observed, closest distance, activity (behavior), habitat(s), and whether or not the observation was auditory only. Bird behavior and habitat type were recorded based on the point of first observation. Approximate flight height and distance from plot center at first observation were recorded to the nearest 5-m (16-ft) interval.

Observation Schedule

As with the large bird surveys, small bird surveys were conducted at each of the 39 points approximately once per month with 9-10 points surveyed each week during the study period. The 10-min small bird surveys were conducted immediately prior to the 60-min large bird surveys to maximize efficiency.

Incidental Observations

Incidental wildlife observations provide records of wildlife seen outside of the standardized surveys. All diurnal raptors, unusual or unique birds, sensitive species, large mammals, reptiles, and amphibians were recorded in a similar fashion to standardized surveys. Observation number, date, time, species, number of individuals, sex/age class, distance from observer, activity, height above ground (for bird species) and habitat were recorded. The location of any sensitive species observed was recorded by Universal Transverse Mercator coordinates using a hand-held Global Positioning System unit.

Data Management

A Microsoft® ACCESS or SQL Server database was developed to store, organize, and retrieve survey data. Data were keyed into the electronic database using a pre-defined protocol to facilitate subsequent quality assurance and quality control (QA/QC) and data analyses. All data forms, field notebooks (if provided), and electronic data files were retained for reference.

At all stages of the study, including in the field, during data entry and analysis, and report writing, QA/QC measures were utilized. Following surveys, observers were responsible for inspecting data forms for completeness, accuracy, and legibility. Potentially erroneous data were identified using a series of database queries. Irregular codes or data suspected as being questionable were discussed with the observer and/or project manager. Errors, omissions, or problems identified in later stages of analysis were traced back to the raw data forms, and appropriate changes in all steps were made.

Statistical Analysis

For analytical purposes, a visit was defined as the required length of time, in days, to survey all of the plots within the Project once, as possible given logistical constraints (i.e., site conditions may have prevented access to certain points during a particular visit). Visits were assigned according to the following criteria: 1) a single visit had to be completed in a single season, and 2) a visit could be spread across multiple dates, but a single date could not contain surveys from multiple visits. Under certain circumstances, such as extreme weather conditions or access issues, plots were not surveyed during some visits. In these cases, a visit might not have constituted a survey of all plots.

Species Composition and Species Richness

The total number of species observed was calculated by season and overall for both large and small bird surveys. Species lists (with the number of observations and the number of groups) were generated by season and included all observations of birds detected. In some cases, the tally may represent repeated sightings of the same individual. For example, a sum of 20 observations of red-tailed hawk (*Buteo jamaicensis*) may be 20 separate birds, or may be one bird observed on 20 separate visits. Species richness by season was calculated by averaging the total number of species observed within each plot (800 m for large birds and 100-m for small birds) during a visit, then averaging across plots within each visit, followed by averaging across visits within the season. Overall species richness was calculated as an average of seasonal values weighted by the number of days in each season. Species richness was compared among seasons for both large and small birds.

Bird Use, Percent of Use, and Frequency of Occurrence

Estimates of bird use were calculated as the number of observations per plot per survey (i.e., number of large birds per 800-m plot per 60-min survey and number of small birds per 100-m plot per 10-min survey). These standardized estimates of bird use were used to compare differences among bird types, seasons, survey points, and other studies where similar methods were used. Mean use by season was calculated by summing the total number of birds seen within each plot during a visit, then averaging across plots within each visit, followed by averaging across visits within the season. Overall bird use was calculated as an average of seasonal values weighted by the number of calendar days in each season (as defined by the season dates). Percent of use was calculated as the proportion of large bird use that was attributable to a particular bird type or species, and frequency of occurrence was calculated as the percent of surveys in which a particular bird type or species was observed.

Bird Flight Height and Behavior

Bird flight was used to calculate the percentage of birds observed flying within rotor-swept heights (RSH) that encompass the full range of turbines with potential to be used at the Project. A RSH for potential collision with a turbine blade of 30-200 m (98-656 ft) AGL was used, which is a conservative estimate that covers the RSH of the smallest and largest turbines that may be used at the Project. The flight height recorded during the initial observation was used to calculate the percentage of birds flying within the RSH and mean flight height. The percentage of birds flying within the RSH at any time was calculated using the lowest and highest flight height recorded.

Spatial Use

Spatial use was evaluated by comparing large bird and small bird use among plots. In addition, flight paths for eagles and other diurnal raptors were mapped to qualitatively assess spatial use of the Project, including in relation to study area characteristics (e.g., topographic features). The objective of mapping locations and flight paths was to identify areas of concentrated use by diurnal raptors and other large birds, and/or consistent flight patterns within the Project.

Eagle Risk Minutes

Eagle risk minutes are defined as the number of minutes (rounded to the next highest integer) an eagle is observed flying within 800-m of the observer at or below 200 m (656 ft) AGL during the survey period (USFWS 2013). For example, a 30-second observation is rounded to one minute and an observation of one minute 10 seconds is rounded to two minutes. Eagle risk minutes were tallied for bald eagles and golden eagles separately by season. These data are provided for use in future eagle risk analyses, as appropriate and applicable once the second year of eagle use surveys has been completed.

Risk Assessment

The risk assessment uses the results of the Year 1 avian use surveys to evaluate the potential for impacts to birds from the construction and operation of the Project. The intent of the risk assessment is not to predict the number of fatalities, but rather to provide a contextual risk assessment based on the pre-construction avian use data collected at the Project to date. To assess the potential risk to birds at the Project, information on spatial and temporal patterns of bird use, abundance, and species composition collected during surveys was reviewed in the context of existing publicly available data from post-construction fatality studies at wind energy facilities in the California and Pacific Northwest regions of the US. These wind energy facilities exhibit a wide range of topographical and vegetative characteristics, and avian assemblages, which likely contribute to the wide range of fatality rates documented. The forested habitats that cover the majority of the Project are atypical of wind energy facilities in the western US which are more commonly composed of desert scrub, grassland, and shrub-steppe vegetation communities, potentially limiting the inference from other projects. Among wind energy facilities in California and the Pacific Northwest with publicly available mortality data, only the Hatchet Ridge Wind Energy Facility (Hatchet Ridge) is located in proximity to the Project and has similar forested habitats and mountainous terrain. As such, Hatchet Ridge likely provides the most relevant source of information for forecasting risk to birds at the proposed Project. While general trends in avian mortality at wind energy facilities throughout North America and the Western US, including the species and species groups most impacted, were considered, the risk assessment relies most heavily on the results of the post-construction fatality monitoring conducted at Hatchet Ridge from 2010-2013 (Tetra Tech 2014). Additionally, the results of pre-construction avian use data collected at Hatchet Ridge in 2006-2007 (Young et al. 2007a) were compared to the results of the Year 1 avian use surveys conducted at the Project in order to identify similarities or differences in avian species composition, use, and abundance that may influence relative risk to species or species groups at the two sites.

RESULTS

Avian use surveys were conducted at the Project from 19 April 2017 through 22 May 2018. Survey results for large bird and small bird surveys are summarized in separate sections below, supplemented by appendices that present species-level detail on numbers of bird groups and observations observed during each season (Appendix A), species-level detail on seasonal use statistics (Appendix B), use by observation point for large and small bird types (Appendix C), and mapped flight paths for diurnal raptor species (Appendix D).

Large Bird Surveys

A total of 531 60-min fixed-point large bird surveys were conducted at the Project over the course of 14 visits (Table 2).

Table 1. Summary of large bird species richness (species/800-meter plot/60-minute survey) and sample size by season and overall during large bird surveys at the Fountain Wind Project from 19 April 2017 – 22 May 2018.

Season	Number of Visits	Number of Surveys Conducted	Number of Species	Large Bird Species Richness
Spring	3	102	18	1.19
Summer	5	195	12	0.91
Fall	3	117	17	0.96
Winter	3	117	11	0.59
Overall	**14**	**531**	**25**	**0.90**

Species Richness and Species Composition

During 60-min large bird surveys, a total of 3,267 observations were recorded among 864 separate groups, regardless of distance from the observer (Appendix A1). This included observation of 25 separate species: 18 in spring, 17 in fall, 12 in summer, and 11 in winter (Table 2). Large bird species richness (mean number of species per plot per survey) was highest during spring (1.19), followed by fall (0.96), summer (0.91), and winter (0.59; Table 2).

Among the large bird types, waterfowl (2,063 observations in 25 groups) accounted for 63.1% of large bird observations during the study period (Appendix A1). Most waterfowl observations were of snow geese (*Chen caerulescens*) recorded in fall and winter (582 and 702 observations, respectively; Appendix A1). Other large bird types observed during surveys included vultures (587 observations), large corvids (228 observations), diurnal raptors (216 observations), waterbirds (144 observations), doves/pigeons (27 observations), upland game birds (nine observations), and owls (two observations; Appendix A1).

Eleven diurnal raptor species were recorded during large bird surveys; the most common were red-tailed hawk (148 observations), sharp-shinned hawk (*Accipiter striatus*; 18 observations), bald eagle (*Haliaeetus leucocephalus;* 16 observations), and Cooper's hawk (*A. cooperii*; nine observations; Appendix A1). The number of diurnal raptor observations was similar across seasons, ranging from 49 observations in summer to 65 observations in fall (Appendix A1). Bald eagles were recorded during all four seasons, with the majority (nine of 16 observations) recorded in winter. Only one bald eagle was observed in summer. Two golden eagles (*Aquila chrysaetos*) were observed during surveys, both in spring (Appendix A1).

Bird Use, Percent of Use, and Frequency of Occurrence

Mean large bird use (birds/800-m plot/60-min survey), percent of use, and frequency of occurrence were calculated by season for all large bird types (Table 3) and species (Appendix B1). The highest overall large bird use occurred during winter (9.74), followed by fall (8.38), spring (4.17), and summer (3.39; Table 3).

<u>Waterbirds</u>

Waterbird use, comprising two species, American white pelican (*Pelecanus erythrorhynchos*) and sandhill crane (*Antigone canadensis*), was highest in winter (0.78), followed by fall (0.28), and spring (0.17). No waterbird use was recorded in summer (Table 3; Appendix B1). Waterbirds accounted for 8.0% of overall large bird use in winter, but only 4.1% in spring and 3.4% in fall. Waterbirds were recorded during 4.3% of winter surveys and 0.9% of both spring and fall surveys (Table 3).

<u>Waterfowl</u>

Waterfowl use was considerably higher in winter and fall (8.02 and 6.53, respectively), than during spring and summer (1.38 and 1.03, respectively; Table 3). Five species of waterfowl were recorded during surveys, with snow goose accounting for the majority of use in winter and fall (6.00 and 4.97, respectively), greater white-fronted goose (*Anser albifrons*) accounting for nearly all spring use (1.37), and unidentified goose composing all summer use (1.03; Appendix B1). Waterfowl accounted for 82.4% of overall large bird use in winter, 78.0% in fall, 33.0% in spring, and 30.2% in summer. Waterfowl were observed most frequently during winter (8.5% of winter surveys) and were rarely observed during summer (0.5% of summer surveys; Table 3).

<u>Diurnal Raptors</u>

Diurnal raptor use was highest during fall (0.56), followed by spring (0.46), winter (0.44), and summer (0.23; Table 3). Eleven diurnal raptor species were recorded during surveys; however, red-tailed hawk had the highest use of any diurnal raptor species during all four seasons (0.18 to 0.33), accounting for between 55.4% and 78.3% of seasonal diurnal raptor use (Appendix

B1). Among other diurnal raptor species, sharp-shinned hawk had relatively higher use in fall (0.13) and bald eagle had relatively higher use in winter (0.08; Appendix B1). Bald eagle use during other seasons ranged from <0.01 in summer to 0.03 in fall. Golden eagle use was recorded only during spring (0.02; Appendix B1). All other diurnal raptor species recorded during surveys had use estimates of 0.03 or less in any given season (Appendix B1).

Diurnal raptors accounted for 11.0% of overall large bird use in the spring, 6.8% in summer, 6.6% in fall, and 4.5% in winter (Table 3). Diurnal raptors were observed more frequently during fall and spring (32.5% and 31.2% of surveys, respectively) than during summer and winter (17.4% and 17.9% of surveys, respectively; Table 3).

<u>Owls</u>

Use by owls was recorded only during spring and was attributed to two species: great horned owl (*Bubo virginianus*) and northern pygmy-owl (*Glaucidium gnoma*), each with a use of <0.01 (Table 3, Appendix B1). Owls accounted for only 0.4% of overall large bird use in spring and were observed during 1.7% of spring surveys (Table 3).

<u>Vultures</u>

Use by vultures (i.e., turkey vultures [*Cathartes aura*]), was highest in summer and spring (1.82 and 1.39, respectively), and lower in fall and winter (0.41 and 0.13, respectively; Table 3, Appendix B1). Vultures accounted for over half (53.5%) of overall large bird use during summer, but only 1.3% of overall large bird use in winter. Vultures were observed during 54.4% of summer surveys, 45.6% of spring surveys, 22.2% of fall surveys, and 6.8% of winter surveys (Table 3).

<u>Upland Game Birds</u>

Mountain quail (*Oreortyx pictus*) was the only upland game bird species observed during surveys (Appendix B1). Use by this species was greatest in spring (0.04), followed by summer (0.02), and fall (<0.01); no upland game bird use was recorded in winter (Table 3). Upland game birds accounted for 1.0% of overall large bird use in spring, 0.5% in summer, and 0.1% in fall, and were recorded during less than 4.0% of surveys during each season (Table 3).

<u>Doves/Pigeons</u>

Band-tailed pigeon (*Patagioenas fasciata*) was the only dove/pigeon species recorded during surveys (Appendix B1). Use by this species was highest in summer (0.11), followed by spring (0.04), and fall (<0.01); no doves/pigeons were recorded in winter (Table 3). Doves/pigeons accounted for 3.2% of overall large bird use in summer, 1.0% in spring, and 0.1% in fall, and were recorded during less than 3.0% of survey during each season (Table 3).

Table 3. Mean large bird use (number of birds/800-meter plot/60-minute survey), percent of total use (%), and frequency of occurrence (%) for each bird type and diurnal raptor subtype by season during large bird surveys at the Fountain Wind Project from 19 April 2017 – 22 May 2018.

Type	Mean Use				Percent of Use				Percent Frequency			
	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter
Waterbirds	0.17	0	0.28	0.78	4.1	0	3.4	8.0	0.9	0	0.9	4.3
Waterfowl	1.38	1.03	6.53	8.02	33.0	30.2	78.0	82.4	2.6	0.5	5.1	8.5
Diurnal Raptors	0.46	0.23	0.56	0.44	11.0	6.8	6.6	4.5	31.2	17.4	32.5	17.9
Accipiters	0.07	0.02	0.16	<0.01	1.6	0.6	1.9	<0.1	6.0	2.1	12.0	0.9
Buteos	0.31	0.18	0.32	0.33	7.4	5.4	3.9	3.4	22.1	15.4	20.5	12.0
Northern Harrier	<0.01	0	0.02	<0.01	0.2	0	0.2	<0.1	0.9	0	1.7	0.9
Eagles	0.03	<0.01	0.03	0.08	0.8	0.2	0.4	0.8	2.6	0.5	3.4	6.8
Falcons	0.02	0.01	0.02	0	0.5	0.3	0.2	0	2.2	1.0	1.7	0
Other Raptors	0.02	0.01	0	<0.01	0.4	0.3	0	<0.1	1.7	1.0	0	0.9
Owls	0.02	0	0	0	0.4	0	0	0	1.7	0	0	0
Vultures	1.39	1.82	0.41	0.13	33.4	53.5	4.9	1.3	45.6	54.4	22.2	6.8
Upland Game Birds	0.04	0.02	<0.01	0	1.0	0.5	0.1	0	3.4	1.5	0.9	0
Doves/Pigeons	0.04	0.11	<0.01	0	1.0	3.2	0.1	0	1.7	2.1	0.9	0
Large Corvids	0.67	0.20	0.58	0.38	16.0	5.9	6.9	3.9	27.6	12.8	23.1	16.2
Overall	**4.17**	**3.39**	**8.38**	**9.74**	**100**	**100**	**100**	**100**	**-**	**-**	**-**	**-**

Large Corvids

Large corvid use was highest in spring (0.67), followed by fall (0.58), winter (0.38), and summer (0.20; Table 3). Nearly all large corvid use was attributed to common raven (*Corvus corax*), with the exception of a single American crow (*Corvus brachyrhynchos*) recorded in summer (Appendix A1). Large corvids accounted for 16.0% of overall large bird use in spring, but only between 3.9% and 6.9% in other seasons. Large corvids were recorded during 12.3% to 27.6% of surveys during each season (Table 3).

Flight Height Characteristics

Flight height characteristics, based on initial flight height observations and estimated use, were calculated for large bird types and raptor subtypes (Table 4). During 60-min large bird surveys, 790 groups of large birds were observed flying within the 800-m plots, totaling 3,184 observations. Overall, 24.2% of flying large birds were recorded within the RSH for turbine blades of 30-200 m AGL, 71.7% were above the RSH, and 4.1% were flying below the RSH (Table 4). The large bird type most often recorded flying with the RSH was large corvids (76.2%; Table 4). Over half (63.4%) of all diurnal raptor observations were recorded flying within the RSH, with 27.8% recorded above the RSH, and 8.8% recorded below (Table 4). Among diurnal raptor subtypes, northern harriers (*Circus cyaneus*) and eagles were most often observed flying within the RSH (100% and 83.3%, respectively; Table 4). The majority of waterbirds and waterfowl were recorded above the RSH (78.5% and 97.1%, respectively; Table 4).

Table 4. Flight height characteristics by bird type and raptor subtype during large bird surveys at the Fountain Wind Project from 19 April 2017 – 22 May 2018.

Type	# Groups Flying	# Obs Flying	Mean Flight Height (m)	% Obs Flying	% within Flight Height Categories		
					0 - 30 m	30 - 200 m*	> 200 m
Waterbirds	10	144	284.00	100	0	21.5	78.5
Waterfowl	24	2060	408.96	99.9	0	2.9	97.1
Diurnal Raptors	186	194	171.58	91.5	8.8	63.4	27.8
Accipiters	*31*	*31*	*150.84*	*96.9*	*19.4*	*61.3*	*19.4*
Buteos	*124*	*132*	*187.98*	*89.8*	*4.5*	*62.1*	*33.3*
Northern Harrier	*4*	*4*	*107.50*	*100*	*0*	*100*	*0*
Eagles	*18*	*18*	*128.33*	*100*	*5.6*	*83.3*	*11.1*
Falcons	*6*	*6*	*22.83*	*100*	*66.7*	*33.3*	*0*
Other Raptors	3	3	350.00	60.0	0	33.3	66.7
Owls	0	0	0	0	0	0	0
Vultures	447	568	143.92	100	11.4	69.5	19
Upland Game Birds	0	0	0	0	0	0	0
Doves/Pigeons	8	25	40.62	92.6	48	52	0
Large Corvids	115	193	91.29	84.6	19.2	76.2	4.7
Overall	**790**	**3,184**	**151.55**	**97.9**	**4.1**	**24.2**	**71.7**

*The likely “rotor-swept height” for potential collision with a turbine blade, or 30-200 meters (m; 98-656 feet) above ground level (AGL).

Spatial Use

Mean use by point for all large birds, major large bird types, and diurnal raptor subtypes is included in Appendix C1). For all large bird species combined, use (birds/800-m plot/60-min survey) was substantially higher at points 3 and 18 (44.14 and 37.62, respectively; Appendix C1). Use at these two points was dominated by waterfowl, which accounted for 96.7% and 93.9% of large bird use at these points, respectively. Overall large bird use at other points varied widely, ranging from 0.43 (birds/800-m plot/60-min survey) at Point 10 to 17.69 (birds/800-m plot/60-min survey) at Point 17 (Appendix C1). Diurnal raptor use was generally more consistent across observation points, ranging from 0.07 at Point 23 to 1.92 at Point 30 (Appendix C1). The higher diurnal raptor use at Point 30 was largely attributed to use by red-tailed hawk (see Appendix D1). Eagle use was recorded at 13 points with use estimates ranging from 0.07 to 0.23 (Appendix C1).

Diurnal raptor use was spread across the Project with no obvious areas of concentrated use or consistent flight patterns evident, with the exception of observation Point 30, which had a larger number of mapped red-tailed hawk flight paths (Appendix D1). Point 30 is adjacent to a large incised drainage where the landscape transitions from forest to shrub/scrub, and offers ideal habitat for soaring birds. Eagle activity was generally low and was recorded across the Project with no clear spatial use patterns evident (Appendix D2).

Eagle Risk Minutes

Sixteen bald eagle observations and two golden eagle observations were recorded within the Project area during 531 hours of large bird use survey effort (Tables 5a and 5b). Bald eagles were observed in flight for a total of 47 min, with 27 of those min recorded during winter, 10 in the fall, six in spring, and four in summer (Table 5a). Of the 47 bald eagle minutes recorded during the study, 35 eagle risk minutes were recorded within the 800-m plots at flight heights of 200 m or less AGL (Table 5a). The majority (68.6%) of bald eagle risk minutes were recorded in winter, with no bald eagle risk minutes recorded in spring (Table 5a). Bald eagle risk minutes per minute of survey were highest during winter (0.2051), followed by fall (0.0684), and summer (0.0154; Table 5a). Golden eagles were observed in flight for a total of four min, all of which were recorded in spring (Table 5a). For golden eagles, all four minutes of flight were within 800-m plots at flight heights of 200 m or less AGL (Table 5a).

Bald eagle risk minutes were recorded at 12 of the 39 observation points (points 1, 4, 7, 8, 12, 18, 19, 24, 26, 27, 35, and 39; Table 6b). The observation point with the greatest number of bald eagle risk minutes was Point 7 (six risk min), with points 18, 19, and 35 contributing an additional four risk minutes each (Table 5b). All four golden eagle risk minutes were recorded at Point 35 (Table 5b).

Table 5a. Bald eagle and golden eagle observations and risk minutes* (min) documented during 60-minute large bird surveys conducted at the Fountain Wind Project from 19 April 2017 – 22 May 2018.

Season	Survey Effort (Hours)	Observations	Flight Min.	Risk Min.	Risk Min. per Min. Survey
		Bald Eagle			
Spring (03/01 – 05/16)	102	2	6	0	0
Summer (05/17 – 08/31)	195	1	4	3	0.0154
Fall (09/01 – 11/30)	117	4	10	8	0.0684
Winter (12/01 – 02/28)	117	9	27	24	0.2051
Total	**531**	**16**	**47**	**35**	**0.0659**
		Golden Eagle			
Spring (03/01 – 05/16)	102	2	4	4	0.0392
Summer (05/17 – 08/31)	195	0	0	0	0
Fall (09/01 – 11/30)	117	0	0	0	0
Winter (12/01 – 02/28)	117	0	0	0	0
Total	**531**	**2**	**4**	**4**	**0.0075**

* Risk minutes are defined as flying behavior at or below 200 meters (m; 656 feet [ft]) and within 800 m (2,625 ft) of the survey location.

Table 5b. Bald eagle (BAEA) and golden eagle (GOEA) observations (obs) and risk minutes* (min) by survey location documented during 60-minute large bird surveys conducted at the Fountain Wind Project from 19 April 2017 – 22 May 2018.

Survey Location	Survey Effort (Hours)	BAEA Obs	BAEA Risk Min.	GOEA Obs	GOEA Risk Min.
1	14	1	2	0	0
2	14	0	0	0	0
3	14	0	0	0	0
4	14	1	3	0	0
5	14	0	0	0	0
6	14	0	0	0	0
7	14	2	6	0	0
8	14	1	1	0	0
9	14	0	0	0	0
10	14	0	0	0	0
11	14	0	0	0	0
12	14	1	1	0	0
13	14	0	0	0	0
14	14	0	0	0	0
15	14	0	0	0	0
16	14	0	0	0	0
17	13	0	0	0	0
18	13	3	4	0	0
19	13	1	4	0	0
20	13	1	0	0	0
21	14	0	0	0	0
22	14	0	0	0	0
23	14	0	0	0	0
24	14	1	2	0	0
25	14	0	0	0	0
26	14	1	2	0	0
27	14	1	3	0	0
28	13	0	0	0	0

Table 5b. Bald eagle (BAEA) and golden eagle (GOEA) observations (obs) and risk minutes* (min) by survey location documented during 60-minute large bird surveys conducted at the Fountain Wind Project from 19 April 2017 – 22 May 2018.

Survey Location	Survey Effort (Hours)	BAEA Obs	BAEA Risk Min.	GOEA Obs	GOEA Risk Min.
29	14	0	0	0	0
30	13	0	0	0	0
31	13	0	0	0	0
32	13	0	0	0	0
33	13	0	0	0	0
34	13	0	0	0	0
35	13	1	4	2	4
36	13	0	0	0	0
37	13	0	0	0	0
38	13	0	0	0	0
39	13	1	3	0	0
Total	**531**	**16**	**35**	**2**	**4**

* Risk minutes are defined as flying behavior at or below 200 meters (m; 656 feet [ft]) and within 800 m (2,625 ft) of the survey location.

Small Bird Surveys

A total of 531 10-min fixed-point small bird surveys were completed at the Project during 14 visits for a total of 88.5 hours of small bird survey effort (Table 6).

Table 6. Summary of small bird species richness (species/100-meter plot/10-minute survey), and sample size by season and overall during small bird surveys at the Fountain Wind Project from 19 April 2017 – 22 May 2018.

Season	Number of Visits	Number of Surveys Conducted	Number of Species	Small Bird Species Richness
Spring	3	102	33	2.19
Summer	5	195	56	2.85
Fall	3	117	37	2.24
Winter	3	117	25	1.07
Overall	**14**	**531**	**71**	**2.12**

Species Richness and Species Composition

During 10-min small bird surveys, 2,408 small bird observations were recorded within 1,475 separate groups comprising 71 species (Table 6, Appendix A2). Small bird species richness was highest during summer (2.85 species/plot/survey), followed by fall (2.24), spring (2.19), and winter (1.07; Table 6). Most (90.4%) small birds recorded were passerines (2,177 observations in 1,289 groups), with the majority of these observations comprising dark-eyed junco (*Junco hyemalis*; 303 observations), mountain chickadee (*Poecile gambeli*; 245 observations), and western bluebird (*Sialia mexicana*; 209 observations; Appendix A2). Other small bird types recorded included woodpeckers (170 observations) and swifts/hummingbirds (59 observations; Appendix A2).

Bird Use, Percent of Use, and Frequency of Occurrence

Mean small bird use (birds/100-m plot/10-min survey), percent of use, and frequency of occurrence were calculated by season for all small bird species (Appendix B2). The highest small bird use was recorded in fall (5.61), followed by summer (4.23), spring (3.56), and winter (2.79).

Passerines

Use by passerines was highest during the fall (5.21), followed by summer (3.93), spring (2.92), and winter (2.59; Appendix B2). In fall and winter, western bluebird had the highest use by any passerine species (0.78 and 0.67, respectively), while dark-eyed junco had the highest use in spring and summer (0.47 and 0.72, respectively; Appendix B2). Passerines accounted for between 82.0% and 93.1% of small bird use during each season, and were observed during 89.7% of summer surveys, 81.7% of spring surveys, 80.3% of fall surveys, and 59.0% of winter surveys (Appendix B2).

Swifts/Hummingbirds

Use by swifts/hummingbirds was highest in spring (0.34), followed by winter (0.07), fall (0.03), and summer (0.02; Appendix B2). Swifts/hummingbirds composed 9.6% of overall small bird use in spring, and consisted primarily of use by Vaux's swift (*Chaetura vauxi*) during this season (0.30; Appendix B2). Swift/hummingbird use during other seasons represented between 0.4% and 2.5% of overall small bird use (Appendix B2). The only other identified swift/hummingbird species recorded during surveys were Anna's hummingbird (*Calypte anna*) and rufous hummingbird (*Selasphorus rufus*; Appendix B2).

Woodpeckers

Use by woodpeckers was highest in fall (0.37), followed by summer (0.28), spring (0.27), and winter (0.13; Appendix B2). Northern flicker (*Colaptes auratus*) had the highest use of any woodpecker species in fall (0.19), summer (0.16), and spring (0.13), while white-headed woodpecker (*Picoides albolarvatus*) had the highest use in winter (0.05; Appendix B2). Woodpeckers accounted for between 4.6% and 7.6% of overall small bird use in any given season. Woodpeckers were recorded during 26.5% of fall surveys, 22.1% of summer surveys, 20.6% of spring surveys, and 9.4% of winter surveys (Appendix B2).

