Avian Use Surveys for the Prevailing Winds Wind Project Bon Homme and Charles Mix Counties, South Dakota

Year Two Final Draft Report

May 2016 – April 2017

Prepared for:

Prevailing Winds, LLC

Prepared by:

Clayton Derby, Sofia Agudelo, and Terri Thorn

Western EcoSystems Technology, Inc.
4007 State Street
Bismarck, North Dakota 58503

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EXECUTIVE SUMMARY

Prevailing Winds, LLC. (Prevailing Winds), has proposed a wind energy facility in Bon Homme and Charles Mix counties, South Dakota, referred to as the Prevailing Winds Wind Project (Project). Prevailing Winds contracted Western EcoSystems Technology, Inc. (WEST) to conduct field surveys developed in coordination with the US Fish and Wildlife Service (USFWS) and South Dakota Game Fish and Parks (SDGFP). Surveys were designed to assess wildlife resources in the Project area and assess risk to sensitive species by addressing the issues posed under Tier 3 of the USFWS Final Land-Based Wind Energy Guidelines. The following document contains results for the general fixed-point bird use surveys and incidental wildlife observations. A summary of all data collected is contained in the document, but the overall body of the report focuses on a smaller group of species – diurnal raptors, eagles, state/federally listed species, and South Dakota Sensitive Species (State Species of Concern [SSC] and State Species of Greatest Conservation Need [SGCN]).

The principal objectives of the fixed-point bird use surveys were to: 1) assess the relative abundance and spatial distribution of species in the Project area during all seasons, and 2) identify and assess the potential risk of adverse impacts to species or groups.

Fixed-point bird use surveys were conducted at 16 survey points from March 3, 2016 – April 19, 2017. This was the second year of surveys at the Project, but the survey area between Year One (March 25, 2015 – February 21, 2016) and Year Two changed significantly and thus the point count locations were modified in Year Two. Each survey plot was surveyed for 60 minutes (min). Every bird and/or unique bird species group observed during the first 20 min of each fixed-point bird use survey was recorded using two viewsheds: 800-meter (m; 2,625-feet [ft]) radius plot for large birds and 100-m (328-ft) radius plot for small birds, observations beyond the radius plots were excluded from analysis. Large birds included waterbirds, waterfowl, rails and coots, grebes and loons, gulls and terns, shorebirds, diurnal raptors, owls, vultures, upland game birds, doves/pigeons, large corvids (e.g., ravens, magpies, and crows), and goatsuckers. Passerines (excluding large corvids), kingfishers, swifts/hummingbirds, woodpeckers, and most cuckoos were considered small birds. During the next 40 min of the survey period, only eagles and state/federally listed species were recorded out to the 800-m radius.

A total of 205 fixed-point bird use surveys were conducted during 13 visits. During all surveys and incidental observations, no federally listed species were recorded but one state-listed species (peregrine falcon) was recorded. Thirteen bird species (great blue heron, bald eagle, Cooper's hawk, ferruginous hawk, sharp-shinned hawk, Swainson's hawk, American pelican, white-faced ibis, bufflehead, common merganser, golden eagle, merlin, and peregrine falcon]) listed as South Dakota SGCN and/or SSC were observed during fixed-point surveys and incidentally.

Diurnal raptor use at the Project during Year Two (0.33 raptors/800-m plot/20-min survey) was low compared to other US wind facilities and comparable to other wind energy facilities in the

Midwest with publicly available data and similar to Year One at the Project (0.31 raptors/800-m plot/20-min survey). Fatality monitoring data collected at wind projects in the Midwest suggest that some collision risk exists for individual raptors, but the level of impact is not likely to cause significant adverse impacts to overall species populations.

Significant adverse impacts to overall bird populations are not anticipated at the Project based on data collected at the site, review of available literature, and results of post-construction fatality monitoring at other wind energy facilities. Further post-construction survey effort should be determined in consultation with appropriate agencies to confirm the anticipated impacts.

STUDY PARTICIPANTS

Western EcoSystems Technology

Clayton Derby	Project Manager
Carmen Boyd	Data Manager
Wendy Bruso	Technical Editing Manager
Katie Wynne	Technical Editing Coordinator
Mandy Kauffman	Data Analyst
Terri Thorn	GIS Specialist
Sofia Agudelo	Report Writer/Technical Editor
Karen Seginak	Field Technician
Brenda Jarski-Weber	Field Technician
Cathy Clayton	Field Technician

REPORT REFERENCE

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INTRODUCTION

In 2015, Prevailing Winds LLC originally contracted Western EcoSystems Technology, Inc. (WEST) to conduct field surveys in accordance with agency recommendations to quantify wildlife resources within the Prevailing Winds Wind Project (Project) in South Dakota. Year-round surveys were conducted by WEST in 2015 – 2016 within an initial assessment area of approximately 18,139.5 hectares (ha; 44,823.7 acres [ac]). A second year of biological surveys was conducted by WEST to address the issues posed under Tier 3, following guidance in the United States (US) Fish and Wildlife Service (FWS) *Final Land-Based Wind Energy Guidelines* (Guidelines; USFWS 2012) and *Eagle Conservation Plan Guidance* (Guidance; USFWS 2013), within a revised Project area being considered in 2016 (Figure 1). This report includes a summary for the Year Two survey efforts.

Fixed-point bird use surveys were conducted to achieve these principal objectives: 1) assess the relative abundance and spatial distribution of species in the Project area during an entire year, with emphasis on eagles, non-eagle raptors, and state/federally listed species, and 2) identify and assess the potential risk of adverse impacts to sensitive species or groups.

The following document contains results for the general fixed-point bird use surveys and incidental wildlife observations for the study period 2016 – 2017 (Year Two), with focus on eagles, non-eagle diurnal raptors, state/federally listed species, and State non-listed special-status species (i.e., State Species of Greatest Conservation Need [SGCN] and State Species of Concern [SSC]). A summary of the data collected during the 2015 – 2016 study period (Year One) is also included in this report.

STUDY AREA

The revised Project area used for surveys conducted in 2016 – 2017 encompassed approximately 14,981.40 ha (37,019.85 ac) in Bon Homme and Charles Mix counties, north of the town of Avon in southeastern South Dakota (Figure 1). The Project, located in a higher elevated area within the greater landscape, is characterized by a generally flat topography, with elevation ranging from 454.46 meters (m; 1,491.01 feet [ft]) – 573.72 m (1,882.28 ft; US Geological Survey [USGS] Digital Elevation Model 2017). The Project area, historically dominated by grasslands, has extensively been converted to agricultural use, with crop production and livestock grazing the primary practices (Bryce et al. 1998). Approximately half (47.5) % of the proposed Project area is cultivated crops followed by pasture/hay land (37.5%); grassland/herbaceous cover represent 6.7% of the Project area while all other land cover/land use types compose 4% or less of the Project area each (USGS National Land Cover Database 2011). As evidenced during the site visit conducted by WEST in 2015 of the general area, trees and woodlands are found mainly in planted shelter belts and within draws and on hillslopes; wetlands are scattered throughout the Project area (Figure 2), with the USFWS National Wetland Inventory (NWI) indicating approximately 528.08 ha (1,304.91 ac) of wetlands (USFWS NWI 2015).

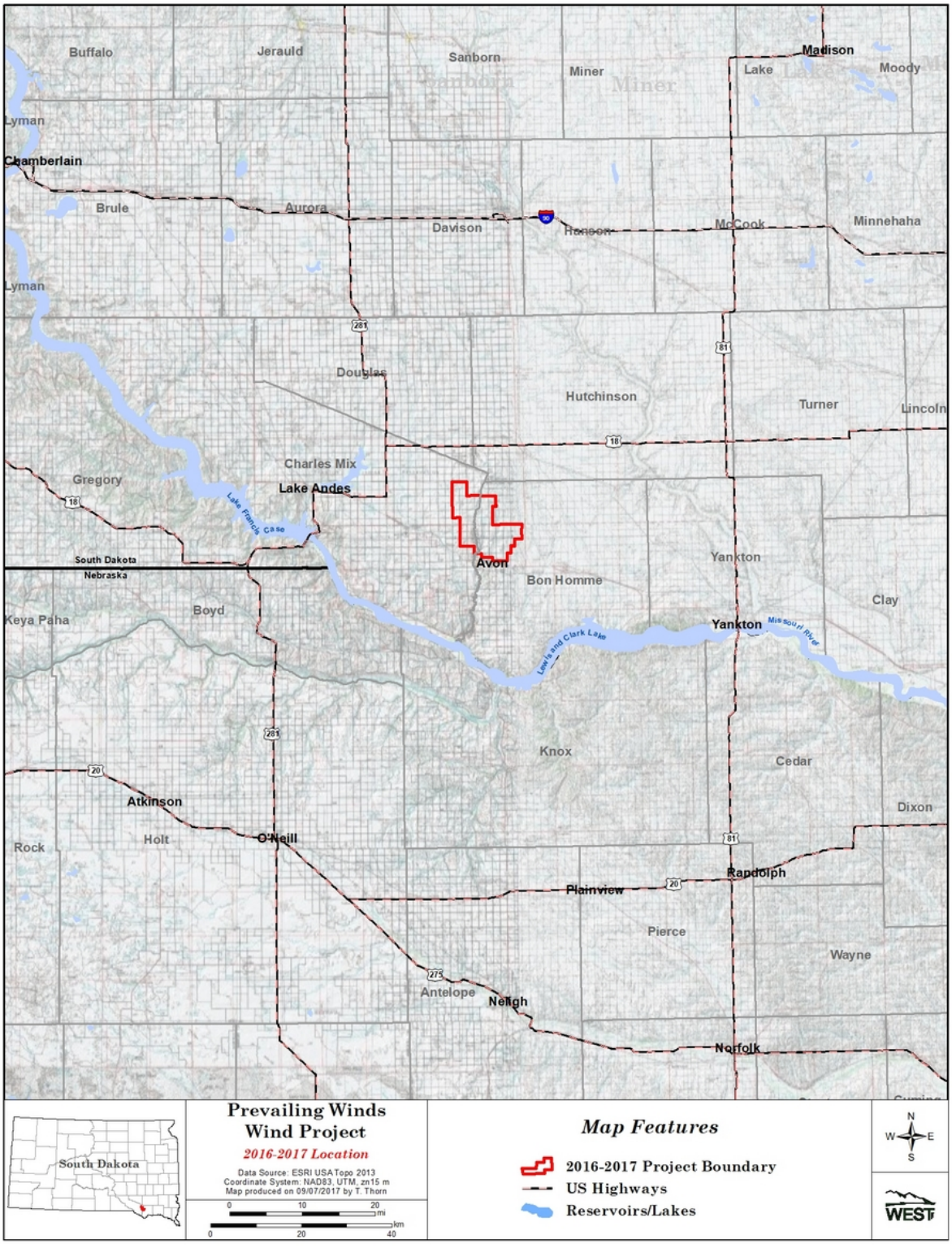

Figure 1. Location of the revised Prevailing Winds Wind Project in Bon Homme and Charles Mix counties, South Dakota, for surveys conducted in 2016 – 2017.

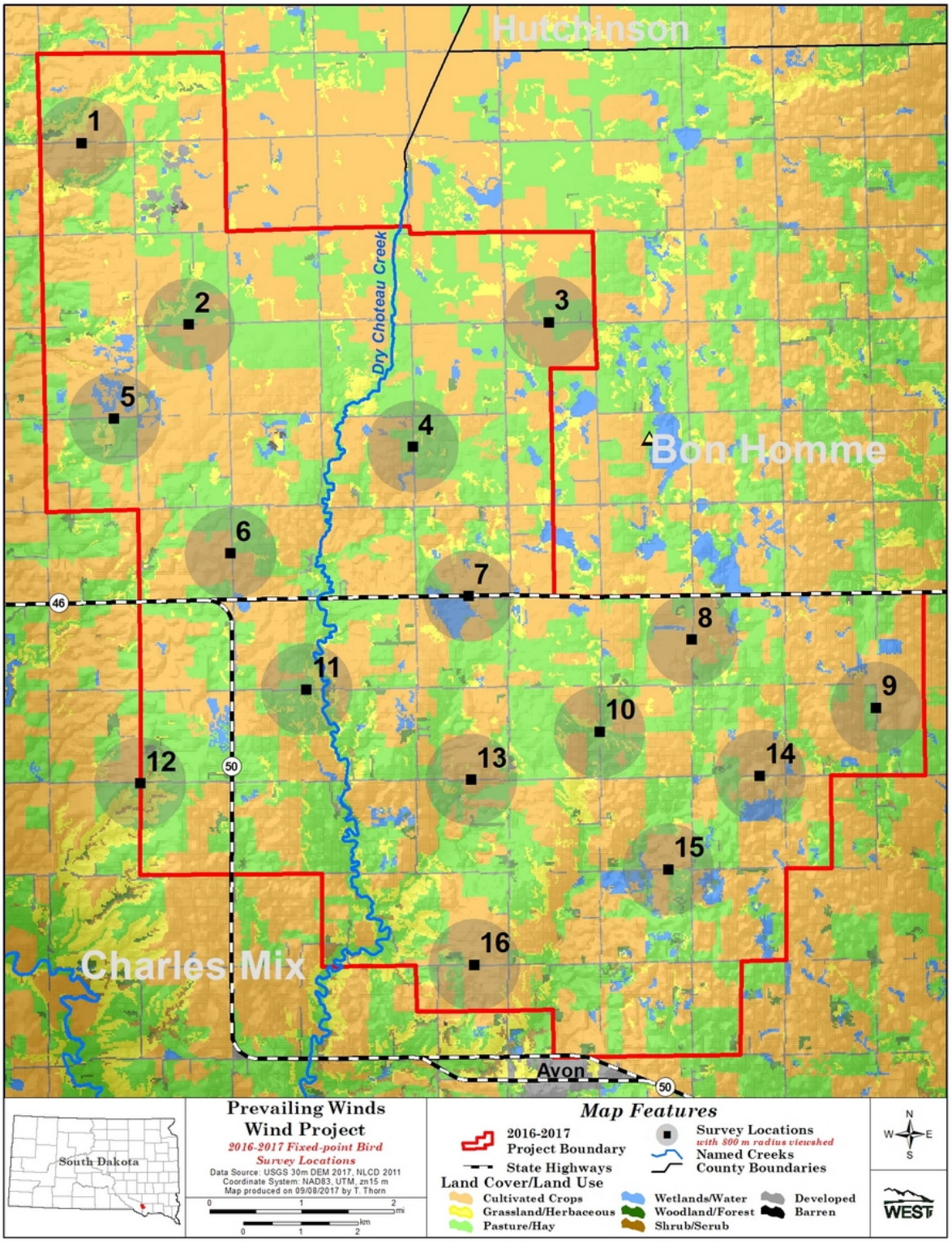

Figure 2. Land cover/Land use and location of the fixed-point plots selected for the Year Two bird use surveys conducted at the Prevailing Winds Wind Project in Bon Homme and Charles Mix counties, South Dakota, from May 3, 2016 – April 19, 2017 (USFWS NLCD 2011, Homer et al. 2015).

