

APPENDIX A – EAGLE SURVEY REPORTS



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July 11, 2013

Casey Willis
Red Pine Wind Project, LLC
3760 State St., Suite 102
Santa Barbara, CA 93105

RE: Red Pine Raptor Nest Surveys

Dear Mr. Willis,

As part of agency approved baseline survey efforts, surveys for raptor nests were completed at the Red Pine Wind Resource Area on May 15-17, 2013 by a qualified biologist from Western EcoSystems Technology, Inc. Surveys were completed by driving and walking public roads and other accessible trails throughout the project area and 2-mile buffer around the project area. Stops were made frequently to look for raptor nests in trees and other potentially suitable structures (e.g., powerline poles) using binoculars. All raptor nests observed were mapped on aerial photographs. All raptor nests were recorded in the project area and a 1-mile buffer. Only eagle nests were to be recorded out to the 2-mile buffer.

Eighteen raptor nest structures were documented during the surveys. Within the project area and 1-mile buffer, two occupied red-tailed hawk nests, one unknown raptor occupied nest and 15 unoccupied unknown raptor nests were observed (see attached map). No confirmed eagle nests were observed during the survey.

This area has an overall raptor nesting density of 0.027 active nests/square mile.

If you have any questions or require additional information, please feel free to call me at 701-250-1756.

Sincerely,

Clayton Derby
Senior Manager

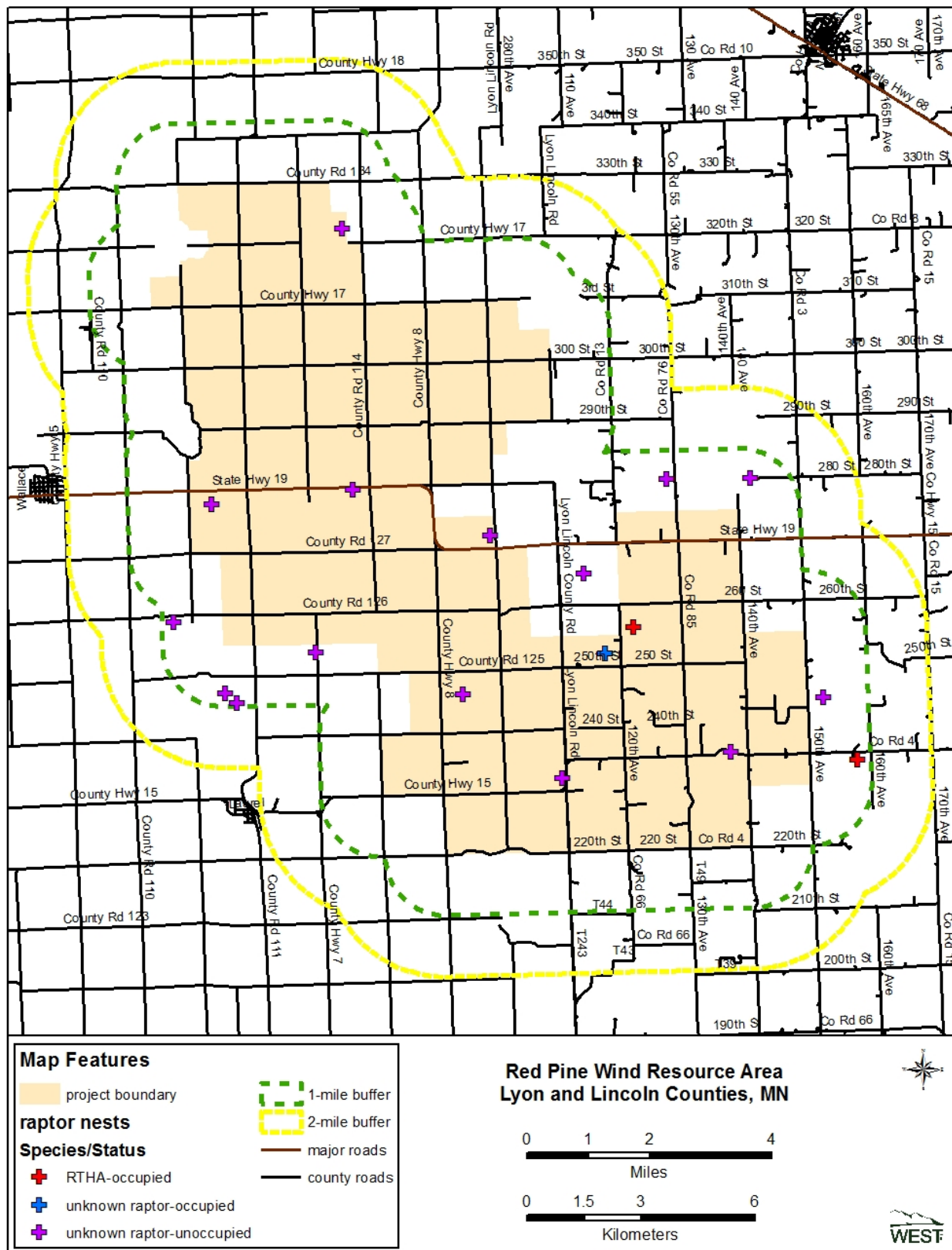


Figure 1. Raptor nests documented at the Red Pine Wind Resource Area in spring 2013.

**Avian Use Surveys for the
Red Pine Wind Resource Area
Lincoln and Lyon Counties, Minnesota**

**Final Report
March 2013 through March 2014**

Prepared for:
Red Pine Wind Project, LLC
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Santa Barbara, California 93105

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June 25, 2014



EXECUTIVE SUMMARY

Red Pine Wind Project, LLC (Red Pine) has proposed a wind energy facility in Lincoln and Lyon Counties, Minnesota, referred to as the Red Pine Wind Resource Area (RPWRA). Red Pine contracted with Western EcoSystems Technology, Inc. to conduct field surveys developed in coordination with the US Fish and Wildlife Service and Minnesota Department of Natural Resources. These surveys were designed to assess wildlife resources in the RPWRA and assess risk to species of concern by addressing the issues posed under Tier 3 of the US Fish and Wildlife Service's Final Land-Based Wind Energy Guidelines. The principal objectives of the fixed-point bird use surveys were to: 1) assess the relative abundance and spatial distribution of species in the RPWRA during all seasons, and 2) identify and assess the potential risk of adverse impacts. The following document contains results for the general fixed-point bird use surveys and incidental wildlife observations.

Surveys were completed within the RPWRA from March 22, 2013 to March 16, 2014. Twenty fixed-points were selected to encompass representative habitats and topography of the RPWRA. Each survey plot was an 800-meter (m; 2,625-foot [ft]) radius circle centered on the point; large birds, particularly eagles, were recorded out to a 1,600-m (5,249-ft) radius. Each survey plot was surveyed for 60 minutes (min). All birds observed during the first 20 min of each fixed-point survey were recorded. Observations of large birds beyond the 800-m radius were recorded, but were not included in analyses. Locations and flight paths, if applicable, of large birds were recorded.

A total of 336 fixed-point bird use surveys were conducted during 18 visits to the RPWRA. One-hundred-thirty-eight unique bird species totaling 4,410 observations in 272 groups were recorded. Overall species richness was higher for large birds (0.43); species richness was calculated as the mean number of species observed per plot per survey (i.e., number of species/plot/20-min survey). Species richness was highest in the spring and lowest in the winter for large birds and lowest in the spring and summer for small birds.

Eighty-eight raptor observations within 56 groups were recorded during the first 20 min of fixed-point bird use surveys at the RPWRA. Red-tailed hawk was the most commonly observed raptor, accounting for 42% of all raptors (37 observations). Northern harrier (40.9% of observations), and bald eagle (12.5%) accounted for all but three observations.

Large birds detected within the 800-m radius plot and small birds recorded within a 100-m radius were used to calculate mean use and frequency of occurrence. The metric used to measure mean bird use was number of birds per plot per 20-min survey. Diurnal raptor use was highest in spring (0.58 raptors/800-m plot/20-min survey) followed by summer (0.21), fall (0.14) and winter (0.02). Most raptor use was attributable to northern harriers (0.33 raptors/800-m plot/20-min survey) and red-tailed hawks (0.19) during spring and red-tailed hawks in the summer (0.19) and fall (0.07). Mean use for bald eagles was 0.05 raptors/800-m plot/20-min survey or less in each season.

Diurnal raptor use (raptors/800-m plot/60-min survey) values calculated from the full 60-min surveys demonstrated a seasonal pattern of use, with spring exhibiting the highest mean use. Data from the first 20 min of the standard 60-min survey captured a significant portion of the observed use (spring, $0.58/0.77=75.3\%$; summer, 84%; fall, 46.7%; winter, 50%). However, by assuming bird observations to be equally spread across the 60-minute survey period, the mean use calculated by dividing by three underestimated raptor use in all seasons compared to the 20-minute survey.

The flight height recorded during the initial observation was used to calculate mean flight height and the percentage of birds flying within the likely rotor-swept height (RSH) for collision with turbine blades of 25 – 150 m (82 to 492 ft) above ground level. Overall, 76.8% of raptors observed flying were recorded initially within the RSH, 22.3% were below the RSH, and 0.9% were observed flying above the RSH. No discernible patterns of bird use concentration were observed during fixed-point surveys nor did eagle flight paths show an apparent pattern.

No federally endangered, threatened, candidate, or proposed species were observed during fixed-point surveys or incidentally. One hundred thirty common terns were observed during fixed-point surveys; common terns are a Minnesota state threatened species. Two Minnesota special concern bird species were recorded: the Franklin's gull and American white pelican. There were 2,455 observations of Franklin's gull and 209 individuals of American white pelican observed during fixed-point surveys. Thirty-four individual bald eagles were observed at the RPWRA during fixed-point surveys or incidentally. Overall, 90.4% of Franklin's gulls observed flying were recorded initially within the RSH. American white pelican observed flying at the RPWRA during fixed-point surveys were all recorded within the RSH as were flying common terns. Eighty percent of bald eagle groups which were observed flying were recorded within the RSH.

STUDY PARTICIPANTS

Western EcoSystems Technology

Clayton Derby	Project Manager
Carmen Kennedy	Data and Report Manager
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Troy Rintz	Report Writer
Andrea Palochak	Technical Editor
Lauren Michelson	Field Technician
Karen Seginak	Field Technician

REPORT REFERENCE

Derby, C. and T. Rintz. 2014. Avian Use Surveys for the Red Pine Wind Resource Area, Lincoln and Lyon Counties, Minnesota. Final Report: March 2013 through March 2014. Prepared for Red Pine Wind Power, Santa Barbara, California. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota.

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INTRODUCTION

Red Pine Wind Project, LLC (Red Pine) has proposed the development of a wind energy facility in Lincoln and Lyon Counties, Minnesota, referred to as the Red Pine Wind Resource Area (RPWRA or project area). Red Pine contracted with Western EcoSystems Technology, Inc. (WEST) to conduct field surveys in accordance with agency recommendations to quantify wildlife resources at the RPWRA and to address the issues posed under Tier 3 of the US Fish and Wildlife Service (USFWS) Final Land-Based Wind Energy Guidelines (Guidelines; USFWS 2012b) and pre-construction surveys are recommended by the Minnesota Department of Natural Resources (MDNR).

Fixed-point bird use surveys were conducted to achieve these principal objectives: 1) assess the relative abundance and spatial distribution of avian species in the RPWRA, and 2) identify and assess the potential risk of adverse impacts to avian species or groups. This report contains results for the general fixed-point bird use surveys and incidental wildlife observations.

STUDY AREA

The proposed 38,826.9 acre (15,712.7 hectare) RPWRA is located in eastern Lincoln and western Lyons Counties, Minnesota, approximately 2.5 kilometers (km; 1.6 miles [mi]) east of the town of Wilno, Minnesota (Figure 1). The RPWRA has flat to rolling topography and is located on a slight ridge. Elevation of the study area ranges from 421 to 516 meters (m; 1,381 to 1,693 feet [ft]) above mean sea level.

The RPWRA contains areas of cultivated agriculture, grasslands, wetlands and lakes, developed areas and rural homes, and small wooded areas; as determined through a combination of existing information and heads up digitizing (Derby 2014). The majority of the study area, approximately 74%, is cultivated agriculture, the majority of which is corn (*Zea mays*) and soybeans (*Glycine max*; US Department of Agriculture [USDA] National Agricultural Statistics Service [NASS] 2012). According to the US Fish and Wildlife Service (USFWS) National Wetlands Inventory (NWI), about 4% of the RPWRA is wetlands; about 74% of those wetlands are freshwater emergent wetlands and about 20% are lakes (USFWS NWI 2007).

Three named creeks and rivers are located in the RPWRA. Coon Creek briefly loops into the southern portion of the RPWRA. The South Branch of the Yellow Medicine River flows west to east through the center of the project area. Three-mile Creek is located in the southern portion of the RPWRA and also flows from west to east. Several other unnamed drainages are located throughout the RPWRA.