Bird Flight Height and Behavior

During 10-min small bird surveys, 431 groups (1,091 observations) were recorded flying within the 100-m radius survey plots (Table 7). Of these, 28.9% were observed flying at heights within the estimated RSH (Table 7). The majority (70.9%) of small birds were recorded flying below the RSH, and only 0.2% were recorded above the RSH (Table 7). The small bird type most often observed flying within the RSH was swift/hummingbird (70.6%; Table 7).

Table 7. Flight height characteristics by bird type during small bird surveys at the Fountain Wind Project from 19 April 2017 – 22 May 2018.

Type	# Groups Flying	# Obs Flying	Mean Flight Height (m)	% Obs. Flying	% within Flight Height Categories 0 - 30 m	30 - 200 m*	> 200 m
Passerines	367	989	12.39	49.5	72.2	27.6	0.2
Swifts/Hummingbirds	16	51	10.69	92.7	29.4	70.6	0
Woodpeckers	48	51	14.15	36.4	88.2	11.8	0
Overall	**431**	**1,091**	**12.52**	**49.7**	70.9	28.9	0.2

*The likely "rotor-swept height" for potential collision with a turbine blade, or 30-200 meters (m; 98-656 feet) above ground level.

Spatial Use

Small bird use varied among the 39 observation points. The highest small bird use was recorded at points 17 and 7 (8.77 and 7.14, respectively), while the lowest use was observed at points 39 and 15 (2.15 and 2.29, respectively; Appendix C2).

Incidental Observations

Eleven bird species and three mammal species were recorded incidentally during the study (Table 8). Of the 11 bird species recorded incidentally, only one species, sooty grouse (*Dendragapus fuliginosus*; one observation), was not also observed during standardized fixed-point surveys (Appendices A1 and A2). Evidence of gray wolf (*Canis lupus*) presence was also documented via tracks observed in February 2018 along a snow-covered road between avian survey points 22 and 26, in the east-central portion of the Project area. Gray wolves have been seen or heard by WEST staff and no other evidence of wolves has been documented during studies conducted to date.

Table 8. Summary of number of groups (grps) and observations (obs) of incidental wildlife observed while conducting surveys at the Fountain Wind Project from 19 April 2017 – 22 May 2018.

Species	Scientific Name	# grps	# obs
sandhill crane	*Antigone canadensis*	1	12
bald eagle	*Haliaeetus leucocephalus*	1	1
northern goshawk	*Accipiter gentilis*	2	2
red-shouldered hawk	*Buteo lineatus*	1	1
red-tailed hawk	*Buteo jamaicensis*	8	8
sharp-shinned hawk	*Accipiter striatus*	5	5
great horned owl	*Bubo virginianus*	1	1
turkey vulture	*Cathartes aura*	4	4
sooty grouse	*Dendragapus fuliginosus*	1	1
band-tailed pigeon	*Patagioenas fasciata*	1	11
pileated woodpecker	*Dryocopus pileatus*	1	1
Bird Total	**11 Species**	**27**	**47**
bobcat	*Lynx rufus*	1	1
fisher	*Martes pennanti*	1	1
gray wolf (tracks only)*	*Canis lupus*	1	1
Mammal Total	**3 Species**	**3**	**3**

* Tracks consistent with size and gait of a single wolf documented in snow.

Sensitive Species Observations

A total of 10 bird species considered sensitive at the state and/or federal level were recorded during fixed-point avian use surveys or incidentally during the study (Table 9). At the state level, this included two state fully-protected species (bald eagle and golden eagle), and six state species of special concern (SSC; American white pelican, northern goshawk [*Accipiter gentilis*], northern harrier, olive-sided flycatcher [*Contopus cooperi*], Vaux's swift, and yellow warbler [*Setophaga petechia*]; Table 9). Additionally, sandhill crane was recorded during surveys and incidentally; however, these observations were not identified to the subspecies level. The two subspecies potentially occurring at the Project include *Antigone canadensis tabida*, a state threatened species, and *A. c. candadensis*, a state species of special concern (Table 9). Evidence of two sensitive mammal species was also recorded incidentally within the Project are during the study, visual observation of a single fisher (*Pekania pennanti*), which is considered a species of special concern in California, and tracks of a single wolf, which is listed as endangered at both the state and federal level (Table 9).

At the federal level, four species recorded during surveys are considered federal birds of conservation concern in the Sierra Nevada Bird Conservation Region (bald eagle, Cassin's finch [*Haemorhous cassinii*], northern goshawk, and olive-sided flycatcher; USFWS 2008). In addition, bald and golden eagles receive protection under the federal Bald and Golden Eagle Protection Act (1940).

Table 9. Summary of sensitive species observed at the Fountain Wind Project during large bird surveys (LB), small bird surveys (SB), and as incidental wildlife observations from 19 April 2017 to 22 May 2018.

Species	Scientific Name	Status*	LB # grps	LB # obs	SB # grps	SB # obs	Inc. # grps	Inc. # obs	Total # grps	Total # obs
American white pelican	*Pelecanus erythrorhynchos*	SSC	2	28	0	0	0	0	2	28
bald eagle	*Haliaeetus leucocephalus*	EA; BCC; FP	16	16	0	0	1	1	17	17
Cassin's finch	*Haemorhous cassinii*	BCC	0	0	2	2	0	0	2	2
golden eagle	*Aquila chrysaetos*	EA; FP	2	2	0	0	0	0	2	2
northern goshawk	*Accipiter gentilis*	BCC; SSC	3	3	0	0	2	2	5	5
northern harrier	*Circus cyaneus*	SSC	4	4	0	0	0	0	4	4
olive-sided flycatcher	*Contopus cooperi*	BCC; SSC	0	0	5	5	0	0	5	5
sandhill crane	*Antigone canadensis*	ST/SSC**	8	116	0	0	1	12	9	128
Vaux's swift	*Chaetura vauxi*	SSC	0	0	1	35	0	0	1	35
yellow warbler	*Setophaga petechia*	SSC	0	0	30	35	0	0	30	35
fisher	*Martes pennanti*	SSC	0	0	0	0	1	1	1	1
gray wolf	*Canis lupus*	SE, FE								
Total	**11 Species**		**35**	**169**	**38**	**77**	**5**	**16**	**78**	**262**

*EA = Bald and Golden Eagle Protection Act (BGEPA 1940), BCC = federal bird of conservation concern (USFWS 2008), ST = state threatened; SE = state endangered, FP = state fully protected; SSC = state species of special concern (CDFW 2018), FE = federally endangered.

**Observations of sandhill crane were not identified to subspecies level; greater sandhill crane (*A. c. tabida*) is a state-threatened species, while lesser sandhill crane (*A. c. canadensis*) is a state species of special concern.

Grps = groups, obs = observations

DISCUSSION AND RISK ASSESSMENT

Over the first 13 months of the two-year avian use study at the Project, approximately 620 hours of avian use surveys were completed and 5,675 bird observations comprising 96 separate species were recorded. Overall, large bird use varied substantially across the Project area; however, most of this variability was the result of large groups of waterfowl observed passing over the Project area, particularly at observation points 3 and 18 (Figure 4; Appendix C1). Most (97.1%) of these waterfowl observations were flying at heights well above the RSH of proposed turbines and not at risk of collision. Use by diurnal raptors was more consistent across observation points, with the exception of observation Point 30 which had a larger number of mapped red-tailed hawk flight paths (see Appendix D1). Point 30 is adjacent to a large incised drainage where the landscape transitions from forest to shrub/scrub, and offers ideal habitat for soaring birds. Eagle activity was generally low and was recorded across the Project area with no clear spatial use patterns evident (see Appendix D2); however, higher eagle use was recorded during winter suggesting temporal patterns in eagle use may exist. Large bird use was approximately twice as high in fall and winter than in summer and spring, and was again primarily the result of relatively few but relatively large (compared to other species observed during surveys) groups of waterfowl (up to about 250 individuals) passing over the Project area in fall and winter. Alternatively, diurnal raptor use was similar across seasons, while vulture use was substantially higher in summer and spring than during other seasons. Small bird use was relatively consistent across the Project area and across seasons with no clear concentration of use at any one observation point or season.

Although this document provides results for all bird species observed during surveys, the following discussion and risk assessment focuses on a smaller group of species, namely waterfowl, vultures, diurnal raptors, and passerines. The risk assessment was limited to these four bird types because: 1) they exhibited relatively higher seasonal or year-round use of the Project area than the other bird types documented during the Year 1 surveys, 2) they contained species that are considered sensitive at the state or federal level, and/or 3) they have shown susceptibility to the potentially adverse impact of wind energy development. In addition, potential impacts to state or federal species of conservation or regulatory concern documented during the surveys are addressed separately for individual species.

Potential Direct Impacts to Birds

Project construction could affect birds directly through loss of habitat or fatalities from construction equipment. Impacts from decommissioning of the facility are anticipated to be similar to construction in terms of noise, disturbance, and equipment used. Potential mortality from construction equipment is expected to be low, as equipment used in wind energy facility construction generally moves at slow rates or is stationary for long periods (e.g., cranes). The highest risk of direct mortality to birds during construction or decommissioning is most likely the potential destruction of nests during initial site clearing, although this risk can be minimized through best management practices that include use of existing roads or previously cleared lands during the construction phase (USFWS 2012). The most probable direct impact to birds at wind energy facilities is mortality resulting from collisions with turbines (Strickland et al. 2011, Marques et al. 2014). Collisions may occur with resident birds foraging and flying within the Project area, or with migrant birds seasonally moving through the Project area (Ferrer et al. 2012, Erickson et al. 2014, Watson et al. 2018, Welcker et al. 2018). Because collision with turbines is likely the primary direct impact to birds at the Project, publicly available information from post-construction fatality monitoring studies at regional wind energy facilities was used to evaluate the potential for avian fatalities at the Project in the context of the species composition and abundance documented during the Year 1 avian use surveys.

Avian Mortality at Regional Wind Energy Facilities

To date, overall fatality rates for birds at wind energy facilities in California and the Pacific Northwest with publicly available data have been variable, ranging from 0.16 to 17.44 birds/MW/year (Figure 5, Appendix E). These facilities are geographically dispersed throughout the western US and exhibit a wide range of ecological characteristics, potentially limiting the strength of inference from these facilities. The only wind energy facility in the western US with habitats and topography similar to the Project is Hatchet Ridge, located less than 3.2 km (2.0 mi) northeast of the Project. At Hatchet Ridge, direct impacts to birds have been low relative to other facilities in the western US. During three years of post-construction fatality monitoring conducted at Hatchet Ridge from 2011-2013, annual all bird fatality rates ranged from 0.84-2.50 birds/MW/year (Tetra Tech 2014). Given the Project's proximity to Hatchet Ridge and similar habitats and mountainous terrain, it is anticipated that overall direct impacts to avian species at the Project would be similar to those documented at Hatchet Ridge. Mortality information for several focal bird types (waterfowl, vultures, diurnal raptors, and passerines), based on data from local and regional wind energy facilities, is presented in greater detail below.

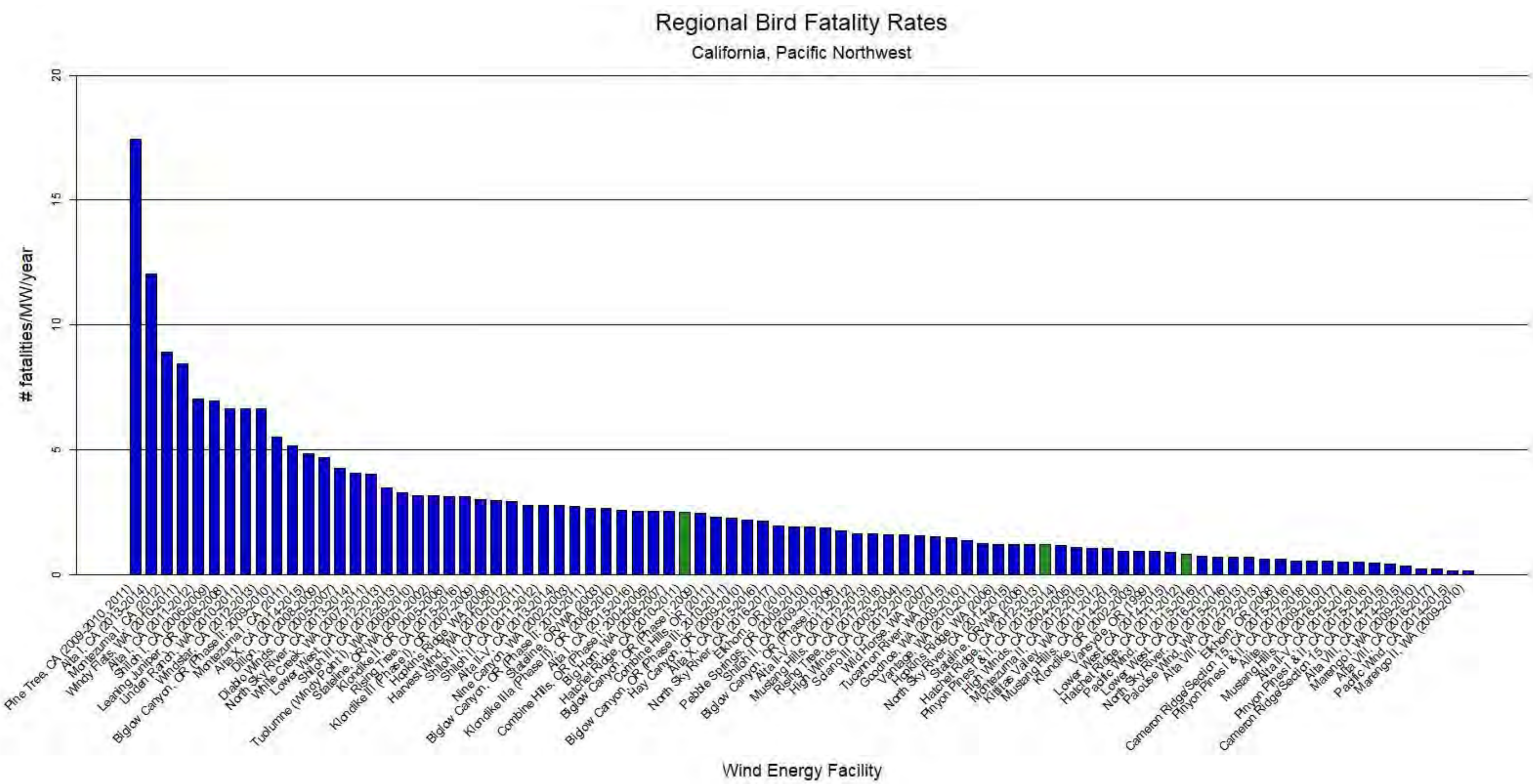


Figure 5. Fatality rates for all birds (number of birds per megawatt per year) from publicly available wind energy facilities in the California and Pacific Northwest regions of North America. Annual all bird fatality rates at the Hatchet Ridge Wind Energy Facility are indicated in green.

Figure 5 (*continued*). Fatality rates for all birds (number of birds per megawatt per year) from publicly available wind energy facilities in the California and Pacific Northwest regions of North America.

Data from the following sources:

Wind Energy Facility	Reference	Wind Energy Facility	Reference	Wind Energy Facility	Reference
Pine Tree, CA (09-10, 11)	BCR 2012	Biglow Canyon, OR (Phase II; 10-11)	Enk et al. 2012a	Hatchet Ridge, CA (12-13)	Tetra Tech 2014
Alta I, CA (13-14)	Chatfield et al. 2014	Stateline, OR/WA (03)	Erickson et al. 2004	Pinyon Pines, CA (12-14)	Chatfield and Russo 2014
Montezuma I, CA (12)	ICF International 2013	Klondike IIIa (Phase II), OR (08-10)	Gritski et al. 2011	High Winds, CA (04-05)	Kerlinger et al. 2006
Windy Flats, WA (10-11)	Enz et al. 2011	Alta I, CA (15-16)	Thompson et al. 2016	Montezuma II, CA (12-13)	Harvey & Associates 2013
Alta I, CA (11-12)	Chatfield et al. 2012	Combine Hills, OR (Phase I; 04-05)	Young et al. 2006	Kittitas Valley, WA (11-12)	Stantec 2012
Shiloh I, CA (06-09)	Kerlinger et al. 2009	Big Horn, WA (06-07)	Kronner et al. 2008	Mustang Hills, CA (14-15)	WEST 2016c
Leaning Juniper, OR (06-08)	Gritski et al. 2008	Hatchet Ridge, CA (10-11)	Tetra Tech 2013	Klondike, OR (02-03)	Johnson et al. 2003
Linden Ranch, WA (10-11)	Enz and Bay 2011	Biglow Canyon, OR (Phase I; 09)	Enk et al. 2010	Vanscycle, OR (99)	Erickson et al. 2000
Windstar, CA (12-13)	Levenstein and Bay 2013b	Combine Hills, OR (11)	Enz et al. 2012	Lower West, CA (14-15)	Levenstein and DiDonato 2015
Biglow Canyon, OR (Phase II; 09-10)	Enk et al. 2011b	Biglow Canyon, OR (Phase III; 10-11)	Enk et al. 2012b	Hatchet Ridge, CA (11-12)	Tetra Tech 2013
Montezuma I, CA (11)	ICF International 2012	Hay Canyon, OR (09-10)	Gritski and Kronner 2010b	Pacific Wind, CA (15-16)	WEST 2017a
Alta X, CA (14-15)	Chatfield et al. 2015	Alta X, CA (15-16)	Thompson et al. 2016	Lower West, CA (16-17)	WEST 2017b
Dillon, CA (08-09)	Chatfield et al. 2009	North Sky River, CA (16-17)	WEST 2017c	North Sky River, CA (15-16)	WEST 2016d
Diablo Winds, CA (05-07)	WEST 2006, 2008	Elkhorn, OR (10)	Enk et al. 2011a	Palouse Wind, WA (12-13)	Stantec 2013a
North Sky River, CA (13-14)	Levenstein et al. 2014	Pebble Springs, OR (09-10)	Gritski and Kronner 2010a	Alta VIII, CA (12-13)	Chatfield and Bay 2014
White Creek, WA (07-11)	Downes and Gritski 2012a	Shiloh II, CA (09-10)	Kerlinger et al. 2010, 2013a	Elkhorn, OR (08)	Jeffrey et al. 2009b
Lower West, CA (12-13)	Levenstein and Bay 2013a	Biglow Canyon, OR (Phase I; 08)	Jeffrey et al. 2009a	Cameron Ridge/Section15, CA (15-16)	Rintz and Thompson 2017
Shiloh III, CA (12-13)	Kerlinger et al. 2013b	Alta II-V, CA (11-12)	Chatfield et al. 2012	Pinyon Pines, CA (17-18)	Rintz and Pham 2018
Tuolumne (Windy Point I), WA (09-10)	Enz and Bay 2010	Mustang Hills, CA (12-13)	Chatfield and Bay 2014	Alite, CA (09-10)	Chatfield et al. 2010
Stateline, OR/WA (01-02)	Erickson et al. 2004	Rising Tree, CA (17-18)	Chatfield et al. 2018	Mustang Hills, CA (16-17)	WEST 2018
Klondike II, OR (05-06)	NWC and WEST 2007	High Winds, CA (03-04)	Kerlinger et al. 2006	Alta II-V, CA (15-16)	Thompson et al. 2016
Rising Tree, CA (15-16)	Rintz et al. 2016	Solano III, CA (12-13)	AECOM 2013	Pinyon Pines, CA (15-16)	Rintz and Starcevich 2016
Klondike III (Phase I), OR (07-09)	Gritski et al. 2010	Wild Horse, WA (07)	Erickson et al. 2008	Cameron Ridge/Section15, CA (14-15)	WEST 2016b
Hopkins Ridge, WA (08)	Young et al. 2009a	Tucannon River, WA (15)	Hallingstad et al. 2016	Alta VIII, CA (14-15)	WEST 2016c
Harvest Wind, WA (10-12)	Downes and Gritski 2012b	Goodnoe, WA (09-10)	URS Corporation 2010a	Marengo I, WA (09-10)	URS Corporation 2010c
Shiloh II, CA (10-11)	Kerlinger et al. 2013a	Vantage, WA (10-11)	Ventus 2012	Alta VIII, CA (16-17)	WEST 2018
Shiloh II, CA (11-12)	Kerlinger et al. 2013a	Hopkins Ridge, WA (06)	Young et al. 2007b	Pacific Wind, CA (14-15)	WEST 2016a
Alta II-V, CA (13-14)	Chatfield et al. 2014	North Sky River, CA (14-15)	Levenstein et al. 2015	Marengo II, WA (09-10)	URS Corporation 2010b
Nine Canyon, WA (02-03)	Erickson et al. 2003	Stateline, OR/WA (06)	Erickson et al. 2007		

Waterfowl

Waterfowl were the most common large bird type recorded during the Year 1 avian use surveys at the Project (2,061 observations among 25 separate groups), accounting for 63.1% of large bird observations recorded. The majority of waterfowl observations (about 78%) comprised three species: snow goose, greater white-fronted goose, and Canada goose, all of which are abundant species in the Pacific flyway (NatureServe 2018). Additionally, the overwhelming majority (97.1%) of waterfowl observations were recorded flying above the estimated RSH, and therefore were not as risk of collision with turbines. Waterfowl were also the most abundant large bird type recorded during pre-construction surveys at Hatchet Ridge in 2005-2006 (Young et al. 2007a), and the most common bird type documented among fatalities during the post-construction monitoring at Hatchet Ridge, composing between 18% and 50% of all bird fatalities recorded annually (Tetra Tech 2014).

Despite accounting for the majority of large bird fatalities at Hatchet Ridge, annual waterfowl fatality rates at Hatchet Ridge were still comparatively low for the region and nationally, ranging from 0.27 to 0.39 birds/MW/year (Tetra Tech 2014). The most common waterfowl fatality at Hatchet Ridge was snow goose (10 fatalities over three years), followed by northern shoveler (*Anas clypeata*; six fatalities), and green-winged teal (*Anas crecca*; three fatalities). Most of these waterfowl fatalities were recorded in the spring and were primarily detected after storms moved through the area. As such, waterfowl fatalities at Hatchet Ridge were primarily attributed to species making localized movements under high wind and/or low visibility conditions (Tetra Tech 2014). Given the similar patterns of waterfowl use observed during pre-construction surveys at both projects, it is reasonable to anticipate similarly low levels of waterfowl mortality at the Project as that estimated at Hatchet Ridge.

Vultures

Vulture (i.e., turkey vulture; 578 observations in 453 separate groups) was the second most common large bird type recorded during surveys at the Project, accounting for 17.7% of all large bird observations. The majority (89.1%) of vulture observations were recorded in spring and summer. Similarly, during pre-construction avian use surveys at Hatchet Ridge, turkey vultures were routinely observed, accounting for 13.4% of all large bird observations (Young et al. 2007a); however, only one turkey vulture fatality was reported over the course of the three-year post-construction monitoring study (Tetra Tech 2014). During 239 post-construction fatality monitoring studies at modern wind energy facilities in North America, turkey vultures (165 fatalities) accounted for 1.6% of all bird fatalities documented (n=10,681; see Appendix E for a list of facilities and references), suggesting generally low risk of collision for this species. Based on the similarities in pre-construction survey data for vultures at Hatchet Ridge and the Project, and the low level of post-construction fatalities at Hatchet Ridge, which is supported by the available data at facilities across North America, impacts to turkey vultures are anticipated to be low at the Project, and similar to impacts documented at Hatchet Ridge.

Diurnal Raptors

Diurnal raptors were observed regularly at the Project, composing 6.6% of all large bird observations recorded during the Year 1 study (216 of 3,267 total large bird observations).

Eleven diurnal raptor species were recorded, the most common being red-tailed hawk (148 observations), sharp-shinned hawk *(*18 observations), bald eagle (16 observations), and Cooper's hawk (nine observations). Diurnal raptor use documented during the Year 1 surveys was fairly consistent across seasons, with the highest use observed in fall (0.56 raptors/800-m plot/60-min survey), followed by spring (0.46), winter (0.44), and summer (0.23), suggesting no obvious increase in diurnal raptor use during migration seasons.

Based on publicly available data from 30 wind energy facilities in California and the Pacific Northwest, diurnal raptor fatality rates have ranged from zero to 1.06 fatalities/MW/year, with a mean of 0.20 fatalities/MW/year (Figure 6). At these facilities, a total of 1,029 diurnal raptors representing 15 species have been documented as fatalities (Table 10; see Appendix E for a list of facilities and references). Red-tailed hawk was the diurnal raptor species most often found as a fatality (551 fatalities; 53.5% of diurnal raptor fatalities), followed by American kestrel (*Falco sparverius*; 261; 25.4%) and golden eagle (100; 9.7%; Table 10).

As mentioned above, the Project differs dramatically in topography and vegetation from other wind energy facilities in California and the Pacific Northwest. As such, species composition of diurnal raptor fatalities may differ somewhat from those found at other regional facilities. Again, Hatchet Ridge is likely the more relevant source of information to inform potential risk to diurnal raptors at the Project. During post-construction fatality monitoring at Hatchet Ridge, raptor fatality rates were not calculated due to low sample size (i.e., less than five fatalities found per year); however, over the three years of monitoring, seven diurnal raptor fatalities were documented: four red-tailed hawks, two sharp-shinned hawks, and one Cooper's hawk (Tetra Tech 2014). During pre-construction avian use surveys conducted at Hatchet Ridge in 2005-2006, red-tailed hawk was the most commonly recorded diurnal raptor species, accounting for 50.7% of all diurnal raptor observations (Young et al. 2007a). American kestrel (15.5%), bald eagle (8.5%), and Cooper's hawk (7.7%) represented the next three most common diurnal raptor species (Young et al. 2007a). The composition of diurnal raptor species recorded during Year 1 avian use surveys at the Project was similar to that recorded at Hatchet Ridge, with slightly higher red-tailed hawk and sharp-shinned hawk use at the Project, and slightly higher American kestrel and bald eagle use at Hatchet Ridge (Young et al. 2007a). Based on the results of pre- and post-construction studies at Hatchet Ridge, as well as the Year 1 avian use surveys conducted at the Project, it is reasonable to assume that diurnal raptor fatality rates at the Project will be similar to Hatchet Ridge.

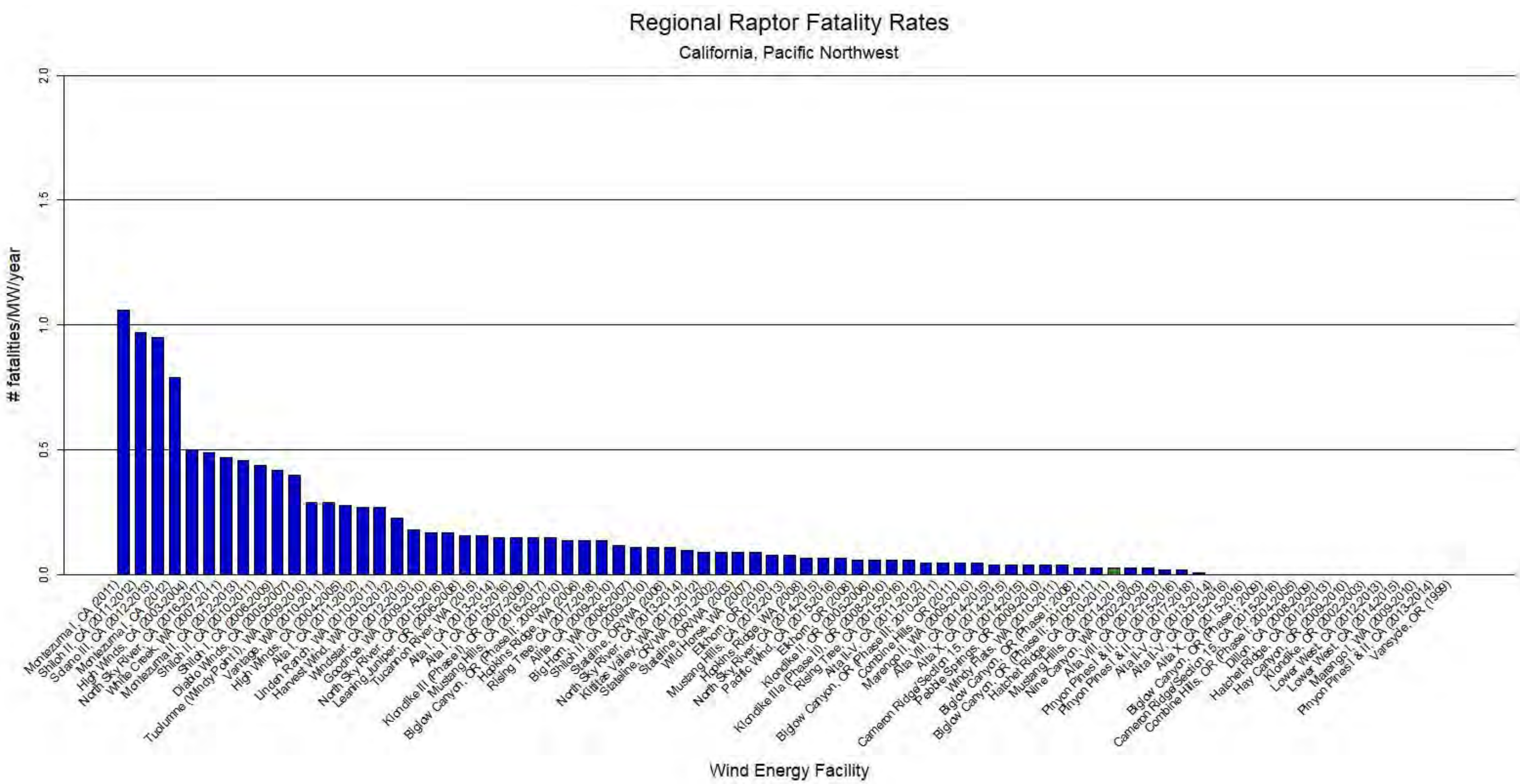


Figure 6. Fatality rates for diurnal raptors (number of raptors per megawatt per year) from publicly available wind energy facilities in the California and Pacific Northwest regions of North America.