METHODS

Fixed-Point Bird Use Surveys

Fixed-point bird use surveys (variable circular plots) were conducted using methods described by Reynolds et al. (1980), to estimate the seasonal and spatial use of the study area by birds, particularly diurnal raptors (defined here as kites, accipiters, buteos, harriers, eagles, falcons, and osprey [*Pandion haliaetus*]). Methodologies employed during avian use surveys conducted at the Project are generally comparable to those used at past wind energy facilities in South Dakota.

Survey Plots

Sixteen points were selected to survey representative habitats and topography of the Project, while achieving relatively even coverage of the study area (Figure 2). Each survey plot was an 800-m (2,625-ft) radius circle centered on the point; for analysis purposes, only birds within the 800-m radius were considered for analysis to allow comparison to other projects that used similar analyses.

Survey Methods

Each survey plot was surveyed for 60 minutes (min). Every bird and/or unique bird species group observed during the first 20 min of each fixed-point bird use survey was recorded by a unique observation number. During the next 40 min of the survey period, only eagles and state/federally listed species and state species of concern were recorded out to the 800-m radius. In some cases, the tally of observations may represent repeated sightings of the same individual. Observations of large birds beyond the 800-m radius were recorded but were not included in statistical analyses. For small birds, observations beyond the 100-m (328-ft) radius were excluded. Large birds included waterbirds, waterfowl, rails and coots, grebes and loons, gulls and terns, shorebirds, diurnal raptors, owls, vultures, upland game birds, doves/pigeons, large corvids (e.g., ravens, magpies, and crows), and goatsuckers. Passerines (excluding large corvids), kingfishers, swifts/hummingbirds, woodpeckers, and most cuckoos were considered small birds.

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. Species or best possible identification, number of individuals, sex and age class (if possible), distance from plot center when first observed, closest distance, altitude above ground, activity (behavior), and habitat(s) were recorded for each observation. 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. Other information collected included whether the observation was auditory only and the 10-min interval of the survey in which the detection first occurred. Locations and flight paths, if applicable, of large birds were recorded during fixed-point bird use surveys on field maps by unique observation number. Data on eagle flight paths and habitat use (i.e., distance from observer, activity, and flight height)

were recorded on a per min basis; comments were made when appropriate. Incidental wildlife observations were recorded while conducting all surveys, moving between fixed-point locations, and traveling within the Project. All raptors, listed species, and State sensitive bird species were documented.

Observation Schedule

Survey intensity (i.e., number of fixed-point circular plots and frequency of monitoring) was designed to document year-round use and behavior of birds in the Project area. Fixed-point bird use surveys were conducted approximately monthly for the year. The schedule was generally conducting even numbered points on one visit and then odd numbered points two week later. Surveys were carried out during daylight hours and survey periods varied to approximately cover all daylight hours during a season. To the extent practicable, each point was surveyed roughly the same number of times.

Statistical Analysis

For analysis purposes, a visit was defined as the required length of time, in days, to survey all of the plots once within the Project area. Under certain circumstances, such as extreme weather conditions, all plots may not have been surveyed during a visit. In these cases, a visit might not have constituted a survey of all plots.

Quality Assurance and Quality Control

Quality assurance and quality control (QA/QC) measures were implemented at all stages of the study, including in the field, during data entry and analysis, and report writing. Following field 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 questionable were discussed with the observer and/or project manager. Errors, omissions, and/or problems identified in later stages of analysis were traced back to the raw data forms, and appropriate changes in all steps were made.

Data Compilation and Storage

A Microsoft® MSSQL 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 QA/QC and data analysis. All data forms and electronic data files were retained for reference.

Fixed-Point Bird Use Surveys

Bird Diversity and Species Richness

Bird diversity was illustrated by the total number of unique species observed. Species lists and counts, with the number of observations and the number of groups, were generated by season and included all observations of birds detected, regardless of their distance from the observer. In some cases, the tally of observations may represent repeated sightings of the same individual. Species richness was calculated for each season by first averaging the total number of species observed within each plot during a visit, then averaging across plots within each visit,

followed by averaging across visits within each season. Overall species richness was calculated as a weighted average of seasonal values by the number of days in each season.

Mean Use, Percent of Use, and Frequency of Occurrence

Large birds detected within the 800-m radius plot and small birds recorded within the 100-m radius plot were used to calculate mean use and frequency of occurrence. The metric used for mean bird use was number of birds per plot (100-m radius plot for small birds, 800-m radius plot for large birds) per 20-min survey. Seasonal mean use was calculated by first averaging 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 each season. Overall mean use was calculated as a weighted average of seasonal values by the number of days in each season. Percent of use was calculated as the proportion of large or small 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. Frequency of occurrence, calculated as the percent of surveys in which a particular bird type or species was observed, provides a relative measure of species exposure to the proposed Project.

Bird Flight Height and Behavior

Bird flight heights are important metrics to assess potential exposure. Flight height information was used to calculate the percentage of birds observed flying within the rotor-swept heights (RSH; estimated to be between 25 – 200 m [82 –656 ft] above ground level). The flight height recorded when the bird was first observed 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 (e.g., first 20-min for all birds, entire 60-min for eagles) was calculated using the lowest and highest flight heights recorded. Auditory only observations were excluded from flight height calculations.

Spatial Use

Spatial use of the Project area was evaluated using mean use by survey point. For each species and bird group, the number of individuals observed at each point during the 20-min survey was divided by the total number of surveys at that point.

RESULTS

Surveys were completed within the Project area from May 3, 2016 – April 19, 2017. Summary statistics for the full suite of species observed in the Project area are presented in Appendix A. Results related to eagles, non-eagle raptors, federally/state-listed species (Endangered Species Act [ESA] 1973, South Dakota Game, Fish and Parks [SDGFP] 2016, USFWS 2017), and State sensitive species (SGCN [SDGFP 2014] and SSC [SDGFP 2017]), are more thoroughly covered in the body of this report.

Fixed-Point Bird Use Surveys

Bird Diversity and Species Richness

A total of 205 fixed-point bird use surveys were conducted during 13 visits to the Project area during Year Two surveys: 47 surveys in spring, 63 in summer, 47 in fall, and 48 in winter (Table 1). Ninety unique bird species were observed during the entire duration (60 min) of the fixed-point bird use surveys (Table 1). Bird diversity (the number of unique species observed for entire 60-min survey) was highest during the summer (60 species), followed by spring and fall (46 and 43, respectively), and was lowest in winter (18). Overall species richness (mean number of species/plot/20-min survey) was higher for small birds (2.64) compared to large birds (1.49), being lowest in the winter compared to all other seasons, for both large and small birds (0.38 and 0.94 species/plot/20-min survey, respectively).

Table 1. Number of visits, surveys, bird diversity (number of unique species for entire 60-minute [min] survey), and bird species richness (species/plot[a]/20-min survey) by season and overall, observed during the Year Two fixed-point bird use surveys conducted at the Prevailing Winds Wind Project in Bon Homme and Charles Mix counties, South Dakota, from May 3, 2016 – April 19, 2017.

Season	Number of Visits	Number of Surveys Conducted	Bird Diversity	Bird Species Richness	
				Large Birds	Small Birds
Spring	3	47	46	2.86	2.50
Summer	4	63	60	1.48	4.43
Fall	3	47	43	1.48	2.32
Winter	3	48	18	0.38	0.94
Overall	**13**	**205**	**90**	**1.49**	**2.64**

[a.] 800-meter (m; 2,625-foot [ft]) radius plot for large birds; 100-m (328-ft) radius plot for small birds

A total of 9,276 observations in 1,090 separate groups (defined as one or more individuals) were recorded during the first 20 min of the Year Two fixed-point bird use surveys (Appendix A1). Regardless of bird size, two identified species (2.2% of all species) accounted for approximately one-third (29%) of all observations: common grackle (*Quiscalus quiscula*; 1,590 observations in 30 groups) and red-winged blackbird (*Agelaius phoeniceus*; 1,105 observations in 84 groups). All other species each accounted for less than 6% of the total observations.

Waterfowl accounted for the majority (2,095 observations within 79 groups) of large bird observations, with snow goose (*Chen caerulescens*) being the most abundant waterfowl species (499 observations within eight groups). Waterbirds composed 1.5% (140 observations) of the total bird observations, with sandhill cranes (111 observations in five groups) being the most abundant waterbird species recorded during bird use surveys. Passerines accounted for the majority (5,855 observations within 681 groups) of small bird observations, with common grackle accounting for the majority of those observations (Appendix A1).

Sixty-nine diurnal raptor observations within 61 groups were recorded during the first 20 min of the Year Two fixed-point bird use surveys conducted at the Project, representing five unique species (Table 2; Appendix A1). Red-tailed hawk (*Buteo jamaicensis*; 34 observations in 32

groups) and northern harrier (*Circus cyaneus*; 11 observations in 10 groups) were the most commonly observed raptor species, accounting for 49.3% and 15.9% of all raptor observations, respectively. One state-listed (SDGFP 2016) species (peregrine falcon [*Falco peregrinus*]) was recorded during Year Two of 60-min fixed-point bird use surveys conducted at the Project; no federally listed (ESA 1973) species were observed during the study period.

Table 2. Number of groups and individuals of diurnal raptors observed, regardless of distance from observer, during the first 20 minutes of the Year Two fixed-point bird use surveys conducted at the Prevailing Winds Wind Project in Bon Homme and Charles Mix counties, South Dakota, from May 3, 2016 – April 19, 2017.

		Spring		Summer		Fall		Winter		Total	
Raptor Subtype/Species	**Scientific Name**	**# Grps**	**# Obs**	**# Grps**	**# Obs**	**# Grps**	**# Obs**	**# Grps**	**# Obs**	**# Grps**	**# Obs**
Diurnal Raptors		**19**	**24**	**11**	**13**	**25**	**26**	**6**	**6**	**61**	**69**
Accipiters		*0*	*0*	*1*	*1*	*0*	*0*	*0*	*0*	*1*	*1*
Cooper's hawk[a]	*Accipiter cooperii*	0	0	1	1	0	0	0	0	1	1
Buteos		*13*	*13*	*10*	*12*	*13*	*13*	*3*	*3*	*39*	*41*
red-tailed hawk	*Buteo jamaicensis*	12	12	9	11	11	11	0	0	32	34
rough-legged hawk	*Buteo lagopus*	0	0	0	0	2	2	3	3	5	5
unidentified buteo	*Buteo spp*	1	1	1	1	0	0	0	0	2	2
Northern Harrier		*3*	*4*	*0*	*0*	*7*	*7*	*0*	*0*	*10*	*11*
northern harrier	*Circus cyaneus*	3	4	0	0	7	7	0	0	10	11
Eagles		*1*	*4*	*0*	*0*	*1*	*1*	*2*	*2*	*4*	*7*
bald eagle[a,b]	*Haliaeetus leucocephalus*	1	4	0	0	1	1	2	2	4	7
Other Raptors		*2*	*3*	*0*	*0*	*4*	*5*	*1*	*1*	*7*	*9*
unidentified raptor		2	3	0	0	4	5	1	1	7	9
Overall Diurnal Raptors		**19**	**24**	**11**	**13**	**25**	**26**	**6**	**6**	**61**	**69**

Grps = Number of groups, # Obs = Number of observations

[a.] State Species of Concern tracked by the South Dakota Natural Heritage Program (SDGFP 2017)

[b.] State Species of Greatest Conservation Need (SDGFP 2014)

Mean Use, Percent of Use, and Frequency of Occurrence

Mean bird use, percent of use, and frequency of occurrence by season for all bird types and species observed during the first 20 min of surveys are shown in Appendix A2; Table 3 shows a summary of mean use and frequency of occurrence by major bird type and species of concern. The highest overall large bird use occurred during spring (36.38 birds/800-m plot/20-min survey), followed by fall (20.11), winter (9.12), and summer (3.65; Appendix A2). Seasonal large bird use was largely driven by waterfowl in the spring and winter, and by shorebirds and waterbirds in the fall and summer, respectively (Appendix A2). Small bird use was lowest in the winter (6.79 birds/100-m plot/20-min survey) compared to any other season, and was largely driven by passerine use across seasons (Appendix A3).

Waterbird use ranged from 0.42 – 1.23 birds/800-m plot/20-min survey in the fall, spring and summer, with no waterbirds being recorded in the winter (Table 3). Of the four waterbird species observed, sandhill cranes (*Antigone canadensis*) were observed only in spring and summer (0.85 and 1.17 birds/800-m plot/20-min survey, respectively) and composed the majority of observations during those seasons; use by great blue heron (*Ardea herodias*), a SSC, was recorded in all seasons but winter, ranging from 0.02 – 0.06 birds/800-m plot/20-min survey (Appendix A2). Waterbirds were observed more frequently during the spring (10.6%) compared to fall (6.4%) and summer (4.8%; Table 3).