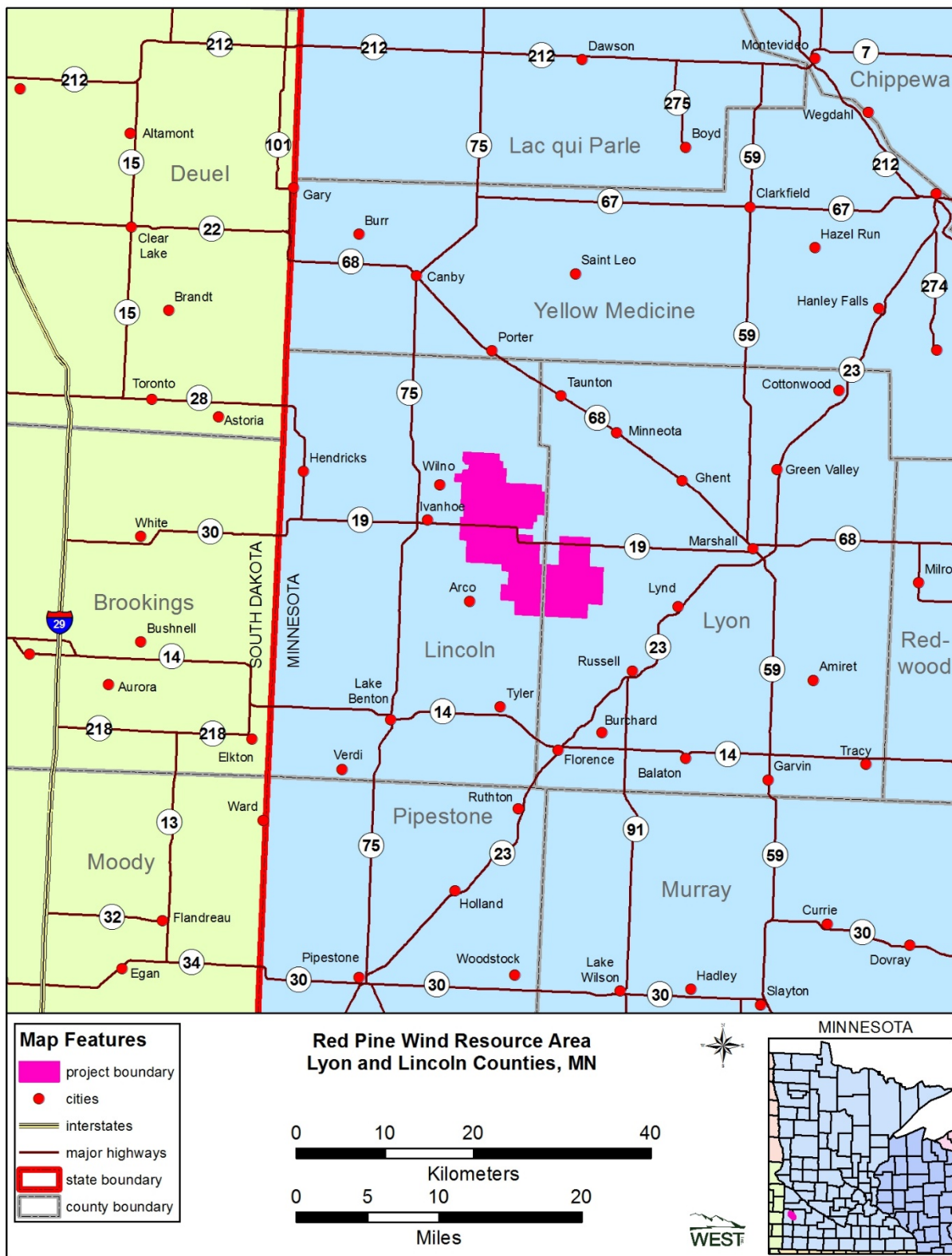


Figure 1. Location of the Red Pine Wind Resource Area, Lyon and Lincoln Counties, Minnesota.

Ownership within the project area is largely private, but numerous protected areas are located in the RPWRA (US Geological Survey [USGS] 2012). The USFWS Lyon County Waterfowl Production Area is located in the southern portion of the RPWRA. There are several USDA Farm Service Agency Conservation Reserve Enhancement Program easements located throughout the RPWRA. Several Minnesota Department of Natural Resources Wildlife Management Areas are also present. Camden State Park is about 6.4 km (4.0 mi) southeast of the RPWRA.

METHODS

Fixed-point bird use surveys (variable circular plots) were conducted using methods described by Reynolds et al. (1980). Methodologies employed at the RPWRA surveys were generally comparable to those used at past wind energy facilities in Minnesota and were approved by the USFWS and Minnesota Department of Natural Resources (MDNR) prior to implementation.

Survey Plots

Twenty points were selected to encompass representative habitats and topography of the RPWRA, while also providing relatively even coverage of the area (Figure 2). Each survey plot was an 800-m (2,625-ft) radius circle centered on the point; large birds, particularly eagles, were recorded out to a 1,600-m (5,249-ft) radius.

Survey Methods

Each survey plot was surveyed for 60 minutes (min). Although the surveys focused on eagles and other raptors, all birds observed during the first 20 min of each fixed-point survey were recorded. Observations of large birds beyond the 800-m radius were recorded, but were not included in statistical analyses. Large birds included waterbirds, waterfowl, rails and coots, grebes and loons, gulls and terns, shorebirds, diurnal raptors, owls, vultures, upland game birds, doves/pigeons, and large corvids (e.g., ravens, magpies, and crows), and goatsuckers. For small birds, observations beyond the 100-m (328-ft) radius were excluded from analysis. 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. 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.

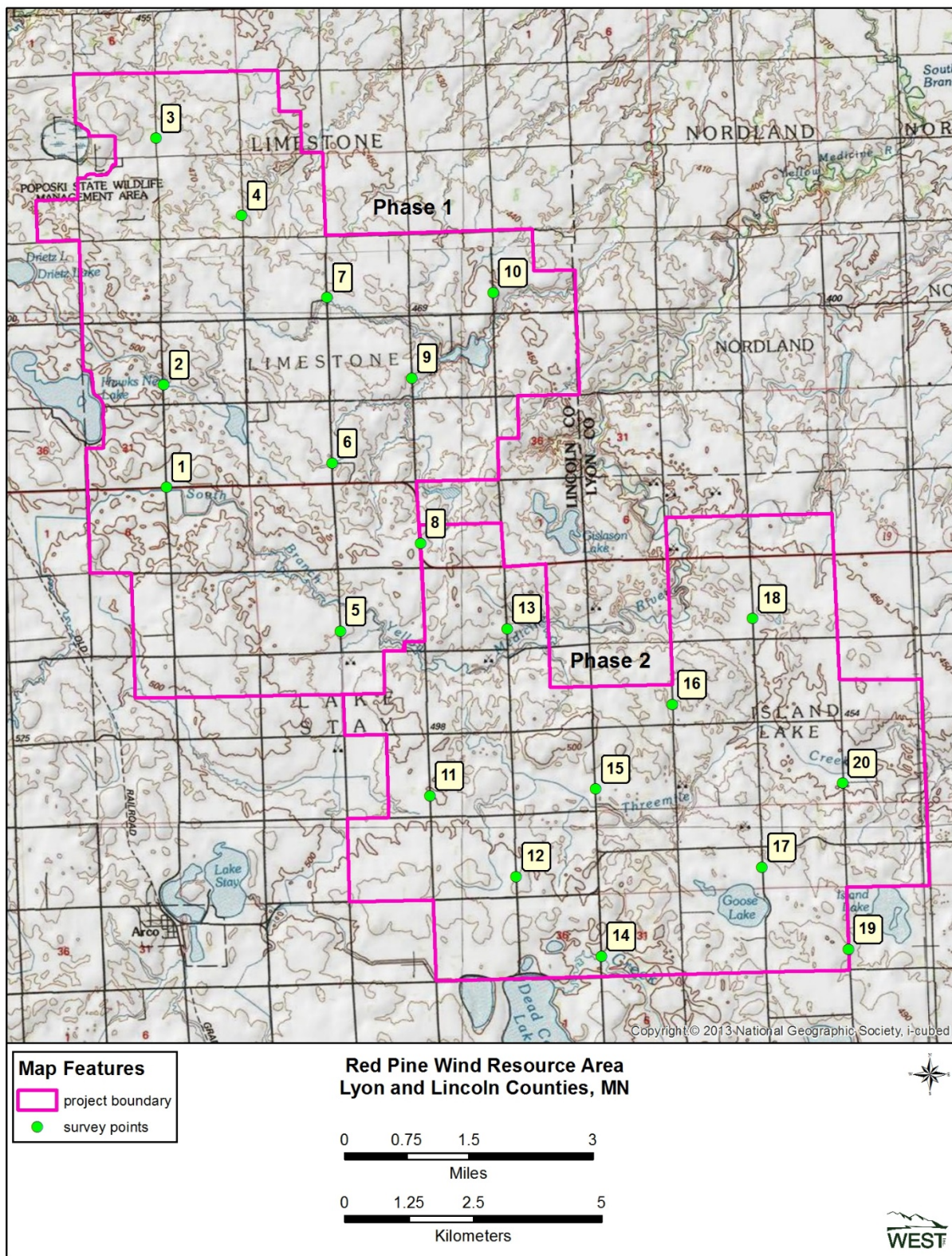


Figure 2. Location of fixed-point bird use points at the Red Pine Wind Resource Area, Lincoln and Lyon Counties, Minnesota.

Locations and flight paths, if applicable, of large birds were recorded during fixed-point bird use surveys on field maps. For each period of time that eagles were observed, distance from observer, activity and flight height, if applicable, were recorded on a per minute basis as specified in the draft Eagle Guidelines (USFWS 2012a).

Incidental wildlife observations were recorded while conducting all surveys, moving between fixed-point locations, and traveling in the RPWRA. All raptors, unusual or unique birds, and sensitive bird species were documented. The 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 sensitive species was recorded.

Survey Schedule

Fixed-point bird use surveys were conducted approximately once per week in the spring (March 15 to May 31) and fall (September 1 to November 15) and twice monthly during winter (November 16 to March 14) and summer (June 1 to August 31). Half (10) of the points were surveyed during each visit, with evens visited on one visit followed by odds on the next visit such that it took two visits to complete one round of surveys at all 20 points. Surveys were conducted 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.

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 study 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.

Species lists, (with number of observations and groups) were generated by season and can be found in Appendix A.

Bird Diversity and Species Richness

Bird diversity was illustrated by the total number of unique species observed. Species richness was calculated as the mean number of species observed per plot per survey (i.e., number of species/plot/20-min survey). 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 the season. Overall species richness was calculated as a weighted average of seasonal values by the number of days in each season.

Bird Use, Percent of Use, and Frequency of Occurrence

Large birds detected within the 800-m radius plot and small birds recorded within a 100-m radius were used to calculate mean use and frequency of occurrence. The metric used to measure mean bird use was number of birds per plot per 20-min survey. Birds seen after the first 20 min of the survey or outside of the plot were excluded from mean use calculations. Mean use by season was calculated by first averaging the total number of birds observed within each plot during a visit, then averaging across plots within each visit, followed by averaging across visits within the

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 mean use that was attributable to a particular bird type or species. Frequency of occurrence was calculated as the percent of surveys in which a particular bird type or species was observed. Mean bird use, percent of use, and frequency of occurrence were generated by season for large bird species (Appendix B-1) and small bird species (Appendix B-2). Use for raptor types and subtypes was calculated by survey length (20-min versus 60-min).

When considered together, frequency of occurrence and percent composition provide relative measures of species use of the proposed wind energy facility. For example, a particular species might have high use estimates based on just a few observations of large groups and the frequency of occurrence would indicate that the species only occurred during a few of the surveys. Therefore, even though the species exhibited high use, only a few, large groups accounted for that use, suggesting that the species might be less likely to be negatively affected by the construction and operation of the wind energy facility. Conversely, a species that has a relatively low percentage of use, but a relatively high frequency of occurrence would have longer-term exposure to the facility, increasing the likelihood that this species may be affected by the facility.

Bird Flight Height and Behavior

The flight height recorded during the initial observation was used to calculate mean flight height and the percentage of birds flying within the likely rotor-swept height (RSH) for collision with turbine blades of 25 – 150 m (82 to 492 ft) above ground level. The percentage of individuals flying within the RSH at any time was calculated using the lowest and highest flight heights recorded.

Spatial Use

Spatial use of the RPWRA by raptors was evaluated using mean use for each survey point. For each species and bird type, 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 RPWRA from March 22, 2013 to March 16, 2014. Summary statistics for the full suite of species observed at the RPWRA are primarily presented in Appendix A, B-1, and B-2; whereas results related to diurnal raptors, bald eagles, federal and state listed species, and Minnesota special concern species (MDNR 2013) are more thoroughly covered in the body of this report.

A total of 336 fixed-point bird use surveys were conducted during 18 visits to the RPWRA (Table 1). One-hundred-thirty-eight unique bird species totaling 4,410 observations in 272 groups were recorded (Table 1; Appendix A). Species richness was highest in the spring and lowest in the winter for large birds (Table 1).

Table 1. Number of visits, surveys, unique species, and species richness (species/plot^a/20-min survey) by season, observed during fixed-point bird use surveys^b at the Red Pine Wind Resource Area from March 22, 2013 to March 16, 2014.

Season	Number of Visits	Number of Surveys	Number of Unique Species	Species Richness	
				Large Birds	Small Birds ^c
Spring	5	100	21	0.85	0
Summer	4	70	15	0.36	0
Fall	5	100	36	0.43	0.34
Winter	4	66	18	0.19	0.17
Overall	18	336	138	0.43	0.13

^a 800-meter radius for large birds and 100-meter radius for small birds

^b first 20 minutes of surveys only

^c Field technician incorrectly did not record small birds during spring and summer as specific small bird surveys were implemented through transect surveys.

Eighty-eight raptor observations within 56 groups were recorded during the first 20 min of fixed-point bird use surveys at the RPWRA (Table 2). Red-tailed hawk (*Buteo jamaicensis*) was the most commonly observed raptor, accounting for 42% of all raptors (37 observations in 32 groups). Northern harrier (*Circus cyaneus*; 40.9% of observations), and bald eagle (*Haliaeetus leucocephalus*; 12.5%) accounted for all but three observations (Table 2).

Table 2. Number of bird groups (# grps) and individuals (# obs) for raptors observed during 20-min fixed-point bird use surveys^a at the Red Pine Wind Resource Area, Lincoln and Lyon Counties, Minnesota, from March 22, 2013 to March 16, 2014^b.

Type / Subtype	Scientific Name	Spring		Summer		Fall		Winter		Total	
		# grps	# obs	# grps	# obs	# grps	# obs	# grps	# obs	# grps	# obs
Diurnal Raptors											
<u>Buteos</u>		15	19	10	11	8	8	1	1	34	39
red-tailed hawk	<i>Buteo jamaicensis</i>	15	19	10	11	7	7	0	0	32	37
Swainson's hawk	<i>Buteo swainsoni</i>	0	0	0	0	0	0	1	1	1	1
unidentified buteo	<i>Buteo spp</i>	0	0	0	0	1	1	0	0	1	1
<u>Northern Harrier</u>		7	33	1	1	2	2	0	0	10	36
northern harrier	<i>Circus cyaneus</i>	7	33	1	1	2	2	0	0	10	36
<u>Eagles</u>		5	5	1	1	3	4	1	1	10	11
bald eagle	<i>Haliaeetus leucocephalus</i>	5	5	1	1	3	4	1	1	10	11
<u>Falcons</u>		1	1	0	0	0	0	0	0	1	1
American kestrel	<i>Falco sparverius</i>	1	1	0	0	0	0	0	0	1	1
<u>Other Raptors</u>		0	0	0	0	1	1	0	0	1	1
unidentified hawk		0	0	0	0	1	1	0	0	1	1
All Diurnal Raptors		28	58	12	13	14	15	2	2	56	88

^a 800-meter radius^b Rough-legged hawk was also observed but outside of the initial 20 min survey period only.