Figure 6 (*continued*). Fatality rates for diurnal raptors (number of raptors per megawatt per year) from publicly available wind energy facilities in the California and Pacific Northwest regions of North America.

Data from the following sources:

Wind Energy Facility	Reference	Wind Energy Facility	Reference	Wind Energy Facility	Reference
Montezuma I, CA (11)	ICF International 2012	Rising Tree, CA (17-18)	Chatfield et al. 2018	Pebble Springs, OR (09-15)	Gritski and Kronner 2010a
Shiloh II, CA (11-12)	Kerlinger et al. 2013a	Alite, CA (09-10)	Chatfield et al. 2010	Windy Flats, WA (10-11)	Enz et al. 2011
Solano III, CA (12-13)	AECOM 2013	Big Horn, WA (06-07)	Kronner et al. 2008	Biglow Canyon, OR (Phase I; 08)	Jeffrey et al. 2009a
Montezuma I, CA (12)	ICF International 2013	Shiloh II, CA (09-10)	Kerlinger et al. 2010, 2013a	Biglow Canyon, OR (Phase II; 10-11)	Enk et al. 2012a
High Winds, CA (03-04)	Kerlinger et al. 2006	Stateline, OR/WA (06)	Erickson et al. 2007	Hatchet Ridge, CA (10-11)	Tetra Tech 2013
North Sky River, CA (16-17)	WEST 2017c	North Sky River, CA (13-14)	Levenstein et al. 2014	Mustang Hills, CA (14-15)	WEST 2016c
White Creek, WA (07-11)	Downes and Gritski 2012a	Kittitas Valley, WA (11-12)	Stantec 2012	Nine Canyon, WA (02-03)	Erickson et al. 2003
Montezuma II, CA (12-13)	Harvey & Associates 2013	Stateline, OR/WA (01-02)	Erickson et al. 2004	Alta VIII, CA (12-13)	Chatfield and Bay 2014
Shiloh II, CA (10-11)	Kerlinger et al. 2013a	Stateline, OR/WA (03)	Erickson et al. 2004	Pinyon Pines, CA (15-16)	Rintz and Starcevich 2016
Shiloh I, CA (06-09)	Kerlinger et al. 2009	Wild Horse, WA (07)	Erickson et al. 2008	Pinyon Pines, CA (17-18)	Rintz and Pham 2018
Diablo Winds, CA (05-07)	WEST 2006, 2008	Elkhorn, OR (10)	Enk et al. 2011a	Alta II-V, CA (13-14)	Chatfield et al. 2014
Tuolumne (Windy Point I), WA (09-10)	Enz and Bay 2010	Mustang Hills, CA (12-13)	Chatfield and Bay 2014	Alta II-V, CA (15-16)	Thompson et al. 2016
Vantage, WA (10-11)	Ventus 2012	Hopkins Ridge, WA (06)	Young et al. 2007b	Alta X, CA (15-16)	Thompson et al. 2016
High Winds, CA (04-05)	Kerlinger et al. 2006	North Sky River, CA (14-15)	Levenstein et al. 2015	Biglow Canyon, OR (Phase I; 09)	Enk et al. 2010
Alta I, CA (11-12)	Chatfield et al. 2012	Pacific Wind, CA (15-16)	WEST 2017a	Cameron Ridge/Section15, CA (15-16)	Rintz and Thompson 2017
Linden Ranch, WA (10-11)	Enz and Bay 2011	Elkhorn, OR (08)	Jeffrey et al. 2009b	Combine Hills, OR (Phase I; 04-05)	Young et al. 2006
Harvest Wind, WA (10-12)	Downes and Gritski 2012b	Klondike II, OR (05-06)	NWC and WEST 2007	Dillon, CA (08-09)	Chatfield et al. 2009
Windstar, CA (12-13)	Levenstein and Bay 2013b	Klondike IIIa (Phase II), OR (08-10)	Gritski et al. 2011	Hatchet Ridge, CA (11-12)	Tetra Tech 2013
Goodnoe, WA (09-10)	URS Corporation 2010a	Rising Tree, CA (15-16)	Rintz et al. 2016	Hay Canyon, OR (09-10)	Gritski and Kronner 2010b
Leaning Juniper, OR (06-08)	Gritski et al. 2008	Alta II-V, CA (11-12)	Chatfield et al. 2012	Klondike, OR (02-03)	Johnson et al. 2003
Tucannon River, WA (15)	Hallingstad et al. 2016	Biglow Canyon, OR (Phase III; 10-11)	Enk et al. 2012b	Lower West, CA (12-13)	Levenstein and Bay 2013a
Alta I, CA (13-14)	Chatfield et al. 2014	Combine Hills, OR (11)	Enz et al. 2012	Lower West, CA (14-15)	Levenstein and DiDonato 2015
Alta I, CA (15-16)	Thompson et al. 2016	Marengo II, WA (09-10)	URS Corporation 2010b	Marengo I, WA (09-10)	URS Corporation 2010c
Klondike III (Phase I), OR (07-09)	Gritski et al. 2010	Alta VIII, CA (14-15)	WEST 2016c	Pacific Wind, CA (14-15)	WEST 2016a
Mustang Hills, CA (16-17)	WEST 2018	Alta X, CA (14-15)	Chatfield et al. 2015	Pinyon Pines, CA (13-14)	Chatfield and Russo 2014
Biglow Canyon, OR (Phase II; 09-10)	Enk et al. 2011b	Cameron Ridge/Section 15, CA (14-15)	WEST 2016b	Vanscycle, OR (99)	Erickson et al. 2000
Hopkins Ridge, WA (06)	Young et al. 2007b				

Table 10. Raptor fatalities, by species, recorded at new-generation wind energy facilities in the California and the Pacific Northwest regions of North America.

Species	Scientific Name	Number of Raptor Fatalities[1]	Percent Composition of Raptor Fatalities
red-tailed hawk	*Buteo jamaicensis*	551	53.5
American kestrel	*Falco sparverius*	261	25.4
golden eagle	*Aquila chrysaetos*	100	9.7
northern harrier	*Circus cyaneus*	19	1.8
Swainson's hawk	*Buteo swainsoni*	16	1.6
unidentified raptor		14	1.4
ferruginous hawk	*Buteo regalis*	14	1.4
rough-legged hawk	*Buteo lagopus*	12	1.2
Cooper's hawk	*Accipiter cooperii*	8	0.8
unidentified buteo		8	0.8
prairie falcon	*Falco mexicanus*	7	0.7
sharp-shinned hawk	*Accipiter striatus*	5	0.5
white-tailed kite	*Elanus leucurus*	4	0.4
merlin	*Falco columbarius*	4	0.4
unidentified hawk		2	0.2
peregrine falcon	*Falco peregrinus*	1	0.1
unidentified accipiter		1	0.1
bald eagle	*Haliaeetus leucocephalus*	1	0.1
red-shouldered hawk	*Buteo lineatus*	1	0.1
Total		**1,029**	**100**

[1] These are raw data and are not corrected for searcher efficiency or scavenging.

Cumulative fatalities and species from data compiled by Western EcoSystems Technology, Inc. from publicly available fatality documents (see Appendix E for a list of facilities and references).

Passerines and Other Small Birds

During the Year 1 avian use surveys at the Project, 71 small bird species were observed, most (90.4%) of which were passerines. Small bird species richness (species/plot/survey) was highest in the summer (56 species) and lowest in the winter (25 species). Over a third (34.8%) of passerine observations at the Project was attributed to just three species: dark-eyed junco, mountain chickadee, and western bluebird. Although small bird use varied among the 39 observation points, ranging from 2.15 to 8.77 birds/plot/survey, the data are not suggestive of any areas of concentrated small bird use, such as important reproductive habitats or migration stopover sites. Furthermore, seasonal small bird use estimates ranged from a low of 2.79 birds/survey in winter to a high of 4.23 birds/survey in summer, with more moderate use in spring and fall, suggesting no substantial increase in small bird use during migration seasons.

During the three-year fatality monitoring study at Hatchet Ridge (2010-2013), annual small bird fatality rates ranged from 0.31 to 2.03 fatalities/MW/year (Tetra Tech 2014). Of the 129 bird fatalities documented during the study, only 47 (36.4%), comprising 17 species, were passerines (Tetra Tech 2014). The most common passerine species found as fatalities at Hatchet Ridge were dark-eyed junco (five fatalities), golden-crowned kinglet (*Regulus satrapa*; four fatalities), and Steller's jay (*Cyanocitta stelleri*; three fatalities; Tetra Tech 2014). Of the 129 bird fatalities documented at Hatchet Ridge, 33 (25.6%) were potential nocturnal migrants (i.e., small bird fatalities documented in spring and fall comprising species known to be nocturnal migrants in the region). However, this is a conservative estimate, as most of the 17 passerine species documented as fatalities at Hatchet Ridge are also known summer or year-round residents in the area and it is likely that at least some of these fatalities were local resident birds rather than migrating birds.

The results of post-construction monitoring at Hatchet Ridge suggest low impacts to passerines and other small bird species at the facility, and no apparent disproportionate impacts to nocturnal migrants. Given the proximity of the Project to Hatchet Ridge, as well as similar topographic and habitat characteristics and species assemblages at the two sites, impacts to passerines and other small birds at the Project, including nocturnal migrants, are expected to be similarly low.

Potential Indirect Impacts

In addition to direct effects through collision mortality, wind energy development can indirectly affect wildlife resources, causing a loss of habitat where infrastructure is placed and loss of habitat through behavioral avoidance and perhaps habitat fragmentation (e.g., Leddy et al. 1999, Strickland et al. 2011, Pearce-Higgins et al. 2012, Marques et al. 2014; Shaffer and Buhl 2016). Loss of habitat from installation of wind energy facility infrastructure (i.e., turbines, access roads, maintenance buildings, substations and overhead transmission lines) can be long-term or temporary. Estimates of temporary construction impacts range from 0.2 to 1.0 ha (0.5 to 2.5 ac) per turbine (Strickland and Johnson 2006, Denholm et al. 2009), while long-term infrastructure generally occupies only 5% to 10% of the entire development area (Bureau of Land Management 2005). Behavioral displacement (avoidance) may lead to decreased habitat suitability for local populations (e.g., Stevens et al. 2013, Shaffer and Buhl 2016) and birds displaced by wind energy development may move to lower quality habitat with fewer disturbances, with an overall effect of reducing breeding success (Loesch et al. 2013, LeBeau et al. 2017). Behavioral avoidance may render much larger areas unsuitable or less suitable for some species of wildlife, depending on how far each species is displaced from wind energy facilities. Indirect effects also include habitat fragmentation (e.g., more habitat edges due to roads and smaller areas of contiguous habitat) which could provide more generalized habitats and resistance-free travel lanes for predators and competitors in, for example, large grasslands and in-tact forests. This may impact the survivorship and reproductive ability of birds in the vicinity of the wind energy facility. The greatest concern for indirect impacts of wind energy facilities on wildlife resources is where these facilities have been constructed in native vegetation communities that provide comparatively rare, high-quality habitat for some bird species and species of concern (USFWS 2012).

The Project area is predominantly coniferous forest which is heavily managed for timber production. This has resulted in a highly fragmented landscape with no large contiguous tracts of undisturbed wildlife habitat. Commercial timber operations currently and will continue to alter the landscape within the Project area, with areas of mature forest being harvested and replanted with conifer seedlings that eventually transition from a scrub-shrub cover type to densely treed early-seral forest over 10-20 years. As timber management changes the landscape, species composition and spatial distribution of bird communities will also change within the Project area. While small-scale displacement may occur for some species, particularly in areas cleared for turbines pads or roads, it is not expected to be different than that caused by the timber harvest operations currently occurring and that will continue to occur throughout the Project area. Siting Project facilities on previously disturbed land and using existing roads will help reduce the potential for increased habitat fragmentation and species displacement (USFWS 2012).

Potential Impacts to Species of Concern

Bald Eagle

During 531 hours of survey effort at the Project during the Year 1 surveys, a total of 16 bald eagles were observed. These 16 observations amounted to 35 bald eagle risk minutes, the majority (68.6%) of which was recorded in winter. Bald eagle risk minutes were recorded at 12 of the 39 observations points. Use of the Project area by bald eagles was lower than bald eagle use documented during pre-construction avian use surveys conducted at Hatchet Ridge, although seasonal patterns of use were relatively consistent. During 135 hours of survey effort at Hatchet Ridge, 12 bald eagle observations were recorded, the majority (75%) of which were recorded in fall and winter (Young et al. 2007a), yet no bald eagle fatalities were documented during the three years of post-construction monitoring at Hatchet Ridge (Tetra Tech 2014). Based on information compiled by the USFWS, there have been 49 documented bald eagle fatalities or injuries at wind energy facilities in the US between 2013 and 2018 (Kritz et al. 2018). The majority of bald eagle casualties occurred in the Upper Midwest, Intermountain West, and Alaska, with only single bald eagle fatalities documented in each of California, Oregon, and Washington (Kritz et al. 2018).

While bald eagle nesting habitat is generally absent from the Project area, the species is known to nest in areas adjacent to rivers and lakes in the surrounding landscape. During eagle nest surveys conducted within a 10-mi radius of the Project area, 11 occupied bald eagle nests were documented, with the closest nests to the Project area located at Lake Margaret, approximately 4.7 km (2.9 mi) east of the Project, and along the Pit River approximately 6.8 km (4.2 mi) north of the Project (Thompson 2018). Despite a number of occupied bald eagle nests in the vicinity of the Project, only three of the 16 bald eagle observations documented during the Year 1 surveys were recorded in the spring and summer nesting season, suggesting even lower use of the Project area by breeding eagles than migrating or wintering bald eagles. Based on the generally low direct impacts to bald eagles documented in the Pacific Northwest, including at Hatchet Ridge, as well as the relatively low use of the Project by bald eagles documented during the Year 1 study, risk of collision at the Project is anticipated to be low.

Golden Eagle

During 531 hours of survey effort at the Project, only two golden eagle observations were recorded, both during spring. These two observations totaled four golden eagle risk minutes. This is consistent with the pre-construction avian use data collected at Hatchet Ridge which included a single golden eagle observation recorded in winter (Young et al. 2007a). No golden eagle fatalities have been documented at Hatchet Ridge (Tetra Tech 2014). Typical golden eagle nesting habitat (e.g., cliffs, rocky outcrops) is absent from the Project area, and during eagle nest surveys conducted for the Project in 2017, no occupied golden eagle nests were identified within 10 mi of the Project (Thompson 2018). Based on the results of the Year 1 surveys which indicate very low use of the Project area by golden eagles, as well as pre- and post-construction information from Hatchet Ridge, risk of collision for golden eagles at the Project is anticipated to be low.

Northern Goshawk and Northern Harrier

Northern goshawk and northern harrier, both designated as California SSC, were recorded in low numbers (four northern harriers and three northern goshawks) during the Year 1 avian use surveys at the Project. Northern harriers generally prefer more open meadow and grassland habitats, and are not likely to frequent the forested habitats present throughout the majority of the Project area. Northern goshawk is a forest raptor; however, dense stands of older forest preferred as nesting habitat by this species are limited within the Project area as a result of management for timber production.

No northern goshawk fatalities have been reported among publicly available fatality data from 239 wind energy facilities throughout North America (see Appendix E for a list of study sites and references). While these data may suggest that northern goshawks are not vulnerable to collision with turbine blades, it may also reflect an absence of wind energy facilities constructed in areas of mature forest habitat used by goshawks. Given the generally low use of the area by goshawks documented during avian use surveys to date, the limited extent of mature forest stands within the Project area, and the absence of known goshawk fatalities at wind energy facilities across North America, potential impacts to the species resulting from collision with Project turbines is anticipated to be low, but cannot be entirely ruled out.

Relatively few northern harrier fatalities have been reported in publicly available fatality studies, despite the fact that they are commonly observed during fixed-point bird counts at wind energy facilities (Erickson et al. 2001, Whitfield and Madders 2006, Smallwood and Karas 2009). Among the 1,029 diurnal raptor fatalities in California and the Pacific Northwest, 19 northern harrier fatalities have been documented, representing 1.9% of all diurnal raptor fatalities (Table 10). Northern harriers typically fly close to the ground (MacWhirter and Bildstein 1996), with some studies reporting up to 97% of flights below 20 m (66 ft; Whitfield and Madders 2006); therefore, risk of collision with turbine blades is considered low for this species (Whitfield and Madders 2005, 2006). Given low use of the Project area by northern harriers, a general lack of the species' preferred open habitat, and low risk of collision, impacts to northern harriers resulting from Project development and operation are not anticipated.

American White Pelican and Sandhill Crane

American white pelican (two groups totaling 28 individuals) and sandhill crane (eight groups totaling 116 individuals), the only two waterbird species recorded during the Year 1 surveys, accounted for 4.4% of overall large bird observations at the Project. American white pelican is designated as a California SSC. Sandhill crane observations recorded during surveys were not identified to the subspecies level; however, each of the two subspecies potentially flying over the Project are considered sensitive at the state level; *Antigone canadensis tabida* is a state-threatened species, and *A. c. canadensis* is a state SSC.

Waterbirds, including sandhill crane and American white pelican, do not appear to be particularly susceptible to collision with wind turbines. According to the NRC (2007) cumulative effects report, waterbirds composed about 1% of documented fatalities at 14 wind energy facilities. Waterbirds made up 0.2% of all bird fatalities (n = 4,975) in an analysis of 116 standardized monitoring studies conducted at over 70 wind energy facilities throughout the US and Canada (Erickson et al. 2014). Among publicly available reports reviewed by WEST, waterbirds accounted for just 0.3% of fatalities recorded during 239 studies at facilities across North America (27 of 10,681 total fatalities; see Appendix E for a list of facilities and references). The 27 waterbird fatalities documented at these facilities include two American white pelicans and one sandhill crane; however, the tally in WEST's database does not include three sandhill crane fatalities documented in non-standardized fatality surveys. These include one fatality at an older-generation facility at Altamont Pass in California (Smallwood and Karas 2009), and two fatalities from a facility in west Texas (Navarrete and Griffis-Kyle 2014 as cited in Gerber et al. 2014; Stehn 2011), documented as part of a wintering crane displacement study conducted by graduate student L. Navarrete of Texas Tech University. No American white pelican or sandhill crane fatalities were documented during the three-year fatality monitoring study at Hatchet Ridge, despite both species recorded flying over the site during pre-construction avian use surveys (Young et al. 2007a, Tetra Tech 2014).

Researchers at WEST monitored use by migrating sandhill cranes at five wind energy facilities in North and South Dakota from 2009 – 2013 for three years at each site. Concurrently, they searched underneath all turbines daily for fatalities of cranes. Cumulatively, observers spent about 13,182 hours recording crane use over 1,305 days, and even though 42,727 sandhill crane observations were recorded, no fatalities of cranes were found beneath turbines (Derby et al. 2012e) A crane monitoring study was conducted at the Forward Energy Center, a wind energy facility in southern Wisconsin located within 3.2 km (2.0 miles) of a large wetland used by sandhill cranes. No crane fatalities were found during the crane monitoring study in the fall of 2008, or during regular bird fatality monitoring studies conducted in the fall of 2008, spring and fall of 2009, and in the spring of 2010, even though sandhill cranes were observed in the study area (Grodsky et al. 2013).

The sandhill crane's range in the Pacific Flyway is from Siberia and Alaska to California's Central Valley. Sandhill cranes typically use large freshwater marshes, prairie ponds, and marshy tundra during summer and grain fields or prairies during migration and winter. Although suitable breeding and stopover habitat is absent from the Project area, sandhill cranes are known to breed in the Fall River Valley approximately 32 km (20 mi) east of the Project area, and there is potential for the species to migrate over the Project in spring and fall. Breeding and stopover habitat for American white pelican is also absent from the Project area. In California, the American white pelican's breeding range is restricted to the Klamath Basin to the north of the Project (Shuford and Gardali 2008); although there is potential for groups to migrate throughout the region, particularly in spring and fall. Given the absence of suitable breeding and stopover habitat within the Project area and the available data regarding these species' interactions with wind turbines, impacts to sandhill crane and American white pelican from Project development and operation are anticipated to be low.

Olive-sided Flycatcher, Yellow Warbler, and Vaux's Swift

Sensitive small bird species recorded during Year 1 avian use surveys at the Project included three species designated as California SSC: olive-sided flycatcher (five observations), yellow warbler (35 observations), and Vaux's swift (35 observations within one group). All three species are likely summer residents, but may also occur as migrants within the Project area. Both olive-sided flycatcher and yellow warbler were observed only in summer (with the exception of a single yellow warbler observed in fall), and the single group of Vaux's swifts was observed in spring. Both olive-sided flycatcher and yellow warbler were also recorded during pre-construction avian use surveys at Hatchet Ridge, primarily in summer.

Based on publicly available data from post-construction fatality monitoring conducted at North American wind energy facilities, all three species have been documented as fatalities, including two olive-sided flycatchers, 36 yellow warblers, and 16 Vaux's swifts (see Appendix E for a list of facilities and references). At Hatchet Ridge, a single yellow warbler fatality and a single Vaux's swift fatality were documented during the three-year monitoring study (Tetra Tech 2014).

Given the presence of these three species within the Project area and known impacts observed at Hatchet Ridge and other wind energy facilities nationwide, risk of collision with Project turbines is anticipated to be low to moderate. The most likely direct impact to potentially suitable nesting habitat would be timber harvest and vegetation clearing in preparation of turbine pads or road construction. However, given the existing level of disturbance and habitat fragmentation within the Project area, it is unlikely that Project development will cause displacement of sensitive small bird species beyond what has occurred and will continue to occur from ongoing timber harvest operations.

CONCLUSIONS

To date, overall fatality rates for birds at wind energy facilities in California and the Pacific Northwest have ranged from 0.16 to 17.44 fatalities/MW/year, while diurnal raptor fatality rates at these same facilities have ranged from zero to 1.06 fatalities/MW/year (Appendix E). However, the forested habitats covering the majority of the Project area are unique to wind energy facilities in the western US, which are more typically composed of desert scrub, grassland, and shrub-steppe vegetation communities, potentially limiting the inference from studies conducted at these facilities. The one exception to this is the Hatchet Ridge facility, which has similar ecological characteristics to the Project, and is located immediately to the northeast, providing the most relevant source of information for assessing potential risk to avian species at the Project. The results of pre-construction avian use surveys conducted at Hatchet Ridge were largely consistent with those documented at the Project during this study. Furthermore, based on post-construction monitoring at Hatchet Ridge, all bird, small bird, and diurnal raptor fatality rates have all been low and within the range of other facilities in California and the Pacific Northwest. Given the similarity in species composition and temporal use patterns reported at Hatchet Ridge and observed at the Project, it is reasonable to expect that fatality rates and the species composition of fatalities at the Project will be similar to that documented at Hatchet Ridge. Following recommendations presented in the ECPG, a second year of large bird/eagle use surveys is currently underway at the Project to collect data sufficient to support a future application for an incidental eagle take permit under the BGEPA, should unanticipated impacts to eagles suggest a need for such permit. Because field studies were being conducted to gather a second year of large bird/eagle use data, Pacific Wind opted to capitalize on the efficiency of being in the field and is also completing a second year of small bird use surveys. The additional avian use surveys are expected to conclude in May 2019 and. an updated risk assessment will be prepared following the completion of the two-year study. The updated risk assessment will focus on risk to bald and golden eagles, as well as any inter-annual variations in species composition or use documented during the Year 2 surveys that may influence perceived risk to avian species at the Project.

REFERENCES

AECOM. 2013. Annual Monitoring Report: July 2012 - June 2013. Solano Wind Project - Phase 3. Prepared for SMUD - Environmental Management, Sacramento, California. Prepared by AECOM, Sacramento, California. September 2013.

Arnett, E. B., M. R. Schirmacher, C. D. Hein, and M. M. P. Huso. 2011. Patterns of Bird and Bat Fatality at the Locust Ridge II Wind Project, Pennsylvania. 2009-2010 Final Report. Prepared for the Bats and Wind Energy Cooperative (BWEC) and the Pennsylvania Game Commission (PGC). Prepared by Bat Conservation International (BCI), Austin, Texas. January 2011.

Arnett, E. B., M. R. Schirmacher, M. M. P. Huso, and J. P. Hayes. 2009. Patterns of Bat Fatality at the Casselman Wind Project in South-Central Pennsylvania: 2008 Annual Report. Annual report prepared for the Bats and Wind Energy Cooperative (BWEC) and the Pennsylvania Game Commission. Bat Conservation International (BCI), Austin, Texas. June 2009. Available online: http://www.batsandwind.org/pdf/2008%20Casselman%20Fatality%20Report.pdf

Arnett, E. B., M. R. Schirmacher, M. M. P. Huso, and J. P. Hayes. 2010. Patterns of Bat Fatality at the Casselman Wind Project in South-Central Pennsylvania. 2009 Annual Report. Annual report prepared for the Bats and Wind Energy Cooperative (BWEC) and the Pennsylvania Game Commission. Bat Conservation International (BCI), Austin, Texas. January 2010.

Bald and Golden Eagle Protection Act (BGEPA). 1940. 16 United States Code (USC) Section (§) 668-668d. Bald Eagle Protection Act of 1940, June 8, 1940, Chapter 278, § 2, 54 Statute (Stat.) 251; Expanded to include the related species of the golden eagle October 24, 1962, Public Law (PL) 87-884, 76 Stat. 1246. [as amended: October 23, 1972, PL 92-535, § 2, 86 Stat. 1065; November 8, 1978, PL 95-616, § 9, 92 Stat. 3114.].

BHE Environmental, Inc. (BHE). 2010. Post-Construction Bird and Bat Mortality Study: Cedar Ridge Wind Farm, Fond Du Lac County, Wisconsin. Interim Report prepared for Wisconsin Power and Light, Madison, Wisconsin. Prepared by BHE Environmental, Inc. Cincinnati, Ohio. February 2010.

BHE Environmental, Inc. (BHE). 2011. Post-Construction Bird and Bat Mortality Study: Cedar Ridge Wind Farm, Fond Du Lac County, Wisconsin. Final Report. Prepared for Wisconsin Power and Light, Madison, Wisconsin. Prepared by BHE Environmental, Inc. Cincinnati, Ohio. February 2011.

BioResource Consultants, Inc. (BRC). 2012. Avian Mortality Monitoring Report, Pine Tree Wind Farm, Kern County, California. Prepared for the City of Los Angeles Department of Water and Power. Report prepared by BioResource Consultants, Inc., Ojai, California. March 26, 2012.

Brown, W. K. and B. L. Hamilton. 2006. Monitoring of Bird and Bat Collisions with Wind Turbines at the Summerview Wind Power Project, Alberta: 2005-2006. Prepared for Vision Quest Windelectric, Calgary, Alberta by TAEM Ltd., Calgary, Alberta, and BLH Environmental Services, Pincher Creek, Alberta. September 2006. Available online: http://www.batsandwind.org/pdf/Brown 2006.pdf

Bureau of Land Management (BLM). 2005. Final Programmatic Environmental Impact Statement on Wind Energy Development on BLM Administered Land in the Western United States. US Department of the Interior (USDOI), BLM, Washington, D. C. Available online: http://windeis.anl.gov /documents/fpeis/index.cfm

California Department of Fish and Wildlife (CDFW). 2018. Special Animals List. California Natural Diversity Database. April 2018. Available online: https://nrm.dfg.ca.gov/FileHandler.ashx? DocumentID=109406&inline

California Energy Commission (CEC) and California Department of Fish and Game (CDFG). 2007. California Guidelines for Reducing Impacts to Birds and Bats from Wind Energy Development. Commission Final Report. CEC, Renewables Committee, and Energy Facilities Siting Division, and CDFG, Resources Management and Policy Division. CEC-700-2007-008-CMF.

