Palmer’s Creek Wind Farm

Draft Environmental Assessment
Chippewa County, Minnesota

Western Area
Power Administration

DOE/EA-2053
October 2017

TABLE OF CONTENTS

TABLES

FIGURES

APPENDICES

LIST OF ABBREVIATIONS

Abbreviation	Term/Phrase/Name
AADT	annual average daily traffic
Applicant	Palmer's Creek Wind Farm, LLC
BMP	best management practices
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CO2	carbon dioxide
CREP	Conservation Reserve Enhancement Program
dBA	A-weighted decibels
EA	Environmental Assessment
EPA	U.S. Environmental Protection Agency
FAA	Federal Aviation Administration
FPPA	Farmland Protection Policy Act
FSA	Farm Service Agency
HAP	hazardous air pollutant
JEDI	Jobs and Economic Development Impact
kV	kilovolt
LIDAR	light detection and ranging
MNDNR	Minnesota Department of Natural Resources
MW	megawatt
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act of 1969
NREL	National Renewable Energy Lab

Abbreviation	**Term/Phrase/Name**
NRHP	National Register of Historic Places
O&M	operations and maintenance
OP	observer points
Palmer's Creek	Palmer's Creek Wind Farm, LLC
PBO	Programmatic Biological Opinion
PEIS	Programmatic Environmental Impact Statement
PPA	power purchase agreement
PWI	Public Waters Inventory
PWP	Permanent Wetland Preserve
RIM	Reinvest in Minnesota
SCADA	supervisory control and data acquisition
SHPO	State Historic Preservation Office
SODAR	sonic detection and ranging
SPP	Southwest Power Pool
SWPPP	Storm Water Pollution Prevention Plan
T-line	transmission line
U.S.C.	United States Code
UGP	Upper Great Plains
FWS	U.S. Fish and Wildlife Service
USGS	United States Geological Survey
WAPA	Western Area Power Administration
WTG	wind turbine generator

1. INTRODUCTION

Palmer's Creek Wind Farm, LLC (Palmer's Creek or Applicant) proposes to construct the Palmer's Creek Wind Farm (Project), a Large Wind Energy Conversion System, with a 44.6-megawatt (MW) nameplate capacity in Chippewa County, Minnesota (**Figure 1**). The project area consists of 18 wind turbines located on approximately 6,150 acres of privately owned land. The Project (Proposed Action) would also include associated access roads, a new collector substation, an operations and maintenance (O&M) facility, and associated transmission interconnection facilities. Palmer's Creek further proposes to interconnect the Project to an existing Western Area Power Administration (WAPA) substation, the Granite Falls Substation, which is within the project area boundary.

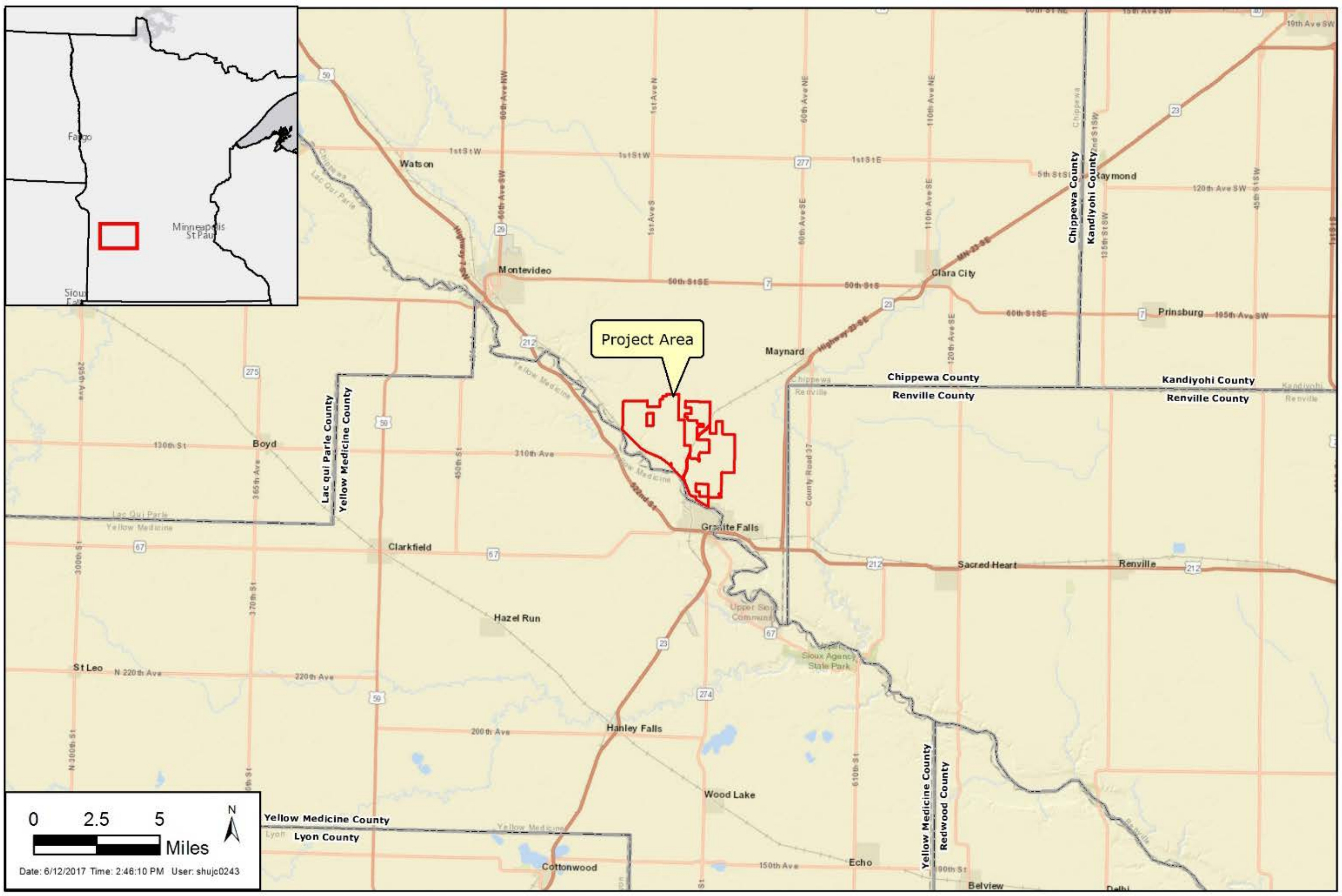


Figure 1: Site Location Map

The interconnection of the proposed Project to WAPA's transmission system is a Federal action under the National Environmental Policy Act of 1969 (NEPA)(42 United States Code (U.S.C.) § 4321 et seq). This Environmental Assessment (EA) tiers from the analysis conducted in the Upper Great Plains (UGP) Wind Energy Final Programmatic Environmental Impact Statement (PEIS), a document prepared jointly by WAPA and the U.S. Fish and Wildlife Service (USFWS) (WAPA and USFWS, 2015a). The UGP region encompasses all or parts of the States of Iowa, Minnesota, Montana, Nebraska, North Dakota, and South Dakota, including Chippewa County, Minnesota.

The PEIS assesses environmental impacts associated with wind energy development and identifies best management practices (BMPs) to avoid and minimize those impacts. As stated in the Executive Summary of the PEIS, if wind energy project developers are willing to implement the applicable evaluation process, BMPs, and conservation measures identified in the PEIS, the NEPA evaluation for that wind energy project may tier off the analyses in the PEIS. Applicable material from the PEIS is incorporated by reference in this EA in accordance with 40 Code of Federal Regulations (CFR) §§ 1502.20 and 1508.28. The analysis in this EA is Project-specific and focuses on site-specific issues that are not already addressed in sufficient detail in the PEIS. This EA is intended to be read in conjunction with the PEIS, and the EA and PEIS together comprise the NEPA documentation for this Federal action. Palmer's Creek has committed to implementing the applicable BMPs and conservation measures from the PEIS to allow for tiering.

1.1 WAPA's Purpose and Need

WAPA's purpose and need is to consider and respond to Palmer's Creek interconnection request in accordance with the Southwest Power Pool (SPP) Tariff and the Federal Power Act as described in Section 1.1.1 of the PEIS (WAPA 2015a). WAPA's UGP Region is currently operating under the SPP Tariff.

1.2 Palmer's Creek Goals and Objectives

Palmer's Creek goals and objectives for the Project are to provide an economically viable, reliable, and cost-effective source of renewable energy to users in Minnesota, the Dakotas and throughout WAPA's service area. To accomplish this, the Project must be technically, environmentally, and economically feasible, and therefore, Palmer's Creek needs:

- Reliable wind resources capable of producing enough power for the Project to be economically viable,
- Landowners willing to participate in the Project,
- Environmental conditions that allow the Project to comply with applicable environmental regulation at a reasonable cost,
- An interconnection agreement with WAPA to interconnect the project to WAPA's system, and
- A transmission service agreement for transmission of power across WAPA's system lines.

2. DESCRIPTION OF PROPOSED ACTION AND NO ACTION ALTERNATIVES

This EA analyzes two alternatives, the Proposed Action and the No Action Alternative.

2.1 Proposed Action

Palmer's Creek Proposed Action is to construct and operate the Palmer's Creek Wind Farm and enter into an interconnection agreement with the SPP to connect the Palmer's Creek Project to WAPA's Granite Falls Substation. As part of the Proposed Action, WAPA would install necessary equipment in their existing substation to accept the generated power.

2.1.1 Palmer's Creek Wind Farm

The Palmer's Creek Wind Farm would consist of two (2) 2.3-MW and sixteen (16) 2.5-MW wind turbines with an aggregate nameplate capacity of 44.6 MW. The Project would also include:

- Underground electric collector lines,
- New central collector substation (Palmer's Creek Substation),
- Approximately 1000-foot long transmission line (T-line) interconnecting the Granite Falls Substation,
- O&M facility,
- Access roads connecting to each turbine,
- One permanent meteorological tower,
- Supervisory control and data acquisition (SCADA) system, and
- Temporary laydown yard.

Figure 2 shows the proposed layout of the Project facilities. The expected life of the Project is approximately 20 to 40 years.

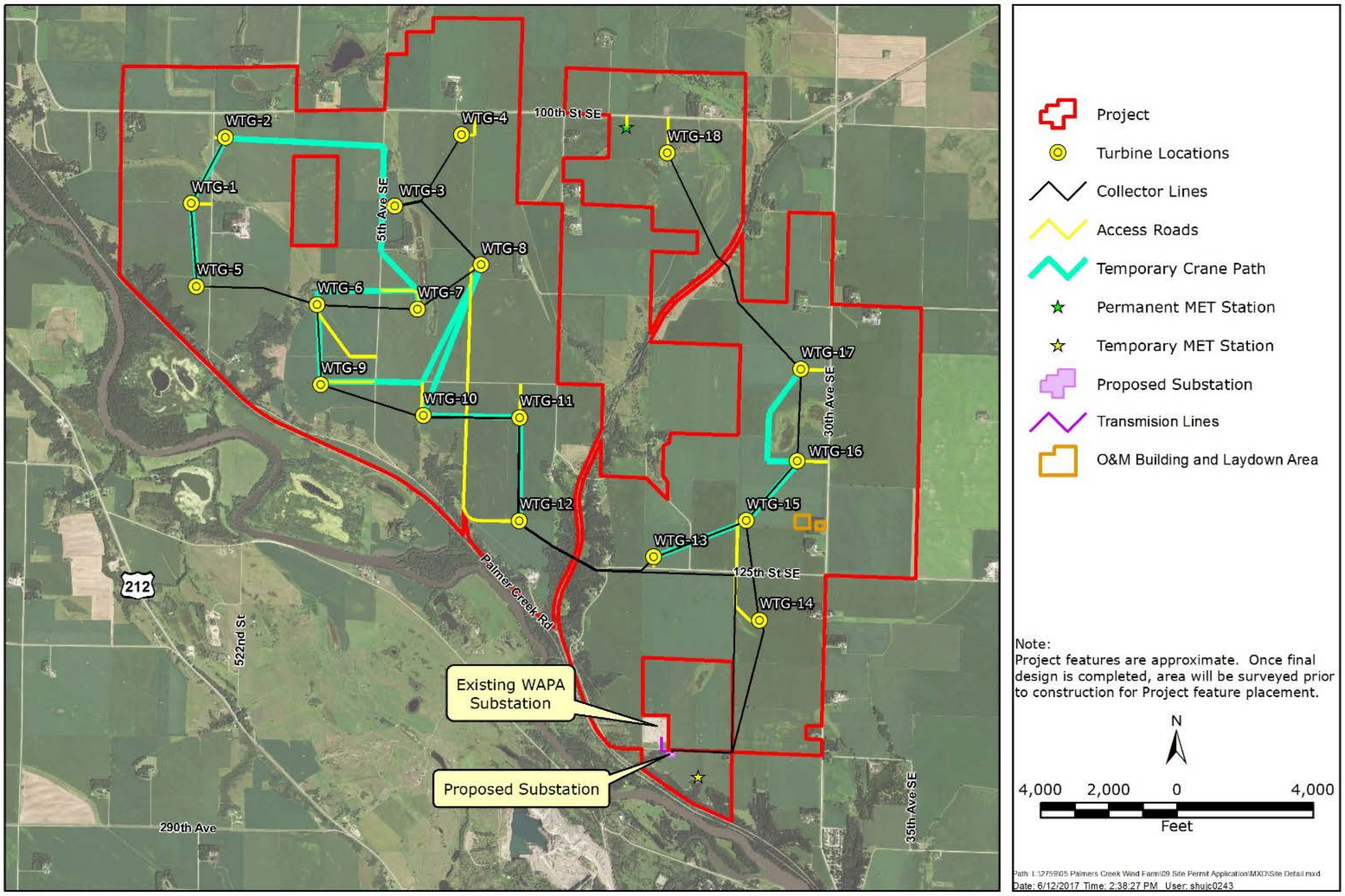


Figure 2: Site Detail Map

2.1.1.1 Wind Turbines

Palmer's Creek plans to install two (2) 2.3-MW and sixteen (16) 2.5-MW horizontal axis wind turbine generators (WTG) for the Project. Each turbine would have a hub height of between 262 and 295 feet and a turbine rotor diameter of approximately 380 feet. The total height of each turbine would be approximately 485 feet with a blade in the vertical position. Additional specifications for the proposed turbine model are provided for reference in **Appendix A** of this EA. Turbine towers would be cylindrical monopoles, approximately 262 to 295 feet in height. The towers would be constructed of high strength tubular steel, approximately 15 feet in diameter at the base, with internal joint flanges. Towers would be fabricated in three sections and assembled onsite. The tower color would be non-reflective light grey, and all surfaces would be multi-layer coated for protection against corrosion. Marking and lighting of the wind farm would be done in compliance with Federal Aviation Administration (FAA) regulations.

2.1.1.2 Wind Turbine Foundations

The wind turbine foundations would typically be concrete spread foundations. The actual foundation for each turbine would be specifically designed based on geotechnical analysis of a 50-foot core sample at each turbine location combined with structural loading requirements for the turbine. The pedestal diameter for a 262-foot tower is approximately 18 feet. In some cases, an area around a turbine may be covered in four inches of gravel, river rock, or crushed stone. Figure

3.3-1 in the PEIS shows a typical foundation under construction. The excavated area for the turbine foundations would typically be approximately 75 feet by 75 feet, approximately 0.1 acres. During construction, a larger area (approximately 300 feet diameter) would be used to lay down the rotors and maneuver cranes during turbine assembly (See Figure 3.3-3 in the PEIS).

2.1.1.3 Generator Step-up Transformers

A generator step up transformer would be installed at the base of each wind turbine to increase the output voltage of the wind turbine to the voltage of the power collection system (34.5-kV). The transformers would be mounted on concrete pads and would be placed next to each wind turbine.

2.1.1.4 Access Roads

Approximately 5.5 miles of new or upgraded roads would be constructed to facilitate both construction and maintenance of the wind turbines. These roads have been designed to minimize length and construction impact. Initially, turbine access roads would be approximately 40 feet in width to accommodate the safe operation of construction equipment. Upon completion of construction, the turbine access roads would be reclaimed and narrowed to an extent allowing for the routine maintenance of the facility, or approximately 16 feet in width.

The wind turbines would be accessible from gravel access roads, which would follow fence lines, field lines, and existing field access roads to the extent possible. Siting roads in areas with unstable soil would be avoided wherever possible. Roads would include appropriate drainage controls, including culverts, and would be constructed in a manner to allow farm and/or land owner equipment to cross. The access road cross sections would consist of graded soil and surfaced with compacted aggregate base course. Final access road locations would be established with input from landowners. Gates would be installed where access roads cross landowner fences.

2.1.1.5 O&M Facility

An O&M facility would be located northeast of the substation off of County Road 5. The property would be graded and a 4,000-square foot utility building would be erected for offices, storage and maintenance work. The proposed O&M facility would house the equipment to operate and maintain the wind farm. A gravel parking pad would provide the building with a parking area. The O&M Facility would have a new septic system and well for domestic purposes.

2.1.1.6 Meteorological Towers and SODAR Units

One temporary 200-foot meteorological tower and one temporary Sonic Detection and Ranging (SODAR) unit are currently installed within the project area. These temporary structures would be removed within approximately one year of Project construction. The Project would include installation of wind measurement equipment, such as a permanent 290-foot meteorological tower to house anemometers to measure the wind speed. The permanent tower would not have guy wires and would be lighted in compliance with FAA regulations.

2.1.1.7 Temporary Laydown/Stockpile Areas /Crane Walks

An approximately three-acre temporary laydown area would be selected within the project area. Turbine components may be temporarily stored within this area before being moved to the final turbine sites. The location of the laydown area would be selected during final design; however, a preferred location would be an undeveloped or previously disturbed area that is flat and does not contain streams, wetlands, or other environmentally sensitive resources.

In addition to the approximately three-acre laydown/stockpile area, temporary crane walk disturbances would also be necessary for the Project. Crane walks are estimated to be 40 feet wide and would be located throughout the Project based on the shortest route to the next turbine in the construction sequence.

2.1.1.8 34.5-kV Collector System

Each wind turbine within the Project Area would be interconnected by communication and electrical power collection circuit facilities. These facilities would include underground feeder lines (collector lines) that would collect wind-generated power from each wind turbine and deliver it to the Palmer's Creek Substation.

This system would be used to route the power from each turbine to the Palmer's Creek Substation (collector substation) where the electrical voltage would be stepped up from 34.5 kV to 115 kV. The underground collector system would be placed in one trench and connect each of the turbines to the Palmer's Creek Substation. The estimated trench length is 73,920 feet (approximately 14 miles).

The underground collector circuits would consist of three power cables contained in an insulated jacket and buried at a minimum depth of four feet that would not interfere with farming operations. Access to the underground lines would be located at each turbine site and where the cables enter Palmer's Creek Substation. Due to the power carrying limits of underground cabling, two underground collector lines or circuits would be used to collect power from the individual turbines.

The underground electrical collector and communication systems generally would be installed by plowing or trenching the cables. Using this method, the disturbed soils and topsoil are typically replaced over the buried cable within one day, and the drainage patterns and surface topography are restored to pre-existing conditions. In grassland/rangeland areas, disturbed soils would be re-vegetated with a weed-free native plant seed mix.

The fiber optic communication cables for the Project would be installed in the same trenches as the underground electrical collector cables and would connect the communication channels from each turbine to the control room in the Palmer's Creek Substation.

2.1.1.9 Collector Substation (Palmer's Creek Substation)

A new collector substation, Palmer's Creek Substation, would be constructed at the south end of the project area, on private farmland, where the 34.5-kV electric collection grid and fiber optic communication network would terminate. Palmer's Creek Substation would include a transformer to step up the voltage of the collection grid from 34.5 kV to 115 kV, above-ground bus structures to interconnect the substation components, breakers, a control building, relays, switchgear, communications and controls, and other related facilities required for delivery of electric power to the proposed adjacent 115-kV Granite Falls Substation.

The design of Palmer's Creek Substation is not finalized, but Palmer's Creeks expects it would be enclosed by a chain link fence with dimensions of roughly 110 feet by 170 feet. The substation components would be placed on concrete and steel foundations.

Palmer's Creek Substation would be designed in compliance with Federal, State and local regulations, National Electrical Safety Code (NESC) standards, and other applicable industry standards and would be interconnected to the Granite Falls Substation, a WAPA-owned interconnection switchyard. The Palmer's Creek Substation would be located adjacent to the Granite Falls Substation, and the proposed transmission interconnection would consist of a 115 kV, 3-phase transmission line, approximately 1,000 feet in length, between the two facilities.

2.1.2 Project Life Cycle

Section 3 of the Final UGP Wind Energy PEIS describes the activities likely to occur during each of the major phases of a typical wind energy project's life cycle – site testing and monitoring, construction, operation, maintenance, and decommissioning. The same project phases, with similar types of activities for each phase, would occur for this proposed Project. The expected life of the Project is approximately 20 to 40 years.

2.2 No Action Alternative

Under the No Action Alternative, WAPA would not approve an interconnection agreement to its transmission system. Although Palmer's Creek could still build the Project and transmit power using privately owned infrastructure, for the purposes of impact analysis and comparison, it is assumed that the proposed Palmer's Creek Wind Farm would not be built and the environmental impacts, both positive and negative, associated with construction and operation would not occur.

3. AFFECTED ENVIRONMENT

This section briefly describes the physical and regulatory environment that would be affected by the Proposed Action or the No Action Alternatives. Resources addressed in the Final UGP Wind Energy PEIS are discussed below, with additional site-specific information presented where appropriate.

3.1 Land Cover and Land Use

As described in Section 4.1 of the PEIS, land cover refers to the physical material at the surface of the earth, while land use addresses how people use the land. Additional land use considerations described in the PEIS include recreation, transportation, aviation, and radar.

3.1.1 Land Cover

The dominant land cover type that occurs within the project area is cultivated crops. Other cover types include pasture, grassland, and developed open space with some deciduous forest. The cover types other than cultivated crops are typically associated with rural residences including windbreaks, lawn, and pasture and grassland. Land cover types within the Project Area are summarized in **Table 3-1** and displayed on **Figure 3**.

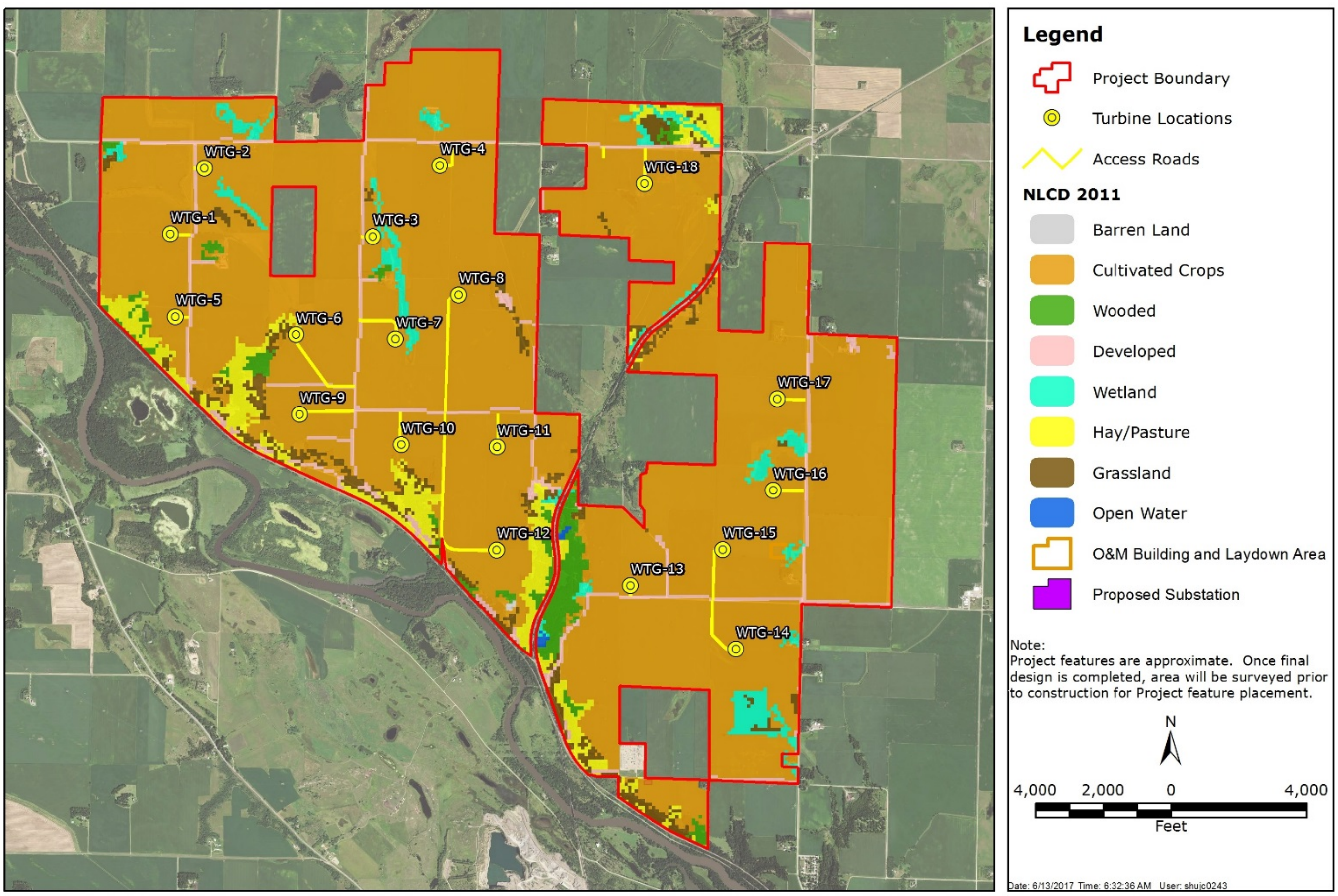


Figure 3: Land Cover

Table 3-1: Land Cover Types within the Project Area

Land Cover Type	Area (acres)	Percentage of Project Area (%)
Barren Land (Rock/Sand/Clay)	1	0.0%
Cultivated Crops	5,157	83.8%
Deciduous Forest	134	2.1%
Developed	213	3.5%
Emergent Herbaceous Wetland	165	2.6%
Forested/shrub Wetland	29	0.3%
Grassland/Herbaceous	177	2.8%
Open Water	15	0.2%
Pasture/Hay	284	4.6%
Shrub/Scrub	4	0.1%
Total	6,150	100.0%

Source: NLCD, 2011 and NWI, 2015

3.1.2 Land Use

The project area contains 47 residences, a farm museum, and an electrical substation (Granite Falls Substation). Most of the area is farmlands or rural lands. Land use within the project area is agricultural, most of which is used for cultivated crops or grazing. There are also some areas of conservation lands enrolled in the Conservation Reserve Enhancement Program (CREP). The CREP pays landowners a yearly rental payment in exchange for removing environmentally sensitive land from agricultural production (USDA 2016). Project turbines would not be located on CREP land. There are other easements located within the vicinity of the project area primarily along the Minnesota River Valley. These include Reinvest in Minnesota (RIM) Reserve and Permanent Wetland Preserve (PWP) land conservation easements, as shown on **Figure 4**. The closest RIM easement is near the existing substation.

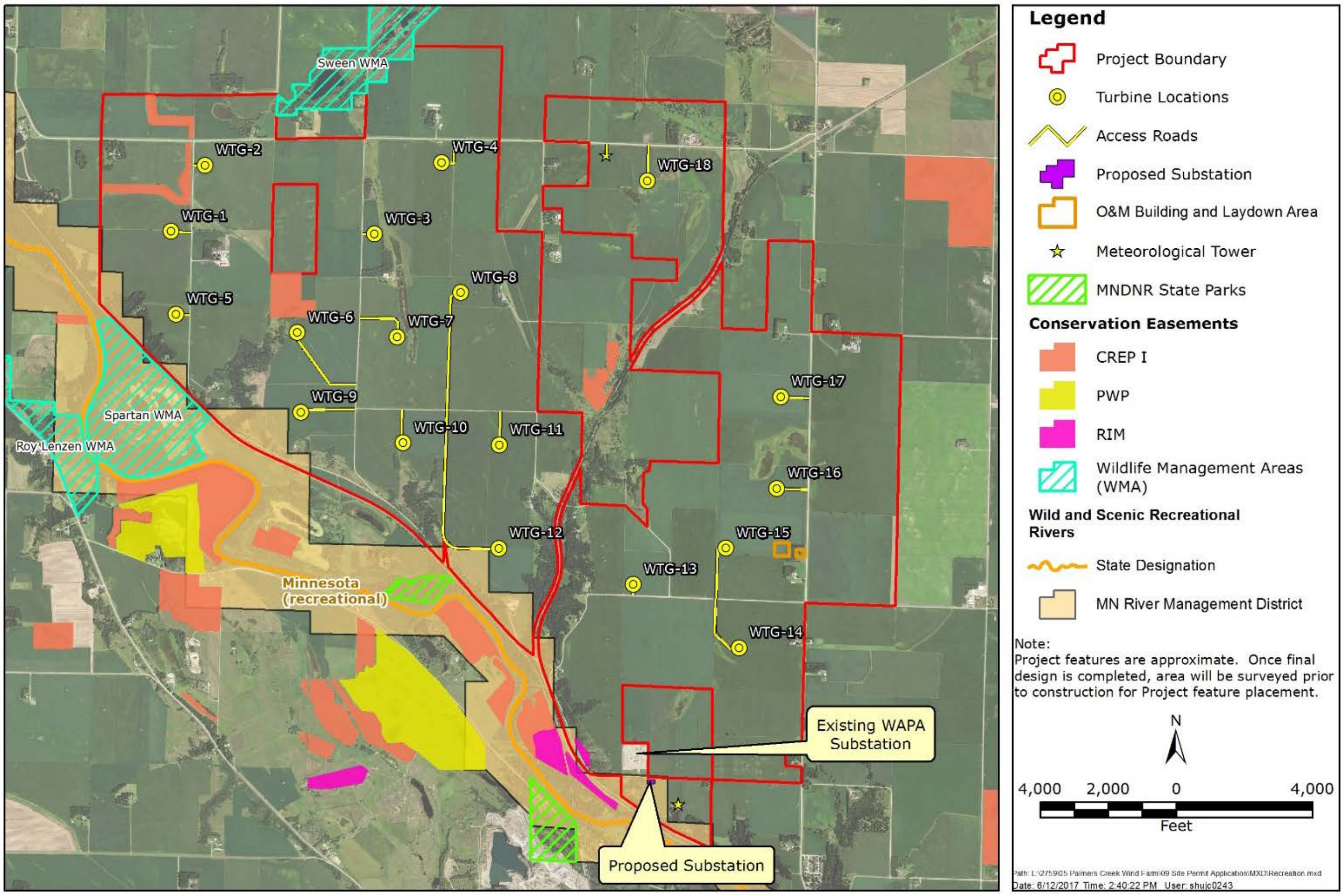


Figure 4: Recreation and Conservation Areas

3.1.2.1 Recreation and Conservation Areas

There are several recreation and conservation areas in the vicinity of the Project. The Minnesota River runs along the western boundary of the project area. The river provides recreational opportunities by watercraft, motor vehicle, and pedestrians. There are also roads in and adjacent to the project area that are part of the National Scenic Byway system, including County Road 5 (CR 5), Palmer Creek Road. Designation of the National Scenic Byway is intended "to strengthen Minnesota River Valley communities through both economic means (i.e., more visitors and tourism) and through a closer connection to the river and the Valley's exceptional history (i.e., through investments in recreational facilities, resource protection and interpretive programs)" (MRVSBA, 2001). Several other recreation resources near the project area include Prairie's Edge Casino and Resort, Fagen Fighters WWII Museum, and Yellow Medicine County Museum and Historical Society. All three businesses are located south of Granite Falls. The Upper Sioux Agency State Park is also located south of Granite Falls.

Wildlife Management Areas (WMA) are public lands, managed by the Minnesota Department of Natural Resources (MNDNR) for hunting, wildlife viewing, and general outdoor activities. Recreational areas within the project area are shown on **Figure 4**. The Spartan WMA is located on the southwestern border of the Project. A wind turbine would be located approximately one-quarter mile northeast of this WMA, and another turbine would be located approximately one-half mile east-southeast from the Spartan WMA. The Sween WMA is outside of the northern border of the project area. The Sween WMA is approximately one-half mile northeast of a turbine site and approximately one-half mile northwest of a second turbine site. Both WMAs are known for deer, small game, forest upland birds, pheasants, and waterfowl (MNDNR 2016a, 2016b). The Spartan WMA is also known for turkey (2016a).

3.1.2.2 Transportation

The project area is bounded by both Chippewa County and Sparta and Granite Falls Township roads. To the north, CR 15/100th Street Southeast (SE) creates the northern boundary, to the east by CR 5/30th Avenue SE, and diagonally to the southwest by Palmer Creek Road. The township roads include Palmer Creek Road, 5th Ave. SE, 15th Ave SE, 115th St. SE, and 10th Ave. SE, 125th St. SE. As shown on **Figure 5**, many of the access roads would lead from the smaller township roads. All paved county roads have an axle restriction of 10 tons, and all gravel county and township roads have an axle restriction of 5 tons (Chippewa County Highway Dept., 2016a).

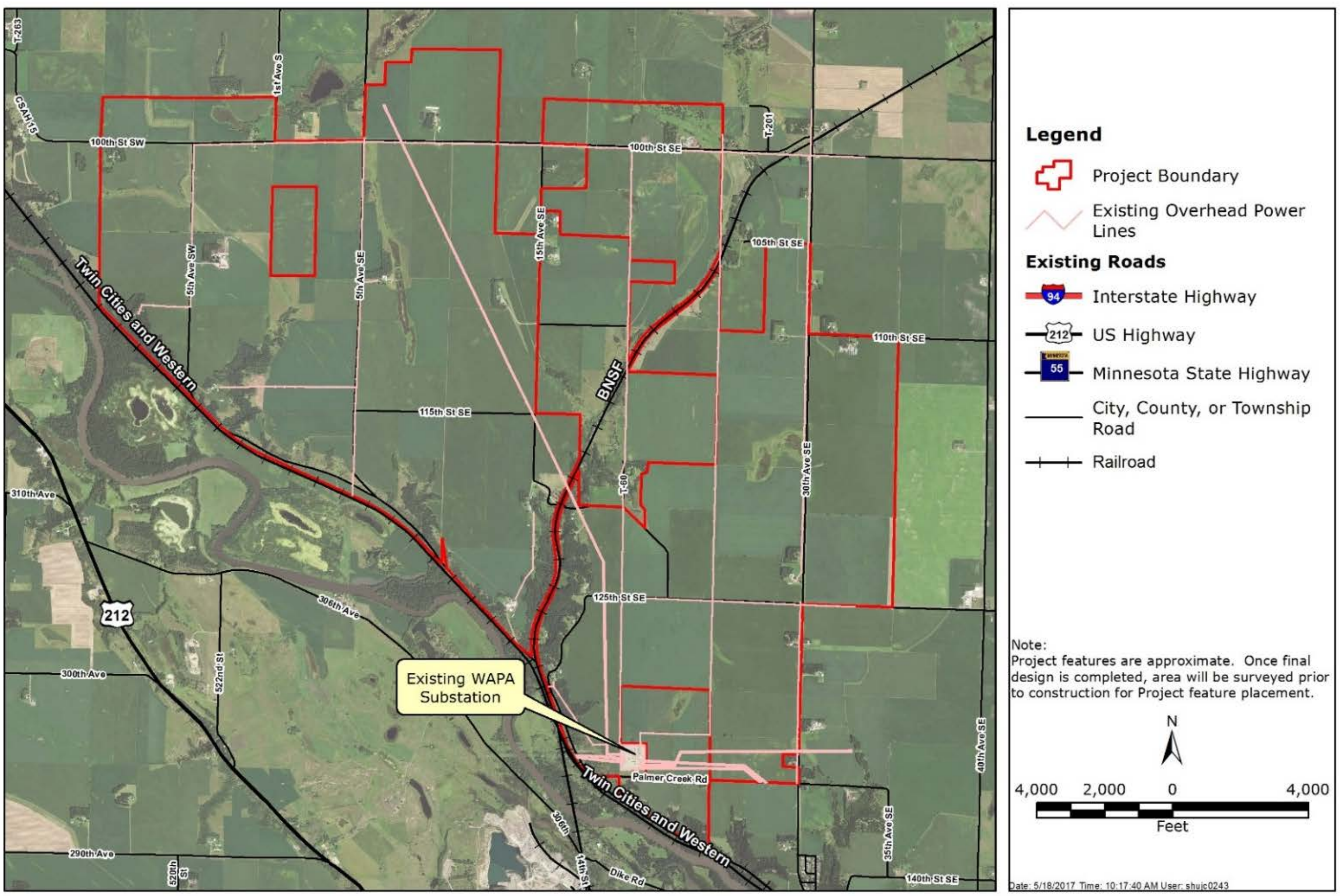


Figure 5: Existing Infrastructure

Annual Average Daily Traffic (AADT) data from Minnesota Department of Transportation (MnDOT) is provided in **Table 3-2**. The highest AADT based on recorded data near the project area is 1,000 vehicles per day on CR 5 between CR 15 and Granite Falls. Traffic counts in Granite

Falls are significantly higher than those recorded north and east of the project area.

Table 3-2: AADT on Project Area Roads

Road Segment Description	AADT	AADT Year
CR 15 (100th St SW) between CR 7 and CR 6	275	2012
CR 15 (100th St SE) between CR 6 and CR 5 (30th Ave SE)	410	2012
CR 5 (30th Ave SE) between CR 15 and Granite Falls	1000	2013

Source: MnDOT 2014 Publication Traffic Volumes – Chippewa County

There are no airports located within the Project Area. The Granite Falls Municipal Airport/Lenzen-Roe-Fagen Memorial Field is located approximately 5.5 miles south of the project area. The Montevideo-Chippewa County Airport, is approximately eight miles northwest of the project area. Both airports are small, regional airports without commercial service.

3.2 Geology and Soil Resources

The project area is located within the Central Lowland physiographic province. Section 4.2.1 of the Final UGP Wind Energy PEIS includes a detailed discussion of this province which makes up the northeastern portion of the Interior Plains. Physiographic features of the Project Area consist of glaciated plains, also known as drift prairie, formed during the Wisconsinan Glaciation. Glacial features of the plains include ice-thrust hills, moraines, and eskers.

The project area is in the upper Minnesota River basin which includes all of Chippewa County. Most of the surficial geology of the project area consists of till with stream-modified surface. There are also fingers of organic deposits and stream sediment deposited by glacial melt in the area. Stream sediment along the Minnesota River is coarser with stratified layers of silt, clay, and sand (U of MN 1999). Soils in the area primarily consist of loams and clay loams with zero to six percent slopes.

Prime farmlands are subject to protection under the Farmland Protection Policy Act (FPPA) (Public Law [PL] 97-98, 7 U.S.C. §§ 4201-4209). Most of the soils in the project area are considered prime farmland, farmland of statewide importance or prime farmland if drained, as shown on **Figure 6**. The surrounding areas, Chippewa and Yellow Medicine Counties, also have most of the land considered prime and unique farmland. The FPPA requires potential impacts to prime farmlands to be identified and avoided as possible for federal projects. The Natural Resources Conservation Service (NRCS) works with a project proposer to identify farmlands and give a farmland conversion impact rating**.** The impact rating is used to determine avoidance actions as needed to minimize the conversion of farmland into nonagricultural lands.

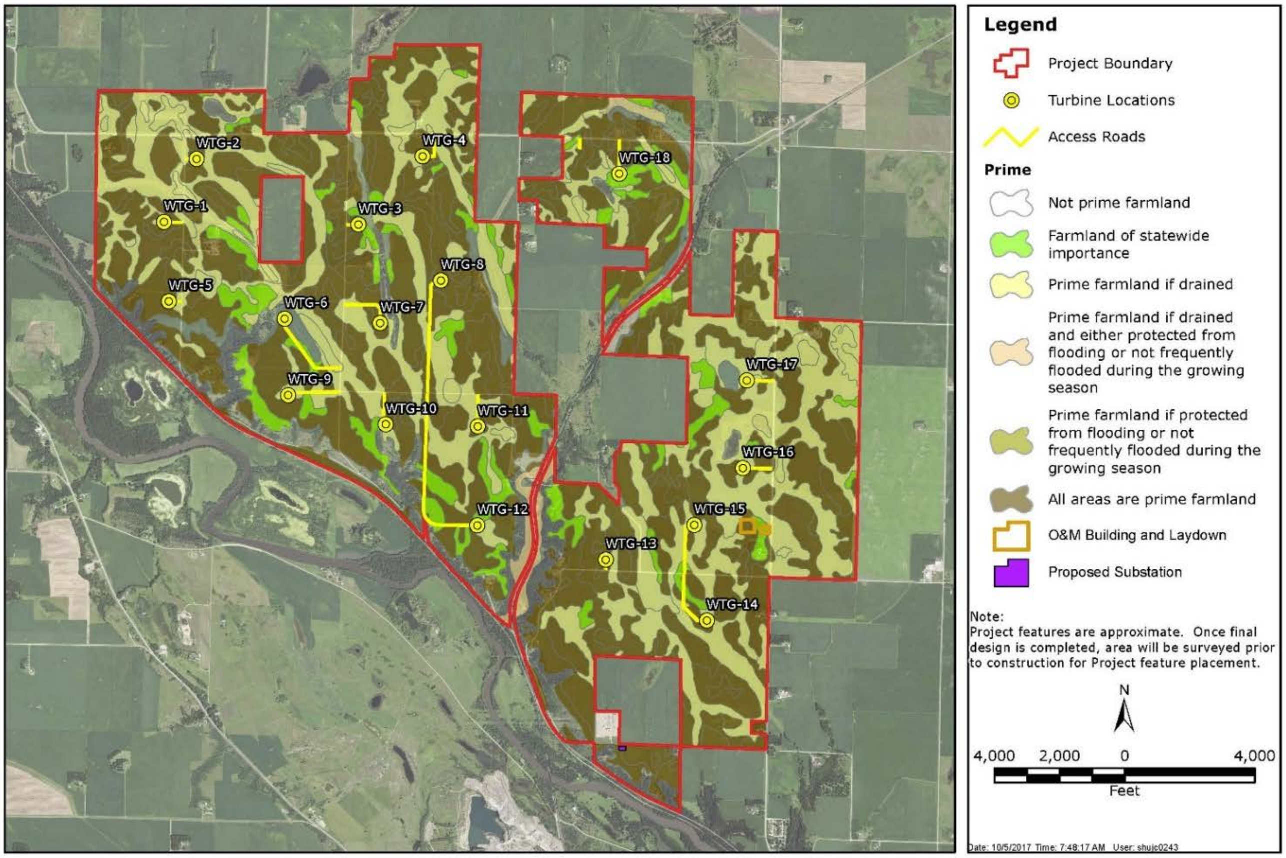


Figure 6: Farmland Soils

There are several active gravel mines located within five miles of the project area in Yellow Medicine County on the other side of the Minnesota River. There are six gravel mines located within five miles of the project area in Chippewa County, but none are within the project area boundary. The gravel mining operations are likely surficial quarries to remove glacial sand and gravel deposits. The risk for subsidence within the project area is considered negligible. The project area is not located in a region of Minnesota identified as prone to development of karst topography (MNDNR 2016), and the surficial gravel mining near the project area would likely not contribute to the potential for subsidence, which is typically correlated with underground mining.

The risk of seismic activity in the project area is very low. Earthquake shaking hazard maps have been developed by the USGS by combining faulting and seismicity information to show the level of horizontal shaking that may occur based on different ground motions and probabilities. In the project area, and most of Minnesota, the USGS 2014 Seismic Hazard Map indicates that the earthquake peak ground acceleration that has a 2 in 100 chance of being exceeded in a 50-year period is 2-4% g (where g is the acceleration due to gravity). From 2010 to 2015, there was only one earthquake recorded in Minnesota in 2014.

3.3 Water Resources

The project area is located within the Upper Mississippi River Basin surface water drainage system.

Section 4.3.1 of the Final UGP Wind Energy PEIS includes a detailed discussion of this drainage system. The project area has limited surface water and floodplain resources as it is primarily comprised of agricultural land. The Minnesota River is on the west side of the project area boundary. There are also waterbodies and small drainages in several places in or within close proximity to the project area. **Figure 7** shows public waterbodies, streams and ditches in the project area. The waterbodies identified on the DNR Public Waters Inventory (PWI) are County Ditch 70 and Palmer's Creek, and waterbodies located in the Sween WMA and the Spartan WMA.

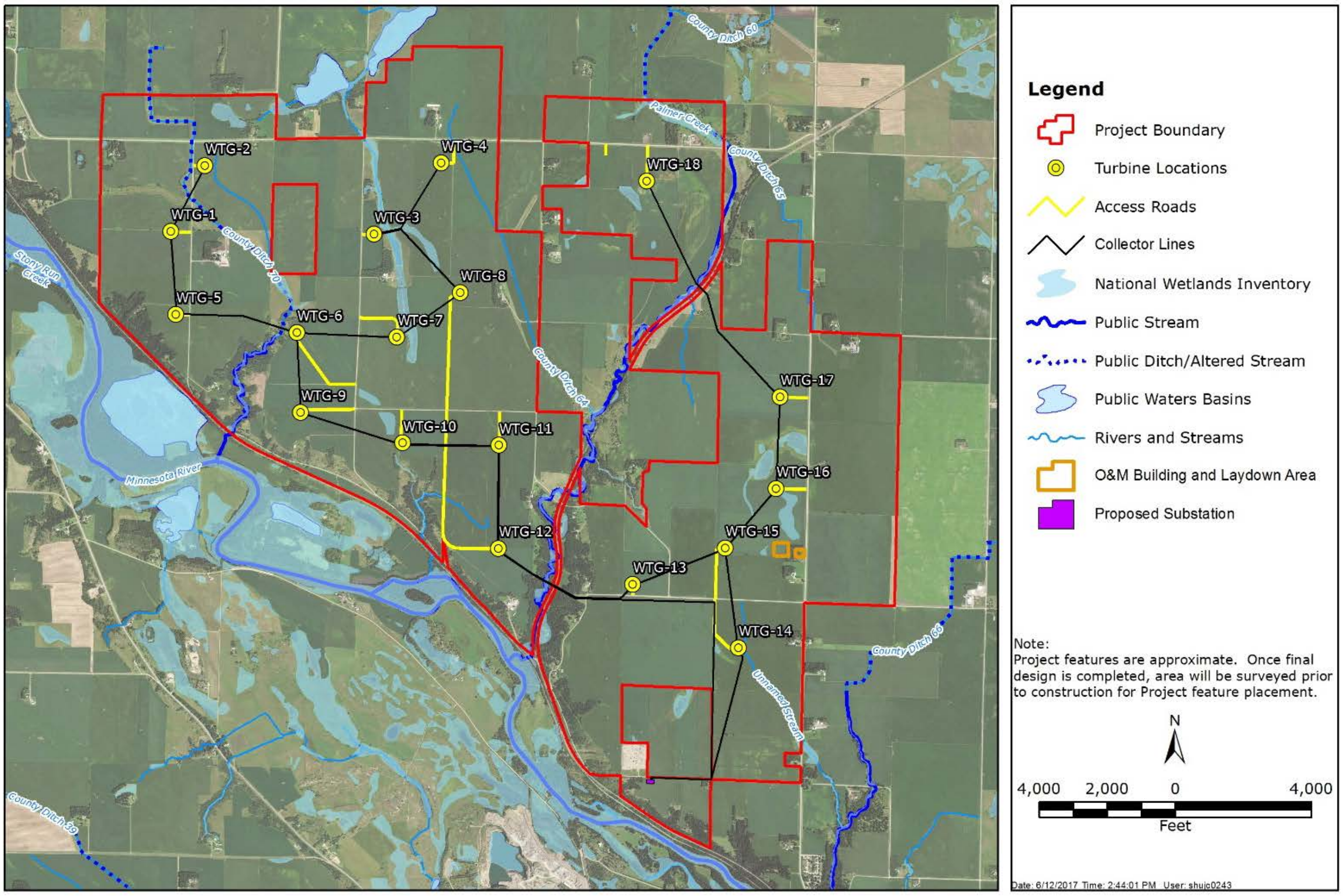


Figure 7: Waterbodies and Wetlands

Streams identified on the DNR PWI include Palmer Creek (eastern half of the project area) and an unnamed stream connected to a public drainage ditch in the western half of the project area. Several other drainages appear to be part of a larger drain tile system for the agricultural fields. These drainages were not identified on the DNR PWI.

The Minnesota River is a designated State Wild and Scenic River. Its shoreline and floodplain areas are managed through special regulations to protect floodplain and other sensitive resources. Federal Emergency Management Agency (FEMA) Maps 2700660155B and 2700660160B were reviewed for the project area. Most the project area is located in Zone C, defined as an area of minimal flooding and outside of the 500-year or 0.2 percent-annual-chance flood (FEMA 1986A, FEMA

1986B). A narrow area along Palmer's Creek and the Minnesota River floodplain are both considered Zone A, defined as areas of 100-year flood.

Based on a review of the National Wetland Inventory (NWI) data, there are approximately 210 acres of wetlands found within the project area (**Figure 7**). A detailed discussion of wetlands in the UGP Region is provided in Section 4.6.1.2 of the PEIS. The types of wetlands found in the project area are typical of this region and consist of approximately 165 acres of freshwater emergent wetlands and 29 acres of freshwater forested/shrub wetland. Freshwater ponds and riverine areas cover approximately five and 10 acres, respectively.

The project area is located within the Northern Great Plains Aquifer System, which includes five major aquifers: (1) lower Tertiary; (2) upper Cretaceous; (3) lower Cretaceous; (4) upper Paleozoic; and (5) lower Paleozoic (USGS, 1996). Section 4.3.2 of the PEIS includes a more detailed discussion of this aquifer system. Groundwater in the project area is approximately 25 feet below the surface (Bradt and Berg, 2000). The project area is estimated to have a mostly moderate geologic sensitivity of pollution of near-surface groundwater, with an estimate of years to decades for surface contaminants to reach near-surface groundwater (Bradt, 2000).

The Drinking Water Supply Management Area (DWSMA), which includes the Wellhead Protection Area (WHPA) for the community of Granite Falls, is located approximately 1.5 miles east of the project area. The DWSMA is considered to have a "Low Vulnerability" to potential pollution and estimated that it takes surface water ten years to reach the aquifer.

3.4 Air Quality and Climate

General air quality and climate conditions for Minnesota and the UGP Region are discussed in Section 4.4 of the Final UGP Wind Energy PEIS. This section of the PEIS describes general meteorological conditions; existing emissions of criteria pollutants and volatile organic compounds (VOCs); the federally based air quality programs likely to affect activities associated with wind energy development; and greenhouse gas emissions (GHGs).

Most of the State of Minnesota is in attainment for all National Ambient Air Quality Standards (NAAQS) criteria pollutants with the exception of Dakota County for lead (U.S. Environmental Protection Agency [EPA], 2015). The nearest ambient air quality monitoring site to the project area is located in Marshall, Lyon County, Minnesota, which is southwest of the project area (MPCA, 2017). The primary emission sources that exist within the Project Area include agriculture related equipment and vehicles traveling along U.S. Highway 212. The nearest Prevention of Significant Deterioration (PSD) Class I Area to the project area is Boundary Waters Canoe Area Wilderness (Minnesota) and the Badlands National Park (South Dakota). Both of these areas are located approximately 300 miles northeast and southwest, respectively, of the project area. PSD Class I Areas are discussed in Section 4.4.2.3 in the PEIS.

3.5 Noise

Section 4.5 of the Final UGP Wind Energy PEIS includes a discussion of noise and vibration and the existing acoustic environment in the UGP Region.

The project area contains 47 residences, a farm museum, and an electrical substation (**Figure 8**).

Most of the area is farmlands or rural lands. Wind is a large contributor to existing ambient noise. Aside from wind, farming activities and occasional vehicular traffic would be the largest contributor to noise in the project area.

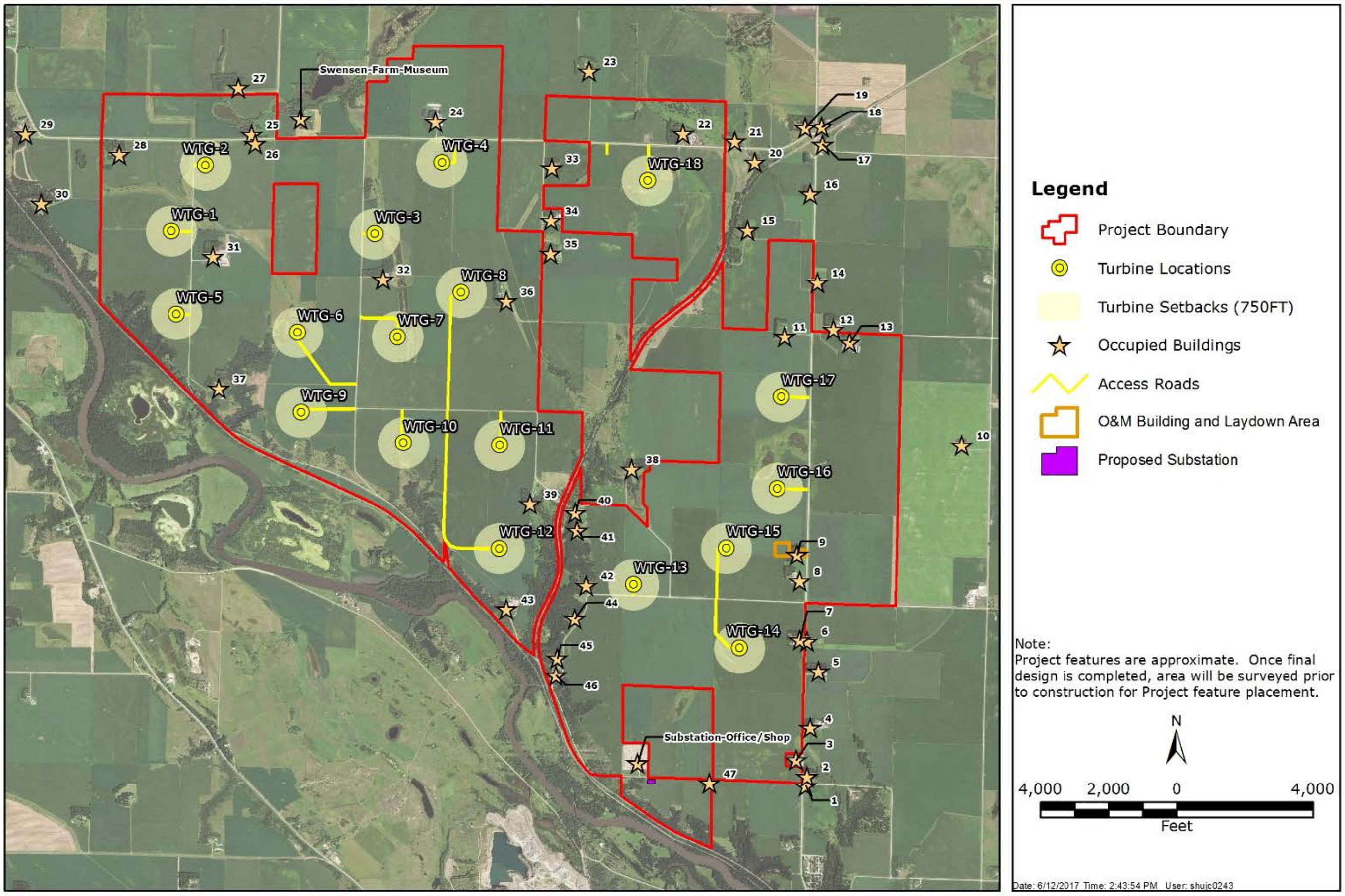


Figure 8: Occupied Buildings

In Minnesota, noise is regulated by the Minnesota Pollution Control Agency (MPCA) under Minnesota Administrative Rules 7030. Noise areas are classified as a 1, 2, or 3 based upon their land use activities (Minnesota Rules 7030.0050) and acceptable noise levels are defined for each Noise Area Classification (NAC) based on day or night times. For residential areas, (NAC 1), including farm houses, noise levels should not exceed 60 dBA (daytime) and 50 dBA (nighttime) as measured from the nearest residence during 30-minutes of a one hour period (referred to as the L50 level). Field assessment monitoring and noise modeling were conducted for the project area as part of the Noise Study. For monitoring locations within the project area, the current daytime L50 sound levels range from 20.3 dBA to 61.2 dBA. Current nighttime L50 levels range from 18.2 dBA to 51.2 dBA.

The monitoring and modeling results indicated that existing sound levels met or exceeded State daytime and nighttime noise standards. In general, the project area noise levels were within state standards. There were spikes in daytime noise levels at two monitoring sites, which were attributed to snowplows and railroad tracks. One monitoring site also had spiked nighttime noise levels, which was also attributed to snow plows. Additional detailed information can be found in the Noise Study (**Appendix B**).

3.6 Ecological Resources

Ecological resources (i.e., plant communities, wildlife, aquatic biota, and threatened, endangered, and special status species) within the UGP Region are discussed in Section 4.6 of the Final UGP Wind Energy PEIS. The following sections describe the site-specific ecological resources within the project area.

3.6.1 Plant Communities

The project area is located within the Northwestern Great Plains Level III ecoregion. Section 4.6.1 and Appendix C of the PEIS include a detailed discussion of this ecoregion. Vegetation communities in this ecoregion and the project area are generally simple with a low diversity of species.

Since the mid-1800s, native prairie in Minnesota has been significantly reduced to about one percent of its extent. This is due to settlement and conversion of native prairie to agriculture, housing and other land uses. Conversion of prairie to farmland also typically included draining and ditching of wetlands. Additionally, fire suppression and planting of trees for windbreaks and other purposes, established trees in some areas where prairie or wetland may have been originally. Prairie and wetland habitats are a fraction of what they were before the mid-1800s, making these a unique resource in Chippewa County.

In general, only about one percent of the original native prairie in Minnesota remains. Specifically, Dry Hill Prairie (native prairie) is identified on the MNDNR Minnesota Biological Survey (MBS) (2007) map in several narrow areas along the railroad in the western portion of the project area. Dry Hill Prairie has well-drained soils that formed from glacial till on slopes and hilltops in large river valleys, such as the Minnesota River. Dominant grasses in Dry Hill Prairie typically include little bluestem (*Schizachyrium scoparium*), side-oats grama (*Bouteloua curtipendula*), porcupine grass (*Hesperostipa spartea*), and prairie dropseed (*Sporobolus heterolepis*), with much Indian grass (*Sorghastrum nutans*), big bluestem (*Andropogon gerardii*), and Leiberg's panic grass (*Dichanthelium leibergii*) in dry-mesic areas such as mid-slopes. Common shrubs include leadplant (*Amorpha canescens*), wolfberry (*Symphoricarpos occidentalis*), and prairie rose (*Rosa arkansana*). Common forbs are rough blazing star (*Liatris aspera*), alumroot (*Heuchera richardsonii*) silverleaf scurf pea (*Psoralea argophylla*), heart-leaved alexanders (*Zizia aptera*), prairie milk vetch (*Astragalus adsurgens*), purple prairie clover (purple prairie clover), heath aster (*Symphyotrichum ericoides*), prairie smoke (*Geum triflorum*), and hairy golden aster (*Chrysopsis villosa*). Visual observations of the prairie areas indicated native prairie species are present, but have been heavily invaded by eastern red cedar (*Juniperus virginiana*) and smooth brome (*Bromus inermis*).

Wetlands identified by the NWI are shown on **Figure 7**. Wetlands found in the project area are comprised of freshwater emergent wetlands, freshwater forested/shrub wetland, freshwater ponds and riverine areas. Vegetation associated with freshwater emergent wetlands in Minnesota typically include grasses, bulrush, spikerush, and various other marsh plants, such as cattail, arrowhead, pickerelweed, and smartweed. Vegetation in forested/shrub wetlands typically includes alder, willow, and dogwood. There is floodplain forest located near, but outside of the project area. The Silver Maple – (Virginia Creeper) Floodplain Forest (rare wetland) has a conservation status rank of S3 by the MNDNR, which may qualify this habitat as a rare natural community. This type of rare wetland is identified on the MNDNR MBS map as located in the Spartan WMA, which is outside of the project area boundary, as shown on **Figure 9**.

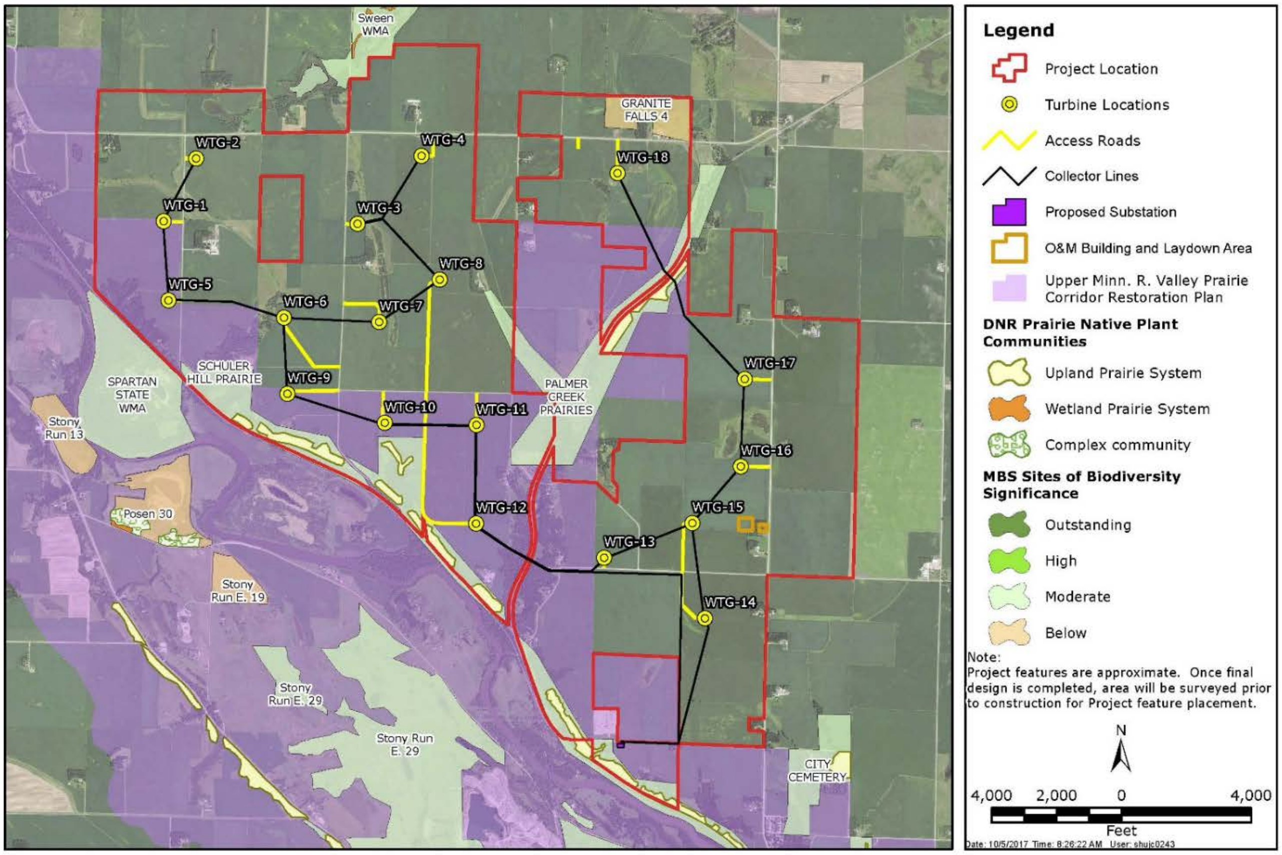


Figure 9: Ecologically Sensitive Areas

3.6.2 Wildlife

Information on wildlife, including reptiles, amphibians, birds, and mammals within the UGP Region, is discussed in Section 4.6.2 of the PEIS. Wildlife species in the project area are typical of those found in the region and discussed in the PEIS. Wildlife within the vicinity of the project area includes white-tailed deer, raccoons, skunk, coyotes, beavers, muskrats, and other small mammals. These species can be found in the project area, but will seek good habitat for foraging, breeding, and shelter. Good habitat is found along the Minnesota River floodplain, nearby Wildlife Management Areas (WMAs), and along some of the drainages in the project area. Agricultural production areas, such as cultivated crops, may be used on a temporary basis by birds and wildlife for foraging or short-term shelter.

The project area is primarily agricultural lands and does not contain significant wetland habitats. The project area is adjacent to the Minnesota River, which provides large riverine and wetland habitats. The project area is approximately 16 miles southeast of the Lac qui Parle Dam, Lac qui Parle State Park, and Lac qui Parle WMA, approximately 33,000 acres, and managed by the

MNDNR. The Lac qui Parle WMA includes a state game refuge, wildlife sanctuary, migratory waterfowl feeding and resting area, and controlled hunting zone. The agricultural landscape and developments of the region have influenced the type of wildlife present.

Wildlife surveys (Tier 1, 2, and 3 Analyses) were conducted for the Project between 2015 and 2017. Surveys requested by the USFWS have been completed for the Project with the exception of the Acoustic Bat Monitoring, which are ongoing through late fall 2017. Ongoing monitoring would continue during Project operation. Surveys were conducted to assess abundance, distribution, and potential wildlife habitat in the project area, with specific assessments conducted for raptors; threatened, endangered, and special status species; and bats. Detailed discussion of the methodology and results of the wildlife surveys conducted for the Project are reported in Palmer's Creek Wind Project Wildlife Assessment and Field Studies (Wildlife Report) (**Appendix C**) and Bird and Bat Conservation Strategy (**Appendix E**).

3.6.3 Birds

Migratory birds and waterfowl travel through Minnesota during the spring and fall of each year, as they alternate between summer breeding grounds in the northern portion of the continent and winter feeding ground in the southern half of the continent. The project area is located within the Mississippi River Flyway, which results in large spring and fall migrations of various bird species. During spring and fall migrations flocks of migratory birds can number in the tens of thousands at traditional migratory staging areas and refuges. Migratory birds and waterfowl typically stage and rest in areas with significant amounts of wetland and open water habitats that provide sufficient food sources for the migration. The Minnesota River corridor is highly used by nesting, over-wintering, and migratory bald eagles.

The project area is adjacent to the Minnesota River and its floodplain. The Minnesota River valley provides a corridor of habitat for many birds and waterfowl. The most common birds observed during the field surveys were red-winged blackbird (*Agelaius phoeniceus*) (270 individuals), American crow (*Corvus brachyrhynchos*) (266 individuals), brown-headed cowbird (*Molothrus ater*) (239 individuals), and barn swallow (*Hirundo rustica*) (180 individuals). These species comprised 45.6 percent of all individual birds observed. Overall, during the completed surveys 56 species were observed. Details of the survey results can be found in **Appendix C**.

Existing data on bald eagle nest locations was received from the MNDNR on July 5, 2016. Based on historical records, one nest is in Section 11, T116N R40W, estimated to be greater than one mile west of the nearest WTG. During field surveys, another eagle's nest was located in the Minnesota River Valley, approximately one mile southeast of the nearest WTG (WTG 12). This nest was not recorded in the NHIS database. Both nests are located outside of the project area. Bald eagles (*Haliaeetus leucocephalus*) were observed during the field surveys in the project area conducted from July 2016 to June 2017, totaling 19 bald eagles.

During the field surveys, Minnesota Listed Special Concern Species, the American white pelican (*Pelecanus erythrorhynchos*), was observed with four individuals in flight.

Part of the western side of the project area, near the Minnesota River, overlaps with the Upper Minnesota River Valley Important Bird Area (IBA). IBAs, identified by Audubon Minnesota in partnership with the MNDNR, are part of an international conservation effort aimed at conserving critical bird habitats. The Upper Minnesota River Valley IBA incorporates the riparian corridor and adjacent river valley and upland communities along the Minnesota River and provides excellent habitat for a wide variety of bird species. This IBA contains significant bird habitat in an intensely agricultural area and is a natural corridor for migrating birds. Over 200 species, including state-listed species and Species in Greatest Conservation Need (SGCN) are known to use the IBA.

3.6.4 Bats

Bats typically utilize farm buildings and dead and dying trees with cavities and loose bark as roosting and maternity habitat. Bats typically use forests, riparian corridors and wetlands as feeding habitats due to higher nocturnal insect densities in these areas. There are seven bat species known to occur in Minnesota – big brown bat (*Eptesicus fuscus*), silver-haired bat (*Lasionycteris noctivagans*), eastern red bat (*Lasiurus borealis*), hoary bat (*Lasiurus cinereus*), little brown bat (*Myotis lucifugus*), northern long-eared bat (*Myotis septentrionalis*) and tri-colored bat (*eastern pipistrelle, Perimyotis subflavus*) (MNDNR 2016). The northern long-eared bat (*Myotis septentrionalis*), tricolored bat (*Perimyotis subflavus*), big brown bat (*Eptesicus fuscus*), and little brown bat (*Myotis lucifugus*) are all state-listed species of special concern. **Appendix D** provides descriptions of all the species, except the northern long-eared bat, which is described below.

There was a total of six bat species documented throughout the course of the surveys to date. Three species of concern in the state of Minnesota were detected during the acoustic bat monitoring (tricolored bat, big brown bat, and little brown bat).

Northern Long-eared Bat

The northern long-eared bat (NLEB), also known as the Northern Myotis, is widely distributed in Canada and throughout the eastern half of the United States, extending west through Minnesota to the western borders of the Dakotas. The NLEB is currently a federally threatened species and was designated in 1984 as a species of special concern in Minnesota, at which time it was known from only a few widely-distributed localities in the state. Subsequent survey work has documented additional locations in Minnesota and confirmed that the species can be found in the state in both summer and winter. A large hibernaculum was discovered in St. Louis County, and NLEBs have been found in most other caves and mines surveyed in Minnesota, though typically in low numbers (Bowman, 2016). The project area is located in an area of Minnesota with no documented NLEB hibernacula, although potentially suitable habitat, particularly for foraging and roosting, does exist.

The UGP Wind Energy Programmatic Biological Assessment (BA), prepared in conjunction with the PEIS, describes the NLEB in detail (WAPA and USFWS, 2015c). Additional information on the northern long-eared bat published subsequent to the PEIS and BA is available in the USFWS's 4(d) rule available online at http://www.fws.gov/Midwest/endangered/mammals/nleb/s7.html. Updated species-specific information and results of the preconstruction evaluations and wildlife surveys, including surveys for federally listed species (as warranted), conducted for the Project are reported in the wildlife report (**Appendix C**).

Acoustic bat monitoring surveys were conducted in the project area in Fall 2015, Spring and Fall

2016, and Spring 2017 with plans for monitoring to be completed in Fall 2017. Bats within the WRA (wind resource area) were surveyed using a bat detector and laptop computer. The ultrasonic calls of foraging bats are displayed on the computer screen and permanently stored in electronic files. No confirmed documentation of the NLEB in the project area was recorded during the acoustic bat monitoring (see **Appendix D** for the Final Acoustic Bat Summary Report). As discussed in the wildlife report, NLEB have not been documented at the Palmer's Creek Wind Farm study site.

Old buildings and hollow trees are potential hibernacula sites during the winter, but caves and mines are the favored choice for hibernating bats, especially for the NLEB. NLEBs have been found in the winter in Minnesota in natural caves, sand mines, and deep iron mines. Hibernacula are shared between both sexes and often multiple species of bat. Preferred sites typically have high humidity levels, minimal airflow, and a constant temperature (Fitch and Shump 1979). Based on the preferred sites criteria, hibernacula sites within the study area are unlikely.