Mean Use and Frequency of Occurrence

Diurnal raptor use was highest in spring (0.58 raptors/800-m plot/20-min survey) followed by summer (0.21), fall (0.14) and winter (0.02; Table 3). Raptors were observed during in 24% of surveys in spring and 18.6% during the summer. During the fall season, raptors were observed during 12% of surveys and 2.7% of winter surveys (Table 3). Most raptor use was attributable to northern harriers (0.33 raptors/800-m plot/20-min survey) and red-tailed hawks (0.19) during spring and red-tailed hawks in the summer (0.19) and fall (0.07). Mean use for bald eagles was 0.05 raptors/800-m plot/20-min survey or less in each season; bald eagles were observed in 4% of spring surveys, followed by fall (2%), winter (1.5%), and summer (1.2%).

Table 3. Mean bird use (number of birds/plot^a/20-min survey) and frequency of occurrence (%) by large bird type, raptor subtypes, species, and season observed during fixed-point bird use surveys^b at the Red Pine Wind Resource Area, Lincoln and Lyon Counties, Minnesota, from March 22, 2013 to March 16, 2014.

Type/Subtype/Species	Mean Use				% Frequency			
	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter
Diurnal Raptors								
<u>Buteos</u>	0.19	0.19	0.08	0.01	14.0	16.2	8.0	1.2
red-tailed hawk	0.19	0.19	0.07	0	14.0	16.2	7.0	0
Swainson's hawk	0	0	0	0.01	0	0	0	1.2
unidentified buteo	0	0	0.01	0	0	0	1.0	0
<u>Northern Harrier</u>	0.33	0.01	0.02	0	5.0	1.2	2.0	0
northern harrier	0.33	0.01	0.02	0	5.0	1.2	2.0	0
<u>Eagles</u>	0.05	0.01	0.04	0.01	4.0	1.2	2.0	1.5
bald eagle	0.05	0.01	0.04	0.01	4.0	1.2	2.0	1.5
<u>Falcons</u>	0.01	0	0	0	1.0	0	0	0
American kestrel	0.01	0	0	0	1.0	0	0	0
Total	0.58	0.21	0.14	0.02	24.0	18.6	12.0	2.7
Other Species								
Waterbirds	0.21	0.2	0.05	0	3	8.8	1	0
American white pelican	0	0.06	0	0	0	1.2	0	0
double-crested cormorant	0.21	0.11	0.05	0	3	5	1	0
great blue heron	0	0.01	0	0	0	1.2	0	0
great egret	0	0.01	0	0	0	1.2	0	0
Waterfowl	15.08	0.06	1.01	0.4	38	5	5	7.5
blue-winged teal	0.93	0.02	0	0	10	2.5	0	0
bufflehead	0.02	0	0	0	1	0	0	0
Canada goose	6.96	0	0.95	0.4	15	0	4	7.5
greater white-fronted goose	4.95	0	0	0	1	0	0	0
mallard	0.8	0.01	0.06	0	18	1.2	1	0
northern shoveler	1.11	0.02	0	0	7	1.2	0	0
ruddy duck	0.04	0	0	0	1	0	0	0
snow goose	0.25	0	0	0	2	0	0	0
wood duck	0.02	0	0	0	1	0	0	0
Shorebirds	0	0.01	0.1	0	0	1.2	4	0
killdeer	0	0	0.1	0	0	0	4	0
upland sandpiper	0	0.01	0	0	0	1.2	0	0
Gulls/Terns	0.14	0.04	5.17	0	1	1.2	6	0
Franklin's gull	0	0	5.17	0	0	0	6	0
ring-billed gull	0.14	0.04	0	0	1	1.2	0	0

Table 3. Mean bird use (number of birds/plot^a/20-min survey) and frequency of occurrence (%) by large bird type, raptor subtypes, species, and season observed during fixed-point bird use surveys^b at the Red Pine Wind Resource Area, Lincoln and Lyon Counties, Minnesota, from March 22, 2013 to March 16, 2014.

Type/Subtype/Species	Mean Use				% Frequency			
	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter
Owls	0	0	0	0.01	0	0	0	1.2
great horned owl	0	0	0	0.01	0	0	0	1.2
Vultures	0.02	0	0.01	0	1	0	1	0
turkey vulture	0.02	0	0.01	0	1	0	1	0
Upland Game Birds	0	0	0.04	0.04	0	0	4	2.6
ring-necked pheasant	0	0	0.04	0.04	0	0	4	2.6
Doves/Pigeons	0	0	0.14	0.05	0	0	4	1.2
mourning dove	0	0	0.03	0	0	0	2	0
rock pigeon	0	0	0.11	0.05	0	0	2	1.2
Large Corvids	0	0.04	0.94	0.45	0	1.2	6	4
American crow	0	0.04	0.94	0.45	0	1.2	6	4
Total	15.45	0.35	7.46	0.95	43.0	17.4	31.0	16.5

^a 800-meter radius

^b first 20 minutes of surveys only

Special Status Species

No federally endangered, threatened, candidate, or proposed species were observed during fixed-point surveys or incidentally (Endangered Species Act [ESA] 1973). One-hundred-thirty common terns (*Sterna hirundo*) in two groups were observed during fixed-point surveys; common terns are a Minnesota state threatened species (MDNR 2013; Table 4). Two Minnesota special concern bird species (MDNR 2013) were recorded: the Franklin's gull (*Leucophaeus pipixcan*) and American white pelican (*Pelecanus erythrorhynchos*). There were 2,455 observations in 28 groups of Franklin's gull and 209 individuals in 19 groups of American white pelican observed during fixed-point surveys. Thirty-four individual bald eagles in 27 groups were observed at the RPWRA during fixed-point surveys or incidentally (Table 4). Bald eagles are protected under the Federal Bald and Golden Eagle Protection Act (BGEPA 1940).

Table 4. Number of groups, individuals (number of observations), and status of sensitive species observed during fixed-point bird use surveys^{a,b} (FP) and as incidental wildlife observations (Inc) at the Red Pine Wind Resource Area, Lincoln and Lyon Counties, Minnesota, from March 22, 2013 to March 16, 2014.

Species	Scientific Name	Status	FP		Inc		Total	
			Number of Groups	Number of Observations	Number of Groups	Number of Observations	Number of Groups	Number of Observations
Franklin's gull	<i>Leucophaeus pipixcan</i>	SCS	28	2,455	0	0	28	2,455
American white pelican	<i>Pelecanus erythrorhynchos</i>	SCS	19	209	0	0	19	209
common tern	<i>Sterna hirundo</i>	MNT	2	130	0	0	2	130
bald eagle	<i>Haliaeetus leucocephalus</i>	EA	14	15	13	19	27	34
Bird Total	4 Species		63	2,809	13	19	76	2,828

SCS = MN Special Concern Species (MDNR 2013);

MNT = MN Threatened Species (MDNR 2013);

EA = Federal Bald and Golden Eagle Protection Act (BGEPA 1940)

^a 60-minute survey period

^b regardless of distance from observer

Bird Flight Height and Behavior

For diurnal raptors, 82 single birds or groups totaling 112 individuals were observed flying within the 800-m plot (Table 5). Overall, 76.8% of raptors observed flying were recorded initially within the RSH, 22.3% were below the RSH, and 0.9% were observed flying above the RSH. Eighty percent of flying bald eagles (five individuals) were observed flying within the RSH while just over half (56.0%) of northern harriers were recorded within the RSH (Table 5).

Twenty-four single birds or groups of Franklin's gulls totaling 2,192 individuals were observed flying within the 800-m plot (Table 6). Overall, 90.4% of Franklin's gulls observed flying were recorded initially within the RSH, 9.6% were below the RSH, and none were observed flying above the RSH. American white pelican observed flying at the RPWRA during fixed-point surveys were all recorded within the RSH. Eighty percent of bald eagle groups which were observed flying were recorded within the RSH; twenty percent flew below the RSH (Table 6). All of the flying common terns were observed flying within the RSH.

Table 5. Raptor flight height characteristics by subtype observed during fixed-point bird use surveys^{a,b} at the Red Pine Wind Resource Area, Lincoln and Lyon Counties, Minnesota, from March 22, 2013 to March 16, 2014.

Subtype	Number of Groups Flying	Number Observed Flying	Mean Flight Height (m)	% Observed Flying	% within Flight Height Categories		
					0 - 25 m	25 - 150 m ^c	> 150 m
Buteos	51	55	62.06	85.9	3.6	94.5	1.8
Northern Harrier	24	50	21.04	100	44.0	56.0	0
Eagles	5	5	57.00	45.5	20.0	80.0	0
Falcons	2	2	35.00	100	0	100	0
Diurnal Raptors	82	112	49.09	88.2	22.3	76.8	0.9

^a 60-minute survey period^b 800-meter radius^c The likely rotor-swept heights for potential collision with a turbine blade, or 25 to 150 m (82 to 492 ft) above ground level**Table 6. Flight characteristics for species of concern observed during fixed-point bird use surveys^{a,b} at the Red Pine Wind Project, Lincoln and Lyon Counties, Minnesota, from March 22, 2013 to March 16, 2014.**

Species	Number of Groups Flying	Number Observed Flying	Mean Flight Height (m)	% Observed Flying	% within Flight Height Categories		
					0 - 25 m	25 - 150 m ^c	> 150 m
Franklin's gull	24	2,192	72.29	93.6	9.6	90.4	0
American. white pelican	9	106	73.33	100.0	0	100.0	0
bald eagle	5	5	57.00	45.5	20.0	80.0	0
common tern	1	100	60.00	100.0	0	100.0	0

^a 60-minute survey period^b 800-meter radius^c RSH: the likely rotor-swept heights for potential collision with a turbine blade, or 25 to 150 m (82 to 492 ft) above ground level

Spatial Use

No discernible patterns of bird use concentration were observed during fixed-point surveys (Table 7). Large bird use was highest at points 2 (31.1 birds/20-min survey) and 4 (31.7). This high use was mainly due to waterfowl use. Small bird use was highest at points 10 (6.11) and 11 (9.53). Mean diurnal raptor use was highest at point 5 (1.8) mainly due to use by the northern harrier (Table 7).

Comparison of Raptor Use for 20-min and 60-min Surveys

Diurnal raptor use (number of birds/plot/survey time) values calculated from the full 60-min surveys demonstrated a seasonal pattern of use, with spring exhibiting the highest, summer and fall less than half of that, and winter with the lowest mean use (Table 8). Data from the first 20 min of the standard 60-min survey captured a considerable portion of the observed use (spring 75.3%; summer, 84%; fall, 46.7%; winter, 50%) and mirrored the seasonal use pattern. On the contrary, by assuming bird observations to be equally spread across the 60-min survey period, the mean use calculated by dividing by three underestimates raptor use in all seasons compared to the 20-min survey.

Eagle Use and Flight Paths

Overall, there were 336 hours of bald eagle fixed-point use surveys conducted at the RPWRA. During this time, bald eagles were visible for 306-min (including perched birds) and 12 flight paths were recorded. Flight paths for eagles showed no apparent pattern (Figure 3).

Table 7. Mean use (number of birds/20-min survey) by each survey point raptor subtype observed during fixed-point bird use surveys^{a,b} at the Red Pine Wind Resource Area, Lincoln and Lyon Counties, Minnesota, from March 22, 2013 to March 16, 2014.

Subtype / Species	Survey Point																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Buteos	0.12	0.11	0	0.11	0.07	0.11	0.12	0.11	0.06	0.06	0	0.06	0.12	0.11	0	0.5	0.19	0.17	0	0.17
Northern Harrier	0.38	0.06	0	0	1.73	0	0	0	0.06	0	0	0	0	0	0	0	0	0.06	0	0.06
Eagles	0	0	0.06	0	0	0	0	0.06	0	0	0.07	0	0	0	0	0.06	0.25	0.11	0.07	0
Falcons	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.07	0
All Raptors	0.5	0.17	0.06	0.11	1.8	0.11	0.12	0.17	0.12	0.06	0.07	0.06	0.12	0.11	0	0.56	0.44	0.33	0.14	0.22

^a 800-meter radius

^b first 20 minutes of surveys only

Table 8. Change in mean use estimates^a (number of birds/plot/survey time) for all raptors and raptor subtypes by season and in response to survey length (60-min versus 20-min surveys) and method of calculating 20-min mean use observed at the Red Pine Wind Resource Area, Lincoln and Lyon Counties, Minnesota, from March 22, 2013 to March 16, 2014.