Chatfield, A. and D. Russo. 2014. Post-Construction Avian and Bat Fatality Monitoring for the Pinyon Pines I & II Wind Energy Project, Kern County, California. Final Report for the First Year of Operation: March 2013 - March 2014. Prepared for MidAmerican Renewables, LLC, Des Moines, Iowa, and Alta Windpower Development, LLC, Mojave, California. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. July 28, 2014.

Chatfield, A. and K. Bay. 2014. Post-Construction Studies for the Mustang Hills and Alta VIII Wind Energy Facilities, Kern County, California. Final Report for the First Year of Operation: July 2012 - October 2013. Prepared for EverPower Wind Holdings, Inc. and Brookfield Renewable Energy Group. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. February 28, 2014.

Chatfield, A., D. Riser-Espinoza, and K. Bay. 2014. Bird and Bat Mortality Monitoring at the Alta Wind Energy Center, Phases I - V, Kern County, California. Final Report for the Second Year of Operation: March 4, 2013 - March 6, 2014. Prepared for Alta Windpower Development, LLC, Mojave, California. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. August 22, 2014.

Chatfield, A., K. Levenstein, and G. DiDonato. 2015. Post-Construction Avian and Bat Mortality Monitoring, Alta X, LLC, Kern County, California. Final Report for the First Year of Operation: March 2014 - March 2015. Prepared for Alta Wind X, LLC, Mojave, California. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. July 10, 2015.

Chatfield, A., M. Sonnenberg, and K. Bay. 2012. Avian and Bat Mortality Monitoring at the Alta-Oak Creek Mojave Project, Kern County, California. Final Report for the First Year of Operation March 22, 2011 – June 15, 2012. Prepared for Alta Windpower Development, LLC, Mojave, California. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. September 12, 2012.

Chatfield, A., T. Rintz, and R. Clark. 2018. Post-Construction Avian and Bat Fatality Monitoring at the Rising Tree and Addison Wind Energy Projects, Kern County, California. Year 2 Final Report: June 2017 – June 2018. Prepared for EDP Renewables North America, LLC (EDPR), Houston, Texas. Prepared by Western EcoSystems Technology, Inc. (WEST), Corvallis, Oregon. August 20, 2018. 35 pp. + appendices.

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

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

Chodachek, K., C. Derby, M. Sonnenberg, and T. Thorn. 2012. Post-Construction Fatality Surveys for the Pioneer Prairie Wind Farm I Llc Phase II, Mitchell County, Iowa: April 4, 2011 – March 31, 2012. Prepared for EDP Renewables, North America LLC, Houston, Texas. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota. August 27, 2012.

Chodachek, K., K. Adachi, and G. DiDonato. 2015. Post Construction Fatality Surveys for the Prairie Rose Wind Energy Facility, Rock County, Minnesota. Final Report: April 15 to June 13, 2014, and August 15 to October 29, 2014. Prepared for Enel Green Power, North America, San Diego, California. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota. January 23, 2015. Available online: https://www.edockets.state.mn.us/EFiling/edockets/searchDocuments.do?method=showPoup&documentId=%7BF38C2FEC-ED84-4813-AF3E-5A397A954A34%7D&documentTitle=20152-107006-01

Denholm, P., M. Hand, M. Jackson, and S. Ong. 2009. Land-Use Requirements of Modern Wind Power Plants in the United States. NREL/TP-6A2-45834. National Renewable Energy Laboratory (NREL), Golden, Colorado. August 2009. Available online at: ftp://ftp.manomet.org/WildlifeandEnergy/Literature_8July10/NREL_Land_Use_2009.pdf

Derby, C., A. Dahl, A. Merrill, and K. Bay. 2010e. 2009 Post-Construction Monitoring Results for the Wessington Springs Wind-Energy Facility, South Dakota. Final Report. Prepared for Wessington Wind Energy Center, LLC, Juno Beach, Florida. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota. August 19, 2010.

Derby, C., A. Dahl, and A. Merrill. 2012c. Post-Construction Monitoring Results for the Prairiewinds Sd1 Wind Energy Facility, South Dakota. Final Report: March 2011 - February 2012. Prepared for Basin Electric Power Cooperative, Bismarck, North Dakota. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota. September 27, 2012.

Derby, C., A. Dahl, and D. Fox. 2013b. Post-Construction Fatality Monitoring Studies for the Prairiewinds Sd1 Wind Energy Facility, South Dakota. Final Report: March 2012 - February 2013. Prepared for Basin Electric Power Cooperative, Bismarck, North Dakota. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota. November 13, 2013.

Derby, C., A. Dahl, and G. DiDonato. 2014. Post-Construction Fatality Monitoring Studies for the Prairiewinds Sd1 Wind Energy Facility, South Dakota. Final Report: March 2013 - February 2014. Prepared for Basin Electric Power Cooperative, Bismarck, North Dakota. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota.

Derby, C., A. Dahl, K. Bay, and L. McManus. 2011d. 2010 Post-Construction Monitoring Results for the Wessington Springs Wind Energy Facility, South Dakota. Final Report: March 9 – November 16, 2010. Prepared for Wessington Wind Energy Center, LLC, Juno Beach, Florida. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota. November 22, 2011.

Derby, C., A. Dahl, W. Erickson, K. Bay, and J. Hoban. 2007. Post-Construction Monitoring Report for Avian and Bat Mortality at the Nppd Ainsworth Wind Farm. Unpublished report prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming, for the Nebraska Public Power District.

Derby, C., G. Iskali, M. Kauffman, T. Thorn, T. Lyon, and A. Dahl. 2013c. Post-Construction Monitoring Results, Red Hills Wind Farm, Roger Mills and Custer Counties, Oklahoma. Final Report: March 2012 to March 2013. Prepared for Acciona Wind Energy, Chicago, Illinois. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota. June 12, 2013.

Derby, C., G. Iskali, S. Howlin, T. Thorn, T. Lyon, and A. Dahl. 2013a. Post-Construction Monitoring Results for the Big Smile Wind Farm, Roger Mills County, Oklahoma. Final Report: March 2012 to February 2013. Prepared for Acciona Wind Energy, Chicago, Illinois. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota. June 12, 2013.

Derby, C., J. Ritzert, and K. Bay. 2010d. Bird and Bat Fatality Study, Grand Ridge Wind Resource Area, Lasalle County, Illinois. January 2009 - January 2010. Prepared for Grand Ridge Energy LLC, Chicago, Illinois. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota. July 13, 2010. Revised January 2011.

Derby, C., K. Chodachek, and M. Sonnenberg. 2012a. Post-Construction Casualty Surveys for the Buffalo Ridge II Wind Project. Iberdrola Renewables: March 2011- February 2012. Prepared for Iberdrola Renewables, LLC, Portland, Oregon. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota. August 31, 2012.

Derby, C., K. Chodachek, and M. Sonnenberg. 2012d. Post-Construction Fatality Surveys for the Elm Creek II Wind Project. Iberdrola Renewables: March 2011-February 2012. Prepared for Iberdrola Renewables, LLC, Portland, Oregon. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota. October 8, 2012.

Derby, C., K. Chodachek, K. Bay, and A. Merrill. 2010a. Post-Construction Fatality Surveys for the Moraine II Wind Project: March - December 2009. Prepared for Iberdrola Renewables, Inc. (IRI), Portland, Oregon. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota.

Derby, C., K. Chodachek, K. Bay, and A. Merrill. 2010b. Post-Construction Fatality Survey for the Buffalo Ridge I Wind Project. May 2009 - May 2010. Prepared for Iberdrola Renewables, Inc., Portland, Oregon. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota.

Derby, C., K. Chodachek, K. Bay, and A. Merrill. 2010c. Post-Construction Fatality Surveys for the Elm Creek Wind Project: March 2009- February 2010. Prepared for Iberdrola Renewables, Inc. (IRI), Portland, Oregon. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota.

Derby, C., K. Chodachek, K. Bay, and A. Merrill. 2010f. Post-Construction Fatality Surveys for the Winnebago Wind Project: March 2009- February 2010. Prepared for Iberdrola Renewables, Inc. (IRI), Portland, Oregon. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota.

Derby, C., K. Chodachek, K. Bay, and S. Nomani. 2011a. Post-Construction Fatality Surveys for the Barton I and II Wind Project: Iri. March 2010 - February 2011. Prepared for Iberdrola Renewables, Inc. (IRI), Portland, Oregon. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota. Version: September 28, 2011.

Derby, C., K. Chodachek, K. Bay, and S. Nomani. 2011c. Post-Construction Fatality Surveys for the Rugby Wind Project: Iberdrola Renewables, Inc. March 2010 - March 2011. Prepared for Iberdrola Renewables, Inc. (IRI), Portland, Oregon. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota. Version: October 14, 2011.

Derby, C., K. Chodachek, T. Thorn, and A. Merrill. 2012b. Post-Construction Surveys for the Prairiewinds Nd1 (2011) Wind Facility Basin Electric Power Cooperative: March - October 2011. Prepared for Basin Electric Power Cooperative, Bismarck, North Dakota. Prepared by Western Ecosystems Technology, Inc. (WEST), Bismarck, North Dakota. August 31, 2012.

Derby, C., K. Chodachek, T. Thorn, K. Bay, and S. Nomani. 2011b. Post-Construction Fatality Surveys for the Prairiewinds Nd1 Wind Facility, Basin Electric Power Cooperative, March - November 2010. Prepared for Basin Electric Power Cooperative, Bismarck, North Dakota. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota. August 2, 2011.

Derby, C., T. Thorn, and M. Wolfe. 2012e. Whooping and Sandhill Crane Monitoring at Five Operating Wind Facilities in North and South Dakota. Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota, and Cheyenne, Wyoming. National Wind Coordinating Collaborative (NWCC) Wind Wildlife Research Meeting IX. November 27-30, 2012, Denver, Colorado.

Downes, S. and R. Gritski. 2012a. White Creek Wind I Wildlife Monitoring Report: November 2007 - November 2011. Prepared for White Creek Wind I, LLC, Roosevelt, Washington. Prepared by Northwest Wildlife Consultants, Inc., Pendleton, Oregon. May 1, 2012.

Downes, S. and R. Gritski. 2012b. Harvest Wind Project Wildlife Monitoring Report: January 2010 – January 2012. Prepared for Harvest Wind Project, Roosevelt, Washington. Prepared by Northwest Wildlife Consultants, Inc., Pendleton, Oregon. May 1, 2012.

Enk, T., C. Derby, K. Bay, and M. Sonnenberg. 2011a. 2010 Post-Construction Fatality Monitoring Report, Elkhorn Valley Wind Farm, Union County, Oregon. January – December 2010. Prepared for EDP Renewables, North America LLC, Houston, Texas. Prepared by Western EcoSystems Technology, Inc. (WEST), Walla Walla, Washington, and Cheyenne, Wyoming. December 8, 2011.

Enk, T., K. Bay, M. Sonnenberg, and J. R. Boehrs. 2012a. Year 2 Avian and Bat Monitoring Report: Biglow Canyon Wind Farm Phase II, Sherman County, Oregon. September 13, 2010 - September 15, 2011. Prepared for Portland General Electric Company, Portland, Oregon. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming, and Walla Walla, Washington. April 23, 2012.

Enk, T., K. Bay, M. Sonnenberg, and J. R. Boehrs. 2012b. Year 1 Avian and Bat Monitoring Report: Biglow Canyon Wind Farm Phase III, Sherman County, Oregon. September 13, 2010 - September 9, 2011. Prepared for Portland General Electric Company, Portland, Oregon. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming, and Walla Walla, Washington. April 24, 2012.

Enk, T., K. Bay, M. Sonnenberg, J. Baker, M. Kesterke, J. R. Boehrs, and A. Palochak. 2010. Biglow Canyon Wind Farm Phase I Post-Construction Avian and Bat Monitoring Second Annual Report, Sherman County, Oregon. January 26, 2009 - December 11, 2009. Prepared for Portland General Electric Company, Portland, Oregon. Prepared by Western EcoSystems Technology, Inc.(WEST) Cheyenne, Wyoming, and Walla Walla, Washington. April 2010.

Enk, T., K. Bay, M. Sonnenberg, J. Flaig, J. R. Boehrs, and A. Palochak. 2011b. Year 1 Post-Construction Avian and Bat Monitoring Report: Biglow Canyon Wind Farm Phase II, Sherman County, Oregon. September 10, 2009 - September 12, 2010. Prepared for Portland General Electric Company, Portland, Oregon. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming, and Walla Walla, Washington. January 7, 2011.

Enz, T. and K. Bay. 2010. Post-Construction Avian and Bat Fatality Monitoring Study, Tuolumne Wind Project, Klickitat County, Washington. Final Report: April 20, 2009 - April 7, 2010. Prepared for Turlock Irrigation District, Turlock, California. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. July 6, 2010.

Enz, T. and K. Bay. 2011. Post-Construction Monitoring at the Linden Ranch Wind Farm, Klickitat County, Washington. Final Report: June 30, 2010 - July 17, 2011. Prepared for EnXco. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. November 10, 2011.

Enz, T., K. Bay, M. Sonnenberg, and A. Palochak. 2012. Post-Construction Monitoring Studies for the Combine Hills Turbine Ranch, Umatilla County, Oregon. Final Report: January 7 - December 2, 2011. Prepared for Eurus Energy America Corporation, San Diego, California. Prepared by Western EcoSystems Technology, Inc. (WEST), Walla Walla, Washington.

Enz, T., K. Bay, S. Nomani, and M. Kesterke. 2011. Bird and Bat Fatality Monitoring Study, Windy Flats and Windy Point II Wind Energy Projects, Klickitat County, Washington. Final Report: February 1, 2010 - January 14, 2011. Prepared for Windy Flats Partners, LLC, Goldendale, Washington. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. August 19, 2011.

Erickson, W. P., G. D. Johnson, M. D. Strickland, and K. Kronner. 2000. Avian and Bat Mortality Associated with the Vansycle Wind Project, Umatilla County, Oregon: 1999 Study Year. Prepared for Umatilla County Department of Resource Services and Development, Pendleton, Oregon. Prepared by Western EcoSystems Technology, Inc., (WEST). February 7, 2000.

Erickson, W.P., G.D. Johnson, M.D. Strickland, D. P. Young, Jr., K.J. Sernka, and R.E. Good. 2001. Avian Collisions with Wind Turbines: A Summary of Existing Studies and Comparisons to Other Sources of Bird Collision Mortality in the United States. National Wind Coordinating Collaborative (NWCC) Publication and Resource Document. Prepared for the NWCC by WEST, Inc., Cheyenne, Wyoming. August 2001.

Erickson, W. P., J. D. Jeffrey, and V. K. Poulton. 2008. Puget Sound Energy Wild Horse Wind Facility Avian and Bat Monitoring: First Annual Report: January–December, 2007. Prepared for Puget Sound Energy, Ellensburg, Washington. Prepared by by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. January 2008.

Erickson, W. P., J. Jeffrey, K. Kronner, and K. Bay. 2004. Stateline Wind Project Wildlife Monitoring Annual Report. July 2001 - December 2003. Technical report peer-reviewed by and submitted to FPL Energy, the Oregon Energy Facility Siting Council, and the Stateline Technical Advisory Committee. Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming, and Northwest Wildlife Consultants, Inc. (NWC), Pendleton, Oregon. December 2004. Available online: http://www.west-inc.com/reports/swp_final_dec04.pdf

Erickson, W. P., K. Kronner, and K. J. Bay. 2007. Stateline 2 Wind Project Wildlife Monitoring Report, January - December 2006. Technical report submitted to FPL Energy, the Oregon Energy Facility Siting Council, and the Stateline Technical Advisory Committee.

Erickson, W. P., K. Kronner, and R. Gritski. 2003. Nine Canyon Wind Power Project Avian and Bat Monitoring Report. September 2002 – August 2003. Prepared for the Nine Canyon Technical Advisory Committee and Energy Northwest by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming, and Northwest Wildlife Consultants (NWC), Pendleton, Oregon. October 2003. Available online: http://www.west-inc.com/reports/nine_canyon_monitoring_final.pdf

Erickson, W. P., M. M. Wolfe, K. J. Bay, D. H. Johnson, and J. L. Gehring. 2014. A Comprehensive Analysis of Small Passerine Fatalities from Collisions with Turbines at Wind Energy Facilities. PLoS ONE 9(9): e107491. doi: 10.1371/journal.pone.0107491.

ESRI. 2013. World Topographic Map. ArcGIS Resource Center. ESRI, producers of ArcGIS software. ESRI, Redlands, California. Last modified June 6, 2018. Available online: http://www.arcgis.com/home/item.html?id=30e5fe3149c34df1ba922e6f5bbf808f

ESRI. 2018a. World Street Map. ArcGIS Resource Center. Environmental Systems Research Institute (ESRI), producers of ArcGIS software, Redlands, California. Data accessed January 2018. Information online: https://www.arcgis.com/home/item.html?id=3b93337983e9436f8db950e38a8629af

ESRI. 2018b. World Imagery and Aerial Photos. ArcGIS Resource Center. Environmental Systems Research Institute (ESRI), producers of ArcGIS software. Redlands, California. Information online: http://www.arcgis.com/home/webmap/viewer.html?useExisting=1

Fagen Engineering, LLC. 2014. 2013 Avian and Bat Monitoring Annual Report: Big Blue Wind Farm, Blue Earth, Minnesota. Prepared for Big Blue Wind Farm. Prepared by Fagen Engineering, LLC. May 2014.

Fagen Engineering, LLC. 2015. 2014 Avian and Bat Monitoring Annual Report: Big Blue Wind Farm, Blue Earth, Minnesota. Prepared for Big Blue Wind Farm. Prepared by Fagen Engineering, LLC.

Ferrer, M., M. de Lucas, G.F.E. Janss, E. Casado, A.R. Muñoz, M.J. Bechard, and C.P. Calabuig. 2012. Weak Relationship between Risk Assessment Studies and Recorded Mortality in Wind Farms. Journal of Applied Ecology 49(1): 38-46.

Fiedler, J. K., T. H. Henry, R. D. Tankersley, and C. P. Nicholson. 2007. Results of Bat and Bird Mortality Monitoring at the Expanded Buffalo Mountain Windfarm, 2005. Tennessee Valley Authority. June 28, 2007.

Gerber, B. D., J. F. Dwyer, S. A. Nesbitt, R. C. Drewien, C. D. Littlefield, T. C. Tacha, and P. A. Vohs. 2014. Sandhill Crane (*Antigone Canadensis*), Version 2.0. A. F. Poole, ed. *In:* The Birds of North America Online. Cornell Lab of Ornithology, Ithaca, New York. Retrieved from the Birds of North America Online: https://birdsna.org/Species-Account/bna/species/sancra

Good, R. E., J. P. Ritzert, and K. Adachi. 2013b. Post-Construction Monitoring at the Top Crop Wind Farm, Gundy and Lasalle Counties, Illinois. Final Report: May 2012 - May 2013. Prepared for EDP Renewables, Houston, Texas. Prepared by Western EcoSystems Technology, Inc. (WEST), Bloomington, Indiana. December 13, 2013.

Good, R. E., M. L. Ritzert, and K. Adachi. 2013a. Post-Construction Monitoring at the Rail Splitter Wind Farm, Tazwell and Logan Counties, Illinois. Final Report: May 2012 - May 2013. Prepared for EDP Renewables, Houston, Texas. Prepared by Western EcoSystems Technology, Inc. (WEST), Bloomington, Indiana. December 16, 2013.

Griffith, G. E., J. M. Omernik, D. W. Smith, T. D. Cook, E. Tallyn, K. Moseley, and C. B. Johnson. 2016. Ecoregions of California. Color poster with map, scale 1:1,100,000. US Geological Survey Open-File Report 2016–1021. Available online: ftp://newftp.epa.gov/EPADataCommons/ORD/Ecoregions/ca/CA_eco_front_ofr20161021_sheet1.pdf and ftp://newftp.epa.gov/EPADataCommons/ORD/Ecoregions/ca/CA_eco_back_ofr20161021_sheet2.pdf

Gritski, R. and K. Kronner. 2010a. Pebble Springs Wind Power Project Wildlife Monitoring Study: January 2009 - January 2010. Prepared for Iberdrola Renewables, Inc. (IRI), and the Pebble Springs Advisory Committee. Prepared by Northwest Wildlife Consultants, Inc. (NWC), Pendleton, Oregon. April 20, 2010.

Gritski, R. and K. Kronner. 2010b. Hay Canyon Wind Power Project Wildlife Monitoring Study: May 2009 - May 2010. Prepared for Iberdrola Renewables, Inc. (IRI), Hay Canyon Wind Power Project LLC. Prepared by Northwest Wildlife Consultants, Inc. (NWC), Pendleton, Oregon. September 20, 2010.

Gritski, R., K. Kronner, and S. Downes. 2008. Leaning Juniper Wind Power Project, 2006 − 2008. Wildlife Monitoring Final Report. Prepared for PacifiCorp Energy, Portland, Oregon. Prepared by Northwest Wildlife Consultants, Inc. (NWC), Pendleton, Oregon. December 30, 2008.

Gritski, R., S. Downes, and K. Kronner. 2010. Klondike III (Phase 1) Wind Power Project Wildlife Monitoring: October 2007-October 2009. Prepared for Iberdrola Renewables, Inc. (IRI), Portland, Oregon, for Klondike Wind Power III LLC. Prepared by Northwest Wildlife Consultants, Inc. (NWC), Pendleton, Oregon. April 21, 2010 (Updated September 2010).

Gritski, R., S. Downes, and K. Kronner. 2011. Klondike IIIa (Phase 2) Wind Power Project Wildlife Monitoring: August 2008 - August 2010. Updated Final. Prepared for Iberdrola Renewables, Inc. (IRI), Portland, Oregon, for Klondike Wind Power III LLC. Prepared by Northwest Wildlife Consultants, Inc. (NWC), Pendleton, Oregon. Updated April 2011.

Grodsky, S. M., C. S. Jennelle, and D. Drake. 2013. Bird Mortality at a Wind-Energy Facility near a Wetland of International Importance. Condor 115(4): 700-711. doi: 10.1525/cond.2013.120167.

Gruver, J., M. Sonnenberg, K. Bay, and W. Erickson. 2009. Post-Construction Bat and Bird Fatality Study at the Blue Sky Green Field Wind Energy Center, Fond Du Lac County, Wisconsin July 21 - October 31, 2008 and March 15 - June 4, 2009. Unpublished report prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. December 17, 2009.

Hallingstad, E., M. Gerringer, and J. Lombardi. 2016. Post-Construction Fatality Monitoring for the Tucannon River Wind Facility, Columbia County, Washington. Final Report: January – December 2015. Prepared for Portland General Electric Company, Portland, Oregon. Prepared by Western EcoSystems Technology, Inc (WEST), Cheyenne, Wyoming. March 18, 2016.

Harvey & Associates. 2013. Montezuma II Wind Energy Center: Post Construction Monitoring Report, Year-1. Prepared by NextEra Montezuma II Wind, LLC, Juno Beach, Florida. Prepared by H.T. Harvey & Associates, Los Gatos, California. September 3, 2013.

Hein, C. D., A. Prichard, T. Mabee, and M. R. Schirmacher. 2013. Avian and Bat Post-Construction Monitoring at the Pinnacle Wind Farm, Mineral County, West Virginia, 2012. Final Report. Bat Conservation International, Austin, Texas, and ABR, Inc., Forest Grove, Oregon. April 2013.

Homer, C. G., J. A. Dewitz, L. Yang, S. Jin, P. Danielson, G. Xian, J. Coulston, N. D. Herold, J. D. Wickham, and K. Megown. 2015. Completion of the 2011 National Land Cover Database for the Conterminous United States-Representing a Decade of Land Cover Change Information. Photogrammetric Engineering and Remote Sensing 81(5): 345-354. Available online: http://www.mrlc.gov/nlcd2011.php

Howe, R. W., W. Evans, and A. T. Wolf. 2002. Effects of Wind Turbines on Birds and Bats in Northeastern Wisconsin. Prepared by University of Wisconsin-Green Bay, for Wisconsin Public Service Corporation and Madison Gas and Electric Company, Madison, Wisconsin. November 21, 2002. 104 pp.

ICF International. 2012. Montezuma Wind Llc (Montezuma I) 2011 Avian and Bat Fatality Monitoring Report. Prepared for NextEra Energy Resources. Prepared by ICF International, Sacramento, California. May 17, 2012.

ICF International. 2013. Montezuma Wind Llc (Montezuma I) 2012 Avian and Bat Fatality Monitoring Report. Prepared for NextEra Energy Resources. Prepared by ICF International, Sacramento, California. May 2013.

Jacques Whitford Stantec Limited (Jacques Whitford). 2009. Ripley Wind Power Project Postconstruction Monitoring Report. Project No. 1037529.01. Report to Suncor Energy Products Inc., Calgary, Alberta, and Acciona Energy Products Inc., Calgary, Alberta. Prepared for the Ripley Wind Power Project Post-Construction Monitoring Program. Prepared by Jacques Whitford, Markham, Ontario. April 30, 2009.

Jain, A. 2005. Bird and Bat Behavior and Mortality at a Northern Iowa Windfarm. Thesis. Iowa State University, Ames, Iowa.

Jain, A., P. Kerlinger, L. Slobodnik, R. Curry, A. Fuerst, and A. Harte. 2010a. Annual Report for the Noble Bliss Windpark, Llc: Postconstruction Bird and Bat Fatality Study - 2009. Prepared for Noble Environmental Power, LLC. Prepared by Curry and Kerlinger, LLC, Cape May, New Jersey. March 9, 2010.

Jain, A., P. Kerlinger, L. Slobodnik, R. Curry, and A. Harte. 2011c. Annual Report for the Noble Wethersfield Windpark, Llc: Postconstruction Bird and Bat Fatality Study - 2010. Prepared for Noble Environmental Power, LLC. Prepared by Curry and Kerlinger, LLC, Cape May, New Jersey. January 22, 2011.

Jain, A., P. Kerlinger, L. Slobodnik, R. Curry, and K. Russell. 2011a. Annual Report for the Noble Altona Windpark, Llc: Postconstruction Bird and Bat Fatality Study - 2010. Prepared for Noble Environmental Power, LLC. Prepared by Curry and Kerlinger, LLC, Cape May, New Jersey. January 22, 2011.

Jain, A., P. Kerlinger, L. Slobodnik, R. Curry, and K. Russell. 2011b. Annual Report for the Noble Chateaugay Windpark, Llc: Postconstruction Bird and Bat Fatality Study - 2010. Prepared for Noble Environmental Power, LLC. Prepared by Curry and Kerlinger, LLC, Cape May, New Jersey. January 22, 2011.

Jain, A., P. Kerlinger, L. Slobodnik, R. Curry, and K. Russell. 2010b. Annual Report for the Noble Clinton Windpark, Llc: Postconstruction Bird and Bat Fatality Study - 2009. Prepared for Noble Environmental Power, LLC. Prepared by Curry and Kerlinger, LLC, Cape May, New Jersey. March 9, 2010.

Jain, A., P. Kerlinger, L. Slobodnik, R. Curry, and K. Russell. 2010c. Annual Report for the Noble Ellenburg Windpark, Llc: Postconstruction Bird and Bat Fatality Study - 2009. Prepared for Noble Environmental Power, LLC. Prepared by Curry and Kerlinger, LLC, Cape May, New Jersey. March 14, 2010.

Jain, A., P. Kerlinger, R. Curry, and L. Slobodnik. 2009a. Annual Report for the Maple Ridge Wind Power Project: Post-Construction Bird and Bat Fatality Study - 2007. Final report prepared for PPM Energy and Horizon Energy and Technical Advisory Committee (TAC) for the Maple Ridge Project Study. May 6, 2009.

Jain, A., P. Kerlinger, R. Curry, L. Slobodnik, A. Fuerst, and C. Hansen. 2009e. Annual Report for the Noble Ellenburg Windpark, Llc, Postconstruction Bird and Bat Fatality Study - 2008. Prepared for Noble Environmental Power, LLC by Curry and Kerlinger, LLC. April 13, 2009.

Jain, A., P. Kerlinger, R. Curry, L. Slobodnik, and M. Lehman. 2009b. Maple Ridge Wind Power Avian and Bat Fatality Study Report - 2008. Annual Report for the Maple Ridge Wind Power Project, Post-construction Bird and Bat Fatality Study - 2008. Prepared for Iberdrola Renewables, Inc, Horizon Energy, and the Technical Advisory Committee (TAC) for the Maple Ridge Project Study. Prepared by Curry and Kerlinger, LLC. May 14, 2009.