After spring emergence, bats migrate to summer roosting and foraging grounds. In summer, the NLEB is often associated with forested habitats (Fire-Dependent Forests, Mesic Hardwood Forests, and Floodplain Forests) where they make use of tree roosts, especially near water sources. Loose bark, broken tree limbs, cavities, and cracks in a tree can all be utilized by bats as roosting sites. The sexes tend to roost separately, with females forming small (~30 individuals) maternity colonies to bear and rear their offspring. Males often roost alone, as they do not have the same high temperature needs as maternity colonies.

Based upon the preferred sites criteria, summer roosting and foraging grounds could occur within the study area (Bowman, 2016).

3.6.5 Aquatic Biota and Habitats

The project area is located within the Upper Mississippi hydrologic region and within the Minnesota River Basin. Aquatic biota typical of this region is discussed in Section 4.6.3 of the PEIS. Aquatic habitat in the project area is limited to Palmer Creek, County Ditch 66, County Ditch 70, and the Minnesota River. The smaller streams and ditches support limited aquatic biota, including aquatic insects, crustaceans, and mollusks. These streams may have small fish. The Minnesota River supports aquatic biota similar to the small streams as well as significant native fish, such as walleye, small-mouth bass, and sunfish. There are also wetlands in and adjacent to the project area that provide habitat for birds, waterfowl, amphibians, reptiles, and small mammals.

3.6.6 Threatened and Endangered Species

3.6.6.1 Federally Listed Species

Section 4.6.4 of the PEIS describes the plant and animal species that are listed as threatened or endangered under the Endangered Species Act (ESA), or that are proposed or candidates for listing under the ESA, and that could occur within the UGP Region.

A list of federally threatened, endangered, candidate and proposed species was obtained for Chippewa County, Minnesota from the USFWS Information for Planning and Conservation (IPaC) website (USFWS 2017a). Federal species with potential to occur are described in **Table 3-3**.

Table 3-3: Federally-listed Species

Species/Critical Habitat	Status[1]	Potential to Occur in the Project Area	Habitat Description and Range in Minnesota
Northern Long-Eared Bat (*Myotis septentrionalis*)	T	Yes	Forested habitats, emergent wetlands, agricultural fields adjacent to forested habitat, caves and mines
Dakota Skipper (*Hesperia dacotae*)	T/CH	No	High-quality mixed and tallgrass prairie
Poweshiek Skipperling *(Oarisma poweshiek)*	E/CH	No	High-quality mixed and tallgrass prairie

[1] Status Codes: E=federally listed endangered; T=federally listed threatened; P=federally proposed for listing; C=federal candidate for listing; and CH=designated critical habitat

Northern Long-eared Bat
The NLEB is a federally-listed species that was previously discussed in detail in Section 3.6.2.

Dakota Skipper
The Dakota skipper is a small butterfly found in the tallgrass and mixed-grass prairies of the Northern Great Plains. It is federally listed as a threatened species with designated critical habitat. There are no records for the Dakota skipper in the US Fish and Wildlife Service data base within the project area. There is no designated critical habitat within or near the project area. The closest designated critical habitat is located approximately 26 miles to the northwest straddling Chippewa and Swift County, Minnesota (USFWS 2017b). Native prairie is limited to a few rocky outcrops. Dakota skippers have a single flight per year occurring from the middle of June through the end of July (Dana 1991). Eggs hatch after incubating for 7–20 days; larvae shelter and forage at the bases of grass plants, overwintering at or below the ground surface (Dana 1991). Current data suggests that dispersal of Dakota skipper is very limited (USFWS 2014, 79 FR 63672), and individuals may be incapable of moving greater than one kilometer (0.6 miles) between patches of prairie habitat separated by structurally similar habitats (Cochrane and Delphey 2002). Roads and crop fields have been suspected to impede movements between patches, and movements are more likely along ridges than across valleys (Dana 1991). The Dakota skipper requires native prairie habitat for reproduction, foraging, and overwintering at or below ground, and do not typically move great distances between native prairie areas.

Poweshiek Skipperling
The Poweshiek skipperling is a small butterfly that requires high quality tallgrass prairie in both upland, dry areas as well as low, moist areas. It is federally-listed as an endangered species with designated critical habitat. There are no records for the Poweshiek skipperling in the US Fish and Wildlife Service data base within the project area. There is no designated critical habitat within or near the project area. The closest designated critical habitat is located approximately 26 miles to

the northwest straddling Chippewa and Swift County, Minnesota (USFWS 2017c). Native prairie is limited to a few rocky outcrops. Similar to the Dakota skipper, the Poweshiek skipperling larvae (caterpillars) hibernate during winter on the ground; they resume activity in spring and continue developing until they pupate and emerge as adult butterflies, which have a short lifespan of only one to two weeks between mid-June and mid-July. Adult butterflies feed on nectar from prairie flowers such as purple coneflower (*Echinacea angustifolia*), blackeyed susan (*Rudbeckia hirta*) and palespike lobelia (*Lobelia spicata*) (USFWS 2017).

Historically, Poweshiek skipperlings were found in tallgrass prairie and prairie fens from Manitoba to Iowa, with populations also found in Michigan and Wisconsin. According to the USFWS, the Poweshiek skipperling may have been extirpated from the Dakotas, Minnesota and Iowa within the last 10 years. During surveys in 2014, the species could be found only at a few limited sites in Michigan, Wisconsin, and in Manitoba (USFWS 2017).

3.6.6.2 State Listed Species

A query of the MNDNR Natural Heritage Information System (NHIS) was completed to determine if there are rare species or other significant features in the project area (**Appendix I**). The results of the NHIS query indicated the presence of Ecologically Significant Areas: Prairie Core Area (Upper Minnesota River Valley); MBS sites of moderate biodiversity including Dry Hill Prairie remnants (native prairie), and Silver Maple – (Virginia Creeper) Floodplain Forest (rare wetland).

Dry Hill Prairie (native prairie) is identified on the MNDNR Minnesota Biological Survey (MBS) (2007) map in several narrow areas along the railroad in the southwestern portion of the project area. MNDNR has indicated the native prairie areas may contain Missouri milk-vetch (*Astragalus missouriensis* var. *missouriensis*), a state-listed plant species of special concern, and Sullivant's milkweed (*Asclepias sullivantii*), a state-listed threatened plant. Visual observations of prairie indicated native prairie species are present, but have been heavily invaded by eastern red cedar (*Juniperus virginiana*) and smooth brome (*Bromus inermis*).

Additionally, there are also several state listed species in or nearby the project area. **Table 3-4** provides a summary of the state listed species as identified by the MNDNR NHIS database. Special Concern (SC) species are not endangered or threatened, but are extremely uncommon in Minnesota, or have unique or highly specific habitat requirements and deserve careful monitoring of their status. Species of Greatest Conservation Need (SGCN) are species whose populations are rare, declining or vulnerable in Minnesota and may be at risk due to their dependence on certain rare or declining habitats, such as native prairie; or species that are subject to specific threats, such as invasive species, over exploitation or disease; or the species is stable in Minnesota but declining in a substantial part of their range outside of Minnesota (MNDNR).

Table 3-4: State-listed Species

Species	Status
Northern Long-Eared Bat (*Myotis septentrionalis*)	SC
Tricolored bat (*Perimyotis subflavus*)	SC
Big brown bat (*Eptesicus fuscus*)	SC
Little brown bat (*Myotis lucifugus*)	SC
Lark sparrow (*Chondestes grammacus*)	SC
Upland sandpiper (*Bartramia longicauda*)	SGCN
American white pelican (*Pelecanus erythrorhynchos*)	SC
Gopher snake (*Pituophis catenifer*)	SC
Western foxsnake *(*Pantherophis vulpina*)*	SGCN

Source: MNDNR 2016

3.7 Visual Resources

Visual resources within the UGP Region are discussed in Section 4.7 of the Final UGP Wind Energy PEIS. The project area is rural with primarily flat agricultural fields and a few rolling hills and valley drainages. **Table 3-5** summarizes the distance from each WTG to the nearest residence. All residences are a minimum of 1,000 feet from each WTG.

Table 3-5: Nearest Residences to Wind Turbine Generators

WTG	Nearest Residence	Distance (ft.)	Direction From Residence
1	31	1,600	East
2	25	1,700	Northeast
3	32	1,400	South-southeast
4	24	1,400	North
5	37	1,000	South-southeast
6	37	2,700	Southwest
7	32	2,000	North
8	36	1,000	Southeast
9	37	2,800	Northwest
10	39	4,000	Southeast
11	39	1,600	South-southeast
12	39	1,600	North-northeast
13	42	1,400	West
14	6	1,800	East-northeast
15	9	2,100	East
16	9	1,400	South
17	12	2,500	Northeast
18	22	2,000	North-northeast
2	Swenson Farm Museum	3,100	Southwest
14	Substation Office/Shop	4,400	Northeast

Scenic resources with sensitive viewsheds within the UGP Region are discussed in Section 4.7 of the PEIS. A scenic resource in the project area is the Minnesota River, which runs along the western boundary of the project area. Dike's Road, a township road, runs along the western edge of the Minnesota River and U.S. Highway (US Hwy) 212 runs along the ridge of the west river bluff. The east boundary of the project area is County Road 5 (CR 5). US Hwy 212 is part of the Minnesota River Valley National Scenic Byway. Designated alternate routes to the National Scenic Byway within the project area boundary include Palmer Creek Road from CR 5 to 5th Avenue SW to CR 15. Other scenic resources near the project area may include the Upper Sioux Agency State Park, and other conservation areas within and near the project area. Conservation areas within the project area are shown on **Figure 4**.

3.8 Paleontological Resources

As discussed in Section 4.8 of the Final UGP Wind Energy PEIS, the UGP Region is composed of sedimentary rocks that have the potential to contain significant fossils; however, occurrence of significant fossils is rare. In the project area, Precambrian rocks exposed in the Granite Falls-

Montevideo area, within the Minnesota River valley, consist of interlayered metamorphic rocks that are granitic gneiss, hornblende-pyroxene gneiss, garnet-biotite gneiss, and a heterogeneous sequence of interlayered gneisses (Himmelberg, 1968). Metamorphic rocks are formed from extreme pressure, heating, and movement over time. These extreme conditions are not conducive for fossils and Precambrian geologic units have a very low likelihood of containing recognizable paleontological resources (BLM 2016).

3.9 Cultural Resources

Section 4.9 of the Final UGP Wind Energy PEIS describes the legal framework for managing cultural resources in the United States, including Federal agency responsibilities under Section 106 of the National Historic Preservation Act (NHPA). The PEIS also provides a brief overview of the cultural context of the UGP Region, or what is known about the settlement and past use of the Great Plain Region. Cultural resources consist of any historic and prehistoric district, site, building, structure, or object (usually) over 50 years of age. Indian Trust Assets (ITAs) and sacred sites are also considered cultural resources. ITAs are defined as legal interests in property held in trust by the United States government for Indian tribes and individuals, or property protected under United States law for Indian tribes and individuals. ITAs can include land, minerals, Federally-reserved hunting and fishing rights, Federally-reserved water rights, and in-stream flows associated with a reservation or rancheria (U.S. Bureau of Reclamation, 2009).

This area was first inhabited by Paleo-Indian tribes that moved through the area as they hunted native herding animals, such as bison. As time went on, tribes diversified their technologies to allow them to hunt, trap, fish, forage, craft wood products, and process plants. Eventually tribes became less migratory and settled into areas of Minnesota including areas near the Minnesota River, where sources of food and building materials were readily available.

The Homestead Act of 1862 and the development of railroads started moving European settlers west into Minnesota. The US Dakota Conflict of 1862 pushed the Dakota people out of the area and onto reservations. Granite Falls became a city in 1889, growing from the construction of a dam and operation of a flour mill. In 1938, approximately 746 acres of land south of Granite Falls was returned to the Dakota Oyate Nation and the Upper Sioux Indian Community was created. An additional 654 acres of land was later added for a total of 1,440 acres comprising the Upper Sioux Community Reservation. (BCA 2017).

A records search of the Minnesota State Historic Preservation Office (SHPO) files was conducted on May 24, 2016, to identify known archeological sites, historic period structures, previous archeological surveys, and other cultural resources data within the area of potential effects (APE) for the Project (**Appendix I**). The literature search revealed 12 archaeological sites and 90 historical/architectural sites within a one-mile radius of the APE.

A cultural resources field study was conducted beginning in late 2016 and completed in Spring 2017 (BCA 2017). The cultural resources study and fieldwork included a review of previously identified cultural resources, intensive pedestrian survey of the APE, and shovel tests. During the field survey, archaeologists verified the locations of several previously recorded cultural sites. Several site leads, and three new historical/architectural sites were identified and recorded. **Table 3-6** summarizes the sites evaluated in the project area. In addition, a light scatter of historic cultural material and a piece of workable lithic raw material were found but were not recorded as sites, following SHPO site form instructions.

Table 3-6: Cultural Resources Sites Within The Project APE

Site Number	Affiliation	Description	NRHP Evaluation
21CPa	Unknown	Site Lead: Gravel Pit NW of Granite Falls	Unevaluated
21CP9	Unknown	Previously recorded: Mounds	Unevaluated
21CP10	Unknown	Previously recorded: Mounds	Unevaluated
21CP11	Unknown	Previously recorded: Mounds	Not eligible
21CP77	Historical/Architectural	New site: Six foundations and one barn	Not eligible
21CP78	Historical/Architectural	New site: One flake	Not eligible
21CP79	Historical/Architectural	New site: Foundation, a House, a Garage/Barn, & a Pump House	Not eligible

Source: BCA 2017

The final design avoids all known eligible or unevaluated sites in the project area.

3.10 Socioeconomics

Section 4.10 of the Final UGP Wind Energy PEIS discusses the socioeconomic environment potentially affected by the development of wind resources in the UGP Region. The PEIS describes 10 key measures of economic development: employment, unemployment, personal income, State sales and income tax revenues, population, vacant rental housing, State and local government expenditures and employment, and recreation. **Table 3-7** lists measures of economic development applicable to the project area.

The project is located in Chippewa County, a rural area in southwestern Minnesota, which has been experiencing a decreasing population trend since 1970 (Headwaters Economics 2017b). The local economy is primarily agricultural-based with tourism providing additional revenue. The Cities of Granite Falls and Montevideo are the nearest economic centers, both providing employment opportunities, goods and services, lodging, entertainment, and commercial and industrial businesses. Chippewa County has a slightly higher unemployment rate and lower annual median household income than the State of Minnesota. In general, since 1970 employment in Chippewa County has been increasing along with personal income, which increased by over 15% from 2000-2015 (Headwaters Economics 2017b). Between 2000 and 2015, agricultural jobs decreased by 25%, which service and government jobs increased by approximately 30% and 14%, respectively. The top three industries in 2000 in Chippewa County were services, retail trade, and government (Headwaters Economics 2017b).

Table 3-7: Measures of Economic Development

Economic Development Measures (Year)	Chippewa County	Minnesota
Population (2010) (a)	12,441	5,303,925
Rental vacancy rate (2010) (a)	7.4%	7.8%
Unemployment rate (Dec 2016) (b)	4.8%	4%
Annual Median Household Income (2007-2011) (c)	$44,712	$57,243
State government expenditures (FY 2013) (d)	-	$32,264,081
State government employment (2015) (a)	-	68,386
State Income Tax Revenue (2016) (g)	-	$10,738,906,000
State and Local Sales Tax Revenue: Leisure and Hospitality Industry (2015) (e)	$8,105,404	$5,808,526,300
Total State Tax revenue (FY 2016 general sales tax) (g)	-	$32,361,078,000

(a) U.S. Census Bureau American FactFinder (accessed 2/16/17)
(b) MN Employment and Economic Development Website (accessed 2/16/17)
(c) Upper Minnesota Valley Regional Development Commission: 2010 Census Data for Chippewa County, MN
(d) Minnesota Management & Budget Historical Expenditures (June 27, 2014)
(e) 2015 Annual Minnesota Sales Tax Statistics For the Leisure and Hospitality Industry (accessed 5/19/17)
(f) Minnesota Department of Revenue: State and Local Tax Collections by Major Tax Category (1957-2021) (accessed 5/19/17)

3.11 Environmental Justice

As discussed in Section 4.11 of the Final UGP Wind Energy PEIS, disproportionately high and adverse human health or environmental effects of Federal agency actions, programs, or policies on minority and low-income populations is required to be addressed by Executive Order 12898. Environmental justice also refers to meaningful involvement of all people, regardless of race, color, national origin or income. An environmental justice evaluation was completed based on the *Environmental Justice Guidance under the National Environmental Policy Act* (CEQ 1997) as discussed in the PEIS.

The Project is located approximately five miles north of the Upper Sioux Community, which is a federally-recognized Native American Sioux tribe. The majority of tribe members reside in Minnesota Falls Township with others located in Sioux Agency and Granite Falls Townships. The Upper Sioux Community operates the Prairie's Edge Casino Resort on their reservation land, which is approximately 1,300 acres, located in Minnesota Falls Township, south of the

City of Granite Falls.

The percentage of minority and low-income residents was determined for townships in the project area and compared to Chippewa County and the state of Minnesota; Granite Falls city data was also reviewed for comparison.

Three townships were chosen for geographic analysis because poverty data was not readily available for the census tract in which the proposed Project is located, and the proposed Project is outside of city limits. Low-income populations were identified based on the percent below the poverty line. Based on the CEQ guidance, if the minority or low-income populations exceed 50 percent or exceed the county or State levels by greater than 20 percent (i.e., "meaningfully greater than the general population"), the area of geographic analysis would be defined as having a minority or low-income population.

Table 3-8 displays the percentage of minority and low-income residents as discussed above. The percentages of minority and low-income residents in Granite Falls and Sioux Agency Townships do not exceed 50 percent nor do they exceed Chippewa County or State levels by greater than 20 percent (Granite Falls city percentages are also not exceeded). Minnesota Falls Township percentage of minority and low-income residents do not exceed 50%, but exceed the county and State levels by greater than 20 percent for minority population. Based on the CEQ guidance, there are no minority or low-income populations in Granite Falls and Sioux Agency Townships, however Minnesota Falls Township has a minority population. None of these townships is located in the project area.

Table 3-8: Minority and Low-Income Populations

Location	Total Population (a)	Percent Minority (a)	Percent Below Poverty (b)
Granite Falls Township	253	3.6%	4.2%
Minnesota Falls Township	429	45.2%	13.4%
Sioux Agency Township	226	5.3%	12.6%
Granite Falls	2,897	10%	14.6%
Chippewa County	12,441	6.5%	12.2%
Minnesota	308,745,538	14.7%	11.3%

Source: U.S. Census Bureau (accessed via American FactFinder 5/19/17)
(a) Minority was calculated by subtracting the white population from the total population (2010 data).
(b) From 2011-2015 American Community Survey 5-year Estimates

As further described in Section 6.0 – Coordination, Palmer's Creek has been in regular contact and met with the Upper Sioux Community. Representatives of the tribe were also invited to participate in the cultural resources field study.

3.12 Hazardous Materials and Health and Safety

Hazardous materials are those substances that have the potential to cause harm to humans, animals or the environment, such as certain chemicals or areas that contain these materials, including waste disposal sites or other facilities using potentially harmful materials. Hazardous materials have the potential to threaten the health and safety of those that come into contact with these substances. Safety issues can also be related to infrastructure, such as electrical transmission, airports or other facilities that have the potential to cause harm.

The project area includes an existing substation located in the southern part of the project area. This substation is enclosed by a fence and posted for trespassing as a safety measure. The existing substation was constructed to meet industry safety standards.

The Granite Falls Municipal Airport/Lenzen-Roe-Fagen Memorial Field is located approximately 5.5 miles south of the project area. The Montevideo-Chippewa County Airport, is approximately eight miles northwest of the project area. Both airports are small, regional airports without commercial service.

4. ENVIRONMENTAL CONSEQUENCES

This section describes the environmental consequences of the Proposed Action and the No Action Alternatives. Section 5 of the PEIS discusses the potential direct and indirect environmental impacts of wind energy development in the UGP Region and identifies BMPs and conservation measures to address impacts. As discussed below for each resource, the potential impacts of the proposed Project fall within the type and range of impacts identified in the PEIS. Additional site-specific impact information is presented below for each resource, where appropriate. Palmer's Creek would implement the applicable BMPs, avoidance, and minimization measures for this Project, which are derived from Section 5 of the PEIS and the Programmatic BA. **Appendix G** of this EA includes a list of the specific measures Palmer's Creek has committed to implement. Commitment to these measures allows for this EA to tier off the analysis in the PEIS.

4.1 Land Cover and Land Use

4.1.1 Proposed Action

General direct and indirect effects to land cover and land use from wind energy development are addressed in Section 5.1 of the Final UGP Wind Energy PEIS, and those impacts are consistent with those expected for this specific Project.

Temporary Impacts

Palmer's Creek proposed Project would result in temporary disturbance to approximately 172 acres (out of 6,150 acres), or 0.03 percent of the total project area, due to construction activities. The existing land cover in these areas is previously cultivated, agricultural land, including collection lines that may be placed across CREP land. The existing land cover would be removed for the duration of construction, typically one growing season, but would be re-vegetated with vegetation types matching the surrounding agricultural landscape, as specified in Section 5.6.2.3 of the PEIS. During construction, there could be temporary access disruptions to privately owned lands, typically lasting one season.

Permanent Impacts

The proposed Project would result in the permanent conversion of 12 acres (out of 6,150 acres), or 0.002 percent of the total project area, of agricultural land to non-agricultural uses due to construction of the wind turbine foundations, access roads, and other associated facilities. The proposed Project activities that would have permanent impacts, such as turbines and access roads, are located outside of CREP, RIM and PWP easements.

There would be some permanent upgrades to existing gravel roads and temporary access impacts to local roads during the construction phase of the Project, but the Project would not result in any permanent impacts or closures to the area's ground transportation resources. Palmer's Creek would work with Chippewa County to obtain the appropriate access and use permits, and to minimize and mitigate the impacts to area transportation. Access roads and turbine pads would not be fenced off except for gates/cattle guards installed in landowner fences. Livestock and the landowners would be able to cross access roads and move about unimpeded.

The air traffic generated by the airports would not be impacted by the proposed Project. Palmer's Creek would follow FAA regulations for marking towers and would implement the necessary safety lighting. Notification of construction and operation of the wind energy facility has been sent to the FAA, and FAA-required conservation measures would be implemented.

Appendix G of this EA lists BMPs and conservation measures from Section 5.1.2 of the PEIS that are applicable to the Project and that Palmer's Creek has committed to implementing to avoid or minimize impacts to land cover and land use.

4.1.2 No Action Alternative

Under the No Action Alternative, there would be no Project developed and, therefore, no related changes to land cover or land use within the project area.

4.2 Geology and Soil Resources

4.2.1 Proposed Action

Section 5.2 of the Final UGP Wind Energy PEIS describes impacts on soil resources from wind energy development and discusses the types of geologic hazards that may be encountered in the UGP Region. The potential impacts on geologic and soil resources that would result from the proposed Project are within the type and range of impacts identified in the PEIS.

Temporary Impacts

Prior to construction, soil borings would be performed at all wind turbine locations to develop the specific design and construction parameters. Laboratory testing of soil samples obtained from the site and geophysical surveys would be performed to determine the engineering characteristics of the site subgrade soils. If necessary, corrections to roadway and foundation subgrade would be prescribed depending on soil conditions and location of turbines and associated infrastructure would be adjusted as necessary.

Project construction would result in temporary impact to approximately 172 acres. Construction activities would result in removal of existing vegetation in the areas associated with the proposed Project components, potentially increasing the risk of soil erosion. Final siting of temporary laydown areas and access routes would be located based on shortest routes to minimize disturbance and would avoid environmentally sensitive resources where feasible. Placement of wind energy facilities and access roads in areas with excessive slopes would be avoided.

Construction of the Project would require coverage under the General Permit Authorization to Discharge Stormwater associated with construction activity under the National Pollutant Discharge Elimination System. This permit is issued by the Minnesota Pollution Control Agency (MPCA). A condition of this permit is to develop and implement a site-specific Storm Water Pollution Prevention Plan (SWPPP). The SWPPP would be developed during civil engineering design of the Project and would incorporate BMPs to control erosion and sedimentation.

Permanent Impacts

Permanent impact to soils includes approximately 12 acres of soil disturbance (i.e., excavation, compaction, and mixing of soil layers) for construction of turbines and associated facilities (including the proposed substation). This conversion of primarily agricultural land would include conversion of prime farmland. Since the majority of the project area (**Figure 6**) and County are considered prime farmland, the percentage of prime farmland impacted by the Project would be considered small. There are no anticipated effects to geological resources as a result of the Project.

Implementation of the BMPs and conservation measures identified in **Appendix G** of this EA, derived from Section 5.2.3 of the PEIS, would avoid or minimize impacts on geological and soil resources.

4.2.2 No Action Alternative

No Project-related impacts on geological or soil resources would occur with the No Action Alternative.

4.3 Water Resources

4.3.1 Proposed Action

Section 5.3 of the Final UGP Wind Energy PEIS discusses the potential impacts on water resources resulting from wind energy projects in the UGP Region. The potential impacts on water resources that would result from the proposed Project are within the type and range of impacts identified in the PEIS. As discussed in Section 3.3, water resources in the Project Area consist of wetlands, streams and the Minnesota River.

Temporary Impacts

Sedimentation in waterways would be minimized by implementing measures identified in the SWPP. Excavations would occur at depths of 10 feet or less, and therefore, are not anticipated to reach the groundwater in this area.

Permanent Impacts

Direct impacts to water resources, including PWI waterbodies, streams, wetlands, and rivers, would be avoided by siting permanent features in non-water areas whenever feasible, and using horizontal boring when infeasible to site features in non-water areas. The proposed Project occurs outside of the County Designated Flood Zone and Wild and Scenic River regulatory area, and therefore, no impacts to these resources are anticipated.

Indirect impacts, such as changes in runoff patterns or volume of runoff, impacts to groundwater or nearby aquifers or contamination of water resources have potential to occur. A well would be drilled for domestic use as part of the O&M facility to supply water for up to eight employees on site using restroom facilities. The Project would use and store small quantities of potentially hazardous materials. As discussed in Section 4.12, these materials would be stored, handled, and disposed of in accordance with all applicable laws and regulations, thus, groundwater contamination from these materials is not anticipated.

Implementation of the BMPs and conservation measures identified in **Appendix G** of this EA, derived from Section 5.2.3 of the PEIS, would avoid or minimize impacts on water resources associated with the Proposed Action.

4.3.2 No Action Alternative

No effects to water resources would occur as a result of the No Action Alternative.

4.4 Air Quality and Climate

4.4.1 Proposed Action

Section 5.4 of the Final UGP Wind Energy PEIS describes potential impacts on ambient air quality and climate that could occur in the UGP Region from wind energy development. Potential impacts on air quality expected from the Project fall within the type and range of impacts identified in the PEIS.

Temporary Impacts

Construction activities could release air emissions of criteria pollutants, VOCs, GHGs (e.g., carbon dioxide [CO2]), and small amounts of hazardous air pollutants (HAPs). During construction of the Project, fugitive dust emissions would temporarily increase due to truck and equipment traffic in the project area. Additionally, there would be short-term emissions from diesel trucks and construction equipment. Air quality effects caused by dust would be short-term, limited to the time of construction or decommissioning, and would not result in NAAQS exceedances or significantly contribute to GHG emissions.

Permanent Impacts

There would be no direct air emissions from operating wind turbines, because no fossil fuels are combusted. Negligible amounts of dust, vehicle exhaust emissions, and combustion-related emissions from diesel emergency generators would occur during maintenance activities. These emissions would not cause exceedances of air quality standards or have any negative impacts on climate change. Operation of WAPA's substation and the Palmer's Creek Substation could produce minute amounts of ozone and nitrogen oxides emissions as a result of atmospheric interactions with the energized conductors. Impacts on ambient air quality from these minor emissions during operation would be negligible. The proposed substation would employ sulfur hexafluoride-filled circuit breakers. Sulfur hexafluoride is a GHG, and, therefore, equipment leaks could contribute to air quality impacts. Equipment would undergo routine inspection and preventative maintenance to minimize such leaks, and if leaks did occur, the sulfur hexafluoride would be captured to prevent entering the atmosphere.

The Project could avoid considerable amounts of criteria pollutants, GHG, and HAP emissions that would otherwise have been generated from power plants burning fossil fuels. As discussed in Section 5.4.1.3 of the PEIS, operation of the Project could avoid from 1.4 percent up to 8.6 percent of air emissions from electric power systems in Minnesota, assuming the Project would displace fossil-fueled generation.

Implementation of the BMPs and conservation measures identified in **Appendix G** of this EA, derived from Section 5.4.2 of the EIS, would avoid or minimize potential impacts on air quality and climate associated with the Proposed Action.

4.4.2 No Action Alternative

No Project-related impacts on air quality or climate would occur with the No Action Alternative.

4.5 Noise

4.5.1 Proposed Action

Section 5.5 of the Final UGP Wind Energy PEIS discusses the potential impacts on the acoustic environment resulting from wind energy projects in the UGP Region. The expected potential noise impacts of the proposed Project are within the type and range of impacts identified in the PEIS.

Noise Study analysis indicated that construction and operation of the Project would contribute to increased noise levels. In general, the current background noise levels are within the state noise standards, but exceeded state standards during the day (60 dBA) and night (50 dBA) on several occasions, as previously discussed in Section 3.5. Two turbine layout scenarios were modeled in the Noise Study (**Appendix B**) to determine the sound-related impact of the proposed wind farm.

Temporary Impacts

During construction, heavy equipment would be used to excavate WTG foundations, improve existing roads, construct new access roads, install collection lines, and construct the proposed substation and O&M facility. Construction activities would likely be heard by the receptors (i.e., homes) nearest the activity in the project area. Noise impacts from construction would be temporary. The Noise Study indicated that during construction activities, which would occur during daylight hours, the noise level would increase by as much as 2.8 dBA from the current levels.

Permanent Impacts

The proposed wind turbines are projected to generate an apparent sound level of approximately 107 dB output per the manufacturer's specifications adjacent to the turbine hub. All conditions were modeled slightly above the worst-case scenario at 109 dB. For a single turbine at an 80-meter hub-height, the worst-case resultant noise produced drops below 50 dBA at distances greater than approximately 160 meters (500 feet). Turbines would be located at least 1,000 feet away from the nearest receptor (i.e., home) (WSB 2017). Operation of the Project would increase noise levels by a maximum of 2.8 dBA during both daytime and nighttime hours.

Changes in sound levels less than 3 dBA are barely perceptible to the human ear (Bolt, Beranek and Newman, Inc., 1973). At most, construction and operation of the project would increase noise levels by 2.8 dBA. As such, the Project is not expected to cause a perceptible increase to daytime or nighttime noise levels.

Implementation of the BMPs and conservation measures identified in **Appendix G** of this EA, derived from Section 5.5.2 of the PEIS, would minimize noise impacts from the proposed Project.

4.5.2 No Action Alternative

With the No Action Alternative, there would be no Project-related noise impacts. Noise levels throughout the area would continue to exceed state-mandated thresholds.

4.6 Ecological Resources

Direct and indirect impacts to ecological resources from wind energy development are discussed in detail in Section 5.6 of the Final UGP Wind Energy PEIS. Potential impacts to ecological resources expected from the proposed Project are within the type and range of impacts identified in the PEIS. These included impacts to plant communities, wildlife, regional wildlife, birds, bats, aquatic biota and habitat, and threatened and endangered species.

4.6.1 Plant Communities

4.6.1.1 Proposed Action

The Project would result in temporary and permanent impacts to vegetation. **Table 4-1** provides a summary of the estimated acres of vegetation disturbance from the Project. Information presented in the table is from the National Land Cover Dataset, which provides estimated vegetation types based on aerial photography interpretation, and therefore has not been field verified. Typical disturbance to vegetation includes removal, such as brush clearing or limited tree removal, compaction or trampling, and increased potential for introduction of invasive species.

Temporary Impacts

During construction, approximately 162 acres of agricultural land (cultivated crops and pasture/hay land) would be temporarily taken out of agricultural production for laydown areas and other construction activities. Roughly 10 acres of non-agricultural land would be temporarily disturbed during construction, including one acre of wetlands and one acre of forest. Directional drilling would be used to avoid direct impacts to wetland and other vegetation as needed to minimize impacts. After construction is complete, disturbed areas would be restored to their condition prior to construction. Restoration would include reseeding and planting trees, as determined during permitting.

Table 4-1: Temporary and Permanent Vegetation Disturbance (acres)

Cover Types	Temporary Disturbance	Permanent Disturbance
Barren Land (Rock/Sand/Clay)	0	0
Cultivated Crops	161	10
Deciduous Forest	1	0
Developed	7	0.6
Emergent Herbaceous Wetlands	1.1	0
Grassland/Herbaceous	0.5	0.1
Open Water	0	0
Pasture/Hay	1.2	0.6
Shrub/Scrub	0.1	0.1
Total	**171.9**	**11.4**

Source: NLCD, 2011

Permanent Impacts
Approximately 10 acres of cultivated crop areas would be permanently cleared of vegetation and converted to non-agricultural uses due to the permanent Project footprint. Less than two acres of non-agricultural, non-native vegetation would be permanently disturbed.

Implementation of the BMPs and conservation measures identified in **Appendix G**, derived from Section 5.6.2 of the PEIS, would further protect plant communities during construction and operation of the Project.

4.6.1.2 No Action Alternative

No effects to vegetation would occur as a result of the No Action Alternative.

4.6.2 Wildlife

4.6.2.1 Proposed Action

Site-specific species and updated information for this Project are provided in Palmer's Creek Wind Project Wildlife Assessment and Field Studies (**Appendix C**) and Bird and Bat Conservation Strategy (**Appendix E**). Temporary and permanent impacts would occur to wildlife in the project area.

Temporary Impacts
During construction, wildlife would be disturbed by noise and human activity and potentially displaced as activities move into areas that are used for foraging and shelter. Wildlife using drainage areas, wetlands, and agricultural areas where construction activity disturbs may seek foraging habitat and shelter in other nearby areas within and adjacent to the project area, such as the WMA or Minnesota River area. Wildlife are anticipated to temporarily relocate with the ability to move back into the project area once construction in certain areas is complete.

Permanent Impacts
Most of the land that would be permanently impacted by the Project is cultivated agricultural land and does not provided long-term habitat. It offers seasonal foraging areas to wildlife, which would be impacted by Project facility placement. Wetlands, forested areas, and native prairie would be avoided, and therefore, permanent impacts to habitat are not anticipated. Due to the disturbance from Project construction, wildlife that relocates outside of the project area may not return as there is an abundance of habitat in close proximity to the project area. It is anticipated, however, that wildlife would eventually return and continue to migrate through the project area.

Implementation of the BMPs and conservation measures identified in **Appendix G**, derived from Section 5.6.2 of the PEIS, would further protect wildlife communities during construction and operation of the Project.

4.6.2.2 No Action Alternative

Effects to wildlife associated with existing transportation, agriculture, and other development would continue to occur as a result of the No Action Alternative. Current agricultural and other activities in the area would move wildlife to more suitable habitat found in the Minnesota River Valley, and primarily along undisturbed hillsides and drainages.

4.6.3 Birds

4.6.3.1 Proposed Action

The proposed Project would cause limited temporary disturbance. The Project could cause permanent impacts to birds due to collision mortality, displacement due to disturbance, habitat fragmentation, and habitat loss. Permanent disturbance would primarily be associated with the placement and operation of WTGs, which have the potential to cause collisions and mortality with birds.

Data collected through June 2017 suggest an overall low impact in the project area on the local avian community as compared to other upper Midwest wind farms. The low mean-use rate in the project area is primarily due to few common resident and migratory bird species. Raptor use was low for each raptor species detected. Although there is potential for turbine-related fatalities of unknown ducks, unknown blackbirds, red-winged blackbirds, American crow, ring-billed gulls, red-tailed hawks, and turkey vultures, fatalities are not expected to have population-level impacts. If avian fatality rates are similar to other wind facilities within the region, it is estimated the Project would result in fatality rates between 0.44 – 11.83 birds/turbine/year (0.49 – 7.17birds/MW/year). Collision mortality rates are anticipated to be low (**Appendix C- Wildlife Assessment and Field Studies Report**). The Project would not directly impact habitat in the project area.

Migratory birds and waterfowl would be most susceptible to impacts from the Project when taking off and landing at staging and resting areas, because these are the times they would be flying at heights that could cause collisions with WTGs. At other times during their migration, migratory birds and waterfowl would be flying at heights well above the maximum height of the WTGs.

Avian collisions and subsequent mortality may be more likely at WTGs located closest to the Minnesota River, WMAs, and wetland or wooded areas. The National Bald Eagle Management Guidelines (USFWS 2007) indicate wind turbines should be sited away from nests, foraging areas, and communal roosting sites. For nesting, a buffer distance of 660 feet from an active nest is recommended to avoid disturbance. Fledged juvenile eagles range from the nest up to one-quarter mile (USFWS 2007). According to the Montana Bald Eagle Management Plan (MDFWP 1994), structures that pose a hazard, such as overhead utility lines, should not be constructed within Zone II, which is considered the Primary Use Area within one-quarter mile of an active nest. The nearest bald eagle nest to the Project is approximately one-mile to WTG 12. Based on available guidance, Project impacts to bald eagles are expected to be very low.

Estimates for bald eagle fatality rates were calculated for the Project following the *Eagle Conservation Plan Guidance Module 1- Land-based Wind Energy, Version 2* (USFWS 2013), which constitutes a Stage 3 Assessment of potential project impacts to bald eagles. All the observed eagles were within or below the rotor sweep area (RSA) and are considered in the eagle fatality calculations. Based on available data for the project site, the estimated bald eagle fatalities per year is approximately 0.0002. Over a 30-year project life, this equates to 0.006 eagle fatalities. This low annual eagle fatality rate categorizes the project area as a Category 3 – Minimal Risk to Eagles, indicating the cumulative annual take of the local area eagle population would be less than 5 percent of the estimated local population size.

The IBA follows the Minnesota River Valley. Project construction would occur outside of the IBA. Birds following the river valley would migrate through the project area and have the potential to collide with WTGs. Lac qui Parle Dam is located about 16 miles north, and therefore, impacts to migration routes and patterns and resting and staging areas at the State Park or WMA are not anticipated.

Implementation of the BMPs and conservation measures identified in **Appendix G**, derived from Section 5.6.2 of the PEIS, would further protect bird populations during construction and operation of the Project.

4.6.3.2 No Action Alternative

No new effects to birds would occur under the No Action Alternative.

4.6.4 Bats

4.6.4.1 Proposed Action

For bats, the mean mortality rate is 9.6 bats per turbine per year (Stantec 2012). There are bats in the project area and some wind turbine collision bat mortality would likely occur from the Project. Compared to birds, less is known about bat populations and habitat preferences on a local, regional or national level. Bat mortality is likely to be greatest for migratory tree bat species, including hoary, eastern red and silver-haired bats during the fall migration period (Johnson 2005, Arnett et al. 2008).

Implementation of the BMPs and conservation measures identified in **Appendix G**, derived from Section 5.6.2 of the PEIS, would avoid and minimize potential impacts to bats during construction and operation of the Project.

4.6.4.2 No Action Alternative

No new effects to bats would occur under the No Action Alternative.

4.6.5 Aquatic Biota and Habitats

4.6.5.1 Proposed Action

As described in Section 4.6.3, impacts to wetlands and streams would be avoided by siting facilities away from aquatic resources and implementing SWPPP requirements. Implementation of BMPs and conservation measures identified in **Appendix G**, derived from Section 5.6.2 of the PEIS, would protect aquatic biota and habitats.

4.6.5.2 No Action Alternative

No effects to aquatic biota or habitat would occur as a result of the No Action Alternative.

4.6.6 Threatened and Endangered Species

4.6.6.1 Federally Listed Species

4.6.6.1.1 Proposed Action

Palmer's Creek has committed to implement the conservation measures identified in the Programmatic BA applicable to species in the project area. With implementation of these measures, the Palmer's Creek Project **may affect, but is not likely to adversely effect,** these species.

For programmatic consultations that tier off of the PEIS, a Project Consistency Evaluation Form and individual Species Consistency Evaluation Forms (CEFs) have been developed for the listed, candidate, or proposed species that may occur within the UGP Region. The project and species forms are used as a tool for documenting and verifying that project proponents have complied with the requirements of the programmatic BA and are consistent with Tiers I, II, and III of the *U.S. Fish and Wildlife Service Land-Based Wind Energy Guidelines* (USFWS 2012c). The forms that document agency verification (WAPA and the USFWS) that the Project is in compliance with the Programmatic BA are included in **Appendix F** of this EA.

Northern Long-eared Bat

Potential direct and indirect effects to the northern long-eared bat from wind energy development in the UGP Region are analyzed in detail in Sections 5.5.6 and 5.6.6, respectively, of the UGP Wind Energy Programmatic EA.

No northern long-eared bats were detected in the project area in pre-construction surveys and hibernacula are unlikely in the area due to a lack of adequate habitat. The project area is not currently affected by white nose syndrome, and there are no known hibernacula within 0.25 mile of the Project or roost trees within the project area. Northern long-eared bats migrate only short distances between winter hibernacula and summer roosting habitat. As there are no known hibernacula in Chippewa County, the presence of northern long-eared bats within the project area is unlikely.

Dakota Skipper and Poweshiek Skipperling

The Dakota skipper and Poweshiek skipperling require similar habitat (i.e., native prairie) and have similar lifecycle characteristics. Therefore, the discussion about the potential impacts to these species has been combined. There are no records for the Dakota skipper and Powesheik skipperling in the US Fish and Wildlife Service data base within the project area. There is no designated critical habitat. The project area contains relatively small areas of native prairie. Native prairie is limited to a few rocky outcrops, which do not contain the appropriate botanical species to support the Dakota skipper and/or Poweshiek skipperling. The native prairie areas are outside of the construction limits of the Project, and would therefore not be disturbed.

The Project has been designed to avoid native prairie, where Dakota skippers and Poweshiek skipperlings complete their life cycle, by following established utility corridors along active roadways and previously disturbed areas, such as cultivated or managed agricultural areas. Therefore, the Project would not cause additional fragmentation of habitat, new barriers to dispersal, loss of connectivity, changes in distribution or isolation of known populations. There is no indication that the Project would result in biologically meaningful or measurable changes to the existing habitat, individuals, or population of Dakota skipper or Poweshiek skipperling due to the lack of suitable habitat within the project area.

4.6.6.1.2 No Action Alternative
No effects to threatened and endangered species would occur as a result of the No Action Alternative.

4.6.6.2 State Listed Species

4.6.6.2.1 Proposed Action
The Project would not directly impact important bird habitat or IBAs in the project area. Minnesota Biological Survey (MBS) sites, native prairie, and wetland areas would be avoided if possible. WTGs closest to the Minnesota River are WTGs 1, 5, 9 and 12 (**Figure 2, Site Detail Map**). Avian collisions and subsequent mortality may be more likely with these WTGs than other WTGs in the project area.

The Project is not anticipated to adversely impact populations of state-listed bird species, such as the American white pelican, upland sandpiper, and lark sparrow. The Project is also not anticipated to adversely impact populations of state-listed bats (NLEB, tricolored bat, and big brown bat) and snakes (gopher snake and western fox snake). Please refer to **Table 3-4** for a complete list of state-listed species that may occur in the project area. Post-construction monitoring is required to determine Project impact on bird mortality.

The USFWS and MNDNR have provided guidance for avian surveys. Palmer's Creek has agreed to avoid eagle nesting areas, as feasible. Additionally, due to the Minnesota River Valley being a significant migration corridor, post-construction avian fatality monitoring would be required, including bat monitoring.

Implementation of the BMPs and conservation measures identified in **Appendix G**, derived from Section 5.6.2 of the PEIS, would further protect state listed species during construction and operation of the Project.

4.6.6.2.2 No Action Alternative
No effects to state-listed species would occur as a result of the No Action Alternative.

4.7 Visual Resources

4.7.1 Proposed Action
Section 5.7 of the PEIS describes potential visual impacts that could occur in the UGP Region from wind energy development. The potential visual impacts of the proposed Project would fall within the type and range of impacts identified in the PEIS. Visual impacts to the landscape attributable to the Project would depend on the extent to which the existing landscape is already altered from its natural condition, the number of viewers (residents, travelers, visiting recreational users, etc.) within visual range of the area, and the degree of public or agency concern for the quality of the landscape. The primary direct visual impacts associated with the proposed Project would result from the introduction of the numerous vertical lines of the 18 wind turbines into the generally strongly horizontal landscape found in the Project Area.

As discussed in Section 3.7, viewers of the Project would include occupied residences within and adjacent to the Project Area, travelers along U.S. Highway 212, and recreation users of the Minnesota River valley. The magnitude of the visual impacts associated with the Project would depend on many factors, including distance of the proposed wind energy facility from viewers, weather and lighting conditions, the presence and arrangements of lights on the turbines and other structures, and viewer attitudes. Viewer attitudes are very subjective, and their reactions to visual changes may be influenced by several non-visual factors, such as positions on renewable energy and wind power and on financial considerations.

A preliminary viewshed analysis was completed in December 2016 (BCA 2016), which evaluated three observer points (OPs): Granite Falls city center and two on the Upper Sioux Reservation. Follow up viewshed analysis, visual impact assessments, and three-dimensional (3-D) virtual simulations were completed for the Project in June 2017 to evaluate the visibility of the Project from 18 additional OPs (BCA 2017b). The OPs included the city center of Granite Falls, two observation points on the Upper Sioux Reservation, architectural structures, and the scenic byway along the river (BCA 2016 and 2017). Eight OPs were identified during coordination with the Minnesota State Historic Preservation Office (SHPO) and are located within Granite Falls. The remaining 10 OPs are located along the Minnesota River Valley National Scenic Byway.

Table 4-2 provides a summary of the OPs and potential visual impact of the Project on each OP.

Table 4-2: Summary of the OPs and Visual Impact

OP	Association	WTG Visibility	Visual Impact	Distance from nearest WTG
OP1	Olof Swensson Farmstead	Visible	High	0.60 miles
OP2	Andrew J. Volstead House	Not Visible	None	1.88 miles
OP3	Julian A. Weaver House	Not Visible	None	2.04 miles
OP4	Prentice St. in Granite Falls	Not Visible	None	1.60 miles
OP5	Prentice St. in Granite Falls	Not Visible	None	1.84 miles
OP6	Prentice St. in Granite Falls	Not Visible	None	2.00 miles
OP7	Prentice St. in Granite Falls	Not Visible	None	2.07 miles
OP8	12th Ave. & 7th St. in Granite Falls	Not Visible	None	2.09 miles
OP9	U.S. Highway 212, Scenic Byway	Visible	Moderate-Low	3.58 miles
OP10	U.S. Highway 212, Scenic Byway	Not Visible	None	3.18 miles
OP11	U.S. Highway 212, Scenic Byway	Not Visible	None	2.50 miles
OP12	U.S. Highway 212, Scenic Byway	Not Visible	None	3.05 miles
OP13	U.S. Highway 212, Scenic Byway	Not Visible	None	1.91 miles
OP14	U.S. Highway 212, Scenic Byway	Visible	Moderate-High	1.59 miles
OP15	U.S. Highway 212, Scenic Byway	Visible	Moderate-High	1.21 miles
OP16	U.S. Highway 212, Scenic Byway	Visible	Moderate-High	1.35 miles
OP17	U.S. Highway 212, Scenic Byway	Visible	Moderate-Low	1.91 miles
OP18	U.S. Highway 212, Scenic Byway	Visible	Low	2.04 miles
OP19	Granite Falls City Center	Visible	Low	2.12 miles
OP20	Upper Sioux Reservation West	Not Visible	None	5.09 miles
OP21	Upper Sioux Reservation East	Visible	Moderate	6.51 miles

* Please note that this data is from a digital rendering and the project results may differ slightly.
Source: BCA, 2017c

Figure 10 shows the locations of the OPs relative to the project area, including the OP locations in the City of Granite Falls, along U.S. Highway 212, and the Upper Sioux Reservation.

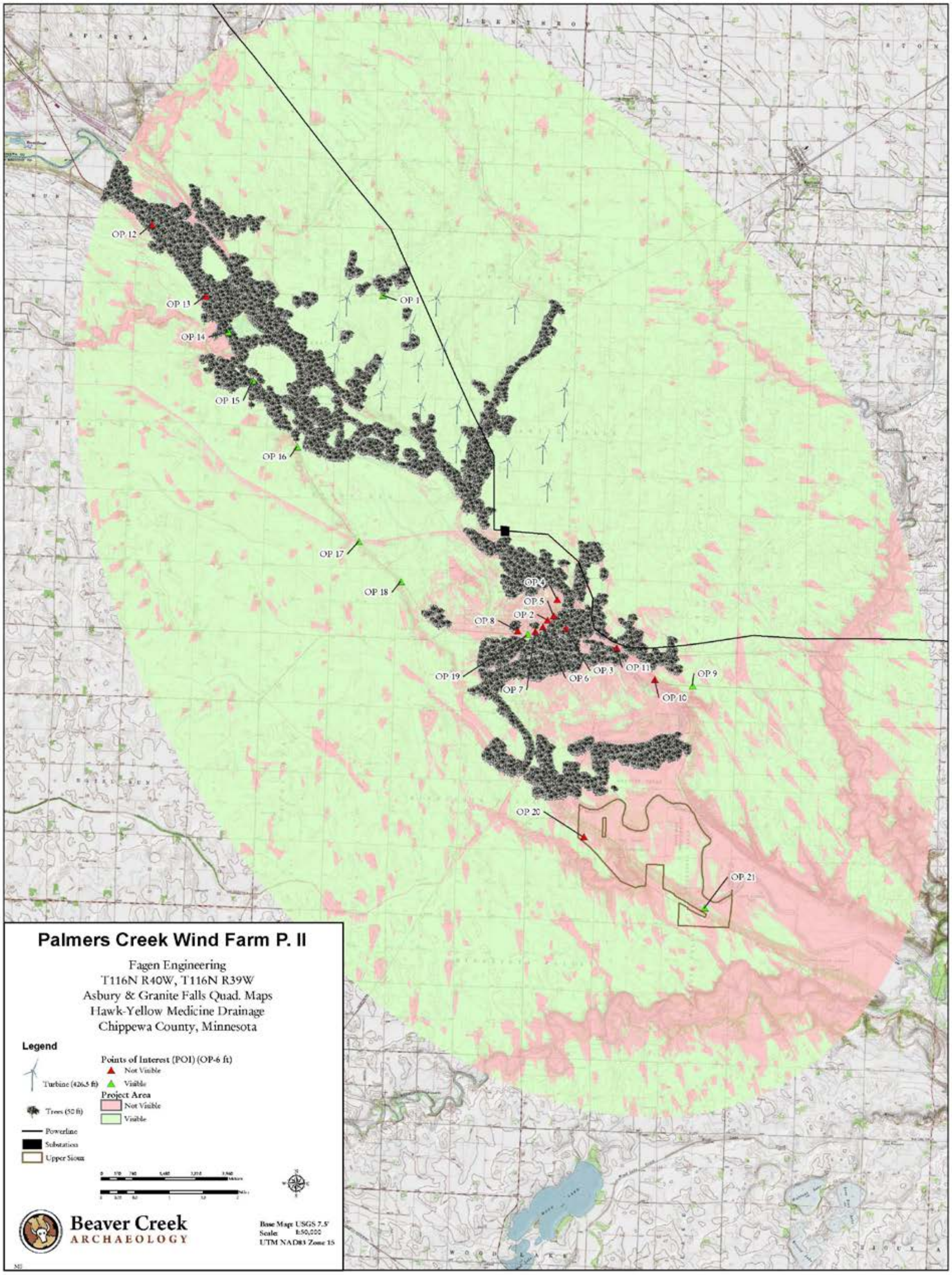


Figure 10: Observer Points Evaluated for Visual Impacts

The viewshed analysis indicated that two WTGs would be visible from the city center of Granite Falls. The results of the viewshed analysis, a visual impact assessment, and ground truthing (BCA 2017) indicate the Project would not be seen from the majority of the town of Granite Falls and concluded the Project would have limited visual effect on Granite Falls.

Up to 15 WTGs would be visible from the east OP on the Upper Sioux Reservation (BCA 2016).

WTGs would not be visible from most residences and would interrupt some horizon views within the project area and in some areas outside of the project area boundary. The proposed substation would be located next to the existing substation and is not anticipated to result in a significant visual impact. There would be no visual impact on the OPs provided by WAPA in consultation with the Minnesota SHPO, with the exception of the Olof Swenson Farmstead. The Olof Swenson Farmstead has some tree vegetation, but not enough to significantly block the view of the Project.

Within the project area, the Project would be visible along CR 15, which runs along the north edge of the project area. While traveling Palmer Creek Road in the river floodplain, travelers would not have a good view of the WTGs due to the location of the WTGs above on the bluff and existing tree cover along the bluff slope. Those using the Minnesota River Valley National Scenic Byway alternate routes would be directly adjacent to the proposed substation. The Project would not be seen from the majority of the scenic byway due to tree vegetation and topography adjacent to the road. The viewshed analysis (BCA 2017) concluded the Project would have a limited visual effect on U.S. Highway 212, a portion of the Minnesota River Valley National Scenic Byway.

Minnesota River Valley National Scenic Byway technical staff were contacted regarding potential impacts from the Project. If the viewshed of the Byway has significant impacts to its scenic nature, the Byway could lose national designation. Based on the viewshed analysis (BCA 2017), substantial visual impacts to the Byway are not anticipated relative to the existing transmission lines, substations, and other visible infrastructure in the area.

Consideration of viewsheds during design and construction would help reduce potential impacts to the viewshed and Scenic Byway. The WTGs would be lit to meet the minimum FAA regulations, which require red flashing, strobe, or pulsed obstruction lights at night. No daytime lighting is required (FAA 2016).

Implementation of the BMPs and conservation measures identified in **Appendix G**, derived from Section 5.7.1.3 of the PEIS, would help reduce visual impacts from the proposed Project. The viewshed analysis also recommended planting a tree row along the southern edge of the Swenson Farmstead site to reduce visual impacts.

4.7.2 No Action Alternative

With the No Action Alternative, there would be no Project-related visual changes in the Project Area.

4.8 Paleontological Resources

4.8.1 Proposed Action

Section 5.8 of the Final UGP Wind Energy PEIS discusses the potential of wind energy development activities to impact paleontological resources in the UGP Region. Ground-disturbing activities, most of which take place during construction, represent the greatest impacting factor to paleontological resources. Based on the presence of metamorphic rocks and associated geology in the project area, the risk for impacts to paleontological resources from the Project is very low (BLM 2016). The construction of the turbine foundations would have the greatest potential to affect fossil-bearing formations. Foundations for substation equipment, while not nearly as deep, could also affect fossil-bearing formations at the substation and switchyard sites.

Implementation of the BMPs and conservation measures identified in **Appendix G**, derived from Section 5.8.1.6 of the PEIS, would minimize potential paleontological resource impacts.

4.8.2 No Action Alternative

No paleontological resource impacts would occur as a result of the No Action Alternative.

4.9 Cultural Resources

4.9.1 Proposed Action

Section 5.9 of the PEIS describes the wind energy development activities with a potential to affect cultural resources. The project area is in the Prairie Lake Region (Region 2), which is in southwestern and southcentral Minnesota. From a regional perspective, material from any cultural period (Paleo-Indian to modern) could be expected to be encountered in any archaeological region.

Field surveys identified one site within the APE; this site was recommended as ineligible for the NRHP, and no avoidance is required (**Appendix H**).

During Project construction and operation activities, Palmer's Creek would physically avoid NRHP-eligible properties and unevaluated properties, which are being treated as eligible for purpose of this Project. It is WAPA's practice to avoid all sites potentially eligible for listing in the NRHP. **Table 4-3** provides a summary of the avoidance measures identified for each site. If an unevaluated site cannot be avoided, it would be evaluated for NRHP eligibility, and the criteria for adverse effects would be assessed.

Table 4-3: Avoidance Measures for Previously Recorded Cultural Resources Sites

Site Number	Avoidance Measures
21CPa	No avoidance necessary
21CP9	Avoidance
21CP10	Avoidance
21CP11	No avoidance necessary
21CP77	No avoidance necessary
21CP78	No avoidance necessary
21CP79	No avoidance necessary

Source: BCA 2017

If cultural resources were to be found during construction activities, all work would cease at that location and the notification and protection protocols identified in **Appendix G** would be followed. As such, the Project is not anticipated to adversely affect historic resources.

With implementation of the minimization measures identified in **Appendix G**, derived from Section 5.9.1.6 of the PEIS, significant cultural resources in the project area would be identified and appropriately protected during Project development activities.

4.9.2 No Action Alternative

There would be no cultural resources impacts with the No Action Alternative.

4.10 Socioeconomics

4.10.1 Proposed Action

The direct and indirect socioeconomic impacts produced from construction and operation of wind energy facilities in the UGP Region are described in Section 5.10 of the Final UGP Wind Energy PEIS. The anticipated short-term and long-term economic impacts associated with the proposed Project are consistent with the type and range of impacts identified in the PEIS.

Temporary Impacts

The number of short-term construction jobs created is expected to be approximately 100. Any increase in the local population due to construction would be temporary. There would likely not be sufficient trained local labor to fill the number of jobs available. Non-local construction workforce would probably be located within an approximately 40-mile radius that would include Willmar, Montevideo, and Redwood Falls, MN and workers could commute to the project area. Construction labor could also commute to the site from South Dakota from cities such as Brookings or Watertown, both approximately 90 miles from the project area. The need for additional temporary or permanent housing in the project area would be unlikely.

Construction activities for the Project would be short-term, and any short-term effects to local businesses would most likely be beneficial.

Permanent Impacts

Operation of the Project has the potential to create long-term beneficial impacts to Chippewa County's tax base. The Project would provide a new source of property taxes for the County, thus increasing the potential tax revenues. These increased revenues could be used to improve local government or community services, benefitting all local residents. Local spending during the construction and operation periods would result in additional personal income, as well as increased State and local tax revenue. Landowners who participate in the Project would receive the most direct economic benefit from lease payments for wind turbines and roads located on their property. These payments would provide a predictable supplementary source of income for the life of the Project, which is expected to be 20 to 40 years.

The Project would generate approximately five long-term jobs, which would have a positive effect on local income levels. The salary range for these jobs would be between $30,000 and $70,000, annually. These long-term positions could bring additional people into the County and positively contribute to the local economy.

Section 5.10 of the Final UGP Wind Energy PEIS discusses potential impacts to property values from wind farm projects, indicating no evidence that wind turbines decreased property values. It is anticipated that the proposed Project would have similar implications on property values in the project area to those described in the PEIS.

4.10.2 No Action Alternative

The No Action Alternative would not result in new jobs for construction or operation of the Project. It would also not result in new tax revenue for Chippewa County.

4.11 Environmental Justice

Minority populations are located approximately five miles south of the project area. Palmer's Creek has been in ongoing discussions with the Upper Sioux Community regarding the Project and working with the tribe to avoid and minimize impacts. No disproportionately high and adverse human health or environmental effects are expected from the Project. No further environmental justice analysis is required for either the proposed Project or No Action Alternative in accordance with the provisions of EO 12898.

4.12 Hazardous Materials and Health and Safety

4.12.1 Hazardous Waste

4.12.1.1 Proposed Action

Section 5.12 of the Final UGP Wind Energy PEIS discusses the possible adverse impacts resulting from the presence and use of hazardous materials and the generation, management, and disposal of wastes. The use of lubricants and other potentially hazardous materials are necessary for proper equipment operation of the Project. These materials would be used in small quantities on an as needed basis for equipment maintenance. A small amount of turbine hydraulic fluids and lubricants would be contained within the nacelle of the individual WTGs. A small amount of hydraulic fluid, lubricating oil, grease and solvents would be stored in appropriate containers in the O&M Facility. When fluids or oils are replaced, the waste substances would be disposed of at an appropriate hazardous materials management disposal facility or landfill.

Palmer's Creek would implement the appropriate minimization strategies identified in Section 5.12.1.4 of the PEIS to eliminate or reduce adverse impacts from Project-related hazardous materials and wastes. Section 3.9 of the PEIS provides a discussion of the amounts and types of hazardous materials that would be present at a wind farm during its construction, operation, and decommissioning phases. These same amounts and types of hazardous materials would also be anticipated for the Palmer's Creek Wind Farm. Based on the small quantities, use of proper storage, spill cleanup, and regulated disposal methods, impacts from hazardous materials are not anticipated.

4.12.1.2 No Action Alternative

There would be no Project-related hazardous materials impacts with the No Action Alternative.

4.12.2 Health and Safety

4.12.2.1 Proposed Action

Health and safety concerns of wind energy development are discussed in Section 5.13 of the PEIS. Palmer's Creek would implement the BMPs and conservation measures identified in **Appendix G**, derived from Section 5.13.4 of the PEIS, for protection of wind energy facility and transmission line workers and for the protection of public health and safety during the various phases of Project development associated with the Project.

Several safety hazards are associated with wind turbines, including turbine height, high winds, and rotating machinery. Wind turbines are designed with safety features including wind sensors and brakes. Wind sensors prompt the turbine to turn and face oncoming wind to maximize efficiency and prevent damage during high winds. WTGs also include brakes to stop the turbine during emergencies and control rotation speed.

WTG safety features require regular, ongoing maintenance for proper operation, which requires personnel to inspect and repair the nacelle and other parts of the turbine. Precautions are taken to prevent falls and other injuries. Precautions to prevent accidents include training and use of proper equipment.

Palmer's Creek has sited the proposed WTGs for the Project a minimum of 1,000 feet from residences. When maintenance of the WTG is conducted, trained personnel are required to use safety equipment to prevent injury and accidents. The proposed substation would be fenced and posted for trespassing to minimize potential public safety impacts. Safety measures would be included in the substation design to comply with industry standards and applicable regulations.

As indicated in Section 5.13.3 of the PEIS, Palmer's Creek is responsible for ensuring the operability and reliability of their systems. To do so, they must evaluate the potential risks from all credible events, including natural disasters (earthquakes, storms, etc.) as well as mechanical failure, human error, sabotage, cyber-attack, or deliberate destructive acts, recognizing intrinsic system vulnerabilities, the realistic potential for each event/threat, and the potential consequences. The proposed Project is not anticipated to be at any unusual risk for accidents or acts of sabotage or terrorism.

Due to the height of the WTGs, FAA Form 7460-1 must be completed and submitted when a construction permit is filed or at least 45 days before the start date of Project construction, whichever is earliest. Based on distance and FAA compliance measures, the Project is not anticipated to cause impacts to the Granite Falls Municipal Airport/Lenzen-Roe-Fagen Memorial Field or the Montevideo-Chippewa County Airport.

4.12.2.2 No Action Alternative

There would be no Project-related health or safety concerns with the No Action Alternative.

5. CUMULATIVE IMPACTS

The cumulative impacts of past, present, and future actions on resources within the UGP Region are analyzed in Section 6 of the UGP Wind Energy Final PEIS. The contribution of cumulative impacts associated with the proposed Project are within the scope of the cumulative impacts analysis in the PEIS. The PEIS (Section 2.4) projected wind energy development through the year 2030 for the UGP Region, and the proposed Project is part of that projected development.

Past and present impacts to soils and vegetation in the project area are primarily related to agriculture from cultivated crops and livestock, and therefore, the top soil layers have been disturbed, and mixed and native vegetation have been removed. The project area is crossed by existing roads, a railroad track, and high voltage transmission lines connecting to an existing substation. Noise levels in the project area are consistent with rural areas and at times exceed the state noise standards.

Additionally, there are a number of wind development projects in the UGP Region. There are 28 known wind projects within 55 miles of the project area and another 117 wind projects within 150 miles (USGS 2014). **Table 5-1** provides a summary of the wind projects within 55 miles of the project area.

The construction and operation of the Project, in combination with these other existing and proposed wind farms, as well as other private and public development occurring within 55 miles of the project area, could contribute to cumulative impacts on resources within the UGP Region, which would be similar to those described in the PEIS. A summary of cumulative impacts analyzed for each resource area under the PEIS's preferred alternative (of which this Project is a part) is provided in Table 6.3-2 of the PEIS.

With the implementation of conservation measures, the Project would avoid or minimize impacts to the resources described above and therefore, would not measurably contribute to cumulative effects on resources from other past, present, and reasonably foreseeable future actions.

Table 5-1: Wind Projects Within 55 Miles of Project Area

Wind Project	Number of Turbines	Miles to Project Area
Lac qui Parle Valley School Wind Farm	1	25
Redwood Falls Wind	2	29
Willmar Wind	2	32
Adams Community Wind	12	37
Marshall Wind	9	38
Danielson Wind	12	39
Borderline Wind Project	1	46
Lakeview Ridge Wind	1	46
Shaokatan Hills	18	49
Buffalo Ridge 1&2	129	50
Shaokata Power Partners Wind	2	50
Lakota Ridge	15	50
North Shaokatan Wind	18	51
Lake Benton 1	143	52
Salty Dog 1	3	52
University of Minnesota - Morris	2	53
Hope Creek LLC	3	53
Buffalo Ridge Wind	73	53
U of Minnesota-Morris	2	54
Soliloquy Ridge LLC	3	54
Spartan Hills LLC	3	54
Florence Hills LLC	3	54
MinnDakota Wind	100	54
Ruthton Ridge 1 LLC	3	54
Hadley Ridge LLC	3	54
Ruthton Ridge 2 LLC	3	54
Winter's Spawn LLC	3	54
Lake Benton 2	138	55

Source: USGS 2104

6. COORDINATION

A public scoping meeting was held on December 1, 2016, in Granite Falls, Minnesota. Federal, State, and local agencies were invited to the meeting and to provide comments regarding the Project. The public was invited through newspaper and radio announcements, and residents near the Project were invited to comment. The public scoping meeting documentation is included in **Appendix I**. Comments received regarding the proposed Project from agencies and the public are included in **Appendix J.**

6.1 Federal Agencies

The Federal agencies that were contacted for the purpose of the EA scoping process are:

- Federal Aviation Administration
- U.S. Fish and Wildlife Service

6.2 State and Local Agencies

The State and local agencies that were contacted for the purpose of the EA scoping process are:

- Minnesota Department of Transportation
- Minnesota Department of Natural Resources
- Minnesota Public Utilities Commission
- Minnesota State Historic Preservation Office
- Upper Minnesota Regional Development Commission
- Chippewa County
- City of Granite Falls

6.3 Native American Tribes and Associated Bodies

Pursuant to NEPA and Section 106 of the NHPA, Native American tribes that may attach religious and cultural significance to resources within the project area were contacted and invited to participate in the consultation processes.

WAPA initiated Section 106 tribal consultation with the following 12 tribes on November 10, 2016: the Cheyenne and Arapaho Tribes of Oklahoma; Flandreau Santee Sioux Tribe; Santee Sioux Nation; Lower Sioux Indian Community; Prairie Island Indian Community; Spirit Lake Tribe; Sisseton-Wahpeton Oyate Nation; Upper Sioux Indian Community; Iowa Tribe of Kansas and Nebraska; Fort Belknap Indian Community; Apache Tribe of Oklahoma; and Menominee Indian Tribe of Wisconsin. The Upper Sioux Community and the Cheyenne and Arapaho Tribes of Oklahoma were the only tribes to respond to WAPA's request for information and invitation for consultation. The Cheyenne and Arapaho Tribes of Oklahoma determined they had "No Properties" within the project APE.

On April 24, 2017, the previously mentioned tribes were invited by WAPA, in collaboration with the Upper Sioux THPO and Fagen Engineering, Inc., to attend a tribal consultation meeting located at the Upper Sioux Indian Community near Granite Falls, Minnesota. Replies were received from the Prairie Island Indian Community, the Santee Sioux Nation, and the Flandreau Santee Sioux. The Prairie Island THPO indicated they would not be able to attend. The Santee Sioux THPO stated that his Tribe is in total support of the Upper Sioux. The Flandreau THPO indicated that two tribal representatives would be in attendance.

On May 4, 2017, the tribal consultation meeting was held at the Upper Sioux Indian Community casino. Those in attendance were representatives of WAPA, Fagen Engineering, Inc., Beaver Creek Archaeology, and the Upper Sioux THPO. A representative of the Flandreau Santee Sioux arrived near the end of the meeting.

A Tribal Cultural Specialist (TCS) was invited from each consulting tribe to participate in the cultural resources survey, site recording, interpretation, and NRHP evaluations. Spirit Lake Nation sent one TCS, Ryan Longie. None of the other consulting tribes had an available TCS, and therefore, Dylan Youpee and Colma 'Jason' Dupree from the Fort Peck Assiniboine and Sioux Tribes and Russell Red Horn, an enrolled member of the Pine Ridge reservation who serves as a TCS for multiple Tribal Historic Preservation Offices in the area, participated as representatives of Sioux tribes.

Field inventories were completed by BCA archaeologists and tribal participants from the Spirit Lake Nation and Fort Peck Assiniboine and Sioux Tribes in November 2016 (Stage I), the Fort Peck Assiniboine and Sioux Tribes in February 2017 (Stage II), and Spirit Lake Nation, Three Affiliated Tribes, and Flandreau Santee Sioux Tribe in March 2017 (BCA 2017a). Representatives from the Upper Sioux completed field surveys of the project area in June 2017.

6.4 Non-Governmental Organizations

Non-governmental organizations have been contacted to participate in the EA scoping process. The non-governmental organizations that were contacted for the purpose of the EA scoping process are:

- Minnesota River National Scenic Byway Commission
- Chippewa County Historical Society

7. LIST OF PREPARERS

Table 7-1 identifies the personnel responsible for the preparation of this EA.

Table 7-1: List of EA Preparers

Name	Agency/Firm	Title
Christina Gomer	WAPA	NEPA Coordinator (Natural Resources Specialist)
Louis Hanebury	WAPA	UGP Environmental Protection Specialist (Biologist)
David Kluth	WAPA	UGP Archeologist
Matthew Marsh	WAPA	UGP Environmental Manager
Mike Rutledge	Fagen Engineering	Environmental Services Director
Amy Denz	Wenck, Inc.	Environmental Review Manager

8. REFERENCES

Audubon. 2016. Minnesota Important Bird Areas. Available online: http://mn.audubon.org/conservation/minnesota-important-bird-areas (Accessed November 2016).

Beaver Creek Archaeology (BCA). 2016. Viewshed Analysis: Palmer's Creek Wind Farm, LLC., December 2, 2016.

BCA. 2017a. A Phase I Reconnaissance Survey of the Palmer's Creek Wind Project in Chippewa County, Minnesota. Reiners, L., Bohner C., Brooks, B. April, 2017.

BCA. 2017b. A Virtual Viewshed Analysis, Visual Impact Assessment, and Ground Truthing of Palmer's Creek Wind Project in Chippewa County, Minnesota. June 2017.

Bolt, Beranek and Newman, Inc., Fundamentals and Abatement of Highway Traffic Noise, Report No. PB-222-703. Prepared for Federal Highway Administration, June 1973.

Bowman, Melissa. 2016. Rare Species Guide. Minnesota Department of Natural Resources. <http://www.dnr.state.mn.us/>.

Bureau of Land Management (BLM). (2016, July 8). *Potential Fossil Yield Classification System.* Retrieved from Potential Fossil Yield Classification (PFYC) System for Paleontological Resources on Public Lands: https://www.blm.gov/policy/im-2016-124

Chippewa County 2005. Zoning Ordinance Section 12 – Windpower Management. Adopted: February 15, 2005. Available online: http://www.co.chippewa.mn.us/Ordinance%20Section%2012%20Windpower%20Mgt.pdf. Accessed September 2016.

Chippewa County 2014. *The 2013-2023 Chippewa County Water Plan*. Available online: http://www.co.chippewa.mn.us/Chippewa%20County%20Water%20Plan.pdf. Accessed September 2016.

Chippewa County Highway Department 2016a. *Spring Load Restrictions.* Available online: http://www.co.chippewa.mn.us/highway9.htm. Accessed September 2016.