Survey Length	Raptors	Mean Use			
		Spring	Summer	Fall	Winter
All observations recorded during 60-min surveys	Diurnal Raptors	0.77	0.25	0.30	0.06
	<i>Buteos</i>	0.29	0.21	0.19	0.05
	<i>Northern Harrier</i>	0.42	0.02	0.06	0
	<i>Eagles</i>	0.05	0.01	0.04	0.01
	<i>Falcons</i>	0.01	0	0.01	0
Mean use per 20 minutes calculated by scaling the mean use from the 60-min surveys	Diurnal Raptors	0.26	0.08	0.10	0.02
	<i>Buteos</i>	0.10	0.07	0.06	0.02
	<i>Northern Harrier</i>	0.14	0.01	0.02	0
	<i>Eagles</i>	0.02	<0.01	0.01	<0.01
	<i>Falcons</i>	<0.01	0	<0.01	0
Mean use during the first 20 minutes of surveys	Diurnal Raptors	0.58	0.21	0.14	0.03
	<i>Buteos</i>	0.19	0.19	0.08	0.01
	<i>Northern Harrier</i>	0.33	0.01	0.02	0
	<i>Eagles</i>	0.05	0.01	0.04	0.01
	<i>Falcons</i>	0.01	0	0	0

^a 800-meter radius

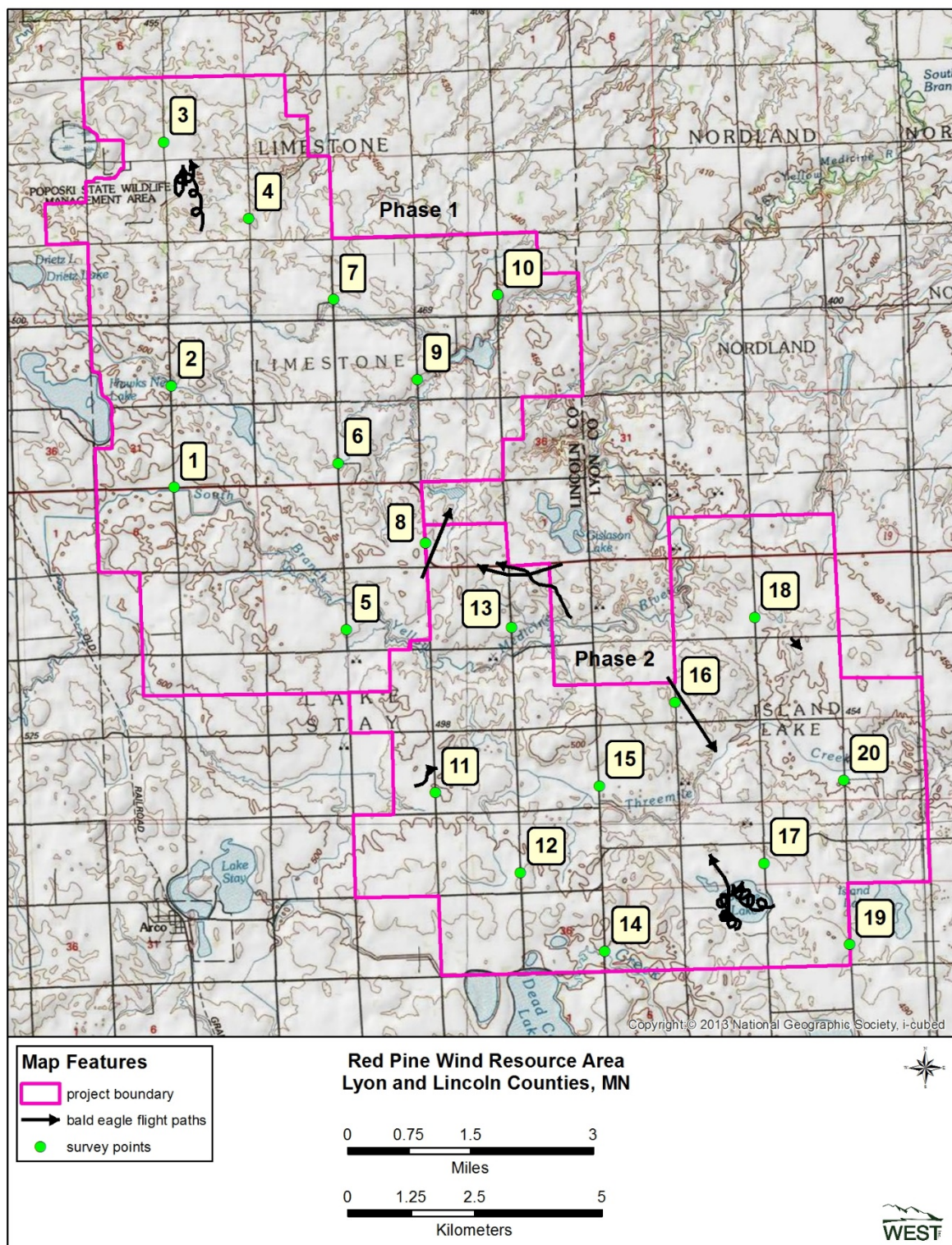


Figure 3. Bald eagle flight paths observed during 60-min fixed-point bird use surveys at the Red Pine Wind Resource Area, Lyon and Lincoln Counties, Minnesota.

DISCUSSION

The Wind Energy Guidelines (USFWS 2012b) use a tiered approach to assess impacts to species and their habitats. Tier 3 studies, as defined in the Wind Energy Guidelines, were targeted to address questions regarding impact that could not be sufficiently addressed using available literature (i.e., Tiers 1 and 2 desktop analysis). Similar efforts have been promoted by the MDNR. These studies provide additional data that, when combined with available literature reviewed in previous Tiers, allows for a confident assessment of the risk of significant adverse impacts to species of concern; identify measures to mitigate significant adverse impacts, if necessary; and/or identify a need for more field studies. 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, state/federally listed species, and Minnesota special concern species; avian use surveys are one of a suite of Tier 3 studies used as part of risk analyses at the RPWRA.

Raptor Use and Fatalities

Overall mean diurnal raptor use observed during this study was 0.22 raptors/800-m plot/20-min survey (Figure 4). Compared to other publicly available project data from the central and western US with similar study seasons, mean raptor use at RPWRA is relatively low. Of 49 projects with raptor use, RPWRA ranked 41st (Figure 4). Results of post-construction bird fatality monitoring in the Midwest ranged from 0.27 to 8.25 bird fatalities per megawatt (MW) per year (Table 9). Bird mortality at the RPWRA would likely be within this range and potentially similar to those rates observed at other wind projects in Minnesota (1.43 to 5.59 bird fatalities/MW/year).

Raptor fatality rates reported at other Minnesota wind energy facilities have been relatively low (zero at Buffalo Ridge and Elm Creek and 0.37 fatalities/MW/year at Moraine II (Table 9). 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. The only directly comparable data is from Grand Ridge I in Illinois, which had a mean raptor use of 0.19 raptors/800-m plot/20-min survey and no raptor fatalities (Derby et al. 2010g). Although not directly comparable, a project in South Dakota (Wessington Springs, which only had spring and fall use) had a mean raptor use for the spring and fall seasons of 0.23 raptors/800-m plot/20-min survey (Derby et al. 2008) and raptor fatality rates of 0.06 and 0.07 fatalities/MW/year (Derby et al. 2010f, 2011b). Mean raptor use at the RPWRA is similar to that reported at the above-mentioned facilities, but still relatively low, which may suggest low overall impact to diurnal raptors should this project be constructed.

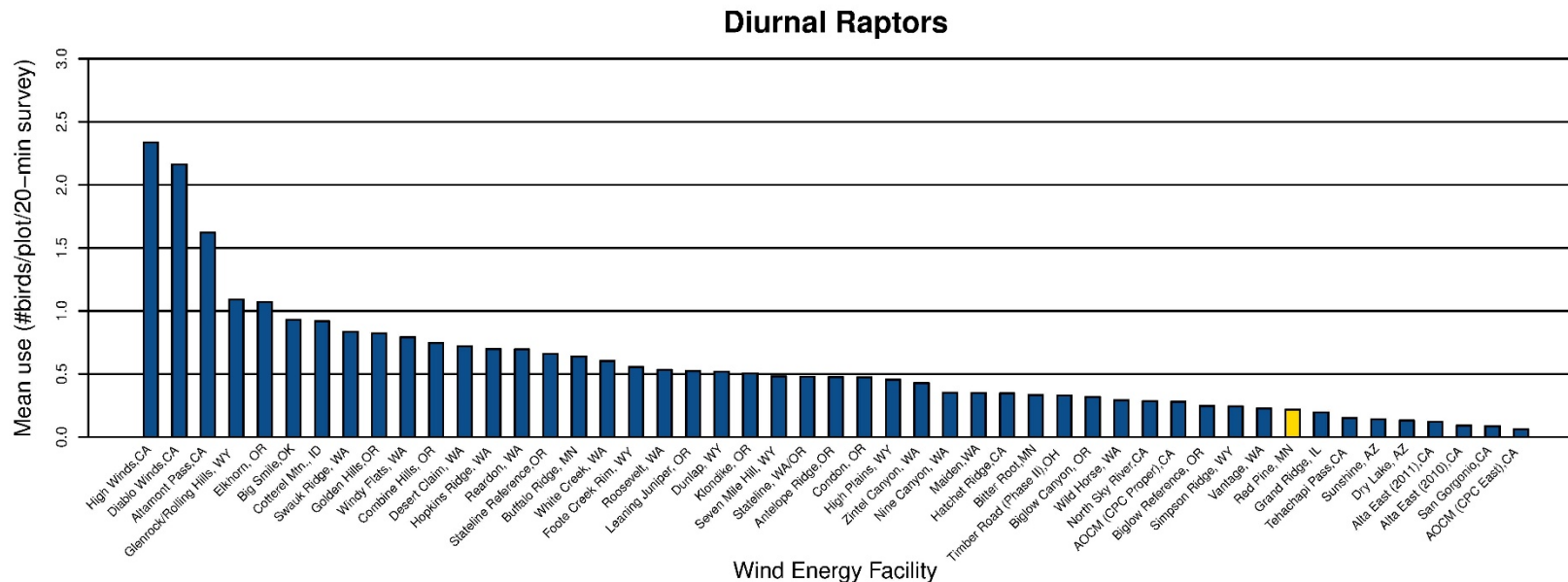


Figure 4. Annual diurnal raptor use (raptor/plot/20-min survey) observed during fixed-point bird use surveys at the Red Pine Wind Resource Area from March 22, 2013 to March 16, 2014, and raptor use observed at other US wind resource areas.

Data from the following sources:

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

Table 9. Raptor and all bird fatality estimates (number of fatalities per megawatt [MW] per year) and dominant land cover for wind energy facilities in the Midwest.

Facility/Project Name	All Bird Fatalities /MW/Year	Raptor Fatalities /MW/Year	Dominant Land Cover	Reference
Barton I & II, IA (2010-2011)	5.5	0	agriculture	Derby et al. 2011a
Blue Sky Green Field, WI (2008; 2009)	7.17	0	agriculture	Gruver et al. 2009
Buffalo Ridge, MN (Phase I; 1996)	4.14	0	agriculture	Johnson et al. 2000a
Buffalo Ridge, MN (Phase I; 1997)	2.51	0	agriculture	Johnson et al. 2000a
Buffalo Ridge, MN (Phase I; 1998)	3.14	0	agriculture	Johnson et al. 2000a
Buffalo Ridge, MN (Phase I; 1999)	1.43	0	agriculture	Johnson et al. 2000a
Buffalo Ridge, MN (Phase II; 1998)	2.47	0	agriculture	Johnson et al. 2000a
Buffalo Ridge, MN (Phase II; 1999)	3.57	0	agriculture	Johnson et al. 2000a
Buffalo Ridge, MN (Phase III; 1999)	5.93	0	agriculture	Johnson et al. 2000a
Buffalo Ridge I, SD (2009-2010)	5.06	0.2	agriculture/grassland	Derby et al. 2010b
Buffalo Ridge II, SD (2011-2012)	1.99	0	agriculture, grassland	Derby et al. 2012a
Cedar Ridge, WI (2009)	6.55	0.18	agriculture	BHE Environmental 2010
Cedar Ridge, WI (2010)	3.72	0.13	agriculture	BHE Environmental 2011
Elm Creek, MN (2009-2010)	1.55	0	agriculture	Derby et al. 2010c
Elm Creek II, MN (2011-2012)	3.64	0	agriculture, grassland	Derby et al. 2012b
Fowler I, IN (2009)	2.83	0	agriculture	Good et al. 2011
Grand Ridge I, IL (2009-2010)	0.48	0	agriculture	Derby et al. 2010g
Kewaunee County, WI (1999-2001)	1.95	0	agriculture	Howe et al. 2002
Moraine II, MN (2009)	5.59	0.37	agriculture/grassland	Derby et al. 2010d
NPPD Ainsworth, NE (2006)	1.63	0.06	agriculture/grassland	Derby et al. 2007
Pioneer Prairie I, IA (Phase II; 2011-2012)	0.27	0	agriculture, grassland	Chodachek et al. 2012
PrairieWinds ND1 (Minot), ND (2010)	1.48	0.05	agriculture	Derby et al. 2011c
PrairieWinds ND1 (Minot), ND (2011)	1.56	0.05	agriculture, grassland	Derby et al. 2012c
PrairieWinds SD1, SD (2011-2012)	1.41	0	grassland	Derby et al. 2012d
Ripley, Ont (2008)	3.09	0.1	agriculture	Jacques Whitford 2009
Rugby, ND (2010-2011)	3.82	0.06	agriculture	Derby et al. 2011b
Top of Iowa, IA (2003)	0.42	0	agriculture	Jain 2005
Top of Iowa, IA (2004)	0.81	0.17	agriculture	Jain 2005
Wessington Springs, SD (2009)	8.25	0.06	grassland	Derby et al. 2010f
Wessington Springs, SD (2010)	0.89	0.07	grassland	Derby et al. 2011d
Winnebago, IA (2009-2010)	3.88	0.27	agriculture/grassland	Derby et al. 2010e

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. Almost 80% of flying diurnal raptors at the RPWRA were observed within the RSH. A higher proportion of buteos, eagles, and falcons flew within the RSH compared to northern harriers, potentially indicating that species in those raptor groups may have a higher risk for collision with wind turbines compared to northern harriers.

This fixed-point bird use survey was designed to provide a relative index of use by raptors during all seasons at the RPWRA. Mean diurnal raptor use was higher during the spring (0.58; Table 3), yet still relatively low when compared to other wind facilities in central and western US. The RPWRA is not within a known raptor migration corridor, and there are no features unique to the RPWRA 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. Further, there is some potential for habitat loss and displacement of individuals, but the resources available in the RPWRA are widely available in the local landscape.

Comparison of Raptor Use for 20-min and 60-min Surveys

Raptor observations were not equally distributed across the 60-min survey period. The results indicated that, for the buteos and the northern harrier groups, the majority of birds were first observed in the first 20-min segment of the survey (Table 8). This was true in spring and summer, but less obvious in fall. For eagles, the observations from the first 20-min survey period were indicative of the mean use observed during the 60-min survey period. The bald eagle was rarely observed throughout the year and the observations recorded after the first 20-min period coincided with observations well outside the 800 m area used in mean use analysis. If observations beyond 800 m were included in the summary statistics, the majority of bald eagle use was still observed in the first 20-min of the 60-min survey.

Survey length is analogous to sampling area: the longer you survey (or the larger the area surveyed), the more observations you will make. A 60-min survey generally results in more bird observations. However, for this study, the information regarding raptor seasonal use and group composition generally considers the 20-min survey period as this is more directly comparable to historic studies for comparison.

Sensitive Species

Common Tern

One-hundred-thirty individuals in two groups of common terns were observed after the first 20-min fixed point surveys and outside the 100-m radius (Table 4). The terns were observed in September and October and could possibly be migrating birds; both observations were over water. RPWRA is not located near the six primary nesting areas and, based on natural history, the potential for nesting in the vicinity is small (MDNR 2014b). One group of flying common terns flew within the RSH, suggesting collision with turbine blades is possible (Table 6). If turbines are sited away from potential common tern habitat (lakes), then impacts to common terns could be reduced.