Diurnal raptor use was highest in the fall and spring (0.55 and 0.51 raptors/800-m plot/20-min survey, respectively), followed by summer (0.21), and winter (0.12; Table 3). Higher raptor use during the fall and spring was primarily due to use of the Project area by red-tailed hawks (0.23 and 0.25, respectively). Diurnal raptor use in the winter consisted of rough legged hawks (*Buteo lagopus*), bald eagles (*Haliaeetus leucocephalus*; a SGCN), and one unidentified raptor (Table 3, Appendices A1 and A2). Diurnal raptors were observed during 38.2% of fall and 33.9% of spring surveys compared to 15.9% of summer and 8.3% of winter surveys (Table 3).

Use by Cooper's hawk (*Accipiter cooperii*; a SSC) was observed exclusively during the summer (0.02 birds/800-m plot/20-min survey) and use by northern harriers was observed exclusively during fall and spring migration (0.15 and 0.09 birds/800-m plot/20-min survey, respectively). Bald eagles were observed in all seasons but summer during the first 20 min of fixed-point bird use surveys, and were the only eagle species observed during fixed-point bird use surveys conducted at the Project (Appendix A1). Use by bald eagles ranged from 0.02 – 0.08 birds/800-m plot/20-min survey (Appendix A2) and they were observed during 2.1% of spring, fall, and winter surveys (Table 3).

Passerine use was lowest during the winter (6.58 birds/100-m plot/20-min survey), compared to any other season (Table 3), and was largely due to use by horned larks (*Eremophila alperstris*; 5.54 birds/100-m plot/20-min survey; Appendix A3). Red-winged blackbird (*Agelaius phoeniceus*) had the highest use (13.19 birds/100-m plot/20-min survey) of passerine species observed in spring, while common grackle (*Quiscalus quiscula*) had the highest passerine use during the summer and fall (16.14 and 12.00, respectively; Appendix A3). Passerines were

observed during 97.9% of spring surveys, 96.9% of summer surveys, 75.0% of fall surveys, and 62.5% of winter surveys (Appendix A3).

Table 3. Seasonal bird mean use and frequency of occurrence for waterbirds, waterfowl, passerines, diurnal raptor species, and sensitive species observed during the first 20 minutes of Year Two fixed-point bird use surveys conducted at the Prevailing Winds Wind Project in Bon Homme and Charles Mix counties, South Dakota, from May 3, 2016 – April 19, 2017.

	Mean Use[1]				Frequency of Occurrence (%)			
Type/Species	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**
Waterbirds	**0.96**	**1.23**	**0.42**	**0**	**10.6**	**4.8**	**6.4**	**0**
great blue heron[a]	0.02	0.02	0.06	0	2.1	1.6	6.4	0
Waterfowl	**29.2**	**0.48**	**5.12**	**8.71**	**44.7**	**7.8**	**6.2**	**8.3**
bufflehead	0	0	0.25	0	0	0	2.1	0
Common merganser	0	0	0	0.02	0	0	0	2.1
Diurnal Raptors	**0.51**	**0.21**	**0.55**	**0.12**	**33.9**	**15.9**	**38.2**	**8.3**
Accipiters	*0*	*0.02*	*0*	*0*	*0*	*1.7*	*0*	*0*
Cooper's hawk[a]	0	0.02	0	0	0	1.7	0	0
Buteos	*0.28*	*0.19*	*0.28*	*0.06*	*23.3*	*14.3*	*25.4*	*6.2*
red-tailed hawk	0.25	0.17	0.23	0	21.1	12.7	21.2	0
rough-legged hawk	0	0	0.04	0.06	0	0	4.2	6.2
unidentified buteo	0.02	0.02	0	0	2.2	1.6	0	0
Northern Harrier	*0.09*	*0*	*0.15*	*0*	*6.4*	*0*	*14.9*	*0*
northern harrier	0.09	0	0.15	0	6.4	0	14.9	0
Eagles	*0.08*	*0*	*0.02*	*0.04*	*2.1*	*0*	*2.1*	*2.1*
bald eagle[a,b]	0.08	0	0.02	0.04	2.1	0	2.1	2.1
Other Raptors	*0.06*	*0*	*0.10*	*0.02*	*4.2*	*0*	*8.3*	*2.1*
unidentified raptor	0.06	0	0.10	0.02	4.2	0	8.3	2.1
Passerines	**22.10**	**28.8**	**35.31**	**6.58**	**97.9**	**96.9**	**75.0**	**62.5**

Note: Totals by bird type and overall might not correspond to the sum of individual species due to rounding

1. 800-meter (m; 2,625-foot [ft]) radius plot for large birds; 100-m (328-ft) radius plot for small birds

a. State Species of Concern tracked by the South Dakota Natural Heritage Program (SDGFP 2017)

b. State Species of Greatest Conservation Need (SDGFP 2014)

State/Federally Listed Species and Sensitive Species Observations

No federally listed species (ESA 1973) were observed during Year Two of fixed-point bird use surveys conducted in the Project area from May 3, 2016 – April 19, 2017 (Table 4). One peregrine falcon, a state-listed species, was observed during the 60-min fixed-point bird use surveys (Table 4) conducted in the fall of the Year Two surveys. Twelve non-listed special-status species were recorded during fixed-point bird use surveys and incidentally, including 24 bald eagles (a SGCN) within 15 groups, and one golden eagle (*Aquila chrysaetos*; a SSC) observed incidentally in the winter of 2016 (Table 4); both eagle species are further protected under the Bald and Golden Eagle Protection Act (1940). Two additional South Dakota SGCN were recorded during the Year Two survey period: ferruginous hawk (*Buteo regalis*; three observations within three groups), and American white pelican (*Pelecanus erythrorhynchos*; 10 observations within one group). The other eight non-listed special-status species observed were: great blue heron, white-faced ibis (*Plegadis chihi*), bufflehead (*Bucephala albeola*), common merganser (*Mergus merganser*), Cooper's hawk, merlin (*Falco columbarius*), sharp-shinned hawk (*Accipiter striatus*), and Swainson's hawk (*Buteo swainsoni*); see Species Specific Summaries section for a detailed discussion of these species.

Table 4. Sensitive species observed during fixed-point bird use surveys (FP)[a] and Incidentally (Inc.) within the Prevailing Winds Wind Project in Bon Homme and Charles Mix counties, South Dakota, from May 3, 2016 – April 19, 2017.

			FP		Inc.		Total	
Species	Scientific Name	Status	# Grps	# Obs	# Grps	# Obs	# Grps	# Obs
American white pelican	*Pelecanus erythrorhynchos*	SGCN, SSC	1	10	0	0	1	10
great blue heron	*Ardea herodias*	SSC	5	5	0	0	5	5
white-faced ibis	*Plegadis chihi*	SSC	1	1	0	0	1	1
bufflehead	*Bucephala albeola*	SSC	1	12	0	0	1	12
common merganser	*Mergus merganser*	SSC	2	10	0	0	2	10
bald eagle	*Haliaeetus leucocephalus*	SGCN, SSC, BGEPA	12	20	3	4	15	24
golden eagle	*Aquila chrysaetos*	SSC, BGEPA	0	0	1	1	1	1
Cooper's hawk	*Accipiter cooperii*	SSC	1	1	0	0	1	1
ferruginous hawk	*Buteo regalis*	SGCN	3	3	0	0	3	3
merlin	*Falco columbarius*	SSC	1	1	0	0	1	1
peregrine falcon	*Falco peregrinus*	SE, SGCN, SSC	1	1	0	0	1	1
sharp-shinned hawk	*Accipiter striatus*	SSC	2	2	0	0	2	2
Swainson's hawk	*Buteo swainsoni*	SSC	2	2	0	0	2	2

Grps = Number of groups, # Obs = Number of observations

[a.] Within 60-minute (min) survey for large birds and 20-min survey for small birds

BGEPA = Bald and Golden Eagle Protection Act (1940)

SE = State Endangered,

SGCN = State Species of Greatest conservation Need (SDGFP 2014)

SSC = State Species of Concern tracked by the South Dakota Natural Heritage Program (SDGFP 2017)

Bird Flight Height and Behavior

Flight height characteristics, based on initial flight height observations and estimated use, were estimated for both bird types and species (Tables 5 and 6). During the 60-min fixed-point bird use surveys, 240 groups of large birds were observed flying within the 800-m radius plot, totaling 2,682 individuals. Although the percentage of large birds observed flying was evenly spread across flight height categories, the majority of waterbirds (78.1%) and shorebirds (84.1%) were recorded flying within the RSH, while approximately half (47.1%) of the waterfowl observations were recorded flying within the RSH for collision with turbine blades of 25 -- 200 m (82 – 656 ft) above ground level (Table 5). Diurnal raptors tended to fly within (53.6%) and below (39.3%) the RSH, with some subtype differences. The majority (61.9%) of flying buteos was recorded within the RSH, while the majority (90.0%) of harriers were recorded flying below the RSH and the majority (71.4%) of eagles were recorded flying within the RSH (Table 5).

During the first 20 min of the fixed-point bird use surveys, 326 groups of small birds were observed flying within the 100-m radius plot, totaling 3,098 individuals, mostly passerines (Table 5). Overall, 91.1% of flying small birds were recorded below the RSH (Table 5).

Table 5. Flight height (meters [m] above ground level), based on initial observation, characteristics by bird types and raptor subtypes observed during Year Two of the fixed-point bird use surveys[a] conducted at the Prevailing Winds Wind Project in Bon Homme and Charles Mix counties, South Dakota, from May 3, 2016 – April 19, 2017.

Bird Type/Subtype	# Groups Flying	# Obs Flying	Mean Flight Height (m)	% Obs Flying	% Within Flight Height Categories		
					< 25 m	25 - 200 m[b]	> 200 m
Loons/Grebes	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Waterbirds	**10**	**96**	**83.40**	**63.6**	**11.5**	**78.1**	**10.4**
Waterfowl	**54**	**1,621**	**77.76**	**77.0**	**20.9**	**47.1**	**32**
Shorebirds	**34**	**477**	**12.94**	**90.3**	**15.9**	**84.1**	**0**
Gulls/Terns	**7**	**194**	**25.43**	**100**	**90.2**	**9.8**	**0**
Rails/Coots	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Diurnal Raptors	**72**	**84**	**72.31**	**91.3**	**39.3**	**53.6**	**7.1**
Accipiters	*3*	*3*	*31.33*	*100*	*66.7*	*33.3*	*0*
Buteos	*40*	*42*	*62.83*	*91.3*	*38.1*	*61.9*	*0*
Northern Harrier	*9*	*10*	*14.11*	*90.9*	*90.0*	*10.0*	*0*
Eagles	*13*	*21*	*143.08*	*100*	*4.8*	*71.4*	*23.8*
Falcons	*2*	*2*	*8.50*	*100*	*100*	*0*	*0*
Unidentified Raptors	*5*	*6*	*119.00*	*66.7*	*50.0*	*33.3*	*16.7*
Vultures	**6**	**6**	**50.33**	**66.7**	**66.7**	**33.3**	**0**
Upland Game Birds	**2**	**3**	**1.00**	**4.2**	**100**	**0**	**0**
Doves/Pigeons	**45**	**110**	**6.33**	**72.4**	**99.1**	**0.9**	**0**
Large Corvids	**10**	**91**	**9.20**	**91.0**	**100**	**0**	**0**
Goatsuckers	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Large Birds Overall	**240**	**2,682**	**48.08**	**78.7**	**31.3**	**48.7**	**19.9**
Passerines	**320**	**3,092**	**7.64**	**64.4**	**91.1**	**8.9**	**0**
Woodpeckers	**5**	**5**	**3.80**	**38.5**	**100**	**0**	**0**
Kingfishers	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Unidentified Birds	**1**	**1**	**10.00**	**3.2**	**100**	**0**	**0**
Small Birds Overall[c]	**326**	**3,098**	**7.59**	**63.9**	**91.1**	**8.9**	**0**

Obs = Observations

[a.] 800-meter (m; 2,625-foot [ft]) radius plot and 60 min survey for large birds; 100-m (328-ft) radius plot and 20 min survey for small birds

[b.] The likely rotor-swept height for potential collision with a turbine blade, or 25 – 200 m (82 – 656 ft) above ground level

[c.] Excluding large corvids

One-hundred percent of Swainson's hawks and common merganser groups were observed flying within RSH based on initial observation (Table 6) while half (50.0%) of sharp-shinned hawk groups were observed flying within RSH; 75.0% of bald eagle and 33.3% of ferruginous hawk groups were also observed flying within RSH. No other special-status species were observed flying within the RSH at any time (Table 6).

Table 6. Flight characteristics for non-listed special-status species observed[a] during Year Two of the fixed-point bird use surveys conducted at the Prevailing Winds Wind Project in Bon Homme and Charles Mix counties, South Dakota, from May 3, 2016 – April 19, 2017.

Species	# Groups Flying	Overall Mean Use	% Flying	% Flying within RSH[b] Based on Initial Observation	% Within RSH at Any time
American white pelican	1	0.04	100	0	0
great blue heron	3	0.02	60.0	0	0
white-faced ibis	1	<0.01	100	0	0
bufflehead	0	0.06	0	0	0
common merganser	1	0.05	10	100	100
bald eagle[c]	12	0.09	100	75.0[c]	95.0
Cooper's hawk	1	<0.01	100	0	0
ferruginous hawk	3	0.01	100	33.3	33.3
merlin	1	<0.01	100	0	0
peregrine falcon	1	<0.01	100	0	0
sharp-shinned hawk	2	<0.01	100	50.0	50.0
Swainson's hawk	2	<0.01	100	100	100

[a.] 800-meter (m; 2,625-foot [ft]) radius plot and 60 min survey for large birds; 100-m (328-ft) radius plot and 20 min survey for small birds

[b.] The likely rotor-swept height (RSH) for potential collision with a turbine blade, or 25 – 200 m (82-656 ft) above ground level

[c.] Does not include the one unidentified eagle observed during fixed-point bird use surveys.