Chippewa County Highway Department 2016b. *Road Construction 2017-2021.* Available online: http://www.co.chippewa.mn.us/HWY%20Five%20Year%20Plan.pdf. Accessed September 2016.

Dana, R. P. 1991. Conservation management of the prairie skippers Hesperia dacotae and Hesperia ottoe. Station Bulletin 594-1991 (AD-SB-5511-S), Minnesota Agricultural Experiment Station, University of Minnesota, St. Paul, Minnesota.

EAPC Wind Energy (EAPC) 2016. Palmers Creek Wind Project Microwave Beam Study. Granite Falls, MN. October 15, 2016. Authored by Chester Harvey (GIS Specialist), checked by Nick Laskovski (Project Analyst), and approved by Robert Sherwin (Managing Partner).

Federal Aviation Administration (FAA) 2016. Advisory Circular: Obstruction Marking and Lighting (AC No. 70/7460-1L). October 8, 2016. Available online: http://www.faa.gov/documentlibrary/media/advisory_circular/ac_70_7460-1l_change_1_obstruction_marking_and_lighting_10062016.pdf. Accessed October 2016.

Federal Emergency Management Agency (FEMA) 1986A. Flood Insurance Rate Map, Panel 155 of 170. Community Panel Number 2700660155B, effective June 17, 1986. Available online: http://map1.msc.fema.gov/idms/IntraView.cgi?KEY=64511988&IFIT=1. Accessed September 2016.

FEMA 1986B. Flood Insurance Rate Map, Panel 160 of 170. Community Panel Number 2700660160B, effective June 17, 1986. Available online: http://map1.msc.fema.gov/idms/IntraView.cgi?KEY=64581656&IFIT=1. Accessed September 2016.

Federal Register 79:206 (24 October, 2014) pp. 63672-63748.

Fitch, J. H., and K. A. Shump, Jr. 1979. *Myotis keenii*. Mammalian Species 121:1-3.

GE Renewable Energy 2016. 2.0-2.4 MW Platform website. Available online: https://www.gerenewableenergy.com/wind-energy/turbines/23-107.html. Accessed September 2016.

Headwaters Economics. 2017a. Populations at Risk: Minnesota Non-Metro. May 19, 2017.

Headwaters Economics. 2017b. Economic Profile System (EPS): A Profile of Socioeconomics Measures. May 19, 2017.

Johnson, Jolene. 2017. Email correspondence: Gravel mines in Yellow Medicine County near the project area. February 16, 2017.

Midwest Rural Energy Council (MREC). 2014. Wind Turbines and Farm Stray Voltage. February 2014.

Minnesota Department of Health (MNDH) 2016. Minnesota Well Index Mapper. Available online: https://apps.health.state.mn.us/cwi/#. Accessed: September 2016.

MN Dept. of Natural Resources (MNDNR). 2011. Minnesota Prairie Conservation Plan (2011). Available online: http://www.dnr.state.mn.us/prairieplan/index.html (Accessed November 2016).

MNDNR. 2016. Minnesota Regions Prone to Surface Karst Feature Development, Series GW-01. Roberta Adams, John Barry, and Jeff Green.

MNDNR. 2016a. Spartan Wildlife Management Area. Available online: http://www.dnr.state.mn.us/wmas/detail_report.html?id=WMA0026100. Accessed September 2016.

MNDNR 2016b. Sween Wildlife Management Area. Available online: http://www.dnr.state.mn.us/wmas/detail_report.html?id=WMA0092000. Accessed September 2016.

MNDNR. 2016c. Natural Heritage Information System Correspondence #ERDB 20160322-0002, July 5, 2016.

MNDNR. 2006. Tomorrow's Habitat for the Wild and Rare: An Action Plan for Minnesota Wildlife, Comprehensive Wildlife Conservation Strategy. Division of Ecological Services, Minnesota Department of Natural Resources.

Minnesota Management and Budget. 2014. Historical Expenditures: General Fun and All Funds: Actual and Estimated Expenditures and Transfers, Updated End of 2014 Legislative Session. June 27, 2014.

Minnesota Management and Budget. 2014. Price of Government: State and Local Government Revenues. End of 2014 Legislative Session.

Minnesota Pollution Control Agency (MPCA). 2017. Minnesota Air Monitoring Sites, 2017. https://www.pca.state.mn.us/air/minnesota-air-monitoring-sites

Minnesota Public Utilities Commission (MNPUC) 2008. In the Matter of Establishment of General Permit Standards for the Siting of Wind Generation Projects Less than 25 Megawatts. Order Establishing General Wind Permit Standards. Docket No. E, G-999/M-07-1102. January 11, 2008. Available online: http://mn.gov/commerce/energyfacilities/documents/19302/PUC%20Order%20Standards%20and%20Setbacks.pdf. Accessed October 2016.

Minnesota Department of Revenue. 2015 Annual Minnesota Sales Tax Statistics For the Leisure and Hospitality Industry (accessed 5/19/17)

Minnesota Department of Revenue. State and Local Tax Collections by Major Tax Category (1957-2021) (accessed 5/19/17)

Minnesota State Interagency Working Group on EMF Issues 2002. *A White Paper on Electric and Magnetic (EMF) Policy and Mitigation Options.* September 2002. Available online: http://www.capx2020.com/Images/EMFWhitePaper2002.pdf. Accessed February 2017.

Montana Department of Fish, Wildlife and Parks (MDFWP). 1994. Montana Bald Eagle Management Plan. July 1994.

National Institute of Environmental Health Sciences, National Institutes of Health (NIEHS) 1999. *Health Effects from Exposure to Power-Line Frequency Electric and Magnetic Fields.* May 4, 1999. Available online: https://www.niehs.nih.gov/health/assets/docs_f_o/report_powerline_electric_mg_predates_508.pdf. Accessed February 2017.

National Land Cover Database (NLCD). 2011. From Homer et al. 2015 Completion of the 2011 National Land Cover Database for the conterminous United States-Representing a decade of land cover change information. *Photogrammetric Engineering and Remote Sensing*, v. 81, no. 5, p. 345-354. Accessed online February 2015 at: http://www.mrlc.gov/nlcd2011.php.

New Century Environmental, LLC (NCE). 2016. Final Acoustic Bat Summary Report: Palmer's Creek Wind Farm, LLC., November 10, 2016

Stantec Consulting Ltd. (Stantec). 2012. Wolfe Island Wind Plant Post-Construction Follow-up Plan. Bird and Bat Resources Monitoring Report No. 6: July-December 2011. File No. 160960494. Prepared for TransAlta Corporation's wholly owned subsidiary, Canadian Renewable Energy Corporation. Prepared by Stantec Consulting Ltd., Guelph, Ontario. July 2012.

U.S. Census Bureau (USCB), 2010a; 2010 Demographic Profile; generated by Alicia Showalter; using American Fact Finder; http://factfinder.census.gov/faces/nav/jsf/pages/community_facts.xhtml; (September 2016).

USCB, 2010b; 2010 -2014 American Community Survey 5-Year Estimates; generated by Alicia Showalter; using American Fact Finder; http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=CF;http://factfinder.census.gov/faces/nav/jsf/pages/community_facts.xhtml (September 2016).

U.S. Department of Agriculture (USDA), Farm Service Agency 2016. *Landowners & Conservationists: Conservation Reserve Enhancement Program.* Available online: http://www.fsa.usda.gov/FSA/webapp?area=home&subject=lown&topic=cep. Accessed October 2016.

U.S. Department of Energy, Western Area Power Administration and U.S. Department of the Interior, U.S. Fish and Wildlife Service (WAPA) 2015. *Upper Great Plans Wind Energy Final Programmatic Environmental Impact Statement*. Billings, MT. April 2015. Available online: https://www.wapa.gov/regions/UGP/Environment/Pages/ugp-nepa.aspx. Accessed September 2016.

U.S. Fish and Wildlife Service (USFWS). 2007. National Bald Eagle Management Guidelines. May 2007.

USFWS. 2013. Eagle Conservation Plan Guidance Module 1- Land-based Wind Energy, Version 2. USFWS Division of Migratory Bird Management. April 2013

USFWS. 2014. (79 FR 63672) Endangered and Threatened Wildlife and Plants; Threatened Species Status for Dakota Skipper and Endangered Species Status for Poweshiek Skipperling.

USFWS. 2017a. Information for Planning and Conservation (IPaC). Web Application. Available online at: https://ecos.fws.gov/ipac/. Accessed May 2017.

USFWS. 2017b. Dakota Skipper Critical Habitat. Available online at: https://www.fws.gov/midwest/Endangered/insects/dask/fCHmaps/daskchMN.pdf. Accessed May 2017.

USFWS. 2017c. Poweshiek Skipperling Critical Habitat. Available online at: https://www.fws.gov/midwest/Endangered/insects/posk/fCHmaps/poskchMN.pdf. Accessed May 2017.

U.S. Geological Survey (USGS). 2014. USGS 2014 Seismic Hazard Map: Two-percent probability of exceedance in 50 years map of peak ground acceleration.

USGS. 2015. Onshore Industrial Wind Turbine Locations for the United States up to March 2014. Online data and metadata. May 2015.

USGS. 2016. Earthquake Statistics: Earthquake Counts by State 2010-2015 (M3+). Accessed online: http://earthquake.usgs.gov/earthquakes/browse/stats.php. February 16, 2017.

Upper Minnesota Valley Regional Development Commission (UMVRDC). 2010 Census Data for Chippewa County, Minnesota.

University of Minnesota (U of MN). 1999. Regional Hydrogeoloic Assessment, RHA-4, Part A. Plate 1 – Surficial Geology. Carrie J. Patterson, Alan R. Knaeble, Sara E. Gran, and Stephanie J. Phippen with support from the Minnesota Department of Natural Resources.

Wenck. 2016. Palmer's Creek Wind Farm, LLC.: Avian Point Count Survey Preliminary Results. November 20, 2016.

Western Area Power Administration (WAPA). 2015a. Upper Great Plains Wind Energy Programmatic Environmental Impact Statement-Final. Vol. 1. USDOE-WAPA and USDOI-USFWS.

WAPA. 2015b. Upper Great Plains Wind Energy Programmatic Environmental Impact Statement-Final. Vol. 2: Appendices A-F. USDOE-WAPA and USDOI-USFWS.

WAPA. 2015c. Programmatic Biological Assessment for the Upper Great Plains Region Wind Energy Program. USDOE-WAPA and USDOI-USFWS.

APPENDIX A - WIND TURBINE CHARACTERISTICS

Palmer's Creek Wind Turbine Characteristics

	GE 2.3	GE 2.5
Turbine Make	General Electric	General Electric
Nameplate Capacity and Model	2.3 MW - 116	2.5 MW - 116
Base Height	77.3 m	87.5 m
Base Width at Bottom	4.56 m	4.56 m
Base Width at Top	3.09 m	3.09 m
Nacelle Length	9.09 m	9.09 m
Blade Length	56.9 m	56.9 m
Blade Width	2.4 m	2.4 m
Rotor Diameter	380 feet (116 meters)	380 feet (116 meters)
Total Height	452 feet (150 meters)	485 feet (146 meters)
Swept Area	113,411 feet (10,568 meters)	113,411 feet (10,568 meters)
Cut-in Wind Speed	6.7 mph (3 m/s)	6.7 mph (3 m/s)
Cut-out Wind Speed	56 mph (25 m/s)	56 mph (25 m/s)
Rated Wind Speed	85 mph (38 m/s)	85 mph (38 m/s)
Rotor Speed	8-15.7 rpm	8-15.7 rpm

APPENDIX B – NOISE ANALYSIS: PROPOSED PALMER’S CREEK WIND FARM

Noise Analysis

Proposed Palmer's Creek Wind Farm

Prepared for:

Palmer’s Creek Wind Farm, LLC

February 3, 2017

Prepared by:

WSB & Associates, Inc.
701 Xenia Avenue South, Suite 300
Minneapolis, MN 55416

Title Page
Table of Contents
Definitions

List of Tables

List of Figures

Definitions

A-Weighting: A-weighting is applied to instrument-measured sound levels in an effort to account for the relative loudness perceived by the human ear

C-Weighting: C-weighting measures uniformly over the frequency range of 30 to 10,000 Hz. This weighting scale is useful for monitoring sources such as engines, and machinery

dBA: A-weighted decibel level

dBC: C-weighted decibel level

L_{10}: Statistical noise level that is exceeded 10% of the time in a defined time frame

L_{50}: Statistical noise level that is exceeded 50% of the time in a defined time frame, or the arithmetic mean of all data in a defined time frame.

L_{eq}: When a noise varies over time, the Leq is the equivalent continuous sound which would contain the same sound energy as the time varying sound

LA_{eq}: A-weighted equivalent continuous sound

LC_{eq}: C-weighted equivalent continuous sound

MW: Megawatt, unit of power equivalent to 1 million watts, commonly used for classifying outputs of wind turbines.

NOAA: National Oceanic and Atmospheric Administration

Pascal (Pa): Unit of air pressure, normal atmosphere is equal to 101,325 Pa

I. Purpose

Palmer's Creek Wind Farm, LLC has proposed the installation of 18 wind turbines for the Palmer's Creek Wind Farm Project just north of Granite Falls, MN. The boundaries of the proposed wind farm are 100th Street SE to the north, 30th Avenue SE to the east, Palmer Creek Road to the south, and Palmer Creek to the west. The area of study can be found in **Figure 1**. This report details the existing conditions found within the proposed project limits and also the modeled results for two configurations of turbines upon the identified receptors.

II. Noise

Any unwanted sound is called noise. Sound is carried through the air in compression waves of measurable frequency and amplitude. Sound can be tonal, predominating at a few frequencies, or it can contain a random mix of a broad range of frequencies and lack any tonal quality. This type of noise is often called white noise.

The human ear is sensitive to only a relatively narrow frequency range of air pressure changes – approximately 20-20,000 cycles per second or Hertz (Hz). Sub-audible frequency sound is often called infrasound. It cannot be heard, but it may be sensed as a vibration. Humans are also sensitive to changes in the amplitude of the air compression waves. Increasing amplitude, or increasing sound pressure, is perceived as increasing volume or loudness. The sound pressure level (SPL) is measured in micro Pascals (μPa). SPLs are typically converted to decibels (dB), which is a log scale, relative to a reference air pressure value of 20 μPa. When measuring sound, A-weighted decibels (dBA) are typically used to normalize readings to equal loudness over the audible range of frequencies at low loudness. **Table 1** shows a range of sound pressure levels and the associated Noise sources.

Table 1 – Decibel Levels of Common Noise Sources

Sound Pressure Level (dBA)	Noise Source
140	Jet Engine (at 25 meters)
130	Jet Aircraft (at 100 meters)
120	Rock and Roll Concert
110	Pneumatic Chipper
100	Jointer/Planer
90	Chainsaw
80	Heavy Truck Traffic
70	Business Office
60	Conversational Speech
50	Library
40	Bedroom
30	Secluded Woods
20	Whisper
Source: "A Guide to Noise Control in Minnesota," MPCA	

Along with the volume of the noise source there are other factors (such as topography of the area) that contribute to the loudness of noise. The distance of a receptor from a sound's source is also an important factor. Sound levels decrease as distance from a source increases. The following rule of thumb regarding sound decreases due to distance is commonly used: beyond approximately 50 feet, each time the distance between a source and a receptor is doubled, sound levels decrease by three decibels over hard ground (such as pavement or water) and by 4.5 decibels over vegetated areas.

A. Noise from Wind Turbines

Mechanical Noise

Mechanical noise from a wind turbine is sound that originates in the generator, gearbox, yaw motors (that intermittently turn the nacelle and blades to face the wind), tower ventilation system, and transformer. Generally, theses sounds are limited in new wind turbines so that they are a negligible fraction of the aerodynamic noise. Mechanical noise from the turbine or gearbox would only be heard above aerodynamic noise when they are not functioning properly.

Aerodynamic Noise

Aerodynamic noise is caused by wind passing over the blade of the wind turbine. As wind passes over a moving blade, the blade interrupts the laminar flow of air, causing turbulence and noise. Unexpectedly high aerodynamic noise can be caused by improper blade angle or improper alignment of the rotor to the wind. This is correctable and is usually adjusted during the turbine break-in period. This is the primary source of noise produced by wind turbines. Wind turbines are generally quiet enough for people to hold a normal conversation while standing at the base of the tower.

Modulation of Aerodynamic Noise

Rhythmic modulation of noise, especially low frequency noise, is also perceptible by the human ear. To a receptor on the ground in front of the wind turbine, the detected blade noise is loudest as the blade is at the bottom of its rotation, and quietest when the blade is at the top of its rotation. For a modern 3-blade turbine, this distance-to-blade effect can cause a pulsing of the blade noise about once per second (1 Hz). The distance-to-blade effect diminishes as receptor distance increases because the relative difference in distance from the receptor to the top or bottom of the blade becomes smaller.

Another source of rhythmic modulation may occur if the wind through the rotor is not uniform. Horizontal layers with different wind speeds or directions can form in the atmosphere. This wind condition is called shear. If the winds at the top and bottom of the blade rotation are different, blade noise will vary between the top and bottom of blade rotation, causing modulation of aerodynamic noise.

Wind Farm Noise

The noise from multiple turbines similarly distant from a residence can be noticeably louder than a lone turbine through the addition of multiple noise sources. Under steady wind conditions, noise from a wind turbine farm may be greater than noise from the nearest turbine due to synchrony between noise from more than one turbine. If the dominant frequencies of different turbines vary by small amounts, an audible dissonance may be heard when wind conditions are stable.

B. Assessment and Regulation

The Minnesota Pollution Control Agency (MPCA) is given power to adopt noise standards in Minnesota Statute 116.07 Subd. 2. The adopted standards are given in Minnesota Administrative Rules Chapter 7030. The MPCA standards require A-weighted noise measurements. Different standards are specified for daytime (7:00 AM – 10:00 PM) and nighttime (10:00 PM – 7:00 AM) hours. The noise standards specify the maximum allowable noise volumes that may not be exceeded for more than 10 percent of any hour (L_{10}) and 50 percent of any hour (L_{50}). Household units, including farm houses, are included in Noise Area Classification (NAC)-1. **Table 2** shows the MPCA State noise standards. All the land within the project area is considered NAC-1.

Table 2 - MPCA State Noise Standards – Hourly A-Weighted Sound Levels

Land Use	NAC: Noise Area Classification	Exterior Hourly Noise Livel Limit, dBA			
		Daytime		Nighttime	
		7:00 am to 10:00 pm		10:00 pm to 7:00 am	
		L10	L50	L10	L50
Residential	NAC-1	65	60	55	50
Commercial	NAC-2	70	65	70	65
Industrial	NAC-3	80	75	80	75
Notes,					
1. NAC-1 includes household units, transient lodging and hotels, educational, religious, cultural entertainment, camping, and picnicking land uses					
2. NAC-2 includes retail and resturants, transportation terminals, professional offices, parks, recreational and amusement land uses					
3. NAC-3 includes industrial, manufacturing, transportation facilities (except terminals), and utilities land uses					
4. From Minnesota Pollution Control Agency, Minn. Rules sec 7030.0040					

Since wind farms generate a relatively constant noise volume, the anticipated noise from wind farms are typically reported in terms of an equivalent sound level (L_{eq}) that has the same energy and A-weighted level as the community noise over a given time interval rather than reporting both L_{10} and L_{50}. When describing relatively constant sound levels, the L_{10} and L_{50} values will be roughly equal. This equivalent sound level is most appropriately compared to the State L_{50} standards. The difference between L_{eq} and L_{50} is mathematically similar to the difference between the mean and the median for a data set. These values will be roughly equal for data sets without extreme values or statistical outliers (such as wind turbine noise).

III. Monitoring Conditions & Methodology

Noise monitoring was conducted at four sites; three within the project area and a fourth that is outside (but nearby) the project area. All four noise monitors were left to collect data for seven days (January 3 to January 10, 2017) at locations that represent the receptors within the project area. The monitoring locations can be found in **Figure 1**. The conditions for the seven days were typical of a Minnesota winter, with temperatures in the single digits and snow on two of the seven days.

Each of the three locations within the project limits (M1-M3) was picked to represent typical distances from receptors to the proposed turbines and were all within public road right-of-way. As required by the LWECS Guidance for Noise Study Protocol and Report, one of the monitoring locations (M1) was located in proximity to the worst-case receptor as predicted by the model (R36). Since the topographical surroundings of the project area are predominately flat, distance from the proposed turbines was the most important factor in collecting the existing conditions. Monitoring location M2 was selected because it represents a total of six receptors in proximity to five proposed turbines on the east edge of the project boundary. Monitoring location M3 was selected because it represents a receptor that may be impacted by at least six proposed turbines. Monitoring location M4 was selected for its similarity to the existing conditions found at the other three monitoring locations, such as near an impacted receptor on a township road.

Each of the monitoring sites was equipped with a Larson Davis 831 Precision Integrating Sound Level Meter that meets compliance with the following American National Standards Institute (ANSI) regulations:

- S1.4-1983 (R2006) Type1
- S1.4A-185 (10Hz-26kHz)
- S1.43-1997 (R2007) Type 1

- S1.11-2004: 1/1 & 1/3 Octave Band Class 0
- S1.25-1991 (R2002)

The microphones attached to the monitoring units were mounted to tripods at a height of at least 3 feet above the ground. Monitoring units were calibrated prior to, and following, the monitoring period. A Vaisala weather station was attached to each of the monitoring locations to record not only wind speed and direction, but also temperature, barometric pressure, humidity, and precipitation. The weather data are included in each of the noise measurements recorded by the Larson Davis 831 units. The average wind speed for the one-hour measurement histories varied between calm conditions and 19 miles per hour with gusts over 30 miles per hour in some cases. Wind direction was typically out of the west or west-southwest. Temperatures remained low and varied from -16°F to 27°F with the coldest conditions in the first three days of collection. There was no rain recorded but the M1 weather station recorded trace amounts of precipitation on January 10. NOAA data reported up to an inch of snow falling in the area between January 9 and January 10.

The instrumentation was set up to collect the following noise values:

- 1/3 Octave Band Data
- A – Weighted Time History (60 second)
- A-Weighted Measurement History (1 hour)
- C-Weighted Time History (60 second, L_{min}, L_{max} and L_{eq} only)
- C-Weighted Measurement History (1 hour, L_{min}, L_{max} and L_{eq} only)

All data from the noise monitors were downloaded and exported to Excel spreadsheets for analysis. Data points were collected every 60 seconds and supplemented with a 60-minute measurement history that is used to represent the monitoring data results.

Graphs were created from the seven days of data for each monitoring location to compare noise levels to wind speed and create a reasonable expectation for background noise while modeling the proposed turbine locations. The following values were used for the graphs based on protocol found in the Minnesota Department of Commerce's LWECS Guidance for Noise Study Protocol and Report:

- LA_{eq}
- LC_{eq}
- L_{10} (A-Weighted)
- L_{50} (A-Weighted)
- L_{90} (A-Weighted)
- Wind Speed

The graphs can be found in **Figures 2, 3, 4,** and **5.**

The 21-amp batteries powering the noise monitors had to be replaced on January 7 due to the extreme cold conditions experienced at each of the sites. During this process, it was found that the off-site monitor (site M4) had stopped recording data for a period of nearly 54 hours. This was due to battery failure caused by the cold conditions. The unit was able to resume recording data after the batteries were exchanged, but then failed again during the afternoon of January 9. The data in **Figure 5** indicates these gaps. Data gaps are not uncommon when monitoring noise for long periods of time. These gaps in data can be caused by natural events that the MPCA requests be removed from data analysis (e.g., wind speeds in excess of 11 mph, rain events) or mechanical failure. Although some data loss was experienced, there was enough data collected on January 3, 4, 7, 8 and 9 to provide an accurate portrayal of ambient noise for this off-site location. Site M1 also experienced a short gap in data near the end of the collection period on the afternoon of January 9 and during the morning of January 10. This was found to be also due to low battery power caused by cold weather over the course of the final three days of data collection. The data collected during between January 3 and January 9 is sufficient to provide an accurate portrayal of the ambient noise in that location.

Figure 2 – Noise Monitoring Results, Site M1

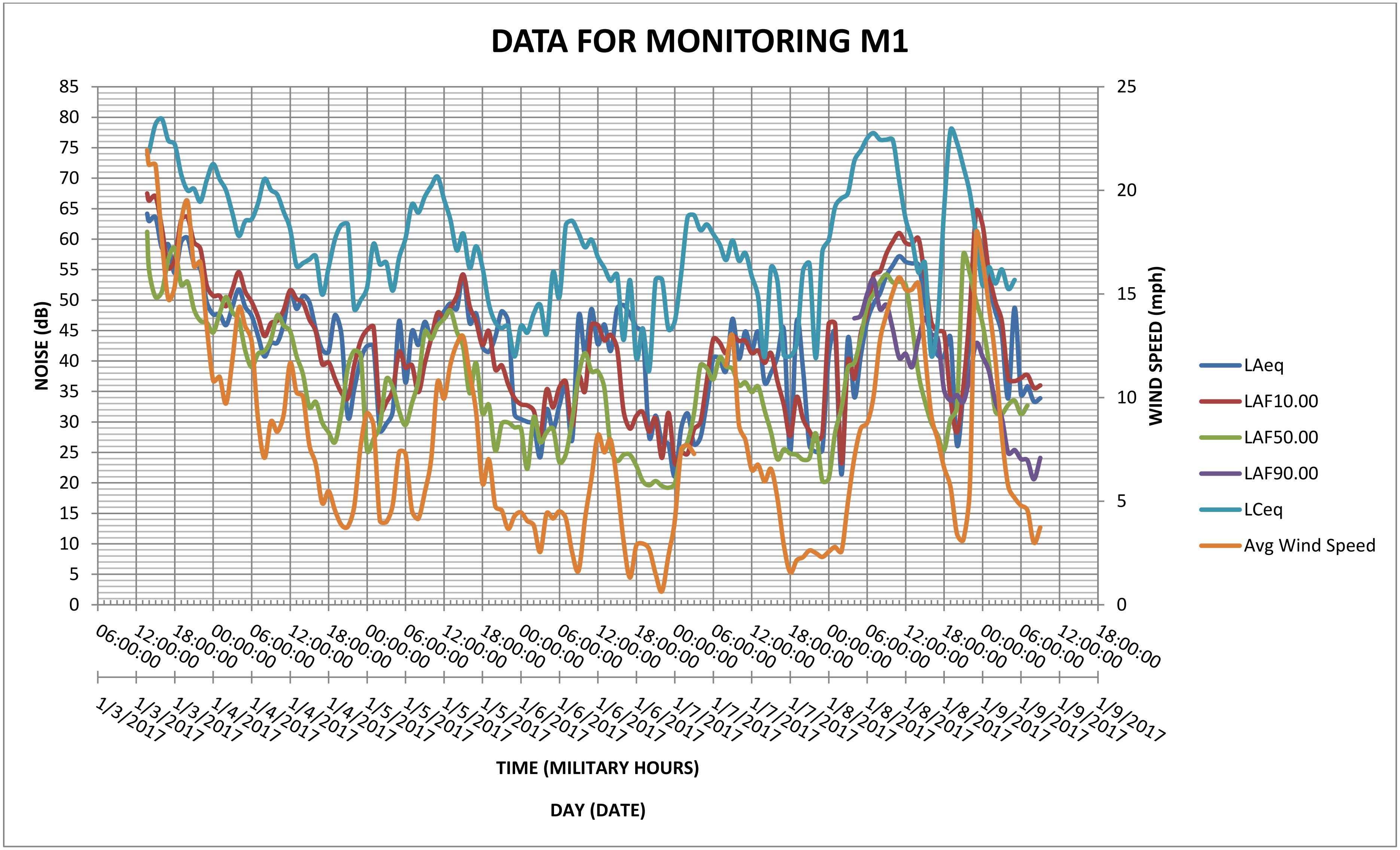


Figure 3 – Noise Monitoring Results, Site M2

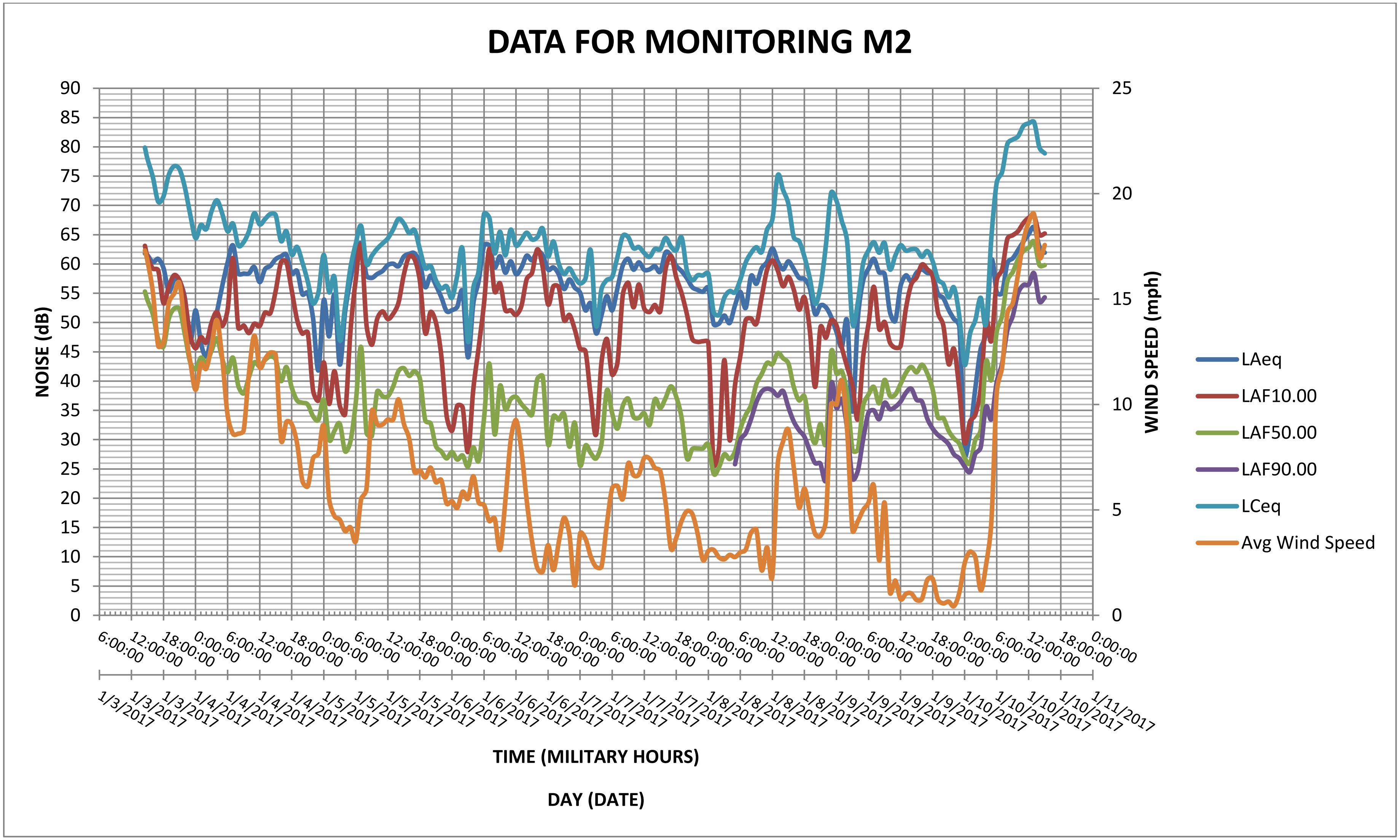


Figure 4 – Noise Monitoring Results, Site M3

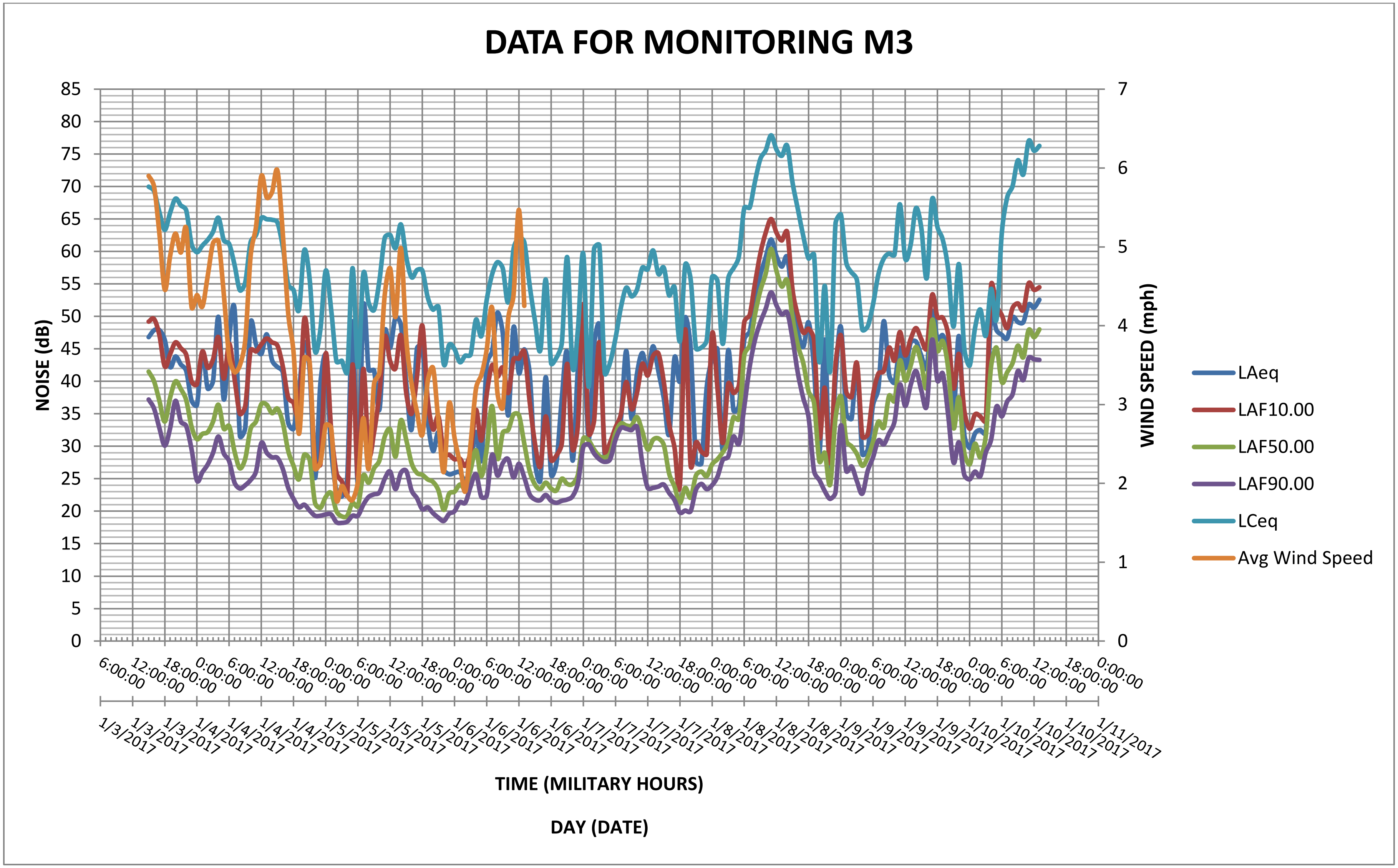
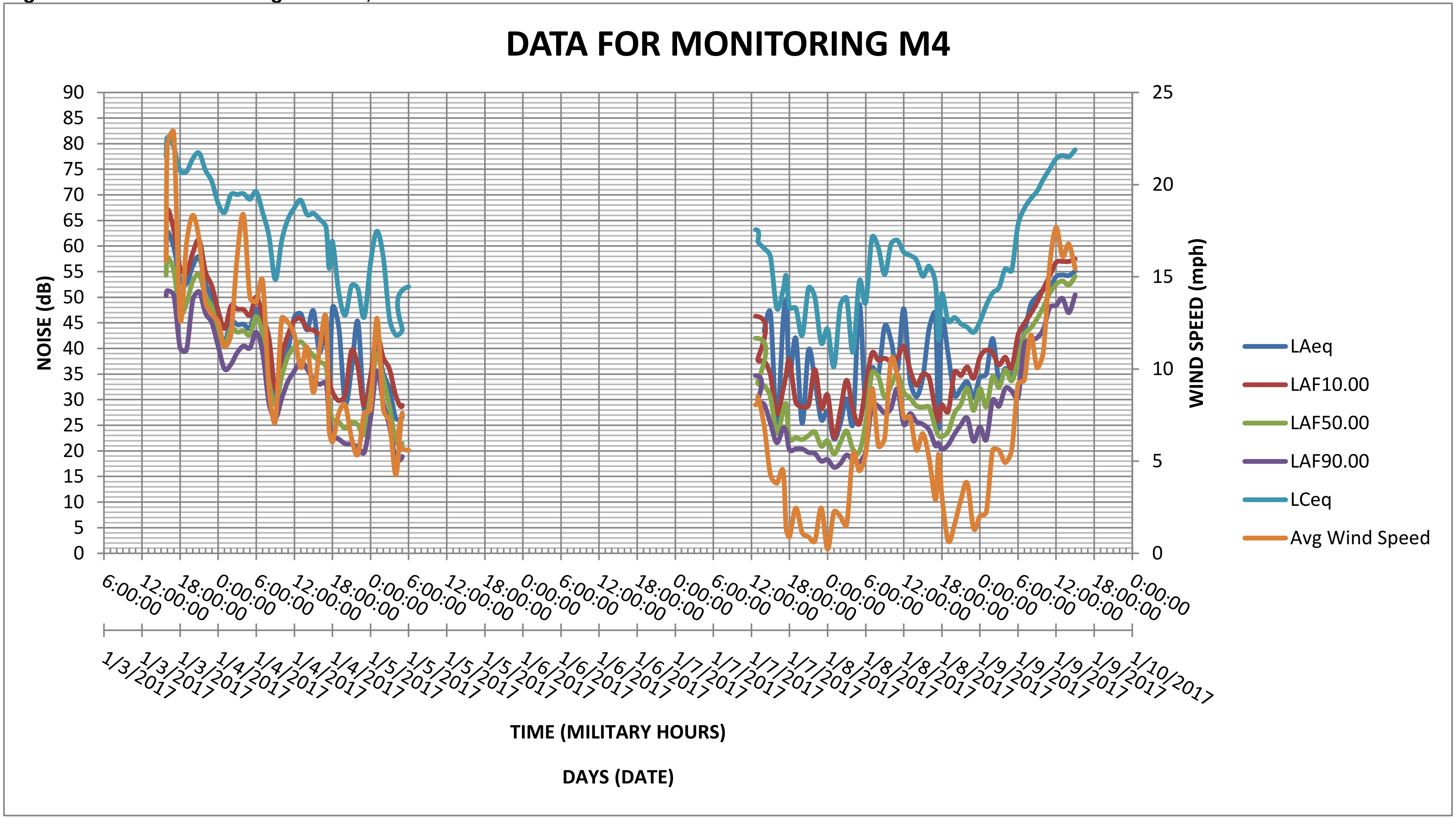


Figure 5 – Noise Monitoring Results, Site M4



IV. Comparison to Minnesota Noise Standards

Figures 6, 7, 8 and **9** show the hourly L_{10} and L_{50} values over the seven days with any measurements indicating wind speeds over 11 miles-per-hour (mph) removed. Wind speeds in excess of 11 mph may distort sound; therefore those measurements are removed at the request of MPCA. With a few exceptions, the existing sound levels at most sites are below Minnesota standards for daytime and nighttime L_{10} and L_{50} values. Site M1 experienced a spike at 3:00 PM on January 3. The Granite Falls area experienced nearly 3.5 inches of snowfall on January 1 and January 2. This spike could be attributed to snowplows operating near the monitoring equipment. Site M3 experienced a spike in noise around noon on January 8. The spike in noise reached the threshold for the daytime L_{10} standard and exceeded the L_{50} standard. This spike could be explained by the proximity of railroad tracks to the site. Nighttime L_{50} standards are also already exceeded at Site M1 during the early morning hours of January 9. The spike could also be attributed to snow removal equipment since Granite Falls experienced 6.5 inches of snowfall between January 9 and January 10. The L_{10} and L_{50} range for each of the monitoring sites is found below in **Table 3**. Existing sound levels that exceed the State Noise Standards are bolded.

Table 3 – Daytime and Nighttime Noise Monitoring Results

Time Period	Location	L_{10} Range (dBA)	L_{50} Range (dBA)
Daytime 7:00 AM to 10:00 PM	M1	27.7 - **67**	20.3 – **61.2**
	M2	39 - 63.1	26.8 - 45.8
	M3	24 - 65	21.3 - **60.4**
	M4	25.9 - 51.7	22.2 - 48.1
Nighttime 10:00 PM to 7:00 AM	M1	23.2 - **57.7**	18.2 - **51.2**
	M2	25.9 - **57.4**	24.2 - 48.4
	M3	22.6 - 54.8	19.2 - 45.2
	M4	22.6 - 42.6	19.4 - 37.5
MN State Standards		L_{10}	L_{50}
Daytime		65	60
Nighttime		55	50

Figure 6 - Noise Monitoring Results, Site M1 L_{10} and L_{50} Values Only

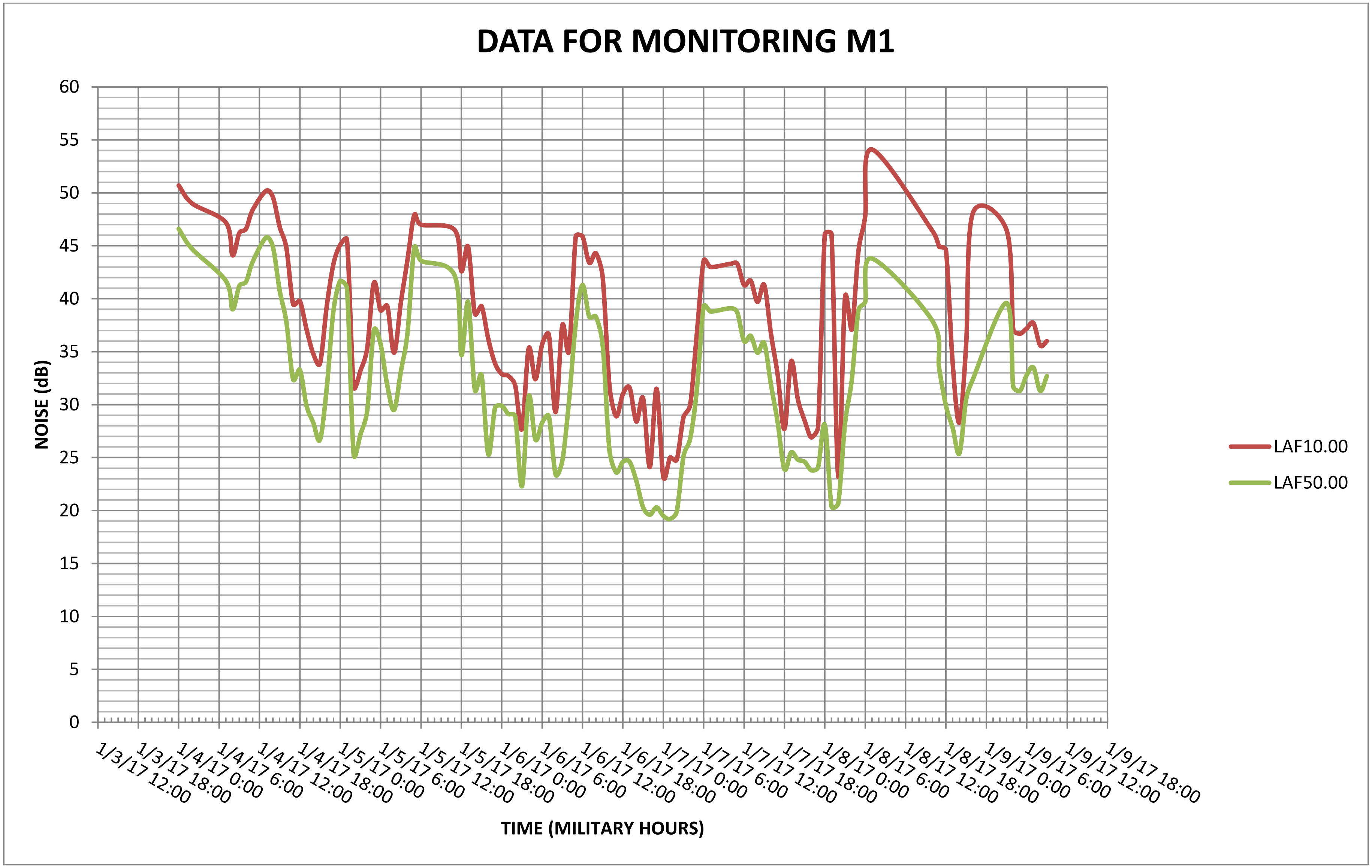


Figure 7 - Noise Monitoring Results, Site M2 L_{10} and L_{50} Values Only

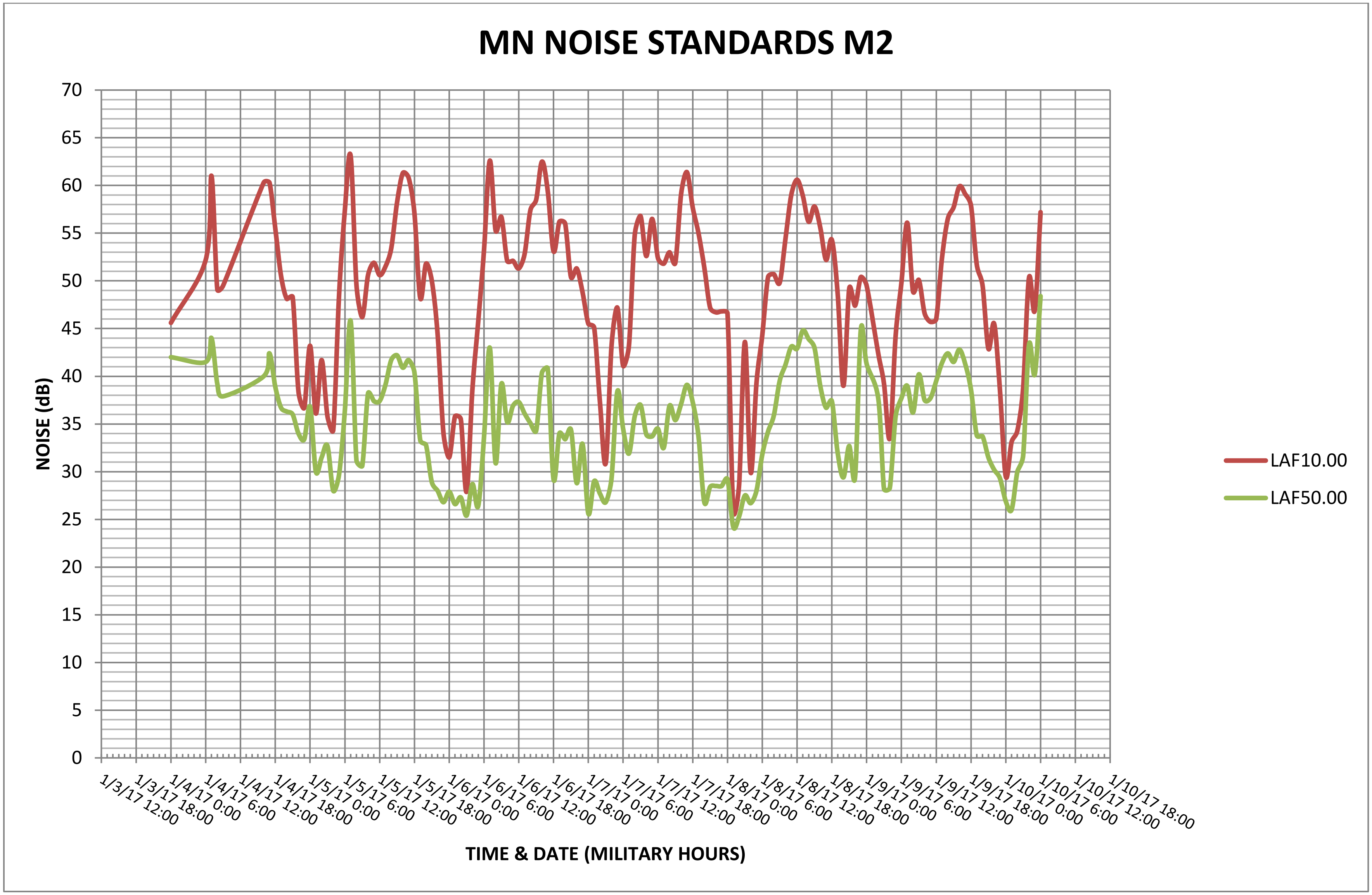


Figure 8 - Noise Monitoring Results, Site M3 L_{10} and L_{50} Values Only

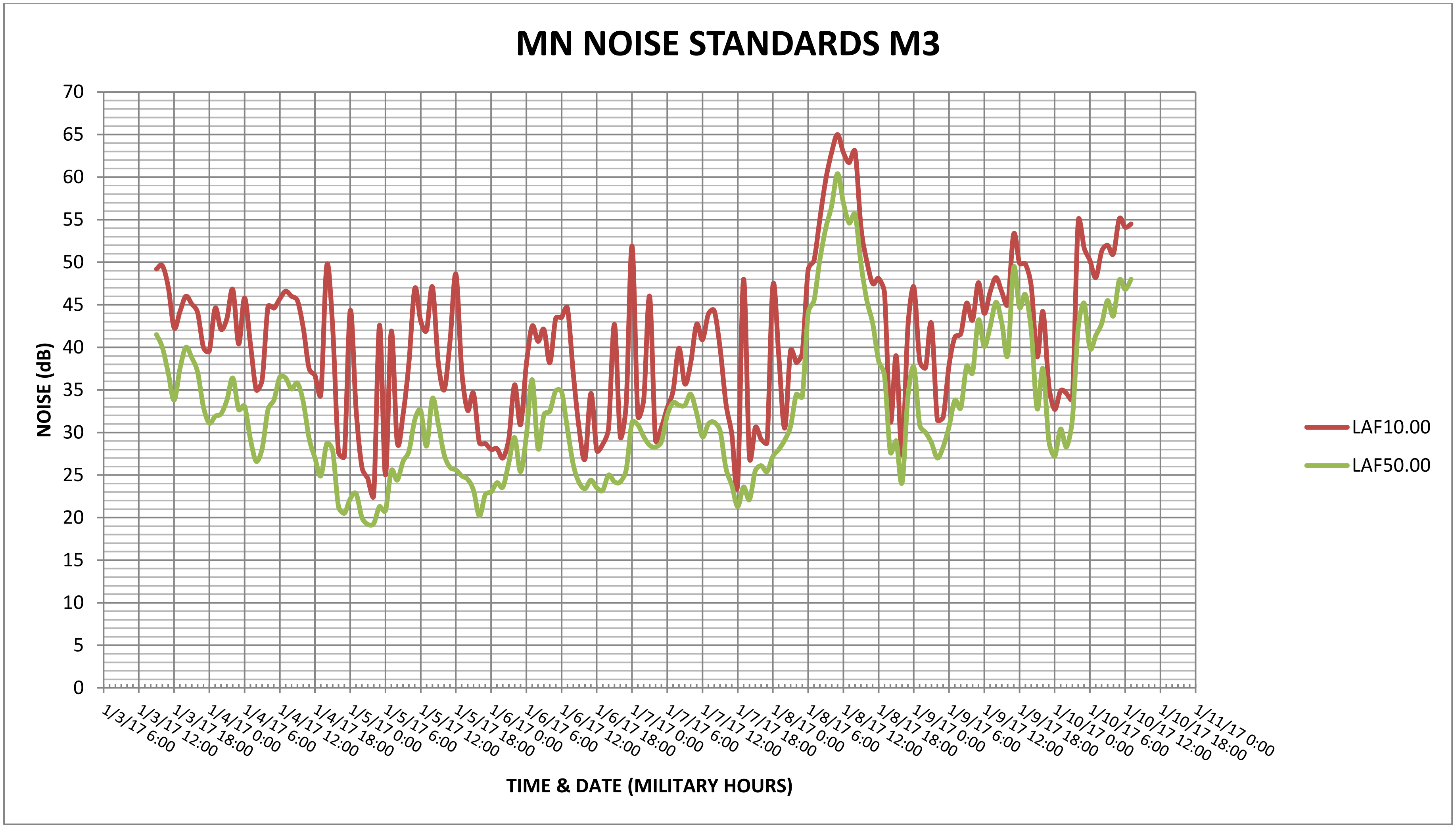
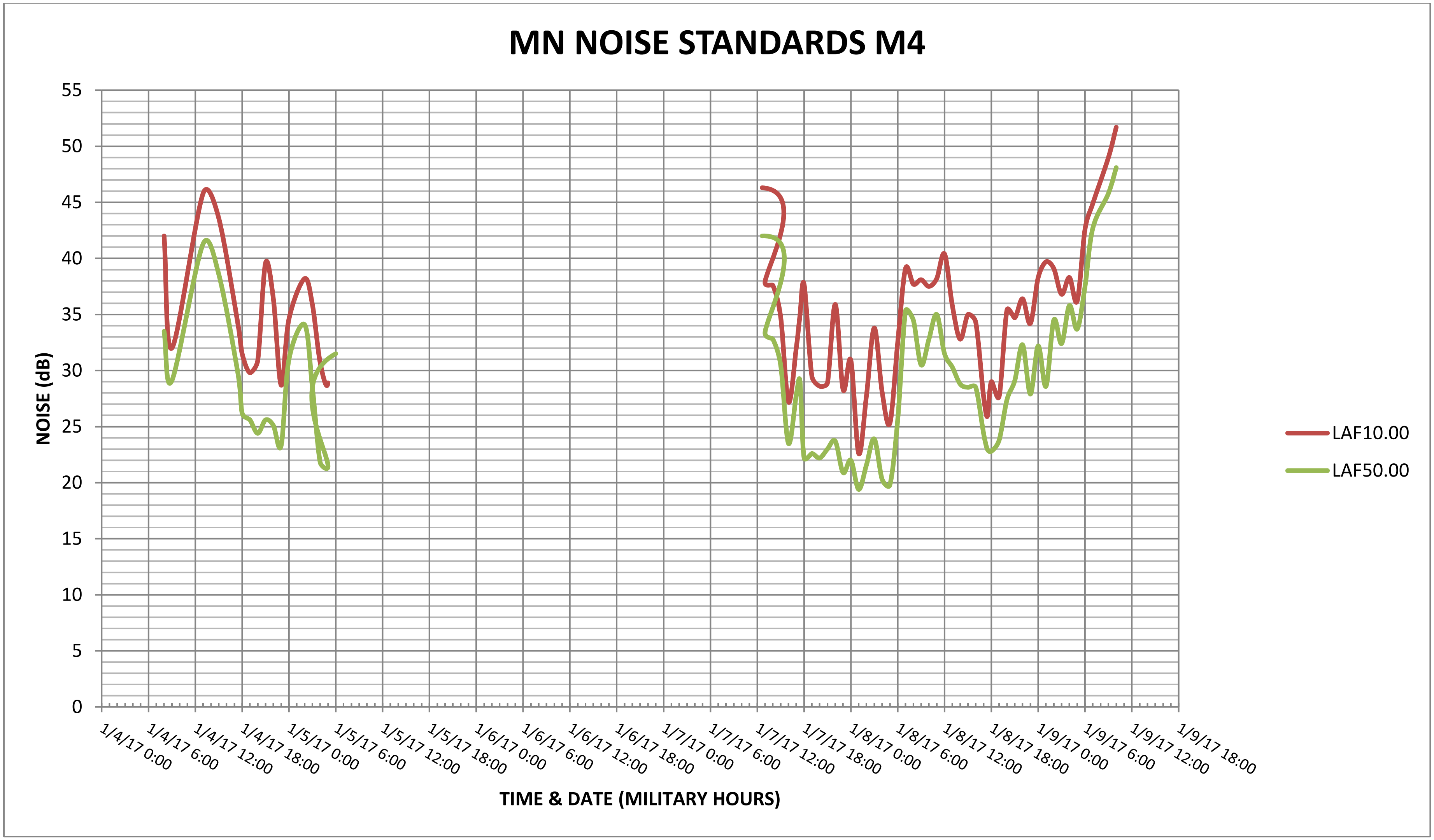


Figure 9 - Noise Monitoring Results, Site M4 L_{10} and L_{50} Values Only



V. Modeling and Results

Along with the noise data collected in the field, a model of the proposed turbines and existing receptors was created to determine the impact of the proposed wind farm. Cadna A software was used for analysis and assumes the attenuation of sound propagation as specified by the International Organization for Standardization (ISO) Standard 9613-2 and a ground attenuation factor of 0.5. Turbine locations were provided by Palmer's Creek Wind Farm, LLC. The turbines modeled were 16 General Electric (GE) 2.5-116 and two GE 2.3-116 that produce 2.5 and 2.3 MW respectively. The models included two scenarios:

1. All 18 turbines with an 80-meter hub-height
2. Two 2.3 MW turbines at an 80-meter hub-height (Turbine 14 and Turbine 15) with the remaining 2.5 MW turbines at a 90-meter hub-height.

The 2.5 MW turbines are projected to generate an apparent maximum sound level of 107 dB per the manufacturer's specifications adjacent to the turbine hub, and the 2.3 MW turbines will generate a maximum 107.5 dB output per the manufacturer's specifications (also adjacent to the turbine hub). All conditions were modeled slightly above these specifications at 109 dB.

For a single 2.3 MW turbine at an 80-meter hub-height, the worst-case noise output would produce the sound contours found in **Figure 10**. The resultant noise produced drops below 50 dBA at distances greater than approximately 160 meters (500 feet). Turbine WTG 08 was found to be the closest to any of the proposed receptors, and is 1,076 feet away from Receptor R36.

Figures 11 and **12** represent the sound contours predicted by the construction of the 18 turbines in the two scenarios. These contours only represent the turbine-generated sound and do not include any cumulative noise from existing background sources. The existing background noise is not known for each specific receptor. Due to this unknown, values of 35, 40, 45, 50, 55 and 60 dBA were used to depict varying degrees of existing noise. This is consistent with the results of the noise monitoring data in the previous section of the report, which showed the existing noise levels at monitoring locations within the project area to range between 45.2 and 60.4 dBA. The resultant noise from the turbines on each receptor was added to the six projected background noise levels, and the summaries of Scenario 1 and 2 can be found in **Tables 4** and **5**.

With background noise levels of 45 dBA and above, the largest increase is predicted to be 2.8 decibels at R36 (Scenario 2) which is considered to be barely perceptible to the human ear.

Table 4 – Noise Modeling Results (Scenario 1)

Receptor ID	Turbine Impact (dBA) (Calculated)	Background Sound Levels + Turbine Impact (dBA)					
		35.0	40.0	45.0	50.0	55.0	60.0
R01	30.9	36.4	40.5	45.2	50.1	55.0	60.0
R02	31.4	36.6	40.6	45.2	50.1	55.0	60.0
R03	32.9	37.1	40.8	45.3	50.1	55.0	60.0
R04	34.4	37.7	41.1	45.4	50.1	55.0	60.0
R05	36.6	38.9	41.6	45.6	50.2	55.1	60.0
R06	38	39.8	42.1	45.8	50.3	55.1	60.0
R07	38.7	40.2	42.4	45.9	50.3	55.1	60.0
R08	38.5	40.1	42.3	45.9	50.3	55.1	60.0
R09	39.8	41.0	42.9	46.1	50.4	55.1	60.0
R10	29.6	36.1	40.4	45.1	50.0	55.0	60.0

Receptor ID	Turbine Impact (dBA) (Calculated)	Background Sound Levels + Turbine Impact (dBA)					
		35.0	40.0	45.0	50.0	55.0	60.0
R11	37.3	39.3	41.9	45.7	50.2	55.1	60.0
R12	34.8	37.9	41.1	45.4	50.1	55.0	60.0
R13	34.8	37.9	41.1	45.4	50.1	55.0	60.0
R14	32.5	36.9	40.7	45.2	50.1	55.0	60.0
R15	33.2	37.2	40.8	45.3	50.1	55.0	60.0
R16	29.9	36.2	40.4	45.1	50.0	55.0	60.0
R17	28.4	35.9	40.3	45.1	50.0	55.0	60.0
R18	27.9	35.8	40.3	45.1	50.0	55.0	60.0
R19	28.6	35.9	40.3	45.1	50.0	55.0	60.0
R20	32.2	36.8	40.7	45.2	50.1	55.0	60.0
R21	32.9	37.1	40.8	45.3	50.1	55.0	60.0
R22	36.6	38.9	41.6	45.6	50.2	55.1	60.0
R23	32.5	36.9	40.7	45.2	50.1	55.0	60.0
R24	40.4	41.5	43.2	46.3	50.5	55.1	60.0
SWENSEN MUSEUM	35.8	38.4	41.4	45.5	50.2	55.1	60.0
R25	38.5	40.1	42.3	45.9	50.3	55.1	60.0
R26	38.8	40.3	42.5	45.9	50.3	55.1	60.0
R27	35.2	38.1	41.2	45.4	50.1	55.0	60.0
R28	30.1	36.2	40.4	45.1	50.0	55.0	60.0
R29	36.8	39.0	41.7	45.6	50.2	55.1	60.0
R30	32.5	36.9	40.7	45.2	50.1	55.0	60.0
R31	41.9	42.7	44.1	46.7	50.6	55.2	60.1
R32	42.4	43.1	44.4	46.9	50.7	55.2	60.1
R33	36.6	38.9	41.6	45.6	50.2	55.1	60.0
R34	37.4	39.4	41.9	45.7	50.2	55.1	60.0
R35	37.7	39.6	42.0	45.7	50.2	55.1	60.0
R36	42.5	43.2	44.4	46.9	50.7	55.2	60.1
R37	39.8	41.0	42.9	46.1	50.4	55.1	60.0
R38	37.1	39.2	41.8	45.7	50.2	55.1	60.0
R39	41	42.0	43.5	46.5	50.5	55.2	60.1
R40	38.7	40.2	42.4	45.9	50.3	55.1	60.0
R41	39.1	40.5	42.6	46.0	50.3	55.1	60.0
R42	41.5	42.4	43.8	46.6	50.6	55.2	60.1
R43	39.1	40.5	42.6	46.0	50.3	55.1	60.0
R44	39	40.5	42.5	46.0	50.3	55.1	60.0
R45	35.8	38.4	41.4	45.5	50.2	55.1	60.0
R46	34.9	38.0	41.2	45.4	50.1	55.0	60.0
R47	32.2	36.8	40.7	45.2	50.1	55.0	60.0

Guide to Reading **Tables 4** and **5**:

At receptor 11, we can predict that the sound impact from the proposed turbines will be 37.3 dBA. However, the existing sound levels at this specific location can only be estimated based on the sound monitoring results presented earlier. If the existing sound level is 45 dBA, the resulting cumulative sound level (background noise + turbine noise) at receptor 11 will be 45.7 dBA, an imperceptible increase.

Receptor ID	Turbine Impact (dBA) (Calculated)	Background Sound Levels + Turbine Impact (dBA)					
		35.0	40.0	45.0	50.0	55.0	60.0
SUBSTATION	32.1	36.8	40.7	45.2	50.1	55.0	60.0

Table 5– Noise Modeling Results (Scenario 2)

Receptor ID	Turbine Impact (Calculated)	Background Sound Levels + Turbine Impact (dBA)					
		35.0	40.0	45.0	50.0	55.0	60.0
R01	32.5	36.9	40.7	45.2	50.1	55.0	60.0
R02	33	37.1	40.8	45.3	50.1	55.0	60.0
R03	34.5	37.8	41.1	45.4	50.1	55.0	60.0
R04	36	38.5	41.5	45.5	50.2	55.1	60.0
R05	38.2	39.9	42.2	45.8	50.3	55.1	60.0
R06	39.6	40.9	42.8	46.1	50.4	55.1	60.0
R07	40.3	41.4	43.2	46.3	50.4	55.1	60.0
R08	40.2	41.3	43.1	46.2	50.4	55.1	60.0
R09	41.5	42.4	43.8	46.6	50.6	55.2	60.1
R10	31.5	36.6	40.6	45.2	50.1	55.0	60.0
R11	39.3	40.7	42.7	46.0	50.4	55.1	60.0
R12	36.8	39.0	41.7	45.6	50.2	55.1	60.0
R13	36.7	38.9	41.7	45.6	50.2	55.1	60.0
R14	34.4	37.7	41.1	45.4	50.1	55.0	60.0
R15	35.2	38.1	41.2	45.4	50.1	55.0	60.0
R16	31.9	36.7	40.6	45.2	50.1	55.0	60.0
R17	30.3	36.3	40.4	45.1	50.0	55.0	60.0
R18	29.9	36.2	40.4	45.1	50.0	55.0	60.0
R19	30.6	36.3	40.5	45.2	50.0	55.0	60.0
R20	34.2	37.6	41.0	45.3	50.1	55.0	60.0
R21	34.9	38.0	41.2	45.4	50.1	55.0	60.0
R22	38.6	40.2	42.4	45.9	50.3	55.1	60.0
R23	34.4	37.7	41.1	45.4	50.1	55.0	60.0
R24	42.4	43.1	44.4	46.9	50.7	55.2	60.1
SWENSEN MUSEUM	37.7	39.6	42.0	45.7	50.2	55.1	60.0
R25	40.5	41.6	43.3	46.3	50.5	55.2	60.0
R26	40.8	41.8	43.4	46.4	50.5	55.2	60.1
R27	37.2	39.2	41.8	45.7	50.2	55.1	60.0
R28	32.1	36.8	40.7	45.2	50.1	55.0	60.0
R29	38.8	40.3	42.5	45.9	50.3	55.1	60.0
R30	34.5	37.8	41.1	45.4	50.1	55.0	60.0
R31	43.9	44.4	45.4	47.5	51.0	55.3	60.1

Receptor ID	Turbine Impact (Calculated)	Background Sound Levels + Turbine Impact (dBA)					
		35.0	40.0	45.0	50.0	55.0	60.0
R32	44.3	44.8	45.7	47.7	51.0	55.4	60.1
R33	38.6	40.2	42.4	45.9	50.3	55.1	60.0
R34	39.4	40.7	42.7	46.1	50.4	55.1	60.0
R35	39.7	41.0	42.9	46.1	50.4	55.1	60.0
R36	44.5	45.0	45.8	47.8	51.1	55.4	60.1
R37	41.8	42.6	44.0	46.7	50.6	55.2	60.1
R38	39	40.5	42.5	46.0	50.3	55.1	60.0
R39	43	43.6	44.8	47.1	50.8	55.3	60.1
R40	40.7	41.7	43.4	46.4	50.5	55.2	60.1
R41	41	42.0	43.5	46.5	50.5	55.2	60.1
R42	43.4	44.0	45.0	47.3	50.9	55.3	60.1
R43	41.1	42.1	43.6	46.5	50.5	55.2	60.1
R44	40.9	41.9	43.5	46.4	50.5	55.2	60.1
R45	37.8	39.6	42.0	45.8	50.3	55.1	60.0
R46	36.8	39.0	41.7	45.6	50.2	55.1	60.0
R47	33.9	37.5	41.0	45.3	50.1	55.0	60.0
SUBSTATION	33.9	37.5	41.0	45.3	50.1	55.0	60.0

VI. Conclusion

WSB collected noise and meteorological data at four different sites representing the proposed Palmer's Creek Wind Farm. For monitoring locations within the proposed project area, the current L_{50} sound levels range from 45.1 dBA to 60.4 dBA for both daytime and nighttime. The existing sound levels met or exceeded State daytime noise standards at monitoring location 3, and met or exceeded nighttime noise standards at monitoring locations 1 and 2.

Two turbine layout scenarios were modeled to determine the sound-related impact of the proposed wind farm. **Tables 6** and **7** provide a summary of the sound impacts predicted under both turbine layout scenarios. The highest predicted change in sound level above 45 dBA is 2.8 dBA. Changes in sound levels less than 3 dBA are barely perceptible to the human ear (Bolt, Beranek and Newman, Inc., 1973).

Table 6: Summary of Scenario 1 Sound Impacts

Background Sound (dBA)	Highest Cumulative Sound (dBA)	Change in Sound Level (dBA)
45	46.9	1.9
50	50.7	0.7
55	55.2	0.2
60	60.1	0.1

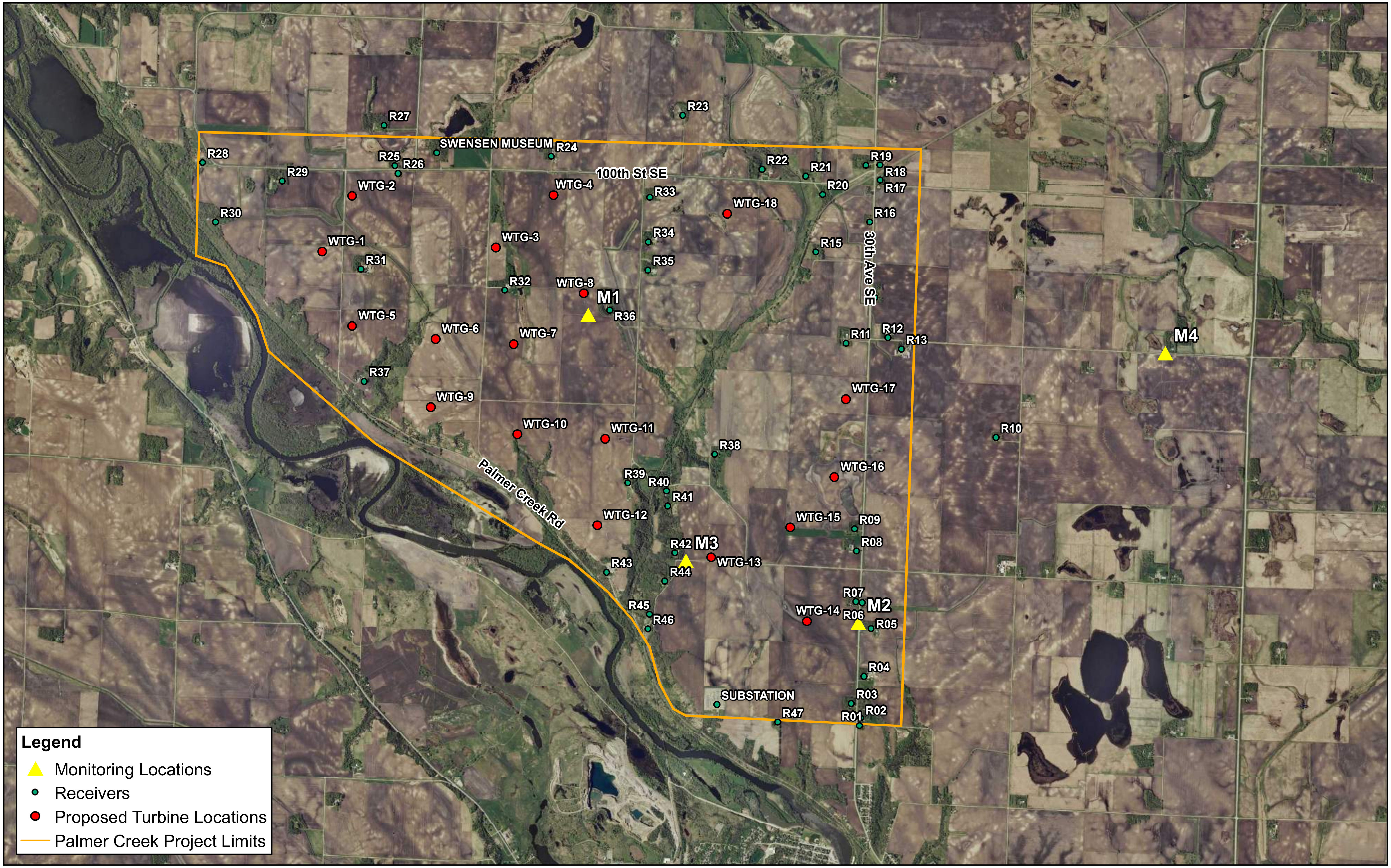
Table 7: Summary of Scenario 2 Sound Impacts

Background Sound (dBA)	Highest Cumulative Sound (dBA)	Change in Sound Level (dBA)
45	47.8	2.8
50	51.1	1.1
55	55.4	0.4
60	60.1	0.1

In Minnesota, the MPCA State Noise Standards (L_{50}) restrict noise levels to 60 dBA during the daytime and 50 dBA during the nighttime. The analysis indicates that construction of the Palmer's Creek Wind Farm project will not have an impact of 60 dBA or greater on any modeled receptor, nor will the cumulative impact on any receptor exceed 60 dBA when assuming a 35 dBA, 40 dBA, 45 dBA, 50 dBA, or 55 dBA background sound level. During the daytime, and only with a background sound level already approaching or exceeding the 60 dBA threshold would the cumulative sound level (background and wind turbine sound) exceed 60 dBA. The same is true for the nighttime threshold; only with a background sound level already approaching or exceeding the 50 dBA threshold would the cumulative sound level exceed 50 dBA.