Bald Eagle

Fifteen observations of bald eagles (11 observations during all bird 20-min fixed point surveys and four observations after the first 20-min of surveys) were also recorded during this study; nineteen additional incidental observations was recorded (Table 4). These results suggest that

bald eagles are year around residents in the vicinity of the RPWRA but do not appear to utilize the project area to any great degree during any season. Four of the five flying bald eagles flew within the RSH (Table 6), suggesting some risk of collision with turbines. However, given the low susceptibility of bald eagles to collisions with wind turbines (six bald eagle fatalities have been publicly reported nationwide; Pagel et al. 2013), and their low use of the project area but overall population increase across the species range, the RPWRA is unlikely to have significant adverse impacts on bald eagle populations.

Franklin's Gull

Franklin's gulls were observed 2,455 times in 28 groups (Table 4), with most groups observed in the fall, suggesting that the birds were migrating. Most birds were observed over cultivated agriculture fields. Breeding colonies are rare in the state. During non-breeding seasons, Franklin's gulls utilize prairie wetlands and lakes, feeding both over water and in fields (MDNR 2014c). All flying Franklin's gulls were observed flying within the RSH. Given the number of gulls observed and their propensity to fly within the RSH (Table 6), there could be potential for turbine-related fatalities to occur. However, the lack of documented fatalities at wind facilities with publicly available data within the breeding range and migratory pathway of Franklin's gulls appear to indicate a low risk of collision with turbines (Tetra Tech 2012).

American White Pelican

Two-hundred-nine observations in nineteen groups of American white pelicans were observed at RPWRA (Table 4). All observations were recorded in the spring, summer, and fall seasons and were of flying birds or birds on water. No evidence of breeding colonies (MDNR 2014a) was observed during surveys. Flying pelicans were observed 100% of the time within the RSH (Table 6). Impacts to pelicans may be reduced by placing turbines away from potential habitat such as wetlands and lakes.

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Appendix A. Individual (# obs) and group (# grps) observations by bird type, raptor subtype, and species observed during fixed-point bird use surveys^{a,b} at the Red Pine Wind Resource Area^a from March 22, 2013 to March 16, 2014.

Type / Common Name	Scientific Name	Spring		Summer		Fall		Winter		Total	
		# grps	# obs	# grps	# obs	# grps	# obs	# grps	# obs	# grps	# obs
Waterbirds		7	55	16	50	1	5	0	0	24	110
American white pelican	<i>Pelecanus erythrorhynchos</i>	3	25	3	21	0	0	0	0	6	46
double-crested cormorant	<i>Phalacrocorax auritus</i>	4	30	6	17	1	5	0	0	11	52
great blue heron	<i>Ardea herodias</i>	0	0	3	6	0	0	0	0	3	6
great egret	<i>Ardea alba</i>	0	0	4	6	0	0	0	0	4	6
Waterfowl		82	2,543	5	9	8	277	7	49	101	2,878
blue-winged teal	<i>Anas discors</i>	11	93	1	1	0	0	0	0	12	94
bufflehead	<i>Bucephala albeola</i>	1	2	0	0	0	0	0	0	1	2
Canada goose	<i>Branta canadensis</i>	29	1,109	1	2	7	271	6	29	43	1,411
greater white-fronted goose	<i>Anser albifrons</i>	1	495	0	0	0	0	0	0	1	495
mallard	<i>Anas platyrhynchos</i>	21	80	2	4	1	6	0	0	24	90
northern shoveler	<i>Anas clypeata</i>	11	111	1	2	0	0	0	0	12	113
ruddy duck	<i>Oxyura jamaicensis</i>	2	4	0	0	0	0	0	0	2	4
snow goose	<i>Chen caerulescens</i>	3	25	0	0	0	0	0	0	3	25
unidentified duck		0	0	0	0	0	0	1	20	1	20
unidentified swan	<i>Cygnus spp</i>	1	22	0	0	0	0	0	0	1	22
unidentified waterfowl		1	600	0	0	0	0	0	0	0	600
wood duck	<i>Aix sponsa</i>	1	2	0	0	0	0	0	0	1	2
Shorebirds		0	0	1	1	4	10	0	0	5	11
killdeer	<i>Charadrius vociferus</i>	0	0	0	0	4	10	0	0	4	10
upland sandpiper	<i>Bartramia longicauda</i>	0	0	1	1	0	0	0	0	1	1
Gulls/Terns		1	14	5	43	8	551	0	0	14	608
Franklin's gull	<i>Leucophaeus pipixcan</i>	0	0	0	0	7	547	0	0	7	547
ring-billed gull	<i>Larus delawarensis</i>	1	14	5	43	0	0	0	0	6	57
unidentified gull		0	0	0	0	1	4	0	0	1	4
Diurnal Raptors		28	58	12	13	14	15	2	2	56	88
<u>Buteos</u>		15	19	10	11	8	8	1	1	34	39
red-tailed hawk	<i>Buteo jamaicensis</i>	15	19	10	11	7	7	0	0	32	37
Swainson's hawk	<i>Buteo swainsoni</i>	0	0	0	0	0	0	1	1	1	1
unidentified buteo	<i>Buteo spp</i>	0	0	0	0	1	1	0	0	1	1
<u>Northern Harrier</u>		7	33	1	1	2	2	0	0	10	36
northern harrier	<i>Circus cyaneus</i>	7	33	1	1	2	2	0	0	10	36
<u>Eagles</u>		5	5	1	1	3	4	1	1	10	11
bald eagle	<i>Haliaeetus leucocephalus</i>	5	5	1	1	3	4	1	1	10	11
<u>Falcons</u>		1	1	0	0	0	0	0	0	1	1
American kestrel	<i>Falco sparverius</i>	1	1	0	0	0	0	0	0	1	1
<u>Other Raptors</u>		0	0	0	0	1	1	0	0	1	1

Appendix A. Individual (# obs) and group (# grps) observations by bird type, raptor subtype, and species observed during fixed-point bird use surveys^{a,b} at the Red Pine Wind Resource Area^a from March 22, 2013 to March 16, 2014.

Type / Common Name	Scientific Name	Spring		Summer		Fall		Winter		Total	
		# grps	# obs	# grps	# obs	# grps	# obs	# grps	# obs	# grps	# obs
unidentified hawk		0	0	0	0	1	1	0	0	1	1
Owls		0	0	0	0	0	0	1	1	1	1
great horned owl	<i>Bubo virginianus</i>	0	0	0	0	0	0	1	1	1	1
Vultures		1	2	0	0	1	1	0	0	2	3
turkey vulture	<i>Cathartes aura</i>	1	2	0	0	1	1	0	0	2	3
Upland Game Birds		0	0	0	0	4	4	2	3	6	7
ring-necked pheasant	<i>Phasianus colchicus</i>	0	0	0	0	4	4	2	3	6	7
Doves/Pigeons		0	0	0	0	4	14	1	4	5	18
mourning dove	<i>Zenaida macroura</i>	0	0	0	0	2	3	0	0	2	3
rock pigeon	<i>Columba livia</i>	0	0	0	0	2	11	1	4	3	15
Large Corvids		0	0	1	3	7	94	3	31	11	128
American crow	<i>Corvus brachyrhynchos</i>	0	0	1	3	7	94	3	31	11	128
Passerines^c		0	0	0	0	33	376	11	180	44	556
American goldfinch	<i>Spinus tristis</i>	0	0	0	0	7	25	1	1	8	26
American robin	<i>Turdus migratorius</i>	0	0	0	0	4	71	1	10	5	81
barn swallow	<i>Hirundo rustica</i>	0	0	0	0	2	10	0	0	2	10
blue jay	<i>Cyanocitta cristata</i>	0	0	0	0	1	1	0	0	1	1
brown-headed cowbird	<i>Molothrus ater</i>	0	0	0	0	1	12	0	0	1	12
cliff swallow	<i>Petrochelidon pyrrhonota</i>	0	0	0	0	2	9	0	0	2	9
common grackle	<i>Quiscalus quiscula</i>	0	0	0	0	5	142	0	0	5	142
dark-eyed junco	<i>Junco hyemalis</i>	0	0	0	0	4	34	1	22	5	56
European starling	<i>Sturnus vulgaris</i>	0	0	0	0	1	32	1	1	2	33
horned lark	<i>Eremophila alpestris</i>	0	0	0	0	0	0	4	110	4	110
Lapland longspur	<i>Calcarius lapponicus</i>	0	0	0	0	0	0	1	3	1	3
red-winged blackbird	<i>Agelaius phoeniceus</i>	0	0	0	0	1	10	0	0	1	10
snow bunting	<i>Plectrophenax nivalis</i>	0	0	0	0	1	6	2	33	3	39
unidentified sparrow		0	0	0	0	2	21	0	0	2	21
western meadowlark	<i>Sturnella neglecta</i>	0	0	0	0	2	3	0	0	2	3
Woodpeckers		0	0	0	0	2	2	0	0	2	2
downy woodpecker	<i>Picoides pubescens</i>	0	0	0	0	1	1	0	0	1	1
northern flicker	<i>Colaptes auratus</i>	0	0	0	0	1	1	0	0	1	1
Overall		119	2,672	40	119	86	1,349	27	270	272	4,410

^a regardless of distance from observer

^b first 20 minutes of surveys only

^c Excluding large corvids

^d Species only observed after the initial 20 minutes of survey

Appendix B-1. Mean bird use (number of birds/800-m plot/20-min survey), percent of total use (%), and frequency of occurrence (%) for large bird types, raptor subtypes, and species by season observed during fixed-point bird use surveys^{a,b} at the Red Pine Wind Resource Area from March 22, 2013 to March 16, 2014.

Type / Species	Mean Use				% of Use				% Frequency			
	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter
Waterbirds	0.21	0.20	0.05	0	1.3	35.6	0.7	0	3.0	8.8	1.0	0
American white pelican	0	0.06	0	0	0	11.1	0	0	0	1.2	0	0
double-crested cormorant	0.21	0.11	0.05	0	1.3	20.0	0.7	0	3.0	5.0	1.0	0
great blue heron	0	0.01	0	0	0	2.2	0	0	0	1.2	0	0
great egret	0	0.01	0	0	0	2.2	0	0	0	1.2	0	0
Waterfowl	15.08	0.06	1.01	0.40	94.1	11.1	13.3	41.0	38.0	5.0	5.0	7.5
blue-winged teal	0.93	0.02	0	0	5.8	4.4	0	0	10.0	2.5	0	0
bufflehead	0.02	0	0	0	0.1	0	0	0	1.0	0	0	0
Canada goose	6.96	0	0.95	0.40	43.4	0	12.5	41.0	15.0	0	4.0	7.5
greater white-fronted goose	4.95	0	0	0	30.9	0	0	0	1.0	0	0	0
mallard	0.80	0.01	0.06	0	5.0	2.2	0.8	0	18.0	1.2	1.0	0
northern shoveler	1.11	0.02	0	0	6.9	4.4	0	0	7.0	1.2	0	0
ruddy duck	0.04	0	0	0	0.2	0	0	0	1.0	0	0	0
snow goose	0.25	0	0	0	1.6	0	0	0	2.0	0	0	0
wood duck	0.02	0	0	0	0.1	0	0	0	1.0	0	0	0
Shorebirds	0	0.01	0.10	0	0	2.2	1.3	0	0	1.2	4.0	0
killdeer	0	0	0.10	0	0	0	1.3	0	0	0	4.0	0
upland sandpiper	0	0.01	0	0	0	2.2	0	0	0	1.2	0	0
Gulls/Terns	0.14	0.04	5.17	0	0.9	6.7	68.0	0	1.0	1.2	6.0	0
Franklin's gull	0	0.00	5.17	0	0	0	68.0	0	0	0	6.0	0
ring-billed gull	0.14	0.04	0	0	0.9	6.7	0	0	1.0	1.2	0	0
Diurnal Raptors	0.58	0.21	0.14	0.03	3.6	37.8	1.8	2.8	24.0	18.8	12.0	2.7
<u>Buteos</u>	0.19	0.19	0.08	0.01	1.2	33.3	1.1	1.3	14.0	16.2	8.0	1.2
red-tailed hawk	0.19	0.19	0.07	0	1.2	33.3	0.9	0	14.0	16.2	7.0	0
Swainson's hawk	0	0	0	0.01	0	0	0	1.3	0	0	0	1.2
unidentified buteo	0	0	0.01	0	0	0	0.1	0	0	0	1.0	0
<u>Northern Harrier</u>	0.33	0.01	0.02	0	2.1	2.2	0.3	0	5.0	1.2	2.0	0
northern harrier	0.33	0.01	0.02	0	2.1	2.2	0.3	0	5.0	1.2	2.0	0
<u>Eagles</u>	0.05	0.01	0.04	0.01	0.3	2.2	0.5	1.5	4.0	1.2	2.0	1.5
bald eagle	0.05	0.01	0.04	0.01	0.3	2.2	0.5	1.5	4.0	1.2	2.0	1.5
<u>Falcons</u>	0.01	0	0	0	<0.1	0	0	0	1.0	0	0	0
American kestrel	0.01	0	0	0	<0.1	0	0	0	1.0	0	0	0
Owls	0	0	0	0.01	0	0	0	1.3	0	0	0	1.2
great horned owl	0	0	0	0.01	0	0	0	1.3	0	0	0	1.2

Appendix B-1. Mean bird use (number of birds/800-m plot/20-min survey), percent of total use (%), and frequency of occurrence (%) for large bird types, raptor subtypes, and species by season observed during fixed-point bird use surveys^{a,b} at the Red Pine Wind Resource Area from March 22, 2013 to March 16, 2014.

Type / Species	Mean Use				% of Use				% Frequency			
	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter
Vultures	0.02	0	0.01	0	0.1	0	0.1	0	1.0	0	1.0	0
turkey vulture	0.02	0	0.01	0	0.1	0	0.1	0	1.0	0	1.0	0
Upland Game Birds	0	0	0.04	0.04	0	0	0.5	4.0	0	0	4.0	2.6
ring-necked pheasant	0	0	0.04	0.04	0	0	0.5	4.0	0	0	4.0	2.6
Doves/Pigeons	0	0	0.14	0.05	0	0	1.8	5.1	0	0	4.0	1.2
mourning dove	0	0	0.03	0	0	0	0.4	0	0	0	2.0	0
rock pigeon	0	0	0.11	0.05	0	0	1.4	5.1	0	0	2.0	1.2
Large Corvids	0	0.04	0.94	0.45	0	6.7	12.4	45.8	0	1.2	6.0	4.0
American crow	0	0.04	0.94	0.45	0	6.7	12.4	45.8	0	1.2	6.0	4.0
Overall	16.03	0.56	7.60	0.98								

^a 800-m radius

^b first 20 minutes of surveys only

Appendix B-2. Mean bird use (number of birds/100-m plot/20-min survey), percent of total use (%), and frequency of occurrence (%) for small bird types and species by season observed during fixed-point bird use surveys^{a,b} at the Red Pine Wind Resource Area from March 22, 2013 to March 16, 2014.