Spatial Use

For all large bird species combined, use (focused within 800 m) was highest at Point 9 (47.15 birds/20-min survey) largely due to high waterfowl use at this point (32.08 birds/20-min survey). Waterfowl were observed at all but two points, with use ranging from 0.08 – 32.42 birds/20-min survey (Table 7). Large bird use at other points ranged from 2.62 – 39.17 birds/20-min survey. Waterbird use was observed at seven of the 16 points, ranging from 0.08 (at Point 6) – 5.46 (at Point 9) birds/20-min survey and shorebird use was recorded at all points, ranging from 0.15 – 23.54 birds/20-min survey. Diurnal raptors were observed at all points but one, with use largely driven by buteos and harriers (Table 7). Diurnal raptor use was highest at Point 9 (0.62 birds/20-min survey), and ranged from 0.08 – 0.54 birds/20-min survey at other points. Eagle use (for the observations included in analysis) occurred at Points 4, 9, and 13 (0.08, 0.31, and 0.15 birds/20-min survey, respectively), while accipiters were only observed at Point 8 (0.08 birds/20-min). Small bird use (focused within 100 m), was highest at Point 8 (101.67 birds/20-min survey), and ranged from 4.08 – 84.15 birds/20-min surveys at all other points; small bird use at all points was mostly due to use by passerines (Table 7).

Eagle Use and Flight Paths

Overall, there were 205 hours (12,300 min) of eagle fixed-point use surveys (60-min surveys) conducted at the Project (Table 8) during Year Two. During this time, 20 bald eagles were visible for 135 min and one unidentified eagle for eight min. The majority of total eagle minutes as well as eagle risk minutes were accounted for during one 60-min survey on March 5, 2017 along the eastern edge of the Project at Point 9. During the survey one group of four and one group of five bald eagles were observed for a total of 72 total eagle minutes and 43 eagle risk

minutes. The unidentified eagle was recorded at Point 12 after the initial 20-min survey period. Thirteen of the 20 bald eagle observations were observed after the initial 20-min survey period, including the individuals recorded at Points 7 and 15. Flight paths for bald eagles at the Project showed no apparent pattern (Figure 3).

Table 7. Mean use recorded at each survey point during the first 20 minutes of Year Two fixed-point bird use surveys conducted at the Prevailing Winds Wind Project in Bon Homme and Charles Mix counties, South Dakota, from May 3, 2016 – April 19, 2017.

	Mean Use (number of birds/20-minute survey)[a] by Survey Point															
Bird Type	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
Loons/Grebes	**0**	**0**	**0**	**0**	**0**	**0**	**0.38**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Waterbirds	**0**	**0**	**0**	**0**	**0.46**	**0.08**	**1.85**	**0**	**5.46**	**0.23**	**2.31**	**0**	**0.38**	**0**	**0**	**0**
Waterfowl	**17.85**	**16.67**	**3.46**	**5.62**	**4.62**	**0.92**	**12.31**	**32.42**	**32.08**	**15.46**	**0**	**7.69**	**0**	**1.23**	**15.75**	**0.08**
Shorebirds	**0.31**	**0.17**	**23.54**	**0.54**	**0.92**	**1.46**	**0.62**	**0.58**	**8.54**	**0.23**	**0.15**	**0.23**	**1.92**	**0.31**	**0.50**	**0.69**
Gulls/Terns	**0.77**	**3.33**	**0**	**0**	**2.54**	**0**	**7.85**	**0**	**0**	**0.69**	**0**	**0**	**0**	**0**	**0**	**0**
Rails/Coots	**0**	**0**	**0.08**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Diurnal Raptors	**0.46**	**0.42**	**0.08**	**0.54**	**0.23**	**0.23**	**0.23**	**0.17**	**0.62**	**0.46**	**0.46**	**0.54**	**0.54**	**0.15**	**0**	**0.23**
Accipiters	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0.08*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Buteos	*0.31*	*0.25*	*0*	*0.38*	*0.08*	*0.15*	*0.15*	*0.08*	*0.08*	*0.31*	*0.38*	*0.46*	*0.31*	*0.15*	*0*	*0.08*
Northern Harrier	*0.08*	*0.17*	*0*	*0.08*	*0.15*	*0.08*	*0.08*	*0*	*0.08*	*0.08*	*0.08*	*0*	*0*	*0*	*0*	*0*
Eagles	*0*	*0*	*0*	*0.08*	*0*	*0*	*0*	*0*	*0.31*	*0*	*0*	*0*	*0.15*	*0*	*0*	*0*
Unidentified Raptors	*0.08*	*0*	*0.08*	*0*	*0*	*0*	*0*	*0*	*0.15*	*0.08*	*0*	*0.08*	*0.08*	*0*	*0*	*0.15*
Vultures	**0**	**0.08**	**0**	**0.15**	**0.08**	**0**	**0**	**0**	**0**	**0**	**0**	**0.23**	**0**	**0.08**	**0.08**	**0**
Upland Game Birds	**0.92**	**0.25**	**0.15**	**0.23**	**0.23**	**0.31**	**0.23**	**0.17**	**0.23**	**0.15**	**0.15**	**0.31**	**0.15**	**0.31**	**0.33**	**1.38**
Doves/Pigeons	**0.23**	**0.50**	**0.08**	**0.46**	**0.08**	**0.08**	**0.46**	**0.83**	**0.23**	**1.31**	**4**	**0.46**	**2.08**	**0.54**	**0.25**	**0.23**
Large Corvids	**0**	**0**	**0**	**0.15**	**0.15**	**0**	**0.08**	**5.00**	**0**	**0.08**	**0.08**	**0.38**	**0**	**0**	**2.17**	**0.15**
Goatsuckers	**0.08**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Overall large birds	**20.62**	**21.42**	**27.38**	**7.69**	**9.31**	**3.08**	**24.00**	**39.17**	**47.15**	**18.62**	**7.15**	**9.85**	**5.08**	**2.62**	**19.08**	**2.77**
Passerines	**8.77**	**18.50**	**6.08**	**7.00**	**10.62**	**12.85**	**18.77**	**101.42**	**10**	**37.62**	**23.92**	**11.00**	**4.00**	**15.15**	**9.83**	**83.92**
Woodpeckers	**0**	**0**	**0**	**0.08**	**0**	**0**	**0.08**	**0.17**	**0.08**	**0.08**	**0**	**0.23**	**0.08**	**0.15**	**0.08**	**0**
Kingfishers	**0**	**0**	**0**	**0**	**0**	**0**	**0.08**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Unidentified Birds	**0.23**	**0.17**	**0**	**0.15**	**0.15**	**0.23**	**0.15**	**0.08**	**0.15**	**0**	**0**	**0**	**0**	**0.08**	**0.83**	**0.23**
Overall small birds	**9.00**	**18.67**	**6.08**	**7.23**	**10.77**	**13.08**	**19.08**	**101.67**	**10.23**	**37.69**	**23.92**	**11.23**	**4.08**	**15.38**	**10.75**	**84.15**

800-m (m; 2,625-foot [ft]) radius plot for large birds; 100-m (328-ft) radius plot for small birds

Table 8. Survey effort, number of eagle observations and groups, total eagle minutes (min), risk minutes, and eagle use by season, observed during Year Two of the 60-min bird use surveys conducted at the Prevailing Winds Wind Project in Bon Homme and Charles Mix counties, South Dakota, from May 3, 2016 – April 19, 2017.

Season	Survey Effort (hours)	Number of Eagle Observations	Number of Groups	Total Eagle Minutes	Risk Minutes[a]	Eagle Use[b]
Bald Eagle						
Spring	47	14	6	75	45	0.29
Summer	63	2	2	25	6	0.03
Fall	47	1	1	8	5	0.02
Winter	48	3	3	27	14	0.06
Overall Bald Eagle	**205**	**20**	**12**	**135**	**70**	
Unidentified Eagle						
Spring	47	0	0	0	0	0
Summer	63	0	0	0	0	0
Fall	47	1	1	8	8	0.02
Winter	48	0	0	0	0	0
Overall Unidentified Eagle	**205**	**1**	**1**	**8**	**8**	**0**

[a.] Where eagles flew below 200 meters (m) above ground level and within 800 m of the observer

[b.] Eagles/800-m plot/60 minutes

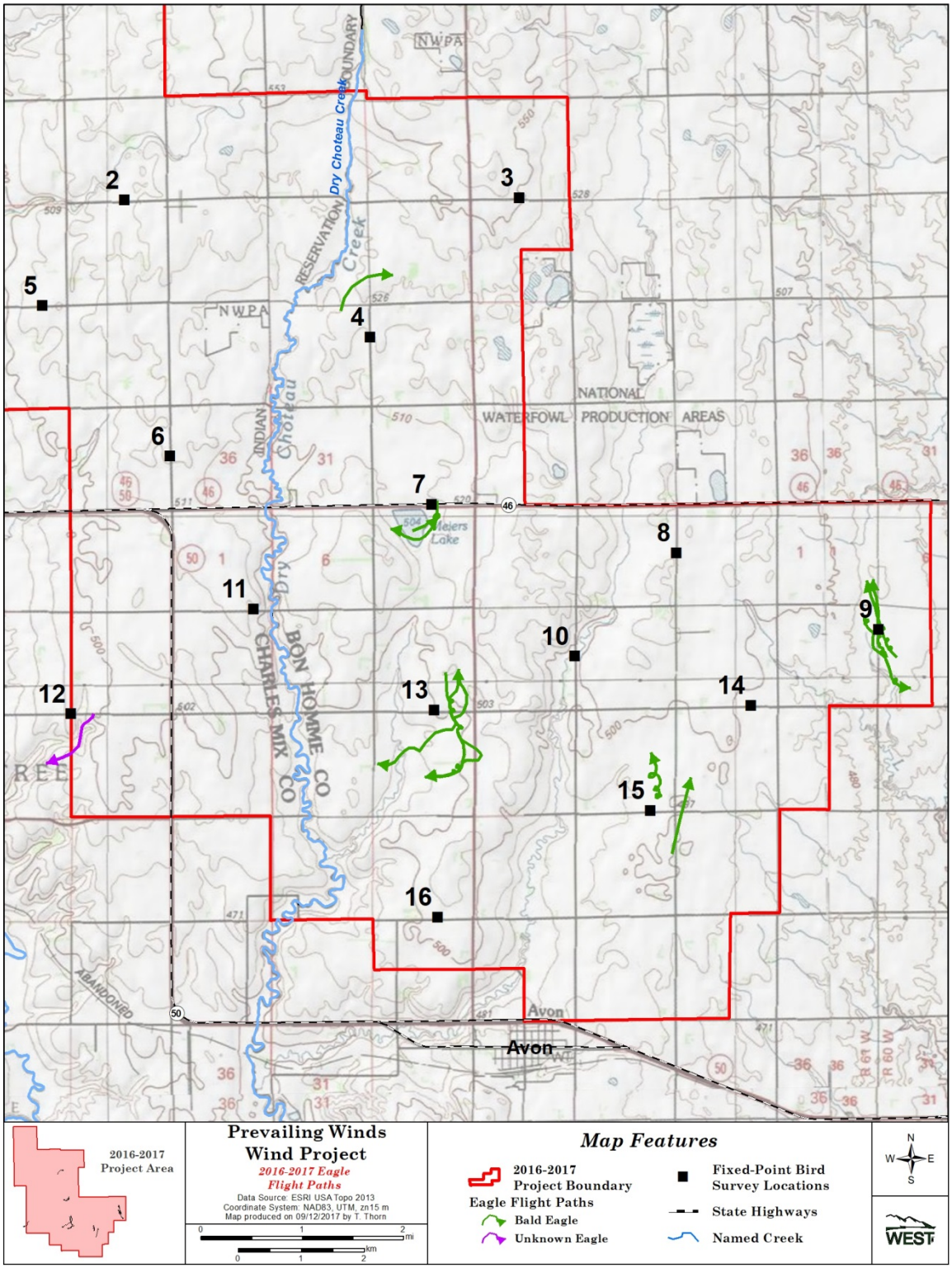

Figure 3. Eagle flight paths observed during the Year Two 60-minute fixed-point bird use surveys conducted at the at the Prevailing Winds Wind Project in Bon Homme and Charles Mix counties, South Dakota, from May 3, 2016 – April 19, 2017.

Incidental Observations

Thirty-six unique bird species and 10 unidentified species were observed incidentally at the Project, totaling 4,029 birds within 379 separate groups (Table 9). Sandhill crane (763 birds within seven groups) and Canada goose (*Branta canadensis*; 400 birds within 19 groups) were the most abundant incidental species observed at the Project (Table 9). Six unique and four unidentified diurnal raptor species were recorded incidentally during the Year Two survey period, totaling 177 individuals within 164 groups. Red-tailed hawk was the most abundant (114 birds within 104 groups) diurnal raptor recorded incidentally; American kestrel (*Falco sparverius*) and golden eagle were only observed incidentally, with three and one observations, respectively (Table 9).

Table 9. Incidental wildlife observed while conducting all surveys at the at the Prevailing Winds Wind Project in Bon Homme and Charles Mix counties, South Dakota, from May 3, 2016 – April 19, 2017.

Species	Scientific Name	# Groups	# Individuals
double-crested cormorant	*Phalacrocorax auritus*	2	2
sandhill crane	*Antigone canadensis*	7	763
blue-winged teal	*Anas discors*	3	13
cackling goose	*Branta hutchinsii*	14	289
Canada goose	*Branta canadensis*	19	400
Canvasback[a]	*Aythya valisineria*	2	33
greater white-fronted goose	*Anser albifrons*	5	87
Mallard	*Anas platyrhynchos*	8	30
northern pintail	*Anas acuta*	1	5
northern shoveler	*Anas clypeata*	1	1
redhead[a]	*Aythya americana*	1	50
ring-necked duck	*Aythya collaris*	1	20
Ross' goose[a]	*Chen rossii*	6	88
ruddy duck	*Oxyura jamaicensis*	2	12
snow goose	*Chen caerulescens*	6	332
unidentified duck		6	25
unidentified goose		3	1,196
unidentified waterfowl		4	54
Killdeer	*Charadrius vociferus*	26	40
upland sandpiper	*Bartramia longicauda*	7	7
Bonaparte's gull[a]	*Chroicocephalus philadelphia*	2	26
Franklin's gull	*Leucophaeus pipixcan*	2	60
ring-billed gull	*Larus delawarensis*	8	60
unidentified gull		2	22
American kestrel[a]	*Falco sparverius*	3	3
bald eagle	*Haliaeetus leucocephalus*	3	4
golden eagle[a]	*Aquila chrysaetos*	1	1
northern harrier	*Circus cyaneus*	17	18
rough-legged hawk	*Buteo lagopus*	9	9
red-tailed hawk	*Buteo jamaicensis*	104	114
unidentified accipiter	*Accipiter spp*	4	4
unidentified buteo	*Buteo spp*	6	7
unidentified eagle		2	2
unidentified raptor		15	15
turkey vulture	*Cathartes aura*	15	24
ring-necked pheasant	*Phasianus colchicus*	24	31

Table 9. Incidental wildlife observed while conducting all surveys at the at the Prevailing Winds Wind Project in Bon Homme and Charles Mix counties, South Dakota, from May 3, 2016 – April 19, 2017.