VII. References

Bolt, Beranek and Newman, Inc., Fundamentals and Abatement of Highway Traffic Noise, Report No. PB-222-703. Prepared for Federal Highway Administration, June 1973.



Document Path: K:\02196-020\GIS\Maps\Figure1.mxd Date Saved: 1/25/2017 8:45:41 AM

Figure 1 - Project Limits & Monitoring Locations

Palmer's Creek Wind Farm

Fagen Engineering

N

0 3,600 Feet

1 inch = 3,600 feet

WSB

Document Path: K:\02196-020\GIS\Maps\Figure10.mxd Date Saved: 1/24/2017 10:29:47 AM

Figure 10 - Closest Reciever to Turbine Impact

Palmer's Creek Wind Farm

Fagen Engineering

N

0 650 Feet

1 inch = 650 feet

WSB

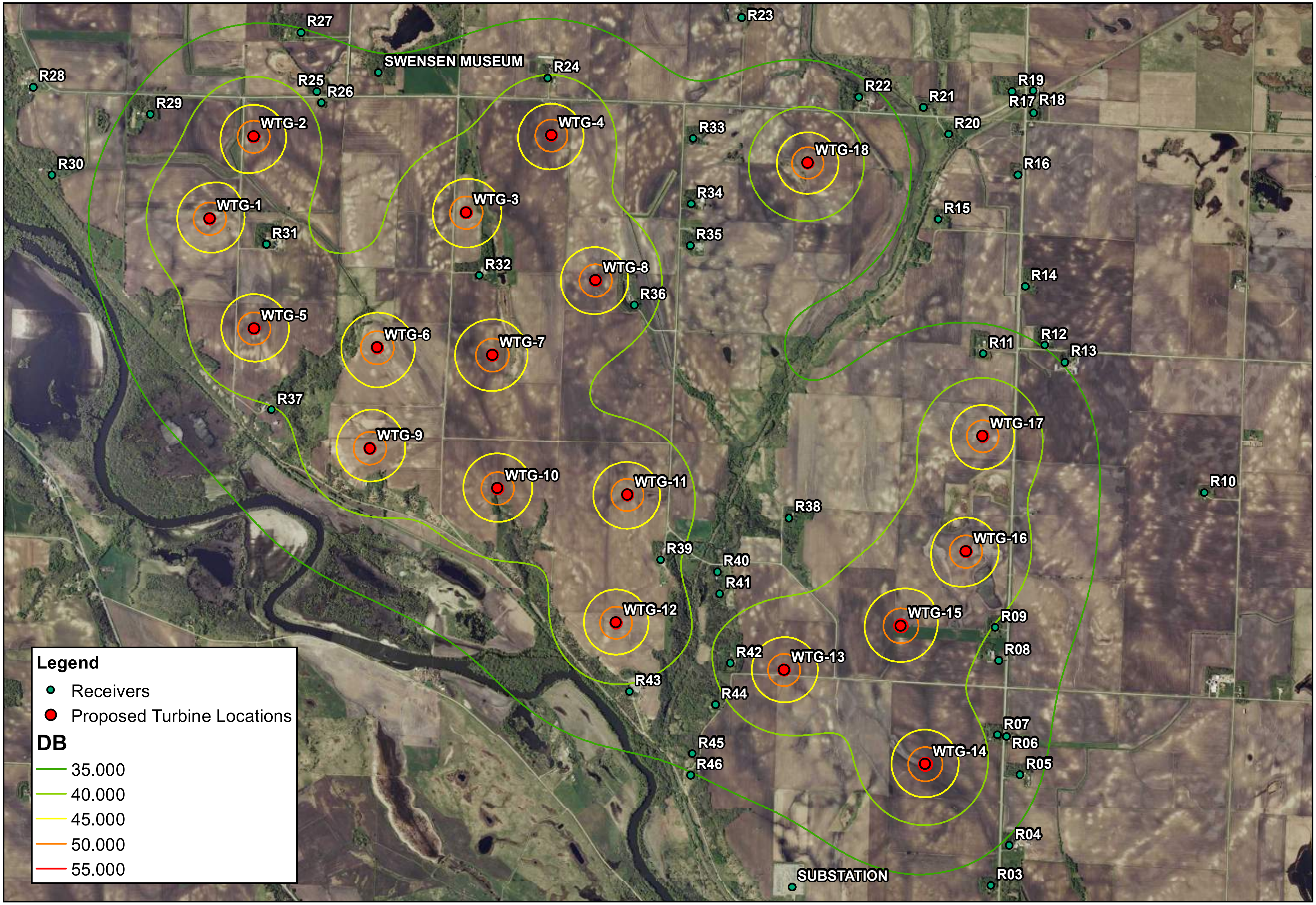


Figure 11 - Turbine Scenario 1,
All Turbines at 80m Hub Height
Palmer's Creek Wind Farm
Fagen Engineering

N

0 3,000 Feet
1 inch = 3,000 feet

WSB

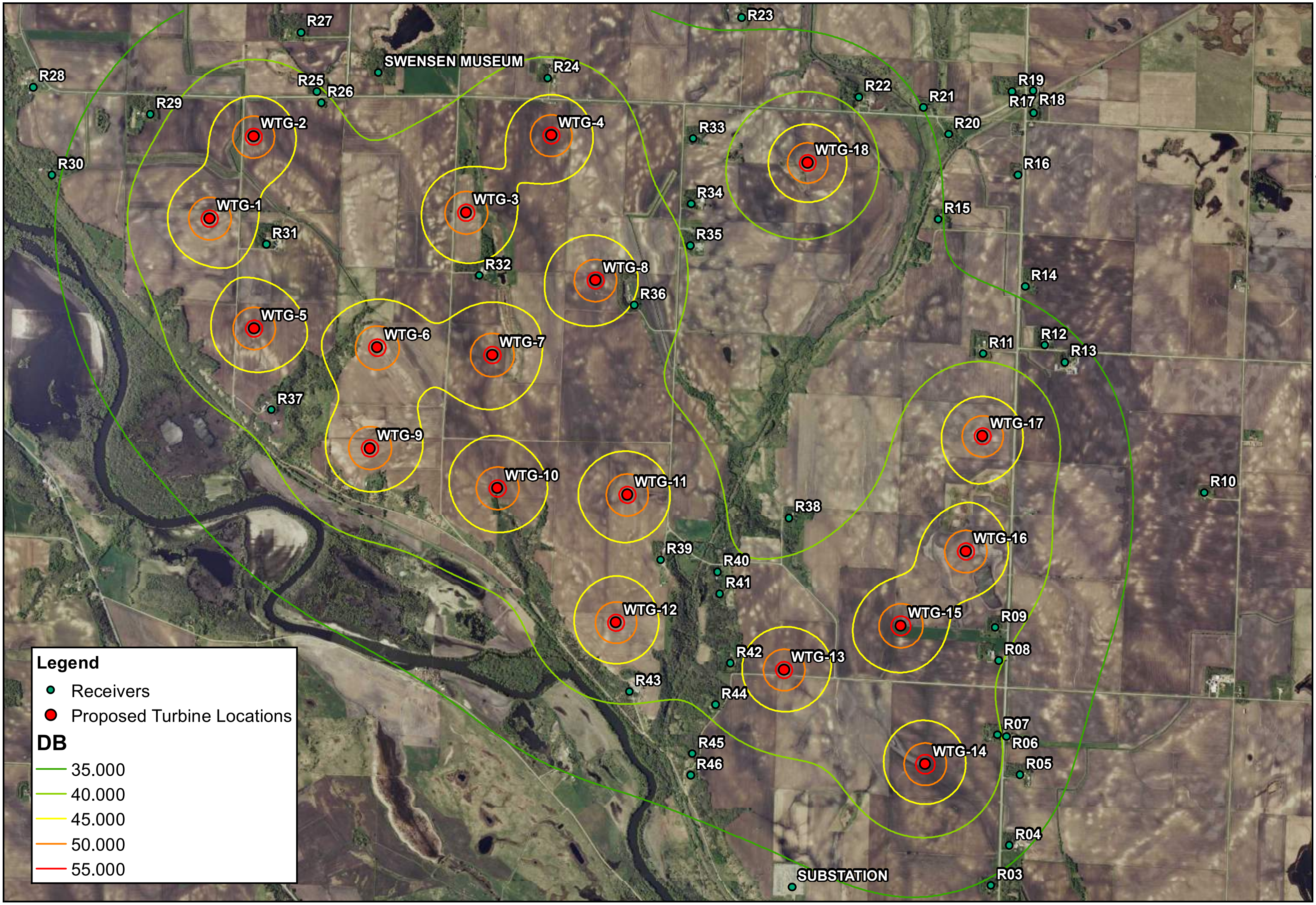


Figure 12 - Turbine Scenario 2

2.3 WM Turbines at 80m Hub Height, 2.5 MW Turbines at 90m Hub Height

Palmer's Creek Wind Farm

Fagen Engineering

N

0 3,000 Feet

1 inch = 3,000 feet

WSB

APPENDIX C – WILDLIFE ASSESSMENT AND FIELD STUDIES REPORT

Wenck File #B2759-0005-02
July 24, 2017

Wildlife Monitoring Report
Palmer's Creek Wind Farm

Palmer's Creek Wind Farm, LLC.

Prepared for:

501 West Highway 212
Granite Falls, MN 56241

Prepared by:

WENCK Associates, Inc.
301 1st Street NE, Suite 202
Mandan, ND 58554
Phone: 701-751-3370
Fax: 701-751-3372

Responsive partner.
Exceptional outcomes.

Table of Contents

IN-TEXT TABLES AND FIGURES

APPENDICES

1.0 Introduction

1.1 PROJECT OVERVIEW

Palmer's Creek Wind Farm, LLC (Palmer's Creek) proposes to construct the Palmer's Creek Wind Energy Facility (Project or PCWF), a Large Wind Energy Conversion System (LWECS), with a 44.6-megawatt (MW) nameplate capacity in Chippewa County, Minnesota (**Figure 1**). Wenck Associates, Inc. (Wenck) and New Century Environmental (NCE) were contracted by Palmer's Creek to conduct and analyze a variety of pre-construction wildlife surveys prior to building and operation of the proposed facility.

The data from these studies were used to identify species, species groups or species of concern that are present in the project area and vicinity that may be at a higher risk of mortality and/or displacement. Data is presented in several categories, and highlight federally listed species and state listed species. This is a final report that contains data collected from June 29, 2016 to June 16, 2017.

1.2 DIURNAL FIXED-POINT AND INCIDENTAL AVIAN USE SURVEYS

Spring and fall are migration periods for non-resident avian species. During the spring, birds move north from wintering grounds to summer breeding grounds. In the fall, birds move south to wintering grounds. Spring and fall are prime periods to conduct avian surveys on potential wind farm areas to observe migratory species and resident species.

Avian surveys focus on inventory and monitoring with specific objectives that include: 1) an inventory of bird species in a specific project area; 2) determining the relative abundance of species; and 3) monitoring seasonal changes in species composition and relative abundance (Whitworth et al. 2007). Diurnal fixed-point surveys are one of the most common methods used to determine avian composition and abundance. Point counts not only focus on visual cues but also on auditory cues to give the observer an advantage in rough terrain. For some species, vocal cues may be the only reliable means of detection (Whitworth et al. 2007).

Incidental avian surveys are used to obtain bird distribution and composition information between point count locations. Larger birds, such as game birds, raptors, and waterfowl, large flocks of smaller birds, and birds that are a rarity in the area are typically recorded during incidental surveys.

1.3 EAGLE USE SURVEYS

Following Stage 2 of the Eagle Conservation Plan Guidance (USFWS 2013), eagle point count surveys have been conducted to collect quantitative data on eagle presence that would allow estimation of eagle exposure rate, which forms the basis of a risk assessment model. Eagle use surveys focus exclusively on eagles and occur at the eight (8) point count locations (**Figure 2**) used for point count surveys in 2016-2017. The objective of the eagle use survey is to document eagle movements and behavior within and adjacent to the study area in all four seasons to assess risk to eagles (primarily bald eagles). Eagle surveys were conducted by a qualified biologist and were conducted for one calendar year to capture temporal variation in eagle use of the study area.

1.4 RAPTOR AND EAGLE NEST SURVEYS

Raptors and eagles spend much of their time hunting and soaring within elevation ranges that correspond to the wind turbine rotor-sweep area (RSA), making them susceptible to turbine blades (Erickson et al. 2002). Because raptors and eagles are long-lived species with low reproduction rates, potential impacts from collision-related mortality are of concern (Erickson et al. 2002). Although specific studies are lacking, adults and recently fledged young could be at particular risk of collision with turbines because of their higher use of areas near nest sites. After young raptors and eagles fledge, fledglings often spend significant amounts of time flying and roosting near nest locations until they become capable flyers and hunters. Additionally, construction activities near active nests during the breeding season may potentially result in disturbance or abandonment of nest sites.

In 2007, the bald eagle was delisted from its federally threatened status in the lower 48 states, but it is still federally protected under the Bald and Golden Eagle Protection Act ("BGEPA"). It was also delisted in Minnesota in 2013.

Bald eagles associate with distinct geographic areas and landscape features, including nest sites, foraging areas, communal roost sites, migration corridors and migration stopover sites (USFWS 2013). They are typically found near water bodies, natural and manmade, due to the presence of fish. They prefer to nest, perch, and roost in old-growth or mature stands of trees, and they usually select a nesting tree that is the tallest among those in its vicinity to provide visibility. Nesting trees are usually situated near a water body that supports fish, their main preferred prey.

1.5 ACOUSTIC BAT SURVEYS

There are seven bat species known to occur in Minnesota – big brown bat (*Eptesicus fuscus*), silver-haired bat (*Lasionycteris noctivagans*), eastern red bat (*Lasiurus borealis*), hoary bat (*Lasiurus cinereus*), little brown bat (*Myotis lucifugus*), northern long-eared bat (*Myotis septentrionalis*) and tri-colored bat (eastern pipistrelle, *Perimyotis subflavus*) (MNDNR 2016). The northern long-eared bat (*Myotis septentrionalis*), tricolored bat (*Perimyotis subflavus*), big brown bat (*Eptesicus fuscus*), and little brown bat (*Myotis lucifugus*) are all state-listed species of special concern.

NCE initiated acoustic monitoring surveys to capture the diversity/abundance of bat species within the proposed Palmer's Creek Wind Farm (project area) and to meet due diligence with regulatory agencies (NCE 2017).

2.0 Methodology

2.1 DIURNAL FIXED-POINT AND INCIDENTAL AVIAN USE SURVEYS

2.1.1 Fixed-point Surveys

Avian point count (PC) surveys were conducted in summer 2016 through summer 2017 to capture migrating and resident species at the project site (**Table 1**). Survey data was used to evaluate avian use, behavior, and species composition during migration and determine resident avian species. Diurnal fixed-point count surveys were conducted at eight (8) circular plots (**Figure 2**). Point count locations were selected to capture a diverse range of habitats and locations with the best possible view shed.

Table 1: Palmer's Creek Point Count Dates

Summer 2016		Fall 2016		Winter 2016-2017		Spring 2017		Summer 2017	
Survey Number	*Survey Date*	*Survey Number*	*Survey Date*	*Survey Number*	*Survey Date*	*Survey Number*	*Survey Date*	*Survey Number*	*Survey Date*
1	6/29/2016	6	9/8/2016	18	12/15/2016	24	3/1/2017	34	5/18/2017
2	7/13/2016	7	9/23/2016	19	12/28/2016	25	3/8/2017	35	6/1/2017
3	7/28/2016	8	9/29/2016	20	1/10/2017	26	3/17/2017	36	6/16/2017
4	8/8/2016	9	10/7/2016	21	1/26/2017	27	3/22/2017		
5	8/23/2016	10	10/13/2016	22	2/9/2017	28	3/29/2017		
		11	10/18/2016	23	2/24/2017	29	4/4/2017		
		12	10/26/2016			30	4/14/2017		
		13	10/31/2016			31	4/18/2017		
		14	11/9/2016			32	4/25/2017		
		15	11/16/2016			33	5/2/2017		
		16	11/23/2016						
		17	11/30/2016						

All observations within an 800-meter radius at each point count were recorded; any observations outside the 800-meter radius were considered incidental. Each PC survey lasted for 20 minutes; all audio and visual observations were recorded. Surveys were conducted by an experience ornithologist. Surveys were rotated to cover all daylight hours to ensure each PC was surveyed at various times of the day. Data recorded for each observation included species, number of individuals, time, and height above ground, behavior, and flight direction. A range finder and topographic maps were used as references to determine bird distances to the observer and flight heights. Birds not easily identifiable due to low light conditions and distance were identified to the lowest taxonomic level possible.

The data collected from these surveys can be used to estimate the potential effects of wind turbines on avian species in the project area. The survey protocol estimates avian use throughout the day and captures a variety of bird species. Songbirds are most active in the morning during the breeding season and can be difficult to detect during the afternoon, compared to raptors which become more active as the sunlight heats the air and creates thermals, which individuals use for soaring.

Twenty-minute survey periods provide adequate time to detect both raptors and non-raptors. Double counting may occur during the 20-minute survey because individuals may appear and disappear from view. Double-counting of birds is not problematic for this type of survey because the objective is to document use in terms of number of birds noted per 20-minute survey, not number of distinct individual birds.

The ability to detect all species within the 800-meter survey radius varies among species and potentially not all individuals within the survey area are counted. This variation in detectability results in an overestimate of mean use in conspicuous species and an underestimate of mean use in reclusive species (Thompson 2002).

2.1.2 Incidental Observations

Incidental observations included those occurring while traveling between PC locations, pre- and post-PC survey time period, and outside the 800-meter radius circular plot. These observations were recorded but not used in the formal analysis.

2.1.3 Species Groupings

The data is presented in two primary groups of interest: raptors and non-raptors. Raptors were defined as vultures, hawks, eagles, falcons, and owls. Non-raptors were defined as all other avian species.

2.1.4 Mean Avian Use

Mean use was calculated by dividing the total number of birds per species observed by the total number of surveys conducted. Mean use was also calculated for each individual point count location to determine if there were areas with a higher mean use compared to other areas. The number of observations is also presented. This information helps depict whether a high mean use is driven by a single observation.

2.1.5 Flight Behavior

Flight behavior was evaluated by calculating the proportion of flying birds that were observed flying below, within, or above the turbine rotor sweep area (RSA). The Project is comprised of two (2) 2.3-MW and sixteen (16) 2.5-MW horizontal axis wind turbines. Each will have an anticipated hub height between 80 and 90 meters and a rotor diameter of approximately 116 meters. Therefore, an RSA between 22 and 148 meters above the ground was used.

2.1.6 Encounter Rate

The encounter rate is the rate at which a species was observed flying through the RSA during the avian point count surveys in the project area and suggests potential mortality risk from flight behavior.

To estimate the rate at which a species flies through the RSA, the following equation was applied to every species observed in the project area:
Encounter Rate = A*P*f**P*t*

- A is the mean use of birds/20 minutes for a given species

- P*f* is the proportion of all activity observations for a given species that were flying
- P*t* is the proportion of flying observations that were within the turbine RSA

The encounter rate index is relative to the observations of species during the surveys and within the study area and cannot be extrapolated to the species that may use the project area in the future. The encounter rate index from this study does not take into consideration behavior (e.g. foraging, courtship), habitat use, and turbine avoidance differences between species.

2.2 EAGLE USE SURVEYS

Eagle use data was collected in 1-minute intervals so that the data could be translated into eagle exposure minutes. The data recorded for each survey includes the count start and stop times, eagle species observed, numbers and age classes of eagles seen, minutes of eagle flight in two height categories based on the USFWS Eagle Conservation Plan Guidance (< 200 and > 200 meters [m] above ground), notes on flight and other behaviors, and an individual identifier for each flight observation allowing it to be linked to a flight map. Each sampling point consisted of an 800-meter (0.5-mile) radius circle (0.77 square mile) that provides distant, unobstructed views and allows visual observations of eagles and other large birds at a 2 to 3-mile distance. Numerical data was collected within 800-m-radius plots, but flight lines were documented across line-of-sight and were not limited to the 800-m-redius survey plot. Detailed protocol study-specific data sheets and a data management plan were utilized in the field.

Surveys were conducted once per month during the non-migration months (April-August), and conducted at a minimum of twice per month during the migration months (September-March) starting July 2016 and concluding in June 2017 for a total of 20 survey weeks. Individual surveys consisted of a 1-hour observation period at each of the eight point-count locations during each week of the surveys for a total of 160 hours of observations (**Figure 2** and **Table 2**). Surveys occurred in all weather conditions except when visibility was poor. The eagle use surveys were conducted outside of the 20-minute avian point count surveys.

Table 2: Palmer's Creek Eagle Use Survey Dates

Summer 2016		Fall 2016		Winter 2016-2017		Spring 2017		Summer 2017	
Survey Number	*Survey Date*	*Survey Number*	*Survey Date*	*Survey Number*	*Survey Date*	*Survey Number*	*Survey Date*	*Survey Number*	*Survey Date*
1	7/28/2016	3	9/7/2016	10	12/14/2016	16	3/7/2017	19	5/18/2017
2	8/22/2016	4	9/22/2016	11	12/27/2016	17	3/21/2017	20	6/16/2017
		5	10/6/2016	12	1/9/2017	18	4/13/2017		
		6	10/17/2016	13	1/26/2017				
		7	10/31/2016	14	2/9/2017				
		8	11/15/2016	15	2/24/2017				
		9	11/29/2016						

2.3 GROUND AND AERIAL RAPTOR AND EAGLE NEST SURVEYS

During Spring 2017, a ground raptor nest survey was conducted to locate raptor nests, and determine nest activity status and the species using those nests. The initial surveys were conducted before trees leaf out to locate nests and identify early breeding species. The project area and a 1-mile buffer was surveyed from a vehicle using binoculars and spotting scopes. All raptor nest locations were documented with Global Positioning System (GPS) coordinates. Raptor species, height of nest, nest activity status, nest condition, substrate, and other relevant data were recorded for each nest. An additional visit was conducted if nests were found to document the activity status of nests located during the initial survey and to identify nesting attempts by late nesting raptors such as Swainson's hawks. Raptors may use nests intermittently among years as well as re-nest after a nest failure; therefore, early- and late-season nest surveys allow for a more accurate summary of breeding raptors.

A review of historical eagle nest data (MNDNR 2016) within one mile of the Project was completed at the request of Fagen, Inc. (Fagen). A bald eagle (*Haliaeetus leucocephalus*) nest has been documented in T116N R40W Section 11 just outside of the project area boundary. This nest was active when checked in 2000, 2001, and 2005.

An additional nest was located Spring 2016 by Fagen. This nest was active in 2016 and 2017 and located in T116N R39W Section 20, immediately outside of the project area boundary. Fagen staff monitored this nest in 2016 and 2017 or until all eaglets have fledged (Michael Rutledge, Fagen, Inc., Personal Communication, March 7, 2017).

The objective of the aerial eagle nest surveys is to locate and record nests that may be in the proximity of the project area, identify concentration and density of eagle nests, and identify nests that may be vulnerable to disturbance and/or displacement effects by the Project. The intent of the nest survey is to gather information on species nesting in the area, including nest locations, nesting season (timing), and nest success.

The survey was conducted within a ten-mile buffer from the project area (defined as the analysis area). Eagle Aviation Inc. was contracted to fly an aerial survey of the project area on April 20, 2017. A Cessna Skyhawk with two observers (Ray Jilek, Eagle Aviation Pilot and Justin Askim, Wenck biologist) were used during the survey. Complete coverage of the project area was obtained by systematically flying over the landscape and visually scanning all areas for potential roosting, nesting and foraging eagles. Aerial surveys were conducted using a fixed-wing aircraft, flying over relatively even terrain at approximately 250 – 500 feet above ground level and at speeds of 85 to 125 miles per hour.

2.4 ACOUSTIC BAT SURVEYS

2.4.1 2015 and 2016 Surveys

Fagen deployed five separate Anabat systems (Anabat® SD-2 ultrasonic detectors) to record bat activity throughout the study area. The first deployment was done with two of the Anabat recorders during the fall of 2015 and continued through October 15, 2016. Three additional Anabat recorders were launched on August 3, 2016. Refer to **Figure 3** below.

2.4.2 2017 Surveys

Data was gathered in the field within the study area from four different Anabat acoustic recorders and two SM3 full spectrum monitors. The monitors gathered data from late March 2017 and are currently active gathering data throughout the 2017 field season.

3.0 Results

3.1 DIURNAL FIXED-POINT AND INCIDENTAL AVIAN USE SURVEYS

Of the approximate 6,150 acres that comprise the Palmer's Creek project area, approximately 3,970 acres were surveyed during PC surveys. Eight point-count locations were established and surveyed in the project area (**Figure 2**). A total of 36 surveys were conducted over four seasons, with seasons defined as summer (June 27, 2016–August 31, 2016 and May 14, 2017-June 17, 2017 [8-point count surveys]), fall (September 1, 2016–November 30, 2016 [12-point count surveys]), winter (December 1, 2016–February 25, 2017 [6-point count surveys]), and spring (February 26, 2017–May 15, 2017 [10-point count surveys]), as provided in **Table 1** above.

3.1.1 Species Composition

The summer 2016 and summer 2017 surveys consisted of 875 avian individuals (46 different species) that were recorded during the eight fixed-PC surveys (**Table 3a**). The most frequently observed birds were brown-headed cowbird (*Molothrus bonariensis*), (15.54 percent of all birds observed), red-winged blackbird (*Agelaius phoeniceus*), (14.74 percent) and barn swallow (*Hirundo rustica*), (12.79 percent) (**Table 3a**). The remaining 43 species comprised approximately 57.03 percent of the total birds observed.

The fall 2016 survey consisted of 1,702 avian individuals (39 different species) that were recorded during the eight fixed-PC surveys (**Table 3b**). The most frequently observed birds were American crow (*Corvus brachyrhynchos*), (14.63 percent of all birds observed), red-winged blackbird, (12.04 percent), and brown-headed cowbird, (11.69 percent) (**Table 3b**). The remaining 36 species comprised approximately 61.63 percent of the total birds observed.

The winter 2016-2017 survey consisted of 822 avian individuals (18 different species) that were recorded during the eight fixed-PC surveys (**Table 3c**). The most frequently observed birds were European starling (*Sturnus vulgaris*), (41.24 percent of all birds observed), snow bunting, (*Plectrophenax nivalis*) (13.26 percent), and wild turkey, (*Meleagris gallopavo*) (11.19 percent) (**Table 3c**). The remaining 15 species comprised approximately 34.31 percent of the total birds observed.

The spring 2017 survey consisted of 1,714 avian individuals (42 different species) that were recorded during the eight fixed-PC surveys (**Table 3d**). The most frequently observed birds were European starling, (28.80 percent of all birds observed), red-winged blackbird, (17.98 percent), American crow (11.22 percent), and Canada goose (*Branta canadensis*), (10.56 percent) (**Table 3d**). The remaining 36 species comprised approximately 31.44 percent of the total birds observed.

Cumulatively, surveys identified 5,368 avian individuals (64 different species) that were recorded during the eight fixed-PC surveys (**Table 4**). The most frequently observed birds were European starling, (19.63 percent of all birds observed/1,054 individuals), red-winged blackbird, (12.82 percent/688 individuals), American crow, (10.54 percent/566 individuals), brown-headed cowbird, (6.99 percent/375 individuals), and Canada goose, (6.48

percent/348 individuals) (**Table 4**). The remaining 59 species comprised approximately 43.54 percent of the total birds observed.

3.1.2 Avian Use

Summer 2016 and summer 2017 overall mean bird use was 13.67 birds/20 min (**Table 5**). The overall mean use by non-raptors was 13.53 birds/20 min; the highest mean use was brown-headed cowbird (2.13 birds/20 min), red-winged blackbird (2.02 birds/20 min), and barn swallow (1.73 birds/20 min) (**Table 5**). Raptors are a group of special interest because of their propensity to fly at heights within a turbine RSA. The mean use for raptors/vultures/owls was 0.14 birds/20 min; the highest mean use was turkey vulture (*Cathartes aura*) (0.08 birds/20 min), red-tailed hawk (*Buteo jamaicensis*) (0.05 birds/20 min), and Swainson's hawk (*Buteo swainsoni*) (0.02 birds/20 min) (**Table 5**). For the species groups, overall mean use was highest for songbirds (10.97 birds/20 min) (**Table 5**).

Fall 2016 overall mean bird use was 17.73 birds/20 min (**Table 5**). The overall mean use by non-raptors was 17.27 birds/20 min; the highest mean use was American crow (2.59 birds/20 min), red-winged blackbird (2.14 birds/20 min), and brown-headed cowbird (2.07 birds/20 min) (**Table 5**). The mean use for raptors/vultures/owls was 0.46 birds/20 min; the highest mean use was red-tailed hawk (0.20 birds/20 min), bald eagle (*Haliaeetus leucocephalus*) (0.10 birds/20 min), and turkey vulture (0.07 birds/20 min) (**Table 5**). For the species groups, overall mean use was highest for songbirds (10.73 birds/20 min) (**Table 5**).

Winter 2016-2017 overall mean bird use was 17.13 birds/20 min (**Table 5**). The overall mean use by non-raptors was 16.96 birds/20 min; the highest mean use was European starling (7.06 birds/20 min), snow bunting (2.27 birds/20 min), and wild turkey (1.92 birds/20 min) (**Table 5**). The mean use for raptors/vultures/owls was 0.17 birds/20 min; the highest mean use was red-tailed hawk (0.13 birds/20 min), Swainson's hawk (0.02 birds/20 min), and northern harrier (*Circus hudsonius*) (0.02 birds/20 min) (**Table 5**). For the species groups, overall mean use was highest for songbirds (11.44 birds/20 min) (**Table 5**).

Spring 2017 overall mean bird use was 24.61 birds/20 min (**Table 5**). The overall mean use by non-raptors was 23.96 birds/20 min; the highest mean use was European starling (7.09 birds/20 min), red-winged blackbird (4.43 birds/20 min), American crow (2.76 birds/20 min), and Canada goose (2.60 birds/20 min) (**Table 5**). The mean use for raptors/vultures/owls was 0.65 birds/20 min; the highest mean use was red-tailed hawk (0.21 birds/20 min), bald eagle (0.21 birds/20 min), and turkey vulture (0.20 birds/20 min) (**Table 5**). For the species groups, overall mean use was highest for songbirds (15.95 birds/20 min) (**Table 5**).

Cumulative overall mean bird use for all surveys was 18.64 birds/20 min (**Table 5**). The overall mean use by non-raptors was 18.25 birds/20 min; the highest mean use was European starling (3.66 birds/20 min), red-winged blackbird (2.39 birds/20 min), American crow (1.97 birds/20 min), brown-headed cowbird (1.30 birds/20 min), and Canada goose (1.21 birds/20 min) (**Table 5**). The mean use for raptors/vultures/owls was 0.39 birds/20 min; the highest mean use was red-tailed hawk (0.16 birds/20 min), turkey vulture (0.10 birds/20 min), and bald eagle (0.09 birds/20 min) (**Table 5**). For the species groups, overall mean use was highest for songbirds (12.35 birds/20 min) (**Table 5**).

3.1.3 Frequency of Occurrence

During the summer 2016 and summer 2017 surveys, the most common species present during the surveys was the red-winged blackbird (34.38 percent of all surveys), which was widely distributed throughout the project area (**Tables 6** and **7a**). Other frequently occurring species included barn swallow (32.81 percent of all surveys), American goldfinch (*Spinus tristis*) (29.69 percent of all surveys), and field sparrow (*Spizella pusilla*) (26.56 percent of all surveys) (**Table 6**).

During the fall 2016 surveys, the most common species present during the surveys was the blue jay (*Cyanocitta cristata*) (27.08 percent of all surveys), which was widely distributed throughout the project area (**Tables 6** and **7b**). Other frequently occurring species included American crow (23.96 percent of all surveys), field sparrow (22.92 percent of all surveys), and rock pigeon (*Columba livia*) (17.71 percent of all surveys) (**Table 6**).

During the winter 2016-2017 surveys, the most common species present during the surveys was the American crow (31.25 percent of all surveys), which was widely distributed throughout the project area (**Tables 6** and **7c**). Other frequently occurring species included European starling (20.83 percent of all surveys), rock pigeon (20.83 percent of all surveys), and blue jay (18.75 percent of all surveys) (**Table 6**).

During the spring 2017 surveys, the most common species present during the surveys was the horned lark (*Eremophila alpestris*) (37.50 percent of all surveys), which was widely distributed throughout the project area (**Tables 6** and **7b**). Other frequently occurring species included Canada goose (25.00 percent of all surveys), and American crow (23.75 percent of all surveys (**Table 6**).

Cumulatively, the most common species present during the surveys was the field sparrow (13.54 percent of all surveys (**Tables 6** and **8**). Other frequently occurring species included blue jay (13.19 percent of all surveys), red-winged blackbird (11.81 percent of all surveys), American goldfinch (11.46 percent of all surveys), and American crow (10.07 percent of all surveys (**Table 6**).

3.1.4 Flight Height and Encounter Rate

During the summer 2016 and summer 2017 surveys, 73.14 percent of all individuals observed were flying (**Table 10**). Flight height and flight direction data was recorded for all the flying birds (**Table 11**). Approximately 0.00 percent of flying raptor species flew above the RSA, 44.44 percent flew below the RSA, and 55.56 percent flew within the RSA. For all other species, 0.00 percent flew above the RSA, 98.89 percent flew below the RSA, and 1.11 percent flew within the RSA (**Table 9**). The turkey vulture and American white pelican (*Pelecanus erythrorhynchos*) were the two highest encounter rates of 0.06 respectively (**Table 10**).

During the fall 2016 surveys, 81.43 percent of all individuals observed were flying (**Table 10**). Flight height and flight direction data was recorded for all the flying birds (**Table 11**). Approximately 34.21 percent of flying raptor species flew above the RSA, 39.47 percent flew below the RSA, and 26.32 percent flew within the RSA. For all other species, 4.47 percent flew above the RSA, 85.88 percent flew below the RSA, and 9.65 percent flew within the RSA (**Table 9**). Species with the highest encounter rate were as follows: unknown blackbird (*Turdus sp.*) (0.42), red-winged blackbird (0.27), American crow (0.23) and ring-billed gull (*Larus delawarensis*) (0.18) (**Table 10**).

During the winter 2016-2017 surveys, 80.78 percent of all individuals observed were flying (**Table 10**). Flight height and flight direction data was recorded for all the flying birds (**Table 11**). Approximately 12.50 percent of flying raptor species flew above the RSA, 62.50 percent flew below the RSA, and 25.00 percent flew within the RSA. For all other species, 1.07 percent flew above the RSA, 91.77 percent flew below the RSA, and 7.16 percent flew within the RSA (**Table 9**). The species with the highest encounter rate was the unknown duck (*Anatidae sp.*) (0.96) (**Table 10**).

During the spring 2017 surveys, 87.05 percent of all individuals observed were flying (**Table 10**). Flight height and flight direction data was recorded for all the flying birds (**Table 11**). Approximately 11.54 percent of flying raptor species flew above the RSA, 23.08 percent flew below the RSA, and 65.38 percent flew within the RSA. For all other species, 1.14 percent flew above the RSA, 85.32 percent flew below the RSA, and 13.54 percent flew within the RSA (**Table 9**). The Canada goose and American crow were the two highest encounter rates of 1.44 and 0.61 respectively (**Table 10**).

Cumulatively, 82.04 percent of all individuals observed were flying (**Table 10**). Flight height and flight direction data was recorded for all the flying birds (**Table 11**). Approximately 18.52 percent of flying raptor species flew above the RSA, 33.33 percent flew below the RSA, and 48.15 percent flew within the RSA. For all other species, 3.21 percent flew above the RSA, 87.73 percent flew below the RSA, and 9.05 percent flew within the RSA (**Table 9**). Species with the highest encounter rate were as follows: Canada goose (0.40), American crow (0.25), unknown duck (0.18) and unknown blackbird (0.14) (**Table 10**).

3.1.5 Sensitive Species Observations

Two state special concern species {bald eagle (21 observations, 27 individuals) and American white pelican (3 observations, 16 individuals)} were observed during the avian surveys (**Table 4**). Neither of these species are protected by the federal Endangered Species Act.

3.1.6 Flight Direction

The summer 2016 and summer 2017 surveys indicated that birds were generally flying in variable directions (60.94 percent). Specific directions of flight and respective percentages are as follows: northwest (8.13 percent), west (7.97 percent), north (5.16 percent), south (4.84 percent), southeast (4.22 percent), east (3.44 percent), northeast (3.28 percent), and southwest (2.03 percent) (**Table 11**).

The fall 2016 surveys indicated that birds were generally flying in variable directions (31.17 percent). Specific directions of flight and respective percentages are as follows: south (20.20 percent), southeast (14.29 percent), southwest (10.25 percent), north (7.50 percent), west (6.13 percent), east (5.84 percent), northwest (3.03 percent), and northeast (1.59 percent) (**Table 11**).

The winter 2016-2017 surveys indicated that birds were generally flying in variable directions (65.96 percent). Specific directions of flight and respective percentages are as follows: north (10.39 percent), southeast (8.28 percent), south (5.12 percent), west (4.37 percent), northeast (2.56 percent), northwest (1.81 percent), southwest (0.90 percent), and east (0.60 percent) (**Table 11**).

The spring 2017 surveys indicated that birds were generally flying in variable directions (51.55 percent). Specific directions of flight and respective percentages are as follows: west (14.36 percent), northwest (9.40 percent), north (8.17 percent), south (5.90 percent), southeast (3.39 percent), east (3.09 percent), northeast (2.36 percent), and southwest (1.52 percent) (**Table 11**).

Cumulatively, the surveys indicated that birds were generally flying in variable directions (48.67 percent). Specific directions of flight and respective percentages are as follows: south (10.13 percent), west (9.33 percent), north (7.86 percent), southeast (7.68 percent), northwest (6.06 percent), southwest (4.25 percent), east (3.63 percent), and northeast (2.38 percent) (**Table 11**).

3.1.7 Incidental Surveys

Staff documented seven species and a total of 45 individual incidental observations. One species, a single northern pintail (*Anas acuta*), was detected during incidental surveys, but not during the point count surveys. See **Table 12** below.

Table 12. Cumulative Palmer's Creek Incidental Point Count Data

Species	Summer 2016 & 2017		Fall 2016		Winter 2016-2017		Spring 2017		Cumulative	
	Observations	Individuals	Observations	Individuals	Observations	Individuals	Observations	Individuals	Observations	Individuals
Red-tailed Hawk	4	4	8	8	0	0	9	9	21	21
American Kestrel	0	0	1	1	0	0	2	3	3	4
Bald Eagle	1	1	1	1	1	1	4	5	7	8
Northern Harrier	1	1	1	1	0	0	4	4	6	6
Northern Pintail	0	0	1	1	0	0	0	0	1	1
American White Pelican	0	0	0	0	0	0	1	6	1	6
Turkey Vulture	3	5	1	1	0	0	2	2	6	8
Totals	**9**	**11**	**13**	**13**	**1**	**1**	**22**	**29**	**45**	**54**

3.2 EAGLE USE SURVEYS

Eagle use surveys documented 19 bald eagles with 87 flight minutes, and 78.9 percent of the individuals were flying within the RSA. Most of these eagles have been observed within one mile of the Minnesota River along point count locations 1, 2, 3 and 4 (**Figure 2** and **Table 13**).

Table 13. Eagle Point Count Results

	Points								Totals
	1	2	3	4	5	6	7	8	
Individuals	1	1	10	7	0	0	0	0	19
Individuals Flying	1	1	10	7	0	0	0	0	19
Above RSA	0	0	0	0	0	0	0	0	0
Within RSA	0	1	9	5	0	0	0	0	15
Below RSA	1	0	1	2	0	0	0	0	4
Flight Minutes	2	3	65	17	0	0	0	0	87

Eagles were observed less than 1 percent of the survey time period (87 minutes observed/9,600 survey minutes). Of the 87 minutes in which eagles were observed, 78 minutes of observations were made with eagles flying within the RSA. The eagle point count surveys are reflective of the eagle data collected during the avian point count surveys, both with a relatively low encounter rate of 0.09 and 0.03 respectively.

3.3 GROUND AND AERIAL RAPTOR AND EAGLE NEST SURVEYS

An aerial (fixed-wing) raptor/eagle nest survey was conducted on April 20, 2017 that encompassed a 10-mile buffer of the project area. Three active nests, three inactive nests and ten individuals (three on nest and seven in flight or perched) were observed during the April 20, 2017 aerial survey (**Figure 4** and **Table 14**). Except for Nest 3, all nests are approximately five miles or greater from the project area.

Table 14: Eagle Nests Within Palmer's Creek Analysis Area

Nest Number	Status	Distance from Project Area	Latitude	Longitude
1	Active	4.9 miles	44.90855599	-95.70717782
2	Inactive	8.5 miles	44.73293894	-95.42223611
3	Active	0.3 miles	44.83149047	-95.56799484
4	Active	7.0 miles	44.72996346	-95.48105437
5	Inactive	10.0 miles	44.67489358	-95.53845803
6	Inactive	9.0 miles	44.68952578	-95.53443812

Eagle nest density within the analysis area is approximately one active nest per 102,000 acres.

See **Appendix C** for the *Aerial Eagle/Raptor Nest Survey Report.*

Two active red-tailed hawk nests were located within the project area during the ground surveys (**Figure 4**).

3.4 ACOUSTIC BAT SURVEYS

3.4.1 2015 and 2016 Surveys

The data collected from Fagen was sent to NCE, who processed the data in zero-crossing through Kaleidoscope (Ver. 3.1.8) to confirm presence diversity and abundance of bat species. The software uses a presence/absent indicator by giving each species of bat a p-value. The lower the p-value, the more likely the species of bat is present. Bat presence, in the form of vocalization, was detected, identified by species, and catalogued, thereby allowing estimates of species occurrences, distribution and relative abundance.

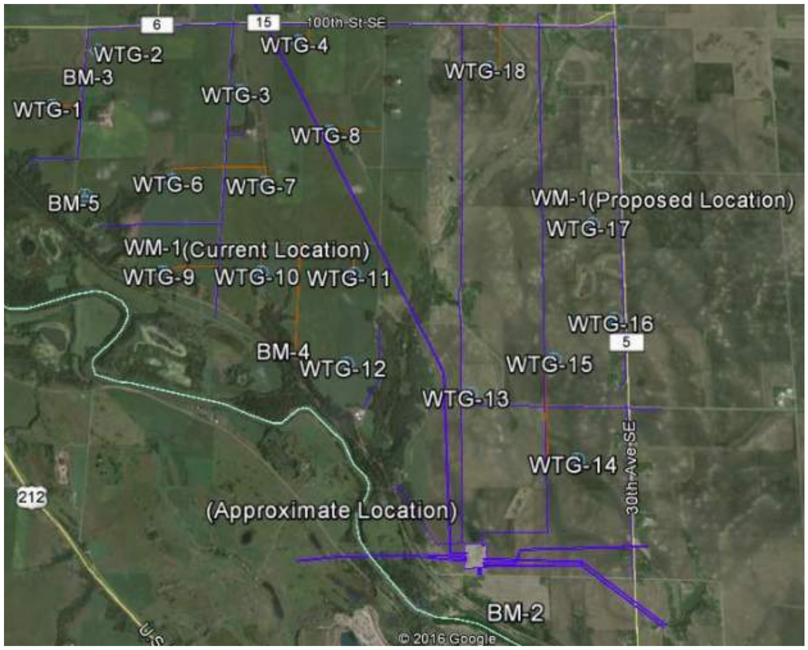


Figure 3. Bat Monitor (BM) Locations. BM-1 is not shown on the map but lies next to BM-2.

Bat Monitors (BM) 1 & 2 gathered data throughout the fall of 2015 and were deployed again in May 2016. Monitors 3-5 were added in September 2016.

Monitors 1 & 2 were deployed on September 13, 2015 and removed on October 11, 2015. They were deployed again on April 12, 2016, then removed on October 15. Monitor 3, Monitor 4 and Monitor 5 were deployed on August 3, 2016 then removed on October 15, 2016. The monitors were deployed for 287 trap nights.

From the five (5) Anabat recording systems, 232,116 sound files were recorded. Visual examination and filtering of files to eliminate extraneous noise (e.g., wind, insects, etc.) resulted in a total of 14,442 bat detections.

There was a total of six bat species documented throughout the course of the study (September-October 2015 and 2016). The tricolored bat, also known as the eastern pipistrelle (*Pipistrellus sublavus*) was documented at this site and is listed as a species of concern in the state of Minnesota. It was detected in small numbers but was found at every monitor except for Monitor 1. The northern long-eared myotis (*Myotis septentrionalis*) is a federally threatened species whose home range lies within the study area. However, no confirmed documentation was recorded here. Even though a total of five clicks of which Kaleidoscope classified as MYSE (northern long-eared myotis) the P-value was given a 1 for every monitor indicating the likelihood of presence is near non-existent. All other species documented are of least concern. Of the six-species documented, the silver-haired bat (*Lasionycteris noctivagans*), hoary bat (*Lasiurus cinereus*) and big brown bat (*Eptesicus fuscus*) were among the most common followed by the little brown bat (*Myotis lucifugus*) and eastern red bat (*Lasiurus borealis*). See **Appendix D** for the entire *Interim Acoustic Bat Summary Report.*

3.4.2 2017 Surveys

At this point in time the four Anabat and two SM3 full spectrum recording system visual examination and filtering of files to eliminate extraneous noise (e.g., wind, insects, etc.) resulted in a total of 15,511 sound files classified as bat detection passes as of data collected through Jun 29, 2017.

Monitor 1 is located on the lower end of a met tower surrounded by agriculture with some roosting trees nearby. The monitor recorded 1,933 files that Kaleidoscope Pro was able to classify as bat passes. The silver haired bat was the most common species at this site being 57% of total detections. The big brown bat was the second most common being 24% of total detections. The federally threatened northern long-eared myotis was detected 1 time (0.05%), but had a P-value of 1 which almost certainly means it was nonexistent at this site. The eastern pipistrelle had a total of 16 (0.8%) detections.

Monitor 2 is located on the upper end of the same met tower as monitor 1, total elevation of 55 m. The monitor recorded only 116 files that Kaleidoscope Pro was able to classify as bat passes. The monitor only recorded a total of two species. The Hoary bat was the dominant species at this with 90 (78%) total bat passes. The second species was the big-brown bat with 26 (22%) total bat passes.

Monitor 3 is one of two SM3 ultrasonic detector which is located along a creek bank just off of the road surrounded by a combination of agriculture and roosting tree habitat. The monitor recorded 3,231 files that Kaleidoscope Pro was able to classify as bat passes. The silver haired bat was the most common species at this site being 35% of total detections. The big brown bat was the second most common being 26% of total detections. The federally threatened northern long-eared myotis was detected 1 time (0.0003%), but had a P-value of 1 which almost certainly means it was nonexistent at this site. The eastern pipistrelle had a total of 16 (0.5%) detections.

Monitor 4 is located in a corn field and is surrounded by agriculture, with a creek with roosting habitat located near the site, the monitor recorded 1,127 files Kaleidoscope Pro classified as bat passes. The most common species at this site was the hoary bat being 49% of total detections. The second most common was the silver-haired bat being 40% of total detections. The northern long-eared myotis was not recorded at this site. The eastern pipistrelle had a total of 10 (0.9%) detections.

Monitor 5 is located along the roadside in agriculturally dominated landscape, the monitor recorded 763 files Kaleidoscope Pro classified as bat passes. The most common species at this site was the silver haired bat being 67% of total detections. The second most common was the hoary bat with being 24% of total detections. The northern long-eared myotis was not detected at this site. The eastern pipistrelle had a total of 8 (1%) detections.

Monitor 6 is located in a tree line near a farm house, this is the second of the SM3 full spectrum devices. The monitor recorded a total of 8,341 files Kaleidoscope Pro classified as bat passes. The most common species at this site was the silver haired bat being 42% of total detections. The second most common was the big brown bat with being 35% of total detections. The northern long-eared myotis was detected 1 time (0.01%), but had a P-value of 1 which almost certainly means it was nonexistent at this site. The eastern pipistrelle had a total of 16 (0.2%) detections.
Bat acoustic surveys will continue through the 2017 season.

4.0 Discussion and Impact Assessment

4.1 DISCUSSION

Based on the point count surveys, the avian community currently using the project area is characterized by species associated with typical midwestern agricultural lands, mixed-grass prairie vegetation and riparian areas. Most of the project area and its vicinity have been developed for agricultural use, specifically row crops such as corn, sunflower and soybeans. Within disturbed habitats such as these, the greatest potential impact of wind facilities to avian species is risk of collisions with turbines. The close proximity of the Minnesota River may serve as an attractant to migratory bird species, especially waterfowl, which pass through the area during the spring and fall migration. Mean avian fatality rates estimated from wind facilities in the Midwest (NE, WI, MN, and IA) range from 0.44 to 11.83 birds/turbine/year (0.49 – 7.17 birds/MW/year; Tetra Tech 2012). Palmer's Creek bird fatalities are estimated to fall within this range.

4.2 RAPTOR USE AND ENCOUNTER RATE

Survey data gathered totaled 113 individual raptors observed for an annual mean use of 0.39 raptors/20 minute (**Table 5**). This rate was compared to a study of 37 other wind facilities that implemented similar protocols. The raptor annual mean use at these wind facilities ranged from 0.09 to 2.34 raptors/20 min survey. Based on the results from these wind facilities, as summarized by Derby et al. 2010, a ranking of seasonal raptor mean use was developed: low (0-0.5 raptors/20 min. survey); low to moderate (0.5-1.0 raptors/20 min); moderate (1.0-2.0 raptors/20 min); high (2.0-3.0 raptors/20 min); and very high (> 3.0 raptors/20 min). Under this ranking, the current mean raptor use in the project area is considered low.

Encounter rate analysis may also suggest which species may be at risk to become turbine casualties. The encounter rate is an index and only considers probability of exposure based on abundance, number of individuals flying, and flight height of each species within the RSA for turbines at the wind facility.

Based on 52 of 108 individuals observed flying within the RSA/20 minutes during the surveys (**Table 9**), raptor encounter rates in the project area are considered moderate. Approximately 48.15 percent of all raptor observations were within the RSA. The highest raptor encounter rate was red-tailed hawk and turkey vulture with each having 0.07 individuals flying within the RSA/20 minutes and bald eagle at 0.03 individuals flying within the RSA/20 minutes (**Table 10**).

High numbers of raptor fatalities have been documented at wind facilities (e.g. Altamont Pass); however other studies at wind facilities in the United States found that 3.2 percent of the total casualties were raptors (Erickson et al. 2001). Results from Altamont Pass in California suggest that species mortality is not all related to abundance (Orloff and Flanery 1992). Based on survey results for species occurrence/abundance and encounter rates within the Palmer's Creek project area, red-tailed hawks, turkey vultures and bald eagles may be at highest collision risk with the Project.

High raptor use (greater than 2.0 birds/20 min) has been associated with high raptor fatality at wind facilities (Strickland et al. 2011). Conversely, raptor fatality appears to be low when raptor use is low (less than 1.0 birds/20 min; Strickland et al. 2011), which is the case for raptor use in the project area. Currently the project area has a raptor use of 0.39 birds/20 minutes (**Table 5**).

Turkey vultures and red-tailed hawks were the raptor species with the highest mean use and were also among the most frequently detected raptor species in the project area. Both species are commonly associated with agricultural and grassland habitats which provide opportunities for foraging and activity associated with susceptibility to turbine-collisions (Thelander et al. 2003). In a recent study of raptor response to wind facilities, red-tailed hawks were observed engaging in high-risk behaviors at operational wind facilities (Garvin et al. 2011). Results from post-construction fatality monitoring studies indicate that red-tailed hawks are frequently found as turbine-related fatalities (228 records of red-tailed hawk from 27 studies – Tetra Tech 2012; Jain 2005, Grodsky and Drake 2011, Johnson and Erickson 2011). However, Garvin et al. (2011) documented that red-tailed hawks, despite high-risk behavior, also demonstrated collision avoidance behavior (Garvin et al. 2011). Thus, risk of turbine-related fatalities in the project area exists for red-tailed hawks, but turbine-related fatalities would be expected to be low given the moderate level of use. Project-related fatalities of red-tailed hawks, should they occur, are unlikely to population-level impacts because red-tailed hawks are common nationwide (Sauer et al. 2011). Turkey vultures are also very common nationwide and Project-related fatalities, should they occur, would not have population-level impacts.

4.3 NON-RAPTOR USE AND ENCOUNTER RATE

Migratory bird species in the United States are protected by the Migratory Bird Treaty Act (MBTA). Passerine species have been the most abundant bird fatality at wind facilities outside California (Erickson et al. 2001 and Erickson et al. 2002), often comprising more than 80 percent of the bird fatalities. Both migrant and resident passerine fatalities have been observed (Erickson et al. 2001 and Erickson et al. 2002). Passerines make up a large proportion of the birds observed during the avian surveys in the project area and would be expected to make up the largest proportion of fatalities. Encounter rates indicate that the Canada goose, American crow, unknown duck, unknown blackbird and red-winged blackbird are likely to be exposed to collisions from wind turbines in the project area (**Table 4** and **10**). The red-winged blackbird is commonly found as a turbine-related fatality (more than 20 records of post-construction fatality from 27 studies; Tetra Tech 2012, Johnson et al. 2000, Howe et al. 2002, TRC Environmental 2008, Gruver et al 2009, BHE Environmental 2010, Jain et al. 2011, Grodsky and Drake 2011). Thus, risk of turbine-related fatalities of red-winged blackbird, and perhaps other at risk non-raptors in the project area, should they occur, are unlikely to have population-level impacts because collision fatalities appears to have little effect on North American land bird populations (Arnold and Zink 2011).

There were other species that flew through the RSA during the PC surveys, but their frequency of occurrence and overall numbers were not high enough to warrant significant collision exposure (**Table 10**).

4.4 LISTED AND SENSITIVE SPECIES RISK

The sensitive species observed in the project area are summarized in Section 3.6. No federally listed threatened, endangered or candidate species were observed during the surveys to date. Based on survey data, one state special concern species (American white pelican (*Pelecanus erythrorhynchos*)) were observed during the avian surveys. None of these species are protected by the federal Endangered Species Act.

Eagle use surveys documented 19 bald eagles with 87 flight minutes, and 78.9 percent of the individuals were flying within the RSA. Most of these eagles have been observed within one mile of the Minnesota River along point count locations 1, 2, 3 and 4 (**Figure 2** and **Table 13**).

4.5 GROUND AND AERIAL RAPTOR AND EAGLE NEST SURVEYS

An aerial (fixed-wing) raptor/eagle nest survey identified three active nests and three inactive nests (**Figure 4** and **Table 14**). Except for Nest 3, which is in close proximity to the project area, all nests are approximately five miles or greater from the project area.

Ground surveys identified two active red-tailed hawk nests were located within the project area during the ground surveys (**Figure 4**).

4.6 ACOUSTIC BAT SURVEYS

4.6.1 2015 and 2016 Surveys

There was a total of six bat species documented throughout the course of the surveys (Fall 2015 and Fall 2016). Three species of concern in the state of Minnesota were observed during the acoustic bat monitoring (tricolored bat, big brown bat, and little brown bat). The northern long-eared bat is a federally threatened species with a species range that includes the majority of the eastern United States, extending west through Minnesota to the western borders of the Dakotas. No confirmed documentation of the northern long-eared bat in the project area was recorded during the Fall 2015 to Fall 2016 acoustic bat monitoring (see **Appendix D**).

Bats typically utilize farm buildings and dead and dying trees with cavities and loose bark as roosting and maternity habitat. Bats typically use forests, riparian corridors and wetlands as feeding habitats due to higher nocturnal insect densities in these areas. There is minimal native vegetation that serves as wildlife habitat within the project area near direct areas of Project impact. There are bats in the project area and some wind turbine collision bat mortality is likely to occur because of the Project. Compared to birds, less is known about bat populations and habitat preferences on a local, regional or national level. Bat mortality is likely to be greatest for migratory tree bat species, including hoary, eastern red and silver-haired bats during the fall migration period (Johnson 2005, Arnett et al. 2008).

4.6.2 2017 Surveys

There were a total of six bat species documented at this point in time during the course of the study (late March, 2017-late June, 2017). The eastern pipistrelle (*Pipistrellus sublavus)* was documented at this site and is listed as a species of concern in the state of Minnesota. It was detected in small numbers but was found at every monitor except for monitor 2. The northern long-eared myotis (*Myotis septentrionalis*) is a federally threatened species whose home range lies within the study site. However no confirmed documentation was recorded here. Even though a total of three passes of which Kaleidoscope classified as MYSE (northern long-eared myotis) the P-value was given a 1 for every monitor indicating the likelihood of presence is near non-existent. All other species documented are of least concern. Of the six species documented the silver-haired bat (*Lasionycteris noctivagans*), hoary bat (*Lasiurus cinereus*) and big brown bat (*Eptesicus fuscus*) were among the most common followed by the little brown bat (*Myotis lucifugus*) and eastern red bat (*Lasiurus borealis*). Bat acoustic surveys will continue through the 2017 season.

5.0 Conclusions

It appeared that birds were using specific areas near the project area, especially along the Minnesota River. Strong associations with topographic features along the Minnesota River were noted for raptors and other large avian species. The Minnesota River appears to be a flyway or concentration area for migrating avian species.

Data collected suggest an overall low impact in the project area on the local avian community as compared to other upper Midwest wind facilities. The low mean-use rate in the project area is primarily due to few common residents and migratory species. Raptor use was low for each raptor species detected. Although there is potential for turbine-related fatalities of Canada goose, American crow, unknown duck, unknown blackbird and red-winged blackbird, fatalities are not expected to have population-level impacts. If avian fatality rates are similar to other wind facilities within the region, it is estimated the Project would result in fatality rates between 0.44 – 11.83 birds/turbine/year (0.49 – 7.17birds/MW/year) which is comparable to other Midwest wind facilities.

Assuming the general relationship between bat activity and bat mortality observed at other sites is broadly applicable to locations with similar characteristics, levels of turbine-related bat mortality at the Palmer's Creek Wind Farm is estimated to be on the lower end of the spectrum, and similar with mortality rates at other wind facilities in the region.

No federally-listed endangered, threatened, or candidate species were observed within the project area. However, one state special concern species (American white pelican) were observed during the avian surveys. Raptor use, including bald eagles, is considered relatively low within the project area. All migratory avian species are protected by the Migratory Bird Treaty Act of 1918, which requires a project proposer to work with the U.S. Fish and Wildlife Service to identify and implement measures to avoid and minimize impacts to migratory bird species.

6.0 References

Arnett, E. B., W. K. Brown, W. P. Erickson, J. K. Fieldler, B. I. Hamilton, T. H. Henry, A. Jain, G. D. Johnson, J. Kerns, R. R. Koford, C. P. Nicholson, T. J. O'Connell, M. D. Piorkowski, R. D. Tankersley Jr. 2008. Patterns of Bat Fatalities at Wind Energy Facilities in North America. Journal of Wildlife Management. 72: 61-78.

Arnold, T.W., and R.M Zink. 2011. Collision mortality has no discernible effect on population trends of North American Birds. PLOS ONE 6: e24708. Doi:10.1371/journal.pone.0024708.

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

Derby, C., T. Thorn, K. Bay. 2010. Wildlife Baseline Studies for the Highmore Wind Resource Area, Hughes, Hyde and Hand Counties, South Dakota. Technical Report prepared by West, Inc. for NextEra Energy, Juno Beach, FL.

Erickson, W.P., G.D. Johnson, M.D. Strickland, D.P. Young, K.J. Sernka, and R.E. Good. 2001. Avian Collisions with Wind Turbines: A Summary of Existing Studies and Comparisons to other Sources of Avian Collision Mortality in the United States. National Wind Coordination Committee Publication. http://www.national wind.org/pubs/default.htm

Erickson, W.P., G. Johnson, D. Young, D. Strickland, R. Good, M. Bourassa, K. Sernka. 2002. Synthesis and Comparison of Baseline Avian and Bat Use, Raptor Nesting and Mortality Information from Proposed and Existing Wind Developments. Technical report prepared by WEST, Inc., for Bonneville Power Administration, Portland, Oregon.

Erickson, W.P., G.D. Johnson, and D.P. Young Jr. 2005. A summary and comparison of bird mortality from anthropogenic causes with an emphasis on collisions. USDA Forest Service Gen. Tech. Rep. PSW-GTR-191.

Garvin, J.C., Jennelle, C.S., Drake, D. and Grodsky, S,M. (2011), Response of raptors to a windfarm. Journal of Applied Ecology, 48: 199-209.

Grodsky, S.M. and D. Drake. 2011. Assessing Bird and Bat Mortality at the Forward Energy Center. Final Report. Public Service Commission (PSC) of Wisconsin. PSC REF#:152052. Prepared for Forward Energy LLC. Prepared by Department of Forest and Wildlife Ecology, University of Wisconsin-Madison, Madison, Wisconsin. August 2011.

Gruver, J., M. Sonnenburg, K. Bay, and W. Erickson. 2009. Post-Construction Bat and Bird Fatality Study at the blue Sky Green Field Wind Energy Center, Fond Du Lac County, Wisconsin July 21 – October 31, 2008 and March 15 – June4, 2009. Unpublished report prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. December 17, 2009.

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

Jain, A.A. 2005. Bird and Bat Behavior and Mortality at a Northern Iowa Windfarm. Thesis submitted to Iowa State University, Ames IA. 133 pgs.

Jain, A.A., R.R. Koford, A.W. Hancock, and G.G. Zenner. 2011. Bat Mortality and Activity at a Northern Iowa Wind Resource Area. Am. Mid. Natur. 165: 185-200.

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

Johnson, G.D., and W.P. Erickson. 2011. Avian Bat and Habitat Cumulative Impacts Associated with Wind Energy Development in the Columbia Plateau Ecoregion of Eastern Washington and Oregon. Prepared by WEST, Inc. for Klickitat County, Washington.

MNDNR. 2016. Natural Heritage Information System Correspondence #ERDB 20160322-0002, July 5, 2016.

New Century Environmental, LLC (NCE). 2017. Acoustic bat summary report; Palmer's Creek Wind Farm. *Interim* Technical Report prepared by NCE for Fagen, Inc.

Sauer, J.R., J.E. Hines, J.E. Fallon, K.L. Pardieck, D.J. Ziolkowski, Jr., and W.A. Link. 2011. The North American Breeding Bird Survey, Results and Analysis 1966 – 2010. Version 12.07.2011 USGS Patuxent Wildlife Research Center, Laurel, MD.

Tetra Tech. 2012. Database of publicly available post-construction fatality rates and records of bird and bat fatality at North American wind projects. Unpublished report.

Thelander, C.G., K.S. Smallwood, and L. Rugge. 2003. Bird Risk Behaviors and Fatalities at the Altamont Pass Wind Resource Area: Period of Performance: March 1988-December 2000.

Thompson, W. L. 2002. Towards Reliable Bird Surveys: Accounting for Individuals Present but not Detected. Auk 119:18-25

TRC Environmental Corporation. 2008. Post-Construction Avian and Bat Fatality Monitoring and Grassland Displacement Surveys at the Judith Gap Wind Energy Project. 45 pgs.

U.S. Fish and Wildlife Service (USFWS). 2013. Eagle Conservation Plan Guidance: Land-based Wind Energy (Vers. 2). April 2013. Available online: http://www.fws.gov/windenergy/PDF/Eagle%20Conservation%20Plan%20Guidance-Module%201.pdf.