Jain, A., P. Kerlinger, R. Curry, L. Slobodnik, J. Histed, and J. Meacham. 2009d. Annual Report for the Noble Clinton Windpark, Llc, Postconstruction Bird and Bat Fatality Study - 2008. Prepared for Noble Environmental Power, LLC by Curry and Kerlinger, LLC. April 13, 2009.

Jain, A., P. Kerlinger, R. Curry, L. Slobodnik, J. Quant, and D. Pursell. 2009c. Annual Report for the Noble Bliss Windpark, Llc, Postconstruction Bird and Bat Fatality Study - 2008. Prepared for Noble Environmental Power, LLC by Curry and Kerlinger, LLC. April 13, 2009.

Jeffrey, J. D., K. Bay, W. P. Erickson, M. Sonneberg, J. Baker, M. Kesterke, J. R. Boehrs, and A. Palochak. 2009a. Portland General Electric Biglow Canyon Wind Farm Phase I Post-Construction Avian and Bat Monitoring First Annual Report, Sherman County, Oregon. January 2008 - December 2008. Technical report prepared for Portland General Electric Company, Portland, Oregon. Prepared by Western EcoSystems Technology (WEST) Inc., Cheyenne, Wyoming, and Walla Walla, Washington. April 29, 2009.

Jeffrey, J. D., W. P. Erickson, K. Bay, M. Sonneberg, J. Baker, J. R. Boehrs, and A. Palochak. 2009b. Horizon Wind Energy, Elkhorn Valley Wind Project, Post-Construction Avian and Bat Monitoring, First Annual Report, January-December 2008. Technical report prepared for Telocaset Wind Power Partners, a subsidiary of Horizon Wind Energy, Portland, Oregon. Prepared by Western EcoSystems Technology, Inc., Cheyenne, Wyoming, and Walla Walla, Washington. May 4, 2009.

Johnson, G. D., M. Ritzert, S. Nomani, and K. Bay. 2010. Bird and Bat Fatality Studies, Fowler Ridge I Wind-Energy Facility Benton County, Indiana. Unpublished report prepared for British Petroleum Wind Energy North America Inc. (BPWENA) by Western EcoSystems Technology, Inc. (WEST).

Johnson, G. D., W. P. Erickson, M. D. Strickland, M. F. Shepherd, and D. A. Shepherd. 2000. Final Report: Avian Monitoring Studies at the Buffalo Ridge Wind Resource Area, Minnesota: Results of a 4-Year Study. Final report prepared for Northern States Power Company, Minneapolis, Minnesota, by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. September 22, 2000. 212 pp.

Johnson, G., W. Erickson, and J. White. 2003. Avian and Bat Mortality During the First Year of Operation at the Klondike Phase I Wind Project, Sherman County, Oregon. Technical report prepared for Northwestern Wind Power, Goldendale, Washington, by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. March 2003.

Kerlinger, P., J. Guarnaccia, R. Curry, and C. J. Vogel. 2014. Bird and Bat Fatality Study, Heritage Garden I Wind Farm, Delta County, Michigan: 2012-2014. Prepared for Heritage Sustainable Energy, LLC. Prepared by Curry and Kerlinger, LLC, McLean, Virginia. November 2014.

Kerlinger, P., R. Curry, A. Hasch, J. Guarnaccia, and D. Riser-Espinoza. 2013a. Post-Construction Bird and Bat Studies at the Shiloh II Wind Project, LLC, Solano County, California. Final Report. Prepared for EDF Renewable Energy (formerly known as enXco). Prepared by Curry and Kerlinger, LLC, McLean, Virginia. December 2012 (Revised June 2013).

Kerlinger, P., R. Curry, A. Hasch, J. Guarnaccia, and D. Riser-Espinoza. 2013b. Post-Construction Bird and Bat Studies at the Shiloh III Wind Project, LLC, Solano County, California. Report on Year 1 Results. Prepared for EDF Renewable Energy (formerly known as enXco). Prepared by Curry and Kerlinger, LLC, McLean, Virginia. August 2013.

Kerlinger, P., R. Curry, L. Culp, A. Hasch, and A. Jain. 2009. Revised Post-Construction Avian Monitoring Study for the Shiloh I Wind Power Project, Solano County, California. Final Report: October 2009. Third Year Report (Revised 2010). Prepared for Iberdrola Renewables, Inc. (IRI). Prepared by Curry and Kerlinger, LLC., McLean, Virginia. Available online: https://www.solanocounty.com/civicax/filebank/blobdload.aspx?blobid=8914

Kerlinger, P., R. Curry, L. Culp, A. Hasch, and A. Jain. 2010. Post-Construction Avian Monitoring Study for the Shiloh II Wind Power Project, Solano County, California. Year One Report. Prepared for enXco Development Inc. Prepared by Curry and Kerlinger, LLC, McLean, Virginia. September 2010. Available online: https://www.solanocounty.com/civicax/filebank/blobdload.aspx?blobid=12118

Kerlinger, P., R. Curry, L. Culp, A. Jain, C. Wilkerson, B. Fischer, and A. Hasch. 2006. Post-Construction Avian and Bat Fatality Monitoring Study for the High Winds Wind Power Project, Solano County, California: Two Year Report. Prepared for High Winds LLC, FPL Energy. Prepared by Curry and Kerlinger, LLC, MacLean, Virginia. April 2006. Available online: http://www.co.solano.ca.us/civicax/filebank/blobdload.aspx?blobid=8915

Kerns, J. and P. Kerlinger. 2004. A Study of Bird and Bat Collision Fatalities at the Mountaineer Wind Energy Center, Tucker County, West Virginia: Annual Report for 2003. Prepared for FPL Energy and the Mountaineer Wind Energy Center Technical Review Committee. February 14, 2004. 39 pp.

Kritz, K., M. Rheude, B. Millsap, M. Sadlowski, J. Pagel, M. Stuber, C. Borgman, T. Wittig, U. Kirpatrick, J. Muir, and H. Beeler. 2018. Bald Eagle Mortalities and Injuries at Wind Energy Facilities in the United States. Poster presented at the 25th Annual Conference of The Wildlife Society (TWS), October 7-11, 2018, Cleveland, Ohio.

Kronner, K., B. Gritski, and S. Downes. 2008. Big Horn Wind Power Project Wildlife Fatality Monitoring Study: 2006−2007. Final report prepared for PPM Energy and the Big Horn Wind Project Technical Advisory Committee by Northwest Wildlife Consultants, Inc. (NWC), Mid-Columbia Field Office, Goldendale, Washington. June 1, 2008.

LeBeau, C.W., G.D. Johnson, M.J. Holloran, J.L. Beck, R.M. Nielson, M.E. Kauffman, E.J. Rodemaker, and T.L. McDonald. 2017. Greater Sage-Grouse Habitat Selection, Survival, and Wind Energy Infrastructure. Journal of Wildlife Management 81(4): 690-711.

Leddy, K.L., K.F. Higgins, and D.E. Naugle. 1999. Effects of Wind Turbines on Upland Nesting Birds in Conservation Reserve Program Grasslands. Wilson Bulletin 111(1): 100-104.

Levenstein, K. and G. DiDonato. 2015. Post-Construction Avian and Bat Mortality Study at the Lower West Wind Energy Project, Kern County, California. Final Report for the Third Year of Operation: July 2014 - July 2015. Prepared for Brookfield Renewable Energy Partners, LP. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. October 31, 2013.

Levenstein, K. and K. Bay. 2013a. Post-Construction Avian and Bat Mortality Study at the Lower West Wind Energy Project, Kern County, California. Final Report for the First Year of Operation: May 2012 - May 2013. Prepared for Brookfield Renewable Energy Partners, LP. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. October 31, 2013.

Levenstein, K. and K. Bay. 2013b. Post-Construction Avian and Bat Mortality Study at the Windstar Wind Energy Project, Kern County, California. Final Mortality Report: May 2012 - May 2013. Prepared for Brookfield Renewable Energy Partners, LP. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. October 29, 2013.

Levenstein, K., A. Chatfield, and D. Riser-Espinoza. 2015. Post-Construction Studies for the North Sky River Wind Energy Facility, Kern County, California. Draft Report for the Second Year of Operation: January 2014 - January 2015. Prepared for North Sky River Energy LLC, Juno Beach, Florida. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. April 10, 2015.

Levenstein, K., E. Baumgartner, and K. Bay. 2014. Post-Construction Studies for the North Sky River Wind Energy Facility, Kern County, California. Final Report for the First Year of Operation: January 2013 - January 2014. Prepared for North Sky River Energy LLC, Juno Beach, Florida. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. March 31, 2014.

Loesch, C., R. Reynolds, N. Niemuth, J. Walker, S. Stephens, J. Gleason, and M. Erickson. 2013. Effect of Wind Energy Development on Breeding Duck Densities in the Prairie Pothole Region. Presented at the National Wind Coordinating Collaborative (NWCC), Research Webinar. November 2013. Available online at: https://www.nationalwind.org/research/webinars/nwcc-webinar-4_loesch-11-20-13/

MacWhirter, R. B. and K. L. Bildstein. 1996. Northern Harrier (*Circus Cyaneus*). Pp. *In*: A. Poole and F. Gill, eds. The Birds of North America, No. 210. The Academy of Natural Sciences, Philadelphia, Pennsylvania, and The American Ornithologists' Union, Washington, D.C. 32 pp.

Marques, A.T., H. Batalha, S. Rodrigues, H. Costa, M. J. Ramos Pereira, C. Fonseca, M. Mascarenhas, and J. Bernardino. 2014. Understanding Bird Collisions at Wind Farms: An Updated Review on the Causes and Possible Mitigation Strategies. Biological Conservation 179: 40-52.

National Research Council (NRC). 2007. Environmental Impacts of Wind-Energy Projects. National Academies Press, Washington, D.C. www.nap.edu

NatureServe. 2018. Natureserve Explorer: An Online Encyclopedia of Life [Web Application]. Version 7.1. Natureserve, Arlington, Virginia. Accessed September 2018. Information online: http://explorer.natureserve.org

Navarrete, L. and K.L. Griffis-Kyle. 2014. Sandhill Crane Collisions with Wind Turbines in Texas. Proceedings of the North American Crane Workshop 12: 65-67.

Nicholson, C. P., R. D. Tankersley, Jr., J. K. Fiedler, and N. S. Nicholas. 2005. Assessment and Prediction of Bird and Bat Mortality at Wind Energy Facilities in the Southeastern United States. Final Report. Tennessee Valley Authority, Knoxville, Tennessee.

Normandeau Associates, Inc. 2010. Stetson Mountain II Wind Project Year 1 Post-Construction Avian and Bat Mortality Monitoring Study, T8 R4 Nbpp, Maine. Prepared for First Wind, LLC, Portland, Maine. Prepared by Normandeau Associates, Inc., Falmouth, Maine. December 2, 2010.

Normandeau Associates, Inc. 2011. Year 3 Post-Construction Avian and Bat Casualty Monitoring at the Stetson I Wind Farm, T8 R4 Nbpp, Maine. Prepared for First Wind Energy, LLC, Portland, Maine. Prepared by Normandeau Associates, Inc., Falmouth, Maine. December 2011.

North American Datum (NAD). 1983. Nad83 Geodetic Datum.

Northwest Wildlife Consultants, Inc. (NWC) and Western EcoSystems Technology, Inc. (WEST). 2007. Avian and Bat Monitoring Report for the Klondike II Wind Power Project. Sherman County, Oregon. Prepared for PPM Energy, Portland, Oregon. Managed and conducted by NWC, Pendleton, Oregon. Analysis conducted by WEST, Cheyenne, Wyoming. July 17, 2007.

Pagel, J. E., K. J. Kritz, B. A. Millsap, R. K. Murphy, E. L. Kershner, and S. Covington. 2013. Bald Eagle and Golden Eagle Mortalities at Wind Energy Facilities in the Contiguous United States. Journal of Raptor Research 47(3): 311-315.

Pearce-Higgins, J.W., L. Stephen, A. Douse, and R.H.W. Langston. 2012. Greater Impacts of Wind Farms on Bird Populations During Construction Than Subsequent Operation: Results of a Multi-Site and Multi-Species Analysis. Journal of Applied Ecology 49(2): 386-394.

Ralph, C. J., G. R. Geupel, P. Pyle, T. E. Martin, and D. F. DeSante. 1993. Handbook of Field Methods for Monitoring Landbirds. General Technical Report (GTR). PSW-GTR-144. US Department of Agriculture (USDA) Forest Service General Technical Report (GTR), Pacific Southwest (PSW) Research Station, Albany, California. Available online: http://www.fs.fed.us/psw/publications/documents/gtr-144/

Reynolds, R. T., J. M. Scott, and R. A. Nussbaum. 1980. A Variable Circular-Plot Method for Estimating Bird Numbers. Condor 82(3): 309-313.

Rintz, T. and D. Pham. 2018. Post-Construction Avian and Bat Fatality Monitoring for the Pinyon Pines I & II Wind Energy Project, Kern County, California. Final Report for the Fifth Year of Operation: March 2017 - March 2018. Prepared for MidAmerican Energy Company, Des Moines, Iowa, and Alta Windpower Development, LLC, Mojave, California. Prepared by Western EcoSystems Technology, Inc. (WEST), Corvalis, Oregon. June 19, 2018. 63 pp. + appendices.

Rintz, T. and J. Thompson. 2017. Post-Construction Avian and Bat Mortality Monitoring at the Cameron Ridge-Section 15 Wind Farm, Coram California Development, Lp, Kern County, California. Mortality Analysis, Fourth Year of Operation: August 2015 - August 2016. Prepared for Renewable Energy Trust, San Francisco, California. Prepared by Western EcoSystems Technology, Inc. (WEST), Corvallis, Oregon. January 12, 2017.

Rintz, T. and L. A. Starcevich. 2016. Post-Construction Avian and Bat Fatality Monitoring for the Pinyon Pines I & II Wind Energy Project, Kern County, California. Final Report for the Third Year of Operation: March 2015 - March 2016. Prepared for Berkshire Hathaway Energy Renewables, LLC, Des Moines, Iowa, and Alta Windpower Development, LLC, Mojave, California. Prepared by Western EcoSystems Technology, Inc. (WEST), Corvalis, Oregon. October 17, 2016.

Rintz, T., J. Thompson, and S. Howlin. 2016. Post-Construction Avian and Bat Mortality Monitoring at the Rising Tree and Addison Wind Energy Projects, Kern County, California. Year 1 – Final Report: September 2015 – September 2016. Prepared for EDP Renewables North America, LLC, Houston, Texas. Prepared by Western EcoSystems Technology, Inc. (WEST), Corvallis, Oregon. November 16, 2016.

Shaffer, J. A. and D. A. Buhl. 2016. Effects of Wind-Energy Facilities on Breeding Grassland Bird Distributions. Conservation Biology 30(1): 59-71. doi: 10.1111/cobi.12569.

Shuford, W. D., and Gardali, T., editors. 2008. California Bird Species of Special Concern: A ranked assessment of species, subspecies, and distinct populations of birds of immediate conservation concern in California. Studies of Western Birds 1. Western Field Ornithologists, Camarillo, California, and California Department of Fish and Game, Sacramento.

Smallwood, K. S. and B. Karas. 2009. Avian and Bat Fatality Rates at Old-Generation and Repowered Wind Turbines in California. Journal of Wildlife Management 73(7): 1062-1071.

Stantec Consulting Ltd. (Stantec Ltd.). 2015. Port Dover and Nanticoke Wind Project: Post-Construction Wildlife Monitoring Report 2014. Prepared for Capital Power LP, Edmonton, Alberta. Prepared by Stantec Ltd., Guelph Ontario. January 21, 2015.

Stantec Consulting Ltd. (Stantec Ltd.). 2017. Grand Valley Wind Farms Phase 3 Wind Project: Year 1 Post-Construction Wildlife Monitoring Report (2016). Prepared for Grand Valley 2 Limited Partnership, Calgary Alberta. Prepared by Stantec Ltd., Guelph Ontario. February 24, 2017. Available online: http://www.vereseninc.com/wp-content/uploads/2013/02/Bird-and-Bat-Mortality-Monitoring-2016.pdf

Stantec Consulting Services, Inc. (Stantec Consulting). 2012. Post-Construction Monitoring, Summer 2011 - Spring 2012. Year 1 Annual Report. Kittitas Valley Wind Power Project, Cle Elum, Washington. Prepared for Sagebrush Power Partners, LLC, Houston, Texas. Prepared by Stantec Consulting, Salt Lake City, Utah.

Stantec Consulting Services, Inc. (Stantec Consulting). 2018. 2017 Post-Construction Bat Mortality Monitoring Report. Wildcat Wind Farm, Madison and Tipton Counties, Indiana. Prepared for Wildcat Wind Farm, LLC, Chicago, Illinois. Prepared by Stantec Consulting, Independence, Iowa. January 26, 2018.

Stantec Consulting, Inc. (Stantec). 2008. 2007 Spring, Summer, and Fall Post-Construction Bird and Bat Mortality Study at the Mars Hill Wind Farm, Maine. Prepared for UPC Wind Management, LLC, Cumberland, Maine. Prepared by Stantec (formerly Woodlot Alternatives, Inc.), Topsham, Maine. January 2008.

Stantec Consulting, Inc. (Stantec). 2009a. Post-Construction Monitoring at the Mars Hill Wind Farm, Maine - Year 2, 2008. Prepared for First Wind Management, LLC, Portland, Maine. Prepared by Stantec Consulting, Topsham, Maine. January 2009.

Stantec Consulting, Inc. (Stantec). 2009b. Post-Construction Monitoring at the Munnsville Wind Farm, New York: 2008. Prepared for E.ON Climate and Renewables, Austin, Texas. Prepared by Stantec Consulting, Topsham, Maine. January 2009.

Stantec Consulting, Inc. (Stantec). 2009c. Stetson I Mountain Wind Project: Year 1 Post-Construction Monitoring Report, 2009 for the Stetson Mountain Wind Project in Penobscot and Washington Counties, Maine. Prepared for First Wind Management, LLC. Portland, Maine. Prepared by Stantec, Topsham, Maine. December 2009.

Stantec Consulting, Inc. (Stantec). 2010. Cohocton and Dutch Hill Wind Farms Year 1 Post-Construction Monitoring Report, 2009, for the Cohocton and Dutch Hill Wind Farms in Cohocton, New York. Prepared for Canandaigua Power Partners, LLC and Canandaigua Power Partners II, LLC, Portland, Maine. Prepared by Stantec, Topsham, Maine. January 2010.

Stantec Consulting, Inc. (Stantec). 2011a. Post-Construction Monitoring 2010 Final Annual Report – Year 1, Milford Wind Corridor Phase I, Milford, Utah. Prepared for First Wind Management, LLC, Portland, Maine. Prepared by Stantec, Topsham, Maine. August 2011.

Stantec Consulting, Inc. (Stantec). 2011b. Cohocton and Dutch Hill Wind Farms Year 2 Post-Construction Monitoring Report, 2010, for the Cohocton and Dutch Hill Wind Farms in Cohocton, New York. Prepared for Canandaigua Power Partners, LLC, and Canandaigua Power Partners II, LLC, Portland, Maine. Prepared by Stantec, Topsham, Maine. October 2011.

Stantec Consulting, Inc. (Stantec). 2012. Post-Construction Monitoring 2011 - 2012, Milford Wind Corridor Phase I and II, Milford, Utah. Prepared for First Wind Management, LLC, Portland, Maine. Prepared by Stantec, Topsham, Maine. May 2012.

Stantec Consulting, Inc. (Stantec). 2013a. Palouse Wind Post-Construction Wildlife Monitoring Report, 2012-2013. Prepared for Palouse Wind, Whitman County, Washington. Prepared by Stantec, Topsham, Maine. December 2013.

Stantec Consulting, Inc. (Stantec). 2013b. Record Hill Wind Project Post-Construction Monitoring Report, 2012. Prepared for Record Hill Wind LLC, Lyme, New Hampshire. Prepared by Stantec, Topsham, Maine. March 2013.

Stantec Consulting, Inc. (Stantec). 2013c. Rollins Wind Project Post-Construction Monitoring Report, 2012. Prepared for First Wind, Portland, Maine. Prepared by Stantec, Topsham, Maine. March 2013.

Stantec Consulting, Inc. (Stantec). 2013d. Stetson II Wind Project Post-Construction Monitoring Report, 2012. Prepared for First Wind, Portland, Maine. Prepared by Stantec, Topsham, Maine. March 2013.

Stantec Consulting, Inc. (Stantec). 2014. Stetson I Wind Project 2013 Post-Construction Wildlife Monitoring Report, Year 5. Stetson I Wind Project, Washington County, Maine. Prepared for First Wind, Portland, Maine. Prepared by Stantec, Topsham, Maine. February 2014.

Stantec Consulting, Inc. (Stantec). 2015. Record Hill Wind Project Year 2 Post-Construction Wildlife Monitoring Report, 2014. Prepared for Record Hill Wind LLC and Wagner Forest Management, Ltd., Lyme, New Hampshire. Prepared by Stantec Consulting, Topsham, Maine. March 2015.

Stehn, T. 2011. Whooping Crane Recovery Activities: October, 2010 - August, 2011. Aransas National Wildlife Refuge, US Fish and Wildlife Service (USFWS). August 31, 2011.

Stevens, T. K., A. M. Hale, K. B. Karsten, and V. J. Bennett. 2013. An Analysis of Displacement from Wind Turbines in a Wintering Grassland Bird Community. Biodiversity and Conservation 22: 1755-1767. doi: 10.1007/s10531-013-0510-8.

Strickland, D. and G. D. Johnson. 2006. Overview of What We Know About Avian/Wind Interaction. Presented at the National Wind Coordinating Collaborative (NWCC) Wildlife Workgroup Research Meeting VI, November 14, San Antonio, Texas.

Strickland, M. D., E. B. Arnett, W. P. Erickson, D. H. Johnson, G. D. Johnson, M. L. Morrison, J. A. Shaffer, and W. Warren-Hicks. 2011. Comprehensive Guide to Studying Wind Energy/Wildlife Interactions. Prepared for the National Wind Coordinating Collaborative (NWCC), Washington, D.C., USA. June 2011. Available online at: http://www.batsandwind.org/pdf/Comprehensive_Guide_to_Studying_Wind_Energy_Wildlife_Interactions_2011.pdf

Tetra Tech. 2013. Hatchet Ridge Wind Farm Post-Construction Mortality Monitoring: Year Two Annual Report. Prepared for Hatchet Ridge Wind, LLC. Prepared by Tetra Tech, Portland, Oregon. March 2013. Available online: http://wintuaudubon.org/Documents/HatchetRidgeYear2FinalReport3-13.pdf

Tetra Tech. 2014. Hatchet Ridge Wind Farm Post-Construction Mortality Monitoring: Comprehensive Three Year Report. Prepared for Hatchet Ridge Wind, LLC. Prepared by Tetra Tech, Portland, Oregon. May 2014.

Tetra Tech. 2017a. 2016 - 2017 Post-Construction Mortality Monitoring Annual Report, Pleasant Valley Wind Farm, Mower and Dodge Counties, Minnesota. Prepared for Northern States Power Company-Minnesota, Xcel Energy. Prepared by Tetra Tech, Bloomington, Minnesota. June 2017. Available online: https://mn.gov/commerce/energyfacilities/Docket.html?Id=25724

Tetra Tech. 2017b. 2016-2017 Post-Construction Fatality Monitoring Annual Report: Waverly Wind Farm, Coffey County, Kansas. Prepared for Waverly Wind Farm, LLC. Prepared by Portland, Oregon. October 2017.

Thompson, J. 2018. 2017 Raptor Nest Survey Report for the Fountain Wind Project, California. Technical memorandum prepared for Pacific Wind Development LLC. Prepared by Western EcoSystems Technology, Inc. (WEST), Corvallis, Oregon. September 19, 2018.

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

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

Thompson, J., J. Lombardi, and C. Boyd. 2016. Bird and Bat Mortality Monitoring at the Alta Wind Energy Center, Phases I - V, Kern County, California. Final Report for the Third Year of Monitoring: March 10, 2015 - March 4, 2016. Prepared for Alta Windpower Development, LLC, Mojave, California. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. June 9, 2016.

Tidhar, D., L. McManus, D. Solick, Z. Courage, and K. Bay. 2012b. 2011 Post-Construction Fatality Monitoring Study and Bat Acoustic Study for the High Sheldon Wind Farm, Wyoming County, New York. Final Report: April 15 - November 15, 2011. Prepared for High Sheldon Wind Farm, Sheldon Energy LLC, Chicago, Illinois. Prepared by Western EcoSystems Technology, Inc. (WEST), Waterbury, Vermont. April 25, 2012.

Tidhar, D., L. McManus, Z. Courage, and W. L. Tidhar. 2012a. 2010 Post-Construction Fatality Monitoring Study and Bat Acoustic Study for the High Sheldon Wind Farm, Wyoming County, New York. Final Report: April 15 - November 15, 2010. Prepared for High Sheldon Wind Farm, Sheldon Energy LLC, Chicago, Illinois. Prepared by Western EcoSystems Technology, Inc. (WEST), Waterbury, Vermont. April 15, 2012.

Tidhar, D., M. Sonnenberg, and D. P. Young, Jr. 2013. 2012 Post-Construction Carcass Monitoring Study for the Beech Ridge Wind Farm, Greenbrier County, West Virginia. Final Report: April 1 - October 28, 2012. Prepared for Beech Ridge Wind Farm, Beech Ridge Energy, LLC, Chicago, Illinois. Prepared by Western EcoSystems Technology, Inc. (WEST), NE/Mid-Atlantic Branch, Waterbury, Vermont. January 18, 2013.

Tidhar, D., W. L. Tidhar, L. McManus, and Z. Courage. 2011. 2010 Post-Construction Fatality Surveys for the Lempster Wind Project, Lempster, New Hampshire. Prepared for Iberdrola Renewables, Inc. and the Lempster Wind Technical Committee. Prepared by Western EcoSystems Technology, Inc., Waterbury, Vermont. May 18, 2011.

Tidhar, D., W. Tidhar, and M. Sonnenberg. 2010. Post-Construction Fatality Surveys for Lempster Wind Project, Iberdrola Renewables. Prepared for Lempster Wind, Llc, Lempster Wind Technical Advisory Committee, and Iberdrola Renewables, Inc. Prepared by Western EcoSystems Technology Inc. (WEST), Waterbury, Vermont. September 30, 2010.

Tierney, R. 2007. Buffalo Gap I Wind Farm Avian Mortality Study: February 2006-January 2007. Final Survey Report. Prepared for AES SeaWest, Inc. TRC, Albuquerque, New Mexico. TRC Report No. 110766-C-01. May 2007.

Tierney, R. 2009. Buffalo Gap 2 Wind Farm Avian Mortality Study: July 2007 - December 2008. Final Survey Report. Submitted by TRC, Albuquerque, New Mexico. TRC Report No. 151143-B-01. June 2009.

URS Corporation. 2010a. Final Goodnoe Hills Wind Project Avian Mortality Monitoring Report. Prepared for PacifiCorp, Salt Lake City, Utah. Prepared by URS Corporation, Seattle, Washington. March 16, 2010.

URS Corporation. 2010b. Final Marengo II Wind Project Year One Avian Mortality Monitoring Report. Prepared for PacifiCorp, Salt Lake City, Utah. Prepared by URS Corporation, Seattle, Washington. March 22, 2010.

URS Corporation. 2010c. Final Marengo I Wind Project Year One Avian Mortality Monitoring Report. Prepared for PacifiCorp, Salt Lake City, Utah. Prepared by URS Corporation, Seattle, Washington. March 22, 2010.

US Fish and Wildlife Service (USFWS). 2008. Birds of Conservation Concern 2008. December 2008. Division of Migratory Bird Management, Arlington, Virginia. Available online: https://www.fws.gov/migratorybirds/pdf/grants/BirdsofConservationConcern2008.pdf

US Fish and Wildlife Service (USFWS). 2012. Land-Based Wind Energy Guidelines. March 23, 2012. 82 pp. Available online: http://www.fws.gov/cno/pdf/Energy/2012_Wind_Energy_Guidelines_final.pdf

US Fish and Wildlife Service (USFWS). 2013. Eagle Conservation Plan Guidance: Module 1 - Land-Based Wind Energy, Version 2. US Department of the Interior, Fish and Wildlife Service, Division of Migratory Bird Management. April 2013. Executive Summary and frontmatter + 103 pp. Available online: https://www.fws.gov/migratorybirds/pdf/management/eagleconservationplanguidance.pdf

US Geological Survey (USGS) National Land Cover Database (NLCD). 2011. National Land Cover Database 2011 (NLCD 2011). Multi-Resolution Land Characteristics Consortium (MRLC), National Land Cover Database (NLCD). USGS Earth Resources Observation and Science (EROS) Center, Sioux Falls, South Dakota. Available online: http://www.mrlc.gov/nlcd2011.php; Legend: http://www.mrlc.gov/nlcd11_leg.php

US Geological Survey (USGS). 2018. USGS Topographic Maps. Accessed January 17, 2018. Information online: https://nationalmap.gov/ustopo/index.html

Ventus Environmental Solutions (Ventus). 2012. Vantage Wind Energy Center Avian and Bat Monitoring Study: March 2011- March 2012. Prepared for Vantage Wind Energy, LLC, Chicago, Illinois. Prepared by Ventus, Portland, Oregon. May 16, 2012.