Species	Scientific Name	# Groups	# Individuals
wild turkey	*Meleagris gallopavo*	2	12
Eurasian collared-dove	*Streptopelia decaocto*	2	2
rock pigeon	*Columba livia*	5	16
American crow	*Corvus brachyrhynchos*	22	94
American robin	*Turdus migratorius*	1	2
blue jay	*Cyanocitta cristata*	2	3
northern shrike	*Lanius excubitor*	1	1
unidentified blackbird		1	50
northern flicker	*Colaptes auratus*	1	1
unidentified large bird		1	1
Total		**379**	**4,029**

[a.] Species that were only 0bserved incidentally.

DISCUSSION

The Guidelines use a tiered approach to assess impacts to species and their habitats, and avian use surveys are one of a suite of Tier 3 studies used to inform risk at the Project. Tier 3 studies were targeted to address questions regarding impact that could not be sufficiently addressed using available literature (i.e., Tiers 1 and 2 desktop analyses). These studies provide additional data that, when combined with available literature reviewed in previous Tiers, allow for a confident assessment of the risk of significant population-level adverse impacts to sensitive species; identify measures to mitigate significant adverse impacts, if necessary; and/or identify a need for more field studies, if the current survey effort did not provide sufficient data to adequately characterize the potential for significant adverse impacts to such species. While the avian use surveys reported herein were conducted across all species observed, the report focuses on a smaller group of species – diurnal raptors, eagles, listed species, and State sensitive species.

The impact of wind energy development on birds can be direct or indirect. Direct impacts include fatalities or injury associated with facility infrastructure and the loss of habitat where infrastructure is placed. Indirect impacts include the displacement of wildlife and rendering habitat unsuitable through fragmentation of the landscape.

The focus of this study was mainly to document large bird use with an emphasis on eagles and diurnal raptors. The majority (86%) of all bird observations during this study were waterfowl or passerine species. The most common waterfowl species were snow and greater-white fronted geese, while the most common passerine species were common grackle and red-winged blackbird. Waterbirds composed a small percentage of the total bird observations, with sandhill cranes being the most abundant waterbird species recorded during bird use surveys. Relatively few (69 observations) diurnal raptors were observed during standardized surveys and 177 were recorded incidentally. The most common diurnal raptor species was red-tailed hawk, documented both incidentally and during scheduled surveys; golden eagles were documented

only incidentally within the Project area, while bald eagles were documented both incidentally and during fixed-point bird use surveys. One State-listed species (the State-endangered peregrine falcon) was documented during the Year Two survey period; no federally listed species were documented within the Project area during the survey period. Diurnal raptors and State sensitive species are discussed in more detail below;

Diurnal Raptors

Annual mean diurnal raptor use at the Project was 0.33 raptors/800-m plot/20-min survey, with highest use in the fall and spring, likely from an influx of migrating raptors. Mean raptor use was compared with other wind energy facilities that implemented similar protocols and had data covering similar seasons, ranking 33rd from the highest compared to the 47 other wind energy facilities in North America (Figure 4).

Publicly available data containing both mean raptor use and raptor fatality information in the Midwest is scarce, while data having this information for four seasons is even rarer (Table 10). The Beethoven Project, immediately adjacent to the Project, had a mean raptor use of 0.103 raptors/800-m plot/20-min survey (Derby and Thorn 2014) and a raptor fatality rate of 0.07 fatalities/MW/year (WEST 2016; Table 10). The Wessington Springs Project, approximately 80 miles north of the project, in South Dakota had a mean raptor use of 0.23 raptors/800-m plot/20-min survey and raptor fatality rates of 0.06 and 0.07 fatalities/MW/year during two separate years of fatality monitoring (Derby et al. 2010f, 2011d). Raptor fatality rates reported at other South Dakota wind energy facilities have ranged from 0 – 0.20 fatalities/MW/year (Table 10). Raptor fatality rates throughout the Midwest have ranged from zero at numerous facilities to 0.47 fatalities/MW/year at Buffalo Ridge, Phase I (Johnson et al. 2000a).

In the Midwest states, 55 diurnal raptor fatalities representing seven species have been documented at wind energy facilities in publicly available fatality studies. Red-tailed hawks represented most of the fatalities (38 fatalities; 69.1% of raptor fatalities), followed by American kestrel (five fatalities; 9.1% of raptor fatalities), sharp-shinned hawk (four fatalities; 7.3% of raptor fatalities), rough-legged hawk (three fatalities; 5.5% of raptor fatalities), and Cooper's hawk (two fatalities; 3.6% of raptor fatalities). Each of the remaining species (merlin, Swainson's hawk, and unidentified raptor) accounted for one fatality each. These are unadjusted, raw data. Cumulative fatalities and species are from data compiled by WEST from publicly available fatality studies (a list of facilities and references are available from WEST). Based on the currently available data, raptor fatality rates in the Project will likely be similar to other wind energy facilities in the Midwest that also have low raptor use and are likely to consist of the relatively common and widespread species documented in this survey.

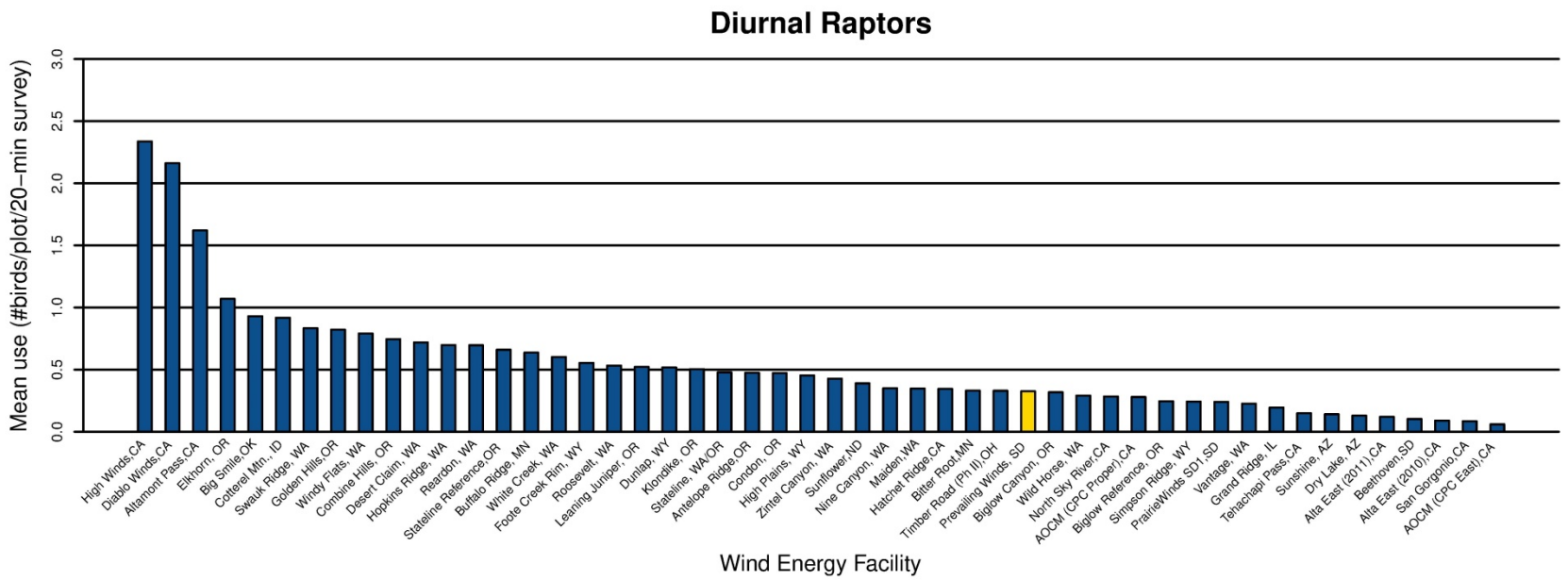

Figure 4. Comparison of estimated annual diurnal raptor use during the Year Two of the fixed-point bird use surveys conducted at the Prevailing Winds Wind Project in Bon Homme and Charles Mix counties, South Dakota, from May 3, 2016 – April 19, 2017, and diurnal raptor use at other US wind resource areas with comparable raptor use data.

Data from the following sources:

Study and Location	Reference	Study and Location	Reference	Study and Location	Reference
Prevailing Winds, SD	This study.				
High Winds, CA	Kerlinger et al. 2005	Foote Creek Rim, WY	Johnson et al. 2000b	Wild Horse, WA	Erickson et al. 2003d
Diablo Winds, CA	WEST 2006	Roosevelt, WA	NWC and WEST 2004	North Sky River, CA	Erickson et al. 2011
Altamont Pass, CA	Orloff and Flannery 1992	Leaning Juniper, OR	Kronner et al. 2005	AOCM (CPC Proper), CA	Chatfield et al. 2010
Elkhorn, OR	WEST 2005a	Dunlap, WY	Johnson et al. 2009a	Biglow Reference, OR	WEST 2005c
Big Smile (Dempsey), OK	Derby et al. 2010a	Klondike, OR	Johnson et al. 2002	Simpson Ridge, WY	Johnson et al. 2000b
Cotterel Mtn., ID	BLM 2006	Stateline, WA/OR	Erickson et al. 2003a	Vantage, WA	Jeffrey et al. 2007
Swauk Ridge, WA	Erickson et al. 2003b	Antelope Ridge, OR	WEST 2009	Grand Ridge, IL	Derby et al. 2009
Golden Hills, OR	Jeffrey et al. 2008	Condon, OR	Erickson et al. 2002b	Tehachapi Pass, CA	Anderson et al. 2000, Erickson et al. 2002b
Windy Flats, WA	Johnson et al. 2007	High Plains, WY	Johnson et al. 2009b	Sunshine, AZ	WEST and the CPRS 2006
Combine Hills, OR	Young et al. 2003c	Zintel Canyon, WA	Erickson et al. 2002a, 2003c	Dry Lake, AZ	Young et al. 2007b
Desert Claim, WA	Young et al. 2003b	Nine Canyon, WA	Erickson et al. 2001	Alta East (2011), CA	Chatfield et al. 2011
Hopkins Ridge, WA	Young et al. 2003a	Maiden, WA	Young et al. 2002	Alta East (2010), CA	Chatfield et al. 2011
Reardon, WA	WEST 2005b	Hatchet Ridge, CA	Young et al. 2007a	San Gorgonio, CA	Anderson et al. 2000, Erickson et al. 2002b
Stateline Reference, OR	URS et al. 2001	Bitter Root. MN	Derby and Dahl 2009	AOCM (CPC East), CA	Chatfield et al. 2010
Buffalo Ridge, MN	Johnson et al. 2000a	Timber Road (Phase II), OH	Good et al. 2010	Beethoven, SD	Derby and Thorn 2014
White Creek, WA	NWC and WEST 2005	Biglow Canyon, OR	WEST 2005c		

Table 10. Raptor use (number of raptors/plot/20-minute survey) and fatality (number of bird fatalities/megawatt/year) estimates for wind-energy facilities in the Midwest with publicly available data.

Project Name	Raptor Use Estimate	Raptor Fatality Estimate	Total #of Turbines	Total MW	Use Reference	Fatality Reference
Barton I & II, IA (2010-2011)	NA	0	80	160.0		Derby et al. 2011a
Beethoven (2016-2016)	0.103	0.07	43	80.0	Derby and Thorn 2014	WEST 2016
Big Blue, MN (2013)	NA	0	18	36.0		Fagen Engineering 2014
Big Blue, MN (2014)	NA	0	18	36.0		Fagen Engineering 2015
Blue Sky Green Field, WI (2008; 2009)	NA	0	88	145.0		Gruver et al. 2009
Buffalo Ridge I, SD (2009-2010)	NA	0.20	24	50.4		Derby et al. 2010b
Buffalo Ridge II, SD (2011-2012)	NA	0	105	210.0		Derby et al. 2012a
Buffalo Ridge, MN (Phase I; 1996)	NA	0	73	25.0		Johnson et al. 2000a
Buffalo Ridge, MN (Phase I; 1997)	NA	0	73	25.0		Johnson et al. 2000a
Buffalo Ridge, MN (Phase I; 1998)	NA	0	73	25.0		Johnson et al. 2000a
Buffalo Ridge, MN (Phase I; 1999)	NA	0.47	73	25.0		Johnson et al. 2000a
Buffalo Ridge, MN (Phase II; 1998)	NA	0	143	107.3		Johnson et al. 2000a
Buffalo Ridge, MN (Phase II; 1999)	NA	0	143	107.3		Johnson et al. 2000a
Buffalo Ridge, MN (Phase III; 1999)	NA	0	138	103.5		Johnson et al. 2000a
Cedar Ridge, WI (2009)	NA	0.18	41	67.6		BHE Environmental 2010
Cedar Ridge, WI (2010)	NA	0.13	41	68.0		BHE Environmental 2011
Elm Creek II, MN (2009-2010)	NA	0	67	100.0		Derby et al. 2010c
Elm Creek, MN (20011-2012)	NA	0	62	148.8		Derby et al. 2012b
Fowler I, IN (2009)	NA	0	162	301.0		Johnson et al. 2010
Grand Ridge I, IL (2009-2010)	0.2	0	66	99.0	Derby et al. 2009	Derby et al. 2010g
Kewaunee County, WI (1999-2001)	NA	0	31	20.5		Howe et al. 2002
Moraine II, MN (2009)	NA	0.37	33	49.5		Derby et al. 2010d
NPPD Ainsworth, NE (2006)	NA	0.06	36	20.5		Derby et al. 2007
Pioneer Prairie II, IA (2011-2012)	NA	0	62	102.3		Chodachek et al. 2012
PrairieWinds ND1 (Minot), ND (2010)	NA	0.05	80	115.5		Derby et al. 2011c
PrairieWinds ND1 (Minot), ND (2011)	NA	0.05	80	115.5		Derby et al. 2012c
PrairieWinds SD1, SD (2011-2012)	NA	0	108	162.0		Derby et al. 2012d
PrairieWinds SD1, SD (2012-2013)	NA	0.03	108	162.0		Derby et al. 2013
PrairieWinds SD1, SD (2013-2014)	NA	0.17	108	162.0		Derby et al. 2014
Rail Splitter, IL (2012-2013)	NA	0	67	100.5		Good et al. 2013
Ripley, Ont (2008)	NA	0.10	38	76.0		Jacques Whitford 2009
Rugby, ND (2010-2011)	NA	0.06	71	149.0		Derby et al. 2011b
Top of Iowa, IA (2003)	NA	0	89	80.0		Jain 2005
Top of Iowa, IA (2004)	NA	0.17	89	80.0		Jain 2005
Wessington Springs, SD (2009)	0.23	0.06	34	51.0	Derby et al. 2008	Derby et al. 2010f

Table 10. Raptor use (number of raptors/plot/20-minute survey) and fatality (number of bird fatalities/megawatt/year) estimates for wind-energy facilities in the Midwest with publicly available data.