Whitworth, D., S. H. Newman, T. Mundkur, and P. Harris. 2007. Wild Birds and Avian Influenza: an introduction to applied field research and disease sampling techniques. FAO Animal Production and Health Manual, No. 5. Rome. (also available at http://www.fao.org/docrep/010/a1521e/a1521e00.HTM)

Appendix A

Table 3a. Palmer's Creek Point Count Data by Season (Summer 2016 & 2017)																						
Species	Group	Obs	Ind	Fly	Mean Use per 20 min	Percent Composition	No. Surveys Species Observed	Frequency (% Surveys)	Proportion Ind. Flying	Proportion Ind. Flying Below RSA	Proportion Ind. Flying Within RSA	Proportion Ind. Flying Above RSA	Encounter Rate	N	NE	E	SE	S	SW	W	NW	Var
Brown-headed Cowbird	SB	13	136	122	2.13	15.54%	13	20.31%	89.71%	100.00%	0.00%	0.00%	0.00	2.46%	0.00%	5.74%	2.46%	0.00%	0.00%	27.87%	11.48%	50.00%
Red-winged Blackbird	SB	22	129	117	2.02	14.74%	22	34.38%	90.70%	100.00%	0.00%	0.00%	0.00	0.85%	3.42%	0.00%	4.27%	0.85%	0.00%	0.85%	2.56%	87.18%
Barn Swallow	SB	21	111	111	1.73	12.69%	21	32.81%	100.00%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	1.80%	0.00%	0.00%	0.00%	0.00%	0.00%	98.20%
American Goldfinch	SB	20	44	44	0.69	5.03%	19	29.69%	100.00%	100.00%	0.00%	0.00%	0.00	25.00%	4.55%	9.09%	18.18%	18.18%	6.82%	6.82%	2.27%	9.09%
European Starling	SB	3	44	44	0.69	5.03%	3	4.69%	100.00%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	13.64%	86.36%
American Crow	C	8	39	32	0.61	4.46%	8	12.50%	82.05%	100.00%	0.00%	0.00%	0.00	12.50%	3.13%	0.00%	0.00%	0.00%	15.63%	15.63%	53.13%	0.00%
Field Sparrow	SB	17	35	12	0.55	4.00%	17	26.56%	34.29%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%
Blue Jay	C	12	28	8	0.44	3.20%	12	18.75%	28.57%	100.00%	0.00%	0.00%	0.00	37.50%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	62.50%
Horned Lark	SB	13	26	21	0.41	2.97%	13	20.31%	80.77%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	4.76%	0.00%	4.76%	9.52%	0.00%	80.95%
Tree Swallow	SB	9	23	23	0.36	2.63%	9	14.06%	100.00%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	13.04%	86.96%
Rock Pigeon	PD	9	22	16	0.34	2.51%	9	14.06%	72.73%	93.75%	6.25%	0.00%	0.02	6.25%	62.50%	12.50%	0.00%	6.25%	0.00%	12.50%	0.00%	0.00%
Common Yellowthroat	SB	10	20	0	0.31	2.29%	10	15.63%	0.00%	0.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Yellow Warbler	SB	4	20	13	0.31	2.29%	3	4.69%	65.00%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%
Clay-colored Sparrow	SB	12	16	0	0.25	1.83%	12	18.75%	0.00%	0.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Mourning Dove	PD	9	14	11	0.22	1.60%	9	14.06%	78.57%	90.91%	9.09%	0.00%	0.02	54.55%	0.00%	18.18%	9.09%	0.00%	0.00%	18.18%	0.00%	0.00%
American Robin	SB	8	14	6	0.22	1.60%	8	12.50%	42.86%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	16.67%	50.00%	0.00%	33.33%	0.00%	0.00%	0.00%
Killdeer	SH	9	12	5	0.19	1.37%	9	14.06%	41.67%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	40.00%	0.00%	0.00%	0.00%	0.00%	0.00%	60.00%
Ring-necked Pheasant	GB	8	12	0	0.19	1.37%	8	12.50%	0.00%	0.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Bank Swallow	SB	1	12	12	0.19	1.37%	1	1.56%	100.00%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%
Common Grackle	SB	4	11	11	0.17	1.26%	4	6.25%	100.00%	100.00%	0.00%	0.00%	0.00	0.00%	36.36%	9.09%	36.36%	18.18%	0.00%	0.00%	0.00%	0.00%
Unknown Duck	WF	2	11	0	0.17	1.26%	2	3.13%	0.00%	0.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Vesper Sparrow	SB	6	10	0	0.16	1.14%	6	9.38%	0.00%	0.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Chipping Sparrow	SB	8	9	5	0.14	1.03%	8	12.50%	55.56%	100.00%	0.00%	0.00%	0.00	20.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	80.00%
Mallard	WF	4	9	0	0.14	1.03%	4	6.25%	0.00%	0.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Song Sparrow	SB	5	7	0	0.11	0.80%	5	7.81%	0.00%	0.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Cedar Waxwing	SB	3	6	4	0.09	0.69%	3	4.69%	66.67%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%
Sedge Wren	SB	5	5	0	0.08	0.57%	5	7.81%	0.00%	0.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Turkey Vulture	RVO	4	5	5	0.08	0.57%	4	6.25%	100.00%	20.00%	80.00%	0.00%	0.06	0.00%	0.00%	0.00%	0.00%	20.00%	0.00%	40.00%	0.00%	40.00%
Eastern Kingbird	SB	3	4	2	0.06	0.46%	3	4.69%	50.00%	100.00%	0.00%	0.00%	0.00	50.00%	0.00%	0.00%	50.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Least Flycatcher	SB	3	4	0	0.06	0.46%	3	4.69%	0.00%	0.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Ring-billed Gull	GT	2	4	4	0.06	0.46%	2	3.13%	100.00%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	25.00%	0.00%	0.00%	0.00%	75.00%	0.00%
Black-capped Chickadee	SB	2	4	0	0.06	0.46%	2	3.13%	0.00%	0.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
American White Pelican	WB	1	4	4	0.06	0.46%	1	1.56%	100.00%	0.00%	100.00%	0.00%	0.06	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%
Red-tailed Hawk	RVO	3	3	3	0.05	0.34%	3	4.69%	100.00%	66.67%	33.33%	0.00%	0.02	33.33%	0.00%	33.33%	0.00%	0.00%	33.33%	0.00%	0.00%	0.00%
Eastern Wood-Pewee	SB	3	3	0	0.05	0.34%	3	4.69%	0.00%	0.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Downy Woodpecker	WP	3	3	0	0.05	0.34%	3	4.69%	0.00%	0.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Canada Goose	WF	2	3	0	0.05	0.34%	2	3.13%	0.00%	0.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Belted Kingfisher	SB	2	2	1	0.03	0.23%	2	3.13%	50.00%	100.00%	0.00%	0.00%	0.00	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Great Blue Heron	WA	2	2	2	0.03	0.23%	2	3.13%	100.00%	50.00%	50.00%	0.00%	0.02	0.00%	0.00%	0.00%	0.00%	50.00%	0.00%	0.00%	50.00%	0.00%
Grasshopper Sparrow	SB	2	2	0	0.03	0.23%	2	3.13%	0.00%	0.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Yellow-headed Blackbird	SB	2	2	1	0.03	0.23%	2	3.13%	50.00%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%
Swainson's Hawk	RVO	1	1	1	0.02	0.11%	1	1.56%	100.00%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%
Bobolink	SB	1	1	0	0.02	0.11%	1	1.56%	0.00%	0.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Willow Flycatcher	SB	1	1	0	0.02	0.11%	1	1.56%	0.00%	0.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Marsh Wren	SB	1	1	0	0.02	0.11%	1	1.56%	0.00%	0.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Wild Turkey	GB	1	1	0	0.02	0.11%	1	1.56%	0.00%	0.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
		284	**875**	**640**	**13.67**	**100.00%**			**73.14%**				**0.19**	**5.16%**	**3.28%**	**3.44%**	**4.22%**	**4.84%**	**2.03%**	**7.97%**	**8.13%**	**60.94%**

Table 3b. Palmer's Creek Point Count Data by Season (Fall 2016)																						
Species	**Group**	**Obs**	**Ind**	**Fly**	**Mean Use per 20 min**	**Percent Composition**	**No. Surveys Species Observed**	**Frequency (% Surveys)**	**Proportion Ind. Flying**	**Proportion Ind. Flying Below RSA**	**Proportion Ind. Flying Within RSA**	**Proportion Ind. Flying Above RSA**	**Encounter Rate**	**N**	**NE**	**E**	**SE**	**S**	**SW**	**W**	**NW**	**Var**
American Crow	C	27	249	70	2.59	14.63%	23	23.96%	28.11%	68.57%	31.43%	0.00%	0.23	14.29%	2.86%	4.29%	10.00%	12.86%	0.00%	0.00%	10.00%	45.71%
Red-winged Blackbird	SB	12	205	205	2.14	12.04%	12	12.50%	100.00%	87.32%	12.68%	0.00%	0.27	0.00%	0.00%	0.00%	26.34%	23.90%	18.54%	0.00%	0.00%	31.22%
Brown-headed Cowbird	SB	15	199	164	2.07	11.69%	14	14.58%	82.41%	100.00%	0.00%	0.00%	0.00	7.32%	0.00%	0.61%	9.15%	23.78%	32.32%	8.54%	0.00%	18.29%
Canada Goose	WF	10	130	124	1.35	7.64%	10	10.42%	95.38%	24.19%	0.00%	75.81%	0.00	0.81%	0.00%	0.00%	41.94%	42.74%	14.52%	0.00%	0.00%	0.00%
European Starling	SB	6	104	75	1.08	6.11%	6	6.25%	72.12%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	58.67%	0.00%	0.00%	0.00%	41.33%
American Goldfinch	SB	15	90	90	0.94	5.29%	14	14.58%	100.00%	97.78%	2.22%	0.00%	0.02	2.22%	2.22%	46.67%	7.78%	18.89%	5.56%	0.00%	0.00%	16.67%
Blue Jay	C	26	80	55	0.83	4.70%	26	27.08%	68.75%	100.00%	0.00%	0.00%	0.00	10.91%	18.18%	18.18%	7.27%	16.36%	12.73%	14.55%	0.00%	1.82%
Rock Pigeon	PD	17	79	79	0.82	4.64%	17	17.71%	100.00%	97.47%	2.53%	0.00%	0.02	26.58%	0.00%	10.13%	0.00%	2.53%	0.00%	6.33%	13.92%	40.51%
Barn Swallow	SB	5	77	77	0.80	4.52%	5	5.21%	100.00%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%
Field Sparrow	SB	22	61	48	0.64	3.58%	22	22.92%	78.69%	100.00%	0.00%	0.00%	0.00	8.33%	0.00%	4.17%	0.00%	4.17%	4.17%	2.08%	0.00%	77.08%
Dark-eyed Junco	SB	6	54	54	0.56	3.17%	6	6.25%	100.00%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	29.63%	0.00%	70.37%
Horned Lark	SB	5	47	43	0.49	2.76%	5	5.21%	91.49%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	34.88%	0.00%	53.49%	0.00%	11.63%
Unknown Blackbird	SB	1	40	40	0.42	2.35%	1	1.04%	100.00%	0.00%	100.00%	0.00%	0.42	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
American Tree Sparrow	SB	5	38	37	0.40	2.23%	5	5.21%	97.37%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	35.14%	64.86%
Black-capped Chickadee	SB	7	36	36	0.38	2.12%	7	7.29%	100.00%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	5.56%	0.00%	0.00%	22.22%	13.89%	0.00%	58.33%
Common Grackle	SB	4	25	25	0.26	1.47%	4	4.17%	100.00%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	8.00%	68.00%	20.00%	0.00%	4.00%	0.00%
Ring-billed Gull	GT	4	21	21	0.22	1.23%	4	4.17%	100.00%	19.05%	80.95%	0.00%	0.18	0.00%	0.00%	0.00%	0.00%	9.52%	0.00%	9.52%	0.00%	80.95%
Snow Goose	WF	2	20	20	0.21	1.18%	2	2.08%	100.00%	10.00%	0.00%	90.00%	0.00	0.00%	0.00%	0.00%	90.00%	10.00%	0.00%	0.00%	0.00%	0.00%
Red-tailed Hawk	RVO	16	19	17	0.20	1.12%	15	15.63%	89.47%	52.94%	23.53%	23.53%	0.04	5.88%	0.00%	0.00%	29.41%	29.41%	5.88%	11.76%	5.88%	11.76%
American Robin	SB	8	15	11	0.16	0.88%	8	8.33%	73.33%	100.00%	0.00%	0.00%	0.00	18.18%	0.00%	0.00%	9.09%	18.18%	0.00%	0.00%	27.27%	27.27%
Northern Flicker	WP	6	15	15	0.16	0.88%	6	6.25%	100.00%	100.00%	0.00%	0.00%	0.00	0.00%	26.67%	0.00%	20.00%	33.33%	20.00%	0.00%	0.00%	0.00%
Cedar Waxwing	SB	3	15	15	0.16	0.88%	3	3.13%	100.00%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	53.33%	46.67%	0.00%	0.00%	0.00%	0.00%	0.00%
Western Meadowlark	SB	3	14	14	0.15	0.82%	3	3.13%	100.00%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	50.00%	35.71%	0.00%	14.29%	0.00%	0.00%
Mourning Dove	PD	8	13	10	0.14	0.76%	8	8.33%	76.92%	100.00%	0.00%	0.00%	0.00	30.00%	0.00%	10.00%	0.00%	10.00%	10.00%	40.00%	0.00%	0.00%
Bald Eagle	RVO	8	10	9	0.10	0.59%	6	6.25%	90.00%	11.11%	33.33%	55.56%	0.03	0.00%	33.33%	0.00%	44.44%	11.11%	0.00%	0.00%	0.00%	11.11%
Downy Woodpecker	WP	7	7	7	0.07	0.41%	7	7.29%	100.00%	100.00%	0.00%	0.00%	0.00	14.29%	0.00%	14.29%	28.57%	0.00%	14.29%	28.57%	0.00%	0.00%
Turkey Vulture	RVO	5	7	7	0.07	0.41%	5	5.21%	100.00%	42.86%	28.57%	28.57%	0.02	0.00%	0.00%	42.86%	57.14%	0.00%	0.00%	0.00%	0.00%	0.00%
Unknown Duck	WF	3	7	1	0.07	0.41%	3	3.13%	14.29%	0.00%	100.00%	0.00%	0.01	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Eastern Bluebird	SB	2	6	6	0.06	0.35%	2	2.08%	100.00%	100.00%	0.00%	0.00%	0.00	16.67%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	83.33%	0.00%
Rough-legged Hawk	RVO	3	4	4	0.04	0.24%	2	2.08%	100.00%	25.00%	25.00%	50.00%	0.01	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Killdeer	SH	2	3	2	0.03	0.18%	2	2.08%	66.67%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%
Swainson's Hawk	RVO	2	3	1	0.03	0.18%	2	2.08%	33.33%	0.00%	100.00%	0.00%	0.01	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Common Yellowthroat	SB	2	2	0	0.02	0.12%	2	2.08%	0.00%	0.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Ring-necked Pheasant	GB	2	2	1	0.02	0.12%	2	2.08%	50.00%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%
American Kestrel	RVO	1	1	1	0.01	0.06%	1	1.04%	100.00%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%
Belted Kingfisher	SB	1	1	1	0.01	0.06%	1	1.04%	100.00%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%
Least Flycatcher	SB	1	1	1	0.01	0.06%	1	1.04%	100.00%	100.00%	0.00%	0.00%	0.00	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Wild Turkey	GB	1	1	0	0.01	0.06%	1	1.04%	0.00%	0.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Wilson's Snipe	SH	1	1	0	0.01	0.06%	1	1.04%	0.00%	0.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
		274	**1,702**	**1,386**	**17.73**	**100.00%**			**81.43%**				**1.26**	**7.50%**	**1.59%**	**5.84%**	**14.29%**	**20.20%**	**10.25%**	**6.13%**	**3.03%**	**31.17%**

Table 3c. Palmer's Creek Point Count Data by Season (Winter 2016-2017)																						
Species	**Group**	**Obs**	**Ind**	**Fly**	**Mean Use per 20 min**	**Percent Composition**	**No. Surveys Species Observed**	**Frequency (% Surveys)**	**Proportion Ind. Flying**	**Proportion Ind. Flying Below RSA**	**Proportion Ind. Flying Within RSA**	**Proportion Ind. Flying Above RSA**	**Encounter Rate**	**N**	**NE**	**E**	**SE**	**S**	**SW**	**W**	**NW**	**Var**
European Starling	SB	10	339	309	7.06	41.24%	10	20.83%	91.15%	100.00%	0.00%	0.00%	0.00	10.03%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	89.97%
Snow Bunting	SB	6	109	109	2.27	13.26%	6	12.50%	100.00%	100.00%	0.00%	0.00%	0.00	0.00%	15.60%	0.00%	0.00%	15.60%	0.00%	18.35%	0.00%	50.46%
Wild Turkey	GB	4	92	0	1.92	11.19%	4	8.33%	0.00%	0.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
American Crow	C	15	57	44	1.19	6.93%	15	31.25%	77.19%	97.73%	2.27%	0.00%	0.02	43.18%	0.00%	0.00%	29.55%	13.64%	11.36%	2.27%	0.00%	0.00%
Unknown Duck	WF	2	46	46	0.96	5.60%	2	4.17%	100.00%	0.00%	100.00%	0.00%	0.96	30.43%	0.00%	0.00%	69.57%	0.00%	0.00%	0.00%	0.00%	0.00%
Unidentified Sparrow	SB	4	35	34	0.73	4.26%	4	8.33%	97.14%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	2.94%	0.00%	97.06%
Rock Pigeon	PD	10	31	31	0.65	3.77%	10	20.83%	100.00%	100.00%	0.00%	0.00%	0.00	6.45%	0.00%	6.45%	0.00%	0.00%	0.00%	16.13%	9.68%	61.29%
Black-capped Chickadee	SB	5	28	28	0.58	3.41%	5	10.42%	100.00%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%
Dark-eyed Junco	SB	4	28	28	0.58	3.41%	4	8.33%	100.00%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	17.86%	82.14%
Blue Jay	C	9	18	11	0.38	2.19%	9	18.75%	61.11%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	9.09%	27.27%	9.09%	0.00%	18.18%	36.36%	0.00%
Ring-necked Pheasant	GB	4	12	6	0.25	1.46%	4	8.33%	50.00%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Savannah Sparrow	SB	1	8	0	0.17	0.97%	1	2.08%	0.00%	0.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Canada Goose	WF	1	7	7	0.15	0.85%	1	2.08%	100.00%	0.00%	0.00%	100.00%	0.00	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%
Red-tailed Hawk	RVO	6	6	6	0.13	0.73%	5	10.42%	100.00%	50.00%	33.33%	16.67%	0.04	50.00%	0.00%	0.00%	16.67%	16.67%	16.67%	0.00%	0.00%	0.00%
Downy Woodpecker	WP	2	2	1	0.04	0.24%	2	4.17%	50.00%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%
Horned Lark	SB	1	2	2	0.04	0.24%	1	2.08%	100.00%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%
Northern Harrier	RVO	1	1	1	0.02	0.12%	1	2.08%	100.00%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Swainson's Hawk	RVO	1	1	1	0.02	0.12%	1	2.08%	100.00%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%
		86	**822**	**664**	**17.13**	**100.00%**			**80.78%**				**0.00**	**10.39%**	**2.56%**	**0.60%**	**8.28%**	**5.12%**	**0.90%**	**4.37%**	**1.81%**	**65.96%**

Table 3d. Palmer's Creek Point Count Data by Season (Spring 2017)

Species	Group	Obs	Ind	Fly	Mean Use per 20 min	Percent Composition	No. Surveys Species Observed	Frequency (% Surveys)	Proportion Ind. Flying	Proportion Ind. Flying Below RSA	Proportion Ind. Flying Within RSA	Proportion Ind. Flying Above RSA	Encounter Rate	N	NE	E	SE	S	SW	W	NW	Var
European Starling	SB	15	567	562	7.09	28.80%	15	18.75%	99.12%	97.69%	2.31%	0.00%	0.16	0.00%	0.00%	0.00%	0.00%	2.31%	0.00%	0.00%	0.00%	97.69%
Red-winged Blackbird	SB	18	354	354	4.43	17.98%	15	18.75%	100.00%	98.31%	1.69%	0.00%	0.08	0.00%	0.00%	0.00%	1.13%	0.56%	3.95%	44.35%	0.28%	49.72%
American Crow	C	23	221	214	2.76	11.22%	19	23.75%	96.83%	77.10%	22.90%	0.00%	0.61	23.36%	9.35%	15.89%	0.00%	27.10%	3.27%	20.09%	0.93%	0.00%
Canada Goose	WF	21	208	119	2.60	10.56%	20	25.00%	57.21%	0.00%	96.64%	3.36%	1.44	14.29%	0.00%	5.04%	8.40%	0.00%	0.00%	0.00%	72.27%	0.00%
Horned Lark	SB	34	124	105	1.55	6.30%	30	37.50%	84.68%	100.00%	0.00%	0.00%	0.00	4.76%	1.90%	2.86%	0.95%	3.81%	0.00%	2.86%	5.71%	77.14%
Common Grackle	SB	6	53	53	0.66	2.69%	6	7.50%	100.00%	73.58%	26.42%	0.00%	0.18	3.77%	0.00%	0.00%	32.08%	0.00%	0.00%	9.43%	54.72%	0.00%
Mallard	WF	13	51	31	0.64	2.59%	11	13.75%	60.78%	45.16%	6.45%	48.39%	0.03	58.06%	19.35%	0.00%	3.23%	6.45%	0.00%	0.00%	9.68%	0.00%
Wild Turkey	GB	4	45	0	0.56	2.29%	4	5.00%	0.00%	0.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Rock Pigeon	PD	13	40	40	0.50	2.03%	12	15.00%	100.00%	77.50%	22.50%	0.00%	0.11	40.00%	0.00%	0.00%	32.50%	10.00%	2.50%	0.00%	0.00%	15.00%
Brown-headed Cowbird	SB	5	40	39	0.50	2.03%	5	6.25%	97.50%	100.00%	0.00%	0.00%	0.00	0.00%	15.38%	0.00%	0.00%	7.69%	0.00%	0.00%	0.00%	76.92%
Unidentified Sparrow	SB	1	25	25	0.31	1.27%	1	1.25%	100.00%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%
American Robin	SB	10	24	13	0.30	1.22%	10	12.50%	54.17%	100.00%	0.00%	0.00%	0.00	15.38%	0.00%	46.15%	0.00%	30.77%	0.00%	7.69%	0.00%	0.00%
Blue Jay	C	11	22	7	0.28	1.12%	11	13.75%	31.82%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	14.29%	0.00%	14.29%	42.86%	28.57%
Dark-eyed Junco	SB	3	18	18	0.23	0.91%	3	3.75%	100.00%	100.00%	0.00%	0.00%	0.00	38.89%	0.00%	0.00%	0.00%	0.00%	0.00%	22.22%	0.00%	38.89%
Red-tailed Hawk	RVO	16	17	17	0.21	0.86%	15	18.75%	100.00%	17.65%	76.47%	5.88%	0.16	11.76%	23.53%	5.88%	23.53%	5.88%	0.00%	11.76%	17.65%	0.00%
Bald Eagle	RVO	13	17	17	0.21	0.86%	8	10.00%	100.00%	47.06%	29.41%	23.53%	0.06	29.41%	0.00%	0.00%	5.88%	29.41%	5.88%	0.00%	23.53%	5.88%
Turkey Vulture	RVO	6	16	16	0.20	0.81%	5	6.25%	100.00%	0.00%	93.75%	6.25%	0.19	0.00%	0.00%	18.75%	0.00%	0.00%	0.00%	0.00%	81.25%	0.00%
American Goldfinch	SB	3	12	12	0.15	0.61%	3	3.75%	100.00%	100.00%	0.00%	0.00%	0.00	66.67%	33.33%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Black-capped Chickadee	SB	2	12	12	0.15	0.61%	2	2.50%	100.00%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%
American White Pelican	WB	2	12	12	0.15	0.61%	2	2.50%	100.00%	0.00%	100.00%	0.00%	0.15	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	25.00%	75.00%	0.00%
Ring-necked Pheasant	GB	9	11	1	0.14	0.56%	9	11.25%	9.09%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%
Field Sparrow	SB	5	11	2	0.14	0.56%	5	6.25%	18.18%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Unknown Duck	WF	5	10	5	0.13	0.51%	5	6.25%	50.00%	0.00%	100.00%	0.00%	0.06	0.00%	0.00%	0.00%	80.00%	0.00%	20.00%	0.00%	0.00%	0.00%
Killdeer	SH	5	8	4	0.10	0.41%	5	6.25%	50.00%	100.00%	0.00%	0.00%	0.00	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Mourning Dove	PD	6	7	3	0.09	0.36%	6	7.50%	42.86%	100.00%	0.00%	0.00%	0.00	66.67%	0.00%	0.00%	0.00%	0.00%	33.33%	0.00%	0.00%	0.00%
Tree Swallow	SB	4	7	7	0.09	0.36%	4	5.00%	100.00%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	14.29%	0.00%	85.71%
Savannah Sparrow	SB	1	7	7	0.09	0.36%	1	1.25%	100.00%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%
Cedar Waxwing	SB	2	6	3	0.08	0.30%	2	2.50%	50.00%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%
Yellow-headed Blackbird	SB	2	6	6	0.08	0.30%	2	2.50%	100.00%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%
Chipping Sparrow	SB	2	2	1	0.03	0.10%	2	2.50%	50.00%	100.00%	0.00%	0.00%	0.00	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Song Sparrow	SB	2	2	0	0.03	0.10%	2	2.50%	0.00%	0.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Northern Flicker	WP	2	2	2	0.03	0.10%	2	2.50%	100.00%	100.00%	0.00%	0.00%	0.00	0.00%	50.00%	0.00%	0.00%	0.00%	0.00%	50.00%	0.00%	0.00%
Downy Woodpecker	WP	2	2	1	0.03	0.10%	2	2.50%	50.00%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Eastern Bluebird	SB	1	2	2	0.03	0.10%	1	1.25%	100.00%	100.00%	0.00%	0.00%	0.00	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Western Meadowlark	SB	1	1	0	0.01	0.05%	1	1.25%	0.00%	0.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Northern Harrier	RVO	1	1	1	0.01	0.05%	1	1.25%	100.00%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%
Cooper's Hawk	RVO	1	1	1	0.01	0.05%	1	1.25%	100.00%	0.00%	100.00%	0.00%	0.01	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%
Belted Kingfisher	SB	1	1	1	0.01	0.05%	1	1.25%	100.00%	100.00%	0.00%	0.00%	0.00	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Upland Sandpiper	SH	1	1	0	0.01	0.05%	1	1.25%	0.00%	0.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Blue-winged teal	WF	1	1	0	0.01	0.05%	1	1.25%	0.00%	0.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Clay-colored Sparrow	SB	1	1	0	0.01	0.05%	1	1.25%	0.00%	0.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Yellow Warbler	SB	1	1	1	0.01	0.05%	1	1.25%	100.00%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%
		275	**1,969**	**1,714**	**24.61**	**100.00%**			**87.05%**				**0.00**	**8.17%**	**2.63%**	**3.09%**	**3.39%**	**5.90%**	**1.52%**	**14.36%**	**9.40%**	**51.55%**

Table 4. Cumulative Palmer's Creek Point Count Data (Summer 2016-Summer 2017)

Species	Group	Obs	Ind	Fly	Mean Use per 20 min	Percent Composition	No. Surveys Species Observed	Frequency (% Surveys)	Proportion Ind. Flying	Proportion Ind. Flying Below RSA	Proportion Ind. Flying Within RSA	Proportion Ind. Flying Above RSA	Encounter Rate	N	NE	E	SE	S	SW	W	NW	Var
European Starling	SB	34	1054	990	3.66	19.63%	8	2.78%	93.93%	98.69%	1.31%	0.00%	0.05	3.13%	0.00%	0.00%	0.00%	5.76%	0.00%	0.00%	0.61%	90.51%
Red-winged Blackbird	SB	52	688	676	2.39	12.82%	34	11.81%	98.26%	95.27%	4.73%	0.00%	0.11	0.15%	0.59%	0.00%	9.32%	7.69%	7.69%	23.37%	0.59%	50.59%
American Crow	C	73	566	360	1.97	10.54%	29	10.07%	63.60%	80.00%	20.00%	0.00%	0.25	23.06%	6.39%	10.28%	5.56%	20.28%	4.72%	13.61%	7.22%	8.89%
Brown-headed Cowbird	SB	33	375	325	1.30	6.99%	27	9.38%	86.67%	100.00%	0.00%	0.00%	0.00	4.62%	1.85%	2.46%	5.54%	12.92%	16.31%	14.77%	4.31%	37.23%
Canada Goose	WF	34	348	250	1.21	6.48%	12	4.17%	71.84%	12.00%	46.00%	42.00%	0.40	7.20%	0.00%	2.40%	24.80%	24.00%	7.20%	0.00%	34.40%	0.00%
Horned Lark	SB	53	199	171	0.69	3.71%	18	6.25%	85.93%	100.00%	0.00%	0.00%	0.00	2.92%	1.17%	1.75%	1.17%	11.11%	0.58%	16.37%	3.51%	61.40%
Barn Swallow	SB	26	188	188	0.65	3.50%	26	9.03%	100.00%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	1.06%	0.00%	0.00%	0.00%	0.00%	0.00%	98.94%
Rock Pigeon	PD	49	172	166	0.60	3.20%	26	9.03%	96.51%	92.77%	7.23%	0.00%	0.04	24.10%	6.02%	7.23%	7.83%	4.22%	0.60%	7.23%	8.43%	34.34%
Blue Jay	C	58	148	81	0.51	2.76%	38	13.19%	54.73%	100.00%	0.00%	0.00%	0.00	11.11%	12.35%	13.58%	8.64%	13.58%	8.64%	13.58%	8.64%	9.88%
American Goldfinch	SB	38	146	146	0.51	2.72%	33	11.46%	100.00%	98.63%	1.37%	0.00%	0.01	14.38%	5.48%	31.51%	10.27%	17.12%	5.48%	2.05%	0.68%	13.01%
Wild Turkey	GB	10	139	0	0.48	2.59%	2	0.69%	0.00%	0.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Snow Bunting	SB	6	109	109	0.38	2.03%	0	0.00%	100.00%	100.00%	0.00%	0.00%	0.00	0.00%	15.60%	0.00%	0.00%	15.60%	0.00%	18.35%	0.00%	50.46%
Field Sparrow	SB	44	107	62	0.37	1.99%	39	13.54%	57.94%	100.00%	0.00%	0.00%	0.00	6.45%	0.00%	3.23%	3.23%	3.23%	3.23%	1.61%	0.00%	79.03%
Dark-eyed Junco	SB	13	100	100	0.35	1.86%	6	2.08%	100.00%	100.00%	0.00%	0.00%	0.00	7.00%	0.00%	0.00%	0.00%	0.00%	0.00%	20.00%	5.00%	68.00%
Common Grackle	SB	14	89	89	0.31	1.66%	8	2.78%	100.00%	84.27%	15.73%	0.00%	0.05	2.25%	4.49%	1.12%	25.84%	21.35%	5.62%	5.62%	33.71%	0.00%
Black-capped Chickadee	SB	16	80	76	0.28	1.49%	9	3.13%	95.00%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	2.63%	0.00%	0.00%	10.53%	6.58%	0.00%	80.26%
Unknown Duck	WF	12	74	52	0.26	1.38%	5	1.74%	70.27%	0.00%	100.00%	0.00%	0.18	26.92%	0.00%	0.00%	71.15%	0.00%	1.92%	0.00%	0.00%	0.00%
Mallard	WF	17	60	31	0.21	1.12%	4	1.39%	51.67%	45.16%	6.45%	48.39%	0.01	58.06%	19.35%	0.00%	3.23%	6.45%	0.00%	0.00%	9.68%	0.00%
Unidentified Sparrow	SB	5	60	59	0.21	1.12%	0	0.00%	98.33%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	44.07%	0.00%	55.93%
American Robin	SB	26	53	30	0.18	0.99%	16	5.56%	56.60%	100.00%	0.00%	0.00%	0.00	13.33%	0.00%	23.33%	13.33%	20.00%	6.67%	3.33%	10.00%	10.00%
Red-tailed Hawk	RVO	41	45	43	0.16	0.84%	18	6.25%	95.56%	39.53%	46.51%	13.95%	0.07	16.28%	9.30%	4.65%	23.26%	16.28%	6.98%	9.30%	9.30%	4.65%
Unknown Blackbird	SB	1	40	40	0.14	0.75%	1	0.35%	100.00%	0.00%	100.00%	0.00%	0.14	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
American Tree Sparrow	SB	5	38	37	0.13	0.71%	5	1.74%	97.37%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	35.14%	64.86%
Ring-necked Pheasant	GB	23	37	8	0.13	0.69%	10	3.47%	21.62%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	75.00%	0.00%	12.50%	12.50%	0.00%	0.00%
Mourning Dove	PD	23	34	24	0.12	0.63%	17	5.90%	70.59%	95.83%	4.17%	0.00%	0.00	45.83%	0.00%	12.50%	4.17%	4.17%	8.33%	25.00%	0.00%	0.00%
Tree Swallow	SB	13	30	30	0.10	0.56%	9	3.13%	100.00%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	3.33%	10.00%	86.67%
Turkey Vulture	RVO	15	28	28	0.10	0.52%	9	3.13%	100.00%	14.29%	75.00%	10.71%	0.07	0.00%	0.00%	21.43%	14.29%	3.57%	0.00%	7.14%	46.43%	7.14%
Bald Eagle	RVO	21	27	26	0.09	0.50%	6	2.08%	96.30%	34.62%	30.77%	34.62%	0.03	19.23%	11.54%	0.00%	19.23%	23.08%	3.85%	0.00%	15.38%	7.69%
Cedar Waxwing	SB	8	27	22	0.09	0.50%	6	2.08%	81.48%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	36.36%	31.82%	31.82%	0.00%	0.00%	0.00%	0.00%
Ring-billed Gull	GT	6	25	25	0.09	0.47%	6	2.08%	100.00%	32.00%	68.00%	0.00%	0.06	0.00%	0.00%	0.00%	4.00%	8.00%	0.00%	8.00%	12.00%	68.00%
Killdeer	SH	16	23	11	0.08	0.43%	11	3.82%	47.83%	100.00%	0.00%	0.00%	0.00	36.36%	0.00%	18.18%	0.00%	0.00%	0.00%	0.00%	0.00%	45.45%
Common Yellowthroat	SB	12	22	0	0.08	0.41%	12	4.17%	0.00%	0.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Yellow Warbler	SB	5	21	14	0.07	0.39%	3	1.04%	66.67%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	92.86%	0.00%	0.00%	7.14%	0.00%
Snow Goose	WF	2	20	20	0.07	0.37%	2	0.69%	100.00%	10.00%	0.00%	90.00%	0.00	0.00%	0.00%	0.00%	90.00%	10.00%	0.00%	0.00%	0.00%	0.00%
Clay-colored Sparrow	SB	13	17	0	0.06	0.32%	12	4.17%	0.00%	0.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Northern Flicker	WP	8	17	17	0.06	0.32%	6	2.08%	100.00%	100.00%	0.00%	0.00%	0.00	0.00%	29.41%	0.00%	17.65%	29.41%	17.65%	5.88%	0.00%	0.00%
American White Pelican	WB	3	16	16	0.06	0.30%	1	0.35%	100.00%	0.00%	100.00%	0.00%	0.06	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	18.75%	81.25%	0.00%
Western Meadowlark	SB	4	15	14	0.05	0.28%	3	1.04%	93.33%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	50.00%	35.71%	0.00%	14.29%	0.00%	0.00%
Savannah Sparrow	SB	2	15	7	0.05	0.28%	0	0.00%	46.67%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%
Downy Woodpecker	WP	14	14	9	0.05	0.26%	10	3.47%	64.29%	100.00%	0.00%	0.00%	0.00	11.11%	0.00%	11.11%	33.33%	11.11%	11.11%	22.22%	0.00%	0.00%
Bank Swallow	SB	1	12	12	0.04	0.22%	1	0.35%	100.00%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%
Chipping Sparrow	SB	10	11	6	0.04	0.20%	8	2.78%	54.55%	100.00%	0.00%	0.00%	0.00	33.33%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	66.67%
Vesper Sparrow	SB	6	10	0	0.03	0.19%	6	2.08%	0.00%	0.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Song Sparrow	SB	7	9	0	0.03	0.17%	5	1.74%	0.00%	0.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Yellow-headed Blackbird	SB	4	8	7	0.03	0.15%	2	0.69%	87.50%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%
Eastern Bluebird	SB	3	8	8	0.03	0.15%	2	0.69%	100.00%	100.00%	0.00%	0.00%	0.00	12.50%	25.00%	0.00%	0.00%	0.00%	0.00%	0.00%	62.50%	0.00%
Sedge Wren	SB	5	5	0	0.02	0.09%	5	1.74%	0.00%	0.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Least Flycatcher	SB	4	5	1	0.02	0.09%	4	1.39%	20.00%	100.00%	0.00%	0.00%	0.00	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Swainson's Hawk	RVO	4	5	3	0.02	0.09%	3	1.04%	60.00%	66.67%	33.33%	0.00%	0.00	0.00%	0.00%	0.00%	33.33%	33.33%	33.33%	0.00%	0.00%	0.00%
Belted Kingfisher	SB	4	4	3	0.01	0.07%	3	1.04%	75.00%	100.00%	0.00%	0.00%	0.00	66.67%	0.00%	0.00%	0.00%	33.33%	0.00%	0.00%	0.00%	0.00%
Eastern Kingbird	SB	3	4	2	0.01	0.07%	3	1.04%	50.00%	100.00%	0.00%	0.00%	0.00	50.00%	0.00%	0.00%	50.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Rough-legged Hawk	RVO	3	4	4	0.01	0.07%	2	0.69%	100.00%	25.00%	25.00%	50.00%	0.00	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Eastern Wood-Pewee	SB	3	3	0	0.01	0.06%	3	1.04%	0.00%	0.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Grasshopper Sparrow	SB	2	2	0	0.01	0.04%	2	0.69%	0.00%	0.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Great Blue Heron	WA	2	2	2	0.01	0.04%	2	0.69%	100.00%	50.00%	50.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	50.00%	0.00%	0.00%	50.00%	0.00%
Northern Harrier	RVO	2	2	2	0.01	0.04%	0	0.00%	100.00%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	50.00%	0.00%	50.00%	0.00%	0.00%	0.00%	0.00%
American Kestrel	RVO	1	1	1	0.00	0.02%	1	0.35%	100.00%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%
Blue-winged teal	WF	1	1	0	0.00	0.02%	0	0.00%	0.00%	0.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Bobolink	SB	1	1	0	0.00	0.02%	1	0.35%	0.00%	0.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Cooper's Hawk	RVO	1	1	1	0.00	0.02%	0	0.00%	100.00%	0.00%	100.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%
Marsh Wren	SB	1	1	0	0.00	0.02%	1	0.35%	0.00%	0.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Upland Sandpiper	SH	1	1	0	0.00	0.02%	0	0.00%	0.00%	0.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Willow Flycatcher	SB	1	1	0	0.00	0.02%	1	0.35%	0.00%	0.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Wilson's Snipe	SH	1	1	0	0.00	0.02%	1	0.35%	0.00%	0.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
		919	**5,368**	**4,404**	**18.64**	**100.00%**			**82.04%**				**1.53**	**7.86%**	**2.38%**	**3.63%**	**7.68%**	**10.13%**	**4.25%**	**9.33%**	**6.06%**	**48.67%**

Table 5. Cumulative Palmer's Creek Point Count Avian Species by Group															
Species	Summer 2016 & 2017			Fall 2016			Winter 2016-2017			Spring 2017			Cumulative		
	Ind	Obs	Mean Use per 20 min	Ind	Obs	Mean Use per 20 min	Ind	Obs	Mean Use per 20 min	Ind	Obs	Mean Use per 20 min	Ind	Obs	Mean Use per 20 min
Songbirds															
European Starling	44	3	0.69	104	6	1.08	339	10	7.06	567	15	7.09	1,054	34	3.66
Red-winged Blackbird	129	22	2.02	205	12	2.14	0	0	0.00	354	18	4.43	688	52	2.39
Brown-headed Cowbird	136	13	2.13	199	15	2.07	0	0	0.00	40	5	0.50	375	33	1.30
Horned Lark	26	13	0.41	47	5	0.49	2	1	0.04	124	34	1.55	199	53	0.69
Barn Swallow	111	21	1.73	77	5	0.80	0	0	0.00	0	0	0.00	188	26	0.65
American Goldfinch	44	20	0.69	90	15	0.94	0	0	0.00	12	3	0.15	146	38	0.51
Snow Bunting	0	0	0.00	0	0	0.00	109	6	2.27	0	0	0.00	109	6	0.38
Field Sparrow	35	17	0.55	61	22	0.64	0	0	0.00	11	5	0.14	107	44	0.37
Dark-eyed Junco	0	0	0.00	54	6	0.56	28	4	0.58	18	3	0.23	100	13	0.35
Common Grackle	11	4	0.17	25	4	0.26	0	0	0.00	53	6	0.66	89	14	0.31
Black-capped Chickadee	4	2	0.06	36	7	0.38	28	5	0.58	12	2	0.15	80	16	0.28
Unidentified Sparrow	0	0	0.00	0	0	0.00	35	4	0.73	25	1	0.31	60	5	0.21
American Robin	14	8	0.22	15	8	0.16	0	0	0.00	24	10	0.30	53	26	0.18
Unknown Blackbird	0	0	0.00	40	1	0.42	0	0	0.00	0	0	0.00	40	1	0.14
American Tree Sparrow	0	0	0.00	38	5	0.40	0	0	0.00	0	0	0.00	38	5	0.13
Tree Swallow	23	9	0.36	0	0	0.00	0	0	0.00	7	4	0.09	30	13	0.10
Cedar Waxwing	6	3	0.09	15	3	0.16	0	0	0.00	6	2	0.08	27	8	0.09
Common Yellowthroat	20	10	0.31	2	2	0.02	0	0	0.00	0	0	0.00	22	12	0.08
Yellow Warbler	20	4	0.31	0	0	0.00	0	0	0.00	1	1	0.01	21	5	0.07
Clay-colored Sparrow	16	12	0.25	0	0	0.00	0	0	0.00	1	1	0.01	17	13	0.06
Western Meadowlark	0	0	0.00	14	3	0.15	0	0	0.00	1	1	0.01	15	4	0.05
Savannah Sparrow	0	0	0.00	0	0	0.00	8	1	0.17	7	1	0.09	15	2	0.05
Bank Swallow	12	1	0.19	0	0	0.00	0	0	0.00	0	0	0.00	12	1	0.04
Chipping Sparrow	9	8	0.14	0	0	0.00	0	0	0.00	2	2	0.03	11	10	0.04
Vesper Sparrow	10	6	0.16	0	0	0.00	0	0	0.00	0	0	0.00	10	6	0.03
Song Sparrow	7	5	0.11	0	0	0.00	0	0	0.00	2	2	0.03	9	7	0.03
Yellow-headed Blackbird	2	2	0.03	0	0	0.00	0	0	0.00	6	2	0.08	8	4	0.03
Eastern Bluebird	0	0	0.00	6	2	0.06	0	0	0.00	2	1	0.03	8	3	0.03
Sedge Wren	5	5	0.08	0	0	0.00	0	0	0.00	0	0	0.00	5	5	0.02
Least Flycatcher	4	3	0.06	1	1	0.01	0	0	0.00	0	0	0.00	5	4	0.02
Belted Kingfisher	2	2	0.03	1	1	0.01	0	0	0.00	1	1	0.01	4	4	0.01
Eastern Kingbird	4	3	0.06	0	0	0.00	0	0	0.00	0	0	0.00	4	3	0.01
Eastern Wood-Pewee	3	3	0.05	0	0	0.00	0	0	0.00	0	0	0.00	3	3	0.01
Grasshopper Sparrow	2	2	0.03	0	0	0.00	0	0	0.00	0	0	0.00	2	2	0.01
Bobolink	1	1	0.02	0	0	0.00	0	0	0.00	0	0	0.00	1	1	0.00
Marsh Wren	1	1	0.02	0	0	0.00	0	0	0.00	0	0	0.00	1	1	0.00
Willow Flycatcher	1	1	0.02	0	0	0.00	0	0	0.00	0	0	0.00	1	1	0.00
Totals	**702**	**204**	**10.97**	**1,030**	**123**	**10.73**	**549**	**31**	**11.44**	**1,276**	**120**	**15.95**	**3,557**	**478**	**12.35**
Raptors/Vultures/Owls															
Red-tailed Hawk	3	3	0.05	19	16	0.20	6	6	0.13	17	16	0.21	45	41	0.16
Turkey Vulture	5	4	0.08	7	5	0.07	0	0	0.00	16	6	0.20	28	15	0.10
Bald Eagle	0	0	0.00	10	8	0.10	0	0	0.00	17	13	0.21	27	21	0.09
Swainson's Hawk	1	1	0.02	3	2	0.03	1	1	0.02	0	0	0.00	5	4	0.02
Rough-legged Hawk	0	0	0.00	4	3	0.04	0	0	0.00	0	0	0.00	4	3	0.01
Northern Harrier	0	0	0.00	0	0	0.00	1	1	0.02	1	1	0.01	2	2	0.01
American Kestrel	0	0	0.00	1	1	0.01	0	0	0.00	0	0	0.00	1	1	0.00
Cooper's Hawk	0	0	0.00	0	0	0.00	0	0	0.00	1	1	0.01	1	1	0.00
Totals	**9**	**8**	**0.14**	**44**	**35**	**0.46**	**8**	**8**	**0.17**	**52**	**37**	**0.65**	**113**	**88**	**0.39**
Waterfowl															
Canada Goose	3	2	0.05	130	10	1.35	7	1	0.15	208	21	2.60	348	34	1.21
Unknown Duck	11	2	0.17	7	3	0.07	46	2	0.96	10	5	0.13	74	12	0.26
Mallard	9	4	0.14	0	0	0.00	0	0	0.00	51	13	0.64	60	17	0.21
Snow Goose	0	0	0.00	20	2	0.21	0	0	0.00	0	0	0.00	20	2	0.07
Blue-winged teal	0	0	0.00	0	0	0.00	0	0	0.00	1	1	0.01	1	1	0.00
Totals	**23**	**8**	**0.36**	**157**	**15**	**1.64**	**53**	**3**	**1.10**	**270**	**40**	**3.38**	**503**	**66**	**1.75**
Shorebirds															
Killdeer	12	9	0.19	3	2	0.03	0	0	0.00	8	5	0.10	23	16	0.08
Upland Sandpiper	0	0	0.00	0	0	0.00	0	0	0.00	1	1	0.01	1	1	0.00
Wilson's Snipe	0	0	0.00	1	1	0.01	0	0	0.00	0	0	0.00	1	1	0.00
Totals	**12**	**9**	**0.19**	**4**	**3**	**0.04**	**0**	**0**	**0.00**	**9**	**6**	**0.11**	**25**	**18**	**0.09**
Gamebirds															
Wild Turkey	1	1	0.02	1	1	0.01	92	4	1.92	45	4	0.56	139	10	0.48
Ring-necked Pheasant	12	8	0.19	2	2	0.02	12	4	0.25	11	9	0.14	37	23	0.13
Totals	**13**	**9**	**0.20**	**3**	**3**	**0.03**	**104**	**8**	**2.17**	**56**	**13**	**0.70**	**176**	**33**	**0.61**
Woodpecker															
Northern Flicker	0	0	0.00	15	6	0.16	0	0	0.00	2	2	0.03	17	8	0.06
Downy Woodpecker	3	3	0.05	7	7	0.07	2	2	0.04	2	2	0.03	14	14	0.05
Totals	**3**	**3**	**0.05**	**22**	**13**	**0.23**	**2**	**2**	**0.04**	**4**	**4**	**0.05**	**31**	**22**	**0.11**
Crows and Allies															
American Crow	39	8	0.61	249	27	2.59	57	15	1.19	221	23	2.76	566	73	1.97
Blue Jay	28	12	0.44	80	26	0.83	18	9	0.38	22	11	0.28	148	58	0.51
Totals	**67**	**20**	**1.05**	**329**	**53**	**3.43**	**75**	**24**	**1.56**	**243**	**34**	**3.04**	**714**	**131**	**2.48**
Pigeons & Doves															
Rock Pigeon	22	9	0.34	79	17	0.82	31	10	0.65	40	13	0.50	172	49	0.60
Mourning Dove	14	9	0.22	13	8	0.14	0	0	0.00	7	6	0.09	34	23	0.12
Totals	**36**	**18**	**0.56**	**92**	**25**	**0.96**	**31**	**10**	**0.65**	**47**	**19**	**0.59**	**206**	**72**	**0.72**
Wadingbirds															
Great Blue Heron	2	2	0.03	0	0	0.00	0	0	0.00	0	0	0.00	2	2	0.01
Totals	**2**	**2**	**0.03**	**0**	**0**	**0.00**	**0**	**0**	**0.00**	**0**	**0**	**0.00**	**2**	**2**	**0.01**
Waterbirds															
American White Pelican	4	1	0.06	0	0	0.00	0	0	0.00	12	2	0.15	16	3	0.06
Totals	**4**	**1**	**0.06**	**0**	**0**	**0.00**	**0**	**0**	**0.00**	**12**	**2**	**0.15**	**16**	**3**	**0.06**
Gulls/Terns															
Ring-billed Gull	4	2	0.06	21	4	0.22	0	0	0.00	0	0	0.00	25	6	0.09
Totals	**4**	**2**	**0.06**	**21**	**4**	**0.22**	**0**	**0**	**0.00**	**0**	**0**	**0.00**	**25**	**6**	**0.09**
Grand Totals	**875**	**284**	**13.67**	**1,702**	**274**	**17.73**	**822**	**86**	**17.13**	**1,969**	**275**	**24.61**	**5,368**	**919**	**18.64**

Table 6. Cumulative Palmer's Creek Point Count Percent Composition and Frequency by Species Group

Species	Summer 2016 & 2017		Fall 2016		Winter 2016-2017		Spring 2017		Cumulative	
	Percent (%) Composition	Percent (%) Frequency	Percent (%) Composition	Percent (%) Frequency	Percent (%) Composition	Percent (%) Frequency	Percent (%) Composition	Percent (%) Frequency	Percent (%) Composition	Percent (%) Frequency
Songbirds										
European Starling	5.03%	4.69%	6.11%	6.25%	41.24%	20.83%	28.80%	18.75%	19.63%	2.78%
Red-winged Blackbird	14.74%	34.38%	12.04%	12.50%	0.00%	0.00%	17.98%	18.75%	12.82%	11.81%
Brown-headed Cowbird	15.54%	20.31%	11.69%	14.58%	0.00%	0.00%	2.03%	6.25%	6.99%	9.38%
Horned Lark	2.97%	20.31%	2.76%	5.21%	0.24%	2.08%	6.30%	37.50%	3.71%	6.25%
Barn Swallow	12.69%	32.81%	4.52%	5.21%	0.00%	0.00%	0.00%	0.00%	3.50%	9.03%
American Goldfinch	5.03%	29.69%	5.29%	14.58%	0.00%	0.00%	0.61%	3.75%	2.72%	11.46%
Snow Bunting	0.00%	0.00%	0.00%	0.00%	13.26%	12.50%	0.00%	0.00%	2.03%	0.00%
Field Sparrow	4.00%	26.56%	3.58%	22.92%	0.00%	0.00%	0.56%	6.25%	1.99%	13.54%
Dark-eyed Junco	0.00%	0.00%	3.17%	6.25%	3.41%	8.33%	0.91%	3.75%	1.86%	2.08%
Common Grackle	1.26%	6.25%	1.47%	4.17%	0.00%	0.00%	2.69%	7.50%	1.66%	2.78%
Black-capped Chickadee	0.46%	3.13%	2.12%	7.29%	3.41%	10.42%	0.61%	2.50%	1.49%	3.13%
Unidentified Sparrow	0.00%	0.00%	0.00%	0.00%	4.26%	8.33%	1.27%	1.25%	1.12%	0.00%
American Robin	1.60%	12.50%	0.88%	8.33%	0.00%	0.00%	1.22%	12.50%	0.99%	5.56%
Unknown Blackbird	0.00%	0.00%	2.35%	1.04%	0.00%	0.00%	0.00%	0.00%	0.75%	0.35%
American Tree Sparrow	0.00%	0.00%	2.23%	5.21%	0.00%	0.00%	0.00%	0.00%	0.71%	1.74%
Tree Swallow	2.63%	14.06%	0.00%	0.00%	0.00%	0.00%	0.36%	5.00%	0.56%	3.13%
Cedar Waxwing	0.69%	4.69%	0.88%	3.13%	0.00%	0.00%	0.30%	2.50%	0.50%	2.08%
Common Yellowthroat	2.29%	15.63%	0.12%	2.08%	0.00%	0.00%	0.00%	0.00%	0.41%	4.17%
Yellow Warbler	2.29%	4.69%	0.00%	0.00%	0.00%	0.00%	0.05%	1.25%	0.39%	1.04%
Clay-colored Sparrow	1.83%	18.75%	0.00%	0.00%	0.00%	0.00%	0.05%	1.25%	0.32%	4.17%
Western Meadowlark	0.00%	0.00%	0.82%	3.13%	0.00%	0.00%	0.05%	1.25%	0.28%	1.04%
Savannah Sparrow	0.00%	0.00%	0.00%	0.00%	0.97%	2.08%	0.36%	1.25%	0.28%	0.00%
Bank Swallow	1.37%	1.56%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.22%	0.35%
Chipping Sparrow	1.03%	12.50%	0.00%	0.00%	0.00%	0.00%	0.10%	2.50%	0.20%	2.78%
Vesper Sparrow	1.14%	9.38%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.19%	2.08%
Song Sparrow	0.80%	7.81%	0.00%	0.00%	0.00%	0.00%	0.10%	2.50%	0.17%	1.74%
Yellow-headed Blackbird	0.23%	3.13%	0.00%	0.00%	0.00%	0.00%	0.30%	2.50%	0.15%	0.69%
Eastern Bluebird	0.00%	0.00%	0.35%	2.08%	0.00%	0.00%	0.10%	1.25%	0.15%	0.69%
Sedge Wren	0.57%	7.81%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.09%	1.74%
Least Flycatcher	0.46%	4.69%	0.06%	1.04%	0.00%	0.00%	0.00%	0.00%	0.09%	1.39%
Belted Kingfisher	0.23%	3.13%	0.06%	1.04%	0.00%	0.00%	0.05%	1.25%	0.07%	1.04%
Eastern Kingbird	0.46%	4.69%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.07%	1.04%
Eastern Wood-Pewee	0.34%	4.69%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.06%	1.04%
Grasshopper Sparrow	0.23%	3.13%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.04%	0.69%
Bobolink	0.11%	1.56%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.35%
Marsh Wren	0.11%	1.56%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.35%
Willow Flycatcher	0.11%	1.56%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.35%
Totals	**80.23%**		**60.52%**		**66.79%**		**64.80%**		**66.26%**	
Raptors/Vultures/Owls										
Red-tailed Hawk	0.34%	4.69%	1.12%	15.63%	0.73%	10.42%	0.86%	18.75%	0.84%	6.25%
Turkey Vulture	0.57%	6.25%	0.41%	5.21%	0.00%	0.00%	0.81%	6.25%	0.52%	3.13%
Bald Eagle	0.00%	0.00%	0.59%	6.25%	0.00%	0.00%	0.86%	10.00%	0.50%	2.08%
Swainson's Hawk	0.11%	1.56%	0.18%	2.08%	0.12%	2.08%	0.00%	0.00%	0.09%	1.04%
Rough-legged Hawk	0.00%	0.00%	0.24%	2.08%	0.00%	0.00%	0.00%	0.00%	0.07%	0.69%
Northern Harrier	0.00%	0.00%	0.00%	0.00%	0.12%	2.08%	0.05%	1.25%	0.04%	0.00%
American Kestrel	0.00%	0.00%	0.06%	1.04%	0.00%	0.00%	0.00%	0.00%	0.02%	0.35%
Cooper's Hawk	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.05%	1.25%	0.02%	0.00%
Totals	**1.03%**		**2.59%**		**0.97%**		**2.64%**		**2.11%**	
Waterfowl										
Canada Goose	0.00%	0.00%	7.64%	10.42%	0.85%	2.08%	10.56%	25.00%	6.48%	4.17%
Unknown Duck	1.26%	3.13%	0.41%	3.13%	5.60%	4.17%	0.51%	6.25%	1.38%	1.74%
Mallard	1.03%	6.25%	0.00%	0.00%	0.00%	0.00%	2.59%	13.75%	1.12%	1.39%
Snow Goose	0.34%	3.13%	1.18%	2.08%	0.00%	0.00%	0.00%	0.00%	0.37%	0.69%
Blue-winged teal	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.05%	1.25%	0.02%	0.00%
Totals	**2.63%**		**9.22%**		**6.45%**		**13.71%**		**9.37%**	
Shorebirds										
Killdeer	1.37%	14.06%	0.18%	2.08%	0.00%	0.00%	0.41%	6.25%	0.43%	3.82%
Upland Sandpiper	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.05%	1.25%	0.02%	0.00%
Wilson's Snipe	0.00%	0.00%	0.06%	1.04%	0.00%	0.00%	0.00%	0.00%	0.02%	0.35%
Totals	**1.37%**		**0.24%**		**0.00%**		**0.46%**		**0.47%**	
Gamebirds										
Wild Turkey	0.11%	1.56%	0.06%	1.04%	11.19%	8.33%	2.29%	5.00%	2.59%	0.69%
Ring-necked Pheasant	1.37%	12.50%	0.12%	2.08%	1.46%	8.33%	0.56%	11.25%	0.69%	3.47%
Totals	**1.49%**		**0.18%**		**12.65%**		**2.84%**		**3.28%**	
Woodpecker										
Northern Flicker	0.00%	0.00%	0.88%	6.25%	0.00%	0.00%	0.10%	2.50%	0.32%	2.08%
Downy Woodpecker	0.34%	4.69%	0.41%	7.29%	0.24%	4.17%	0.10%	2.50%	0.26%	3.47%
Totals	**0.34%**		**1.29%**		**0.24%**		**0.20%**		**0.58%**	
Crows and Allies										
American Crow	4.46%	12.50%	14.63%	23.96%	6.93%	31.25%	11.22%	23.75%	10.54%	10.07%
Blue Jay	3.20%	18.75%	4.70%	27.08%	2.19%	18.75%	1.12%	13.75%	2.76%	13.19%
Totals	**7.66%**		**19.33%**		**9.12%**		**12.34%**		**13.30%**	
Pigeons & Doves										
Rock Pigeon	2.51%	14.06%	4.64%	17.71%	3.77%	20.83%	2.03%	15.00%	3.20%	9.03%
Mourning Dove	1.60%	14.06%	0.76%	8.33%	0.00%	0.00%	0.36%	7.50%	0.63%	5.90%
Totals	**4.11%**		**5.41%**		**3.77%**		**2.39%**		**3.84%**	
Wadingbirds										
Great Blue Heron	0.23%	3.13%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.04%	0.69%
Totals	**0.23%**		**0.00%**		**0.00%**		**0.00%**		**0.04%**	
Waterbirds										
American White Pelican	0.46%	1.56%	0.00%	0.00%	0.00%	0.00%	0.61%	2.50%	0.30%	0.35%
Totals	**0.46%**		**0.00%**		**0.00%**		**0.61%**		**0.30%**	
Gulls/Terns										
Ring-billed Gull	0.46%	3.13%	1.23%	4.17%	0.00%	0.00%	0.00%	0.00%	0.47%	2.08%
Totals	**0.46%**		**1.23%**		**0.00%**		**0.00%**		**0.47%**	
Grand Totals	**100.00%**		**100.00%**		**100.00%**		**100.00%**		**100.00%**	

Table 7a. Avian Species Observed by Point Count at Palmer’s Creek (Summer 2016 & Summer 2017)										
Species	**Number of Observations**	**Number of Individuals**	**Points**							
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Songbirds										
European Starling	3	44	0	0	0	0	0	0	6	38
Red-winged Blackbird	22	129	0	3	90	3	5	7	14	7
Brown-headed Cowbird	13	136	12	2	3	1	0	7	3	108
Horned Lark	13	26	3	2	0	11	5	3	0	2
Barn Swallow	21	111	7	24	3	14	3	38	1	21
American Goldfinch	20	44	5	7	9	8	2	6	5	2
Field Sparrow	17	35	4	3	7	7	6	2	5	1
Common Grackle	4	11	0	0	0	2	0	4	5	0
Black-capped Chickadee	2	4	1	0	3	0	0	0	0	0
American Robin	8	14	3	0	1	4	0	2	0	4
Tree Swallow	9	23	0	5	2	2	1	0	5	8
Cedar Waxwing	3	6	0	2	1	3	0	0	0	0
Common Yellowthroat	10	20	0	5	6	0	2	1	3	3
Yellow Warbler	4	20	0	0	18	0	0	0	0	2
Clay-colored Sparrow	12	16	1	5	4	1	1	1	2	1
Bank Swallow	1	12	0	0	0	0	0	0	0	12
Chipping Sparrow	8	9	1	1	4	0	0	0	1	2
Vesper Sparrow	6	10	6	1	0	0	2	1	0	0
Song Sparrow	5	7	0	1	4	0	1	0	0	1
Yellow-headed Blackbird	2	2	0	0	2	0	0	0	0	0
Sedge Wren	5	5	0	0	3	0	2	0	0	0
Least Flycatcher	3	4	0	0	1	2	1	0	0	0
Belted Kingfisher	2	2	0	0	1	0	0	0	0	1
Eastern Kingbird	3	4	0	1	0	0	2	0	1	0
Eastern Wood-Pewee	3	3	2	0	0	1	0	0	0	0
Grasshopper Sparrow	2	2	1	1	0	0	0	0	0	0
Bobolink	1	1	0	0	0	0	0	0	0	1
Marsh Wren	1	1	0	0	1	0	0	0	0	0
Willow Flycatcher	1	1	0	0	0	1	0	0	0	0
Raptors/Vultures/Owls										
Red-tailed Hawk	3	3	0	1	0	1	0	0	0	1
Turkey Vulture	4	5	0	3	0	1	0	1	0	0
Swainson's Hawk	1	1	0	0	1	0	0	0	0	0
Waterfowl										
Canada Goose	2	3	0	0	3	0	0	0	0	0
Unknown Duck	2	11	0	0	11	0	0	0	0	0
Mallard	4	9	0	0	6	0	0	0	0	3
Shorebirds										
Killdeer	9	12	2	1	0	1	2	0	1	5
Gamebirds										
Wild Turkey	1	1	1	0	0	0	0	0	0	0
Ring-necked Pheasant	8	12	4	1	0	0	2	3	2	0
Woodpecker										
Downy Woodpecker	3	3	0	0	0	0	1	1	0	1
Crows and Allies										
American Crow	8	39	11	21	5	2	0	0	0	0
Blue Jay	12	28	9	1	0	9	0	1	3	5
Pigeons & Doves										
Rock Pigeon	9	22	1	0	0	11	0	3	2	5
Mourning Dove	9	14	0	3	0	4	0	7	0	0
Wadingbirds										
Great Blue Heron	2	2	0	0	1	1	0	0	0	0
Waterbirds										
American White Pelican	1	4	4	0	0	0	0	0	0	0
Gulls/Terns										
Ring-billed Gull	2	4	0	0	1	0	0	3	0	0
Totals	**284**	**875**	**78**	**94**	**191**	**90**	**38**	**91**	**59**	**234**
Mean Use		**13.67**	**9.75**	**11.75**	**23.88**	**11.25**	**4.75**	**11.38**	**7.38**	**29.25**

Table 7b. Avian Species Observed by Point Count at Palmer’s Creek (Fall 2016)										
Species	Number of Observations	Number of Individuals	Points							
			1	2	3	4	5	6	7	8
Songbirds										
European Starling	6	104	75	0	0	0	0	0	0	29
Red-winged Blackbird	12	205	0	0	81	7	11	74	32	0
Brown-headed Cowbird	15	199	13	32	0	14	8	18	15	99
Horned Lark	5	47	0	23	15	0	0	3	1	5
Barn Swallow	5	77	0	1	38	0	0	0	0	38
American Goldfinch	15	90	37	9	18	0	5	1	9	11
Field Sparrow	22	61	19	2	23	3	5	3	5	1
Dark-eyed Junco	6	54	0	0	36	0	14	0	0	4
Common Grackle	4	25	2	0	6	0	0	17	0	0
Black-capped Chickadee	7	36	0	0	8	0	26	0	0	2
American Robin	8	15	2	5	0	0	0	3	1	4
Unknown Blackbird	1	40	0	0	0	0	0	40	0	0
American Tree Sparrow	5	38	0	4	10	18	6	0	0	0
Cedar Waxwing	3	15	3	0	0	0	0	5	7	0
Common Yellowthroat	2	2	1	0	0	0	1	0	0	0
Western Meadowlark	3	14	0	0	5	0	0	0	2	7
Eastern Bluebird	2	6	0	5	1	0	0	0	0	0
Least Flycatcher	1	1	0	0	0	1	0	0	0	0
Belted Kingfisher	1	1	0	0	1	0	0	0	0	0
Raptors/Vultures/Owls										
Red-tailed Hawk	16	19	1	3	5	4	1	1	2	2
Turkey Vulture	5	7	0	2	2	0	2	1	0	0
Bald Eagle	8	10	5	1	0	2	0	1	1	0
Swainson's Hawk	2	3	0	0	2	1	0	0	0	0
Rough-legged Hawk	3	4	0	0	1	0	0	0	3	0
American Kestrel	1	1	0	1	0	0	0	0	0	0
Waterfowl										
Canada Goose	10	130	27	3	64	21	0	3	12	0
Unknown Duck	3	7	0	0	6	0	0	1	0	0
Snow Goose	2	20	2	0	18	0	0	0	0	0
Shorebirds										
Killdeer	2	3	2	0	0	0	0	0	0	1
Wilson's Snipe	1	1	1	0	0	0	0	0	0	0
Gamebirds										
Wild Turkey	1	1	1	0	0	0	0	0	0	0
Ring-necked Pheasant	2	2	0	1	0	0	1	0	0	0
Woodpecker										
Northern Flicker	6	15	0	4	0	3	4	0	4	0
Downy Woodpecker	7	7	1	1	0	1	0	3	1	0
Crows and Allies										
American Crow	27	249	180	24	0	8	5	8	2	22
Blue Jay	26	80	16	17	10	5	12	8	3	9
Pigeons & Doves										
Rock Pigeon	17	79	22	10	7	3	3	6	12	16
Mourning Dove	8	13	0	1	0	5	3	3	1	0
Gulls/Terns										
Ring-billed Gull	4	21	0	0	0	16	1	0	2	2
Totals	**274**	**1,702**	**410**	**149**	**357**	**112**	**108**	**199**	**115**	**252**
Mean Use		**17.73**	**34.17**	**12.42**	**29.75**	**9.33**	**9.00**	**16.58**	**9.58**	**21.00**

Table 7c. Avian Species Observed by Point Count at Palmer's Creek (Winter 2016-2017)										
Species	Number of Observations	Number of Individuals	Points							
			1	2	3	4	5	6	7	8
Songbirds										
European Starling	10	339	51	0	0	0	0	31	0	257
Horned Lark	1	2	0	0	2	0	0	0	0	0
Snow Bunting	6	109	0	48	0	0	20	0	0	41
Dark-eyed Junco	4	28	0	0	10	0	18	0	0	0
Black-capped Chickadee	5	28	0	0	9	0	19	0	0	0
Unidentified Sparrow	4	35	0	0	1	16	0	0	18	0
Savannah Sparrow	1	8	0	0	0	8	0	0	0	0
Raptors/Vultures/Owls										
Red-tailed Hawk	6	6	0	2	1	0	0	1	1	1
Swainson's Hawk	1	1	0	0	1	0	0	0	0	0
Northern Harrier	1	1	1	0	0	0	0	0	0	0
Waterfowl										
Canada Goose	1	7	0	7	0	0	0	0	0	0
Unknown Duck	2	46	0	14	32	0	0	0	0	0
Gamebirds										
Wild Turkey	4	92	89	3	0	0	0	0	0	0
Ring-necked Pheasant	4	12	0	0	6	5	1	0	0	0
Woodpecker										
Downy Woodpecker	2	2	0	0	0	0	0	1	1	0
Crows and Allies										
American Crow	15	57	17	12	10	1	1	0	15	1
Blue Jay	9	18	4	11	0	2	1	0	0	0
Pigeons & Doves										
Rock Pigeon	10	31	0	12	0	3	0	6	6	4
Totals	**86**	**822**	**162**	**109**	**72**	**35**	**60**	**39**	**41**	**304**
Mean Use		**17.13**	**27.00**	**18.17**	**12.00**	**5.83**	**10.00**	**6.50**	**6.83**	**50.67**

Table 7d. Avian Species Observed by Point Count at Palmer's Creek (Spring 2017)										
Species	Number of Observations	Number of Individuals	Points							
			1	2	3	4	5	6	7	8
Songbirds										
European Starling	15	567	104	0	0	0	8	5	0	450
Red-winged Blackbird	18	354	0	0	324	5	10	8	4	3
Brown-headed Cowbird	5	40	0	0	1	3	0	6	0	30
Horned Lark	34	124	10	20	14	32	8	22	14	4
American Goldfinch	3	12	0	8	0	0	0	0	0	4
Field Sparrow	5	11	0	4	2	5	0	0	0	0
Dark-eyed Junco	3	18	0	7	4	0	7	0	0	0
Common Grackle	6	53	6	14	14	0	0	17	2	0
Black-capped Chickadee	2	12	0	0	0	0	12	0	0	0
Unidentified Sparrow	1	25	0	0	0	25	0	0	0	0
American Robin	10	24	3	8	3	0	4	2	2	2
Tree Swallow	4	7	4	2	0	0	0	1	0	0
Cedar Waxwing	2	6	0	6	0	0	0	0	0	0
Yellow Warbler	1	1	0	0	1	0	0	0	0	0
Clay-colored Sparrow	1	1	0	1	0	0	0	0	0	0
Western Meadowlark	1	1	0	1	0	0	0	0	0	0
Savannah Sparrow	1	7	0	0	0	7	0	0	0	0
Chipping Sparrow	2	2	0	1	1	0	0	0	0	0
Song Sparrow	2	2	0	0	0	1	1	0	0	0
Yellow-headed Blackbird	2	6	0	0	6	0	0	0	0	0
Eastern Bluebird	1	2	0	0	0	0	0	0	2	0
Belted Kingfisher	1	1	0	0	0	0	0	0	0	1
Raptors/Vultures/Owls										
Red-tailed Hawk	16	17	2	1	6	4	1	0	2	1
Turkey Vulture	6	16	0	0	2	11	2	0	0	1
Bald Eagle	13	17	3	0	5	8	0	0	1	0
Northern Harrier	1	1	0	1	0	0	0	0	0	0
Cooper's Hawk	1	1	0	0	0	0	1	0	0	0
Waterfowl										
Canada Goose	21	208	21	10	98	0	6	62	11	0
Unknown Duck	5	10	0	0	9	0	1	0	0	0
Mallard	13	51	0	0	25	6	6	0	12	2
Blue-winged teal	1	1	0	0	1	0	0	0	0	0
Shorebirds										
Killdeer	5	8	0	0	0	1	0	0	0	7
Upland Sandpiper	1	1	0	0	0	0	0	0	0	1
Gamebirds										
Wild Turkey	4	45	45	0	0	0	0	0	0	0
Ring-necked Pheasant	9	11	0	3	1	0	6	0	1	0
Woodpecker										
Northern Flicker	2	2	1	0	0	1	0	0	0	0
Downy Woodpecker	2	2	0	0	1	0	0	0	0	1
Crows and Allies										
American Crow	23	221	30	24	72	49	12	22	0	12
Blue Jay	11	22	5	2	2	7	0	5	0	1
Pigeons & Doves										
Rock Pigeon	13	40	0	0	0	3	1	16	9	11
Mourning Dove	6	7	2	0	0	2	1	1	0	1
Waterbirds										
American White Pelican	2	12	0	0	3	9	0	0	0	0
Totals	**275**	**1,969**	**236**	**113**	**595**	**179**	**87**	**167**	**60**	**532**
Mean Use		**24.61**	**23.60**	**11.30**	**59.50**	**17.90**	**8.70**	**16.70**	**6.00**	**53.20**

Table 8. Cumulative Avian Species Observed by Point Count at Palmer's Creek										
Species	Number of Observations	Number of Individuals	Points							
			1	2	3	4	5	6	7	8
Songbirds										
European Starling	34	1,054	230	0	0	0	8	36	6	774
Red-winged Blackbird	52	688	0	3	495	15	26	89	50	10
Brown-headed Cowbird	33	375	25	34	4	18	8	31	18	237
Horned Lark	53	199	13	45	31	43	13	28	15	11
Barn Swallow	26	188	7	25	41	14	3	38	1	59
American Goldfinch	38	146	42	24	27	8	7	7	14	17
Snow Bunting	6	109	0	48	0	0	20	0	0	41
Field Sparrow	44	107	23	9	32	15	11	5	10	2
Dark-eyed Junco	13	100	0	7	50	0	39	0	0	4
Common Grackle	14	89	8	14	20	2	0	38	7	0
Black-capped Chickadee	16	80	1	0	20	0	57	0	0	2
Unidentified Sparrow	5	60	0	0	1	41	0	0	18	0
American Robin	26	53	8	13	4	4	4	7	3	10
Unknown Blackbird	1	40	0	0	0	0	0	40	0	0
American Tree Sparrow	5	38	0	4	10	18	6	0	0	0
Tree Swallow	13	30	4	7	2	2	1	1	5	8
Cedar Waxwing	8	27	3	8	1	3	0	5	7	0
Common Yellowthroat	12	22	1	5	6	0	3	1	3	3
Yellow Warbler	5	21	0	0	19	0	0	0	0	2
Clay-colored Sparrow	13	17	1	6	4	1	1	1	2	1
Western Meadowlark	4	15	0	1	5	0	0	0	2	7
Savannah Sparrow	2	15	0	0	0	15	0	0	0	0
Bank Swallow	1	12	0	0	0	0	0	0	0	12
Chipping Sparrow	10	11	1	2	5	0	0	0	1	2
Vesper Sparrow	6	10	6	1	0	0	2	1	0	0
Song Sparrow	7	9	0	1	4	1	2	0	0	1
Yellow-headed Blackbird	4	8	0	0	8	0	0	0	0	0
Eastern Bluebird	3	8	0	5	1	0	0	0	2	0
Sedge Wren	5	5	0	0	3	0	2	0	0	0
Least Flycatcher	4	5	0	0	1	3	1	0	0	0
Belted Kingfisher	4	4	0	0	2	0	0	0	0	2
Eastern Kingbird	3	4	0	1	0	0	2	0	1	0
Eastern Wood-Pewee	3	3	2	0	0	1	0	0	0	0
Grasshopper Sparrow	2	2	1	1	0	0	0	0	0	0
Bobolink	1	1	0	0	0	0	0	0	0	1
Marsh Wren	1	1	0	0	1	0	0	0	0	0
Willow Flycatcher	1	1	0	0	0	1	0	0	0	0
Raptors/Vultures/Owls										
Red-tailed Hawk	41	45	3	7	12	9	2	2	5	5
Turkey Vulture	15	28	0	5	4	12	4	2	0	1
Bald Eagle	21	27	8	1	5	10	0	1	2	0
Swainson's Hawk	4	5	0	0	4	1	0	0	0	0
Rough-legged Hawk	3	4	0	0	1	0	0	0	3	0
Northern Harrier	2	2	1	1	0	0	0	0	0	0
American Kestrel	1	1	0	1	0	0	0	0	0	0
Cooper's Hawk	1	1	0	0	0	0	1	0	0	0
Waterfowl										
Canada Goose	34	348	48	20	165	21	6	65	23	0
Unknown Duck	12	74	0	14	58	0	1	1	0	0
Mallard	17	60	0	0	31	6	6	0	12	5
Snow Goose	2	20	2	0	18	0	0	0	0	0
Blue-winged teal	1	1	0	0	1	0	0	0	0	0
Shorebirds										
Killdeer	16	23	4	1	0	2	2	0	1	13
Upland Sandpiper	1	1	0	0	0	0	0	0	0	1
Wilson's Snipe	1	1	1	0	0	0	0	0	0	0
Gamebirds										
Wild Turkey	10	139	136	3	0	0	0	0	0	0
Ring-necked Pheasant	23	37	4	5	7	5	10	3	3	0
Woodpecker										
Northern Flicker	8	17	1	4	0	4	4	0	4	0
Downy Woodpecker	14	14	1	1	1	1	1	5	2	2
Crows and Allies										
American Crow	73	566	238	81	87	60	18	30	17	35
Blue Jay	58	148	34	31	12	23	13	14	6	15
Pigeons & Doves										
Rock Pigeon	49	172	23	22	7	20	4	31	29	36
Mourning Dove	23	34	2	4	0	11	4	11	1	1
Wadingbirds										
Great Blue Heron	2	2	0	0	1	1	0	0	0	0
Waterbirds										
American White Pelican	3	16	4	0	3	9	0	0	0	0
Gulls/Terns										
Ring-billed Gull	6	25	0	0	1	16	1	3	2	2
Totals	**919**	**5,368**	**886**	**465**	**1,215**	**416**	**293**	**496**	**275**	**1,322**
Mean Use		**18.64**	**24.61**	**12.92**	**33.75**	**11.56**	**8.14**	**13.78**	**7.64**	**36.72**

Table 9. Avian Flight Heights at Palmer's Creek																				
Species	Summer 2016 & 2017				Fall 2016				Winter 2016-2017				Spring 2017				Cumulative			
	Observation		Individuals		Observation		Individuals		Observation		Individuals		Observation		Individuals		Observation		Individuals	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
Non-Raptors																				
Above RSA (>148m)	0	0.00%	0	0.00%	5	3.05%	51	4.47%	1	1.79%	7	1.07%	5	3.01%	19	1.14%	13	2.38%	138	3.21%
Below RSA (<22m)	138	97.18%	624	98.89%	145	88.41%	979	85.88%	52	92.86%	602	91.77%	129	77.71%	1418	85.32%	480	87.91%	3769	87.73%
Within RSA (≥22m and ≤148m)	4	2.82%	7	1.11%	14	8.54%	110	9.65%	3	5.36%	47	7.16%	32	19.28%	225	13.54%	53	9.71%	389	9.05%
Raptors/Vultures/Owls																				
Above RSA (>148m)	0	0.00%	0	0.00%	8	26.67%	13	34.21%	1	12.50%	1	12.50%	4	10.81%	6	11.54%	13	15.48%	20	18.52%
Below RSA (<22m)	4	50.00%	4	44.44%	13	43.33%	15	39.47%	5	62.50%	5	62.50%	10	27.03%	12	23.08%	32	38.10%	36	33.33%
Within RSA (≥22m and ≤148m)	4	50.00%	5	55.56%	9	30.00%	10	26.32%	2	25.00%	2	25.00%	23	62.16%	34	65.38%	39	46.43%	52	48.15%