Watson, R.T., P.S. Kolar, M. Ferrer, T. Nygård, N. Johnston, W.G. Hunt, H.A. Smit-Robinson, C.J. Farmer, M. Huso, and T.E. Katzner. 2018. Raptor Interactions with Wind Energy: Case Studies from around the World. Journal of Raptor Research 52(1): 1-18.

Welcker, J., M. Liesenjohann, J. Blew, G. Nehls, and T. Grünkorn. 2017. Nocturnal Migrants Do Not Incur Higher Collision Risk at Wind Turbines Than Diurnally Active Species. Ibis 159(2): 366-373.

Western EcoSystems Technology, Inc. (WEST). 2006. Diablo Winds Wildlife Monitoring Progress Report, March 2005 - February 2006. Technical report submitted to FPL Energy and Alameda County California. WEST, Cheyenne, Wyoming.

Western EcoSystems Technology, Inc. (WEST). 2008. Diablo Winds Wildlife Monitoring Progress Report: March 2005 – February 2007. Prepared by WEST, Cheyenne, Wyoming. August 2008.

Western EcoSystems Technology, Inc. (WEST). 2011. Post-Construction Fatality Surveys for the Barton Chapel Wind Project: Iberdrola Renewables. Version: July 2011. Iberdrola Renewables, Portland, Oregon.

Western EcoSystems Technology, Inc. (WEST). 2016a. Post-Construction Avian and Bat Fatality Monitoring at the Pacific Wind Energy Facility, Kern County, California. Final Report for the Third Year of Operation: October 2014 - October 2015. Prepared for Pacific Wind, LLC, San Diego, California. Prepared by WEST, Cheyenne, Wyoming. January 27, 2016.

Western EcoSystems Technology, Inc. (WEST). 2016b. Post-Construction Avian and Bat Mortality Monitoring at the Cameron Ridge-Section 15 Wind Farm, Coram California Development, Lp, Kern County, California. Mortality Analysis, Third Year of Operation: August 2014 - August 2015. Prepared for Renewable Energy Trust, San Francisco, California. Prepared by WEST, Corvallis, Oregon. January 2016.

Western EcoSystems Technology, Inc. (WEST). 2016c. Post-Construction Studies for the Mustang Hills and Alta VIII Wind Energy Facilities, Kern County, California. Draft Report for the Third Year of Operation: September 2014 - September 2015. Prepared for EverPower Wind Holdings, Inc. and Brookfield Renewable Energy Group. Prepared by WEST, Cheyenne, Wyoming. February 22, 2016.

Western EcoSystems Technology, Inc. (WEST). 2016d. Post-Construction Studies for the North Sky River Wind Energy Facility, Kern County, California. Prepared for North Sky River Energy LLC, Juno Beach, Florida. Prepared by WEST, Cheyenne, Wyoming.

Western EcoSystems Technology, Inc. (WEST). 2017a. Post-Construction Avian and Bat Fatality Monitoring at the Pacific Wind Energy Facility, Kern County, California. Final Report for the Fourth Year of Operation, October 2015 - October 2016. Prepared for Pacific Wind, LLC, San Diego, California. Prepared by WEST, Cheyenne, Wyoming. January 2017.

Western EcoSystems Technology, Inc. (WEST). 2017b. Post-Construction Avian and Bat Mortality Study at the Lower West Wind Energy Project, Kern County, California. Final Report for the Fifth Year of Operation: July 2016 – August 2017. Prepared for Brookfield Renewable Energy Partners, LP. Prepared by WEST, Corvallis, Oregon. December 15, 2017.

Western EcoSystems Technology, Inc. (WEST). 2017c. Post-Construction Studies for the North Sky River Wind Energy Facility, Kern County, California. Final Report for the Fourth Year of Operation: January 2016 – January 2017. Prepared for North Sky River Energy LLC, Juno Beach, Florida. Prepared by WEST, Corvallis, Oregon. May 16, 2017. 43 pp. + appendices.

Western EcoSystems Technology, Inc. (WEST). 2018. Post-Construction Avian and Bat Mortality Studies for the Mustang Hills and Alta VIII Wind Energy Facilities, Kern County, California. Final Report for the Fifth Year of Operation: September 2016 – September 2017. Prepared for EverPower Wind Holdings, Inc. and Brookfield Renewable Energy Partners, LP. Prepared by WEST, Corvallis, Oregon. January 12, 2018.

Whitfield, D. P. and M. Madders. 2005. Flight Height in the Hen Harrier *Circus Cyaneus* and Its Incorporation in Wind Turbine Collision Risk Modelling. October 2005. Natural Research Information Note 2, Natural Research Ltd., Banchory, United Kingdom.

Whitfield, D. P. and M. Madders. 2006. A Review of the Impacts of Wind Farms on Hen Harriers *Circus Cyaneus* and an Estimation of Collision Avoidance Rates. Natural Research Information Note 1 (revised), Natural Research Ltd., Banchory, United Kingdom.

Young, D. P., Jr., C. Nations, M. Lout, and K. Bay. 2013. 2012 Post-Construction Monitoring Study, Criterion Wind Project, Garrett County, Maryland. April - November 2012. Prepared for Criterion Power Partners, LLC, Oakland, Maryland. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming, and Waterbury, Vermont. January 15, 2013.

Young, D. P., Jr., G. D. Johnson, V. K. Poulton, and K. Bay. 2007a. Ecological Baseline Studies for the Hatchet Ridge Wind Energy Project, Shasta County, California. Prepared for Hatchet Ridge Wind, LLC, Portland, Oregon. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. August 31, 2007. Available online: https://tethys.pnnl.gov/sites/default/files/publications/Young-et-al-2007.pdf

Young, D. P., Jr., J. D. Jeffrey, K. Bay, and W. P. Erickson. 2009a. Puget Sound Energy Hopkins Ridge Wind Project, Phase 1, Columbia County, Washington. Post-Construction Avian and Bat Monitoring, Second Annual Report: January - December, 2008. Prepared for Puget Sound Energy, Dayton, Washington, and the Hopkins Ridge Wind Project Technical Advisory Committee, Columbia County, Washington. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming, and Walla Walla, Washington. May 20, 2009.

Young, D. P., Jr., J. Jeffrey, W. P. Erickson, K. Bay, V. K. Poulton, K. Kronner, R. Gritski, and J. Baker. 2006. Eurus Combine Hills Turbine Ranch. Phase 1 Post Construction Wildlife Monitoring First Annual Report: February 2004 - February 2005. Technical report prepared for Eurus Energy America Corporation, San Diego, California, and the Combine Hills Technical Advisory Committee, Umatilla County, Oregon. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming, and Walla Walla Washington, and Northwest Wildlife Consultants, Inc. (NWC), Pendleton, Oregon. February 21, 2006. Available online: http://wind.nrel.gov/public/library/young7.pdf

Young, D. P., Jr., K. Bay, S. Nomani, and W. Tidhar. 2009b. Nedpower Mount Storm Wind Energy Facility, Post-Construction Avian and Bat Monitoring: March - June 2009. Prepared for NedPower Mount Storm, LLC, Houston, Texas. Prepared by Western EcoSystems Technology (WEST), Inc., Cheyenne, Wyoming. August 17, 2009.

Young, D. P., Jr., K. Bay, S. Nomani, and W. Tidhar. 2010a. Nedpower Mount Storm Wind Energy Facility, Post-Construction Avian and Bat Monitoring: July - October 2009. Prepared for NedPower Mount Storm, LLC, Houston, Texas. Prepared by Western EcoSystems Technology (WEST), Inc., Cheyenne, Wyoming. February 12, 2010.

Young, D. P., Jr., K. Bay, S. Nomani, and W. Tidhar. 2010b. Nedpower Mount Storm Wind Energy Facility, Post-Construction Avian and Bat Monitoring: April - July 2010. Prepared for NedPower Mount Storm, LLC, Houston, Texas. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. August 27, 2010.

Young, D. P., Jr., M. Kauffman, M. Lout, and K. Bay. 2014b. 2013 Post-Construction Monitoring Study, Criterion Wind Project, Garrett County, Maryland. April - November 2013. Prepared for Criterion Power Partners, LLC, Oakland, Maryland. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming, and Waterbury, Vermont. February 18, 2014.

Young, D. P., Jr., M. Lout, L. McManus, and K. Bay. 2014a. 2013 Post-Construction Monitoring Study, Beech Ridge Wind Energy Project, Greenbrier and Nicholas Counties, West Virginia. Final Report: April 1 - November 15, 2013. Prepared for Beech Ridge Energy, LLC, Chicago, Illinois. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming, and Burlington, Vermont. January 28, 2014.

Young, D. P., Jr., M. Lout, Z. Courage, S. Nomani, and K. Bay. 2012b. 2011 Post-Construction Monitoring Study, Criterion Wind Project, Garrett County, Maryland: April - November 2011. Prepared for Criterion Power Partners, LLC, Oakland, Maryland. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming, and Waterbury, Vermont. April 20, 2012. Revised November 25, 2013.

Young, D. P., Jr., S. Nomani, W. Tidhar, and K. Bay. 2011a. Nedpower Mount Storm Wind Energy Facility, Post-Construction Avian and Bat Monitoring: July - October 2010. Prepared for NedPower Mount Storm, LLC, Houston, Texas. Prepared by Western EcoSystems Technology (WEST), Inc., Cheyenne, Wyoming. February 10, 2011.

Young, D. P., Jr., S. Nomani, Z. Courage, and K. Bay. 2011b. Nedpower Mount Storm Wind Energy Facility, Post-Construction Avian and Bat Monitoring: April - July 2011. Prepared for NedPower Mount Storm, LLC, Houston, Texas. Prepared by Western EcoSystems Technology (WEST), Inc., Cheyenne, Wyoming. August 29, 2011.

Young, D. P., Jr., S. Nomani, Z. Courage, and K. Bay. 2012a. Nedpower Mount Storm Wind Energy Facility, Post-Construction Avian and Bat Monitoring: July - October 2011. Prepared for NedPower Mount Storm, LLC, Houston, Texas. Prepared by Western EcoSystems Technology (WEST), Inc., Cheyenne, Wyoming. February 27, 2012.

Young, D. P., Jr., W. P. Erickson, J. Jeffrey, and V. K. Poulton. 2007b. Puget Sound Energy Hopkins Ridge Wind Project Phase 1 Post-Construction Avian and Bat Monitoring First Annual Report, January - December 2006. Technical report for Puget Sound Energy, Dayton, Washington and Hopkins Ridge Wind Project Technical Advisory Committee, Columbia County, Washington. Western EcoSystems Technology, Inc. (WEST) Cheyenne, Wyoming, and Walla Walla, Washington. 25 pp.

Young, D. P., Jr., W. P. Erickson, R. E. Good, M. D. Strickland, and G. D. Johnson. 2003. Avian and Bat Mortality Associated with the Initial Phase of the Foote Creek Rim Windpower Project, Carbon County, Wyoming, Final Report, November 1998 - June 2002. Prepared for Pacificorp, Inc. Portland, Oregon, SeaWest Windpower Inc. San Diego, California, and Bureau of Land Management, Rawlins District Office, Rawlins, Wyoming. January 10, 2003. Available online: http://west-inc.com/reports/fcr_final_mortality.pdf

Appendix A. All Bird Types and Species Observed at the Fountain Wind Project during Fixed-Point Bird Use Surveys from 19 April 2017 – 22 May 2018

Appendix A1. Summary of number of groups (grps) and observations (obs) by bird type and species for 60-minute large bird surveys at the Fountain Wind Project[a] from 19 April 2017 – 22 May 2018.

		Spring		Summer		Fall		Winter		Total	
Type/Species	**Scientific Name**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**
Waterbirds		**1**	**20**	**0**	**0**	**2**	**33**	**7**	**91**	**10**	**144**
American white pelican	*Pelecanus erythrorhynchos*	1	20	0	0	0	0	1	8	2	28
sandhill crane	*Antigone canadensis*	0	0	0	0	2	33	6	83	8	116
Waterfowl		**4**	**161**	**1**	**200**	**7**	**764**	**13**	**938**	**25**	**2,063**
cackling goose	*Branta hutchinsii*	0	0	0	0	1	20	0	0	1	20
Canada goose	*Branta canadensis*	0	0	0	0	2	60	1	3	3	63
greater white-fronted goose	*Anser albifrons*	3	160	0	0	1	102	0	0	4	262
snow goose	*Chen caerulescens*	1	1	0	0	3	582	7	702	11	1,285
tundra swan	*Cygnus columbianus*	0	0	0	0	0	0	3	123	3	123
unidentified goose		0	0	1	200	0	0	2	110	3	310
Diurnal Raptors		**47**	**51**	**46**	**49**	**65**	**65**	**49**	**51**	**207**	**216**
Accipiters		*8*	*8*	*4*	*4*	*19*	*19*	*1*	*1*	*32*	*32*
Cooper's hawk	*Accipiter cooperii*	4	4	2	2	2	2	1	1	9	9
northern goshawk	*Accipiter gentilis*	3	3	0	0	0	0	0	0	3	3
sharp-shinned hawk	*Accipiter striatus*	1	1	2	2	15	15	0	0	18	18
unidentified accipiter	*Accipiter* spp.	0	0	0	0	2	2	0	0	2	2
Buteos		*30*	*34*	*37*	*40*	*38*	*38*	*37*	*39*	*142*	*151*
red-shouldered hawk	*Buteo lineatus*	0	0	1	1	2	2	0	0	3	3
red-tailed hawk	*Buteo jamaicensis*	30	34	36	39	36	36	37	39	139	148
Northern Harrier		*1*	*1*	*0*	*0*	*2*	*2*	*1*	*1*	*4*	*4*
northern harrier	*Circus cyaneus*	1	1	0	0	2	2	1	1	4	4
Eagles		*4*	*4*	*1*	*1*	*4*	*4*	*9*	*9*	*18*	*18*
bald eagle	*Haliaeetus leucocephalus*	2	2	1	1	4	4	9	9	16	16
golden eagle	*Aquila chrysaetos*	2	2	0	0	0	0	0	0	2	2
Falcons		*2*	*2*	*2*	*2*	*2*	*2*	*0*	*0*	*6*	*6*
American kestrel	*Falco sparverius*	0	0	0	0	1	1	0	0	1	1
merlin	*Falco columbarius*	1	1	0	0	1	1	0	0	2	2
prairie falcon	*Falco mexicanus*	1	1	1	1	0	0	0	0	2	2
unidentified falcon	*Falco* spp.	0	0	1	1	0	0	0	0	1	1
Other Raptors		*2*	*2*	*2*	*2*	*0*	*0*	*1*	*1*	*5*	*5*
unidentified raptor		2	2	2	2	0	0	1	1	5	5
Owls		**2**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**2**
great horned owl	*Bubo virginianus*	1	1	0	0	0	0	0	0	1	1
northern pygmy-owl	*Glaucidium gnoma*	1	1	0	0	0	0	0	0	1	1
Vultures		**121**	**151**	**275**	**364**	**45**	**48**	**12**	**15**	**453**	**578**
turkey vulture	*Cathartes aura*	121	151	275	364	45	48	12	15	453	578

Appendix A1. Summary of number of groups (grps) and observations (obs) by bird type and species for 60-minute large bird surveys at the Fountain Wind Project[a] from 19 April 2017 – 22 May 2018.

		Spring		Summer		Fall		Winter		Total	
Type/Species	**Scientific Name**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**
Upland Game Birds		**4**	**5**	**3**	**3**	**1**	**1**	**0**	**0**	**8**	**9**
mountain quail	*Oreortyx pictus*	4	5	3	3	1	1	0	0	8	9
Doves/Pigeons		**2**	**5**	**7**	**21**	**1**	**1**	**0**	**0**	**10**	**27**
band-tailed pigeon	*Patagioenas fasciata*	2	5	7	21	1	1	0	0	10	27
Large Corvids		**43**	**77**	**33**	**39**	**44**	**68**	**29**	**44**	**149**	**228**
American crow	*Corvus brachyrhynchos*	0	0	1	1	0	0	0	0	1	1
common raven	*Corvus corax*	43	77	32	38	44	68	29	44	148	227
Overall		**224**	**472**	**365**	**676**	**165**	**980**	**110**	**1,139**	**864**	**3,267**

[a] Regardless of distance from observer.

Appendix A2. Summary of number of groups (grps) and observations (obs) by bird type and species for 10-minute small bird surveys at the Fountain Wind Project[a] from 19 April 2017 – 22 May 2018.

Type/Species	Scientific Name	Spring # grps	Spring # obs	Summer # grps	Summer # obs	Fall # grps	Fall # obs	Winter # grps	Winter # obs	Total # grps	Total # obs
Passerines		**243**	**377**	**600**	**780**	**310**	**696**	**136**	**324**	**1,289**	**2,177**
American robin	*Turdus migratorius*	5	5	9	12	11	25	3	3	28	45
ash-throated flycatcher	*Myiarchus cinerascens*	0	0	3	3	0	0	0	0	3	3
Bewick's wren	*Thryomanes bewickii*	1	1	3	3	1	3	1	1	6	8
black-capped chickadee	*Poecile atricapillus*	0	0	13	21	0	0	0	0	13	21
black-headed grosbeak	*Pheucticus melanocephalus*	1	2	6	6	0	0	0	0	7	8
black-throated gray warbler	*Setophaga nigrescens*	1	1	6	9	0	0	0	0	7	10
black phoebe	*Sayornis nigricans*	0	0	0	0	0	0	1	1	1	1
blue-gray gnatcatcher	*Polioptila caerulea*	3	5	2	2	0	0	0	0	5	7
Brewer's blackbird	*Euphagus cyanocephalus*	0	0	0	0	2	2	0	0	2	2
brown-headed cowbird	*Molothrus ater*	0	0	0	0	1	2	0	0	1	2
brown creeper	*Certhia americana*	0	0	0	0	1	2	0	0	1	2
bushtit	*Psaltriparus minimus*	3	3	4	23	1	9	3	55	11	90
California scrub-jay	*Aphelocoma californica*	7	63	5	5	2	2	2	2	16	72
Cassin's finch	*Haemorhous cassinii*	1	1	1	1	0	0	0	0	2	2
Cassin's vireo	*Vireo cassinii*	1	1	2	2	0	0	0	0	3	3
cliff swallow	*Petrochelidon pyrrhonota*	1	3	1	3	0	0	0	0	2	6
dark-eyed junco	*Junco hyemalis*	34	54	107	140	47	84	6	25	194	303
dusky flycatcher	*Empidonax oberholseri*	0	0	4	4	0	0	0	0	4	4
evening grosbeak	*Coccothraustes vespertinus*	0	0	2	4	2	11	0	0	4	15
fox sparrow	*Passerella iliaca*	8	9	27	27	5	6	1	1	41	43
golden-crowned kinglet	*Regulus satrapa*	2	3	1	1	20	43	19	20	42	67
golden-crowned sparrow	*Zonotrichia atricapilla*	0	0	0	0	3	4	0	0	3	4
gray jay	*Perisoreus canadensis*	0	0	0	0	2	2	0	0	2	2
green-tailed towhee	*Pipilo chlorurus*	0	0	1	1	0	0	0	0	1	1
hermit thrush	*Catharus guttatus*	0	0	2	2	2	2	0	0	4	4
hermit warbler	*Setophaga occidentalis*	0	0	2	2	0	0	0	0	2	2
house finch	*Haemorhous mexicanus*	0	0	3	3	1	1	0	0	4	4
house wren	*Troglodytes aedon*	0	0	2	2	0	0	0	0	2	2
Hutton's vireo	*Vireo huttoni*	0	0	6	6	1	2	2	2	9	10
lesser goldfinch	*Spinus psaltria*	0	0	6	12	9	12	0	0	15	24
Lincoln's sparrow	*Melospiza lincolnii*	0	0	0	0	1	1	0	0	1	1
MacGillivray's warbler	*Geothlypis tolmiei*	0	0	1	1	0	0	0	0	1	1
mountain bluebird	*Sialia currucoides*	1	1	3	3	3	14	0	0	7	18
mountain chickadee	*Poecile gambeli*	31	40	42	60	26	88	24	57	123	245
Nashville warbler	*Oreothlypis ruficapilla*	6	6	17	18	0	0	0	0	23	24

Appendix A2. Summary of number of groups (grps) and observations (obs) by bird type and species for 10-minute small bird surveys at the Fountain Wind Project[a] from 19 April 2017 – 22 May 2018.

		Spring		Summer		Fall		Winter		Total	
Type/Species	**Scientific Name**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**
northern rough-winged swallow	*Stelgidopteryx serripennis*	0	0	8	45	0	0	0	0	8	45
oak titmouse	*Baeolophus inornatus*	0	0	0	0	0	0	1	1	1	1
olive-sided flycatcher	*Contopus cooperi*	0	0	5	5	0	0	0	0	5	5
Pacific-slope flycatcher	*Empidonax difficilis*	0	0	1	1	0	0	0	0	1	1
pine siskin	*Spinus pinus*	0	0	0	0	3	22	0	0	3	22
purple finch	*Haemorhous purpureus*	1	1	5	7	6	46	1	4	13	58
red-breasted nuthatch	*Sitta canadensis*	33	44	16	22	45	62	52	59	146	187
ruby-crowned kinglet	*Regulus calendula*	0	0	0	0	10	16	4	4	14	20
song sparrow	*Melospiza melodia*	0	0	4	4	0	0	2	2	6	6
spotted towhee	*Pipilo maculatus*	13	13	51	53	10	12	1	1	75	79
Steller's jay	*Cyanocitta stelleri*	23	29	44	53	45	49	1	1	113	132
Townsend's solitaire	*Myadestes townsendi*	4	4	3	3	0	0	0	0	7	7
Townsend's warbler	*Setophaga townsendi*	0	0	3	4	0	0	0	0	3	4
tree swallow	*Tachycineta bicolor*	0	0	2	7	0	0	0	0	2	7
unidentified empidonax	*Empidonax* spp.	0	0	2	2	0	0	0	0	2	2
unidentified flycatcher		0	0	4	5	0	0	0	0	4	5
unidentified passerine		4	5	34	37	18	32	0	0	56	74
unidentified sparrow		1	1	0	0	0	0	0	0	1	1
unidentified swallow		2	11	2	3	0	0	0	0	4	14
unidentified warbler		2	3	1	1	1	1	0	0	4	5
unidentified wren		0	0	1	2	0	0	0	0	1	2
varied thrush	*Ixoreus naevius*	1	2	0	0	1	1	0	0	2	3
violet-green swallow	*Tachycineta thalassina*	0	0	1	1	0	0	0	0	1	1
western bluebird	*Sialia mexicana*	13	19	5	6	12	106	6	78	36	209
western kingbird	*Tyrannus verticalis*	1	1	0	0	0	0	0	0	1	1
western tanager	*Piranga ludoviciana*	0	0	30	34	0	0	0	0	30	34
western wood-pewee	*Contopus sordidulus*	0	0	13	15	0	0	0	0	13	15
white-breasted nuthatch	*Sitta carolinensis*	0	0	4	4	0	0	0	0	4	4
white-crowned sparrow	*Zonotrichia leucophrys*	0	0	1	1	0	0	0	0	1	1
Wilson's warbler	*Cardellina pusilla*	0	0	1	1	0	0	0	0	1	1
wrentit	*Chamaea fasciata*	8	8	6	7	5	8	6	7	25	30
yellow-rumped warbler	*Setophaga coronata*	31	38	43	47	12	25	0	0	86	110
yellow warbler	*Setophaga petechia*	0	0	29	34	1	1	0	0	30	35
Swifts/Hummingbirds		**6**	**40**	**4**	**7**	**4**	**4**	**7**	**8**	**21**	**59**
Anna's hummingbird	*Calypte anna*	3	3	1	1	2	2	7	8	13	14
rufous hummingbird	*Selasphorus rufus*	2	2	0	0	0	0	0	0	2	2

Appendix A2. Summary of number of groups (grps) and observations (obs) by bird type and species for 10-minute small bird surveys at the Fountain Wind Project[a] from 19 April 2017 – 22 May 2018.

		Spring		Summer		Fall		Winter		Total	
Type/Species	**Scientific Name**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**
unidentified hummingbird		0	0	2	2	2	2	0	0	4	4
Vaux's swift	*Chaetura vauxi*	1	35	0	0	0	0	0	0	1	35
white-throated swift	*Aeronautes saxatalis*	0	0	1	4	0	0	0	0	1	4
Woodpeckers		**37**	**38**	**53**	**54**	**56**	**57**	**17**	**21**	**163**	**170**
downy woodpecker	*Picoides pubescens*	0	0	3	3	3	3	3	3	9	9
hairy woodpecker	*Picoides villosus*	7	8	9	10	12	12	2	2	30	32
northern flicker	*Colaptes auratus*	20	20	32	32	30	31	5	8	87	91
pileated woodpecker	*Dryocopus pileatus*	1	1	0	0	3	3	1	1	5	5
red-breasted sapsucker	*Sphyrapicus ruber*	0	0	1	1	0	0	0	0	1	1
unidentified woodpecker		3	3	5	5	2	2	0	0	10	10
white-headed woodpecker	*Picoides albolarvatus*	6	6	3	3	6	6	6	7	21	22
Unidentified Birds		**2**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**2**
Unidentified small bird		2	2	0	0	0	0	0	0	2	2
Overall		**288**	**457**	**657**	**841**	**370**	**757**	**160**	**353**	**1,475**	**2,408**

[a] Regardless of distance from observer.

Appendix B. Mean Use, Percent of Use, and Frequency of Occurrence for Large Birds and Small Birds Observed during Fixed-Point Bird Use Surveys at the Fountain Wind Project from 19 April 2017 – 22 May 2018

Appendix B1. Mean large bird use (number of large birds/800-meter plot/60-minute survey), percent of total use (%), and frequency of occurrence (%) for each large bird type and species by season during large bird surveys at the Fountain Wind Project from 19 April 2017 – 22 May 2018.

	Mean Use				% of Use				% Frequency			
Type/Species	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**
Waterbirds	**0.17**	**0**	**0.28**	**0.78**	**4.1**	**0**	**3.4**	**8**	**0.9**	**0**	**0.9**	**4.3**
American white pelican	0.17	0	0	0.07	4.1	0	0	0.7	0.9	0	0	0.9
sandhill crane	0	0	0.28	0.71	0	0	3.4	7.3	0	0	0.9	4.3
Waterfowl	**1.38**	**1.03**	**6.53**	**8.02**	**33.0**	**30.2**	**78.0**	**82.4**	**2.6**	**0.5**	**5.1**	**8.5**
cackling goose	0	0	0.17	0	0	0	2.0	0	0	0	0.9	0
Canada goose	0	0	0.51	0.03	0	0	6.1	0.3	0	0	1.7	0.9
greater white-fronted goose	1.37	0	0.87	0	32.8	0	10.4	0	1.7	0	0.9	0
snow goose	<0.01	0	4.97	6.00	0.2	0	59.4	61.6	0.9	0	1.7	5.1
tundra swan	0	0	0	1.05	0	0	0	10.8	0	0	0	1.7
unidentified goose	0	1.03	0	0.94	0	30.2	0	9.7	0	0.5	0	1.7
Diurnal Raptors	**0.46**	**0.23**	**0.56**	**0.44**	**11.0**	**6.8**	**6.6**	**4.5**	**31.2**	**17.4**	**32.5**	**17.9**
Accipiters	*0.07*	*0.02*	*0.16*	*<0.01*	*1.6*	*0.6*	*1.9*	*<0.1*	*6.0*	*2.1*	*12.0*	*0.9*
Cooper's hawk	0.03	0.01	0.02	<0.01	0.8	0.3	0.2	<0.1	3.4	1.0	0.9	0.9
northern goshawk	0.03	0	0	0	0.6	0	0	0	1.7	0	0	0
sharp-shinned hawk	<0.01	0.01	0.13	0	0.2	0.3	1.5	0	0.9	1.0	11.1	0
unidentified accipiter	0	0	0.02	0	0	0	0.2	0	0	0	1.7	0
Buteos	*0.31*	*0.18*	*0.32*	*0.33*	*7.4*	*5.4*	*3.9*	*3.4*	*22.1*	*15.4*	*20.5*	*12.0*
red-shouldered hawk	0	<0.01	0.02	0	0	0.2	0.2	0	0	0.5	1.7	0
red-tailed hawk	0.31	0.18	0.31	0.33	7.4	5.3	3.7	3.4	22.1	14.9	20.5	12.0
Northern Harrier	*<0.01*	*0*	*0.02*	*<0.01*	*0.2*	*0*	*0.2*	*<0.1*	*0.9*	*0*	*1.7*	*0.9*
northern harrier	<0.01	0	0.02	<0.01	0.2	0	0.2	<0.1	0.9	0	1.7	0.9
Eagles	*0.03*	*<0.01*	*0.03*	*0.08*	*0.8*	*0.2*	*0.4*	*0.8*	*2.6*	*0.5*	*3.4*	*6.8*
bald eagle	0.02	<0.01	0.03	0.08	0.4	0.2	0.4	0.8	1.7	0.5	3.4	6.8
golden eagle	0.02	0	0	0	0.4	0	0	0	0.9	0	0	0
Falcons	*0.02*	*0.01*	*0.02*	*0*	*0.5*	*0.3*	*0.2*	*0*	*2.2*	*1.0*	*1.7*	*0*
American kestrel	0	0	<0.01	0	0	0	0.1	0	0	0	0.9	0
merlin	<0.01	0	<0.01	0	0.2	0	0.1	0	0.9	0	0.9	0
prairie falcon	0.01	<0.01	0	0	0.3	0.2	0	0	1.4	0.5	0	0
unidentified falcon	0	<0.01	0	0	0	0.2	0	0	0	0.5	0	0
Other Raptors	*0.02*	*0.01*	*0*	*<0.01*	*0.4*	*0.3*	*0*	*<0.1*	*1.7*	*1*	*0*	*0.9*
unidentified raptor	0.02	0.01	0	<0.01	0.4	0.3	0	<0.1	1.7	1.0	0	0.9
Owls	**0.02**	**0**	**0**	**0**	**0.4**	**0**	**0**	**0**	**1.7**	**0**	**0**	**0**
great horned owl	<0.01	0	0	0	0.2	0	0	0	0.9	0	0	0
northern pygmy-owl	<0.01	0	0	0	0.2	0	0	0	0.9	0	0	0
Vultures	**1.39**	**1.82**	**0.41**	**0.13**	**33.4**	**53.5**	**4.9**	**1.3**	**45.6**	**54.4**	**22.2**	**6.8**

Appendix B1. Mean large bird use (number of large birds/800-meter plot/60-minute survey), percent of total use (%), and frequency of occurrence (%) for each large bird type and species by season during large bird surveys at the Fountain Wind Project from 19 April 2017 – 22 May 2018.