Type / Species	Mean Use				% of Use				% Frequency			
	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter
Passerines^c	0	0	3.76	2.43	0	0	99.5	100.0	0	0	26.0	15.5
American goldfinch	0	0	0.25	0.01	0	0	6.6	0.5	0	0	7.0	1.2
American robin	0	0	0.71	0.25	0	0	18.8	10.3	0	0	4.0	2.5
barn swallow	0	0	0.10	0	0	0	2.6	0	0	0	2.0	0
blue jay	0	0	0.01	0	0	0	0.3	0	0	0	1.0	0
brown-headed cowbird	0	0	0.12	0	0	0	3.2	0	0	0	1.0	0
cliff swallow	0	0	0.09	0	0	0	2.4	0	0	0	2.0	0
common grackle	0	0	1.42	0	0	0	37.6	0	0	0	4.0	0
dark-eyed junco	0	0	0.34	0.28	0	0	9.0	11.3	0	0	4.0	1.2
European starling	0	0	0.32	0.01	0	0	8.5	0.5	0	0	1.0	1.2
horned lark	0	0	0	1.40	0	0	0	57.4	0	0	0	5.5
Lapland longspur	0	0	0	0.08	0	0	0	3.1	0	0	0	2.5
red-winged blackbird	0	0	0.10	0	0	0	2.6	0	0	0	1.0	0
snow bunting	0	0	0.06	0.41	0	0	1.6	17.0	0	0	1.0	2.5
unidentified sparrow	0	0	0.21	0	0	0	5.6	0	0	0	2.0	0
western meadowlark	0	0	0.03	0	0	0	0.8	0	0	0	2.0	0
Woodpeckers	0	0	0.02	0	0	0	0.5	0	0	0	2.0	0
downy woodpecker	0	0	0.01	0	0	0	0.3	0	0	0	1.0	0
northern flicker	0	0	0.01	0	0	0	0.3	0	0	0	1.0	0
Overall	0	0	3.78	2.43								

^a 100-meter radius

^b first 20 minutes of surveys only

^c excluding large corvids

**Raptor Nest Survey and Eagle Nest Monitoring for the
Red Pine Wind Project
Lincoln and Lyon Counties, Minnesota**



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INTRODUCTION

EDF Renewable Energy, Inc. (EDF) has proposed development of the Red Pine Wind Project (Project) in Lincoln and Lyon counties, Minnesota (Figure 1). EDF requested that Western EcoSystems Technology, Inc. (WEST) conduct a ground-based raptor nest survey within two miles of the Project. A majority of the current Project area was previously surveyed for raptor nests in spring 2013 (WEST 2013). This survey was conducted in order to document potential nests within the portions of the expanded Project area that were not previously surveyed as well as to document any new or newly active nests.

This report provides results of the general raptor nest survey conducted at the Project on April 14, 2015. Additional follow up survey efforts include the monitoring of two occupied bald eagle (*Haliaeetus leucocephalus*) nests documented during the ground-based surveys of the Project in mid-May and early June; results are discussed below.

STUDY AREA

The 46,064-acre (72 square miles) Project is located in Lincoln and Lyon counties, in southwest Minnesota, approximately 8 miles west of the city of Marshall (Figure 1). The project falls within the Northern Glaciated Plains Ecoregion, which covers much of the western portion of Minnesota (Bryce et Al. 1996). The Northern Glaciated Plains are characterized by a flat to gently rolling landscape composed of glacial drift. This ecoregion serves as a transitional zone between tall and shortgrass prairie with high concentrations of temporary and seasonal wetlands that are favorable for duck nesting and migration.

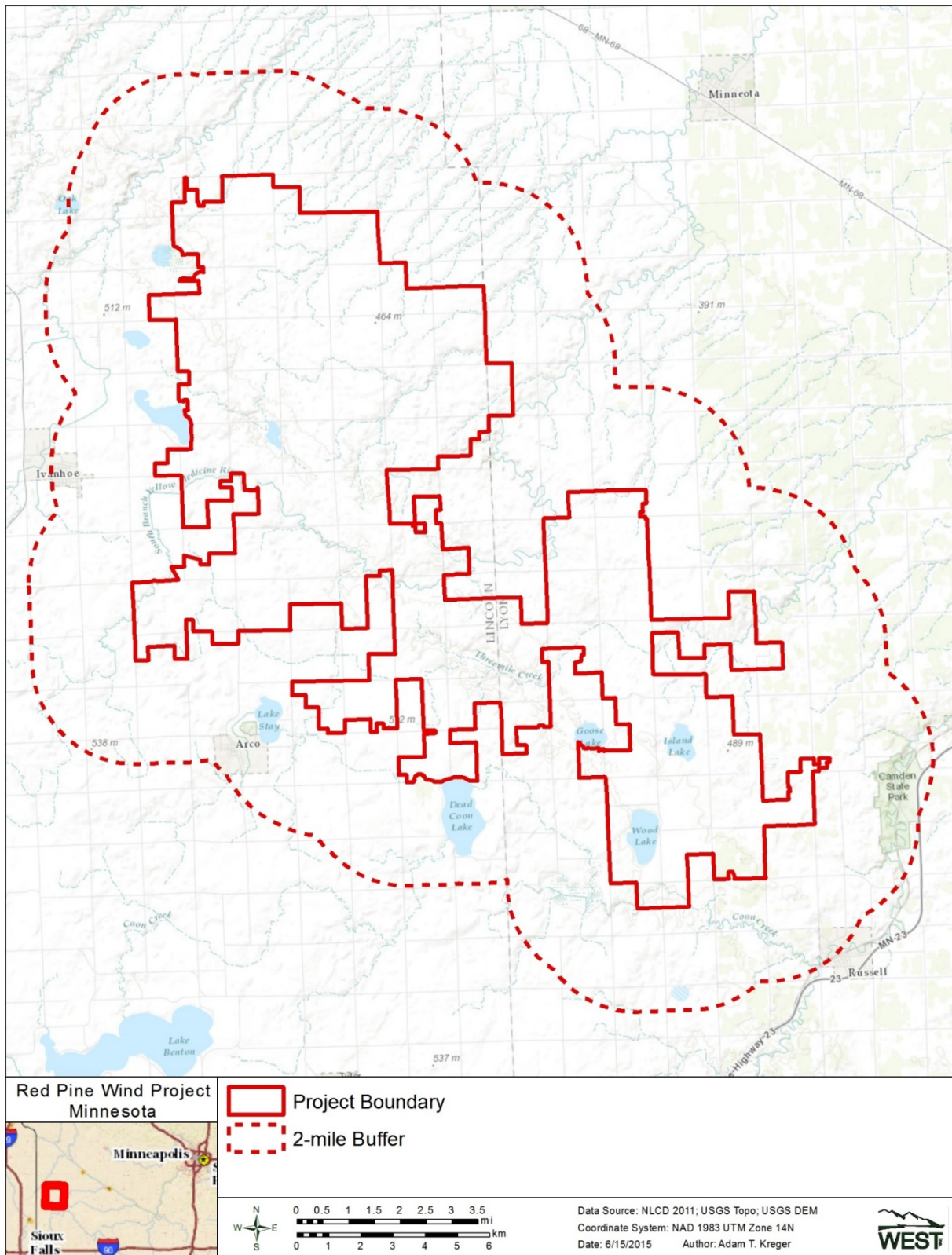


Figure 1. Location of the Red Pine Wind Energy Project

METHODS

Raptor Nest Survey

One ground-based survey was conducted from public access roads in mid-April, a period before leaf out when raptors would be actively tending to a nest or incubating eggs. Surveys were conducted in accordance with the guidance provided in the US Fish and Wildlife Service (USFWS) Eagle Conservation Plan Guidance (April 2013) and USFWS Inventory and Monitoring Protocols (Pagel et al. 2010). An experienced raptor ecologist conducted the survey. Raptors are defined here as kites, accipiters, buteos, harriers, eagles, falcons, and owls. However, the main focus of the survey was to identify bald eagle (*Haliaeetus leucocephalus*) nests. Bald eagle nest surveys focused on locating eyries (large, stick nest structures) in suitable eagle nesting substrate (trees, transmission lines, cliff faces, etc.) within the proposed Project and a two mile buffer (Figure 1); the overall survey area was 132,416 acres (207 square miles). Efforts were made to minimize disturbance to breeding raptors; the greatest possible distance at which the species could be identified was maintained, with distances varying depending upon nest location.

In general, all potential bald eagle and raptor nest habitat was surveyed by driving along public roads and stopping to survey potential raptor nest habitat using binoculars and a tripod mounted spotting scope. Surveys were conducted between 0800 hours and 1700 hours. The locations of all potential raptor nests were recorded using a hand-held Global Positioning System (GPS); coordinates were set at Universal Transverse Mercator (UTMs) North American Datum (NAD) 83 unit. This included all confirmed and potential nests regardless of their activity status. To determine the status of a nest, the biologist relied on clues that included behavior of adults and presence of eggs, young, or whitewash. Attempts were made to identify the species of raptor associated with each active nest. Raptor species, nest type, nest status, nest condition, and substrate, were recorded at each nest location.

Terminology

Included below are descriptions of terms used during the documentation of nests (see Results section).

Nest ID - WEST assigned a unique nest identification number for each nest documented.

Species - A species was assigned to each nest where possible; when a nest could not be identified to species it was classified as an unknown raptor nest. Nests documented as unknown raptor species are defined as any stick nest that did not have an occupant associated with it at the time of the survey. Many times nests will become abandoned or no longer used, and over time, may become a historic nest site. Additionally, an unknown number/type of stick nests are used by corvid (ravens and crows) or owl species and may not have been detected as such during aerial raptor surveys based on differences in nesting chronology. Unknown raptor nests, including old nests or nests that could become suitable for raptors, are documented in

order to populate a nest database to ensure that future surveys include all potentially suitable nest sites.

Nest Condition - Nest condition was categorized using descriptions ranging from poor to excellent. Although the determination of nest condition can be subjective and may vary between observers, it gives a general sense of when a nest or nest site may have last been used. Nests in poor to fair condition are typically in disrepair, sloughing, or sagging heavily, and would require some level of effort to rebuild in order to be suitable for successful nesting. Nests in good to excellent condition are those that appear to have been well maintained, have a well-defined bowl shape, are not sagging or sloughing, and appear to be suitable for nesting.

Substrate - The substrate in which a nest was observed was recorded to provide observers a visual reference. Substrates range from manmade structures (such as power lines, nest platforms, and dock hoists) to conifer and deciduous tree species to cliff faces.

Nest Status - WEST categorizes basic nest use consistent with definitions from the USFWS Eagle Conservation Plan Guidance (April 2013). Nests were classified as occupied if any of the following were observed at the nest structure: (1) an adult in an incubating position, (2) eggs, (3) nestlings or fledglings, (4) occurrence of a pair of adults (or, sometimes sub-adults), (5) a newly constructed or refurbished stick nest in the area where territorial behavior of a raptor had been observed early in the breeding season, or (6) a recently repaired nest with fresh sticks (clean breaks) or fresh boughs on top, and/or droppings and/or molted feathers on its rim or underneath. Occupied nests were further classified as active if an egg or eggs had been laid or nestlings were observed, or inactive if no eggs or chicks were present. A nest that does not meet the above criteria for “occupied” was classified as “unoccupied”.

Follow-up Ground Nest Monitoring Surveys

WEST biologists conducted follow-up ground bald eagle nest monitoring surveys at the two potential bald eagle nests that were located in the 2-mi buffer, southwest and southeast of the Project. Two bald eagle nest monitoring surveys were conducted at both occupied nests, on May 20-21, 2015 and June 9-10, 2015.

The bald eagle nest monitoring surveys consisted of one 1,600 m radius fixed-point established on public roads for each potential bald eagle nest, following methods similar to Reynolds et al. (1980); and consistent with recommendations outlined in the ECPG. The monitoring plot for nest 11 was located approximately 250 feet (76 m) from the nest. The monitoring plot for nest 42 was located approximately 0.3 mi (0.5 km) from the bald eagle nest. The nest monitoring plots were established to attempt to document flight paths of the bald eagles in an effort to determine the nesting territory and surrounding use area within the Project.

Biologists recorded all eagles seen during each survey, regardless of distance to the observer. Estimated distance to each bird observed was recorded to the nearest five meters. Landmarks were located to aid in estimating distances to each bird. Point count duration was for four hours

at each nest. The date, start, and end time of observation period, plot number, number of individuals, sex and age class (if possible), distance from plot center when first observed (in m), closest distance (m), height above ground (m), activity, and habitat were recorded.

Biologists recorded eagle behavior and habitat for each eagle observation during each one-minute interval the bird was within view, per the USFWS ECPG. Behavior categories included soaring flight, flapping-gliding, hunting, kiting-hovering, stooping/diving at prey, stooping or diving in an antagonistic context with other bird species perched, being mobbed, undulating/territorial flight, auditory, and other (noted in comments). The initial flight patterns and habitat types (at first observation) were uniquely identified on the data sheet and subsequent patterns and habitats were also recorded. The flight directions of observed bald eagles were recorded on the data sheet map. Approximate flight height at first observation was recorded to the nearest five meters; the approximate lowest and highest flight heights observed were also recorded. Any comments or unusual observations were noted in the comments section. Weather information recorded for each survey point included temperature, wind speed, wind direction, precipitation, and cloud cover.

RESULTS

Aerial Raptor Nest Survey

WEST biologists detected a total of 46 raptor nests representing two species during surveys conducted on April 14, 2015 (Table 1, Figure 2). Of these nests, three were identified as red-tailed hawk nests (RTHA), one as a bald eagle nest (BAEA), one as a potential BAEA, and 41 unknown raptor species nests (UNKN) (Table 1; Figure 2).

One occupied active bald eagle nest was located within approximately 300 feet of the Project boundary in the southeastern portion of the Project (Nest ID 11; Table 1, Figure 2). This nest was not documented during the previous 2013 surveys conducted at the Project. Two adult bald eagles were seen in the nest and appeared to be feeding chicks, though the chicks could not be directly observed.