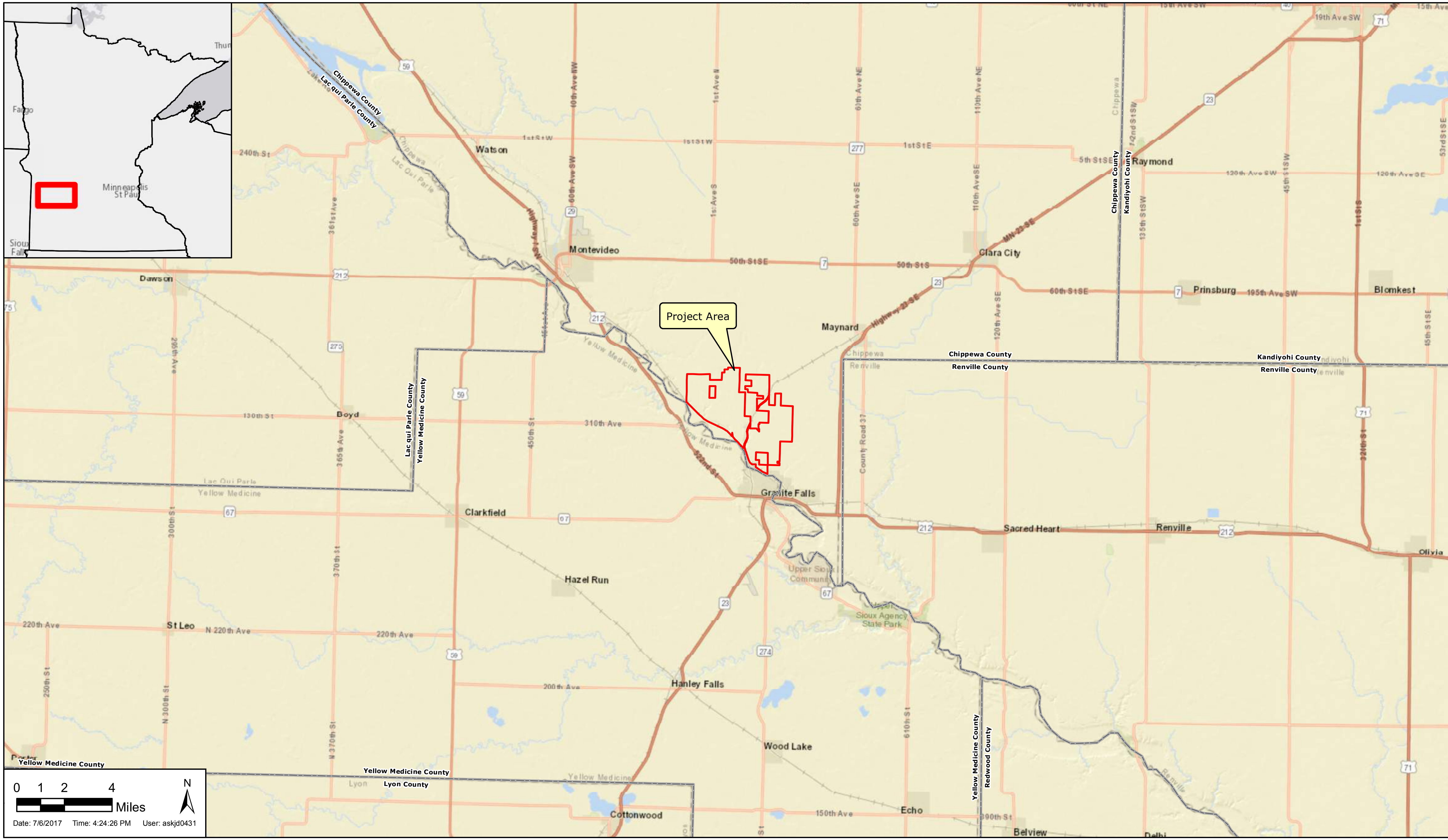
Table 10. Point Count Individuals and RSA at Palmer's Creek

Species	Summer 2016 & 2017						Fall 2016						Winter 2016-2017						Spring 2017						Cumulative					
	Encounter Rate	Mean Use (# birds/20 min)	Flying (%)	Percent (%) Flying Below RSA	Percent (%) Flying Within RSA	Percent (%) Flying Above RSA	Encounter Rate	Mean Use (# birds/20 min)	Flying (%)	Percent (%) Flying Below RSA	Percent (%) Flying Within RSA	Percent (%) Flying Above RSA	Encounter Rate	Mean Use (# birds/20 min)	Flying (%)	Percent (%) Flying Below RSA	Percent (%) Flying Within RSA	Percent (%) Flying Above RSA	Encounter Rate	Mean Use (# birds/20 min)	Flying (%)	Percent (%) Flying Below RSA	Percent (%) Flying Within RSA	Percent (%) Flying Above RSA	Encounter Rate	Mean Use (# birds/20 min)	Flying (%)	Percent (%) Flying Below RSA	Percent (%) Flying Within RSA	Percent (%) Flying Above RSA
Songbirds																														
European Starling	0.00	0.69	100.00%	100.00%	0.00%	0.00%	0.00	1.08	72.12%	100.00%	0.00%	0.00%	0.00	7.06	91.15%	100.00%	0.00%	0.00%	0.16	7.09	99.12%	97.69%	2.31%	0.00%	0.05	3.66	93.93%	98.69%	1.31%	0.00%
Red-winged Blackbird	0.00	2.02	90.70%	100.00%	0.00%	0.00%	0.27	2.14	100.00%	87.32%	12.68%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.08	4.43	100.00%	98.31%	1.69%	0.00%	0.11	2.39	98.26%	95.27%	4.73%	0.00%
Brown-headed Cowbird	0.00	2.13	89.71%	100.00%	0.00%	0.00%	0.00	2.07	82.41%	100.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.50	97.50%	100.00%	0.00%	0.00%	0.00	1.30	86.67%	100.00%	0.00%	0.00%
Horned Lark	0.00	0.41	80.77%	100.00%	0.00%	0.00%	0.00	0.49	91.49%	100.00%	0.00%	0.00%	0.00	0.04	100.00%	100.00%	0.00%	0.00%	0.00	1.55	84.68%	100.00%	0.00%	0.00%	0.00	0.69	85.93%	100.00%	0.00%	0.00%
Barn Swallow	0.00	1.73	100.00%	100.00%	0.00%	0.00%	0.00	0.80	100.00%	100.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.65	100.00%	100.00%	0.00%	0.00%
American Goldfinch	0.00	0.69	100.00%	100.00%	0.00%	0.00%	0.02	0.94	100.00%	97.78%	2.22%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.15	100.00%	100.00%	0.00%	0.00%	0.01	0.51	100.00%	98.63%	1.37%	0.00%
Snow Bunting	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	2.27	100.00%	100.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.38	100.00%	100.00%	0.00%	0.00%
Field Sparrow	0.00	0.55	34.29%	100.00%	0.00%	0.00%	0.00	0.64	78.69%	100.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.14	18.18%	100.00%	0.00%	0.00%	0.00	0.37	57.94%	100.00%	0.00%	0.00%
Dark-eyed Junco	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.56	100.00%	100.00%	0.00%	0.00%	0.00	0.58	100.00%	100.00%	0.00%	0.00%	0.00	0.23	100.00%	100.00%	0.00%	0.00%	0.00	0.35	100.00%	100.00%	0.00%	0.00%
Common Grackle	0.00	0.17	100.00%	100.00%	0.00%	0.00%	0.00	0.26	100.00%	100.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.18	0.66	100.00%	73.58%	26.42%	0.00%	0.05	0.31	100.00%	84.27%	15.73%	0.00%
Black-capped Chickadee	0.00	0.06	0.00%	0.00%	0.00%	0.00%	0.00	0.38	100.00%	100.00%	0.00%	0.00%	0.00	0.58	100.00%	100.00%	0.00%	0.00%	0.00	0.15	100.00%	100.00%	0.00%	0.00%	0.00	0.28	95.00%	100.00%	0.00%	0.00%
Unidentified Sparrow	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.73	97.14%	100.00%	0.00%	0.00%	0.00	0.31	100.00%	100.00%	0.00%	0.00%	0.00	0.21	98.33%	100.00%	0.00%	0.00%
American Robin	0.00	0.22	42.86%	100.00%	0.00%	0.00%	0.00	0.16	73.33%	100.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.30	54.17%	100.00%	0.00%	0.00%	0.00	0.18	56.60%	100.00%	0.00%	0.00%
Unknown Blackbird	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.42	0.42	100.00%	0.00%	100.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.14	0.14	100.00%	0.00%	100.00%	0.00%
American Tree Sparrow	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.40	97.37%	100.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.13	97.37%	100.00%	0.00%	0.00%
Tree Swallow	0.00	0.36	100.00%	100.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.09	100.00%	100.00%	0.00%	0.00%	0.00	0.10	100.00%	100.00%	0.00%	0.00%
Cedar Waxwing	0.00	0.09	66.67%	100.00%	0.00%	0.00%	0.00	0.16	100.00%	100.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.08	50.00%	100.00%	0.00%	0.00%	0.00	0.09	81.48%	100.00%	0.00%	0.00%
Common Yellowthroat	0.00	0.31	0.00%	0.00%	0.00%	0.00%	0.00	0.02	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.08	0.00%	0.00%	0.00%	0.00%
Yellow Warbler	0.00	0.31	65.00%	100.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.01	100.00%	100.00%	0.00%	0.00%	0.00	0.07	66.67%	100.00%	0.00%	0.00%
Clay-colored Sparrow	0.00	0.25	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.01	0.00%	0.00%	0.00%	0.00%	0.00	0.06	0.00%	0.00%	0.00%	0.00%
Western Meadowlark	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.15	100.00%	100.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.01	0.00%	0.00%	0.00%	0.00%	0.00	0.05	93.33%	100.00%	0.00%	0.00%
Savannah Sparrow	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.17	0.00%	0.00%	0.00%	0.00%	0.00	0.09	100.00%	100.00%	0.00%	0.00%	0.00	0.05	46.67%	100.00%	0.00%	0.00%
Bank Swallow	0.00	0.19	100.00%	100.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.04	100.00%	100.00%	0.00%	0.00%
Chipping Sparrow	0.00	0.14	55.56%	100.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.03	50.00%	100.00%	0.00%	0.00%	0.00	0.04	54.55%	100.00%	0.00%	0.00%
Vesper Sparrow	0.00	0.16	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.03	0.00%	0.00%	0.00%	0.00%
Song Sparrow	0.00	0.11	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.03	0.00%	0.00%	0.00%	0.00%	0.00	0.03	0.00%	0.00%	0.00%	0.00%
Yellow-headed Blackbird	0.00	0.03	50.00%	100.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.08	100.00%	100.00%	0.00%	0.00%	0.00	0.03	87.50%	100.00%	0.00%	0.00%
Eastern Bluebird	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.06	100.00%	100.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.03	100.00%	100.00%	0.00%	0.00%	0.00	0.03	100.00%	100.00%	0.00%	0.00%
Sedge Wren	0.00	0.08	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.02	0.00%	0.00%	0.00%	0.00%
Least Flycatcher	0.00	0.06	0.00%	0.00%	0.00%	0.00%	0.00	0.01	100.00%	100.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.02	20.00%	100.00%	0.00%	0.00%
Belted Kingfisher	0.00	0.03	50.00%	100.00%	0.00%	0.00%	0.00	0.01	100.00%	100.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.01	100.00%	100.00%	0.00%	0.00%	0.00	0.01	75.00%	100.00%	0.00%	0.00%
Eastern Kingbird	0.00	0.06	50.00%	100.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.01	50.00%	100.00%	0.00%	0.00%
Eastern Wood-Pewee	0.00	0.05	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.01	0.00%	0.00%	0.00%	0.00%
Grasshopper Sparrow	0.00	0.03	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.01	0.00%	0.00%	0.00%	0.00%
Bobolink	0.00	0.02	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
Marsh Wren	0.00	0.02	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
Willow Flycatcher	0.00	0.02	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
Raptors/Vultures/Owls																														
Red-tailed Hawk	0.02	0.05	100.00%	66.67%	33.33%	0.00%	0.04	0.20	89.47%	52.94%	23.53%	23.53%	0.04	0.13	100.00%	50.00%	33.33%	16.67%	0.16	0.21	100.00%	17.65%	76.47%	5.88%	0.07	0.16	95.56%	39.53%	46.51%	13.95%
Turkey Vulture	0.06	0.08	100.00%	20.00%	80.00%	0.00%	0.02	0.07	100.00%	42.86%	28.57%	28.57%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.19	0.20	100.00%	0.00%	93.75%	6.25%	0.07	0.10	100.00%	14.29%	75.00%	10.71%
Bald Eagle	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.03	0.10	90.00%	11.11%	33.33%	55.56%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.06	0.21	100.00%	47.06%	29.41%	23.53%	0.03	0.09	96.30%	34.62%	30.77%	34.62%
Swainson's Hawk	0.00	0.02	100.00%	100.00%	0.00%	0.00%	0.01	0.03	33.33%	0.00%	100.00%	0.00%	0.00	0.02	100.00%	100.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.02	60.00%	66.67%	33.33%	0.00%
Rough-legged Hawk	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.01	0.04	100.00%	25.00%	25.00%	50.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.01	100.00%	25.00%	25.00%	50.00%
Northern Harrier	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.02	100.00%	100.00%	0.00%	0.00%	0.00	0.01	100.00%	100.00%	0.00%	0.00%	0.00	0.01	100.00%	100.00%	0.00%	0.00%
American Kestrel	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.01	100.00%	100.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	100.00%	100.00%	0.00%	0.00%
Cooper's Hawk	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.01	0.01	100.00%	0.00%	100.00%	0.00%	0.00	0.00	100.00%	0.00%	100.00%	0.00%
Waterfowl																														
Canada Goose	0.00	0.05	0.00%	0.00%	0.00%	0.00%	0.00	1.35	95.38%	24.19%	0.00%	75.81%	0.00	0.15	100.00%	0.00%	0.00%	100.00%	1.44	2.60	57.21%	0.00%	96.64%	3.36%	0.40	1.21	71.84%	12.00%	46.00%	42.00%
Unknown Duck	0.00	0.17	0.00%	0.00%	0.00%	0.00%	0.01	0.07	14.29%	0.00%	100.00%	0.00%	0.96	0.96	100.00%	0.00%	100.00%	0.00%	0.06	0.13	50.00%	0.00%	100.00%	0.00%	0.18	0.26	70.27%	0.00%	100.00%	0.00%
Mallard	0.00	0.14	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.03	0.64	60.78%	45.16%	6.45%	48.39%	0.01	0.21	51.67%	45.16%	6.45%	48.39%
Snow Goose	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.21	100.00%	10.00%	0.00%	90.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.07	100.00%	10.00%	0.00%	90.00%
Blue-winged teal	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.01	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
Shorebirds																														
Killdeer	0.00	0.19	41.67%	100.00%	0.00%	0.00%	0.00	0.03	66.67%	100.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.10	50.00%	100.00%	0.00%	0.00%	0.00	0.08	47.83%	100.00%	0.00%	0.00%
Upland Sandpiper	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.01	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
Wilson's Snipe	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.01	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
Gamebirds																														
Wild Turkey	0.00	0.02	0.00%	0.00%	0.00%	0.00%	0.00	0.01	0.00%	0.00%	0.00%	0.00%	0.00	1.92	0.00%	0.00%	0.00%	0.00%	0.00	0.56	0.00%	0.00%	0.00%	0.00%	0.00	0.48	0.00%	0.00%	0.00%	0.00%
Ring-necked Pheasant	0.00	0.19	0.00%	0.00%	0.00%	0.00%	0.00	0.02	50.00%	100.00%	0.00%	0.00%	0.00	0.25	50.00%	100.00%	0.00%	0.00%	0.00	0.14	9.09%	100.00%	0.00%	0.00%	0.00	0.13	21.62%	100.00%	0.00%	0.00%
Woodpecker																														
Northern Flicker	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.16	100.00%	100.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.03	100.00%	100.00%	0.00%	0.00%	0.00	0.06	100.00%	100.00%	0.00%	0.00%
Downy Woodpecker	0.00	0.05	0.00%	0.00%	0.00%	0.00%	0.00	0.07	100.00%	100.00%	0.00%	0.00%	0.00	0.04	50.00%	100.00%	0.00%	0.00%	0.00	0.03	50.00%	100.00%	0.00%	0.00%	0.00	0.05	64.29%	100.00%	0.00%	0.00%
Crows and Allies																														
American Crow	0.00	0.61	82.05%	100.00%	0.00%	0.00%	0.23	2.59	28.11%	68.57%	31.43%	0.00%	0.02	1.19	77.19%	97.73%	2.27%	0.00%	0.61	2.76	96.83%	77.10%	22.90%	0.00%	0.25	1.97	63.60%	80.00%	20.00%	0.00%
Blue Jay	0.00	0.44	28.57%	100.00%	0.00%	0.00%	0.00	0.83	68.75%	100.00%	0.00%	0.00%	0.00	0.38	61.11%	100.00%	0.00%	0.00%	0.00	0.28	31.82%	100.00%	0.00%	0.00%	0.00	0.51	54.73%	100.00%	0.00%	0.00%
Pigeons & Doves																														
Rock Pigeon	0.02	0.34	72.73%	93.75%	6.25%	0.00%	0.02	0.82	100.00%	97.47%	2.53%	0.00%	0.00	0.65	100.00%	100.00%	0.00%	0.00%	0.11	0.50	100.00%	77.50%	22.50%	0.00%	0.04	0.60	96.51%	92.77%	7.23%	0.00%
Mourning Dove	0.02	0.22	78.57%	90.91%	9.09%	0.00%	0.00	0.14	76.92%	100.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.09	42.86%	100.00%	0.00%	0.00%	0.00	0.12	70.59%	95.83%	4.17%	0.00%
Wadingbirds																														
Great Blue Heron	0.02	0.03	100.00%	50.00%	50.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.01	100.00%	50.00%	50.00%	0.00%
Waterbirds																														
American White Pelican	0.06	0.06	100.00%	0.00%	100.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.15	0.15	100.00%	0.00%	100.00%	0.00%	0.06	0.06	100.00%	0.00%	100.00%	0.00%
Gulls/Terns																														
Ring-billed Gull	0.00	0.06	100.00%	100.00%	0.00%	0.00%	0.18	0.22	100.00%	19.05%	80.95%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.06	0.09	100.00%	32.00%	68.00%	0.00%
Totals	**0.19**	**13.67**	**73.14%**				**1.26**	**17.73**	**81.43%**				**1.02**	**17.13**	**80.78%**				**3.24**	**24.61**	**87.05%**				**1.53**	**18.64**	**82.04%**			

Table 11. Cumulative Point Count Individuals and RSA at Palmer's Creek

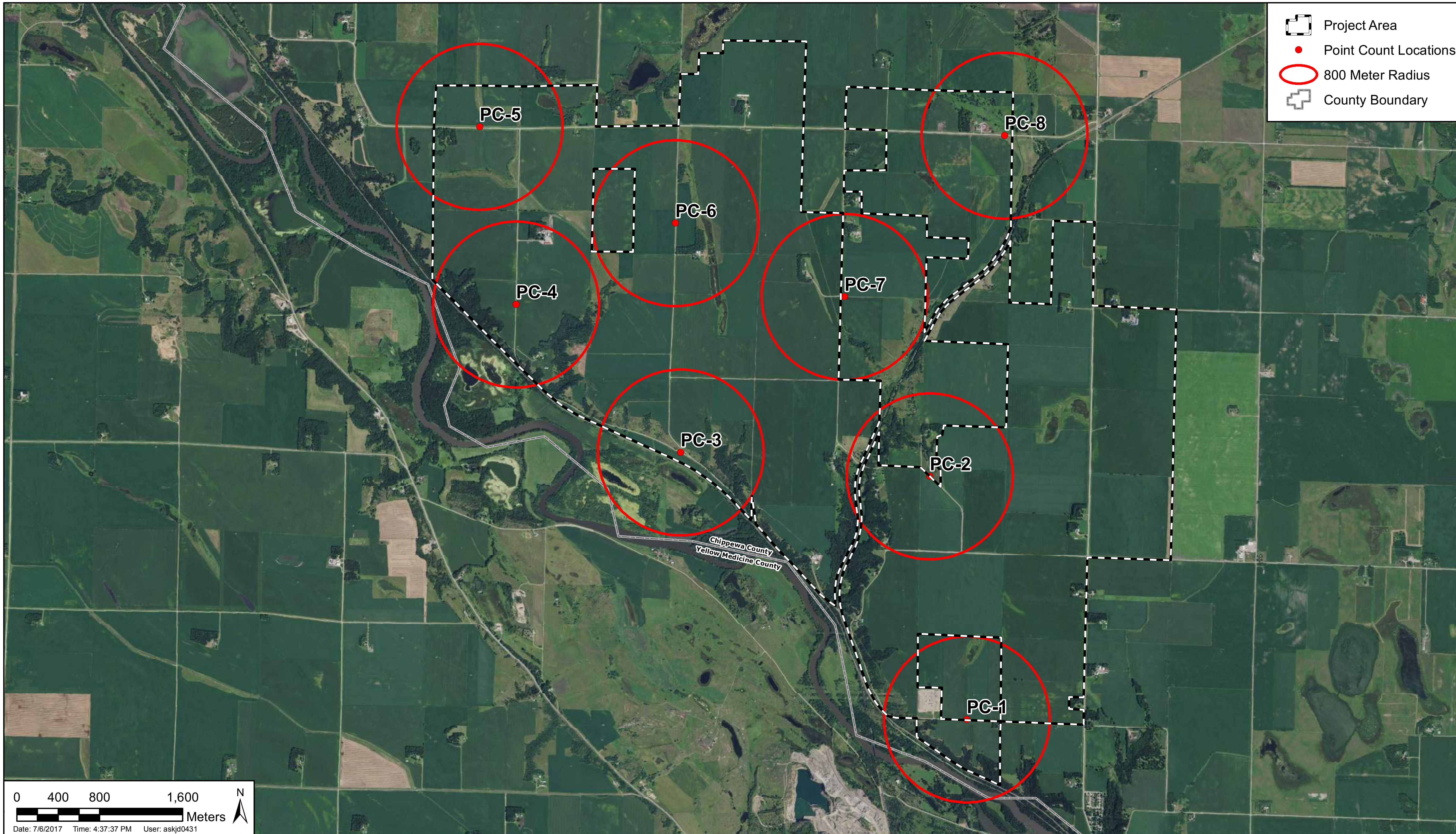
Species	Number Flying	Number of Observations	Summer 2016 & 2017									Fall 2016									Winter 2016-2017									Spring 2017									Cumulative								
			N	NE	E	SE	S	SW	W	NW	Var	N	NE	E	SE	S	SW	W	NW	Var	N	NE	E	SE	S	SW	W	NW	Var	N	NE	E	SE	S	SW	W	NW	Var	N	NE	E	SE	S	SW	W	NW	Var
Songbirds																																															
European Starling	990	34	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	13.64%	86.36%	0.00%	0.00%	0.00%	0.00%	58.67%	0.00%	0.00%	0.00%	41.33%	10.03%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	89.97%	0.00%	0.00%	0.00%	0.00%	2.31%	0.00%	0.00%	0.00%	97.69%	3.13%	0.00%	0.00%	0.00%	5.76%	0.00%	0.00%	0.61%	90.51%
Red-winged Blackbird	676	52	0.85%	3.42%	0.00%	4.27%	0.85%	0.00%	0.85%	2.56%	87.18%	0.00%	0.00%	0.00%	26.34%	23.90%	18.54%	0.00%	0.00%	31.22%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	1.13%	0.56%	3.95%	44.35%	0.28%	49.72%	0.15%	0.59%	0.00%	9.32%	7.69%	7.69%	23.37%	0.59%	50.59%
Brown-headed Cowbird	325	33	2.46%	0.00%	5.74%	2.46%	0.00%	0.00%	27.87%	11.48%	50.00%	7.32%	0.00%	0.61%	9.15%	23.78%	32.32%	8.54%	0.00%	18.29%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	15.38%	0.00%	0.00%	7.69%	0.00%	0.00%	0.00%	76.92%	4.62%	1.85%	2.46%	5.54%	12.92%	16.31%	14.77%	4.31%	37.23%
Horned Lark	171	53	0.00%	0.00%	0.00%	4.76%	0.00%	4.76%	9.52%	0.00%	80.95%	0.00%	0.00%	0.00%	0.00%	34.88%	0.00%	53.49%	0.00%	11.63%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	4.76%	1.90%	2.86%	0.95%	3.81%	0.00%	2.86%	5.71%	77.14%	2.92%	1.17%	1.75%	1.17%	11.11%	0.58%	16.37%	3.51%	61.40%
Barn Swallow	188	26	0.00%	0.00%	1.80%	0.00%	0.00%	0.00%	0.00%	0.00%	98.20%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	1.06%	0.00%	0.00%	0.00%	0.00%	0.00%	98.94%
American Goldfinch	146	38	25.00%	4.55%	9.09%	18.18%	18.18%	6.82%	6.82%	2.27%	9.09%	2.22%	2.22%	46.67%	7.78%	18.89%	5.56%	0.00%	0.00%	16.67%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	66.67%	33.33%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	14.38%	5.48%	31.51%	10.27%	17.12%	5.48%	2.05%	0.68%	13.01%
Snow Bunting	109	6	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	15.60%	0.00%	0.00%	15.60%	0.00%	18.35%	0.00%	50.46%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	15.60%	0.00%	0.00%	15.60%	0.00%	18.35%	0.00%	50.46%
Field Sparrow	62	44	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	8.33%	0.00%	4.17%	0.00%	4.17%	4.17%	2.08%	0.00%	77.08%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	6.45%	0.00%	3.23%	3.23%	3.23%	3.23%	1.61%	0.00%	79.03%
Dark-eyed Junco	100	13	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	29.63%	0.00%	70.37%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	17.86%	82.14%	38.89%	0.00%	0.00%	0.00%	0.00%	0.00%	22.22%	0.00%	38.89%	7.00%	0.00%	0.00%	0.00%	0.00%	0.00%	20.00%	5.00%	68.00%
Common Grackle	89	14	0.00%	36.36%	9.09%	36.36%	18.18%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	8.00%	68.00%	20.00%	0.00%	4.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	3.77%	0.00%	0.00%	32.08%	0.00%	0.00%	9.43%	54.72%	0.00%	2.25%	4.49%	1.12%	25.84%	21.35%	5.62%	5.62%	33.71%	0.00%
Black-capped Chickadee	76	16	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	5.56%	0.00%	0.00%	22.22%	13.89%	0.00%	58.33%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	2.63%	0.00%	0.00%	10.53%	6.58%	0.00%	80.26%
Unidentified Sparrow	59	5	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	2.94%	0.00%	97.06%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	44.07%	0.00%	55.93%
American Robin	30	26	0.00%	0.00%	16.67%	50.00%	0.00%	33.33%	0.00%	0.00%	0.00%	18.18%	0.00%	0.00%	9.09%	18.18%	0.00%	0.00%	27.27%	27.27%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	15.38%	0.00%	46.15%	0.00%	30.77%	0.00%	7.69%	0.00%	0.00%	13.33%	0.00%	23.33%	13.33%	20.00%	6.67%	3.33%	10.00%	10.00%
Unknown Blackbird	40	1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
American Tree Sparrow	37	5	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	35.14%	64.86%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	35.14%	64.86%
Tree Swallow	30	13	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	13.04%	86.96%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	14.29%	0.00%	85.71%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	3.33%	10.00%	86.67%
Cedar Waxwing	22	8	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	53.33%	46.67%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	36.36%	31.82%	31.82%	0.00%	0.00%	0.00%	0.00%
Common Yellowthroat	0	12	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Yellow Warbler	14	5	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	92.86%	0.00%	0.00%	7.14%	0.00%
Clay-colored Sparrow	0	13	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Western Meadowlark	14	4	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	50.00%	35.71%	0.00%	14.29%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	50.00%	35.71%	0.00%	14.29%	0.00%	0.00%
Savannah Sparrow	7	2	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%
Bank Swallow	12	1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%
Chipping Sparrow	6	10	20.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	80.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	33.33%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	66.67%
Vesper Sparrow	0	6	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Song Sparrow	0	7	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Yellow-headed Blackbird	7	4	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%
Eastern Bluebird	8	3	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	16.67%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	83.33%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	12.50%	25.00%	0.00%	0.00%	0.00%	0.00%	0.00%	62.50%	0.00%
Sedge Wren	0	5	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Least Flycatcher	1	4	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Belted Kingfisher	3	4	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	66.67%	0.00%	0.00%	0.00%	33.33%	0.00%	0.00%	0.00%	0.00%
Eastern Kingbird	2	3	50.00%	0.00%	0.00%	50.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	50.00%	0.00%	0.00%	50.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Eastern Wood-Pewee	0	3	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Grasshopper Sparrow	0	2	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Bobolink	0	1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Marsh Wren	0	1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Willow Flycatcher	0	1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Raptors/Vultures/Owls																																															
Red-tailed Hawk	43	41	33.33%	0.00%	33.33%	0.00%	0.00%	33.33%	0.00%	0.00%	0.00%	5.88%	0.00%	0.00%	29.41%	29.41%	5.88%	11.76%	5.88%	11.76%	50.00%	0.00%	0.00%	16.67%	16.67%	16.67%	0.00%	0.00%	0.00%	11.76%	23.53%	5.88%	23.53%	5.88%	0.00%	11.76%	17.65%	0.00%	16.28%	9.30%	4.65%	23.26%	16.28%	6.98%	9.30%	9.30%	4.65%
Turkey Vulture	28	15	0.00%	0.00%	0.00%	0.00%	20.00%	0.00%	40.00%	0.00%	40.00%	0.00%	0.00%	42.86%	57.14%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	18.75%	0.00%	0.00%	0.00%	0.00%	81.25%	0.00%	0.00%	0.00%	21.43%	14.29%	3.57%	0.00%	7.14%	46.43%	7.14%
Bald Eagle	26	21	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	33.33%	0.00%	44.44%	11.11%	0.00%	0.00%	0.00%	11.11%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	29.41%	0.00%	0.00%	5.88%	29.41%	5.88%	0.00%	23.53%	5.88%	19.23%	11.54%	0.00%	19.23%	23.08%	3.85%	0.00%	15.38%	7.69%
Swainson's Hawk	3	4	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	33.33%	33.33%	33.33%	0.00%	0.00%	0.00%
Rough-legged Hawk	4	3	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Northern Harrier	2	2	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	50.00%	0.00%	50.00%	0.00%	0.00%	0.00%	0.00%
American Kestrel	1	1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%
Cooper's Hawk	1	1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%
Waterfowl																																															
Canada Goose	250	34	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.81%	0.00%	0.00%	41.94%	42.74%	14.52%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	14.29%	0.00%	5.04%	8.40%	0.00%	0.00%	0.00%	72.27%	0.00%	7.20%	0.00%	2.40%	24.80%	24.00%	7.20%	0.00%	34.40%	0.00%
Unknown Duck	52	12	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	30.43%	0.00%	0.00%	69.57%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	80.00%	0.00%	20.00%	0.00%	0.00%	0.00%	26.92%	0.00%	0.00%	71.15%	0.00%	1.92%	0.00%	0.00%	0.00%
Mallard	31	17	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	58.06%	19.35%	0.00%	3.23%	6.45%	0.00%	0.00%	9.68%	0.00%	58.06%	19.35%	0.00%	3.23%	6.45%	0.00%	0.00%	9.68%	0.00%
Snow Goose	20	2	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	90.00%	10.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	90.00%	10.00%	0.00%	0.00%	0.00%	0.00%
Blue-winged teal	0	1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Shorebirds																																															
Killdeer	11	16	0.00%	0.00%	40.00%	0.00%	0.00%	0.00%	0.00%	0.00%	60.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	36.36%	0.00%	18.18%	0.00%	0.00%	0.00%	0.00%	0.00%	45.45%
Upland Sandpiper	0	1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Wilson's Snipe	0	1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Gamebirds																																															
Wild Turkey	0	10	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Ring-necked Pheasant	8	23	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	75.00%	0.00%	12.50%	12.50%	0.00%	0.00%
Woodpecker																																															
Northern Flicker	17	8	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	26.67%	0.00%	20.00%	33.33%	20.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	50.00%	0.00%	0.00%	0.00%	0.00%	50.00%	0.00%	0.00%	0.00%	29.41%	0.00%	17.65%	29.41%	17.65%	5.88%	0.00%	0.00%
Downy Woodpecker	9	14	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	14.29%	0.00%	14.29%	28.57%	0.00%	14.29%	28.57%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	11.11%	0.00%	11.11%	33.33%	11.11%	11.11%	22.22%	0.00%	0.00%
Crows and Allies																																															
American Crow	360	73	12.50%	3.13%	0.00%	0.00%	0.00%	15.63%	15.63%	53.13%	0.00%	14.29%	2.86%	4.29%	10.00%	12.86%	0.00%	0.00%	10.00%	45.71%	43.18%	0.00%	0.00%	29.55%	13.64%	11.36%	2.27%	0.00%	0.00%	23.36%	9.35%	15.89%	0.00%	27.10%	3.27%	20.09%	0.93%	0.00%	23.06%	6.39%	10.28%	5.56%	20.28%	4.72%	13.61%	7.22%	8.89%
Blue Jay	81	58	37.50%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	62.50%	10.91%	18.18%	18.18%	7.27%	16.36%	12.73%	14.55%	0.00%	1.82%	0.00%	0.00%	9.09%	27.27%	9.09%	0.00%	18.18%	36.36%	0.00%	0.00%	0.00%	0.00%	0.00%	14.29%	0.00%	14.29%	42.86%	28.57%	11.11%	12.35%	13.58%	8.64%	13.58%	8.64%	13.58%	8.64%	9.88%
Pigeons & Doves																																															
Rock Pigeon	166	49	6.25%	62.50%	12.50%	0.00%	6.25%	0.00%	12.50%	0.00%	0.00%	26.58%	0.00%	10.13%	0.00%	2.53%	0.00%	6.33%	13.92%	40.51%	6.45%	0.00%	6.45%	0.00%	0.00%	0.00%	16.13%	9.68%	61.29%	40.00%	0.00%	0.00%	32.50%	10.00%	2.50%	0.00%	0.00%	15.00%	24.10%	6.02%	7.23%	7.83%	4.22%	0.60%	7.23%	8.43%	34.34%
Mourning Dove	24	23	54.55%	0.00%	18.18%	9.09%	0.00%	0.00%	18.18%	0.00%	0.00%	30.00%	0.00%	10.00%	0.00%	10.00%	10.00%	40.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	66.67%	0.00%	0.00%	0.00%	0.00%	33.33%	0.00%	0.00%	0.00%	45.83%	0.00%	12.50%	4.17%	4.17%	8.33%	25.00%	0.00%	0.00%
Wadingbirds																																															
Great Blue Heron	2	2	0.00%	0.00%	0.00%	0.00%	50.00%	0.00%	0.00%	50.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	50.00%	0.00%	0.00%	50.00%	0.00%
Waterbirds																																															
American White Pelican	16	3	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	25.00%	75.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	18.75%	81.25%	0.00%
Gulls/Terns																																															
Ring-billed Gull	25	6	0.00%	0.00%	0.00%	25.00%	0.00%	0.00%	0.00%	75.00%	0.00%	0.00%	0.00%	0.00%	0.00%	9.52%	0.00%	9.52%	0.00%	80.95%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	4.00%	8.00%	0.00%	8.00%	12.00%	68.00%
Totals			**5.16%**	**3.28%**	**3.44%**	**4.22%**	**4.84%**	**2.03%**	**7.97%**	**8.13%**	**60.94%**	**7.50%**	**1.59%**	**5.84%**	**14.29%**	**20.20%**	**10.25%**	**6.13%**	**3.03%**	**31.17%**	**10.39%**	**2.56%**	**0.60%**	**8.28%**	**5.12%**	**0.90%**	**4.37%**	**1.81%**	**65.96%**	**8.17%**	**2.63%**	**3.09%**	**3.39%**	**5.90%**	**1.52%**	**14.36%**	**9.40%**	**51.55%**	**7.86%**	**2.38%**	**3.63%**	**7.68%**	**10.13%**	**4.25%**	**9.33%**	**6.06%**	**48.67%**

Appendix B



Path: J:\GIS\2759\05 Palmers Creek Wind Farm\01 Avian PC Surveys\MXD\Site Location.mxd

FAGEN ENGINEERING	WENCK ASSOCIATES	JUL 2017
Site Location Map	Responsive partner. Exceptional outcomes.	Figure 1



FAGEN ENGINEERING

Point Count Locations

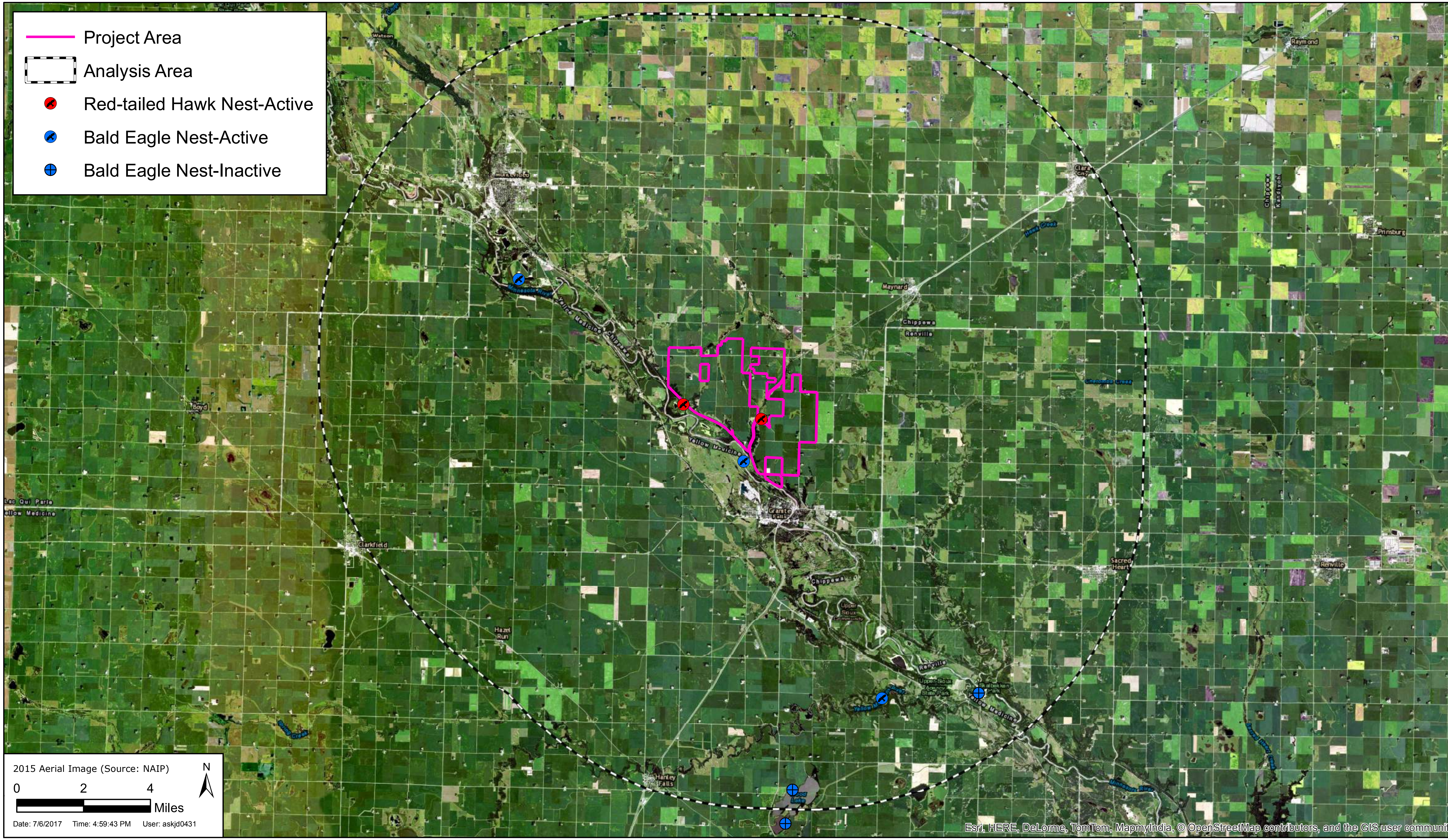
WENCK ASSOCIATES

Responsive partner. Exceptional outcomes.

JUL 2017

Figure 2

Path: J:\GIS\2759\05 Palmers Creek Wind Farm\01 Avian PC Surveys\MXD\Point Count Locations.mxd



PALMER'S CREEK WIND FARM, LLC	WENCK ASSOCIATES	JUL 2017
Nest Locations and Survey Area	Responsive partner. Exceptional outcomes.	Figure 4

Path: J:\GIS\2759\05 Palmers Creek Wind Farm\01 Avian PC Surveys\MXD\F4_Raptor Surveys.mxd

Appendix C

Aerial Eagle/Raptor Nest Survey Report; Palmer's Creek Wind Farm

Responsive partner.
Exceptional outcomes.

April 27, 2017

Michael Rutledge
Palmer's Creek Wind Farm, LLC
501 West Highway 212
Granite Falls, MN 56241

Aerial Eagle/Raptor Nest Survey Report
Palmer's Creek Wind Farm
Chippewa County, Minnesota
Wenck File No. B2759-0005-11

Introduction

Palmer's Creek Wind Farm, LLC contracted Wenck Associates, Inc. to complete an aerial bald eagle (*Haliaeetus leucocephalus*) nest survey on state and private lands surrounding the proposed Palmer's Creek Wind Farm project area (**Figure 1**). The survey was recommended to potentially identify active/inactive nests within a ten-mile buffer of the project area (USFWS 2016). In 2007, the bald eagle (State Special Concern Species) was delisted from its federally threatened status in the lower 48 states, but it is still federally protected under the Bald and Golden Eagle Protection Act ("BGEPA"). It was also delisted in Minnesota in 2013.

Methods

The objective of the aerial eagle nest surveys is to locate and record nests that may be in the proximity of the project area, to identify concentration and density of eagle nests, and to identify nests that may be vulnerable to disturbance and/or displacement effects by the proposed project. The intent of the nest survey is to gather information on species nesting in the area, including nest locations, nesting season (timing), and nest success.

The survey was conducted within a ten-mile buffer from the project area (defined as the analysis area). Eagle Aviation Inc. was contracted to fly an aerial survey of the project area on April 20, 2017. A Cessna Skyhawk with two observers were used during the survey, Ray Jilek (Eagle Aviation, Pilot) and Justin Askim (Wenck, Natural Resources Services Leader) (**Photo 1**). Complete coverage of the project area was obtained by systematically flying over the landscape and visually scanning all areas for potential roosting, nesting and foraging eagles. Aerial surveys were conducted using a fixed-wing aircraft, flying over relatively even terrain at approximately 250 – 500 feet above ground level and at speeds of 85 to 125 miles per hour.

Photo 1: Note low flight ceiling height and minor precipitation prior to the aerial survey.

WENCK ASSOCIATES

Responsive partner.
Exceptional outcomes.

A total of approximately 415 miles were flown in the analysis area to investigate woody draws, riparian areas, farm yards and other appropriate habitats for eagle nests and eagle activity (**Figure 2**).

Existing data on bald eagle nest locations was received from the Minnesota Department of Natural Resources (MNDNR) on July 5, 2016. Based on historical records, one nest is located in Section 11, T116N R40W (MNDNR 2016), is nest was not observed during the aerial surveys. However, two eagles were observed perched in the areas. During the 2016 field surveys, another eagle nest (**Figure 3**, Nest 3) was located in the Minnesota River Valley, approximately one mile southeast of the nearest WTG (WTG 12) and 0.3 miles outside of the project area. This nest was not recorded in the MNDNR Natural Heritage Information System (NHIS) database. Both nests are located outside of the project area. These nests were further examined during the aerial survey, as summarized in **Table 1** below.

Results and Conclusion

Three active nests, three inactive nests and ten individuals (three on nest and seven in flight or perched) were observed during the April 20, 2017 aerial survey (**Figure 2**, **Figure 3** and **Table 1**). With the exception of Nest 3, all nests are approximately five miles or greater from the project area.

Table 1: Eagle Nests Within Palmer's Creek Wind Farm Analysis Area

Nest Number	Status	Distance from Project Area	Latitude	Longitude
1	Active	4.9 miles	44.90855599	-95.70717782
2	Inactive	8.5 miles	44.73293894	-95.42223611
3	Active	0.3 miles	44.83149047	-95.56799484
4	Active	7.0 miles	44.72996346	-95.48105437
5	Inactive	10.0 miles	44.67489358	-95.53845803
6	Inactive	9.0 miles	44.68952578	-95.53443812

Eagle nest density within the analysis area is approximately one active nest per 102,000 acres.

Please contact Justin Askim at 701-751-6125, jaskim@wenck.com if you have comments or require additional information.

Sincerely,

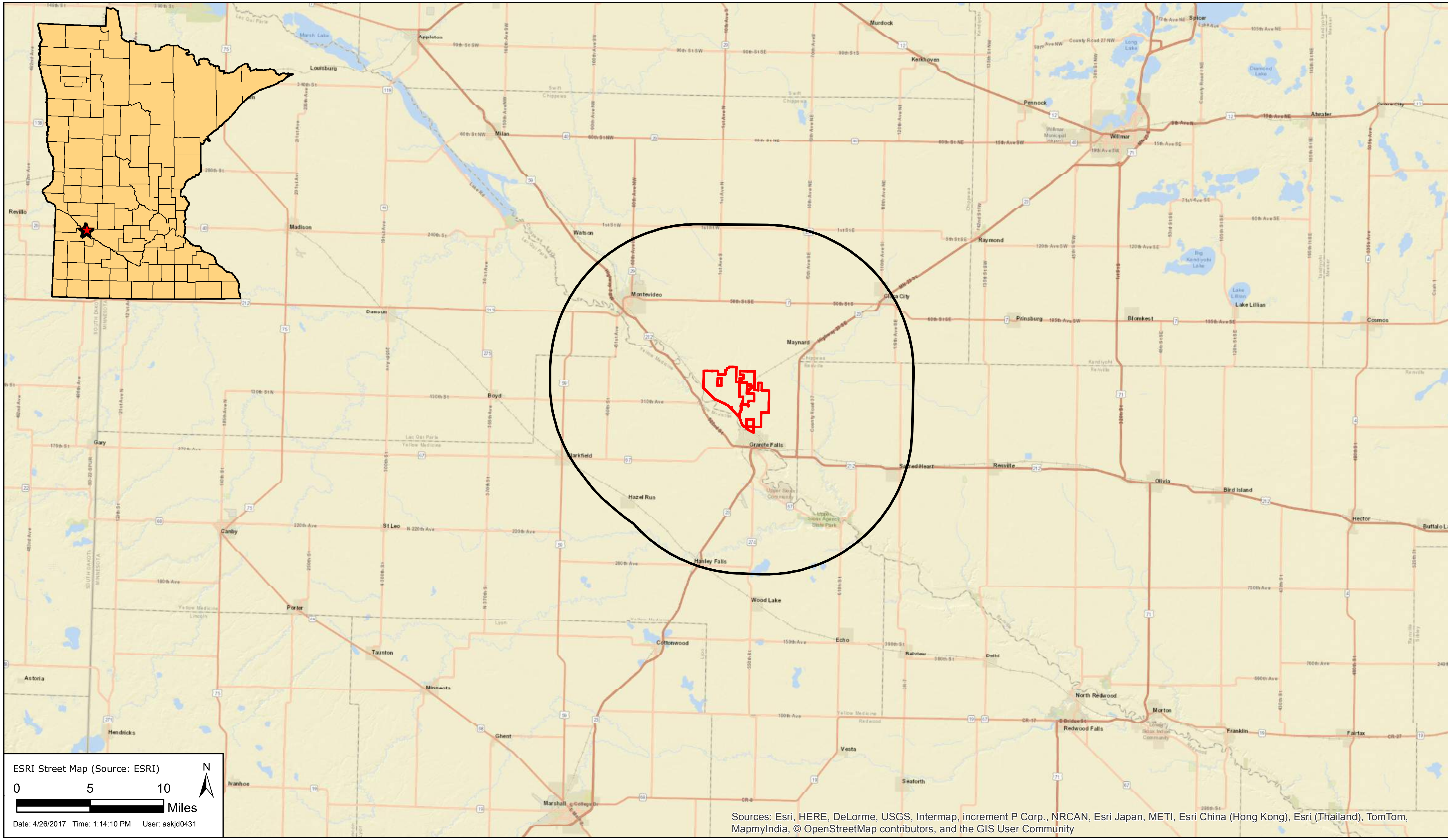
WENCK ASSOCIATES, INC.

Justin Askim
Principal/Natural Resources Services Leader

References

MNDNR. 2016. Natural Heritage Information System Correspondence #ERDB 20160322-0002, July 5, 2016.

USFWS 2016. Palmer's Creek Wind Farm Eagle Use Surveys. Email from Margaret Rheude. August 22, 2016.



PALMER'S CREEK WIND FARM, LLC

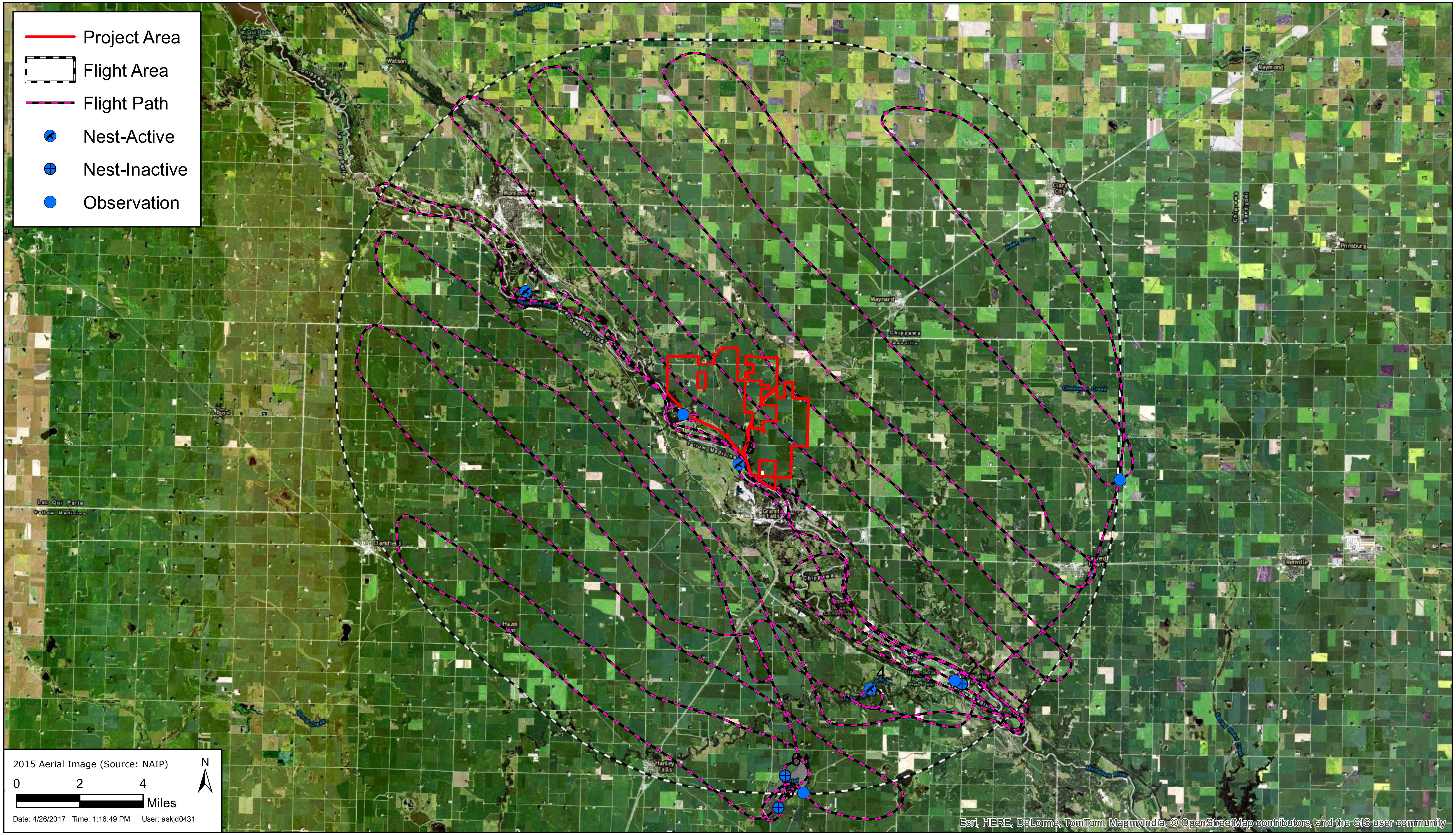
Project Location and Analysis Area

WENCK ASSOCIATES
Responsive partner. Exceptional outcomes.

APR 2017

Figure 1

Path: J:\GIS\2759\05 Palmers Creek Wind Farm\11 Aerial Eagle Surveys\mxd\F1-Flight Area.mxd



PALMER'S CREEK WIND FARM, LLC

Flight Path and Results

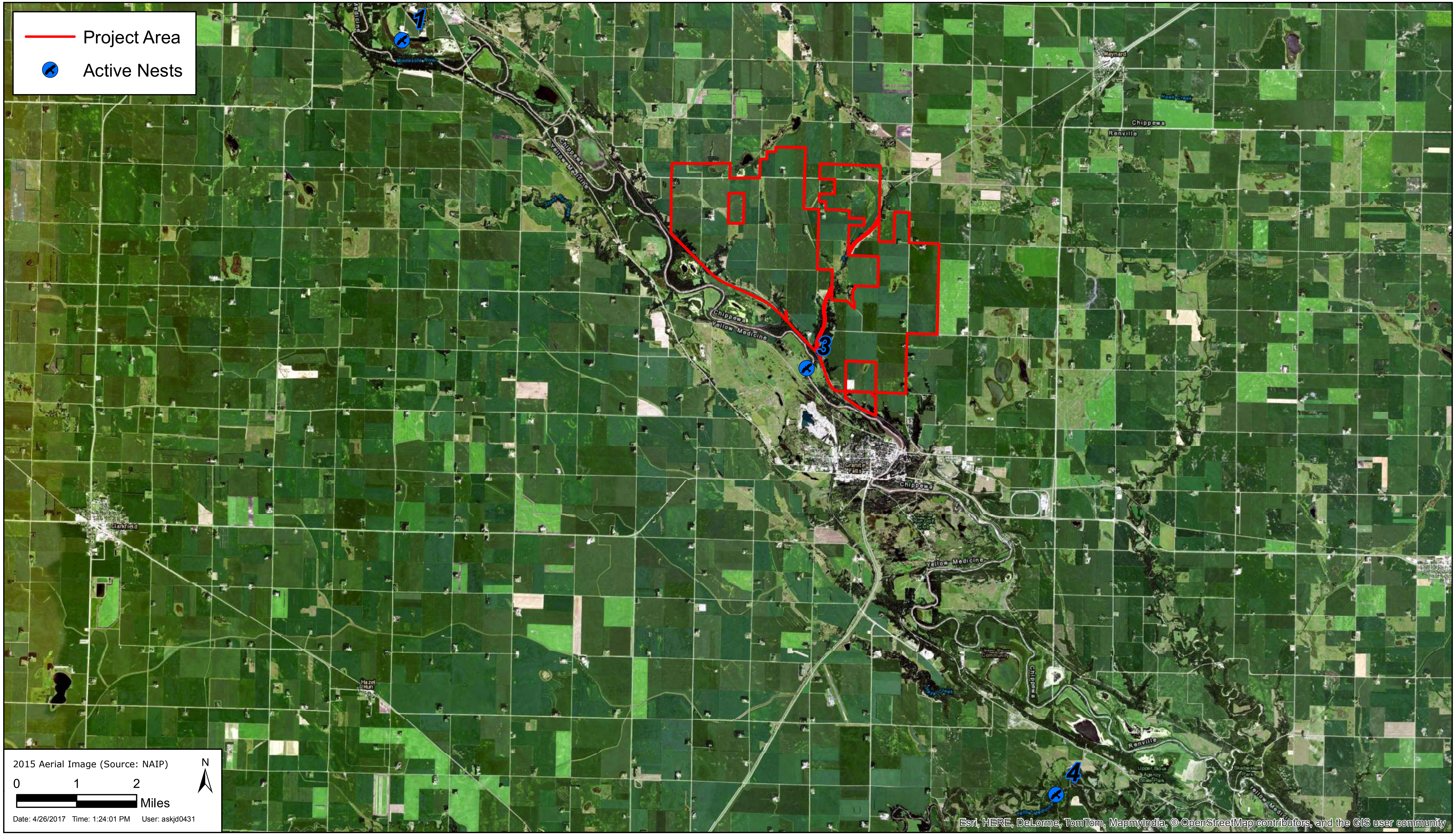
WENCK ASSOCIATES

Responsive partner. Exceptional outcomes.

APR 2017

Figure 2

Path: J:\GIS\2759\05 Palmers Creek Wind Farm\11 Aerial Eagle Surveys\mxd\F2-Flight Path and Results.mxd



PALMER'S CREEK WIND FARM, LLC	WENCK ASSOCIATES Responsive partner. Exceptional outcomes.	APR 2017
Active Nest Locations		Figure 3

Path: J:\GIS\2759\05 Palmers Creek Wind Farm\11 Aerial Eagle Surveys\mxd\F3-Active Nest Locations.mxd

Appendix D

Interim Acoustic Bat Summary Report (2015-2016); Palmer's Creek Wind Farm

Interim Acoustic Bat Summary Report (Spring 2017); Palmer's Creek Wind Farm

FAGEN, INC.
GRANITE FALLS, MINNESOTA

Palmer's Creek Wind Farm

Acoustic Bat Summary Report

2017

NEW CENTURY ENVIRONMENTAL LLC, COLUMBUS, NE

Table of Contents

List of figures

Palmer's Creek WRA Acoustic Bat Monitoring Study
Fagen, Inc.
Granite Falls, Minnesota

Prepared By
New Century Environmental, LLC.
Columbus, Nebraska

Executive Summary

In early summer of 2016, Mike Rutledge of Fagen Engineering contacted Mike Gutzmer of New Century Environmental, LLC (NCE) to aid in the effort of completing a bat report that would capture the diversity/abundance of bat species within the study area of Palmer's Creek to meet due diligence with regulatory agencies, which was done through acoustic monitoring. The client proposed to develop a wind farm within the study area of Chippewa County, Minnesota (just north across the Minnesota River from Granite Falls). The study area lies within the Des Moines Lobe Western Corn Belt Plains (47b) ecoregion of Minnesota. Staff of Fagen Engineering deployed five separate ANABAT systems to record bat activity throughout the study area, the first deployment was done with two of the ANABAT recorders during the fall of 2015 and continued through 15 October 2016. Three more ANABAT recorders were launched on 03 August, 2016. The data collected from Fagen Engineering was sent to NCE via Procore Portal. NCE then took the data and processed in zero-crossing through Kaleidoscope version 3.1.8 to confirm presence diversity and abundance of bat species. The software uses a presence/absent indicator by giving each species of bat a p-value. The lower the p-value, the more likely the species of bat is present. Bat presence, in the form of vocalization, was detected, identified by species, and catalogued, thereby allowing us to estimate species occurrences, distribution and relative abundance.

Introduction

In early summer of 2016, Mike Rutledge of Fagen Engineering, LLC contacted Mike Gutzmer of New Century Environmental, LLC (NCE) to aid in the effort of completing a bat report that would capture the diversity/abundance of bat species within the study area of Palmer's Creek to meet due diligence with regulatory agencies. The client proposed to develop a wind farm in Chippewa County, Minnesota (just north across the Minnesota River from Granite Falls). Bat fatalities result from wind turbine strikes as they feed on insects at night. The heat from the wind turbines attract insects and therefore bring the bats close to the wind turbine. With decreasing bat populations, the gathering of necessary bat data is crucial for this proposed site. Threatened and Endangered bat species become at risk in wind farm areas. Populations of bat species are experiencing long-term declines, due in part to habitat loss and fragmentation, invasive species, and numerous anthropogenic impacts, increasing the concern over the potential effects of energy development. All studies of bat impacts have demonstrated that fatalities peak in late summer and early fall, coinciding with the migration of many species (Johnson 2005; Kunz et al. 2007a; Arnett et al. 2008). A smaller spike in bat fatalities occurs during spring migration for some species at some facilities (Arnett et al. 2008). However, the seasonal fatality peaks noted above may change as more facilities are developed and studied.

Study Area

The study area is located within Chippewa County, Minnesota (just north across the Minnesota River from Granite Falls). The study area lies within the Des Moines Lobe Western Corn Belt Plains (47b) ecoregion of Minnesota. This ecoregion consists of fast fertile plain of deep soils dominated by row crops. The boundaries of the Minnesota River Prairie Subsection coincide with large till plains flanking the Minnesota River. The unit is bounded to the southwest by the Prairie Coteau. A series of moraines define the eastern boundary, the Alexandria Moraine to the northeast and the Bemis moraine to the southeast (Minnesota 2016).

The Minnesota River Prairie is a large subsection that includes part of northwestern Iowa and spreads across southwestern Minnesota into eastern South Dakota. The Minnesota River forms a broad valley, dividing the area in half. This valley once had a continuous band of floodplain forest that extended upstream as far as Lac Qui Parle, with highly unique bedrock exposures. There are 150 lakes larger than 160 acres in the subsection, most of which are shallow. Before settlement by people of European descent, the predominant vegetation was tallgrass prairie and wetlands. Fire was once a common natural disturbance and critical to maintaining native prairie communities (Minnesota, 2016).

Today, row-crop agriculture is the predominant land use, and prairie remnants and floodplain forests are rare. A major concern is impacts on water quality from intensive agricultural activities, including use of fertilizers and pesticides, expanding use of pattern tiling, and ditching and draining of small wetlands. Continued loss of the small amount of native upland habitat and over-intensive grazing remain a concern (Minnesota, 2016).

Figure 1: Vicinity map of study area. Chippewa county is located in southwestern Minnesota.

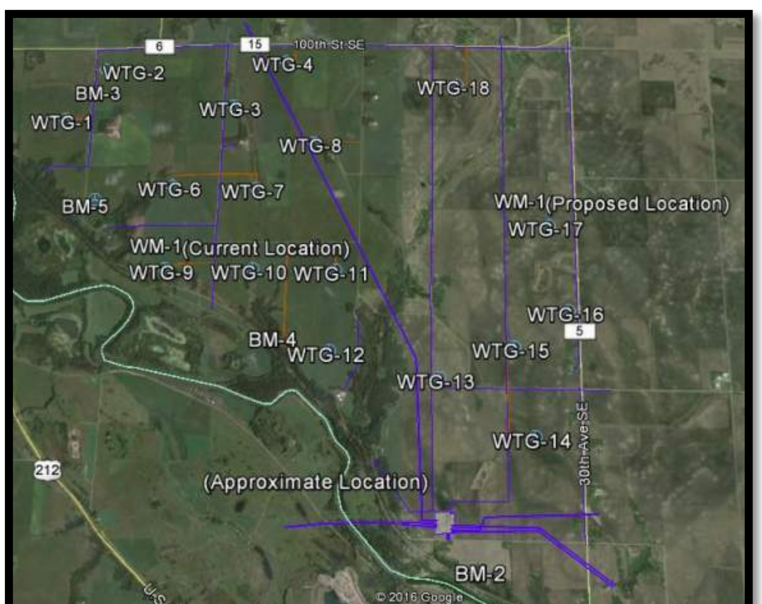


Figure 2: Project location along with bat monitor (BM) locations. BM-1 is not shown on the map but lies next to BM-2.

Methods

Data was gathered in the field by Fagen Engineering, LLC within the study area from five different Anabat acoustic recorders (map in Study Area section shows locations of monitors). Monitors 1 & 2 gathered data throughout the fall of 2015 and were deployed again in May of 2016. Monitors 3-5 were added in September of 2016.

Monitors 1 & 2 were deployed on September 13, 2015 and removed on October 11, 2015. They were deployed again on April 12, 2016 then removed on October 15. Monitor 3, monitor 4 and monitor 5 were deployed on August 3rd, 2016 then removed on October 15th, 2016. The monitors were deployed for 287 trap nights

The data was uploaded through the Procore portal where New Century Environmental staff could access the data to download and process through a program called Kaleidoscope Pro version 3.1.8. The Kaleidoscope classifier uses a source library of user submitted reference calls to compare to recordings. It accepts and displays full-spectrum signals, to match with the calls known bat species. The software uses a presence/absence indicator by giving each species of bat a p-Value of 0 to 1. The lower the P-Value, the more likely the species is present. Variability in the quality of recordings and variations in calls among individual bats creates challenges to acoustic bat classification.

Kaleidoscope Pro has been approved by the U.S. Fish & Wildlife Service for use for presence/absence analysis for Indiana bats (*Myotis sodalis*). Similarly, the approved programs may also be used for presence/absence analysis for northern long-eared bats (*Myotis septentrionalis*). The U.S Geological Survey also tested acoustic matching programs and Kaleidoscope Pro passed their standard validation process (USFWS 2016).

Results

From the five Anabat recording systems, 232,116 sound files were recorded. Visual examination and filtering of files to eliminate extraneous noise (e.g., wind, insects, etc.) resulted in a total of 14,442 bat detections.

Monitor 1 recorded 3,181 files that Kaleidoscope Pro was able to classify as bat passes. The silver haired bat was the most common species at this site being 62% of total detections. The big brown bat was the second most common being 13% of total detections. The federally threatened northern long-eared myotis was detected 4 times (0.001%), but had a P-value of 1 which almost certainly means it was nonexistent at this site. The eastern pipistrelle had a total of 55 (2%) detections.

Code	Common name	Scientific Name	Conservation status	P-Value	# of passes
LANO	Silver-Haired Bat	*Lasionycteris noctivagans*	Least concern	0	1971
EPFU	Big-Brown Bat	*Eptesicus fuscus*	Least concern	0	427
LACI	Hoary Bat	*Lasiurus cinereus*	Least concern	0	347
LABO	Eastern Red Bat	*Lasiurus borealis*	Least concern	0	158
MYLU	Little Brown Bat	*Myotis lucificus*	Least concern	0	219
MYSE	Northern long-eared myotis	*Myotis septentrionalis*	Federally threatened	1	4
PESU	Eastern pipistrelle	*Perimyotis subflavus*	MN species of concern	0	55

Figure 3: Summary of species diversity and abundance for monitor 1.

Monitor 2 recorded 3,004 files that Kaleidoscope Pro was able to classify as bat passes. The silver haired bat was the most common species at this site being 57% of total detections. The second most common was the hoary bat at 30% of detections. The federally threatened northern long eared myotis only had a total of 2 (0.0007%) detections but had a P-value of 1. The eastern pipistrelle had a total of 14 (0.005%) detections.

Code	Common name	Scientific Name	Conservation status	P-Value	# of passes
LANO	Silver-Haired Bat	*Lasionycteris noctivagans*	Least concern	0	1717
EPFU	Big-Brown Bat	*Eptesicus fuscus*	Least concern	0	167
LACI	Hoary Bat	*Lasiurus cinereus*	Least concern	0	887
LABO	Eastern Red Bat	*Lasiurus borealis*	Least concern	0	165
MYLU	Little Brown Bat	*Myotis lucificus*	Least concern	0.14	52
MYSE	Northern long-eared myotis	*Myotis septentrionalis*	Federally threatened	1	2
PESU	Eastern pipistrelle	*Perimyotis subflavus*	MN species of concern	0.01	14

Figure 4: Summary of species abundance and diversity for monitor 2

Monitor 3 recorded 4,870 files that Kaleidoscope Pro was able to classify as bat passes. The hoary bat was the most common species at this site being 75% of total detections. The second most common was the silver haired bat being 8% of total detections. The northern long eared bat had only 1 (0.0002%) detections with a p-value of 1. The eastern pipistrelle had a total of 64 (1%) detections.

Code	Common name	Scientific Name	Conservation status	P-Value	# of passes
LANO	Silver-Haired Bat	*Lasionycteris noctivagans*	Least concern	0.34	401
EPFU	Big-Brown Bat	*Eptesicus fuscus*	Least concern	0	263
LACI	Hoary Bat	*Lasiurus cinereus*	Least concern	0	3672
LABO	Eastern Red Bat	*Lasiurus borealis*	Least concern	0	306
MYLU	Little Brown Bat	*Myotis lucificus*	Least concern	0	163
MYSE	Northern long-eared myotis	*Myotis septentrionalis*	Federally threatened	1	1
PESU	Eastern pipistrelle	*Perimyotis subflavus*	MN species of concern	0	64

Figure 5: Summary of species diversity and abundance for monitor 3

Monitor 4 recorded 1,512 files Kaleidoscope Pro classified as bat passes. The most common species at this site was the silver-haired bat being 46% of total detections. The second most common was the hoary bat being 26% of total detections. The northern long-eared myotis was not recorded at this site. The eastern pipistrelle had a total of 59 (4%) detections.

Code	Common name	Scientific Name	Conservation status	P-Value	# of passes
LANO	Silver-Haired Bat	*Lasionycteris noctivagans*	Least concern	0	688
EPFU	Big-Brown Bat	*Eptesicus fuscus*	Least concern	0	143
LACI	Hoary Bat	*Lasiurus cinereus*	Least concern	0	390
LABO	Eastern Red Bat	*Lasiurus borealis*	Least concern	0	129
MYLU	Little Brown Bat	*Myotis lucificus*	Least concern	0	103
MYSE	Northern long-eared myotis	*Myotis septentrionalis*	Federally threatened	1	0
PESU	Eastern pipistrelle	*Perimyotis subflavus*	MN species of concern	0	59

Figure 6: Summary of species diversity and abundance for monitor 4

Monitor 5 recorded 1,875 files Kaleidoscope Pro classified as bat passes. The most common species at this site was the silver haired bat being 46% of total detections. The second most common was the hoary bat with being 21%) of total detections. The northern long-eared myotis had a total of 2 (0.001%) detections. The eastern pipistrelle had a total of 70 (4%) detections.

Code	Common name	Scientific Name	Conservation status	P-Value	# of passes
LANO	Silver-Haired Bat	*Lasionycteris noctivagans*	Least concern	0	871
EPFU	Big-Brown Bat	*Eptesicus fuscus*	Least concern	0	316
LACI	Hoary Bat	*Lasiurus cinereus*	Least concern	0	403
LABO	Eastern Red Bat	*Lasiurus borealis*	Least concern	0	138
MYLU	Little Brown Bat	*Myotis lucificus*	Least concern	0	75
MYSE	Northern long-eared myotis	*Myotis septentrionalis*	Federally threatened	1	2
PESU	Eastern pipistrelle	*Perimyotis subflavus*	MN species of concern	0	70

Figure 7: Summary of species diversity and abundance for monitor 5.