Project Name	Raptor Use Estimate	Raptor Fatality Estimate	Total #of Turbines	Total MW	Use Reference	Fatality Reference
Wessington Springs, SD (2010)	0.23	0.07	34	51.0	Derby et al. 2008	Derby et al. 2011d
Winnebago, IA (2009-2010)	NA	0.27	10	20.0		Derby et al. 2010e

This fixed-point bird use survey was designed to provide a relative index of use by raptors during all seasons at the Project. While mean diurnal raptor use was higher during the fall and spring (0.55 and 0.51 raptors/800-m plot/20-min survey), probably due to an influx of migrant birds, the Project is not located within a known raptor migration corridor, and there are no features unique to the Project area, as compared to adjacent areas, that would appear to attract large numbers of diurnal raptors. Furthermore, raptor fatality rates reported from studies in the Midwest are typically low. Site-specific and regional data suggest there is some potential for raptor mortality, but these potential impacts to individuals are unlikely to cause significant adverse impacts to raptor populations. Likewise, there is some potential for habitat loss and displacement of individuals, but the resources available within the Project area are widely available at the local landscape level; therefore, any diurnal raptor habitat loss and displacement attributable to the Project is unlikely to result in significant adverse population-level impacts to raptors.

While abundance is intuitively connected to raptor fatality risk to some degree, risk is likely influenced by other factors as well, such as species-specific flight behaviors. Diurnal raptors were observed flying within all three fleight height categories; although the majority (53.6%) of diurnal raptors were observed flying within RSH, some differences were observed among raptor suptypes. A higher proportion of buteos and eagles flew within the RSH compared to other raptor types, while most of the harriers were observed flying below RSH, potentially indicating that some species may have a higher risk for collision; however, many of these are based on a few individual observations.

Species-Specific Summaries

American white Pelican, white-faced ibis, bufflehead, and common merganser

A single flock of 10 American white pelicans was recorded flying over the Project area in the spring; one white-faced ibis was recorded flying over the Project area in the summer; one group of 12 bufflehead was recorded using open water habitats within the Project area in the fall; and two common merganser groups, totaling 10 individuals, were observed flying over or using open water habitats within the Project area in the winter and spring. The limited number of sightings suggests that the Project area is not a major stopover or breeding area for any of these non-listed special-status species. Furthermore, habitats within the Project area are not unique in the general region, thus development of the Project would likely have minimal population-level impacts.

Great blue heron

Five great blue herons, a common summer resident and migrant in South Dakota, were recorded during the surveys conducted at the Project. Site-specific data indicate that use of the Project area by this species is low and population-level effects from Project development are unlikely.

Bald and golden eagles

A total of 24 bald eagle observations (20 during 60-min surveys and regardless of distance from observer, and four incidentally) were recorded within the Project area during Year Two surveys conducted from May 3, 2016 – April 19, 2017 (Table 4). The majority of total eagle minutes were accounted for during one survey in spring 2017 when two groups, totaling nine individual bald eagles, were observed at Point 9 for 72 total minutes. The majority (71.4%) of flying bald eagles recorded during fixed-point bird use surveys were observed within the RSH (Table 5). Bald eagles are uncommon in migration, summer, and winter throughout South Dakota; however, they are locally common below the Missouri River dams in winter and nesting within the State is increasingly reported (South Dakota Birds, Birding, and Nature 2017).

One golden eagle was recorded incidentally in the winter of 2016; no golden eagle nests were recorded during raptor nest surveys conducted in April of 2016, with most golden eagle nesting habitat in South Dakota found in the western portion of the state. Golden eagles are generally found on wide open prairies in the western half of the US (All About Birds 2017). In South Dakota, golden eagles are very often found on the Fort Pierre National Grasslands, located approximately 289.7 km (180 mi) northwest of the Project area, especially in winter and migration (South Dakota Birds, Birding, and Nature 2017).

The number and timing of eagle observations recorded during Year Two of the fixed-point bird use surveys suggest that year-round eagle use is expected. The presence of active bald eagle nests in the vicinity of the Project (Derby 2016) indicates bald eagles are present in the general area for an extended period of time (breeding season). Thus, development of the Project may influence individuals moving through or using the Project area, but given low use and apparent relatively low susceptibility of bald eagles to turbine impacts, potential impact to bald eagle populations appears minimal.

Swainson's and Ferruginous Hawk

There were two observations of Swainson's and three observations of ferruginous hawks during the Year Two study period (Table 4). Both of the Swainson's hawk observations were of flying individuals within the RSH and one of the three ferruginous hawk observations were within the RSH (Table 6). Swainson's hawks are common in South Dakota and utilize a variety of habitats, including open grasslands with occasional trees and shrubs, wetland edges, and agriculture fields, nesting in trees, shrubs, or occasionally on the ground (South Dakota Birds, Birding, and Nature 2017). Ferruginous hawk, an uncommon migrant and summer resident, is rarely observed in winter, and inhabits grasslands and open areas (South Dakota Birds, Birding, and Nature 2017).

The potential for individual mortality does exist for both species; however, the low number of fatalities reported throughout projects in the Midwest (one Swainson's hawk and no ferruginous hawk fatalities out of 55 total reported fatalities) suggests that these species are not particularly susceptible to turbine collisions in the Midwest. Collision mortality may affect a few individuals, but are unlikely to cause significant adverse impacts to either populations of the species.

Sharp-shinned and Cooper's Hawk

Two sharp-shinned hawks and one Cooper's hawk were recorded during the study period (Table 4). Both are an uncommon migrant in South Dakota, generally preferring wooded areas (South Dakota Birds, Birding, and Nature 2017). Only two Cooper's hawks and no sharp-shinned hawks have been found as fatalities through projects in the Midwest. Collision mortality may affect a few individuals of these species, but significant population-level impacts are unlikely.

Peregrine Falcon

Peregrine falcons, listed as endangered in the state of South Dakota, can be found in a variety of habitats, including tundra, moorlands, steppe, and seacoasts, especially where there are suitable nesting cliffs, mountains, open forested regions, and human population centers (All About Birds 2017). When not breeding, they occur in areas where prey concentrate, including farmlands, marshes, lakeshores, river mouths, tidal flats, dunes and beaches, broad river valleys, cities, and airports. Still uncommon throughout most of its former range, reintroduction programs and natural reproduction are resulting in slowly increasing numbers and range (South Dakota Birds, Birding, and Nature 2017). In 2017, the SDGFP confirmed that two pairs of peregrine falcons successfully nested in the Black Hills of South Dakota, located approximately 300 miles west of the Project (Capital Journal 2017).

One juvenile peregrine falcon was recorded during the Year Two fixed-point bird use surveys, using grassland habitats within the Project area during the fall of 2016. Peregrine falcons have been reported in the general region where the Project is located, the closest one recorded on April of 2017 in Bon Homme County along the Missouri River, approximately 20 km (12.4 mi) to the southeast of the Project area (eBird 2017). Significant use of the Project area is unlikely due to the lack of nesting habitat and negative impacts from Project development are not expected.

YEAR ONE AND YEAR TWO SURVEYS COMPARISON SUMMARY

Ninety unique bird species were recorded during Year Two of bird use surveys compared to 72 unique bird species recorded in Year One of surveys conducted at the Project area, mainly due to a higher number of species recorded in the summer of 2016 – 2017 (60 unique species) compared to the summer of 2015 – 2016 (43 unique species). Temporal patterns of bird use were similar between years, with summer having the highest overall use, followed by migration seasons, and use being the lowest during winter. Species richness patterns were also similar between years, with overall species richness being higher for small birds compared to large birds; however, small bird species richness recorded in Year Two was almost twice as the small bird species richness recorded during Year One of surveys (2.64 and 1.64 mean number of species/plot/20-min survey, respectively).

Passerines were the most recorded bird type in both Year One and Year Two of surveys; two species composed approximately one-third (29%) of all observations in Year Two, compared to six species that composed approximately half (52%) of all observation in Year One, with red-

winged blackbird being one of the most common species in both years. Waterfowl accounted for the majority of large bird observations in both years, with snow geese being the most recorded waterfowl species in Year Two and Canada geese being the most recorded waterfowl species in Year One. Waterbirds accounted for 1.5% of the total bird observations in Year Two with four species; they composed 9% of the total bird observations in Year One with only two species. Sandhill cranes were the most recorded waterbird species in both years.

Sixty-nine diurnal raptor observations within 61 groups were recorded in Year Two, compared to 89 within 83 groups Year One. Number of unique diurnal raptor species was similar between years (five in Year Two and eight in Year One); diurnal raptor species composition was similar between years, with red-tailed hawk and northern harrier being the most recorded diurnal raptor species. Diurnal raptor species composition varied between years, with American kestrel, Swainson's hawk, and northern goshawk recorded only in Year One. Peregrine falcon was recorded only during Year Two surveys and golden eagle was observed (incidentally) only during the Year Two survey period.

Patterns of bird use varied seasonally between years. Large Bird use was highest in the spring and lowest in the summer in both years; small bird use patterns were different between years, with winter bird use being the lowest compared to any other season during Year Two surveys and the second highest during Year One surveys. Frequency of occurrence of waterbirds was similar between years, but mean use patterns were different, with waterbird use being recorded in all seasons but winter during Year Two surveys and only migration seasons during Year One surveys; almost 10 times less waterbird use was recorded in spring of Year Two surveys compared to Year One.

Diurnal raptor use was highest in the fall during both years; spring use was the second highest during Year Two and the lowest during Year One surveys. Species-specific patterns of use were different between years, with use by Cooper's hawk being observed only in the summer of Year Two surveys, and both the fall and winter of Year One surveys. Bald eagle use was observed in all seasons but summer during Year Two surveys, and only in the winter during Year One surveys. Winter passerine use was lowest compared to any other season during Year Two surveys and was the second highest during Year One surveys.

Spatial patterns of bird use were similar between years. Although use by point varied annually and seasonally, large bird use by point was largely driven by waterfowl (generally high across points) and shorebirds (lower but consistent across points). Diurnal raptors were observed at all points but one, with use largely driven by buteos and harriers.

Diurnal raptor use at the Project was low during both years (0.33 and 0.31 raptors/800-m plot/20-min survey during Year Two and Year One, respectively), compared to other US wind facilities and comparable to other wind energy facilities in the Midwest with publicly available data. Eagle use was different between years, being higher in Year Two (20 bald eagles for a total of 135 min) compared to Year One (four bald eagles for a total of 15 min). It is unknown why eagle use was higher in Year Two compared to Year One, but most use was focused on

just a one day during migration in Year Two at point 9. Based on current Project design, Point 9 is no longer part of the planned Project area.

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Appendix A. Descriptive Statistics for Bird Species Recorded during Year Two of Fixed-Point Bird Use Surveys Conducted at the Prevailing Winds Project in Bon Homme and Charles Mix counties, South Dakota, from May 3, 2016 – April 19, 2017

Appendix A1. Summary of individuals and group observations, regardless of distance from observer, by bird type and species recorded during the first 20 minutes of Year Two fixed-point bird use surveys conducted in the Prevailing Winds Wind Project in Bon Homme and Charles Mix counties, South Dakota, from May 3, 2016 – April 19, 2017.