One potential bald eagle nest was located within a quarter mile of the boundary in the southwestern portion of the Project (Nest ID 42; Table 1, Figure 2). The nest was a stick nest in good condition that was large enough to support nesting eagles. No eagles were documented in the vicinity of this nest. This nest was also documented in the 2013 nest survey, as an unoccupied raptor nest.

Table 1. Raptor nest location and features for identified nests during 2015 survey for the Red Pine Wind Project, Lincoln and Lyon counties, Minnesota (NAD83, Zone 14).

ID	Northing	Easting	Species	Nest Substrate	Status at time of Survey	Condition	Year First Detected	Within Project Boundary?
0	260158	4927221	unknown	tree	inactive	dilapidated	2013	No
1	254466	4929024	unknown	tree	inactive	fair	2015	Yes
2	255595	4925027	unknown	tree	inactive	good	2013	No
3	255996	4922888	unknown	tree	inactive	good	2013	No
4	254626	4919695	unknown	tree	inactive	good	2013	No
5	253225	4918280	unknown	tree	inactive	good	2015	Yes
6	255480	4913201	unknown	tree	inactive	fair	2015	No
7	256151	4912758	unknown	tree	inactive	poor	2015	No
8	253758	4917033	unknown	tree	inactive	fair	2015	No
9	259196	4915147	RTHA	tree	inactive	good	2015	Yes
10	257435	4918455	unknown	tree	inactive	good	2015	Yes
11	257888	4920706	BAEA	tree	active	excellent	2015	No
12	256778	4923529	RTHA	tree	active	excellent	2013	Yes
13	257620	4930292	unknown	tree	inactive	good	2015	No
14	256722	4930205	unknown	tree	inactive	good	2015	No
15	256459	4929243	unknown	tree	inactive	good	2015	No
16	258283	4928322	unknown	tree	inactive	good	2015	No
17	258052	4930989	unknown	tree	inactive	good	2015	No
18	258309	4931666	unknown	tree	inactive	good	2015	No
19	258487	4932196	unknown	tree	inactive	good	2015	No
20	257058	4934062	unknown	tree	inactive	fair	2015	No
21	257048	4933962	unknown	tree	inactive	fair	2015	No
22	262167	4926918	unknown	tree	inactive	fair	2015	No
23	261652	4921310	RTHA	tree	active	excellent	2013	No
24	262423	4919622	unknown	tree	active	excellent	2013	No
25	260486	4918584	unknown	tree	inactive	good	2015	Yes
26	243706	4938164	unknown	tree	inactive	fair	2015	No
27	241833	4931177	unknown	tree	inactive	poor	2015	No
28	241149	4924158	unknown	tree	inactive	fair	2015	No
29	244889	4920860	unknown	tree	inactive	fair	2015	No
30	246141	4937171	unknown	tree	inactive	poor	2015	Yes
31	245801	4920146	unknown	tree	inactive	fair	2015	No
32	247768	4920083	unknown	tree	inactive	fair	2015	No
33	247895	4920236	unknown	tree	inactive	good	2015	No
34	248435	4928527	unknown	tree	inactive	poor	2015	Yes

Table 1. Raptor nest location and features for identified nests during 2015 survey for the Red Pine Wind Project, Lincoln and Lyon counties, Minnesota (NAD83, Zone 14).

ID	Northing	Easting	Species	Nest Substrate	Status at time of Survey	Condition	Year First Detected	Within Project Boundary?
35	248722	4930296	unknown	tree	inactive	fair	2015	Yes
36	250503	4929044	unknown	tree	inactive	fair	2015	Yes
37	253630	4921541	unknown	tree	inactive	fair	2015	Yes
38	243021	4929468	unknown	tree	inactive	good	2015	No
39	245953	4927557	unknown	tree	active	good	2013	Yes
40	249676	4927668	unknown	tree	inactive	poor	2013	Yes
41	253207	4926201	unknown	tree	inactive	good	2013	Yes
42	246226	4922288	BAEA	tree	inactive	good	2013	No
43	245935	4922564	unknown	tree	inactive	fair	2013	No
44	252192	4922076	unknown	tree	inactive	good	2013	No
45	246096	4920339	unknown	tree	inactive	poor	2013	Yes

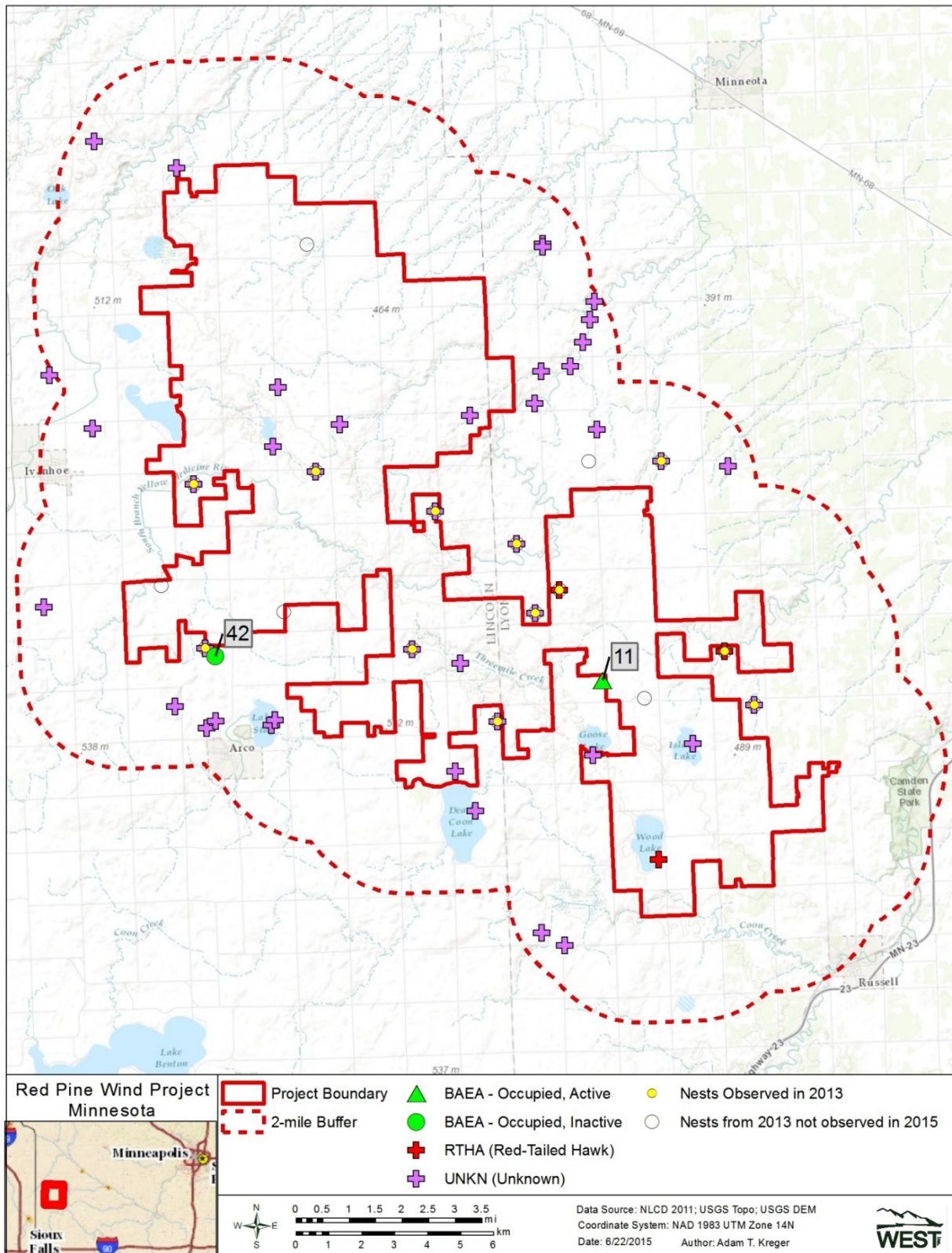


Figure 2. Raptor Nests at the Red Pine Wind Energy Project.

Follow-up Ground Nest Surveys

Biologists completed 24 total survey observation hours of eagle nest monitoring. Eagle nest monitoring surveys were conducted May 20, 2015 and June 9, 2015 at the eastern eagle nest and May 21 and June 10, 2015 at the western eagle nest. During the 18 total hours of nest observation, two bald eagle chicks and two adult bald eagles were documented at the eastern nest (Figure 2, nest 11) confirming that this is an active and occupied bald eagle nest. The bald eagle chicks at nest 11 had not fledged at the time of the survey and were observed flapping wings and jumping to test wings at the nest. Adults at nest 11 were observed flying above the nest and flying away from the nest in a south to southwest direction to forage and returning with fish to feed chicks. This flight pattern suggests that Goose Lake (0.9 mi south of the nest) and Dead Coon Lake (3.2 mi southwest of the nest) may be primary foraging areas for this breeding pair.

There were no chicks observed in the western nest (Figure 2, nest 42) and adult activity at the nest consisted of occasional and infrequent perching on or near the nest, confirming that it is inactive.

DISCUSSION/CONCLUSION

These surveys provided additional information on raptor and eagle use within the vicinity of the Project. Nest survey results suggest that there are no bald eagle nests within the Project, although there are two located within 250 feet to a quarter mile of the boundary. The Project site is dominated by cultivated agricultural lands with relatively little forest cover. In summary, a total of 46 occupied and unoccupied nest locations were recorded. The majority of raptor nests observed within the Project area and a 2-mile buffer (40 nests) appeared to be unoccupied and not identified to a particular species. Three raptor nest locations that had previously been recorded in 2013 were not located during this survey, and 32 raptor nests were documented in this 2015 survey that were not located during the 2013 survey (both within and outside of the 2013 survey boundaries). One active bald eagle nest was observed during the ground-based survey as well as one potential bald eagle nest. This potential nest was later confirmed to be an occupied, but inactive, bald eagle nest. The remaining three nests were identified as occupied red-tailed hawk nests.

The bald eagle nest monitoring conducted at the Project confirmed that nest 11 is an occupied active bald eagle nest with a breeding pair of eagles fledging two chicks. Flight patterns observed during eagle nest monitoring showed a lot of flights directly above the nest (within 800 meters of nest, but did also show adults leaving the nest and flying in a south to southwest direction and returning with fish to feed the fledgling eagle chicks. These observations suggest that the eagles may be using nearby Goose Lake to the south and Dead Coon Lake to the southwest as hunting and foraging habitat. Both of these lakes are outside the Project boundary, with some portion of the shoreline bordering the Project boundary. Monitoring of nest 42 showed only occasional occupancy by adult eagles perching on or nearby the nest for short periods of time. This nest

does not contain chicks and is not occupied by an active breeding pair of eagles. The infrequent presence of adult eagles at nest 42 confirms that it is an occupied but inactive nest.

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**Eagle Nest Survey Results for the
Red Pine Wind Energy Project
Lincoln County, Minnesota**

Draft Report



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INTRODUCTION

EDF Renewable Energy (EDF) is developing the Red Pine Wind Project (Project) in Lincoln County, Minnesota (Figure 1). WEST conducted a ground-based raptor nest survey in 2015 covering a two-mile buffer of the 2015 Project boundary. EDF requested that Western EcoSystems Technology, Inc. (WEST) conduct an aerial-based eagle nest survey in 2016 of the modified 2016 Project boundary following the U.S. Fish and Wildlife Service (USFWS) *Eagle Conservation Plan Guidance: Module 1 – Land-based Wind Energy, Version 2* (ECPG; USFWS 2013). This report provides results of the eagle nest survey conducted at the Project on March 29 - 31, 2016.

STUDY AREA

The Project is located on about 42,000 acres in Lincoln County in southwest Minnesota, approximately thirteen miles west of the town of Marshall and ten miles east of the town of Hendricks in western Minnesota (Figure 1). The proposed Project is located in the Northern Glaciated Plains Level III Ecoregion, with portions in the Prairie Coteau and Prairie Coteau Escarpment Level IV Ecoregions (U.S. Environmental Protection Agency [USEPA] 2013a). This region, previously dominated by shortgrass and tallgrass prairies, seasonal and semi-permanent wetlands, mixed tall shrubs, and riparian and oak-aspen groves, has been extensively converted to farmland and cropland, livestock production, and pasture lands (USEPA 2013b). Topography in the region is flat to gently rolling.

METHODS

Aerial Raptor Nest Survey

One aerial survey was conducted from a helicopter in late March (March 29 – 31, 2016), a period before leaf out when eagles would be actively tending to a nest or incubating eggs. Aerial surveys were conducted in accordance with the guidance provided in the *Eagle Conservation Plan Guidance: Module 1 – Land-based Wind Energy, Version 2* (ECPG; USFWS 2013) and the USFWS Inventory and Monitoring Protocols (Pagel et al. 2010). An experienced raptor ecologist and a skilled helicopter pilot conducted the survey. Raptors are defined here as kites, accipiters, buteos, harriers, eagles, falcons, and owls. However, the main focus of the survey was to identify bald eagle nests. Bald eagle nest surveys focused on locating eyries (large, stick nest structures) in suitable eagle nesting substrate (trees, transmission lines, cliff faces, etc.) within and around the proposed Project (Figure 1), considering a 10-mile buffer (Figure 1). Efforts were made to minimize disturbance to breeding raptors; the greatest possible distance at which the species could be identified was maintained, with distances varying depending upon nest location and wind conditions.

In general, all potential bald eagle and raptor nest habitat was surveyed by flying meandering transects between 0.25 and 0.5 miles apart, flying at speeds of 60 to 75 miles per hour throughout the proposed Project and associated 10-mi buffer. Surveys were typically conducted between

07:00 hours and 18:00 hours. The locations of all potential eagle nests were recorded using a hand-held Global Positioning System (GPS); coordinates were set at Latitude/Longitude (hddd.ddddd°) World Geodetic System (WGS) 84 unit. This included all confirmed and potential nests regardless of their activity status. To determine the status of a nest, the biologist relied on clues that included behavior of adults and presence of eggs, young, or whitewash. Nest type, nest status, nest condition, and substrate, were recorded at each nest location to the extent possible.

Terminology

Included below are descriptions of terms used during the documentation of nests (see Results section).

Nest ID - WEST assigned a unique nest identification number for each nest documented.

Species - A species was assigned to each nest when possible, otherwise, it was classified as an unknown raptor nest. Nests documented as unknown raptor species are defined as any stick nest that did not have an occupant associated with it at the time of the survey. Many times nests will become abandoned or no longer used, and over time, may become a historic nest site. Unknown raptor nests, including old nests or nests that could become suitable for raptors, are documented in order to populate a nest database to ensure that future surveys include all potentially suitable nest sites.