Discussion

There are seven species of bats that occur regularly in Minnesota; our most common species, the little brown myotis, occurs over most of North America. Along with the Northern myotis and big brown bat, it hibernates in Minnesota caves and mines. In summer, they roost in caves, mines, hollow trees, and buildings. Large groups of these bats hang upside-down in caves. The eastern pipistrelle is the smallest species, weighing only two-tenths of an ounce. It is found in the same Minnesota caves and mines, though it is less common and in fewer numbers.

The silver-haired bat and Eastern red bad are forest dwellers that usually live near water and feed among the trees. Usually a red bat pair will repeatedly fly the same route in search of food. Another woodland species is the hoary bat. It is the largest Minnesota bat, weighing an ounce or more. All three species are somewhat solitary, roost in trees, and migrate south for the winter (Minnesota, 2016).

In early July 2016, a species previously not known to be native to Minnesota, the evening bat, was discovered. Researchers from the DNR Nongame Wildlife Program and Central Lakes College were conducting a survey as part of a project to study summer breeding habits of the state's forest bats. The bat was captured at the Minnesota Army National Guard's Training Site in Arden Hills.

All seven bat species that occur in Minnesota may be found throughout the state.

Common name	Scientific Name	State Status	Federal Status
Northern long-eared myotis	*Myotis septentrionalis*	Threatened	Threatened
Eastern Pipistrelle	*Pipistrellus subflavus*	MN species concern	Not listed
Little brown bat	*Myotis lucifugus*	Not listed	Not listed
Big brown bat	*Eptesicus fuscus*	Not listed	Not listed
Silver-haired bat	*Lasionycteris noctivagans*	Not listed	Not listed
Eastern red bat	*Lasiurus borealis*	Not listed	Not listed
Hoary bat	*Lasiurus cinereus*	Not listed	Not listed
Evening bat	*Nycticeius humeralis*	Newly discovered	Not listed

Figure 8: Bat species found in Minnesota with federal and state conservation status.

There were a total of six bat species documented throughout the course of the study (September-October 2015 and 2016). The eastern pipistrelle (*Pipistrellus sublavus)* was documented at this site and is listed as a species of concern in the state of Minnesota. It was detected in small numbers but was found at every monitor except for monitor 1. The northern long-eared myotis (*Myotis septentrionalis*) is a federally threatened species whose home range lies within the study site. However no confirmed documentation was recorded here. Even though a total of five clicks of which Kaleidoscope classified as MYSE (northern long-eared myotis) the P-value was given a 1 for every monitor indicating the likelihood of presence is near non-existent. All other species documented are of least concern. Of the six species documented the silver-haired bat (*Lasionycteris noctivagans*), hoary bat (*Lasiurus cinereus*) and big brown bat (*Eptesicus fuscus*) were among the most common followed by the little brown bat (*Myotis lucifugus*) and eastern red bat (*Lasiurus borealis*).

References

Arnett, E. B., W. K. Brown, W. P. Erickson, J. K. Fiedler, B. I. Hamilton, T. H. Henry, A. Jain, G. D. Johnson, J. Kerns, R. R. Koford, C. P. Nicholson, T. J. O'Connell, M. D. Piorkowski, R. D. Tankersley Jr. 2008. Patterns of Bat Fatalities at Wind Energy Facilities in North America. *Journal of Wildlife Management*. 72: 61-78.

Johnson, G.D. 2005. A review of bat mortality at wind-energy developments in the United States. *Bat Research News*. 46: 45-49.

Kunz, T. H., E. B. Arnett, W. P. Erickson, A. R. Hoar, G. D. Johnson, R. P. Larkin, M. D. Strickland, R. W. Thresher, and M. D. Tuttle. 2007a. Ecological impacts of wind energy development on bats: questions, research needs, and hypotheses. *Frontiers in Ecology & the Environment*. 5: 315–324.

Minnesota Department of Natural Resources, 2006. Tomorrow's Habitat for the Wild and Rare: An Action Plan for Minnesota Wildlife, Comprehensive Wildlife Conservation Strategy. Division of Ecological Services, Minnesota Department of Natural Resources.

US Fish and Wildlife Service. 2016. Endangered Species Midwest Region. Accessed on 7 November 2016 at <https://www.fws.gov/midwest/Endangered/mammals/inba/surveys/inbaAcousticSoftware.html>.

Appendix

Summary Graphs

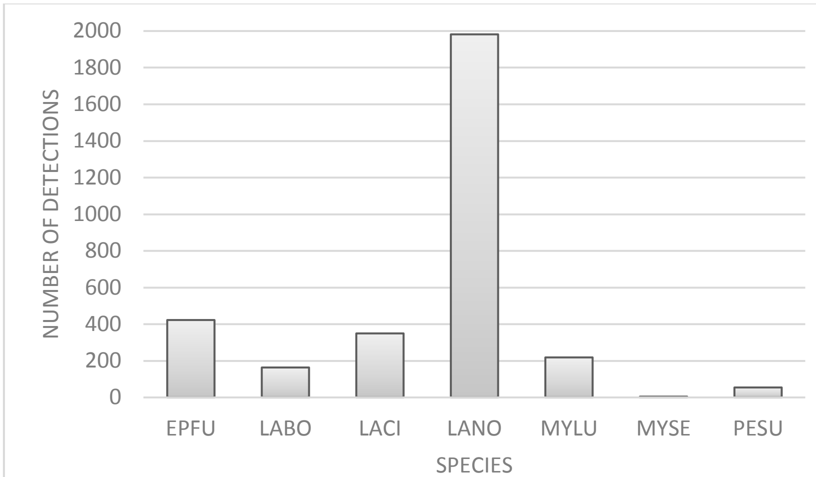


Figure 9.1: Total number of bat detections by species for monitor 1

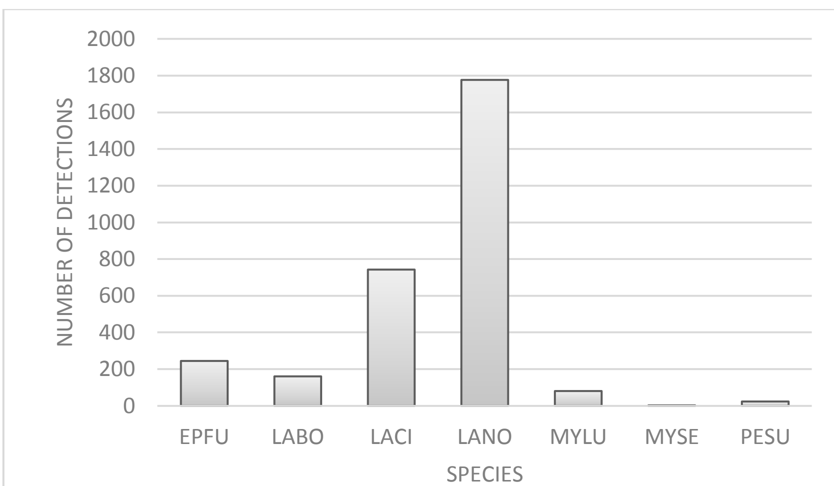


Figure 9.2: Total number of bat detections by species for monitor 2

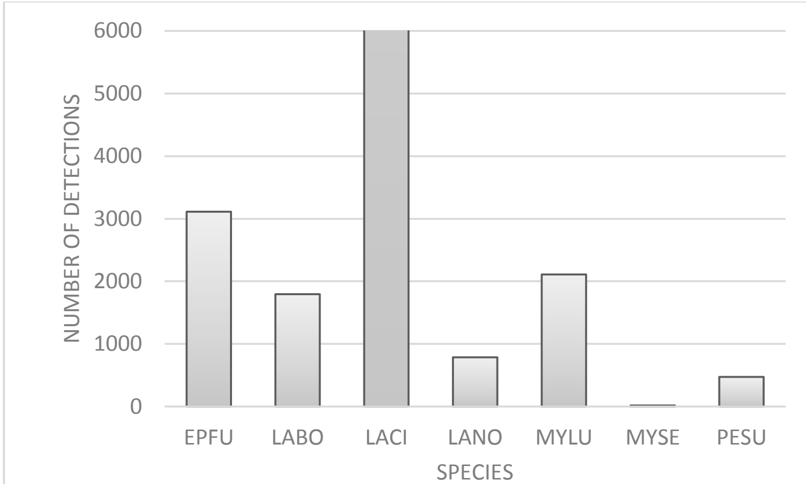


Figure 9.3: Total number of bat detections by species for monitor 3

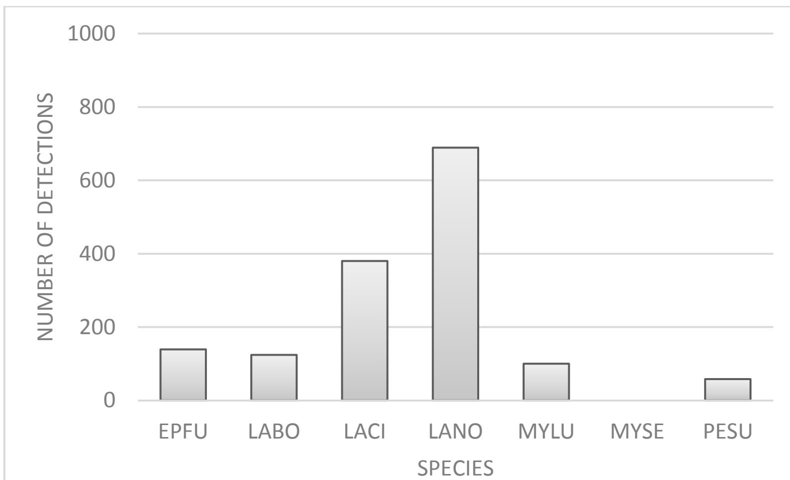


Figure 9.4: Total number of bat detections by species for monitor 4

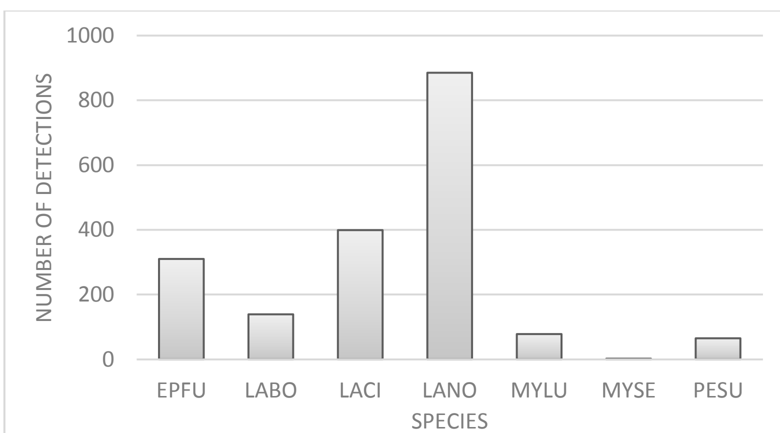


Figure 9.5: Total number of bat detections by species for monitor 5

Kaleidoscope Data

KALEIDOSCOPE 3.1.8

Bats of North America 3.1.0 S/A:+1

Monitor 1			
	Species	Detections	Presence p-value
Fall 2015	EPFU	123	0.95
	LABO	41	0
	LACI	144	0
	LANO	725	0
	MYLU	45	0
	MYSE	0	1
	PESU	10	0
5/28/2016	EPFU	118	0.77
	LABO	34	0
	LACI	104	0
	LANO	670	0
	MYLU	39	0
	MYSE	0	1
	PESU	8	0
9/2/2016	EPFU	91	0
	LABO	46	0
	LACI	53	0
	LANO	194	0
	MYLU	96	0
	MYSE	2	1
	PESU	23	0
10/7/2016	EPFU	92	0
	LABO	34	0
	LACI	38	0
	LANO	377	0
	MYLU	39	0
	MYSE	0	1
	PESU	14	0
10/15/2016	EPFU	3	0.33
	LABO	3	0
	LACI	8	0
	LANO	5	0.46
	MYLU	0	1
	MYSE	0	1
	PESU	0	1

Monitor 2			
	Species	Detections	Presence p-value
Fall 2015	EPFU	33	0.22
	LABO	31	0
	LACI	38	0
	LANO	148	0
	MYLU	15	0
	MYSE	1	1
	PESU	0	1
5/28/2016	EPFU	9	1
	LABO	8	0
	LACI	29	0
	LANO	167	0
	MYLU	9	0
	MYSE	0	1
	PESU	2	0.08
9/2/2016	EPFU	108	1
	LABO	84	0
	LACI	631	0
	LANO	1085	0
	MYLU	20	0
	MYSE	1	1
	PESU	9	0.01
10/7/2016	EPFU	17	1
	LABO	41	0
	LACI	189	0
	LANO	313	0
	MYLU	8	0.14
	MYSE	0	1
	PESU	3	0.33
10/15/2016	EPFU	0	1
	LABO	1	0.10
	LACI	0	1
	LANO	4	0
	MYLU	0	1
	MYSE	0	1
	PESU	0	1

KALEIDOSCOPE 3.1.8
Bats of North America 3.1.0 S/A:+1

Monitor 3			
	Species	Detections	Presence p-value
9/2/2016	EPFU	2	1
	LABO	0	1
	LACI	208	0
	LANO	0	1
	MYLU	0	1
	MYSE	0	1
	PESU	0	0
10/7/2016	EPFU	260	0
	LABO	303	0
	LACI	3463	0
	LANO	399	1
	MYLU	163	0
	MYSE	1	1
	PESU	69	0
10/15/2016	EPFU	1	0.77
	LABO	3	0
	LACI	1	0.09
	LANO	2	0.34
	MYLU	0	1
	MYSE	0	1
	PESU	0	1

Monitor 4			
	Species	Detections	Presence p-value
9/2/2016	EPFU	96	0
	LABO	82	0
	LACI	309	0
	LANO	289	0
	MYLU	85	0
	MYSE	0	1
	PESU	34	0
10/7/2016	EPFU	46	1
	LABO	47	0
	LACI	84	0
	LANO	397	0
	MYLU	18	0
	MYSE	0	1
	PESU	25	0
10/15/2016	EPFU	1	0.69
	LABO	0	1
	LACI	0	1
	LANO	2	0.16
	MYLU	0	1
	MYSE	0	1
	PESU	0	1

KALEIDOSCOPE 3.1.8
Bats of North America 3.1.0 S/A:+1

Monitor 5			
	Species	Detections	Presence p-value
9/2/2016	EPFU	130	0
	LABO	79	0
	LACI	162	0
	LANO	427	0
	MYLU	58	0
	MYSE	2	1
	PESU	40	0
10/7/2016	EPFU	186	0
	LABO	58	0
	LACI	239	0
	LANO	444	0
	MYLU	17	0
	MYSE	0	1
	PESU	27	0
10/15/2016	EPFU	1	1
	LABO	0	0.61
	LACI	2	0
	LANO	0	1
	MYLU	0	1
	MYSE	0	1
	PESU	3	0

Species Descriptions

Silver Haired Bat

The silver-haired bat (*Lasionycteris noctivagans*) is a solitary migratory species and the only member of the genus *Lasionycteris*. They are found in Bermuda, Canada, Mexico and the United States. They often roost in tree cavities or in bark crevices on tree trunks, especially during migration. This medium-sized bat is mostly black (including the wings, ears, interfemoral membrane, and fur) with white-tipped hairs. The basal upper half of its tail membrane is densely furred. This gives the bat a frosted appearance for which it is named. This species has a flattened skull with a broad rostrum. This species weighs around 8–12 g, has a total length of ~100 mm, a tail length of 40 mm, and a forearm length of 37–44 mm. Silver-haired bats consume primarily soft-bodied insects, such as moths, but will also take spiders and harvestmen. This species will forage low, over both still and running water, and also in forest openings. Silver-haired bats are slow but maneuverable flyers that typically detect prey only a short distance away. In addition to the hoary bat (*Lasiurus cinereus*) and eastern red bat (*Lasiurus borealis*), the silver-haired bat is one of the three tree bat species most commonly killed at wind energy facilities (over 75% of the mortalities).

Big Brown Bat

The big brown bat (*Eptesicus fuscus*) is native to North America, Central America, the Caribbean, and extreme northern South America. This medium-sized bat ranges from 10–13 cm in body length, with a wingspan 28-33, and weighs between 14-16 g. The fur is moderately long and shiny brown. The wing membranes, ears, feet, and face are dark brown to blackish in color. Big brown bats roost during the day in hollow trees, beneath loose tree bark, in the crevices of rocks, or in man-made structures such as attics, barns, old buildings, eaves and window shutters. Big brown bats are insectivorous, eating many kinds of night-flying insects including moths, beetles, and wasps.

Hoary Bat

The hoary bat (*Lasiurus cinereus*) is a species of bat in the vesper bat family, Vespertilionidae. It occurs throughout most of North America and much of South America. The hoary bat averages 13-14.5 cm long with a 40 cm wingspan and a weight of 26 g. Its coat is dark brown and the hairs on the back are frosted with silver. The body is covered in fur except for the undersides of the wings. This species normally roosts alone on trees, hidden in the foliage, but on occasion has been seen in caves with other bats. It prefers woodland, mainly coniferous forests, but hunts over open areas or lakes. It hunts alone and its main food source is moths. The bat is migratory and may travel from Canada as far south as the southern United States or Bermuda.

Eastern Red Bat

The eastern red bat (*Lasiurus borealis*) is widespread across eastern North America, with additional records in Bermuda. This is a medium-sized bat, averaging weights of 9.5-14 g and measurements of 112.3 mm in total length. Adults are usually dimorphic: males have red hair while females are chestnut-colored with whitish frosting on the tips of the fur. Moths form the majority of the diet, but red bats also prey on beetles, flies, and other insects.

Eastern Pipistrelle

The Eastern Pipistrelle (*Perimyotis subflavus*) is found commonly in the eastern portion of the United States, but extends into southeastern Nebraska. This reddish, yellowish and brownish bat is one of the smallest bats in the eastern part of the US. The forearms are orange to red while the wing membrane is black. Adults weigh between 4-10g and reach a forearm length of 30-35mm. These bats feed on small insects on the edges of forested areas, rivers, streams or open water.

Little Brown Bat

The Little Brown Bat (Myotis lucifigus) is found throughout much of North America. It is most common in the northern half of the continental United States and Southern Canada. The bat's fur is dark brown and glossy on the back with slightly paler, greyish fur underneath. Wing membranes are dark brown on a typical wingspan of 22–27 cm. Ears are small and black with a short, rounded tragus. Adult bats are typically 6–10 cm long and weigh 5–14g. Since many of their preferred meals are insects with an aquatic life stage, such as mosquitoes, they prefer to roost and forage near water.

Fagen, Inc.

Palmer's Creek Wind Farm 2017 Field Season-Interim Acoustic Bat Report

Granit Falls, MN

New Century Environmental
7-11-2017

Table of Contents

List of Figures

List of Tables

Palmer's Creek WRA Acoustic Bat Monitoring Interim Report 2017
Fagen, Inc.
Granite Falls, Minnesota

Prepared By
New Century Environmental, LLC.
Columbus, Nebraska
July 11,2017

Executive Summary

In early summer of 2016, Mike Rutledge of Fagen Engineering contacted Mike Gutzmer of New Century Environmental, LLC (NCE) to aid in the effort of completing a bat report that would capture the diversity/abundance of bat species within the study area of Palmer's Creek to meet due diligence with regulatory agencies, which was done through acoustic monitoring. The client proposed to develop a wind farm within the study area of Chippewa County, Minnesota (just north across the Minnesota River from Granite Falls). The study area lies within the Des Moines Lobe Western Corn Belt Plains (47b) ecoregion of Minnesota. Staff of Fagen Engineering deployed four separate ANABAT systems and two SM3 full spectrum systems to record bat activity throughout the study area, the first deployment of the six monitors was done late March, 2017. This report captures data gathered from late March, 2017 through late June, 2017. The data collected from Fagen Engineering was sent to NCE via certified mail. NCE then took the data and processed in zero-crossing through Kaleidoscope version 3.1.8 to confirm presence diversity and abundance of bat species. The software uses a presence/absent indicator by giving each species of bat a p-value. The lower the p-value, the more likely the species of bat is present. Bat presence, in the form of vocalization, was detected, identified by species, and catalogued, thereby allowing us to estimate species occurrences, distribution and relative abundance.

Introduction

In early summer of 2016, Mike Rutledge of Fagen Engineering, LLC contacted Mike Gutzmer of New Century Environmental, LLC (NCE) to aid in the effort of completing a bat report that would capture the diversity/abundance of bat species within the study area of Palmer's Creek to meet due diligence with regulatory agencies. The client proposed to develop a wind farm in Chippewa County, Minnesota (just north across the Minnesota River from Granite Falls). This interim report captures the results from the acoustic monitors from late March, 2017 up to late June, 2017. The full report will be drafted upon completion of the data gathering season.

Study Area

The study area is located within Chippewa County, Minnesota (just north across the Minnesota River from Granite Falls). The study area lies within the Des Moines Lobe Western Corn Belt Plains (47b) ecoregion of Minnesota. This ecoregion consists of fast fertile plain of deep soils dominated by row crops. The boundaries of the Minnesota River Prairie Subsection coincide with large till plains flanking the Minnesota River. The unit is bounded to the southwest by the Prairie Coteau. A series of moraines define the eastern boundary, the Alexandria Moraine to the northeast and the Bemis moraine to the southeast (Minnesota 2016).

The Minnesota River Prairie is a large subsection that includes part of northwestern Iowa and spreads across southwestern Minnesota into eastern South Dakota. The Minnesota River forms a broad valley, dividing the area in half. This valley once had a continuous band of floodplain forest that extended upstream as far as Lac Qui Parle, with highly unique bedrock exposures. There are 150 lakes larger than 160 acres in the subsection, most of which are shallow. Before settlement by people of European descent, the predominant vegetation was tallgrass prairie and wetlands. Fire was once a common natural disturbance and critical to maintaining native prairie communities (Minnesota, 2016).

Today, row-crop agriculture is the predominant land use, and prairie remnants and floodplain forests are rare. A major concern is impacts on water quality from intensive agricultural activities, including use of fertilizers and pesticides, expanding use of pattern tiling, and ditching and draining of small wetlands. Continued loss of the small amount of native upland habitat and over-intensive grazing remain a concern (Minnesota, 2016).

Figure 1: Vicinity map of study area. Chippewa county is located in southwestern Minnesota.

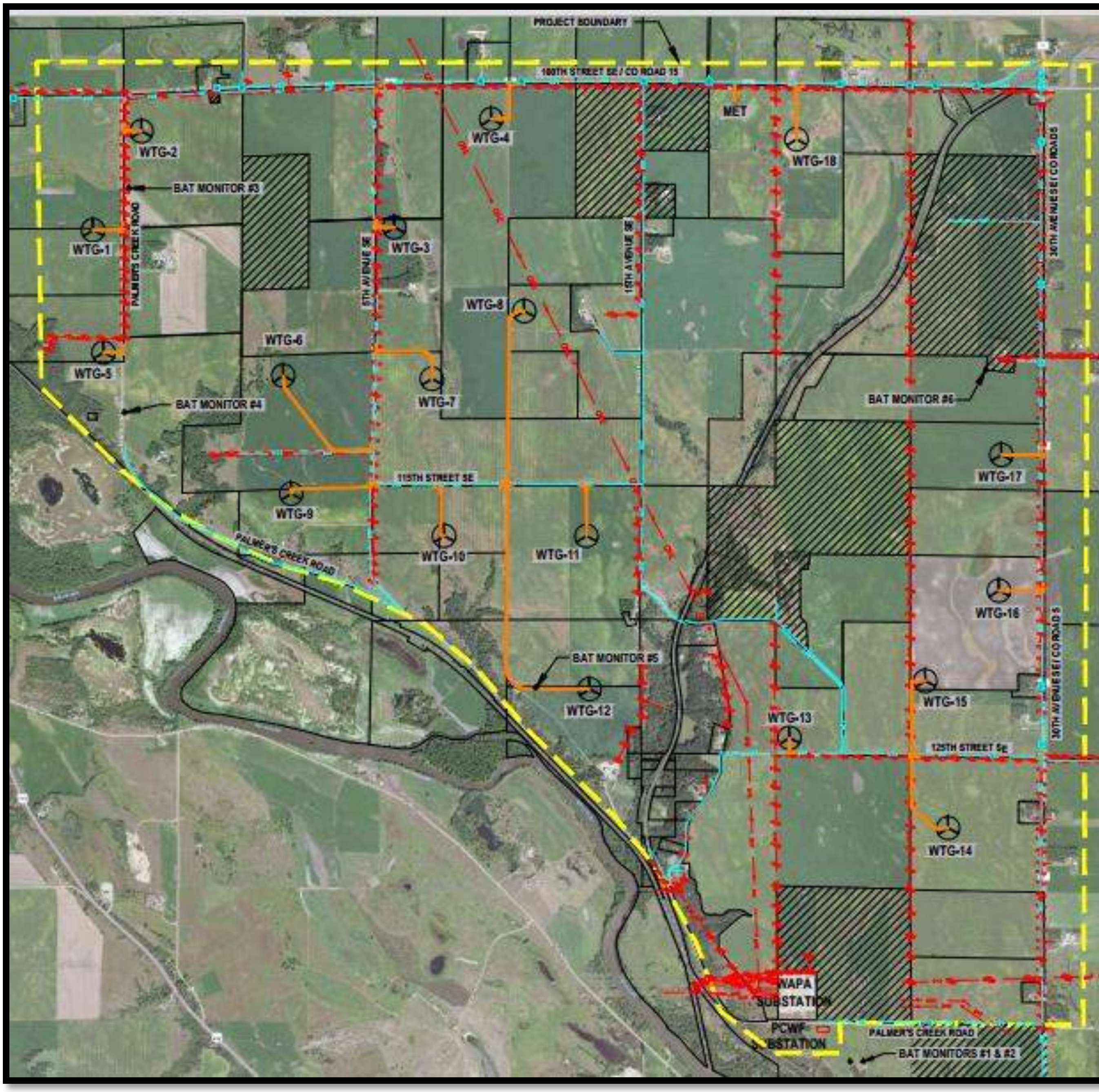


Figure 2. Map of study area showing bat monitor locations.

Methods

Data was gathered in the field by Fagen Engineering, LLC within the study area from four different Anabat acoustic recorders and two SM3 full spectrum monitors (map in Study Area section shows locations of monitors). The monitors gathered data from late March, 2017 and are currently active gathering data.

The memory cards were sent to New Century Environmental staff via certified mail, the data was then downloaded and processed through a program called Kaleidoscope Pro version 3.1.8. The Kaleidoscope classifier uses a source library of user submitted reference calls to compare to recordings. It accepts and displays full-spectrum signals, to match with the calls known bat species. The software uses a presence/absence indicator by giving each species of bat a p-Value of 0 to 1. The lower the P-Value, the more likely the species is present. Variability in the quality of recordings and variations in calls among individual bats creates challenges to acoustic bat classification.

Kaleidoscope Pro has been approved by the U.S. Fish & Wildlife Service for use for presence/absence analysis for Indiana bats (*Myotis sodalis*). Similarly, the approved programs may also be used for presence/absence analysis for northern long-eared bats (*Myotis septentrionalis*). The U.S Geological Survey also tested acoustic matching programs and Kaleidoscope Pro passed their standard validation process (USFWS 2016).

Results

At this point in time the four Anabat and two SM3 full spectrum recording system visual examination and filtering of files to eliminate extraneous noise (e.g., wind, insects, etc.) resulted in a total of 15,511 sound files classified as bat detection passes.

Monitor 1 is located on the lower end of a met tower surrounded by agriculture with some roosting trees nearby. The monitor recorded 1,933 files that Kaleidoscope Pro was able to classify as bat passes. The silver haired bat was the most common species at this site being 57% of total detections. The big brown bat was the second most common being 24% of total detections. The federally threatened northern long-eared myotis was detected 1 time (0.05%), but had a P-value of 1 which almost certainly means it was nonexistent at this site. The eastern pipistrelle had a total of 16 (0.8%) detections.

Code	Common name	Scientific Name	Conservation status	P-Value	# of passes
LANO	Silver-Haired Bat	*Lasionycteris noctivagans*	Least concern	0	1093
EPFU	Big-Brown Bat	*Eptesicus fuscus*	Least concern	0	464
LACI	Hoary Bat	*Lasiurus cinereus*	Least concern	0	287
LABO	Eastern Red Bat	*Lasiurus borealis*	Least concern	0	35
MYLU	Little Brown Bat	*Myotis lucificus*	Least concern	0	37
MYSE	Northern long-eared myotis	*Myotis septentrionalis*	Federally threatened	1	1
PESU	Eastern pipistrelle	*Perimyotis subflavus*	MN species of concern	0	16

Table 1. Results from monitor 1.

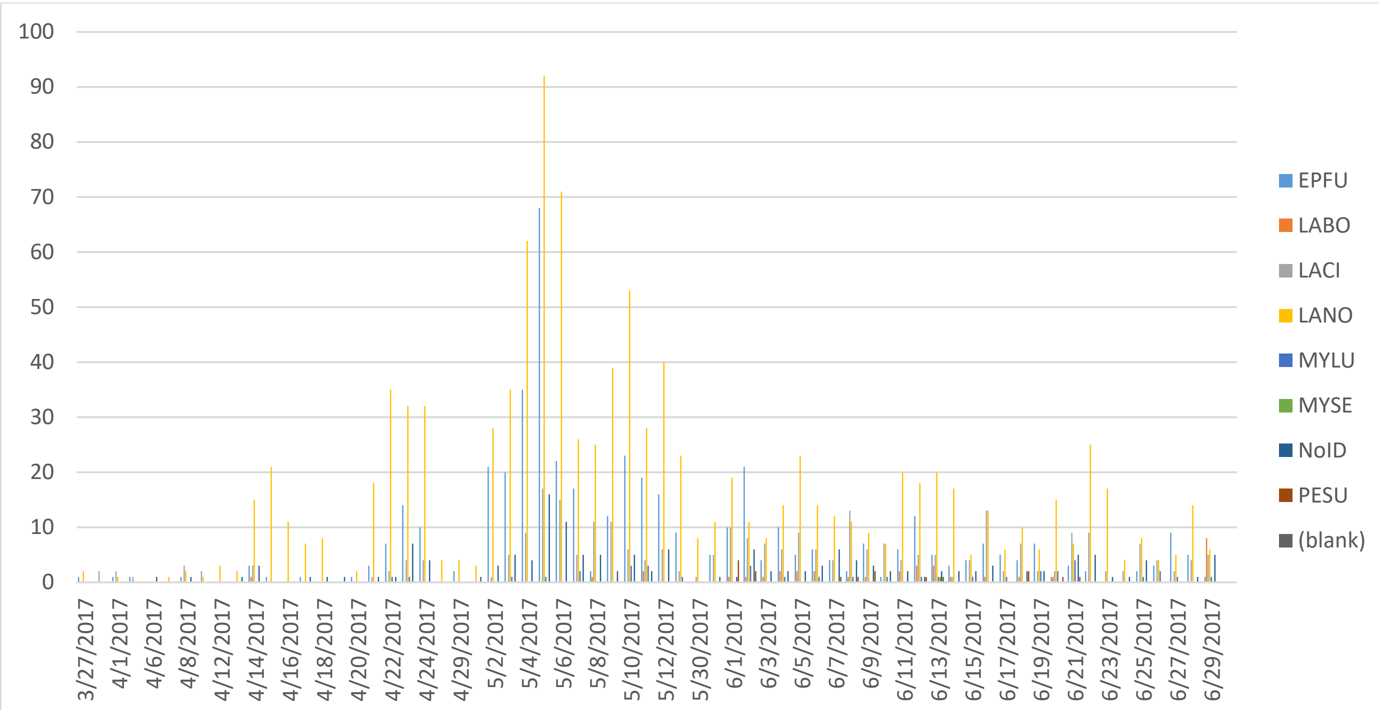


Figure 3. Bar graph of monitor 1 results by date.

Monitor 2 is located on the upper end of the same met tower as monitor 1, total elevation of 55 m. The monitor recorded only 116 files that Kaleidoscope Pro was able to classify as bat passes. The monitor only recorded a total of two species. The Hoary bat was the dominant species at this with 90 (78%) total bat passes. The second species was the big-brown bat with 26 (22%) total bat passes.

Code	Common name	Scientific Name	Conservation status	P-Value	# of passes
EPFU	Big-Brown Bat	*Eptesicus fuscus*	Least concern	0	26
LACI	Hoary Bat	*Lasiurus cinereus*	Least concern	0	90

Table 2. Results from monitor 2.

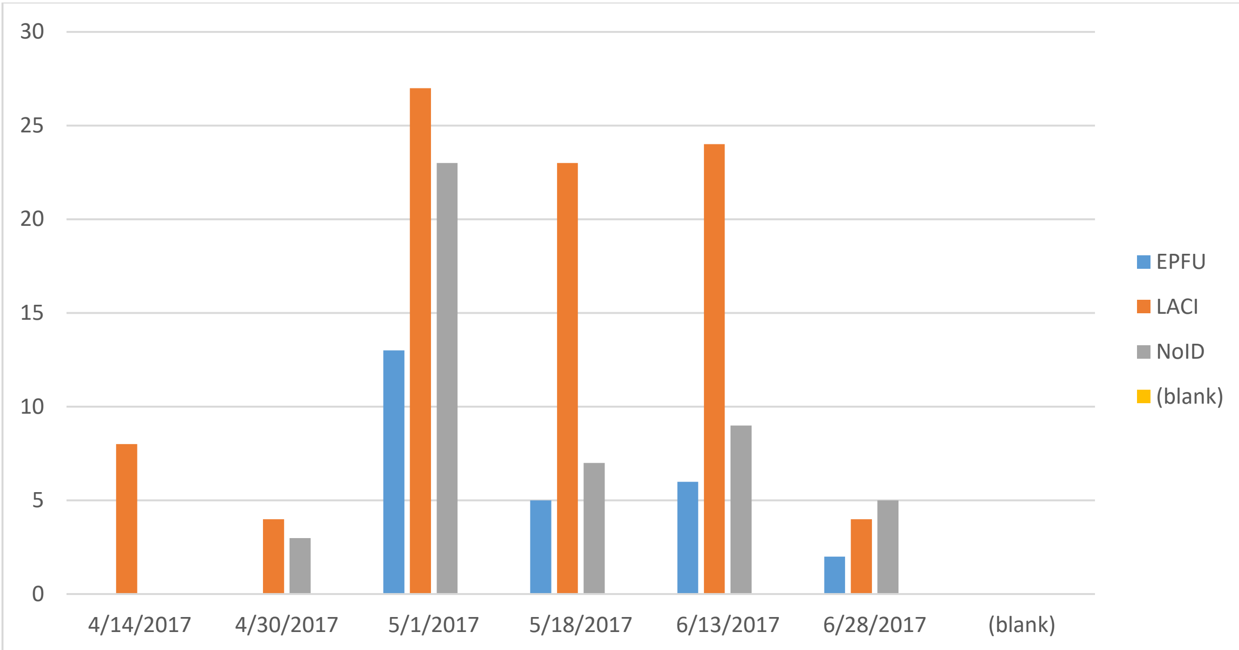


Figure 4. Bar graph of results from monitor 2 by date.

Monitor 3 is one of two SM3 ultrasonic detector which is located along a creek bank just off of the road surrounded by a combination of agriculture and roosting tree habitat. The monitor recorded 3,231 files that Kaleidoscope Pro was able to classify as bat passes. The silver haired bat was the most common species at this site being 35% of total detections. The big brown bat was the second most common being 26% of total detections. The federally threatened northern long-eared myotis was detected 1 time (0.0003%), but had a P-value of 1 which almost certainly means it was nonexistent at this site. The eastern pipistrelle had a total of 16 (0.5%) detections.

Code	Common name	Scientific Name	Conservation status	P-Value	# of passes
LANO	Silver-Haired Bat	*Lasionycteris noctivagans*	Least concern	0	1144
EPFU	Big-Brown Bat	*Eptesicus fuscus*	Least concern	0	850
LACI	Hoary Bat	*Lasiurus cinereus*	Least concern	0	703
LABO	Eastern Red Bat	*Lasiurus borealis*	Least concern	0	137
MYLU	Little Brown Bat	*Myotis lucificus*	Least concern	0	380
MYSE	Northern long-eared myotis	*Myotis septentrionalis*	Federally threatened	1	1
PESU	Eastern pipistrelle	*Perimyotis subflavus*	MN species of concern	0.000111	16

Table 3. Results from monitor 3.

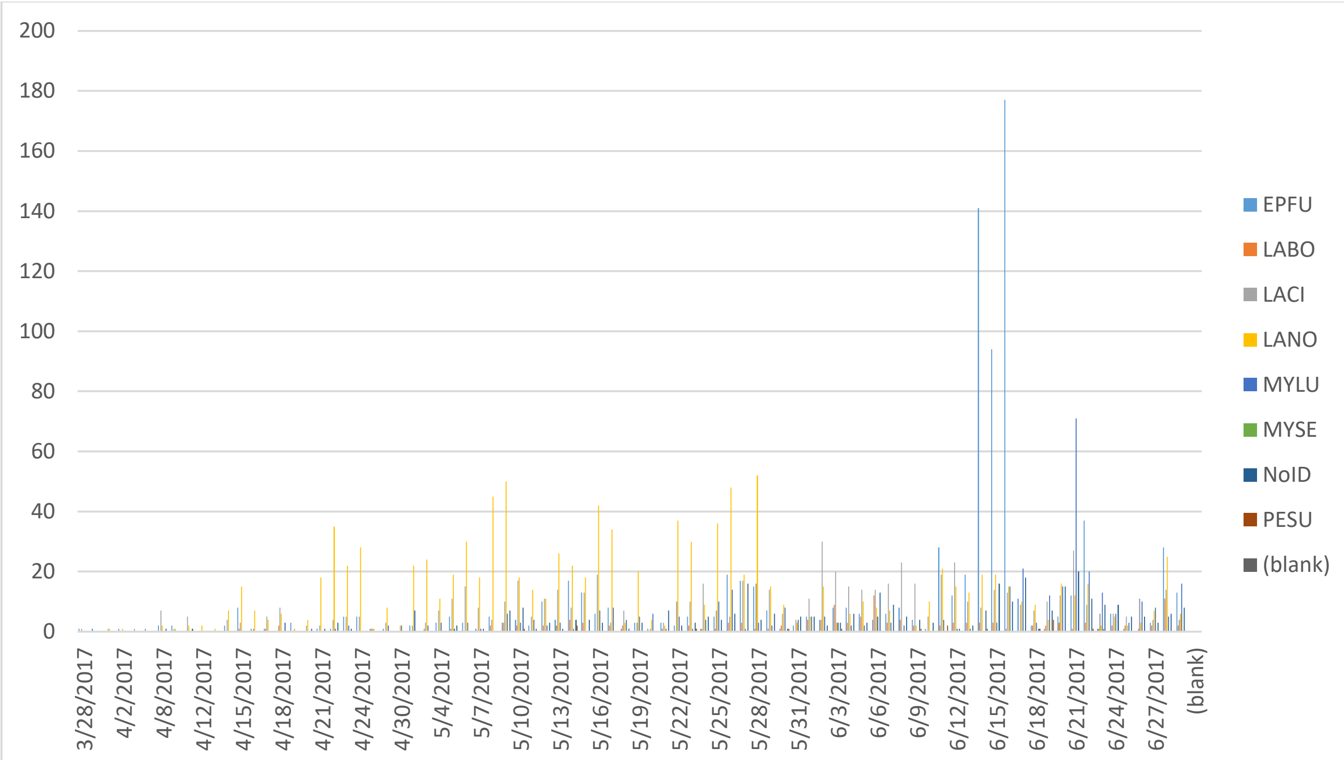


Figure 5. Bar graph of results for monitor 3 by date.

Monitor 4 is located in a corn field and is surrounded by agriculture, with a creek with roosting habitat located near the site, the monitor recorded 1,127 files Kaleidoscope Pro classified as bat passes. The most common species at this site was the hoary bat being 49% of total detections. The second most common was the silver-haired bat being 40% of total detections. The northern long-eared myotis was not recorded at this site. The eastern pipistrelle had a total of 10 (0.9%) detections.

Code	Common name	Scientific Name	Conservation status	P-Value	# of passes
LANO	Silver-Haired Bat	*Lasionycteris noctivagans*	Least concern	0	455
EPFU	Big-Brown Bat	*Eptesicus fuscus*	Least concern	0	54
LACI	Hoary Bat	*Lasiurus cinereus*	Least concern	0	553
LABO	Eastern Red Bat	*Lasiurus borealis*	Least concern	0	24
MYLU	Little Brown Bat	*Myotis lucificus*	Least concern	0	31
MYSE	Northern long-eared myotis	*Myotis septentrionalis*	Federally threatened	1	0
PESU	Eastern pipistrelle	*Perimyotis subflavus*	MN species of concern	0	10

Table 4. Results from monitor 4.

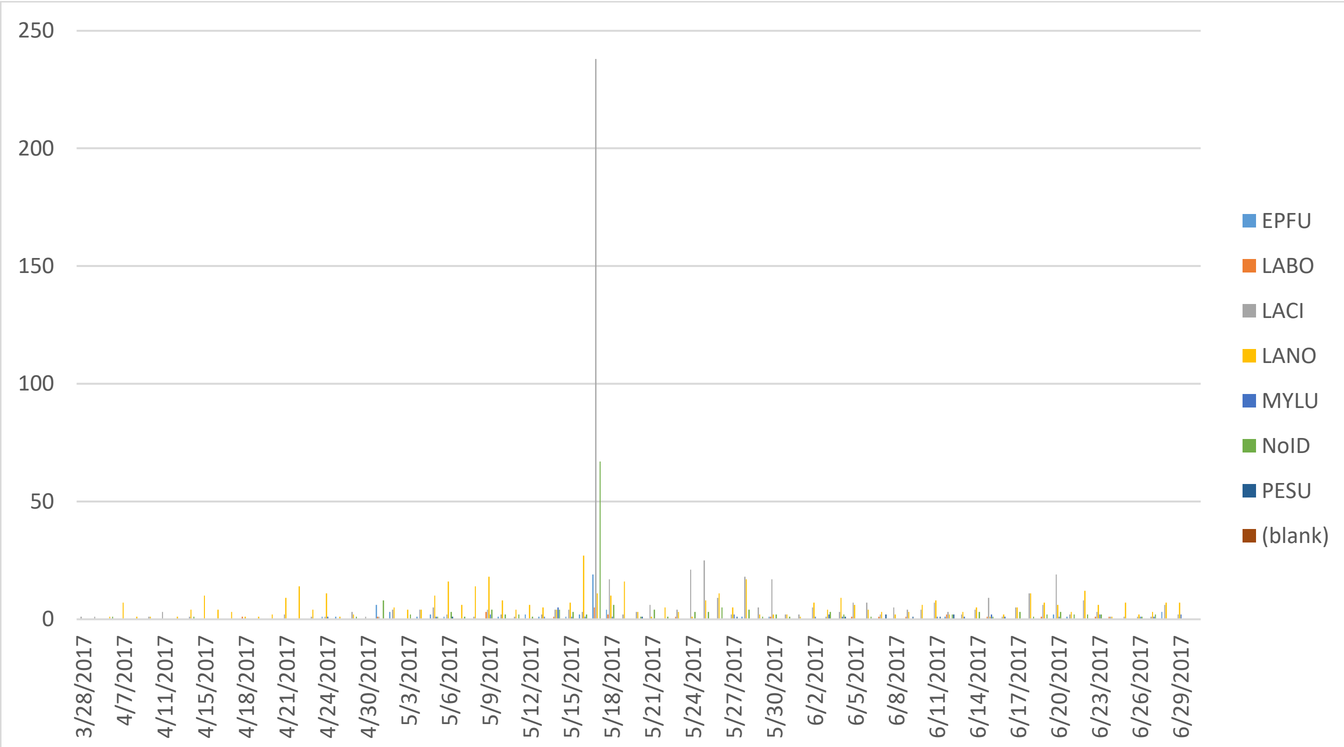


Figure 6. Bar graph of results for monitor 4 by date.

Monitor 5 is located along the roadside in agriculturally dominated landscape, the monitor recorded 763 files Kaleidoscope Pro classified as bat passes. The most common species at this site was the silver haired bat being 67% of total detections. The second most common was the hoary bat with being 24% of total detections. The northern long-eared myotis was not detected at this site. The eastern pipistrelle had a total of 8 (1%) detections.

Code	Common name	Scientific Name	Conservation status	P-Value	# of passes
LANO	Silver-Haired Bat	*Lasionycteris noctivagans*	Least concern	0	514
EPFU	Big-Brown Bat	*Eptesicus fuscus*	Least concern	1	16
LACI	Hoary Bat	*Lasiurus cinereus*	Least concern	0	185
LABO	Eastern Red Bat	*Lasiurus borealis*	Least concern	0	27
MYLU	Little Brown Bat	*Myotis lucificus*	Least concern	0.0000607	13
MYSE	Northern long-eared myotis	*Myotis septentrionalis*	Federally threatened	1	0
PESU	Eastern pipistrelle	*Perimyotis subflavus*	MN species of concern	0.0000124	8

Table 4. Results from monitor 5.

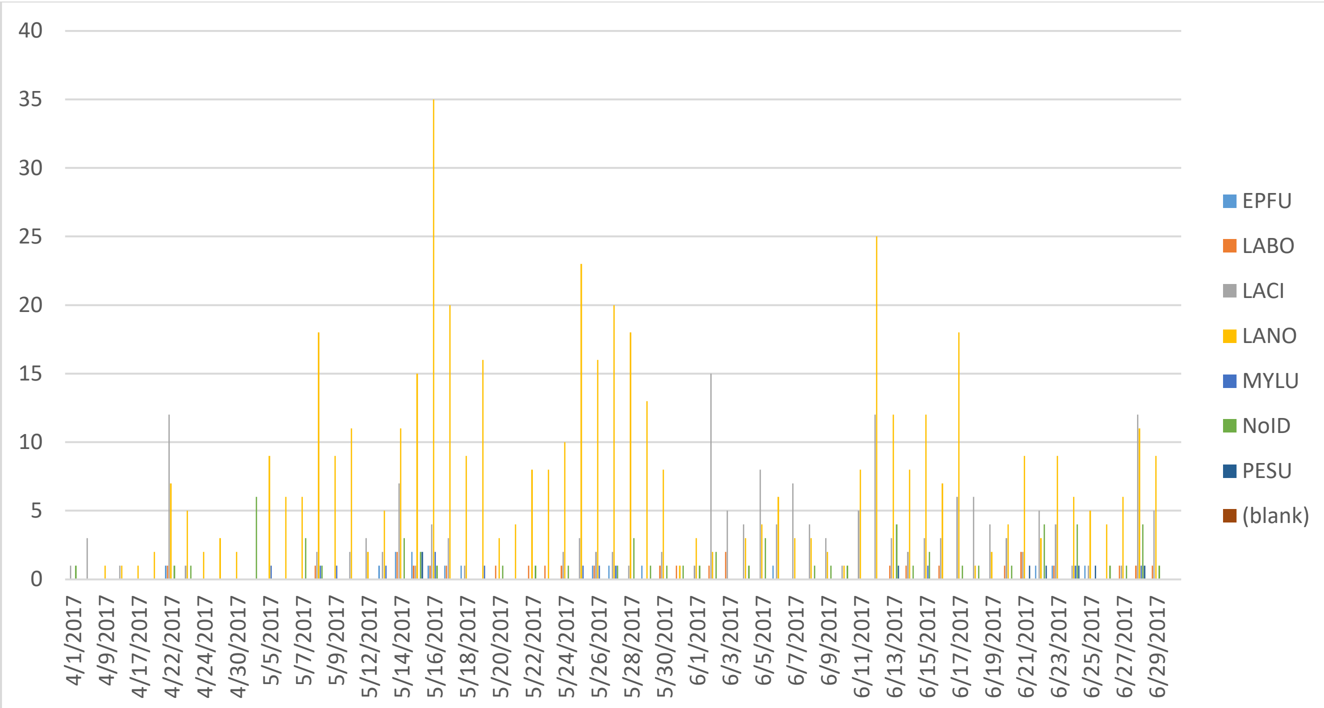


Figure 7. Bar graph of results for monitor 5 by date.

Monitor 6 is located in a tree line near a farm house, this is the second of the SM3 full spectrum devices. The monitor recorded a total of 8,341 files Kaleidoscope Pro classified as bat passes. The most common species at this site was the silver haired bat being 42% of total detections. The second most common was the big brown bat with being 35% of total detections. The northern long-eared myotis was detected 1 time (0.01%), but had a P-value of 1 which almost certainly means it was nonexistent at this site. The eastern pipistrelle had a total of 16 (0.2%) detections.

Code	Common name	Scientific Name	Conservation status	P-Value	# of passes
LANO	Silver-Haired Bat	*Lasionycteris noctivagans*	Least concern	0	3470
EPFU	Big-Brown Bat	*Eptesicus fuscus*	Least concern	0	2934
LACI	Hoary Bat	*Lasiurus cinereus*	Least concern	0	1612
LABO	Eastern Red Bat	*Lasiurus borealis*	Least concern	0	204
MYLU	Little Brown Bat	*Myotis lucificus*	Least concern	0	104
MYSE	Northern long-eared myotis	*Myotis septentrionalis*	Federally threatened	1	1
PESU	Eastern pipistrelle	*Perimyotis subflavus*	MN species of concern	0.707657	16

Table 5. Results from monitor 6.

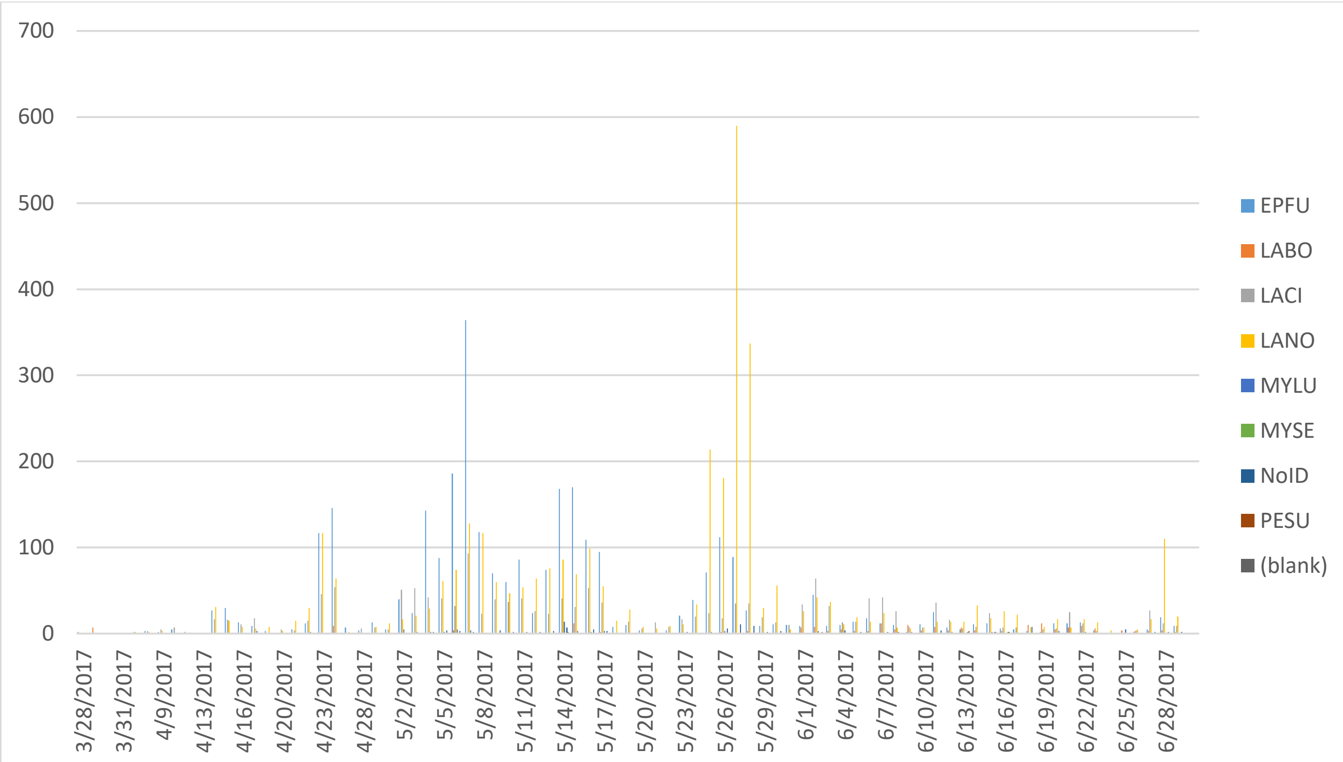


Figure 8. Bar graph of results for monitor 6 by date.

Discussion

There are seven species of bats that occur regularly in Minnesota; our most common species, the little brown myotis, occurs over most of North America. Along with the Northern myotis and big brown bat, it hibernates in Minnesota caves and mines. In summer, they roost in caves, mines, hollow trees, and buildings. Large groups of these bats hang upside-down in caves. The eastern pipistrelle is the smallest species, weighing only two-tenths of an ounce. It is found in the same Minnesota caves and mines, though it is less common and in fewer numbers.

The silver-haired bat and Eastern red bad are forest dwellers that usually live near water and feed among the trees. Usually a red bat pair will repeatedly fly the same route in search of food. Another woodland species is the hoary bat. It is the largest Minnesota bat, weighing an ounce or more. All three species are somewhat solitary, roost in trees, and migrate south for the winter (Minnesota, 2016).

All seven bat species that occur in Minnesota may be found throughout the state.

Common name	Scientific Name	State Status	Federal Status
Northern long-eared myotis	*Myotis septentrionalis*	Threatened	Threatened
Eastern Pipistrelle	*Pipistrellus subflavus*	MN species concern	Not listed
Little brown bat	*Myotis lucifugus*	Not listed	Not listed
Big brown bat	*Eptesicus fuscus*	Not listed	Not listed
Silver-haired bat	*Lasionycteris noctivagans*	Not listed	Not listed
Eastern red bat	*Lasiurus borealis*	Not listed	Not listed
Hoary bat	*Lasiurus cinereus*	Not listed	Not listed
Evening bat	*Nycticeius humeralis*	Newly discovered	Not listed

Figure 9. Bat species found in Minnesota with federal and state conservation status.

There were a total of six bat species documented at this point in time during the course of the study (late March, 2017-late June, 2017). The eastern pipistrelle (*Pipistrellus sublavus)* was documented at this site and is listed as a species of concern in the state of Minnesota. It was detected in small numbers but was found at every monitor except for monitor 2. The northern long-eared myotis (*Myotis septentrionalis*) is a federally threatened species whose home range lies within the study site. However no confirmed documentation was recorded here. Even though a total of three passes of which Kaleidoscope classified as MYSE (northern long-eared myotis) the P-value was given a 1 for every monitor indicating the likelihood of presence is near non-existent. All other species documented are of least concern. Of the six species documented the silver-haired bat (*Lasionycteris noctivagans*), hoary bat (*Lasiurus cinereus*) and big brown bat (*Eptesicus fuscus*) were among the most common followed by the little brown bat (*Myotis lucifugus*) and eastern red bat (*Lasiurus borealis*).

References

Minnesota Department of Natural Resources, 2006. Tomorrow's Habitat for the Wild and Rare: An Action Plan for Minnesota Wildlife, Comprehensive Wildlife Conservation Strategy. Division of Ecological Services, Minnesota Department of Natural Resources.

US Fish and Wildlife Service. 2016. Endangered Species Midwest Region. Accessed on 10 July 2017 at <https://www.fws.gov/midwest/Endangered/mammals/inba/surveys/inbaAcousticSoftware.html>.

WENCK

Responsive partner.
Exceptional outcomes.

Responsive partner.
Exceptional outcomes.

April 27, 2017

Michael Rutledge
Palmer's Creek Wind Farm, LLC
501 West Highway 212
Granite Falls, MN 56241

Aerial Eagle/Raptor Nest Survey Report
Palmer's Creek Wind Farm
Chippewa County, Minnesota
Wenck File No. B2759-0005-11

Introduction

Palmer's Creek Wind Farm, LLC contracted Wenck Associates, Inc. to complete an aerial bald eagle (*Haliaeetus leucocephalus*) nest survey on state and private lands surrounding the proposed Palmer's Creek Wind Farm project area (**Figure 1**). The survey was recommended to potentially identify active/inactive nests within a ten-mile buffer of the project area (USFWS 2016). In 2007, the bald eagle (State Special Concern Species) was delisted from its federally threatened status in the lower 48 states, but it is still federally protected under the Bald and Golden Eagle Protection Act ("BGEPA"). It was also delisted in Minnesota in 2013.

Methods

The objective of the aerial eagle nest surveys is to locate and record nests that may be in the proximity of the project area, to identify concentration and density of eagle nests, and to identify nests that may be vulnerable to disturbance and/or displacement effects by the proposed project. The intent of the nest survey is to gather information on species nesting in the area, including nest locations, nesting season (timing), and nest success.

The survey was conducted within a ten-mile buffer from the project area (defined as the analysis area). Eagle Aviation Inc. was contracted to fly an aerial survey of the project area on April 20, 2017. A Cessna Skyhawk with two observers were used during the survey, Ray Jilek (Eagle Aviation, Pilot) and Justin Askim (Wenck, Natural Resources Services Leader) (**Photo 1**). Complete coverage of the project area was obtained by systematically flying over the landscape and visually scanning all areas for potential roosting, nesting and foraging eagles. Aerial surveys were conducted using a fixed-wing aircraft, flying over relatively even terrain at approximately 250 – 500 feet above ground level and at speeds of 85 to 125 miles per hour.

Photo 1: Note low flight ceiling height and minor precipitation prior to the aerial survey.

A total of approximately 415 miles were flown in the analysis area to investigate woody draws, riparian areas, farm yards and other appropriate habitats for eagle nests and eagle activity (**Figure 2**).

Existing data on bald eagle nest locations was received from the Minnesota Department of Natural Resources (MNDNR) on July 5, 2016. Based on historical records, one nest is located in Section 11, T116N R40W (MNDNR 2016), is nest was not observed during the aerial surveys. However, two eagles were observed perched in the areas. During the 2016 field surveys, another eagle nest (**Figure 3**, Nest 3) was located in the Minnesota River Valley, approximately one mile southeast of the nearest WTG (WTG 12) and 0.3 miles outside of the project area. This nest was not recorded in the MNDNR Natural Heritage Information System (NHIS) database. Both nests are located outside of the project area. These nests were further examined during the aerial survey, as summarized in **Table 1** below.

Results and Conclusion

Three active nests, three inactive nests and ten individuals (three on nest and seven in flight or perched) were observed during the April 20, 2017 aerial survey (**Figure 2**, **Figure 3** and **Table 1**). With the exception of Nest 3, all nests are approximately five miles or greater from the project area.

Table 1: Eagle Nests Within Palmer's Creek Wind Farm Analysis Area

Nest Number	Status	Distance from Project Area	Latitude	Longitude
1	Active	4.9 miles	44.90855599	-95.70717782
2	Inactive	8.5 miles	44.73293894	-95.42223611
3	Active	0.3 miles	44.83149047	-95.56799484
4	Active	7.0 miles	44.72996346	-95.48105437
5	Inactive	10.0 miles	44.67489358	-95.53845803
6	Inactive	9.0 miles	44.68952578	-95.53443812

Eagle nest density within the analysis area is approximately one active nest per 102,000 acres.

Please contact Justin Askim at 701-751-6125, jaskim@wenck.com if you have comments or require additional information.

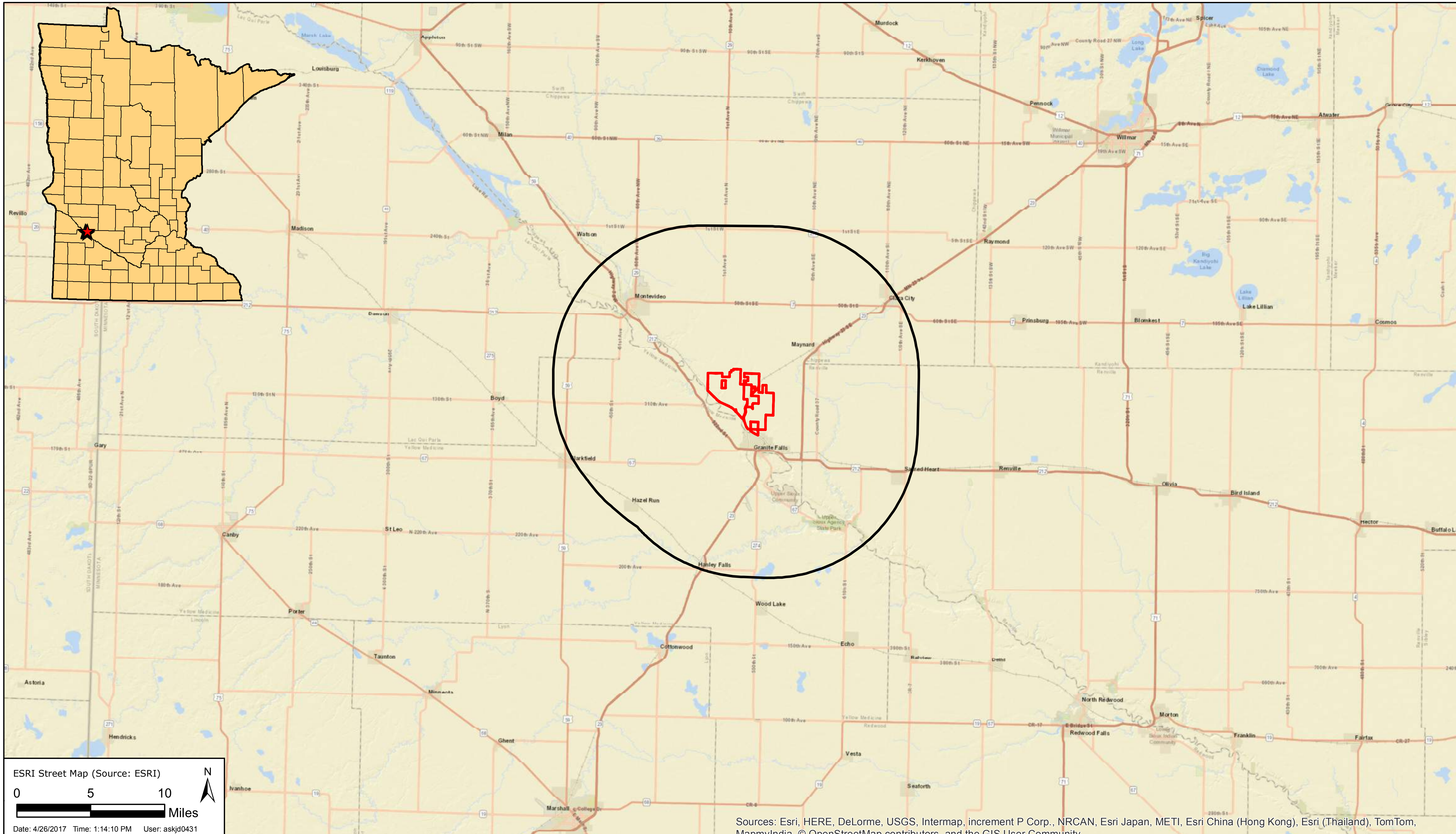
Sincerely,

WENCK ASSOCIATES, INC.

Justin Askim
Principal/Natural Resources Services Leader

References

MNDNR. 2016. Natural Heritage Information System Correspondence #ERDB 20160322-0002, July 5, 2016.
USFWS 2016. Palmer's Creek Wind Farm Eagle Use Surveys. Email from Margaret Rheude. August 22, 2016.



PALMER'S CREEK WIND FARM, LLC

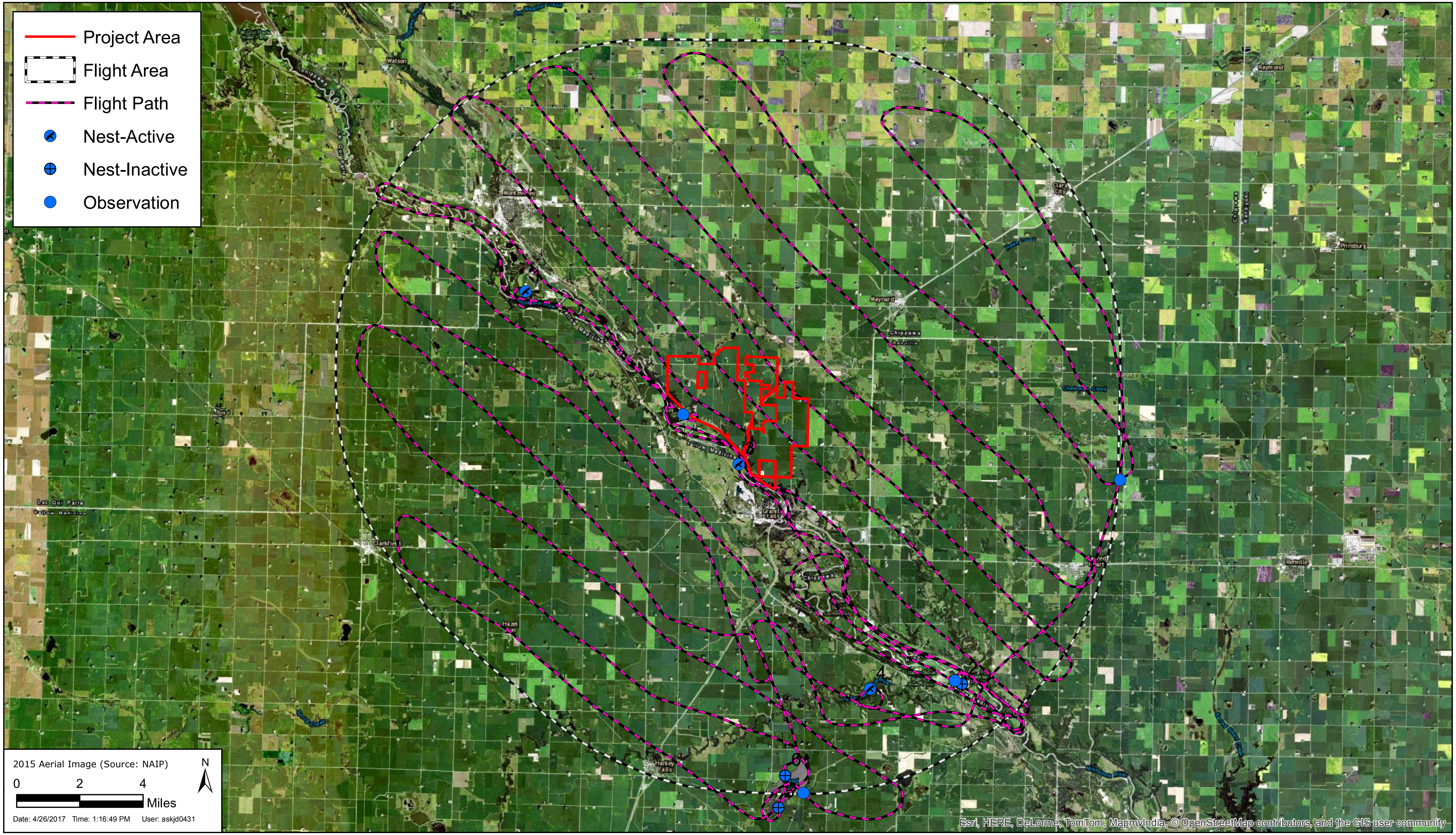
Project Location and Analysis Area

WENCK ASSOCIATES
Responsive partner. Exceptional outcomes.

APR 2017

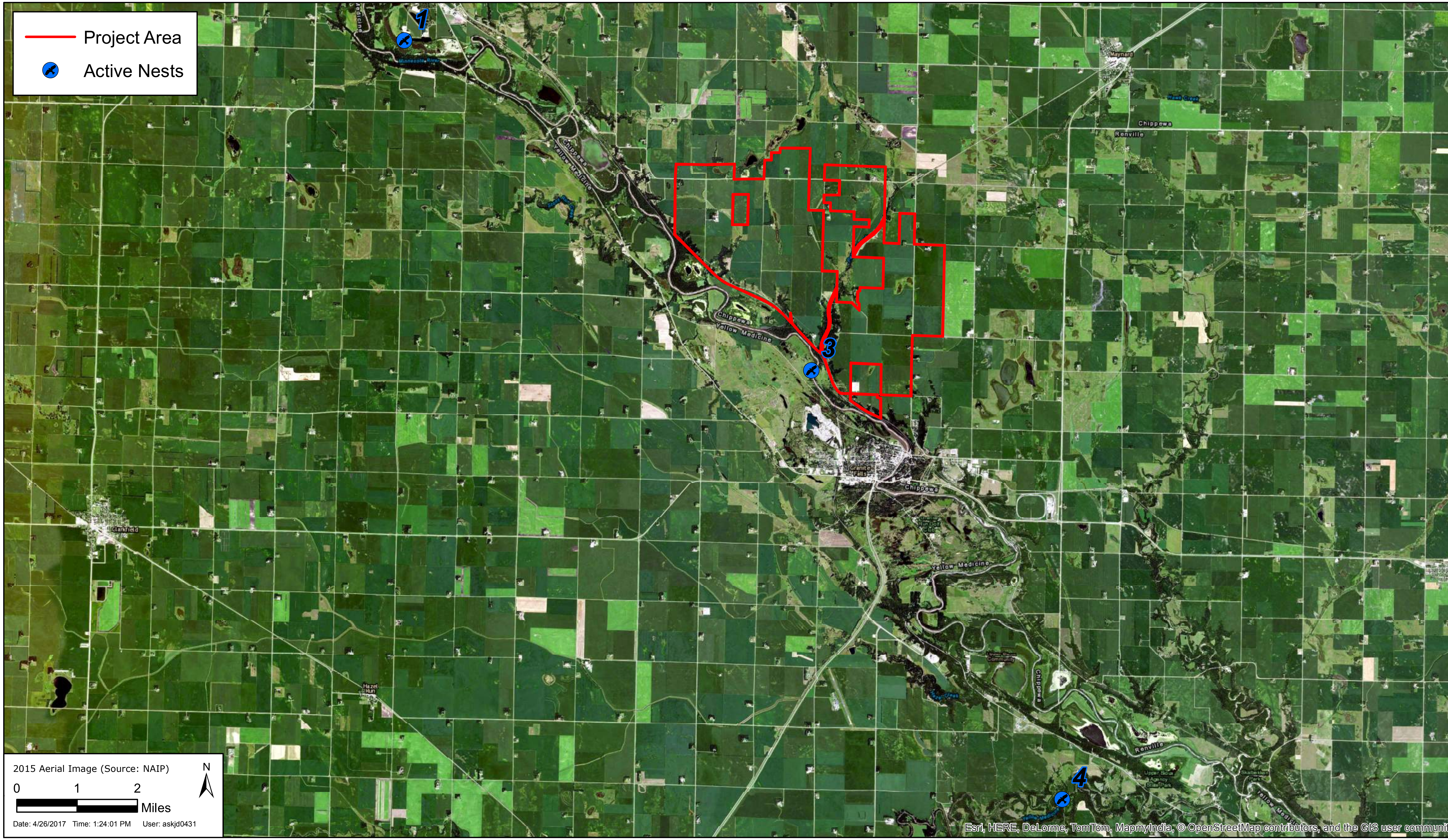
Figure 1

Path: J:\GIS\2759\05 Palmers Creek Wind Farm\11 Aerial Eagle Surveys\mxd\F1-Flight Area.mxd



Path: J:\GIS\2759\05 Palmers Creek Wind Farm\11 Aerial Eagle Surveys\mxd\F2-Flight Path and Results.mxd

PALMER'S CREEK WIND FARM, LLC	WENCK ASSOCIATES Responsive partner. Exceptional outcomes.	APR 2017
Flight Path and Results		Figure 2



PALMER'S CREEK WIND FARM, LLC

Active Nest Locations

WENCK ASSOCIATES

Responsive partner. Exceptional outcomes.