	Mean Use				% of Use				% Frequency			
Type/Species	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**
turkey vulture	1.39	1.82	0.41	0.13	33.4	53.5	4.9	1.3	45.6	54.4	22.2	6.8
Upland Game Birds	**0.04**	**0.02**	**<0.01**	**0**	**1.0**	**0.5**	**0.1**	**0**	**3.4**	**1.5**	**0.9**	**0**
mountain quail	0.04	0.02	<0.01	0	1.0	0.5	0.1	0	3.4	1.5	0.9	0
Doves/Pigeons	**0.04**	**0.11**	**<0.01**	**0**	**1.0**	**3.2**	**0.1**	**0**	**1.7**	**2.1**	**0.9**	**0**
band-tailed pigeon	0.04	0.11	<0.01	0	1.0	3.2	0.1	0	1.7	2.1	0.9	0
Large Corvids	**0.67**	**0.20**	**0.58**	**0.38**	**16.0**	**5.9**	**6.9**	**3.9**	**27.6**	**12.8**	**23.1**	**16.2**
American crow	0	<0.01	0	0	0	0.2	0	0	0	0.5	0	0
common raven	0.67	0.19	0.58	0.38	16.0	5.7	6.9	3.9	27.6	12.3	23.1	16.2
Overall	**4.17**	**3.39**	**8.38**	**9.74**	**100**	**100**	**100**	**100**				

Appendix B2. Mean small bird use (number of small birds/100-meter plot/10-minute survey), percent of total use (%), and frequency of occurrence (%) for each small bird type and species by season during small bird surveys at the Fountain Wind Project from 19 April 2017 – 22 May 2018.

	Mean Use				% of Use				% Frequency			
Type/Species	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**
Passerines	**2.92**	**3.93**	**5.21**	**2.59**	**82.0**	**93.1**	**92.8**	**92.9**	**81.7**	**89.7**	**80.3**	**59.0**
American robin	0.03	0.06	0.09	0.02	0.7	1.5	1.7	0.6	2.6	4.1	4.3	1.7
ash-throated flycatcher	0	0.02	0	0	0	0.4	0	0	0	1.5	0	0
Bewick's wren	<0.01	0.02	0.03	<0.01	0.2	0.4	0.5	0.3	0.9	1.0	0.9	0.9
black-capped chickadee	0	0.11	0	0	0	2.5	0	0	0	6.2	0	0
black-headed grosbeak	0.03	0.03	0	0	0.8	0.7	0	0	1.4	2.6	0	0
black-throated gray warbler	<0.01	0.05	0	0	0.2	1.1	0	0	0.9	3.1	0	0
blue-gray gnatcatcher	0.07	0.01	0	0	1.9	0.2	0	0	2.8	1.0	0	0
Brewer's blackbird	0	0	0.02	0	0	0	0.3	0	0	0	0.9	0
brown-headed cowbird	0	0	0.02	0	0	0	0.3	0	0	0	0.9	0
brown creeper	0	0	0.02	0	0	0	0.3	0	0	0	0.9	0
bushtit	0.04	0.12	0.08	0.47	1.2	2.8	1.4	16.9	2.8	2.1	0.9	2.6
California scrub-jay	0.29	0.02	0.02	<0.01	8.2	0.5	0.3	0.3	3.4	2.1	1.7	0.9
Cassin's finch	<0.01	<0.01	0	0	0.2	0.1	0	0	0.9	0.5	0	0
Cassin's vireo	0	0.01	0	0	0	0.2	0	0	0	1.0	0	0
cliff swallow	0.03	0.02	0	0	0.7	0.4	0	0	0.9	0.5	0	0
dark-eyed junco	0.47	0.72	0.70	0.21	13.3	17.0	12.5	7.7	24.1	41.0	28.2	4.3
dusky flycatcher	0	0.02	0	0	0	0.5	0	0	0	2.1	0	0
evening grosbeak	0	0.02	0.09	0	0	0.5	1.7	0	0	0.5	1.7	0
fox sparrow	0.09	0.14	0.03	<0.01	2.6	3.3	0.6	0.3	7.1	10.3	3.4	0.9
golden-crowned kinglet	0.03	<0.01	0.37	0.17	0.7	0.1	6.6	6.1	1.7	0.5	17.1	16.2
golden-crowned sparrow	0	0	0.03	0	0	0	0.6	0	0	0	2.6	0
gray jay	0	0	0.02	0	0	0	0.3	0	0	0	1.7	0
green-tailed towhee	0	<0.01	0	0	0	0.1	0	0	0	0.5	0	0
hermit thrush	0	0.01	0.02	0	0	0.2	0.3	0	0	1.0	1.7	0
hermit warbler	0	0.01	0	0	0	0.2	0	0	0	1.0	0	0
house finch	0	0.02	<0.01	0	0	0.4	0.2	0	0	1.5	0.9	0
house wren	0	0.01	0	0	0	0.2	0	0	0	0.5	0	0
Hutton's vireo	0	0.03	0.02	0.02	0	0.7	0.3	0.6	0	2.6	0.9	1.7
lesser goldfinch	0	0.06	0.10	0	0	1.5	1.8	0	0	2.1	2.6	0
Lincoln's sparrow	0	0	<0.01	0	0	0	0.2	0	0	0	0.9	0
MacGillivray's warbler	0	<0.01	0	0	0	0.1	0	0	0	0.5	0	0
mountain bluebird	0	0.02	0.11	0	0	0.4	2.0	0	0	1.0	0.9	0
mountain chickadee	0.37	0.30	0.61	0.48	10.3	7.0	10.8	17.2	25.2	19.5	15.4	17.9

Appendix B2. Mean small bird use (number of small birds/100-meter plot/10-minute survey), percent of total use (%), and frequency of occurrence (%) for each small bird type and species by season during small bird surveys at the Fountain Wind Project from 19 April 2017 – 22 May 2018.

	Mean Use				% of Use				% Frequency			
Type/Species	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**
Nashville warbler	0.07	0.09	0	0	1.9	2.2	0	0	5.9	7.2	0	0
northern rough-winged swallow	0	0.23	0	0	0	5.5	0	0	0	3.1	0	0
oak titmouse	0	0	0	<0.01	0	0	0	0.3	0	0	0	0.9
olive-sided flycatcher	0	0.03	0	0	0	0.6	0	0	0	2.6	0	0
Pacific-slope flycatcher	0	<0.01	0	0	0	0.1	0	0	0	0.5	0	0
pine siskin	0	0	0.19	0	0	0	3.4	0	0	0	2.6	0
purple finch	<0.01	0.04	0.37	0.03	0.2	0.8	6.6	1.2	0.9	2.1	4.3	0.9
red-breasted nuthatch	0.33	0.10	0.42	0.36	9.4	2.3	7.5	12.9	22.2	7.7	23.1	26.5
ruby-crowned kinglet	0	0	0.14	0.03	0	0	2.4	1.2	0	0	8.5	3.4
song sparrow	0	0.02	0	0.02	0	0.5	0	0.6	0	2.1	0	0.9
spotted towhee	0.11	0.27	0.10	<0.01	3.1	6.4	1.8	0.3	11.1	21.5	8.5	0.9
Steller's jay	0.23	0.26	0.25	<0.01	6.4	6.2	4.4	0.3	16.8	19.5	20.5	0.9
Townsend's solitaire	<0.01	0.01	0	0	0.2	0.2	0	0	0.9	1.0	0	0
Townsend's warbler	0	0.02	0	0	0	0.5	0	0	0	1.5	0	0
tree swallow	0	0.04	0	0	0	0.8	0	0	0	1.0	0	0
unidentified empidonax	0	0.01	0	0	0	0.2	0	0	0	1.0	0	0
unidentified flycatcher	0	0.03	0	0	0	0.6	0	0	0	2.1	0	0
unidentified passerine	0.06	0.19	0.27	0	1.6	4.5	4.9	0	5	15.4	12.8	0
unidentified sparrow	0.01	0	0	0	0.4	0	0	0	1.4	0	0	0
unidentified swallow	0.01	<0.01	0	0	0.4	0.1	0	0	1.4	0.5	0	0
unidentified warbler	0.04	<0.01	<0.01	0	1.2	0.1	0.2	0	2.8	0.5	0.9	0
unidentified wren	0	0.01	0	0	0	0.2	0	0	0	0.5	0	0
varied thrush	0.02	0	<0.01	0	0.5	0	0.2	0	0.9	0	0.9	0
violet-green swallow	0	<0.01	0	0	0	0.1	0	0	0	0.5	0	0
western bluebird	0.17	0.03	0.78	0.67	4.7	0.6	13.9	23.9	11.6	2.1	6.8	5.1
western kingbird	<0.01	0	0	0	0.2	0	0	0	0.9	0	0	0
western tanager	0	0.17	0	0	0	4.1	0	0	0	14.4	0	0
western wood-pewee	0	0.08	0	0	0	1.8	0	0	0	5.6	0	0
white-breasted nuthatch	0	0.02	0	0	0	0.5	0	0	0	2.1	0	0
white-crowned sparrow	0	<0.01	0	0	0	0.1	0	0	0	0.5	0	0
Wilson's warbler	0	<0.01	0	0	0	0.1	0	0	0	0.5	0	0
wrentit	0.06	0.04	0.07	0.06	1.7	0.8	1.2	2.1	5.1	2.6	4.3	5.1
yellow-rumped warbler	0.32	0.24	0.21	0	8.9	5.6	3.8	0	24.1	19.5	7.7	0
yellow warbler	0	0.17	<0.01	0	0	4.1	0.2	0	0	9.2	0.9	0

Appendix B2. Mean small bird use (number of small birds/100-meter plot/10-minute survey), percent of total use (%), and frequency of occurrence (%) for each small bird type and species by season during small bird surveys at the Fountain Wind Project from 19 April 2017 – 22 May 2018.

	Mean Use				% of Use				% Frequency			
Type/Species	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**
Swifts/Hummingbirds	**0.34**	**0.02**	**0.03**	**0.07**	**9.6**	**0.4**	**0.6**	**2.5**	**4.3**	**1.5**	**2.6**	**5.1**
Anna's hummingbird	0.03	<0.01	0.02	0.07	0.7	0.1	0.3	2.5	2.6	0.5	1.7	5.1
rufous hummingbird	0.02	0	0	0	0.5	0	0	0	1.7	0	0	0
unidentified hummingbird	0	0.01	0.02	0	0	0.2	0.3	0	0	1.0	0.9	0
Vaux's swift	0.30	0	0	0	8.4	0	0	0	0.9	0	0	0
Woodpeckers	**0.27**	**0.28**	**0.37**	**0.13**	**7.6**	**6.6**	**6.6**	**4.6**	**20.6**	**22.1**	**26.5**	**9.4**
downy woodpecker	0	0.02	0.03	0.03	0	0.4	0.5	0.9	0	1.5	2.6	2.6
hairy woodpecker	0.07	0.05	0.08	0.02	1.9	1.2	1.4	0.6	6.0	4.6	6.0	1.7
northern flicker	0.13	0.16	0.19	0.03	3.7	3.9	3.4	1.2	13.2	15.4	16.2	2.6
pileated woodpecker	0	0	<0.01	0	0	0	0.2	0	0	0	0.9	0
red-breasted sapsucker	0	<0.01	0	0	0	0.1	0	0	0	0.5	0	0
unidentified woodpecker	0.02	0.03	0.02	0	0.6	0.6	0.3	0	2.2	2.6	1.7	0
white-headed woodpecker	0.05	0.02	0.05	0.05	1.3	0.4	0.9	1.8	4.0	1.5	4.3	3.4
Unidentified Birds	**0.03**	**0**	**0**	**0**	**0.8**	**0**	**0**	**0**	**2.8**	**0**	**0**	**0**
Unidentified small bird	0.03	0	0	0	0.8	0	0	0	2.8	0	0	0
Overall	**3.56**	**4.23**	**5.61**	**2.79**	**100**	**100**	**100**	**100**				

Appendix C. Mean Use by Point for All Birds, Major Bird Types, and Diurnal Raptor Subtypes during Fixed-Point Surveys at the Fountain Wind Project from 19 April 2017 – 22 May 2018

Appendix C1. Mean use (number of birds/800-meter plot/60-minute survey) by point for all large birds, major bird types, and diurnal raptor subtypes observed at the Fountain Wind Project during large bird surveys from 19 April 2017 – 22 May 2018.

Obs. Pt.	Waterbirds	Waterfowl	Diurnal Raptors	Accipiters	Buteos	Northern Harrier	Eagles	Falcons	Other Raptors	Owls	Vultures	Upland Game Birds	Doves/ Pigeons	Large Corvids	All Large Birds
1	0	0	0.36	0.14	0.14	0	0.07	0	0	0.07	0.36	0	0	0.29	**1.07**
2	0	2.14	0.36	0.14	0.21	0	0	0	0	0	0.79	0	0	0.93	**4.21**
3	0.14	42.64	0.14	0	0.07	0.07	0	0	0	0	0.43	0	0	0.79	**44.14**
4	0	0	0.43	0.07	0.29	0	0.07	0	0	0	0.57	0	0	0.64	**1.64**
5	0	0.21	1	0.21	0.64	0.07	0	0.07	0	0	2.29	0	0	0.07	**3.57**
6	0	0	0.43	0.21	0.21	0	0	0	0	0	0.71	0	0	0.29	**1.43**
7	0	0	0.93	0	0.79	0	0.14	0	0	0	0.36	0	0	0.57	**1.86**
8	0	1.43	0.07	0	0	0	0.07	0	0	0	0.21	0.07	0	0.07	**1.86**
9	0	0	0.29	0.07	0.21	0	0	0	0	0	0.5	0.07	0.14	0.57	**1.57**
10	0	0	0.07	0	0	0	0	0	0.07	0	0.36	0	0	0	**0.43**
11	0	7.21	0.14	0	0	0	0	0.07	0.07	0	0.64	0	0.93	0.14	**9.07**
12	0	0	0.14	0	0.07	0	0.07	0	0	0	0.93	0	0	0.29	**1.36**
13	0	0	0.07	0	0.07	0	0	0	0	0	0.86	0.07	0	0	**1**
14	0	0	0.64	0.14	0.5	0	0	0	0	0.07	1.07	0	0.07	0.07	**1.93**
15	0	0	0.43	0	0.36	0	0	0.07	0	0	1.64	0	0	0.36	**2.43**
16	0	13.57	0.29	0	0.29	0	0	0	0	0	0.64	0.07	0	0	**14.57**
17	0	13.85	0.77	0.15	0.54	0	0	0	0.08	0	2.85	0	0.23	0	**17.69**
18	0	35.31	0.46	0	0.23	0	0.23	0	0	0	1.77	0	0	0.08	**37.62**
19	0	0	0.31	0.08	0.15	0	0.08	0	0	0	0.85	0	0	0.15	**1.31**
20	0	0.08	0.08	0	0	0	0.08	0	0	0	0.62	0	0	0.08	**0.85**
21	0	2	0.14	0	0.14	0	0	0	0	0	1.07	0.07	0.43	0.43	**4.14**
22	0	0	0.21	0.07	0.14	0	0	0	0	0	0.64	0	0	0.21	**1.07**
23	0	0.71	0.07	0	0.07	0	0	0	0	0	0.21	0	0	0	**1**
24	0	0	0.36	0.14	0.14	0	0.07	0	0	0	1.5	0	0	1.86	**3.71**
25	1.14	7.29	0.21	0	0.21	0	0	0	0	0	0.93	0	0	0.64	**10.21**
26	2.36	0	0.86	0.07	0.71	0	0.07	0	0	0	1.93	0	0	0.86	**6**
27	0	8.36	0.36	0.07	0.14	0	0.07	0.07	0	0	0.5	0	0	0.14	**9.36**
28	0	0	0.46	0.15	0.31	0	0	0	0	0	0.85	0.15	0	0.62	**2.08**
29	4.21	0	0.71	0	0.57	0.07	0	0	0.07	0	2.07	0	0.14	0.64	**7.79**
30	0	3.08	1.92	0.15	1.62	0	0	0.15	0	0	3.77	0.08	0	1.31	**10.15**
31	0.38	0	0.31	0	0.31	0	0	0	0	0	1	0	0	0	**1.69**
32	0	0	0.31	0	0.23	0	0	0	0.08	0	1.08	0	0	0.69	**2.08**
33	0	8.85	0.23	0.08	0.15	0	0	0	0	0	1.38	0	0	0.46	**10.92**
34	0	0	0.46	0.15	0.31	0	0	0	0	0	0.85	0	0	0.23	**1.54**
35	0	5.38	0.62	0.08	0.31	0	0.23	0	0	0	1.31	0.08	0	0.15	**7.54**
36	0	0	0.23	0	0.15	0.08	0	0	0	0	1.46	0	0	1	**2.69**

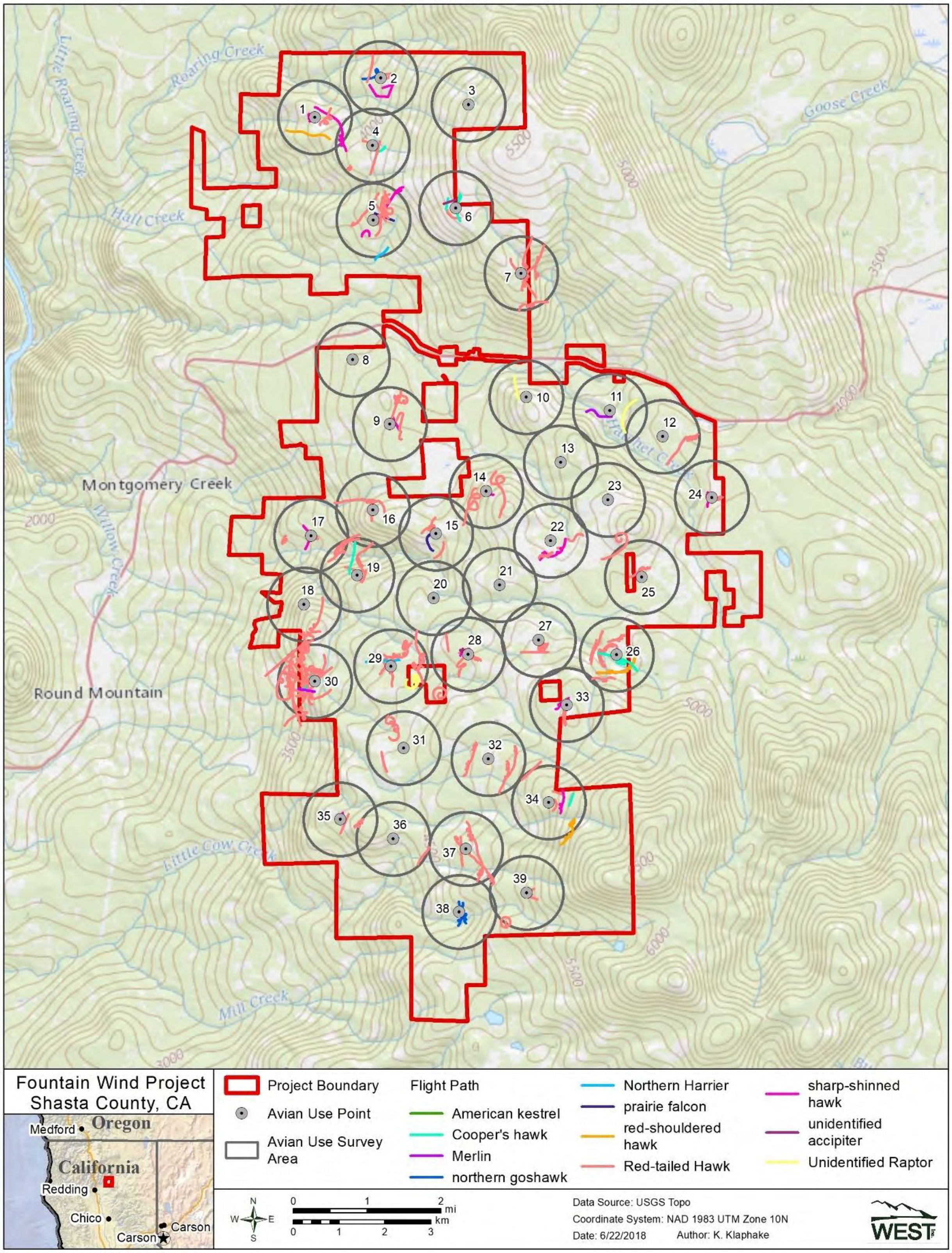
Appendix C1. Mean use (number of birds/800-meter plot/60-minute survey) by point for all large birds, major bird types, and diurnal raptor subtypes observed at the Fountain Wind Project during large bird surveys from 19 April 2017 – 22 May 2018.

Obs. Pt.	Waterbirds	Waterfowl	Diurnal Raptors	Accipiters	Buteos	Northern Harrier	Eagles	Falcons	Other Raptors	Owls	Vultures	Upland Game Birds	Doves/ Pigeons	Large Corvids	All Large Birds
37	0	0	0.31	0	0.31	0	0	0	0	0	1.92	0	0	0.62	**2.85**
38	0	0	0.23	0.15	0.08	0	0	0	0	0	0.69	0	0	0.85	**1.77**
39	2.23	0	0.23	0	0.15	0	0.08	0	0	0	0.46	0	0	0.69	**3.62**

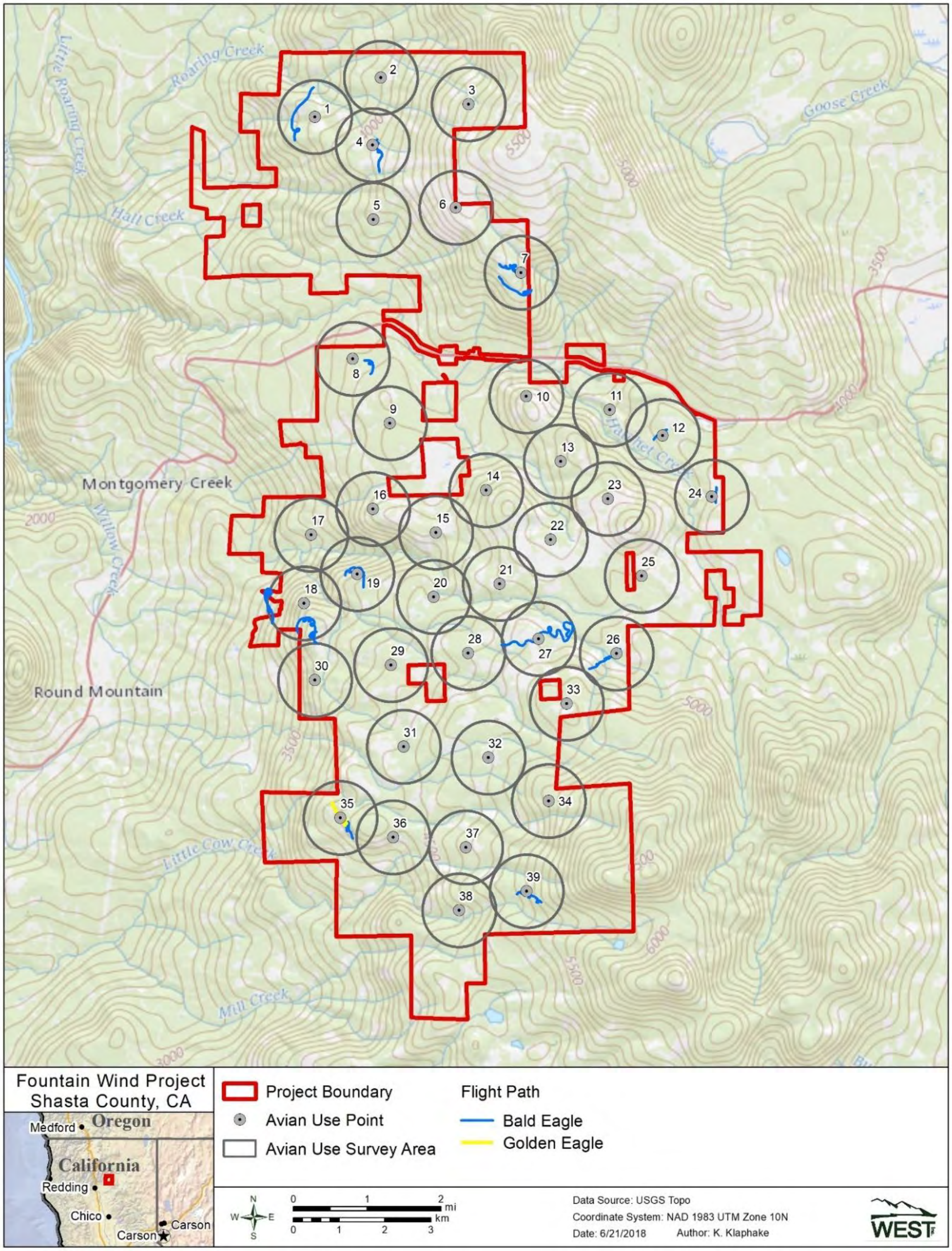
Appendix C2. Mean use (number of birds/100-meter plot/10-minute survey) by point for all small birds and major small bird types observed at the Fountain Wind Project during small bird surveys from 19 April 2017 – 22 May 2018.

Observation Point	Passerines	Swifts/ Hummingbirds	Woodpeckers	Unidentified Birds	All Small Birds
1	5.36	0	0.29	0	5.64
2	2.79	0	0.50	0	3.29
3	3.79	0	0.29	0	4.07
4	3.57	0.07	0.57	0	4.21
5	2.86	0.07	0	0	2.93
6	2.50	2.57	0.36	0	5.43
7	6.93	0	0.21	0	7.14
8	3.64	0	0.14	0	3.79
9	3.14	0	0.07	0	3.21
10	2.86	0	0	0	2.86
11	5.50	0.07	0.14	0.07	5.79
12	3.29	0	0.50	0.07	3.86
13	3.36	0	0.07	0	3.43
14	4.43	0	0.07	0	4.50
15	2.00	0	0.29	0	2.29
16	4.29	0	0.14	0	4.43
17	8.15	0.31	0.31	0	8.77
18	2.85	0.15	0	0	3.00
19	4.38	0.08	0.31	0	4.77
20	2.23	0	0.46	0	2.69
21	3.50	0	0.29	0	3.79
22	2.71	0	0.14	0	2.86
23	4.00	0	0.07	0	4.07
24	4.79	0	0.21	0	5.00
25	3.64	0	0.21	0	3.86
26	1.64	0.07	0.43	0	2.14
27	2.36	0.07	0.36	0	2.79
28	2.23	0	0.54	0	2.77
29	3.57	0.21	0.29	0	4.07
30	4.85	0.23	0.31	0	5.38
31	5.85	0	0.23	0	6.08
32	3.15	0	0.15	0	3.31
33	4.69	0	0.46	0	5.15
34	5.31	0	0.38	0	5.69
35	5.54	0	0.23	0	5.77
36	2.92	0	0.31	0	3.23
37	3.00	0	0.54	0	3.54
38	3.62	0	0.08	0	3.69
39	1.69	0.08	0.38	0	2.15

Appendix D. Diurnal Raptor and Eagle Flight Paths Recorded during Fixed-Point Avian Use Surveys at the Fountain Wind Project from 19 April 2017 – 22 May 2018



Appendix D1. Diurnal raptor (non-eagle) flight paths recorded during large bird surveys at the Fountain Wind Project from 19 April 2017 – 22 May 2018.