Nest Condition - Nest condition was categorized using descriptions ranging from poor to excellent. Although the determination of nest condition can be subjective and may vary between observers, it gives a general sense of when a nest or nest site may have last been used. Nests in poor to fair condition are typically in disrepair, sloughing, or sagging heavily, and would require some level of effort to rebuild in order to be suitable for successful nesting. Nests in good to excellent condition are those that appear to have been well maintained, have a well-defined bowl shape, are not sagging or sloughing, and appear to be suitable for nesting.

Substrate - The substrate in which a nest was observed was recorded to provide observers a visual reference. Substrates range from manmade structures (such as power lines, nest platforms, and dock hoists) to biological and physical structures (conifer and deciduous tree species, cliff faces).

Nest Status - WEST categorizes basic nest use consistent with definitions from the ECPG. Nests were classified as occupied if any of the following were observed at the nest structure: (1) an adult in an incubating position, (2) eggs, (3) nestlings or fledglings, (4) occurrence of a pair of adults (or, sometimes sub-adults), (5) a newly constructed or refurbished stick nest in the area where territorial behavior of a raptor had been observed early in the breeding season, or (6) a recently repaired nest with fresh sticks (clean breaks) or fresh boughs on top, and/or droppings and/or molted feathers on its rim or underneath. Occupied nests were further classified as active if an egg or eggs had been laid or nestlings were observed, or inactive if no eggs or chicks were present. A nest that does not meet the above criteria for "occupied" was classified as "unoccupied".

RESULTS

Aerial Raptor Nest Survey

A WEST biologist detected a total of 10 eagle nests during aerial surveys conducted on March 29 - 31, 2016 (Table 1). Seven occupied bald eagle nests and three inactive likely bald eagle nests were identified (Table 1; Figure 1).

No occupied or potential bald eagle nests were located within the Project (Figure 1). No bald eagles were observed during the survey within the Project boundary. Seven occupied active bald eagle nests were documented in this survey, along with three likely bald eagle nests that appeared to be inactive and/or unoccupied (Figure 1). The two bald eagle nests documented by WEST in 2015 were both active in 2016; an additional five active bald eagle nests were observed within the expanded 10-mile survey area. No federal or state-listed threatened or endangered raptor species were observed nesting within the Project or associated buffer.

Nest A – this nest is located approximately 1.9 miles east of the Project boundary, and was active in 2015. The nest is in good condition, and an adult bald eagle was seen sitting in the nest during the 2016 aerial survey. The nest is therefore considered occupied and active (Appendix A, Figure A).

Nest B – this nest is located approximately 0.8 mile west of the Project boundary, and was occupied but inactive in 2015. The nest is in good condition, and an adult bald eagle was seen sitting in the nest during the 2016 aerial survey. The nest is therefore considered occupied and active (Appendix A, Figure B).

Nest C – this nest is located approximately 0.8 mile west-southwest of the Project boundary just to the northeast of the Northern Tallgrass Prairie National Wildlife Refuge unit, and was not observed in 2015. The nest is in good condition, and an adult bald eagle was seen sitting in the nest during the 2016 aerial survey. The nest is therefore considered occupied and active (Appendix A, Figure C).

Nest D – this nest is located approximately 2.0 miles north of the Project boundary, and was outside of the 2015 survey area. The nest is in good condition, and an adult bald eagle was seen sitting in the nest during the 2016 aerial survey; when it flew off the nest, two eggs were visible. The nest is therefore considered occupied and active (Appendix A, Figure D).

Nest E – this nest is located approximately 6.8 miles southwest of the Project boundary on the northern shore of Lake Benton, and was outside of the 2015 survey area. The nest is in good condition, and an adult bald eagle was seen sitting in the nest during the 2016 aerial survey. The nest is therefore considered occupied and active (Appendix A, Figure E).

Nest F – this nest is located approximately 6.7 miles west of the Project boundary on the northern shore of Lake Shaokatan, and was outside of the 2015 survey area. The nest is in good condition, and an adult bald eagle was seen sitting in the nest during the 2016 aerial survey; when it flew off the nest, three eggs were visible. The nest is therefore considered occupied and active (Appendix A, Figure F).

Nest G – this nest is located approximately 7.5 miles north of the Project boundary, and was outside of the 2015 survey area. The nest is in good condition, and an adult bald eagle was seen sitting in the nest during the 2016 aerial survey. The nest is therefore considered occupied and active (Appendix A, Figure G).

Nest H – this nest is located approximately 3.6 miles east of the Project boundary on a tree on the island in Island Lake, and was outside of the 2015 survey area. The nest is in good condition and is consistent with an eagle nest, but no signs of activity were observed (Appendix A, Figure H).

Nest I – this nest is located approximately 5.7 miles west of the Project boundary within the Ash Lake WMA, and was outside of the 2015 survey area. The nest is in good condition and is consistent with an eagle nest, but no signs of activity were observed (Appendix A, Figure I).

Nest J – this nest is located approximately 5.8 miles northwest of the Project boundary, and was outside of the 2015 survey area. The nest is in poor condition and is consistent with an eagle nest, but no signs of activity were observed (Appendix A, Figure J).

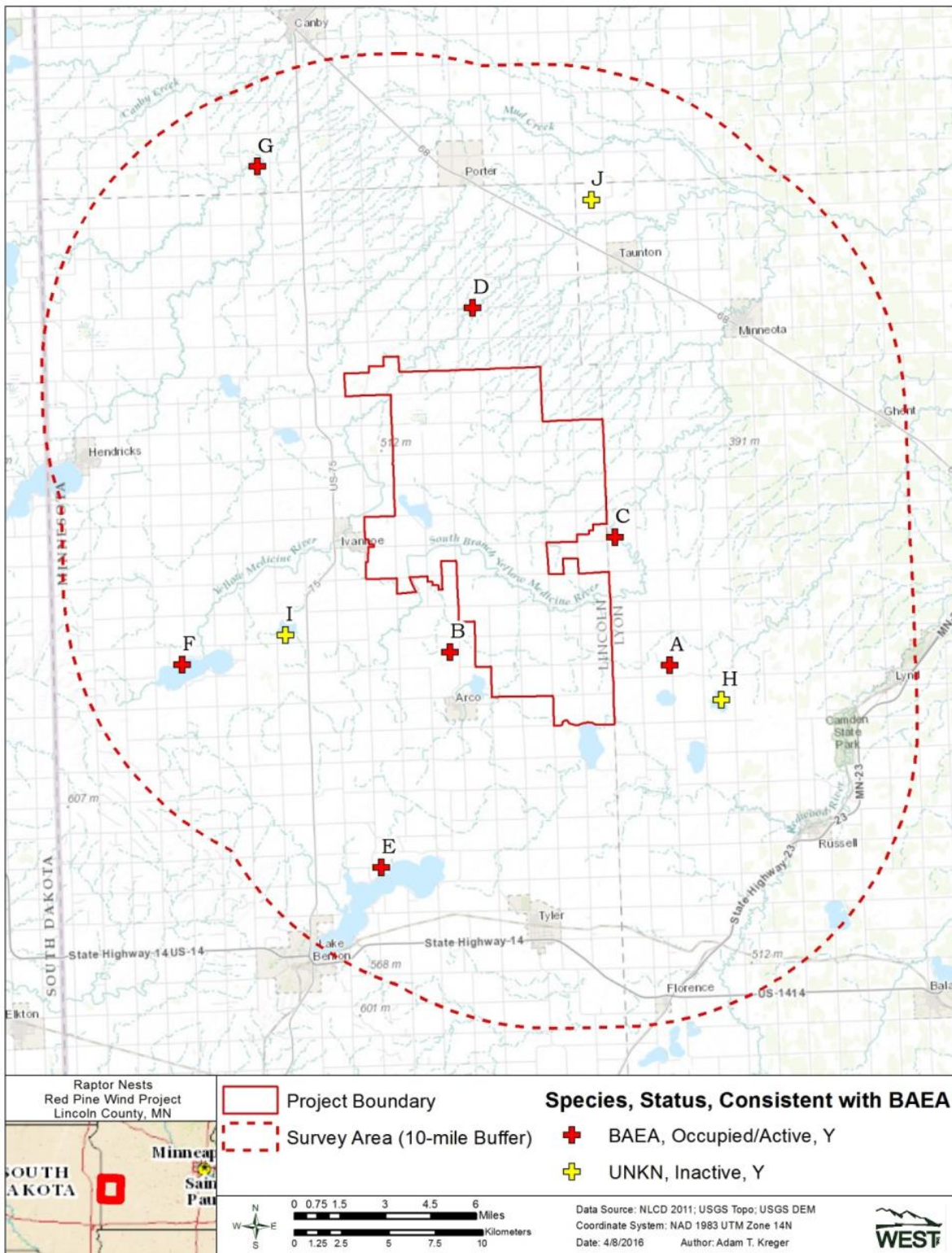


Figure 1. Overview of the Red Pine Wind Project, Lincoln County, Minnesota, and associated 10-mile buffer, nest locations, and bald eagle observations during raptor nest surveys conducted March 29-31, 2016 survey.

Table 1. Eagle nest unique ID (NEST ID), locations (Lat/Long, hddd.dddd°; WGS 84) and features for identified nests during the March 29-31, 2016 survey for the Red Pine Wind Project, Lincoln County, Minnesota.

Nest	Nest ID	Species	Nest Substrate	Latitude	Longitude	Status at time of survey	Condition
A	032916-BAEA-MN-175	Bald Eagle	Tree	44.39921	-96.0405	occupied, active	Good
B	033016-BAEA-MN-186	Bald Eagle	Tree	44.40915	-96.1878	occupied, active	Good
C	032916-BAEA-MN-177	Bald Eagle	Tree	44.46089	-96.0745	occupied, active	Good
D	033016-BAEA-MN-184	Bald Eagle	Tree	44.57303	-96.1642	occupied, active	Good
E	033016-BAEA-MN-188	Bald Eagle	Tree	44.30697	-96.2384	occupied, active	Good
F	033116-BAEA-MN-197	Bald Eagle	Tree	44.40707	-96.3669	occupied, active	Good
G	033116-BAEA-MN-201	Bald Eagle	Tree	44.64394	-96.305	occupied, active	Good
H	032916-UNKN-MN-169	Likely Bald Eagle	Tree	44.38148	-96.0071	unoccupied, inactive	Good
I	033116-UNKN-MN-198	Likely Bald Eagle	Tree	44.41962	-96.2966	unoccupied, inactive	Good
J	032916-UNKN-MN-180	Likely Bald Eagle	Tree	44.62316	-96.0824	unoccupied, inactive	Poor

DISCUSSION/CONCLUSION

These surveys provided additional information on eagle nest distribution and activity status within the vicinity of the Project. Aerial survey results indicate that there are no bald eagle nests within the Project. The mean inter-nest distance of all 10 bald eagle nests observed (active and likely inactive nests) is 4.8 miles. The ECPG states that eagle pairs at nests within one-half the mean internest distance, in this case 2.4 miles, are susceptible to disturbance take and blade strike mortality. However, it is anticipated that most flight corridors used by nesting bald eagles are located much closer than 2.4 miles from the nest. Additionally, the draft Midwest Wind Energy Multi-Species Habitat Conservation Plan, of which EDF is a participating member, lists 1.6 miles as a maximum area for turbine setbacks from bald eagle nests, with potential for turbines to be sited closer if evidence shows they are not located within higher use travel corridors.

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**APPENDIX A: IMAGES OF OCCUPIED-ACTIVE BALD EAGLE NESTS AND UNKNOWN-
INACTIVE LIKELY BALD EAGLE NESTS IN THE 10-MILE BUFFER OF THE RED PINE
WIND PROJECT, LINCOLN COUNTY, MINNESOTA**

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Figure A. Nest A is located approximately 1.9 miles east of the Project boundary, and was active in 2015. The nest is in good condition, and an adult bald eagle was seen sitting in the nest during the 2016 aerial survey. The nest is therefore considered occupied and active in 2016.



Figure B. Nest B is located approximately 0.8 mile west of the Project boundary, and was occupied but inactive in 2015. The nest is in good condition, and an adult bald eagle was seen sitting in the nest during the 2016 aerial survey. The nest is therefore considered occupied and active in 2016.



Figure C. Nest C is located approximately 0.8 mile west-southwest of the Project boundary just to the northeast of the Northern Tallgrass Prairie National Wildlife Refuge unit, and was not observed in 2015. The nest is in good condition, and an adult bald eagle was seen sitting in the nest during the 2016 aerial survey. The nest is therefore considered occupied and active in 2016.



Figure D. Nest D is located approximately 2.0 miles north of the Project boundary, and was outside of the 2015 survey area. The nest is in good condition, and an adult bald eagle was seen sitting in the nest during the 2016 aerial survey; when it flew off the nest, two eggs were visible. The nest is therefore considered occupied and active in 2016.



Figure E. Nest E is located approximately 6.8 miles southwest of the Project boundary on the northern shore of Lake Benton, and was outside of the 2015 survey area. The nest is in good condition, and an adult bald eagle was seen sitting in the nest during the 2016 aerial survey. The nest is therefore considered occupied and active in 2016.



Figure F. Nest F is located approximately 6.7 miles west of the Project boundary on the northern shore of Lake Shaokatan, and was outside of the 2015 survey area. The nest is in good condition, and an adult bald eagle was seen sitting in the nest during the 2016 aerial survey; when it flew off the nest, three eggs were visible. The nest is therefore considered occupied and active in 2016.



Figure G. Nest G is located approximately 7.5 miles north of the Project boundary, and was outside of the 2015 survey area. The nest is in good condition, and an adult bald eagle was seen sitting in the nest during the 2016 aerial survey. The nest is therefore considered occupied and active in 2016.



Figure H. Nest H is located approximately 3.6 miles east of the Project boundary on a tree on the island in Island Lake, and was outside of the 2015 survey area. The nest is in good condition and is consistent with an eagle nest, but no signs of activity were observed during the aerial survey in 2016.



Figure I. Nest I is located approximately 5.7 miles west of the Project boundary within the Ash Lake WMA, and was outside of the 2015 survey area. The nest is in good condition and is consistent with an eagle nest, but no signs of activity were observed during the aerial survey in 2016.



Figure J. Nest J is located approximately 5.8 miles northwest of the Project boundary, and was outside of the 2015 survey area. The nest is in poor condition and is consistent with an eagle nest, but no signs of activity were observed during the aerial survey in 2016.