		Spring		Summer		Fall		Winter		Total	
Type/Species	Scientific Name	# Grps	# Obs	# Grps	# Obs	# Grps	# Obs	# Grps	# Obs	# Grps	# Obs
Loons/Grebes		**0**	**0**	**0**	**0**	**1**	**5**	**0**	**0**	**1**	**5**
unidentified grebe		0	0	0	0	1	5	0	0	1	5
Waterbirds		**6**	**46**	**4**	**74**	**5**	**20**	**0**	**0**	**15**	**140**
double-crested cormorant	*Phalacrocorax auritus*	1	4	0	0	2	17	0	0	3	21
glossy ibis	*Plegadis falcinellus*	0	0	2	3	0	0	0	0	2	3
great blue heron[a]	*Ardea herodias*	1	1	1	1	3	3	0	0	5	5
sandhill crane	*Antigone canadensis*	4	41	1	70	0	0	0	0	5	111
Waterfowl		**45**	**1,400**	**16**	**31**	**8**	**246**	**10**	**418**	**79**	**2,095**
blue-winged teal	*Anas discors*	5	10	7	12	0	0	0	0	12	22
bufflehead[a]	*Bucephala albeola*	0	0	0	0	1	12	0	0	1	12
cackling goose	*Branta hutchinsii*	3	74	0	0	0	0	0	0	3	74
Canada goose	*Branta canadensis*	4	21	0	0	0	0	2	8	6	29
common merganser[a]	*Mergus merganser*	0	0	0	0	0	0	1	1	1	1
greater white-fronted goose	*Anser albifrons*	2	129	0	0	0	0	2	350	4	479
green-winged teal	*Anas crecca*	0	0	1	1	1	2	0	0	2	3
mallard	*Anas platyrhynchos*	9	12	5	12	2	201	3	17	19	242
northern pintail	*Anas acuta*	2	10	0	0	0	0	0	0	2	10
northern shoveler	*Anas clypeata*	0	0	2	3	0	0	0	0	2	3
ring-necked duck	*Aythya collaris*	2	28	0	0	0	0	0	0	2	28
ruddy duck	*Oxyura jamaicensis*	0	0	0	0	1	1	0	0	1	1
snow goose	*Chen caerulescens*	7	496	1	3	0	0	0	0	8	499
unidentified duck		4	95	0	0	0	0	0	0	4	95
unidentified goose		4	480	0	0	0	0	0	0	4	480
unidentified waterfowl		3	45	0	0	3	30	2	42	8	117
Shorebirds		**41**	**58**	**20**	**26**	**12**	**443**	**1**	**1**	**74**	**528**
killdeer	*Charadrius vociferus*	41	58	18	23	7	21	0	0	66	102
unidentified shorebird		0	0	0	0	5	422	1	1	6	423
upland sandpiper	*Bartramia longicauda*	0	0	2	3	0	0	0	0	2	3
Gulls/Terns		**4**	**83**	**1**	**1**	**2**	**110**	**0**	**0**	**7**	**194**
Franklin's gull	*Leucophaeus pipixcan*	3	82	0	0	1	10	0	0	4	92
Herring gull	*Larus argentatus*	0	0	1	1	0	0	0	0	1	1
ring-billed gull	*Larus delawarensis*	1	1	0	0	0	0	0	0	1	1
unidentified gull		0	0	0	0	1	100	0	0	1	100

Appendix A1. Summary of individuals and group observations, regardless of distance from observer, by bird type and species recorded during the first 20 minutes of Year Two fixed-point bird use surveys conducted in the Prevailing Winds Wind Project in Bon Homme and Charles Mix counties, South Dakota, from May 3, 2016 – April 19, 2017.

		Spring		Summer		Fall		Winter		Total	
Type/Species	Scientific Name	# Grps	# Obs	# Grps	# Obs	# Grps	# Obs	# Grps	# Obs	# Grps	# Obs
Rails/Coots		**0**	**0**	**1**	**1**	**0**	**0**	**0**	**0**	**1**	**1**
American coot	*Fulica americana*	0	0	1	1	0	0	0	0	1	1
Diurnal Raptors		**19**	**24**	**11**	**13**	**25**	**26**	**6**	**6**	**61**	**69**
Accipiters		*0*	*0*	*1*	*1*	*0*	*0*	*0*	*0*	*1*	*1*
Cooper's hawk[a]	*Accipiter cooperii*	0	0	1	1	0	0	0	0	1	1
Buteos		*13*	*13*	*10*	*12*	*13*	*13*	*3*	*3*	*39*	*41*
red-tailed hawk	*Buteo jamaicensis*	12	12	9	11	11	11	0	0	32	34
rough-legged hawk	*Buteo lagopus*	0	0	0	0	2	2	3	3	5	5
unidentified buteo	*Buteo spp*	1	1	1	1	0	0	0	0	2	2
Northern Harrier		*3*	*4*	*0*	*0*	*7*	*7*	*0*	*0*	*10*	*11*
northern harrier	*Circus cyaneus*	3	4	0	0	7	7	0	0	10	11
Eagles		*1*	*4*	*0*	*0*	*1*	*1*	*2*	*2*	*4*	*7*
bald eagle[a,b,c]	*Haliaeetus leucocephalus*	1	4	0	0	1	1	2	2	4	7
Other Raptors		*2*	*3*	*0*	*0*	*4*	*5*	*1*	*1*	*7*	*9*
unidentified raptor		2	3	0	0	4	5	1	1	7	9
Vultures		**1**	**1**	**5**	**7**	**1**	**1**	**0**	**0**	**7**	**9**
turkey vulture	*Cathartes aura*	1	1	5	7	1	1	0	0	7	9
Upland Game Birds		**29**	**44**	**9**	**10**	**9**	**16**	**1**	**1**	**48**	**71**
ring-necked pheasant	*Phasianus colchicus*	27	28	9	10	8	9	1	1	45	48
wild turkey	*Meleagris gallopavo*	2	16	0	0	1	7	0	0	3	23
Doves/Pigeons		**10**	**16**	**39**	**61**	**12**	**68**	**1**	**7**	**62**	**152**
Eurasian collared-dove	*Streptopelia decaocto*	0	0	6	8	1	1	0	0	7	9
mourning dove	*Zenaida macroura*	8	12	33	53	7	27	0	0	48	92
rock pigeon	*Columba livia*	2	4	0	0	4	40	1	7	7	51
Large Corvids		**8**	**68**	**1**	**1**	**4**	**26**	**5**	**5**	**18**	**100**
American crow	*Corvus brachyrhynchos*	8	68	1	1	4	26	5	5	18	100
Passerines		**166**	**1,054**	**321**	**1,829**	**137**	**2,655**	**57**	**317**	**681**	**5,855**
alder flycatcher	*Empidonax alnorum*	0	0	1	1	0	0	0	0	1	1
American goldfinch	*Spinus tristis*	0	0	13	13	10	19	4	15	27	47
American robin	*Turdus migratorius*	14	25	16	21	13	52	5	8	48	106
American tree sparrow	*Spizella arborea*	0	0	0	0	0	0	2	7	2	7
Baltimore oriole	*Icterus galbula*	0	0	2	2	0	0	0	0	2	2
barn swallow	*Hirundo rustica*	4	5	24	63	0	0	0	0	28	68

Appendix A1. Summary of individuals and group observations, regardless of distance from observer, by bird type and species recorded during the first 20 minutes of Year Two fixed-point bird use surveys conducted in the Prevailing Winds Wind Project in Bon Homme and Charles Mix counties, South Dakota, from May 3, 2016 – April 19, 2017.

		Spring		Summer		Fall		Winter		Total	
Type/Species	Scientific Name	# Grps	# Obs	# Grps	# Obs	# Grps	# Obs	# Grps	# Obs	# Grps	# Obs
blue jay	*Cyanocitta cristata*	0	0	4	4	6	8	0	0	10	12
bobolink	*Dolichonyx oryzivorus*	0	0	5	5	0	0	0	0	5	5
Brewer's blackbird	*Euphagus cyanocephalus*	0	0	1	4	2	3	0	0	3	7
brown-headed cowbird	*Molothrus ater*	10	16	29	64	8	293	0	0	47	373
brown thrasher	*Toxostoma rufum*	1	1	3	4	1	1	0	0	5	6
clay-colored sparrow	*Spizella pallida*	0	0	0	0	1	1	0	0	1	1
cliff swallow	*Petrochelidon pyrrhonota*	1	25	25	127	3	35	0	0	29	187
common grackle	*Quiscalus quiscula*	6	18	17	1,032	7	540	0	0	30	1,590
common yellowthroat	*Geothlypis trichas*	0	0	5	5	0	0	0	0	5	5
dickcissel	*Spiza americana*	0	0	13	15	0	0	0	0	13	15
eastern bluebird	*Sialia sialis*	1	1	2	2	0	0	1	5	4	8
eastern kingbird	*Tyrannus tyrannus*	1	2	26	45	0	0	0	0	27	47
European starling	*Sturnus vulgaris*	5	14	0	0	7	238	0	0	12	252
field sparrow	*Spizella pusilla*	1	1	3	3	0	0	0	0	4	4
horned lark	*Eremophila alpestris*	13	39	1	1	11	80	35	266	60	386
house finch	*Haemorhous mexicanus*	0	0	2	2	0	0	0	0	2	2
house sparrow	*Passer domesticus*	0	0	4	15	0	0	0	0	4	15
house wren	*Troglodytes aedon*	0	0	1	1	1	1	0	0	2	2
Lincoln's sparrow	*Melospiza lincolnii*	0	0	1	1	0	0	0	0	1	1
marsh wren	*Cistothorus palustris*	0	0	4	4	0	0	0	0	4	4
northern shrike	*Lanius excubitor*	0	0	0	0	1	1	2	2	3	3
orchard oriole	*Icterus spurius*	0	0	3	3	0	0	0	0	3	3
red-winged blackbird	*Agelaius phoeniceus*	23	631	45	235	16	239	0	0	84	1,105
Savannah sparrow	*Passerculus sandwichensis*	1	1	0	0	0	0	0	0	1	1
snow bunting	*Plectrophenax nivalis*	0	0	0	0	0	0	6	12	6	12
song sparrow	*Melospiza melodia*	2	2	7	7	3	53	0	0	12	62
spotted towhee	*Pipilo maculatus*	0	0	1	1	0	0	0	0	1	1
swamp sparrow	*Melospiza georgiana*	0	0	1	1	0	0	0	0	1	1
tree swallow	*Tachycineta bicolor*	2	3	0	0	0	0	0	0	2	3
unidentified blackbird		6	92	0	0	12	998	0	0	18	1,090
unidentified sparrow		3	9	1	1	10	36	1	1	15	47
vesper sparrow	*Pooecetes gramineus*	3	3	5	6	1	3	0	0	9	12
western bluebird	*Sialia mexicana*	0	0	2	2	0	0	0	0	2	2
western kingbird	*Tyrannus verticalis*	0	0	2	2	0	0	0	0	2	2

Appendix A1. Summary of individuals and group observations, regardless of distance from observer, by bird type and species recorded during the first 20 minutes of Year Two fixed-point bird use surveys conducted in the Prevailing Winds Wind Project in Bon Homme and Charles Mix counties, South Dakota, from May 3, 2016 – April 19, 2017.

		Spring		Summer		Fall		Winter		Total	
Type/Species	**Scientific Name**	**# Grps**	**# Obs**	**# Grps**	**# Obs**	**# Grps**	**# Obs**	**# Grps**	**# Obs**	**# Grps**	**# Obs**
western meadowlark	*Sturnella neglecta*	67	150	42	49	24	54	1	1	134	254
yellow-headed blackbird	*Xanthocephalus xanthocephalus*	2	16	6	82	0	0	0	0	8	98
yellow warbler	*Setophaga petechia*	0	0	4	6	0	0	0	0	4	6
Goatsuckers		**0**	**0**	**1**	**1**	**0**	**0**	**0**	**0**	**1**	**1**
common nighthawk	*Chordeiles minor*	0	0	1	1	0	0	0	0	1	1
Woodpeckers		**1**	**1**	**6**	**6**	**7**	**8**	**0**	**0**	**14**	**15**
downy woodpecker	*Picoides pubescens*	0	0	0	0	1	1	0	0	1	1
northern flicker	*Colaptes auratus*	0	0	2	2	4	5	0	0	6	7
red-bellied woodpecker	*Melanerpes carolinus*	0	0	2	2	0	0	0	0	2	2
red-headed woodpecker	*Melanerpes erythrocephalus*	1	1	2	2	2	2	0	0	5	5
Kingfishers		**0**	**0**	**0**	**0**	**1**	**1**	**0**	**0**	**1**	**1**
belted kingfisher	*Megaceryle alcyon*	0	0	0	0	1	1	0	0	1	1
Unidentified Birds		**9**	**16**	**0**	**0**	**3**	**13**	**8**	**11**	**20**	**40**
unidentified bird (small)		9	16	0	0	3	13	8	11	20	40
Overall		**339**	**2,811**	**435**	**2,061**	**227**	**3,638**	**89**	**766**	**1,090**	**9,276**

Grps = Number of groups, # Obs = Number of observations

[a.] State Species of Concern tracked by the South Dakota Natural Heritage Program (SDGFP 2017)

[b.] State Species of Greatest Conservation Need (SDGFP 2014)

[c.] Bald and Golden Eagle Protection Act (1940)

Appendix A2. Mean large bird use (number of large birds/800-meter radius plot/20-minute survey), percent of total use, and frequency of occurrence for each large bird type and species by season during Year Two of the fixed-point bird use surveys conducted at the Prevailing Winds Project in Bon Homme and Charles Mix counties, South Dakota, from May 3, 2016 – April 19, 2017.