Appendix D2. Eagle flight paths recorded during large bird surveys at the Fountain Wind Project from 19 April 2017 – 22 May 2018.

Appendix E. All Bird and Diurnal Raptor Fatality Rates at Wind Energy Facilities in North America

Appendix E. Wind energy facilities in North America, by region, with publicly available and comparable fatality data for all bird species and diurnal raptor species.

Wind Energy Facility	All Bird Fatality Estimate[A]	Diurnal Raptor Fatality Estimate	No. of Turbines	Total MW
	California			
Pine Tree, CA (2009-2010, 2011)	17.44	-	90	135
Alta I, CA (2013-2014)	12.05	0.15	290	720
Montezuma I, CA (2012)	8.91	0.79	16	36.8
Alta I, CA (2011-2012)	7.07	0.27	100	150
Shiloh I, CA (2006-2009)	6.96	0.42	100	150
Windstar, CA (2012-2013)	6.65	0.18	53	106
Montezuma I, CA (2011)	5.19	1.06	16	36.8
Alta X, CA (2014-2015)	4.88	0.04	48	137
Dillon, CA (2008-2009)	4.71	0	45	45
Diablo Winds, CA (2005-2007)	4.29	0.4	31	20.46
Lower West, CA (2012-2013)	3.25	0	7	14
Shiloh III, CA (2012-2013)	3.3	-	50	102.5
Rising Tree, CA (2015-2016)	3.1	0.06	60	198
Shiloh II, CA (2010-2011)	2.8	0.44	75	150
Shiloh II, CA (2011-2012)	2.8	0.97	75	150
Alta II-V, CA (2013-2014)	2.79	0	290	720
Alta I, CA (2015-2016)	2.57	0.15	290	720
Hatchet Ridge, CA (2011)	2.5	0.03	44	101
Alta X, CA (2015-2016)	2.17	0	48	137
North Sky River, CA (2013-2014)	2.05	0.05	100	160
Shiloh II, CA (2009-2010)	1.9	0.11	75	150
Alta II-V, CA (2011-2012)	1.66	0.05	190	570
Mustang Hills, CA (2012-2013)	1.66	0.08	50	150
Rising Tree, CA (2017-2018)	1.63	0.14	60	198
High Winds, CA (2003-2004)	1.62	0.5	90	162
Solano III, CA (2012-2013)	1.6	0.95	55	128
North Sky River, CA (2014-2015)	1.23	0.07	100	160
Hatchet Ridge, CA (2013)	1.22	-	44	101
Pinyon Pines I & II, CA (2013-2014)	1.18	0	100	300
High Winds, CA (2004-2005)	1.1	0.28	90	162
Montezuma II, CA (2012-2013)	1.08	0.46	34	78.2
Mustang Hills, CA (2014-2015)	0.97	0.03	100	300
Lower West, CA (2014-2015)	0.9	0	7	14
Hatchet Ridge, CA (2012)	0.83	0	44	101
Pacific Wind, CA (2015-2016)	0.77	0.07	70	144
Lower West, CA (2016-2017)	0.73	0	7	14
North Sky River, CA (2015-2016)	0.72	0.17	100	160
Alta VIII, CA (2012-2013)	0.66	0.02	50	150
Cameron Ridge/Section 15, CA (2015-2016)	0.57	0	34	102
Pinyon Pines I & II, CA (2017-2018)	0.56	0.01	100	300
Alite, CA (2009-2010)	0.55	0.12	8	24
Mustang Hills, CA (2016-2017)	0.54	0.15	50	150
Alta II-V, CA (2015-2016)	0.51	0	290	720
Pinyon Pines I&II, CA (2015-2016)	0.5	0.02	100	300
Cameron Ridge/Section 15, CA (2014-2015)	0.45	0.04	34	102
Alta VIII, CA (2014-2015)	0.38	0.04	50	150
Alta VIII, CA (2016-2017)	0.25	0	50	150
Pacific Wind, CA (2014-2015)	0.17	0	70	144
	Pacific Northwest			

Appendix E. Wind energy facilities in North America, by region, with publicly available and comparable fatality data for all bird species and diurnal raptor species.

Wind Energy Facility	All Bird Fatality Estimate[A]	Diurnal Raptor Fatality Estimate	No. of Turbines	Total MW
Windy Flats, WA (2010-2011)	8.45	0.04	114	262.2
Leaning Juniper, OR (2006-2008)	6.66	0.16	67	100.5
Linden Ranch, WA (2010-2011)	6.65	0.27	25	50
Biglow Canyon, OR (Phase II; 2009-2010)	5.53	0.14	65	150
White Creek, WA (2007-2011)	4.05	0.47	89	204.7
Tuolumne (Windy Point I), WA (2009-2010)	3.2	0.29	62	136.6
Stateline, OR/WA (2001-2002)	3.17	0.09	454	299
Klondike II, OR (2005-2006)	3.14	0.06	50	75
Klondike III (Phase I), OR (2007-2009)	3.02	0.15	125	223.6
Hopkins Ridge, WA (2008)	2.99	0.07	87	156.6
Harvest Wind, WA (2010-2012)	2.94	0.23	43	98.9
Nine Canyon, WA (2002-2003)	2.76	0.03	37	48.1
Biglow Canyon, OR (Phase II; 2010-2011)	2.68	0.03	65	150
Stateline, OR/WA (2003)	2.68	0.09	454	299
Klondike IIIa (Phase II), OR (2008-2010)	2.61	0.06	51	76.5
Combine Hills, OR (Phase I; 2004-2005)	2.56	0	41	41
Big Horn, WA (2006-2007)	2.54	0.11	133	199.5
Biglow Canyon, OR (Phase I; 2009)	2.47	0	76	125.4
Combine Hills, OR (2011)	2.33	0.05	104	104
Biglow Canyon, OR (Phase III; 2010-2011)	2.28	0.05	76	174.8
Hay Canyon, OR (2009-2010)	2.21	0	48	100.8
Elkhorn, OR (2010)	1.95	0.08	61	101
Pebble Springs, OR (2009-2010)	1.93	0.04	47	98.7
Biglow Canyon, OR (Phase I; 2008)	1.76	0.03	76	125.4
Wild Horse, WA (2007)	1.55	0.09	127	229
Goodnoe, WA (2009-2010)	1.4	0.17	47	94
Vantage, WA (2010-2011)	1.27	0.29	60	90
Hopkins Ridge, WA (2006)	1.23	0.14	83	150
Stateline, OR/WA (2006)	1.23	0.11	454	299
Kittitas Valley, WA (2011-2012)	1.06	0.09	48	100.8
Klondike, OR (2002-2003)	0.95	0	16	24
Vansycle, OR (1999)	0.95	0	38	24.9
Palouse Wind, WA (2012-2013)	0.72	-	58	104.4
Elkhorn, OR (2008)	0.64	0.06	61	101
Marengo I, WA (2009-2010)	0.27	0	78	140.4
Marengo II, WA (2009-2010)	0.16	0.05	39	70.2
Southwestern				
Dry Lake I, AZ (2009-2010)	2.02	0	30	63
Dry Lake II, AZ (2011-2012)	1.57	0	31	65
Southern Plains				
Buffalo Gap I, TX (2006)	1.32	0.1	67	134
Barton Chapel, TX (2009-2010)	1.15	0.25	60	120
Buffalo Gap II, TX (2007-2008)	0.15	0	155	233
Big Smile, OK (2012-2013)	0.09	0	66	132
Red Hills, OK (2012-2013)	0.08	0.04	82	123
Rocky Mountains				
Foote Creek Rim, WY (Phase I; 1999)	3.4	0.08	69	41.4
Foote Creek Rim, WY (Phase I; 2000)	2.42	0.05	69	41.4
Foote Creek Rim, WY (Phase I; 2001-2002)	1.93	0	69	41.4

Appendix E. Wind energy facilities in North America, by region, with publicly available and comparable fatality data for all bird species and diurnal raptor species.

Wind Energy Facility	All Bird Fatality Estimate[A]	Diurnal Raptor Fatality Estimate	No. of Turbines	Total MW
Summerview, Alb (2005-2006)	1.06	0.11	39	70.2
Milford I & II, UT (2011-2012)	0.73	0.04	107	160.5
Milford I, UT (2010-2011)	0.56	-	58	145
Midwest				
Wessington Springs, SD (2009)	8.25	0.06	34	51
Blue Sky Green Field, WI (2008; 2009)	7.17	0	88	145
Cedar Ridge, WI (2009)	6.55	0.18	41	67.6
Buffalo Ridge, MN (Phase III; 1999)	5.93	0	138	103.5
Moraine II, MN (2009)	5.59	0.37	33	49.5
Barton I & II, IA (2010-2011)	5.5	0	80	160
Buffalo Ridge I, SD (2009-2010)	5.06	0.2	24	50.4
Buffalo Ridge, MN (Phase I; 1996)	4.14	0	73	25
Winnebago, IA (2009-2010)	3.88	0.27	10	20
Rugby, ND (2010-2011)	3.82	0.06	71	149
Cedar Ridge, WI (2010)	3.72	0.13	41	68
Elm Creek II, MN (2011-2012)	3.64	0	62	148.8
Buffalo Ridge, MN (Phase II; 1999)	3.57	0	143	107.25
Buffalo Ridge, MN (Phase I; 1998)	3.14	0	73	25
Ripley, Ont (2008)	3.09	0.1	38	76
Fowler I, IN (2009)	2.83	0	162	301
Buffalo Ridge, MN (Phase I; 1997)	2.51	0	73	25
Buffalo Ridge, MN (Phase II; 1998)	2.47	0	143	107.25
PrairieWinds SD1, SD (2012-2013)	2.01	0.03	108	162
Buffalo Ridge II, SD (2011-2012)	1.99	0	105	210
Kewaunee County, WI (1999-2001)	1.95	0	31	20.46
Port Dover and Nanticoke, ON (2014)	1.66	0.07	58	104
PrairieWinds SD1, SD (2013-2014)	1.66	0.17	108	162
NPPD Ainsworth, NE (2006)	1.63	0.06	36	20.5
PrairieWinds ND1 (Minot), ND (2011)	1.56	0.05	80	115.5
Elm Creek, MN (2009-2010)	1.55	0	67	100
PrairieWinds ND1 (Minot), ND (2010)	1.48	0.05	80	115.5
Buffalo Ridge, MN (Phase I; 1999)	1.43	0.47	73	25
PrairieWinds SD1, SD (2011-2012)	1.41	0	108	162
Top Crop I & II (2012-2013)	1.35	-	68	300
Heritage Garden I, MI (2012-2014)	1.3	-	14	28
Wessington Springs, SD (2010)	0.89	0.07	34	51
Rail Splitter, IL (2012-2013)	0.84	0	67	100.5
Top of Iowa, IA (2004)	0.81	0.17	89	80
Grand Valley, ON (2016)	0.68	0.04	16	40
Big Blue, MN (2013)	0.6	0	18	36
Grand Ridge I, IL (2009-2010)	0.48	0	66	99
Top of Iowa, IA (2003)	0.42	0	89	80
Big Blue, MN (2014)	0.37	0	18	36
Pioneer Prairie II, IA (2011-2012)	0.27	0	62	102.3
Northeast				
Stetson Mountain I, ME (2013)	6.95	0	38	57
Criterion, MD (2011)	6.4	0.02	28	70
Mount Storm, WV (2011)	4.24	0.03	132	264
Pinnacle, WV (2012)	3.99	0	23	55.2
Mount Storm, WV (2009)	3.85	0	132	264

Appendix E. Wind energy facilities in North America, by region, with publicly available and comparable fatality data for all bird species and diurnal raptor species.

Wind Energy Facility	All Bird Fatality Estimate[A]	Diurnal Raptor Fatality Estimate	No. of Turbines	Total MW
Record Hill, ME (2012)	3.7	-	22	50.6
Criterion, MD (2013)	3.49	-	28	70
Lempster, NH (2009)	3.38	0	12	24
Stetson Mountain II, ME (2012)	3.37	0	17	25.5
Rollins, ME (2012)	2.9	-	40	60
Casselman, PA (2009)	2.88	0	23	34.5
Mountaineer, WV (2003)	2.69	0.07	44	66
Stetson Mountain I, ME (2009)	2.68	0	38	57
Noble Ellenburg, NY (2009)	2.66	0.25	54	80
Lempster, NH (2010)	2.64	0	12	24
Mount Storm, WV (2010)	2.6	0.1	132	264
Maple Ridge, NY (2007)	2.34	0.03	195	321.75
Noble Bliss, NY (2009)	2.28	0.12	67	100
Criterion, MD (2012)	2.14	0.02	28	70
Maple Ridge, NY (2007-2008)	2.07	0.03	195	321.75
Record Hill, ME (2014)	1.84	-	22	50.6
Noble Altona, NY (2010)	1.84	0	65	97.5
High Sheldon, NY (2010)	1.76	0.06	75	112.5
Mars Hill, ME (2008)	1.76	0	28	42
Noble Wethersfield, NY (2010)	1.7	0.13	84	126
Mars Hill, ME (2007)	1.67	0	28	42
Noble Chateaugay, NY (2010)	1.66	0.08	71	106.5
Noble Clinton, NY (2008)	1.59	0.1	67	100
High Sheldon, NY (2011)	1.57	0	75	112.5
Casselman, PA (2008)	1.51	0	23	34.5
Beech Ridge, WV (2013)	1.48	0.01	67	100.5
Munnsville, NY (2008)	1.48	0.59	23	34.5
Stetson Mountain II, ME (2010)	1.42	0	17	25.5
Cohocton/Dutch Hill, NY (2009)	1.39	0	50	125
Cohocton/Dutch Hills, NY (2010)	1.32	0.08	50	125
Noble Bliss, NY (2008)	1.3	0.1	67	100
Beech Ridge, WV (2012)	1.19	0.01	67	100.5
Stetson Mountain I, ME (2011)	1.18	0	38	57
Noble Clinton, NY (2009)	1.11	0.16	67	100
Locust Ridge, PA (Phase II; 2009)	0.84	0	51	102
Noble Ellenburg, NY (2008)	0.83	0.11	54	80
Locust Ridge, PA (Phase II; 2010)	0.76	0	51	102
Southeastern				
Buffalo Mountain, TN (2000-2003)	11.02	0	3	1.98
Buffalo Mountain, TN (2005)	1.1	0	18	28.98

A=number of bird fatalities/MW/year

Appendix E (*continued*). Wind energy facilities in North America, by region, with publicly available and comparable fatality data for all bird species and diurnal raptor species.

Data from the following sources:

Wind Energy Facility	Fatality Estimate	Wind Energy Facility	Fatality Estimate
Alite, CA (2009-2010)	Chatfield et al. 2010	Lower West, CA (2016-2017)	WEST 2017b
Alta I, CA (2011-2012)	Chatfield et al. 2012	Maple Ridge, NY (2007)	Jain et al. 2009a
Alta I, CA (2013-2014)	Chatfield et al. 2014	Maple Ridge, NY (2007-2008)	Jain et al. 2009b
Alta I, CA (2015-2016)	Thompson et al. 2016	Marengo I, WA (2009-2010)	URS Corporation 2010c
Alta II-V, CA (2011-2012)	Chatfield et al. 2012	Marengo II, WA (2009-2010)	URS Corporation 2010b
Alta II-V, CA (2013-2014)	Chatfield et al. 2014	Mars Hill, ME (2007)	Stantec 2008
Alta II-V, CA (2015-2016)	Thompson et al. 2016	Mars Hill, ME (2008)	Stantec 2009a
Alta VIII, CA (2012-2013)	Chatfield and Bay 2014	Milford I & II, UT (2011-2012)	Stantec 2012
Alta VIII, CA (2014-2015)	WEST 2016c	Milford I, UT (2010-2011)	Stantec 2011a
Alta VIII, CA (2016-2017)	WEST 2018	Montezuma I, CA (2011)	ICF International 2012
Alta X, CA (2014-2015)	Chatfield et al. 2015	Montezuma I, CA (2012)	ICF International 2013
Alta X, CA (2015-2016)	Thompson et al. 2016	Montezuma II, CA (2012-2013)	Harvey & Associates 2013
Barton Chapel, TX (2009-2010)	WEST 2011	Moraine II, MN (2009)	Derby et al. 2010a
Barton I & II, IA (2010-2011)	Derby et al. 2011a	Mount Storm, WV (2009)	Young et al. 2009b, 2010a
Beech Ridge, WV (2012)	Tidhar et al. 2013	Mount Storm, WV (2010)	Young et al. 2010b, 2011a
Beech Ridge, WV (2013)	Young et al. 2014a	Mount Storm, WV (2011)	Young et al. 2011b, 2012a
Big Blue, MN (2013)	Fagen Engineering 2014	Mountaineer, WV (2003)	Kerns and Kerlinger 2004
Big Blue, MN (2014)	Fagen Engineering 2015	Munnsville, NY (2008)	Stantec 2009b
Big Horn, WA (2006-2007)	Kronner et al. 2008	Mustang Hills, CA (2012-2013)	Chatfield and Bay 2014
Big Smile, OK (2012-2013)	Derby et al. 2013a	Mustang Hills, CA (2014-2015)	WEST 2016c
Biglow Canyon, OR (Phase I; 2008)	Jeffrey et al. 2009a	Mustang Hills, CA (2016-2017)	WEST 2018
Biglow Canyon, OR (Phase I; 2009)	Enk et al. 2010	Nine Canyon, WA (2002-2003)	Erickson et al. 2003
Biglow Canyon, OR (Phase II; 2009-2010)	Enk et al. 2011b	Noble Altona, NY (2010)	Jain et al. 2011a
Biglow Canyon, OR (Phase II; 2010-2011)	Enk et al. 2012a	Noble Bliss, NY (2008)	Jain et al. 2009c
Biglow Canyon, OR (Phase III; 2010-2011)	Enk et al. 2012b	Noble Bliss, NY (2009)	Jain et al. 2010a
Blue Sky Green Field, WI (2008; 2009)	Gruver et al. 2009	Noble Chateaugay, NY (2010)	Jain et al. 2011b
Buffalo Gap I, TX (2006)	Tierney 2007	Noble Clinton, NY (2008)	Jain et al. 2009d
Buffalo Gap II, TX (2007-2008)	Tierney 2009	Noble Clinton, NY (2009)	Jain et al. 2010b
Buffalo Mountain, TN (2000-2003)	Nicholson et al. 2005	Noble Ellenburg, NY (2008)	Jain et al. 2009e
Buffalo Mountain, TN (2005)	Fiedler et al. 2007	Noble Ellenburg, NY (2009)	Jain et al. 2010c
Buffalo Ridge I, SD (2009-2010)	Derby et al. 2010b	Noble Wethersfield, NY (2010)	Jain et al. 2011c
Buffalo Ridge II, SD (2011-2012)	Derby et al. 2012a	North Sky River, CA (2013-2014)	Levenstein et al. 2014
Buffalo Ridge, MN (Phase I; 1996)	Johnson et al. 2000	North Sky River, CA (2014-2015)	Levenstein et al. 2015
Buffalo Ridge, MN (Phase I; 1997)	Johnson et al. 2000	North Sky River, CA (2015-2016)	WEST 2016d
Buffalo Ridge, MN (Phase I; 1998)	Johnson et al. 2000	NPPD Ainsworth, NE (2006)	Derby et al. 2007
Buffalo Ridge, MN (Phase I; 1999)	Johnson et al. 2000	Pacific Wind, CA (2014-2015)	WEST 2016a
Buffalo Ridge, MN (Phase II; 1998)	Johnson et al. 2000	Pacific Wind, CA (2015-2016)	WEST 2017a
Buffalo Ridge, MN (Phase II; 1999)	Johnson et al. 2000	Palouse Wind, WA (2012-2013)	Stantec 2013a
Buffalo Ridge, MN (Phase III; 1999)	Johnson et al. 2000	Pebble Springs, OR (2009-2010)	Gritski and Kronner 2010a

Appendix E (*continued*). Wind energy facilities in North America, by region, with publicly available and comparable fatality data for all bird species and diurnal raptor species.

Data from the following sources:

Wind Energy Facility	Fatality Estimate	Wind Energy Facility	Fatality Estimate
Cameron Ridge/Section 15, CA (2014-2015)	WEST 2016b	Pine Tree, CA (2009-2010, 2011)	BioResource Consultants 2012
Cameron Ridge/Section 15, CA (2015-2016)	Rintz and Thompson 2017	Pinnacle, WV (2012)	Hein et al. 2013
Casselman, PA (2008)	Arnett et al. 2009	Pinyon Pines I & II, CA (2013-2014)	Chatfield and Russo 2014
Casselman, PA (2009)	Arnett et al. 2010	Pinyon Pines I & II, CA (2017-2018)	Rintz and Pham 2018
Cedar Ridge, WI (2009)	BHE Environmental 2010	Pinyon Pines, CA (2015-2016)	Rintz and Starcevich 2016
Cedar Ridge, WI (2010)	BHE Environmental 2011	Pioneer Prairie II, IA (2011-2012)	Chodachek et al. 2012
Cohocton/Dutch Hill, NY (2009)	Stantec 2010	Pleasant Valley, MN (2016-2017)	Tetra Tech 2017a
Cohocton/Dutch Hills, NY (2010)	Stantec 2011b	Port Dover and Nanticoke Wind Project, ON (2014)	Stantec Consulting Ltd. 2015
Combine Hills, OR (2011)	Enz et al. 2012	Prairie Rose, MN (2014)	Chodachek et al. 2015
Combine Hills, OR (Phase I; 2004-2005)	Young et al. 2006	PrairieWinds ND1 (Minot), ND (2010)	Derby et al. 2011b
Criterion, MD (2011)	Young et al. 2012b	PrairieWinds ND1 (Minot), ND (2011)	Derby et al. 2012b
Criterion, MD (2012)	Young et al. 2013	PrairieWinds SD1, SD (2011-2012)	Derby et al. 2012c
Criterion, MD (2013)	Young et al. 2014b	PrairieWinds SD1, SD (2012-2013)	Derby et al. 2013b
Diablo Winds, CA (2005-2007)	WEST 2006, 2008	PrairieWinds SD1, SD (2013-2014)	Derby et al. 2014
Dillon, CA (2008-2009)	Chatfield et al. 2009	Rail Splitter, IL (2012-2013)	Good et al. 2013a
Dry Lake I, AZ (2009-2010)	Thompson et al. 2011	Record Hill, ME (2012)	Stantec 2013b
Dry Lake II, AZ (2011-2012)	Thompson and Bay 2012	Record Hill, ME (2014)	Stantec 2015
Elkhorn, OR (2008)	Jeffrey et al. 2009b	Red Hills, OK (2012-2013)	Derby et al. 2013c
Elkhorn, OR (2010)	Enk et al. 2011a	Ripley, Ont (2008)	Jacques Whitford 2009
Elm Creek II, MN (2011-2012)	Derby et al. 2012d	Rising Tree, CA (2015-2016)	Rintz et al. 2016
Elm Creek, MN (2009-2010)	Derby et al. 2010c	Rising Tree, CA (2017-2018)	Chatfield et al. 2018
Foote Creek Rim, WY (Phase I; 1999)	Young et al. 2003	Rollins, ME (2012)	Stantec 2013c
Foote Creek Rim, WY (Phase I; 2000)	Young et al. 2003	Rugby, ND (2010-2011)	Derby et al. 2011c
Foote Creek Rim, WY (Phase I; 2001-2002)	Young et al. 2003	Shiloh I, CA (2006-2009)	Kerlinger et al. 2009
Fowler I, IN (2009)	Johnson et al. 2010	Shiloh II, CA (2009-2010)	Kerlinger et al. 2010, 2013a
Goodnoe, WA (2009-2010)	URS Corporation 2010a	Shiloh II, CA (2010-2011)	Kerlinger et al. 2013a
Grand Ridge I, IL (2009-2010)	Derby et al. 2010d	Shiloh II, CA (2011-2012)	Kerlinger et al. 2013a
Grand Valley, (2016)	Stantec Consulting Ltd. 2017	Shiloh III, CA (2012-2013)	Kerlinger et al. 2013b
Harvest Wind, WA (2010-2012)	Downes and Gritski 2012b	Solano III, CA (2012-2013)	AECOM 2013
Hatchet Ridge, CA (2011)	Tetra Tech 2013	Stateline, OR/WA (2001-2002)	Erickson et al. 2004
Hatchet Ridge, CA (2012)	Tetra Tech 2013	Stateline, OR/WA (2003)	Erickson et al. 2004
Hatchet Ridge, CA (2013)	Tetra Tech 2014	Stateline, OR/WA (2006)	Erickson et al. 2007
Hay Canyon, OR (2009-2010)	Gritski and Kronner 2010b	Stetson Mountain I, ME (2009)	Stantec 2009c
Heritage Garden I, MI (2012-2013)	Kerlinger et al. 2014	Stetson Mountain I, ME (2011)	Normandeau Associates 2011

Appendix E (*continued*). Wind energy facilities in North America, by region, with publicly available and comparable fatality data for all bird species and diurnal raptor species.

Data from the following sources:

Wind Energy Facility	Fatality Estimate	Wind Energy Facility	Fatality Estimate
Heritage Garden I, MI (2013-2014)	Kerlinger et al. 2014	Stetson Mountain I, ME (2013)	Stantec 2014
High Sheldon, NY (2010)	Tidhar et al. 2012a	Stetson Mountain II, ME (2010)	Normandeau Associates 2010
High Sheldon, NY (2011)	Tidhar et al. 2012b	Stetson Mountain II, ME (2012)	Stantec 2013d
High Winds, CA (2003-2004)	Kerlinger et al. 2006	Summerview, Alb (2005-2006)	Brown and Hamilton 2006
High Winds, CA (2004-2005)	Kerlinger et al. 2006	Top Crop I & II (2012-2013)	Good et al. 2013b
Hopkins Ridge, WA (2006)	Young et al. 2007b	Top of Iowa, IA (2003)	Jain 2005
Hopkins Ridge, WA (2008)	Young et al. 2009a	Top of Iowa, IA (2004)	Jain 2005
Kewaunee County, WI (1999-2001)	Howe et al. 2002	Tucannon River, WA (2015)	Hallingstad et al. 2016
Kittitas Valley, WA (2011-2012)	Stantec 2012	Tuolumne (Windy Point I), WA (2009-2010)	Enz and Bay 2010
Klondike II, OR (2005-2006)	NWC and WEST 2007	Vansycle, OR (1999)	Erickson et al. 2000
Klondike III (Phase I), OR (2007-2009)	Gritski et al. 2010	Vantage, WA (2010-2011)	Ventus 2012
Klondike IIIa (Phase II), OR (2008-2010)	Gritski et al. 2011	Waverly Wind, KS (2016-2017)	Tetra Tech 2017b
Klondike, OR (2002-2003)	Johnson et al. 2003	Wessington Springs, SD (2009)	Derby et al. 2010e
Leaning Juniper, OR (2006-2008)	Gritski et al. 2008	Wessington Springs, SD (2010)	Derby et al. 2011d
Lempster, NH (2009)	Tidhar et al. 2010	White Creek, WA (2007-2011)	Downes and Gritski 2012a
Lempster, NH (2010)	Tidhar et al. 2011	Wild Horse, WA (2007)	Erickson et al. 2008
Linden Ranch, WA (2010-2011)	Enz and Bay 2011	Wildcat, IN (2017)	Stantec 2018
Locust Ridge, PA (Phase II; 2009)	Arnett et al. 2011	Windstar, CA (2012-2013)	Levenstein and Bay 2013b
Locust Ridge, PA (Phase II; 2010)	Arnett et al. 2011	Windy Flats, WA (2010-2011)	Enz et al. 2011
Lower West, CA (2012-2013)	Levenstein and Bay 2013a	Winnebago, IA (2009-2010)	Derby et al. 2010f
Lower West, CA (2014-2015)	Levenstein and DiDonato 2015		