	Mean Use				Percent of Use (%)				Frequency of Occurrence (%)			
Type/Species	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**
Loons/Grebes	**0**	**0**	**0.1**	**0**	**0**	**0**	**0.5**	**0**	**0**	**0**	**2.1**	**0**
unidentified grebe	0	0	0.1	0	0	0	0.5	0	0	0	2.1	0
Waterbirds	**0.96**	**1.23**	**0.42**	**0**	**2.6**	**33.7**	**2.1**	**0**	**10.6**	**4.8**	**6.4**	**0**
double-crested cormorant	0.09	0	0.35	0	0.2	0	1.8	0	2.2	0	4.2	0
glossy ibis	0	0.05	0	0	0	1.3	0	0	0	3.1	0	0
great blue heron[a]	0.02	0.02	0.06	0	<0.1	0.4	0.3	0	2.1	1.6	6.4	0
sandhill crane	0.85	1.17	0	0	2.3	32	0	0	6.2	1.7	0	0
Waterfowl	**29.2**	**0.48**	**5.12**	**8.71**	**80.3**	**13.3**	**25.5**	**95.4**	**44.7**	**7.8**	**6.2**	**8.3**
blue-winged teal	0.22	0.19	0	0	0.6	5.1	0	0	11.1	6.2	0	0
bufflehead[a]	0	0	0.25	0	0	0	1.2	0	0	0	2.1	0
cackling goose	1.54	0	0	0	4.2	0	0	0	6.2	0	0	0
Canada goose	0.44	0	0	0.17	1.2	0	0	1.8	8.5	0	0	2.1
common merganser[a]	0	0	0	0.02	0	0	0	0.2	0	0	0	2.1
greater white-fronted goose	2.69	0	0	7.29	7.4	0	0	79.9	4.2	0	0	2.1
green-winged teal	0	0.02	0.04	0	0	0.4	0.2	0	0	1.6	2.1	0
mallard	0.26	0.19	4.19	0.35	0.7	5.1	20.8	3.9	17.1	3.1	4.2	4.2
northern pintail	0.21	0	0	0	0.6	0	0	0	4.2	0	0	0
northern shoveler	0	0.05	0	0	0	1.3	0	0	0	3.1	0	0
ring-necked duck	0.58	0	0	0	1.6	0	0	0	4.2	0	0	0
ruddy duck	0	0	0.02	0	0	0	0.1	0	0	0	2.1	0
snow goose	10.34	0.05	0	0	28.4	1.3	0	0	10.6	1.6	0	0
unidentified duck	1.98	0	0	0	5.4	0	0	0	8.5	0	0	0
unidentified goose	10	0	0	0	27.5	0	0	0	8.3	0	0	0
unidentified waterfowl	0.94	0	0.62	0.88	2.6	0	3.1	9.6	6.2	0	2.1	4.2
Shorebirds	**1.21**	**0.41**	**9.26**	**0.02**	**3.3**	**11.3**	**46**	**0.2**	**52.2**	**30.2**	**25.8**	**2.1**
killdeer	1.21	0.37	0.47	0	3.3	10.1	2.3	0	52.2	28.6	15.4	0
unidentified shorebird	0	0	8.79	0.02	0	0	43.7	0.2	0	0	10.4	2.1
upland sandpiper	0	0.05	0	0	0	1.3	0	0	0	3.1	0	0
Gulls/Terns	**1.77**	**0.02**	**2.29**	**0**	**4.9**	**0.5**	**11.4**	**0**	**8.5**	**1.7**	**4.2**	**0**
Franklin's gull	1.75	0	0.21	0	4.8	0	1	0	6.4	0	2.1	0
Herring gull	0	0.02	0	0	0	0.5	0	0	0	1.7	0	0
ring-billed gull	0.02	0	0	0	<0.1	0	0	0	2.1	0	0	0
unidentified gull	0	0	2.08	0	0	0	10.4	0	0	0	2.1	0
Rails/Coots	**0**	**0.02**	**0**	**0**	**0**	**0.4**	**0**	**0**	**0**	**1.6**	**0**	**0**
American coot	0	0.02	0	0	0	0.4	0	0	0	1.6	0	0

Appendix A2. Mean large bird use (number of large birds/800-meter radius plot/20-minute survey), percent of total use, and frequency of occurrence for each large bird type and species by season during Year Two of the fixed-point bird use surveys conducted at the Prevailing Winds Project in Bon Homme and Charles Mix counties, South Dakota, from May 3, 2016 – April 19, 2017.

	Mean Use				Percent of Use (%)				Frequency of Occurrence (%)			
Type/Species	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**
Diurnal Raptors	**0.51**	**0.21**	**0.55**	**0.12**	**1.4**	**5.7**	**2.7**	**1.4**	**33.9**	**15.9**	**38.2**	**8.3**
Accipiters	*0*	*0.02*	*0*	*0*	*0*	*0.5*	*0*	*0*	*0*	*1.7*	*0*	*0*
Cooper's hawk[a]	0	0.02	0	0	0	0.5	0	0	0	1.7	0	0
Buteos	*0.28*	*0.19*	*0.28*	*0.06*	*0.8*	*5.2*	*1.4*	*0.7*	*23.3*	*14.3*	*25.4*	*6.2*
red-tailed hawk	0.25	0.17	0.23	0	0.7	4.8	1.2	0	21.1	12.7	21.2	0
rough-legged hawk	0	0	0.04	0.06	0	0	0.2	0.7	0	0	4.2	6.2
unidentified buteo	0.02	0.02	0	0	<0.1	0.4	0	0	2.2	1.6	0	0
Northern Harrier	*0.09*	*0*	*0.15*	*0*	*0.2*	*0*	*0.7*	*0*	*6.4*	*0*	*14.9*	*0*
northern harrier	0.09	0	0.15	0	0.2	0	0.7	0	6.4	0	14.9	0
Eagles	*0.08*	*0*	*0.02*	*0.04*	*0.2*	*0*	*0.1*	*0.5*	*2.1*	*0*	*2.1*	*2.1*
bald eagle[a,b,c]	0.08	0	0.02	0.04	0.2	0	0.1	0.5	2.1	0	2.1	2.1
Other Raptors	*0.06*	*0*	*0.1*	*0.02*	*0.2*	*0*	*0.5*	*0.2*	*4.2*	*0*	*8.3*	*2.1*
unidentified raptor	0.06	0	0.1	0.02	0.2	0	0.5	0.2	4.2	0	8.3	2.1
Vultures	**0.02**	**0.11**	**0.02**	**0**	**<0.1**	**3.1**	**0.1**	**0**	**2.2**	**8**	**2.2**	**0**
turkey vulture	0.02	0.11	0.02	0	<0.1	3.1	0.1	0	2.2	8	2.2	0
Upland Game Birds	**0.93**	**0.16**	**0.34**	**0.02**	**2.6**	**4.4**	**1.7**	**0.2**	**53.8**	**12.7**	**19**	**2.1**
ring-necked pheasant	0.6	0.16	0.19	0.02	1.7	4.4	0.9	0.2	51.7	12.7	16.8	2.1
wild turkey	0.33	0	0.16	0	0.9	0	0.8	0	4.2	0	2.2	0
Doves/Pigeons	**0.34**	**0.98**	**1.45**	**0.15**	**0.9**	**26.8**	**7.2**	**1.6**	**17.2**	**49.5**	**15**	**2.1**
Eurasian collared-dove	0	0.13	0.02	0	0	3.5	0.1	0	0	8	2.2	0
mourning dove	0.26	0.85	0.6	0	0.7	23.2	3	0	13.1	43	10.8	0
rock pigeon	0.08	0	0.83	0.15	0.2	0	4.1	1.6	4.2	0	6.2	2.1
Large Corvids	**1.42**	**0.02**	**0.54**	**0.1**	**3.9**	**0.5**	**2.7**	**1.1**	**14.7**	**1.7**	**2.1**	**6.2**
American crow	1.42	0.02	0.54	0.1	3.9	0.5	2.7	1.1	14.7	1.7	2.1	6.2
Goatsuckers	**0**	**0.02**	**0**	**0**	**0**	**0.4**	**0**	**0**	**0**	**1.6**	**0**	**0**
common nighthawk	0	0.02	0	0	0	0.4	0	0	0	1.6	0	0
Overall	**36.38**	**3.65**	**20.11**	**9.12**	**100**	**100**	**100**	**100**				

Note: Totals by bird type and overall might not correspond to the sum of individual species due to rounding

[a.] State Species of Concern tracked by the South Dakota Natural Heritage Program (SDGFP 2017)

[b.] State Species of Greatest Conservation Need (SDGFP 2014)

[c.] Bald and Golden Eagle Protection Act (1940)

Appendix A3. Mean small bird use (number of large birds/100-meter plot/20-minute survey), percent of total use, and frequency of occurrence for each small bird type and species by season during Year Two of the fixed-point bird use surveys conducted at the Prevaling Winds Project in Bon Homme and Charles Mix counties, South Dakota, from May 3, 2016 – April 19, 2017.

	Mean Use				Percent of Use (%)				Frequency of Occurrence %)			
	Spring	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**
Passerines	**22.10**	**28.8**	**35.31**	**6.58**	**99.2**	**99.7**	**98.8**	**96.9**	**97.9**	**96.9**	**75.0**	**62.5**
alder flycatcher	0	0.02	0	0	0	<0.1	0	0	0	1.6	0	0
American goldfinch	0	0.21	0.41	0.31	0	0.7	1.2	4.6	0	21.2	21.9	6.2
American robin	0.53	0.34	0.40	0.17	2.4	1.2	1.1	2.5	21.2	23.8	10.8	8.3
American tree sparrow	0	0	0	0.15	0	0	0	2.1	0	0	0	2.1
Baltimore oriole	0	0.03	0	0	0	0.1	0	0	0	3.1	0	0
barn swallow	0.11	1.00	0	0	0.5	3.4	0	0	8.8	31.7	0	0
blue jay	0	0.07	0.04	0	0	0.2	0.1	0	0	6.6	4.4	0
bobolink	0	0.08	0	0	0	0.3	0	0	0	6.2	0	0
Brewer's blackbird	0	0.07	0.07	0	0	0.2	0.2	0	0	1.7	4.4	0
brown-headed cowbird	0.36	1.00	6.51	0	1.6	3.5	18.2	0	15.6	36.1	15.6	0
brown thrasher	0.02	0.06	0.02	0	<0.1	0.2	<0.1	0	2.2	4.8	2.2	0
clay-colored sparrow	0	0	0.02	0	0	0	<0.1	0	0	0	2.2	0
cliff swallow	0.56	2.06	0.78	0	2.5	7.1	2.2	0	2.2	38.5	6.7	0
common grackle	0.38	16.14	12.00	0	1.7	55.9	33.6	0	8.3	22.4	11.1	0
common yellowthroat	0	0.08	0	0	0	0.3	0	0	0	7.9	0	0
dickcissel	0	0.23	0	0	0	0.8	0	0	0	17.2	0	0
eastern bluebird	0.02	0.03	0	0.10	<0.1	0.1	0	1.5	2.1	3.3	0	2.1
eastern kingbird	0.04	0.71	0	0	0.2	2.5	0	0	2.2	34.6	0	0
European starling	0.29	0	0.8	0	1.3	0	2.2	0	10.4	0	10.7	0
field sparrow	0.02	0.05	0	0	<0.1	0.2	0	0	2.1	4.7	0	0
horned lark	0.81	0.02	1.67	5.54	3.6	<0.1	4.7	81.6	22.9	1.6	14.6	45.8
house finch	0	0.03	0	0	0	0.1	0	0	0	3.2	0	0
house sparrow	0	0.25	0	0	0	0.9	0	0	0	6.4	0	0
house wren	0	0.02	0.02	0	0	<0.1	<0.1	0	0	1.7	2.2	0
Lincoln's sparrow	0	0.02	0	0	0	<0.1	0	0	0	1.6	0	0
marsh wren	0	0.06	0	0	0	0.2	0	0	0	6.2	0	0
northern shrike	0	0	0.02	0.02	0	0	<0.1	0.3	0	0	2.1	2.1
orchard oriole	0	0.05	0	0	0	0.2	0	0	0	4.8	0	0
red-winged blackbird	13.19	3.67	5.28	0	59.2	12.7	14.8	0	34.2	50.6	30.6	0
Savannah sparrow	0.02	0	0	0	<0.1	0	0	0	2.1	0	0	0
snow bunting	0	0	0	0.25	0	0	0	3.7	0	0	0	10.4
song sparrow	0.04	0.11	1.18	0	0.2	0.4	3.3	0	4.2	11.1	6.7	0
spotted towhee	0	0.02	0	0	0	<0.1	0	0	0	1.6	0	0

Appendix A3. Mean small bird use (number of large birds/100-meter plot/20-minute survey), percent of total use, and frequency of occurrence for each small bird type and species by season during Year Two of the fixed-point bird use surveys conducted at the Prevaling Winds Project in Bon Homme and Charles Mix counties, South Dakota, from May 3, 2016 – April 19, 2017.

	Mean Use				Percent of Use (%)				Frequency of Occurrence %)			
	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter
swamp sparrow	0	0.02	0	0	0	<0.1	0	0	0	1.6	0	0
tree swallow	0.07	0	0	0	0.3	0	0	0	4.4	0	0	0
unidentified blackbird	1.92	0	4.19	0	8.6	0	11.7	0	10.4	0	4.2	0
unidentified sparrow	0.19	0.02	0.76	0.02	0.8	<0.1	2.1	0.3	4.2	1.6	21.1	2.1
vesper sparrow	0.07	0.09	0.07	0	0.3	0.3	0.2	0	4.4	6.2	2.2	0
western bluebird	0	0.03	0	0	0	0.1	0	0	0	3.1	0	0
western kingbird	0	0.02	0	0	0	<0.1	0	0	0	1.6	0	0
western meadowlark	3.14	0.78	1.07	0.02	14.1	2.7	3	0.3	71.7	52.1	39.3	2.1
yellow-headed blackbird	0.33	1.36	0	0	1.5	4.7	0	0	2.1	6.4	0	0
yellow warbler	0	0.10	0	0	0	0.3	0	0	0	6.4	0	0
Woodpeckers	0.02	0.10	0.13	0	<0.1	0.3	0.4	0	2.2	9.8	10.7	0
downy woodpecker	0	0	0.02	0	0	0	<0.1	0	0	0	2.1	0
northern flicker	0	0.03	0.06	0	0	0.1	0.2	0	0	3.3	4.2	0
red-bellied woodpecker	0	0.03	0	0	0	0.1	0	0	0	3.3	0	0
red-headed woodpecker	0.02	0.03	0.04	0	<0.1	0.1	0.1	0	2.2	3.1	4.4	0
Kingfishers	0	0	0.02	0	0	0	<0.1	0	0	0	2.1	0
belted kingfisher	0	0	0.02	0	0	0	<0.1	0	0	0	2.1	0
Unidentified Birds	0.17	0	0.27	0.21	0.7	0	0.8	3.1	12.5	0	6.2	12.5
unidentified bird (small)	0.17	0	0.27	0.21	0.7	0	0.8	3.1	12.5	0	6.2	12.5
Overall	22.29	28.9	35.73	6.79	100	100	100	100				

Note: Totals by bird type and overall might not correspond to the sum of individual species due to rounding