APR 2017

Figure 3

Path: J:\GIS\2759\05 Palmers Creek Wind Farm\11 Aerial Eagle Surveys\mxd\F3-Active Nest Locations.mxd

APPENDIX D – PALMER’S CREEK WIND FARM ACOUSTIC BAT SUMMARY REPORT

FAGEN, INC.

GRANITE FALLS, MINNESOTA

Palmer's Creek Wind Farm

Acoustic Bat Summary Report

2017

NEW CENTURY ENVIRONMENTAL LLC, COLUMBUS, NE

Table of Contents

List of figures

Palmer's Creek WRA Acoustic Bat Monitoring Study
Fagen, Inc.
Granite Falls, Minnesota

Prepared By
New Century Environmental, LLC.
Columbus, Nebraska

Executive Summary

In early summer of 2016, Mike Rutledge of Fagen Engineering contacted Mike Gutzmer of New Century Environmental, LLC (NCE) to aid in the effort of completing a bat report that would capture the diversity/abundance of bat species within the study area of Palmer's Creek to meet due diligence with regulatory agencies, which was done through acoustic monitoring. The client proposed to develop a wind farm within the study area of Chippewa County, Minnesota (just north across the Minnesota River from Granite Falls). The study area lies within the Des Moines Lobe Western Corn Belt Plains (47b) ecoregion of Minnesota. Staff of Fagen Engineering deployed five separate ANABAT systems to record bat activity throughout the study area, the first deployment was done with two of the ANABAT recorders during the fall of 2015 and continued through 15 October 2016. Three more ANABAT recorders were launched on 03 August, 2016. The data collected from Fagen Engineering was sent to NCE via Procore Portal. NCE then took the data and processed in zero-crossing through Kaleidoscope version 3.1.8 to confirm presence diversity and abundance of bat species. The software uses a presence/absent indicator by giving each species of bat a p-value. The lower the p-value, the more likely the species of bat is present. Bat presence, in the form of vocalization, was detected, identified by species, and catalogued, thereby allowing us to estimate species occurrences, distribution and relative abundance.

Introduction

In early summer of 2016, Mike Rutledge of Fagen Engineering, LLC contacted Mike Gutzmer of New Century Environmental, LLC (NCE) to aid in the effort of completing a bat report that would capture the diversity/abundance of bat species within the study area of Palmer's Creek to meet due diligence with regulatory agencies. The client proposed to develop a wind farm in Chippewa County, Minnesota (just north across the Minnesota River from Granite Falls). Bat fatalities result from wind turbine strikes as they feed on insects at night. The heat from the wind turbines attract insects and therefore bring the bats close to the wind turbine. With decreasing bat populations, the gathering of necessary bat data is crucial for this proposed site. Threatened and Endangered bat species become at risk in wind farm areas. Populations of bat species are experiencing long-term declines, due in part to habitat loss and fragmentation, invasive species, and numerous anthropogenic impacts, increasing the concern over the potential effects of energy development. All studies of bat impacts have demonstrated that fatalities peak in late summer and early fall, coinciding with the migration of many species (Johnson 2005; Kunz et al. 2007a; Arnett et al. 2008). A smaller spike in bat fatalities occurs during spring migration for some species at some facilities (Arnett et al. 2008). However, the seasonal fatality peaks noted above may change as more facilities are developed and studied.

Study Area

The study area is located within Chippewa County, Minnesota (just north across the Minnesota River from Granite Falls). The study area lies within the Des Moines Lobe Western Corn Belt Plains (47b) ecoregion of Minnesota. This ecoregion consists of fast fertile plain of deep soils dominated by row crops. The boundaries of the Minnesota River Prairie Subsection coincide with large till plains flanking the Minnesota River. The unit is bounded to the southwest by the Prairie Coteau. A series of moraines define the eastern boundary, the Alexandria Moraine to the northeast and the Bemis moraine to the southeast (Minnesota 2016).

The Minnesota River Prairie is a large subsection that includes part of northwestern Iowa and spreads across southwestern Minnesota into eastern South Dakota. The Minnesota River forms a broad valley, dividing the area in half. This valley once had a continuous band of floodplain forest that extended upstream as far as Lac Qui Parle, with highly unique bedrock exposures. There are 150 lakes larger than 160 acres in the subsection, most of which are shallow. Before settlement by people of European descent, the predominant vegetation was tallgrass prairie and wetlands. Fire was once a common natural disturbance and critical to maintaining native prairie communities (Minnesota, 2016).

Today, row-crop agriculture is the predominant land use, and prairie remnants and floodplain forests are rare. A major concern is impacts on water quality from intensive agricultural activities, including use of fertilizers and pesticides, expanding use of pattern tiling, and ditching and draining of small wetlands. Continued loss of the small amount of native upland habitat and over-intensive grazing remain a concern (Minnesota, 2016).

Figure 1: Vicinity map of study area. Chippewa county is located in southwestern Minnesota.

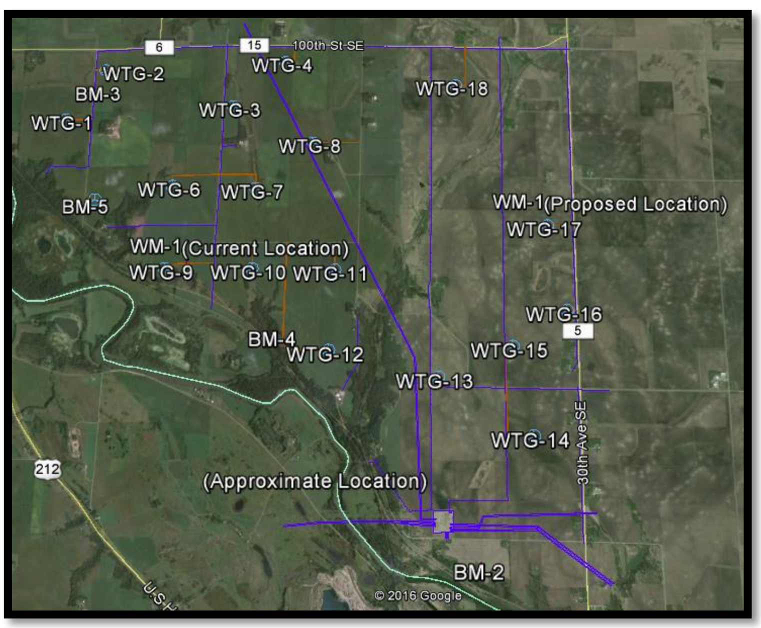


Figure 2: Project location along with bat monitor (BM) locations. BM-1 is not shown on the map but lies next to BM-2.

Methods

Data was gathered in the field by Fagen Engineering, LLC within the study area from five different Anabat acoustic recorders (map in Study Area section shows locations of monitors). Monitors 1 & 2 gathered data throughout the fall of 2015 and were deployed again in May of 2016. Monitors 3-5 were added in September of 2016.

Monitors 1 & 2 were deployed on September 13, 2015 and removed on October 11, 2015. They were deployed again on April 12, 2016 then removed on October 15. Monitor 3, monitor 4 and monitor 5 were deployed on August 3rd, 2016 then removed on October 15th, 2016. The monitors were deployed for 287 trap nights

The data was uploaded through the Procore portal where New Century Environmental staff could access the data to download and process through a program called Kaleidoscope Pro version 3.1.8. The Kaleidoscope classifier uses a source library of user submitted reference calls to compare to recordings. It accepts and displays full-spectrum signals, to match with the calls known bat species. The software uses a presence/absence indicator by giving each species of bat a p-Value of 0 to 1. The lower the P-Value, the more likely the species is present. Variability in the quality of recordings and variations in calls among individual bats creates challenges to acoustic bat classification.

Kaleidoscope Pro has been approved by the U.S. Fish & Wildlife Service for use for presence/absence analysis for Indiana bats (*Myotis sodalis*). Similarly, the approved programs may also be used for presence/absence analysis for northern long-eared bats (*Myotis septentrionalis*). The U.S Geological Survey also tested acoustic matching programs and Kaleidoscope Pro passed their standard validation process (USFWS 2016).

Results

From the five Anabat recording systems, 232,116 sound files were recorded. Visual examination and filtering of files to eliminate extraneous noise (e.g., wind, insects, etc.) resulted in a total of 14,442 bat detections.

Monitor 1 recorded 3,181 files that Kaleidoscope Pro was able to classify as bat passes. The silver haired bat was the most common species at this site being 62% of total detections. The big brown bat was the second most common being 13% of total detections. The federally threatened northern long-eared myotis was detected 4 times (0.001%), but had a P-value of 1 which almost certainly means it was nonexistent at this site. The eastern pipistrelle had a total of 55 (2%) detections.

Code	Common name	Scientific Name	Conservation status	P-Value	# of passes
LANO	Silver-Haired Bat	*Lasionycteris noctivagans*	Least concern	0	1971
EPFU	Big-Brown Bat	*Eptesicus fuscus*	Least concern	0	427
LACI	Hoary Bat	*Lasiurus cinereus*	Least concern	0	347
LABO	Eastern Red Bat	*Lasiurus borealis*	Least concern	0	158
MYLU	Little Brown Bat	*Myotis lucificus*	Least concern	0	219
MYSE	Northern long-eared myotis	*Myotis septentrionalis*	Federally threatened	1	4
PESU	Eastern pipistrelle	*Perimyotis subflavus*	MN species of concern	0	55

Figure 3: Summary of species diversity and abundance for monitor 1.

Monitor 2 recorded 3,004 files that Kaleidoscope Pro was able to classify as bat passes. The silver haired bat was the most common species at this site being 57% of total detections. The second most common was the hoary bat at 30% of detections. The federally threatened northern long eared myotis only had a total of 2 (0.0007%) detections but had a P-value of 1. The eastern pipistrelle had a total of 14 (0.005%) detections.

Code	Common name	Scientific Name	Conservation status	P-Value	# of passes
LANO	Silver-Haired Bat	*Lasionycteris noctivagans*	Least concern	0	1717
EPFU	Big-Brown Bat	*Eptesicus fuscus*	Least concern	0	167
LACI	Hoary Bat	*Lasiurus cinereus*	Least concern	0	887
LABO	Eastern Red Bat	*Lasiurus borealis*	Least concern	0	165
MYLU	Little Brown Bat	*Myotis lucificus*	Least concern	0.14	52
MYSE	Northern long-eared myotis	*Myotis septentrionalis*	Federally threatened	1	2
PESU	Eastern pipistrelle	*Perimyotis subflavus*	MN species of concern	0.01	14

Figure 4: Summary of species abundance and diversity for monitor 2

Monitor 3 recorded 4,870 files that Kaleidoscope Pro was able to classify as bat passes. The hoary bat was the most common species at this site being 75% of total detections. The second most common was the silver haired bat being 8% of total detections. The northern long eared bat had only 1 (0.0002%) detections with a p-value of 1. The eastern pipistrelle had a total of 64 (1%) detections.

Code	Common name	Scientific Name	Conservation status	P-Value	# of passes
LANO	Silver-Haired Bat	*Lasionycteris noctivagans*	Least concern	0.34	401
EPFU	Big-Brown Bat	*Eptesicus fuscus*	Least concern	0	263
LACI	Hoary Bat	*Lasiurus cinereus*	Least concern	0	3672
LABO	Eastern Red Bat	*Lasiurus borealis*	Least concern	0	306
MYLU	Little Brown Bat	*Myotis lucificus*	Least concern	0	163
MYSE	Northern long-eared myotis	*Myotis septentrionalis*	Federally threatened	1	1
PESU	Eastern pipistrelle	*Perimyotis subflavus*	MN species of concern	0	64

Figure 5: Summary of species diversity and abundance for monitor 3

Monitor 4 recorded 1,512 files Kaleidoscope Pro classified as bat passes. The most common species at this site was the silver-haired bat being 46% of total detections. The second most common was the hoary bat being 26% of total detections. The northern long-eared myotis was not recorded at this site. The eastern pipistrelle had a total of 59 (4%) detections.

Code	Common name	Scientific Name	Conservation status	P-Value	# of passes
LANO	Silver-Haired Bat	*Lasionycteris noctivagans*	Least concern	0	688
EPFU	Big-Brown Bat	*Eptesicus fuscus*	Least concern	0	143
LACI	Hoary Bat	*Lasiurus cinereus*	Least concern	0	390
LABO	Eastern Red Bat	*Lasiurus borealis*	Least concern	0	129
MYLU	Little Brown Bat	*Myotis lucificus*	Least concern	0	103
MYSE	Northern long-eared myotis	*Myotis septentrionalis*	Federally threatened	1	0
PESU	Eastern pipistrelle	*Perimyotis subflavus*	MN species of concern	0	59

Figure 6: Summary of species diversity and abundance for monitor 4

Monitor 5 recorded 1,875 files Kaleidoscope Pro classified as bat passes. The most common species at this site was the silver haired bat being 46% of total detections. The second most common was the hoary bat with being 21%) of total detections. The northern long-eared myotis had a total of 2 (0.001%) detections. The eastern pipistrelle had a total of 70 (4%) detections.

Code	Common name	Scientific Name	Conservation status	P-Value	# of passes
LANO	Silver-Haired Bat	*Lasionycteris noctivagans*	Least concern	0	871
EPFU	Big-Brown Bat	*Eptesicus fuscus*	Least concern	0	316
LACI	Hoary Bat	*Lasiurus cinereus*	Least concern	0	403
LABO	Eastern Red Bat	*Lasiurus borealis*	Least concern	0	138
MYLU	Little Brown Bat	*Myotis lucificus*	Least concern	0	75
MYSE	Northern long-eared myotis	*Myotis septentrionalis*	Federally threatened	1	2
PESU	Eastern pipistrelle	*Perimyotis subflavus*	MN species of concern	0	70

Figure 7: Summary of species diversity and abundance for monitor 5.

Discussion

There are seven species of bats that occur regularly in Minnesota; our most common species, the little brown myotis, occurs over most of North America. Along with the Northern myotis and big brown bat, it hibernates in Minnesota caves and mines. In summer, they roost in caves, mines, hollow trees, and buildings. Large groups of these bats hang upside-down in caves. The eastern pipistrelle is the smallest species, weighing only two-tenths of an ounce. It is found in the same Minnesota caves and mines, though it is less common and in fewer numbers.

The silver-haired bat and Eastern red bad are forest dwellers that usually live near water and feed among the trees. Usually a red bat pair will repeatedly fly the same route in search of food. Another woodland species is the hoary bat. It is the largest Minnesota bat, weighing an ounce or more. All three species are somewhat solitary, roost in trees, and migrate south for the winter (Minnesota, 2016).

In early July 2016, a species previously not known to be native to Minnesota, the evening bat, was discovered. Researchers from the DNR Nongame Wildlife Program and Central Lakes College were conducting a survey as part of a project to study summer breeding habits of the state's forest bats. The bat was captured at the Minnesota Army National Guard's Training Site in Arden Hills.

All seven bat species that occur in Minnesota may be found throughout the state.

Common name	Scientific Name	State Status	Federal Status
Northern long-eared myotis	*Myotis septentrionalis*	Threatened	Threatened
Eastern Pipistrelle	*Pipistrellus subflavus*	MN species concern	Not listed
Little brown bat	*Myotis lucifugus*	Not listed	Not listed
Big brown bat	*Eptesicus fuscus*	Not listed	Not listed
Silver-haired bat	*Lasionycteris noctivagans*	Not listed	Not listed
Eastern red bat	*Lasiurus borealis*	Not listed	Not listed
Hoary bat	*Lasiurus cinereus*	Not listed	Not listed
Evening bat	*Nycticeius humeralis*	Newly discovered	Not listed

Figure 8: Bat species found in Minnesota with federal and state conservation status.

There were a total of six bat species documented throughout the course of the study (September-October 2015 and 2016). The eastern pipistrelle (*Pipistrellus sublavus)* was documented at this site and is listed as a species of concern in the state of Minnesota. It was detected in small numbers but was found at every monitor except for monitor 1. The northern long-eared myotis (*Myotis septentrionalis*) is a federally threatened species whose home range lies within the study site. However no confirmed documentation was recorded here. Even though a total of five clicks of which Kaleidoscope classified as MYSE (northern long-eared myotis) the P-value was given a 1 for every monitor indicating the likelihood of presence is near non-existent. All other species documented are of least concern. Of the six species documented the silver-haired bat (*Lasionycteris noctivagans*), hoary bat (*Lasiurus cinereus*) and big brown bat (*Eptesicus fuscus*) were among the most common followed by the little brown bat (*Myotis lucifugus*) and eastern red bat (*Lasiurus borealis*).

References

Arnett, E. B., W. K. Brown, W. P. Erickson, J. K. Fiedler, B. I. Hamilton, T. H. Henry, A. Jain, G. D. Johnson, J. Kerns, R. R. Koford, C. P. Nicholson, T. J. O'Connell, M. D. Piorkowski, R. D. Tankersley Jr. 2008. Patterns of Bat Fatalities at Wind Energy Facilities in North America. *Journal of Wildlife Management*. 72: 61-78.

Johnson, G.D. 2005. A review of bat mortality at wind-energy developments in the United States. *Bat Research News*. 46: 45-49.

Kunz, T. H., E. B. Arnett, W. P. Erickson, A. R. Hoar, G. D. Johnson, R. P. Larkin, M. D. Strickland, R. W. Thresher, and M. D. Tuttle. 2007a. Ecological impacts of wind energy development on bats: questions, research needs, and hypotheses. *Frontiers in Ecology & the Environment*. 5: 315–324.

Minnesota Department of Natural Resources, 2006. Tomorrow's Habitat for the Wild and Rare: An Action Plan for Minnesota Wildlife, Comprehensive Wildlife Conservation Strategy. Division of Ecological Services, Minnesota Department of Natural Resources.

US Fish and Wildlife Service. 2016. Endangered Species Midwest Region. Accessed on 7 November 2016 at <https://www.fws.gov/midwest/Endangered/mammals/inba/surveys/inbaAcousticSoftware.html>.

Appendix

Summary Graphs

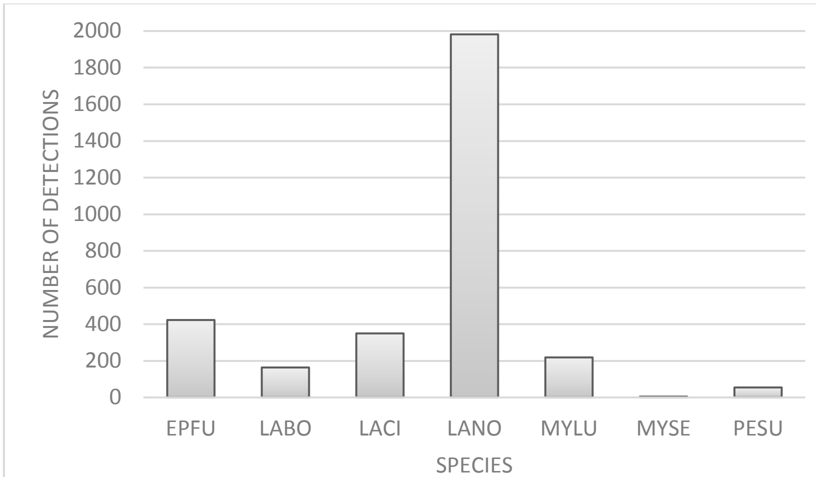


Figure 9.1: Total number of bat detections by species for monitor 1

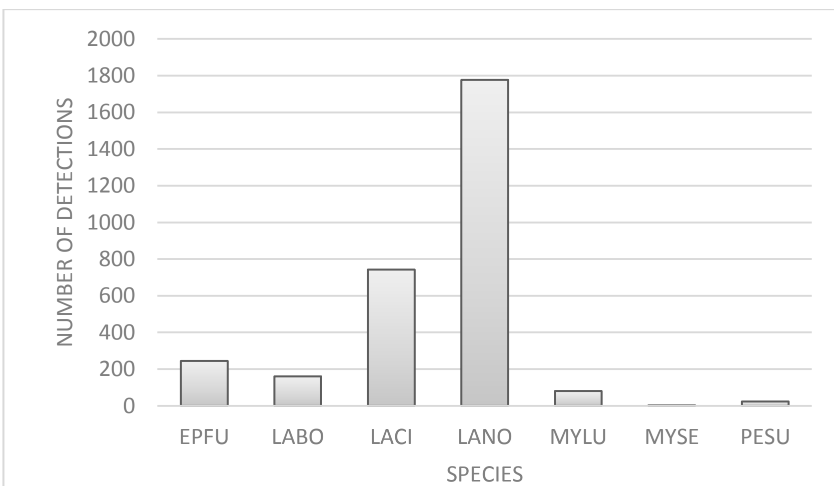


Figure 9.2: Total number of bat detections by species for monitor 2

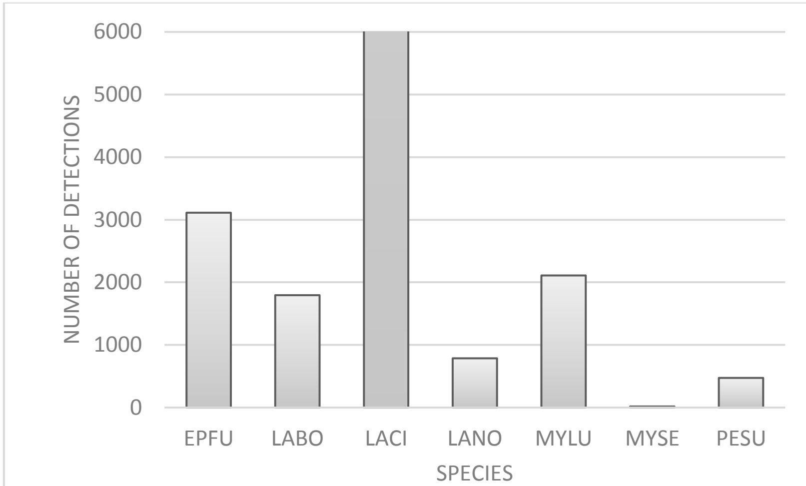


Figure 9.3: Total number of bat detections by species for monitor 3

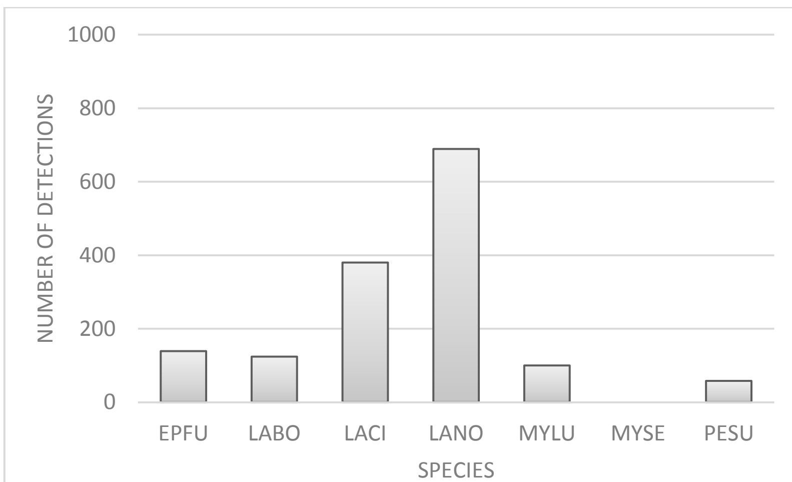


Figure 9.4: Total number of bat detections by species for monitor 4

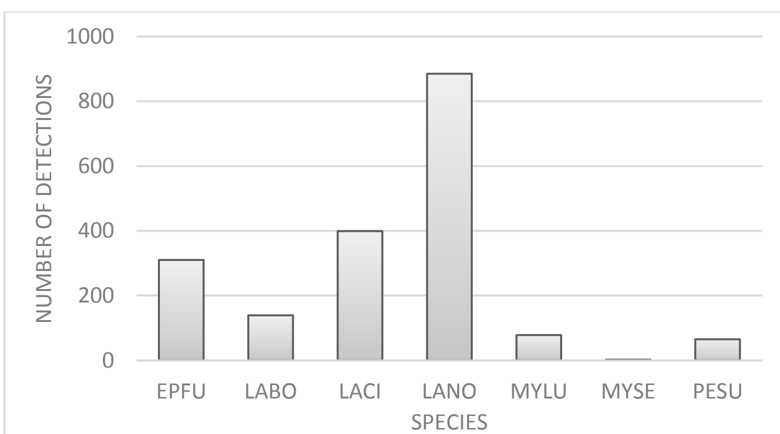


Figure 9.5: Total number of bat detections by species for monitor 5

Kaleidoscope Data

KALEIDOSCOPE 3.1.8

Bats of North America 3.1.0 S/A:+1

Monitor 1			
	Species	Detections	Presence p-value
Fall 2015	EPFU	123	0.95
	LABO	41	0
	LACI	144	0
	LANO	725	0
	MYLU	45	0
	MYSE	0	1
	PESU	10	0
5/28/2016	EPFU	118	0.77
	LABO	34	0
	LACI	104	0
	LANO	670	0
	MYLU	39	0
	MYSE	0	1
	PESU	8	0
9/2/2016	EPFU	91	0
	LABO	46	0
	LACI	53	0
	LANO	194	0
	MYLU	96	0
	MYSE	2	1
	PESU	23	0
10/7/2016	EPFU	92	0
	LABO	34	0
	LACI	38	0
	LANO	377	0
	MYLU	39	0
	MYSE	0	1
	PESU	14	0
10/15/2016	EPFU	3	0.33
	LABO	3	0
	LACI	8	0
	LANO	5	0.46
	MYLU	0	1
	MYSE	0	1
	PESU	0	1

Monitor 2			
	Species	Detections	Presence p-value
Fall 2015	EPFU	33	0.22
	LABO	31	0
	LACI	38	0
	LANO	148	0
	MYLU	15	0
	MYSE	1	1
	PESU	0	1
5/28/2016	EPFU	9	1
	LABO	8	0
	LACI	29	0
	LANO	167	0
	MYLU	9	0
	MYSE	0	1
	PESU	2	0.08
9/2/2016	EPFU	108	1
	LABO	84	0
	LACI	631	0
	LANO	1085	0
	MYLU	20	0
	MYSE	1	1
	PESU	9	0.01
10/7/2016	EPFU	17	1
	LABO	41	0
	LACI	189	0
	LANO	313	0
	MYLU	8	0.14
	MYSE	0	1
	PESU	3	0.33
10/15/2016	EPFU	0	1
	LABO	1	0.10
	LACI	0	1
	LANO	4	0
	MYLU	0	1
	MYSE	0	1
	PESU	0	1

KALEIDOSCOPE 3.1.8
Bats of North America 3.1.0 S/A:+1

Monitor 3			
	Species	Detections	Presence p-value
9/2/2016	EPFU	2	1
	LABO	0	1
	LACI	208	0
	LANO	0	1
	MYLU	0	1
	MYSE	0	1
	PESU	0	0
10/7/2016	EPFU	260	0
	LABO	303	0
	LACI	3463	0
	LANO	399	1
	MYLU	163	0
	MYSE	1	1
	PESU	69	0
10/15/2016	EPFU	1	0.77
	LABO	3	0
	LACI	1	0.09
	LANO	2	0.34
	MYLU	0	1
	MYSE	0	1
	PESU	0	1

Monitor 4			
	Species	Detections	Presence p-value
9/2/2016	EPFU	96	0
	LABO	82	0
	LACI	309	0
	LANO	289	0
	MYLU	85	0
	MYSE	0	1
	PESU	34	0
10/7/2016	EPFU	46	1
	LABO	47	0
	LACI	84	0
	LANO	397	0
	MYLU	18	0
	MYSE	0	1
	PESU	25	0
10/15/2016	EPFU	1	0.69
	LABO	0	1
	LACI	0	1
	LANO	2	0.16
	MYLU	0	1
	MYSE	0	1
	PESU	0	1

KALEIDOSCOPE 3.1.8
Bats of North America 3.1.0 S/A:+1

Monitor 5			
	Species	Detections	Presence p-value
9/2/2016	EPFU	130	0
	LABO	79	0
	LACI	162	0
	LANO	427	0
	MYLU	58	0
	MYSE	2	1
	PESU	40	0
10/7/2016	EPFU	186	0
	LABO	58	0
	LACI	239	0
	LANO	444	0
	MYLU	17	0
	MYSE	0	1
	PESU	27	0
10/15/2016	EPFU	1	1
	LABO	0	0.61
	LACI	2	0
	LANO	0	1
	MYLU	0	1
	MYSE	0	1
	PESU	3	0

Species Descriptions

Silver Haired Bat

The silver-haired bat (*Lasionycteris noctivagans*) is a solitary migratory species and the only member of the genus *Lasionycteris*. They are found in Bermuda, Canada, Mexico and the United States. They often roost in tree cavities or in bark crevices on tree trunks, especially during migration. This medium-sized bat is mostly black (including the wings, ears, interfemoral membrane, and fur) with white-tipped hairs. The basal upper half of its tail membrane is densely furred. This gives the bat a frosted appearance for which it is named. This species has a flattened skull with a broad rostrum. This species weighs around 8–12 g, has a total length of ~100 mm, a tail length of 40 mm, and a forearm length of 37–44 mm. Silver-haired bats consume primarily soft-bodied insects, such as moths, but will also take spiders and harvestmen. This species will forage low, over both still and running water, and also in forest openings. Silver-haired bats are slow but maneuverable flyers that typically detect prey only a short distance away. In addition to the hoary bat (*Lasiurus cinereus*) and eastern red bat (*Lasiurus borealis*), the silver-haired bat is one of the three tree bat species most commonly killed at wind energy facilities (over 75% of the mortalities).

Big Brown Bat

The big brown bat (*Eptesicus fuscus*) is native to North America, Central America, the Caribbean, and extreme northern South America. This medium-sized bat ranges from 10–13 cm in body length, with a wingspan 28-33, and weighs between 14-16 g. The fur is moderately long and shiny brown. The wing membranes, ears, feet, and face are dark brown to blackish in color. Big brown bats roost during the day in hollow trees, beneath loose tree bark, in the crevices of rocks, or in man-made structures such as attics, barns, old buildings, eaves and window shutters. Big brown bats are insectivorous, eating many kinds of night-flying insects including moths, beetles, and wasps.

Hoary Bat

The hoary bat (*Lasiurus cinereus*) is a species of bat in the vesper bat family, Vespertilionidae. It occurs throughout most of North America and much of South America. The hoary bat averages 13-14.5 cm long with a 40 cm wingspan and a weight of 26 g. Its coat is dark brown and the hairs on the back are frosted with silver. The body is covered in fur except for the undersides of the wings. This species normally roosts alone on trees, hidden in the foliage, but on occasion has been seen in caves with other bats. It prefers woodland, mainly coniferous forests, but hunts over open areas or lakes. It hunts alone and its main food source is moths. The bat is migratory and may travel from Canada as far south as the southern United States or Bermuda.

Eastern Red Bat

The eastern red bat (*Lasiurus borealis*) is widespread across eastern North America, with additional records in Bermuda. This is a medium-sized bat, averaging weights of 9.5-14 g and measurements of 112.3 mm in total length. Adults are usually dimorphic: males have red hair while females are chestnut-colored with whitish frosting on the tips of the fur. Moths form the majority of the diet, but red bats also prey on beetles, flies, and other insects.

Eastern Pipistrelle

The Eastern Pipistrelle (*Perimyotis subflavus*) is found commonly in the eastern portion of the United States, but extends into southeastern Nebraska. This reddish, yellowish and brownish bat is one of the smallest bats in the eastern part of the US. The forearms are orange to red while the wing membrane is black. Adults weigh between 4-10g and reach a forearm length of 30-35mm. These bats feed on small insects on the edges of forested areas, rivers, streams or open water.

Little Brown Bat

The Little Brown Bat (Myotis lucifigus) is found throughout much of North America. It is most common in the northern half of the continental United States and Southern Canada. The bat's fur is dark brown and glossy on the back with slightly paler, greyish fur underneath. Wing membranes are dark brown on a typical wingspan of 22–27 cm. Ears are small and black with a short, rounded tragus. Adult bats are typically 6–10 cm long and weigh 5–14g. Since many of their preferred meals are insects with an aquatic life stage, such as mosquitoes, they prefer to roost and forage near water.

APPENDIX E – BIRD AND BAT CONSERVATION STRATEGY

Wenck File #B2759-0005-05
April 2017

Palmer's Creek Wind Farm
Bird And Bat Conservation Strategy

Prepared for:

Palmer's Creek Wind Farm, LLC.

501 West Highway 212
Granite Falls, MN 56241

Prepared by:

WENCK Associates, Inc.
301 1st Street NE, Suite 202
Mandan, ND 58554
(701) 751-3370

Responsive partner.
Exceptional outcomes.

Table of Contents

TABLES

FIGURES

APPENDICES

Documents Appended by Reference and Available in Site Permit Application and Environmental Assessment

1.0 Palmer's Creek Information

Palmer's Creek Wind Farm, LLC (Palmer's Creek) proposes to construct the Palmer's Creek Wind Energy Facility (Project or PCWF), a Large Wind Energy Conversion System (LWECS), with a 44.6- megawatt (MW) nameplate capacity wind energy facility in Chippewa County, Minnesota (**Figures 1 and 2, Site Location Map and Site Detail Map, respectively**). The project area consists of 18 wind turbines located on approximately 6,150 acres of privately owned land. The Project will also include associated access roads, a new collector substation, an operations and maintenance (O&M) facility, and associated transmission interconnection facilities. Palmer's Creek further proposes to interconnect the Project to an existing Western Area Power Administration (WAPA) substation, the Granite Falls Substation, which is within the project area boundary.

Palmer's Creek Proposed Action is to execute an interconnection agreement with the Southwest Power Pool (SPP) to connect the Palmer's Creek Project to WAPA's Granite Falls Substation. As part of the Proposed Action, WAPA will install necessary equipment in their existing substation to accept the generated power.

The Palmer's Creek Wind Farm will consist of two (2) 2.3-MW and sixteen (16) 2.5-MW wind turbines with an aggregate nameplate capacity of 44.6 MW. The Project will also include:

- Underground electric collector lines,
- New central collector substation (Palmer's Creek Substation),
- Approximately 1000-foot long T-line interconnecting the Granite Falls Substation,
- O&M facility,
- Access roads connecting to each turbine,
- One permanent meteorological tower,
- Supervisory control and data acquisition (SCADA) system, and
- Temporary laydown yard.

Figures 1 and 2 (Site Location Map and Site Detail Map, respectively) show the proposed layout of the Project facilities. The expected life of the Project is approximately 20 to 40 years (leases for the Project are for the life of the power purchase agreement (PPA), with an option to upgrade turbines and extend leases for an additional 20 years).

The interconnection of the Project to Western's transmission system is a federal action under the National Environmental Policy Act of 1969 (NEPA), and therefore requires the completion of Federal environmental review. A Programmatic Environmental Assessment (EA), of which this bird and bat conservation strategy is part, will be prepared for the Project.

Palmer's Creek is committed to its responsibility to be a good steward of the environment and to adhere to federal, state, and local laws and ordinances. Palmer's Creek wind project policy calls for wind projects to be designed, constructed, and operated in an environmentally sensitive manner and, either avoid or minimize potential avian and bat impacts. Palmer's Creek understands that even with diligent design, construction and operation activities, avian and bat fatalities may occur, including species that are protected under federal and state laws. As part of this commitment, Palmer's Creek has developed a Bird & Bat Conservation Strategy (BBCS) for the Project. The development and application of this ABPP will ensure that:

- All Project-related actions comply with federal and state regulations;
- All Project-related actions comply with permit conditions;
- Project-specific species concerns are included in the BBCS, including avoidance and minimization measures;
- Public and private organizations are included in programs and research that minimize detrimental effects of bird and bat interactions with wind projects.
- The procedures described in this BBCS are followed;
- The Palmer's Creek' staff and all relevant subcontractors will receive the appropriate training pursuant to wildlife monitoring and reporting protocols; and,
- The documentation of bird and bat injuries and fatalities may provide the basis for future modifications to the BBCS.

This BBCS continues Palmer's Creek regulatory compliance concerning bird and bat interactions with its wind projects through a proactive approach to reducing risk to birds and bats and their habitats.

2.0 Project Description and Overview

Palmer's Creek proposes to construct a Large Wind Energy Conversion System (LWECS), with a 44.6 megawatt (MW) nameplate capacity wind energy facility in Chippewa County, Minnesota, approximately 1.5 miles north of the City of Granite Falls (**Figures 1 and 2, Site Location Map and Site Detail Map, respectively**). The Project includes approximately 18 wind turbines, associated access roads, a new collector substation, an O&M facility, and associated transmission interconnection facilities. Palmer's Creek further proposes to interconnect the Project to the existing Granite Falls Substation within the project area boundary. The anticipated timeline for construction is July 2017 to February 2018 with commercial operation date (COD) of March 2018.

The Project will place 18 turbines across the project area, connecting these turbines by access roads and transmission facilities. Project construction is anticipated to include land disturbance for the 18 turbines, approximately 14 miles of collection lines, an approximately 1,000-foot transmission line at 115 kV, approximately 5.5 miles of new or upgraded roads; approximately 5.5. miles of temporary, construction access roads; a new substation using approximately one acre; approximately three acres of laydown area; a 2,800-square foot O&M Facility; and one meteorological tower.

2.1 PROJECT LOCATION

The southern boundary of the project area is located approximately one mile north of the City of Granite Falls in Chippewa County, Minnesota in Granite Falls Township, east of the Minnesota River (**Figure 1, Site Location Map**).

Table 2-1: Project Location.

County	Township Name	Township	Range	Sections
Chippewa	Granite Falls	116 North	39 West	3-10, 15-22, 27, 28, 29
Chippewa	Granite Falls	116 North	40 West	1, 12, 13

2.2 SIZE OF THE PROJECT AREA

The project area boundary is approximately 6,150 acres. Project construction is anticipated to include temporary land disturbance of approximately 172 acres for Project construction. Permanent land disturbance will be approximately 12 acres for turbines and associated facilities. Refer to **Table 2-2, Temporary and Permanent Land Disturbance**.

Table 2-2: Temporary and Permanent Land Disturbance.

Cover Types	Temporary Disturbance	Permanent Disturbance
Barren Land (Rock/Sand/Clay)	0	0
Cultivated Crops	161	10
Deciduous Forest	1	0
Developed	7	0.6
Emergent Herbaceous Wetlands	1.1	0
Grassland/Herbaceous	0.5	0.1
Open Water	0	0
Pasture/Hay	1.2	0.6
Shrub/Scrub	0.1	0.1
Total	**171.9**	**11.4**

Source: NLCD, 2011.

3.0 Project Design

The Project was designed to optimize wind resources, while minimizing potential impacts to ecological and cultural resources. Primary Project features include: wind turbines, collection lines, access roads, new substation, O&M facility, temporary and permanent meteorological towers, and SODAR unit. Temporary features include laydown areas and crane walks (**Figure 2, Site Detail Map**).

3.1 DESCRIPTION OF LAYOUT AND SETBACK

The Project will construct the turbines primarily on agricultural land. The applicable setbacks for the Project are summarized in **Table 3-1, PUC Setback Requirements**.

Table 3-1: Public Utilities Commission Setback Requirements.

Object	Setback
Wind Access Buffer – Prevailing Wind Directions	5 rotor diameters
Wind Access Buffer – Non-Prevailing Wind Directions	3 rotor diameters
Internal Turbine Spacing: Crosswind	3 rotor diameters
Internal Turbine Spacing: Downwind	5 rotor diameters
Meteorological Towers	250 feet
Residences	1,000 feet (or further to meet noise standards)
Public Roads (from right-of-way)	250 feet[1]
Noise Requirements	Minnesota Noise Standards (Minnesota Rules Chapter 7030) at all residential receivers (homes). Residential noise standard NAC 1, L50 50 dBA during overnight hours.
Protected Waters and Wetlands	Avoidance, crossing subject to agency approval

[1]PUC has adopted as case-by-case approach where necessary and in the public interest which applies to public roads and trails.

The current Project layout (**Figure 2, Site Detail Map**) may differ from the final construction layout, but Palmer's Creek anticipates the final layout will remain substantially similar to what is presented in the Site Permit Application. The changes that may occur to the current Project layout will be the result of ongoing information gathering and monitoring data, permitting, and micro-siting activities. Any changes in the proposed turbine layout will be evaluated throughout the Site Permit process, and any layout changes that would work following Site Permit issuance will be evaluated to ensure that the revised turbine locations have similar human and environmental impacts when compared with the original proposed and/or permit turbine locations. Any turbine location changes will be identified, evaluated, and discussed with the DOC-Energy, Environmental Review and Analysis (EERA) staff prior to beginning construction.

3.2 DESCRIPTION OF TURBINES AND TOWERS

Basic wind turbine components include a nacelle, hub, blades, tower and foundation. A wind turbine operates three propeller-like blades mounted to a hub, which forms the rotor.

3.2.1 Wind Turbine Design

Palmer's Creek plans to install two (2) 2.3-MW and sixteen (16) 2.5-MW horizontal axis wind turbines for the Project. Each will have an anticipated hub height between 262 and 295 feet (80 and 90 meters) and a rotor diameter of approximately 380 feet (116 meters). The total height of each turbine will be approximately 485 feet (146 meters) when a blade is in vertical position. The rotor consists of three blades mounted to a rotor hub. Turbine towers will be cylindrical monopoles, approximately 262 to 295 feet (80 to 90 meters) in height. The tower color will be non-reflective light grey, and all surfaces will be multi-layer coated for protection against corrosion. Marking and lighting of the wind farm will be done in compliance with Federal Aviation Administration (FAA) regulations. **Table 3-2** provides a summary of the turbine characteristics.

Table 3-2: Turbine Characteristics.

	GE 2.3	GE 2.5
Nameplate Capacity	2.3 MW	2.5 MW
Hub Height	262 feet (80 meters)	295 feet (90 meters)
Rotor Diameter	380 feet (116 meters)	380 feet (116 meters)
Total Height	452 feet (150 meters)	485 feet (146 meters)
Swept Area	113,411 feet (10,568 meters)	113,411 feet (10,568 meters)
Cut-in Wind Speed	6.7 mph (3 m/s)	6.7 mph (3 m/s)
Cut-out Wind Speed	56 mph (25 m/s)	56 mph (25 m/s)
Rated Wind Speed	85 mph (38 m/s)	85 mph (38 m/s)
Rotor Speed	8 to 15.7 rpm	8 to 15.7 rpm

3.2.2 Foundations

The wind turbine foundations will typically be reinforced concreate spread foundations. A spread foundation requires a shallow excavation, generally 10 to 12 feet deep. The actual foundation for each turbine will be specifically designed based on geotechnical analysis of a 50-foot (15 meter) core sample at each turbine location combined with structural loading requirements for the turbine. The pedestal diameter for an approximate 262 feet (80 meter) tower is approximately 18 feet (five meters) anchored by high strength bolts into a concrete foundation of approximately 60 feet in diameter. The excavated area for the turbine foundations will typically be approximately 75 feet by 75 feet (23 meters by 23 meters). During construction, a larger area, approximately 300-foot diameter (92 meters), will be used to lay down the rotors and maneuver cranes during turbine assembly.

3.2.3 Temporary Laydown and Crane Walks

An approximate 3-acre laydown area is located near the proposed substation and O&M building (**Figure 2, Site Detail Map**). The temporary area will serve as locations for job trailers, temporary offices, parking, and storage for items necessary for the Project. The location of the laydown area will be selected during final design; however, a preferred location will be an undeveloped or previously disturbed area that is flat (**Figure 4, Topographic Map**) and does not contain streams, wetlands (**Figure 8, Waterbodies and Wetlands**) or other environmentally sensitive resources.

In addition to the approximately 3-acre laydown area, temporary crane walk (**Figure 2, Site Detail Map**) disturbances will also be necessary for the Project. Crane walks are estimated to be 40 feet in width and will be located throughout the Project based on the shortest route to the next turbine in the construction sequence. However, cranes will utilize access roads if feasible. Where feasible, Palmer's Creek will make every effort to avoid streams, wetlands, and other environmentally sensitive resources. If avoidance is not possible, Palmer's Creek will acquire the necessary permits/approvals for Project construction and operation and will minimize impacts to the greatest extent possible.

3.2.4 Operation

Palmer's Creek Wind Farm, LLC will oversee all operations, maintenance, and management of the Project facilities through a service agreement with a qualified operations and maintenance (O&M) service. WTG and substation maintenance schedules and required outage durations are based on equipment manufacturer's recommendations and Palmer's Creek operating experience. O&M Service Provider will address both scheduled and unscheduled maintenance on the wind project, including repairs, replacement of parts and removal of failed parts. WTG maintenance will be performed as an on-going function during the life of the Project. Transformer and other substation maintenance will be completed on an annual basis and will be scheduled during times with minimal impact to production.

General maintenance includes maintaining Project structures, access roads, drainage systems and other facilities. General maintenance will be ongoing for the life of the project and scheduled as needed. Palmer's Creek will operate a SCADA system located at the base section of each WTG, substation control building, and O&M building.

3.3 DESCRIPTION OF ELECTRICAL SYSTEM

Each turbine will have a step-up transformer to raise the voltage to the 34.5 kilovolt (kV) collection line system. The electricity generated by each turbine will run through underground collection lines to the proposed Palmer's Creek Substation. The electricity will be converted to 115 kV at the new Palmer's Creek Substation and distributed via new proposed 115 kV transmission line to the existing Granite Falls (WAPA) Substation.

3.3.1 Transformers

A generator step-up transformer will be installed at the base of each wind turbine to increase the output voltage of the wind turbine to the voltage of the power collection system (34.5-kV). The transformers will be mounted on concrete pads and will be placed next to each wind turbine.

3.3.2 Electrical Collection Systems

Each wind turbine within the project area will be interconnected by underground communication and electrical power collection circuit facilities and routed to the Palmer's Creek Substation (collector substation) where the electrical voltage will be stepped up from 34.5-kV to 115-kV. The underground collector system will be placed in one trench, approximately 18-24 inches wide, and will connect each of the turbines to the Palmer's Creek Substation. The estimate trench length, is approximately 73,920 feet (approximately 14 miles).

The underground electrical collector and communication systems generally will be installed by plowing or trenching the cables. Using this method, the disturbed soils and topsoil are typically replaced over the buried cable within one day, and the drainage patterns and surface topography are restored to pre-existing conditions. In grassland/rangeland areas, disturbed soils will be re-vegetated with a weed-free native plant seed mix.

3.3.3 Substation and Switching Station

A new collector substation, Palmer's Creek Substation (**Figure 2, Site Detail Map**), will be constructed at the south end of the project area, on private land, where the 34.5-kV electric collection grid and fiber optic communication network will terminate. Palmer's Creek Substation will include a transformer to step up the voltage of the collection grid from 34.5-kV to 115-kV, above-ground bus structures or T-lines to interconnect the substation components for delivery of electric power to the adjacent 115-kV Granite Falls Substation.

The design of Palmer's Creek Substation is not finalized, but Palmer's Creek Wind Farm expects it will be enclosed by a chain link fence with dimensions roughly 110 feet by 170 feet (33.5 meters by 52 meters). The substation components will be placed on concrete and steel foundations. Palmer's Creek Substation will be designed in compliance with Federal, State and local regulations, NESC standards, Independent Systems Operator needs (Southwest Power Pool), transmission owner, and other applicable industry standards.

3.3.4 Interconnection

The Project will also include 34.5 kV underground collection lines, a central collector substation (Palmer's Creek Substation) which will convert the electricity from 34.5 kV to 115 kV via the Main Transformer, an approximately 1,000-foot long (304 meter) 115 kV 3-Phase transmission line interconnecting the Project to the Granite Falls (WAPA) Substation. There are several options for the power to be directed out of the Granite Falls (WAPA) Substation as there are seven different transmission lines exiting the facility.

3.4 ASSOCIATED FACILITIES

There are several facilities associated with the Project that will be required for operation. These include project substation, collector lines, an approximate 1,000-foot 115 kV 3-phase transmission line, which have all been previously described. Other associated facilities include a permanent meteorological tower, SCADA building, O&M facility, and access roads.

3.4.1 Meteorological Tower

One permanent meteorological tower will be installed at the Project site to monitor the wind during the operation of the wind farm (**Figure 2, Site Detail Map**). This tower will be approximately 90 meters in height (295 ft. tall). The tower will have a grounding system similar to that of the WTGs with a buried copper ring and grounding rod or rod installed at the top of the tower to provide an umbrella of protection for the upper sensors. The tower will be connected to the wind farms central SCADA system. In addition, some of the previously permitted temporary meteorological test towers may be kept in place for approximately one year after construction.

3.4.2 SCADA Building

Palmer's Creek will operate a Site Control and Data Acquisition (SCADA) System located at the base section of each WTG, substation control building, and O&M building. Each WTG in the Project will communicate directly with the SCADA system for the purposes of performance monitoring, energy reporting, and trouble-shooting. The SCADA system provides the O&M team with access to WTG and production data, availability, meteorological, and communications data, as well as alarms and communication error information.

3.4.3 O&M Facility

An O&M facility will be located near the approach and access road to a proposed turbine location (**Figure 2, Site Detail Map**). The property will be graded and a 4,000-square foot utility building will be erected for offices, storage and maintenance work. The proposed O&M facility will house the equipment to operate and maintain the wind farm. A gravel parking pad will provide the building with a parking area. The O&M Facility will have a new septic system and well for domestic purposes.

3.4.4 Access Roads

Approximately 5.5 miles of new or upgraded roads will be constructed to facilitate both construction and maintenance of the wind turbines (**Figure 2, Site Detail Map**). These roads have been designed to minimize length and construction impact. Initially, turbine access roads will be approximately 40 feet in width to accommodate the safe operation of construction equipment. Upon completion of construction, the turbine access roads will be reclaimed and narrowed to an extent allowing for the routine maintenance of the facility, or approximately 16 feet in width. The wind turbines will be accessible from public roads. Access roads will follow fence lines, field lines, and existing field access roads to the extent possible. Siting roads in areas with unstable soil will be avoided wherever possible. Roads will include appropriate drainage controls, including culverts and will be constructed in a manner to allow farm and/or land owner equipment to cross. The access road cross-sections will consist of graded soil, with soil stabilization, and surfaced with compacted base of course aggregate. Gates will be installed where access roads cross landowner fences.

4.0 Environmental Conditions

The environmental conditions within the project area and other information used to complete the environmental analysis are described in greater detail in the Site Permit Application of which this Bird and Bat Conservation Strategy is a part. The analysis was conducted following PUC procedures on siting LWECS and applicable portions of the Power Plant Siting Act, which was used to determine various exclusion and avoidance criteria considered in the selection of the project area.

Preliminary information used for evaluating environmental conditions and selecting the project area included agency queries to the Minnesota Department of Natural Resources (MNDNR), Minnesota State Historic Preservation Office (SHPO), Minnesota Department of Commerce (DOC), and Chippewa County.

The southern boundary of the project area is located approximately one mile north of the City of Granite Falls in Chippewa County, Minnesota in Granite Falls Township, east of the Minnesota River (**Figure 1, Site Location Map**). The project area is at approximately 1040 feet above mean sea level (amsl) above the Minnesota River valley at approximately 925 feet amsl (**Figure 4, Topographic Map**). The project area is comprised primarily of agricultural fields with dispersed rural homesteads (**Figure 2, Site Detail Map**).

The Minnesota River Valley provides habitat for many birds, waterfowl, and wildlife. It also supports a large fish population. The area also provides potential habitat for several federal and state-listed species.

4.1 VEGETATION

Cover types within the project area are summarized in **Table 4-1** and displayed on **Figure 3, Land Cover**. Cultivated crops comprise the vast majority of cover types in this area. Other cover types include pasture, grassland, and developed open space with some deciduous forest. The cover types other than cultivated crops are typically associated with rural residences including windbreaks, lawn, and pasture and grassland.

Table 4-1: Existing Cover Types of Palmer's Creek Wind Farm.

Cover Types	Total Acreage
Barren Land (Rock/Sand/Clay)	1
Cultivated Crops	5,157
Deciduous Forest	134
Developed	213
Emergent Herbaceous Wetlands	160
Grassland/Herbaceous	192
Open Water	5
Pasture/Hay	284
Shrub/Scrub	4
Total	**6,150**

Source: NLCD, 2011

4.2 WILDLIFE

Good habitat is found along the Minnesota River floodplain, nearby WMAs, and along some of the drainages in the project area. Agricultural production areas, such as cultivated crops, may be used on a temporary basis by birds and wildlife for foraging or short-term shelter.

The project area is primarily agricultural lands and does not contain significant wetland habitats (**Table 4-1, Existing Cover Types of Palmer's Creek Wind Farm and Figure 3, Land Cover**). The project area is adjacent to the Minnesota River, which provides large riverine and wetland habitats. The agricultural landscape and developments of the region have determined the type of wildlife present.

4.2.1 Birds

Migratory birds and waterfowl travel through Minnesota during the spring and fall of each year, as they alternate between summer breeding grounds in the northern portion of the continent and winter feeding ground in the southern half of the continent. The project area is located within the Mississippi River Flyway, which results in large spring and fall migrations of various bird species. During spring and fall migrations, flocks of migratory birds can number in the tens of thousands at traditional migratory staging areas and refuges. Migratory birds and waterfowl typically stage and rest in areas with significant amounts of wetland and open water habitats that provide sufficient food sources for the migration. The Minnesota River corridor is highly used by nesting, over-wintering, and migratory bald eagles.

The project area is adjacent to the Minnesota River and its floodplain. The Minnesota River valley provides a corridor of habitat for many birds and waterfowl. The project area is predominantly cropland, and the most common birds observed during the completed surveys are passerines (61%, thru February 24, 2017). Unidentified blackbirds (0.22 birds/20 min) and red-winged blackbirds (0.14 birds/20 min) are most likely to be exposed to collisions from wind turbines at PCWF. Other passerine and waterfowl species that flew through the RSA during the surveys include; unknown duck (0.250 birds/20 min) and American crow (0.13 birds/20 min). Red-winged blackbirds (*Agelaius phoeniceus*) (270 individuals), American crows (*Corvus brachyrhynchos*) (323 individuals), brown-headed cowbirds (*Molothrus ater*) (239 individuals), and barn swallows (*Hirundo rustica*) (180 individuals) are the most abundant (45.6 percent of all individual birds observed). As of February 24, 2017, 60 species were observed (refer to **Appendix A, Avian Point Count Results Thru Feb 24 2017**).

One Minnesota Listed Special Concern Species, the American white pelican (*Pelecanus erythrorhynchos*), and one MNDNR rare species, Bald Eagle (*Haliaeetus leucocephalus*), were observed during the field surveys in the project area. One observation of the American white pelican was made that had four individuals in flight. Eight observations of the Bald Eagle were made totaling ten individuals. Additional eagles were observed during the eagle point count surveys. Refer to **Appendix A, Avian Point Count Results Thru Feb 24 2017** for further details.

Project siting will occur primarily on agricultural land that have been previously disturbed for cultivated crops and other agricultural practices. Minnesota Biological Survey (MBS) sites, native prairie, and wetland areas will be avoided if possible.

The Project could affect birds due to collision mortality, displacement due to disturbance, habitat fragmentation, and habitat loss. Collision mortality rates are anticipated to be low. The Project will not directly impact habitat in the project area. The Applicant is currently conducting wildlife surveys of the project area to evaluate the potential presence of threatened and endangered species. The Applicant has been coordinating with the MNDNR and USFWS. The results of the surveys will be used by permitting authorities to determine permit conditions based on the potential for impacts to wildlife.

Migratory birds and waterfowl will be most susceptible to impacts from the Project when taking off and landing at staging and resting areas, because these are the times they will be flying at heights that could cause collisions with WTGs. At other times during their migration, migratory birds and waterfowl will be flying at heights well above the maximum height of the WTGs.

WTGs closest to the Minnesota River are WTGs 1, 5, 9 and 12 (**Figure 2, Site Detail Map**). Avian collisions and subsequent mortality may be more likely with these WTGs than other WTGs in the project area. Lac qui Parle Dam is located about 16 miles north, and therefore, impacts to migration routes and patterns, resting and staging areas at the State Park or WMA are not anticipated.

4.2.2 Bats

There are seven bat species known to occur in Minnesota – big brown bat (*Eptesicus fuscus*), silver-haired bat (*Lasionycteris noctivagans*), eastern red bat (*Lasiurus borealis*), hoary bat (*Lasiurus cinereus*), little brown bat (*Myotis lucifugus*), northern long-eared bat (*Myotis septentrionalis*) and tri-colored bat (eastern pipistrelle, *Perimyotis subflavus*) (MNDNR 2016). The northern long-eared bat (*Myotis septentrionalis*), tricolored bat (*Perimyotis subflavus*), big brown bat (*Eptesicus fuscus*), and little brown bat (*Myotis lucifugus*) are all state-listed species of special concern.

There was a total of six bat species documented throughout the course of the surveys (Fall 2015 and Fall 2016). Three species of concern in the state of Minnesota were observed during the acoustic bat monitoring (tricolored bat, big brown bat, and little brown bat). The northern long-eared bat is a federally threatened species with a species range that includes the majority of the eastern United States, extending west through Minnesota to the western borders of the Dakotas. No confirmed documentation of the northern long-eared bat in the project area was recorded during the Fall 2015 to Fall 2016 acoustic bat monitoring (see *Acoustic Bat Summary Report, NCE 2017*, appended by reference).

Bats typically utilize farm buildings and dead and dying trees with cavities and loose bark as roosting and maternity habitat. Bats typically use forests, riparian corridors and wetlands as feeding habitats due to higher nocturnal insect densities in these areas. There is minimal native vegetation that serves as wildlife habitat within the project area near direct areas of Project impact. For bats, the mean mortality rate at seventeen wind energy facilities in the Midwest is 9.6 bats per turbine per year (s.d. 24.1) (Stantec 2012). There are bats in the project area and some wind turbine collision bat mortality is likely to occur because of the Project. Compared to birds less is known about bat populations and habitat preferences on a local, regional or national level. Bat mortality is likely to be greatest for migratory tree bat species, including hoary, eastern red and silver-haired bats during the fall migration period (Johnson 2005, Arnett et al. 2008).

4.2.3 Important Bird Areas

Part of the western side of the project area, near the Minnesota River, overlaps with the Upper Minnesota River Valley Important Bird Area (IBA). Refer to **Figure 5, Ecologically Significant Areas**. IBAs, identified by Audubon Minnesota in partnership with the MNDNR, are part of an international conservation effort aimed at conserving critical bird habitats. The Upper Minnesota River Valley IBA incorporates the riparian corridor and adjacent river valley and upland communities along the Minnesota River and provides excellent habitat for a wide variety of bird species. This IBA contains significant bird habitat in an intensely agricultural area and is a natural corridor for migrating birds. Over 200 species, including state-listed species and Species in Greatest Conservation Need (SGCN) are known to use the IBA.

4.2.4 Rare and Unique Wildlife

4.2.4.1 Minnesota NHIS Data

A query of the MNDNR Natural Heritage Information System (NHIS) was completed (MNDNR 2016) to determine if there are rare species or other significant features in the project area. Ecologically Significant Areas (ESAs) were identified within the project area (**Figure 5**). The ESA results are detailed in the Site Permit Application.

The NHIS query also identified state-listed bird and wildlife species in the project vicinity. Although there are no NHIS records for bats near the Project, the MNDNR indicated that all seven of Minnesota's bats can be found throughout Minnesota. The northern long-eared bat (*Myotis septentrionalis*), tricolored bat (*Perimyotis subflavus*), big brown bat (*Eptesicus fuscus*), and little brown bat (*Myotis lucifugus*) are all state-listed species of special concern. There was a total of six bat species documented throughout the course of the surveys (Fall 2015 and Fall 2016) (NCE 2017). Three species of concern in the State of Minnesota were observed during the acoustic bat monitoring. These species included the tricolored bat, big brown bat, and the little brown bat. The northern long-eared bat is a federally threatened species with a species range that includes the majority of the eastern United States, extending west through Minnesota to the western borders of the Dakotas. No confirmed documentation of the northern long-eared bat in the project area was recorded during the Fall 2015 to Fall 2016 acoustic bat monitoring (see *Acoustic Bat Summary Report, NCE 2017*, appended by reference).

The NHIS query indicates a documented bald eagle (*Haliaeetus leucocephalus*) nest located just outside the project area (Section 11, T116N R40W) along the Minnesota River. This nest was active when checked in 2000, 2001, and 2005. The current status of this nest is unknown. An additional nest was in Section 20, T116N R39W which was not in the historical database, and is located outside of the project area. Palmer's Creek is completing point count surveys of bald eagles and plans to conduct aerial eagle nest surveys with 10 miles of the project area in Spring 2017. This information will be used to further evaluate eagle activity in the area.

The NHIS indicated breeding season observations of two rare grassland birds: the lark sparrow (*Chondestes grammacus*), a state-listed species of concern, and the upland sandpiper (*Bartramia longicauda*), a SGCN. A minimum of 20 SGCN are known to use grassland habitat within the Minnesota River Prairie Ecological Subsection (where the Project is located). Potential impacts to grassland birds are a concern because many of these species are declining in number nationwide. There are small areas of grassland located within the project area, which may provide habitat for these species. The primary land disturbance for the Project will occur on cultivated, agricultural land, and as feasible, avoid grassland areas. As of February 24, 2017, the lark sparrow and upland sandpiper have not been identified during the avian point count surveys. Refer to **Appendix A, Avian Point Count Results Thru Feb 24 2017**.

4.2.4.2 Federal Bird/Bat Species Known From County/Project Area Records

A list of federally threatened, endangered, candidate and proposed species was obtained for Chippewa County, Minnesota (MNDNR 2016) from the U.S. Fish and Wildlife Service (USFWS) Information for Planning and Conservation (IPaC) website (USFWS 2017). The Project Action and impact to Federal species are addressed by adherence to the Programmatic Biological Assessment Species Consistency Evaluation Form (*in-progress*). The only Federally-listed bird and bat species with potential to occur is the northern long-eared bat. Refer to **Table 4-2, Federal/State Listed Bat Species**.

Table 4-2: Federal/State Listed Bat Species.

Scientific Names	Common Names	Status[1]	Documented in Project Area[2]
Eptesicus fuscus	Big Brown Bat	ST: Special Concern	Yes
Myotis lucifugus	Little Brown Myotis	ST: Special Concern	Yes
Myotis septentrionalis	Northern Myotis/ Northern long-eared bat	ST: Special Concern F: Threatened	No
Perimyotis subflavus	Tri-colored Bat/Eastern Pipistrelle	ST: Special Concern	Yes

[1]Status = Federal Status (F), State Status (ST): E = endangered; T = threatened; P=proposed; C = candidate.
[2]Natural Heritage Information System (NHIS), or Eagle/Avian Point Count Surveys (**Appendix A**).

4.2.4.3 State Endangered, Threatened or Special Concern Species

A species is considered **endangered** if the species is threatened with extinction throughout all or a significant portion of its range within Minnesota. A species is considered **threatened** if the species is likely to become endangered within the foreseeable future throughout all or a significant portion of its range within Minnesota. A species is considered a species of **special concern** if, although the species is not endangered or threatened, it is extremely uncommon in Minnesota, or has unique or highly specific habitat requirements and deserves careful monitoring of its status. Species on the periphery of their range that are not listed as threatened may be included in this category along with those species that were once threatened or endangered but now have increasing or protected, stable populations (MNDNR 2013).

Minnesota state-listed species and Species in Greatest Conservation Need are identified in Minnesota's State Wildlife Action Plan (MNDNR 2013).

The northern long-eared bat (*Myotis septentrionalis*), tricolored bat (*Perimyotis subflavus*), big brown bat (*Eptesicus fuscus*), and little brown bat (*Myotis lucifugus*) are all state-listed species of special concern (MNDNR 2016, refer to **Table 4-2**).

The Natural Heritage Information System (MNDNR 2016) identified breeding season observations of two rare grassland birds: the lark sparrow (*Chondestes grammacus*), a state-listed species of concern (**Table 4-3, Federal/State Listed Bird Species**), and the upland sandpiper (*Bartramia longicauda*), a Species in Greatest Conservation Need.

Table 4-3: Federal/State Listed Bird Species.

Scientific Names	Common Names	Status[1]	Documented in Project Area[2]
Accipiter gentilis	Northern Goshawk	ST: Special Concern	No
Aegolius funereus	Boreal Owl	ST: Special Concern	No
Ammodramus bairdii	Baird's Sparrow	ST: Endangered	No
Ammodramus henslowii	Henslow's Sparrow	ST: Endangered	No
Ammodramus nelsoni	Nelson's Sparrow	ST: Special Concern	No
Anthus spragueii	Sprague's Pipit	ST: Endangered	No
Asio flammeus	Short-eared Owl	ST: Special Concern	No
Athene cunicularia	Burrowing Owl	ST: Endangered	No
Buteo lineatus	Red-shouldered Hawk	ST: Special Concern	No
Calcarius ornatus	Chestnut-collared Longspur	ST: Endangered	No
Charadrius melodus	Piping Plover	ST: Endangered	No
Chondestes grammacus	Lark Sparrow	ST: Special Concern	Yes

Scientific Names	Common Names	Status[1]	Documented in Project Area[2]
Coturnicops noveboracensis	Yellow Rail	ST: Special Concern	No
Cygnus buccinator	Trumpeter Swan	ST: Special Concern	No
Empidonax virescens	Acadian Flycatcher	ST: Special Concern	No
Falco peregrinus	Peregrine Falcon	ST: Special Concern	No
Gallinula galeata	Common Gallinule	ST: Special Concern	No
Haliaeetus leucocephalus	Bald Eagle		Yes
Lanius ludovicianus	Loggerhead Shrike	ST: Endangered	No
Leucophaeus pipixcan	Franklin's Gull	ST: Special Concern	No
Limosa fedoa	Marbled Godwit	ST: Special Concern	No
Parkesia motacilla	Louisiana Waterthrush	ST: Special Concern	No
Pelecanus erythrorhynchos	American White Pelican	ST: Special Concern	Yes
Phalaropus tricolor	Wilson's Phalarope	ST: Threatened	No
Podiceps auritus	Horned Grebe	ST: Endangered	No
Progne subis	Purple Martin	ST: Special Concern	No
Rallus elegans	King Rail	ST: Endangered	No
Setophaga cerulea	Cerulean Warbler	ST: Special Concern	No
Setophaga citrina	Hooded Warbler	ST: Special Concern	No
Sterna forsteri	Forster's Tern	ST: Special Concern	No
Sterna hirundo	Common Tern	ST: Threatened	No
Tympanuchus cupido	Greater Prairie Chicken	ST: Special Concern	No
Vireo bellii	Bell's Vireo	ST: Special Concern	No

[1] Status = Federal Status (F), State Status (ST): E = endangered; T = threatened; P=proposed; C = candidate.
[2] Natural Heritage Information System (NHIS), or Eagle/Avian Point Count Surveys (**Appendix A**).

As of February 27, 2017, two state special concern species (bald eagle (*Haliaeetus leucocephalus*) and American white pelican (*Pelecanus erythrorhynchos*)) were observed during the avian surveys. None of these species are protected by the federal Endangered Species Act.

Bald Eagle

In 2007, the bald eagle (State Special Concern) was delisted from its federally threatened status in the lower 48 states, but it is still federally protected under the Bald and Golden Eagle Protection Act ("BGEPA"). It was also delisted in Minnesota in 2013.

Bald eagles associate with distinct geographic areas and landscape features, including nest sites, foraging areas, communal roost sites, migration corridors and migration stopover sites (USFWS 2013). They are typically found near water bodies, natural and manmade, due to the presence of fish. They prefer to nest, perch, and roost in old-growth or mature stands of trees, and they usually select a nesting tree that is the tallest among those in its vicinity, to provide visibility. Nesting trees are usually situated near a water body that supports fish, their main preferred prey.

Existing data on bald eagle nest locations was received from the MNDNR on July 5, 2016. Based on historical records, one nest is in Section 11, T116N R40W, estimated to be greater than one mile west of the nearest WTG. During field surveys, another eagle nest was located in the Minnesota River Valley, approximately one mile southeast of the nearest WTG (WTG 12). This nest was not recorded in the NHIS database. Both nests are located outside of the project area.

As of February 24, 2017, eight eagle observations consisting of ten individuals were identified during the Avian Point Count Surveys (**Appendix A**). Additional eagles were observed during the Eagle Point Count Surveys. At this time, Palmer's Creek has met with the USFWS and MNDNR and has provided preliminary avian point count data. Based on agency discussions, eagle nesting areas will be avoided, as feasible, and Palmer's Creek will continue to conduct point count surveys of bald eagles, and conduct aerial eagle nest surveys within 10 miles of the project area in Spring 2017. This information will be used to further evaluate eagle activity in the area. Additionally, due to the Minnesota River Valley being a significant migration corridor, MNDNR has recommended post-construction avian fatality monitoring, which Palmer's Creek will implement as part of this Site Permit.

American White Pelican

The MNDNR currently lists this species as special concern, and several studies have shown this species increasing in abundance across its range over the past 20-25 years (Wires et al. 2005; Evans and Knopf 1993). This species is a colonial nesting species that selects large, shallow bodies of water with flat bare islands isolated from human disturbance (Coffin and Pfannmueller 1988).

As of February 24, 2017, American white pelicans (State Special Concern) were observed on one occasion during the Avian Point Count Surveys. One flock was observed consisting of four individuals. Overall 0.1 individuals per hour were observed during the avian point count surveys. The observation was made within the RSA (see **Appendix A, Avian Point Count Results Though Feb 24 2017**).

5.0 Regulatory Framework and Agency Consultation

Avian and bat surveys voluntarily began at the beginning of the permitting process. This Bird and Bat Conservation Strategy document is to be a “living” document, due to the timing of the requirement to be included in the Site Permit Application with the understanding the wildlife surveys are not-complete and will not be completed until Fall 2017. All pre-construction avian and bat survey results will be submitted to the United States Department of Energy, Western Area Power Administration (WAPA), United States Fish and Wildlife Service (USFWS), Minnesota Department of Natural Resources (MNDNR), and Minnesota Department of Commerce (DOC). Due to Palmer’s Creek adherence to best management practices and conservation measures outlined by WAPA in the Upper Great Plains Wind Energy Final Programmatic Environmental Impact Statement (EIS), a formal Biological Assessment is not required and the project will be appropriate for the Programmatic Biological Assessment for Upper Great Plains Region Wind Energy Development Program Impact Information and Consistency Determination. The Consistency Evaluation Forms will be submitted as a separate document from this Bird and Bat Conservation Strategy.

This Bird and Bat Conservation Strategy is required by the DOC as part of the permitting process for the Project.

5.1 REGULATORY FRAMEWORK

5.1.1 Federal Laws

5.1.1.1 Federal Endangered Species Act

The federal Endangered Species Act (ESA 1973) defines and lists species as “endangered” and “threatened” and provides regulatory protection for the listed species. The federal ESA provides a program for conservation and recovery of threatened and endangered species; it also ensures the conservation of designated critical habitat that the USFWS has determined is required for the survival and recovery of these listed species. Section 9 of the federal ESA prohibits the take of species listed by USFWS as threatened or endangered. Take is defined as follows: “to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect or attempt to engage in such conduct.” In recognition that take cannot always be avoided, Section 10(a) of the federal ESA includes provisions for take that is incidental to, but not the purpose of, otherwise lawful activities. Section 10(a)(1)(B) permits (Incidental Take Permits) may be issued if take is incidental and does not jeopardize the survival and recovery of the species.

Section 7(a)(2) of the federal ESA requires that all federal agencies, including the USFWS, evaluate projects with respect to any species proposed for listing or already listed as endangered or threatened and any proposed or designated critical habitat for the species. Federal agencies are prohibited from authorizing, funding, or carrying out any action that will jeopardize the continued existence of a listed species or destroy or modify its critical habitat. As defined in the federal ESA, individuals, organizations, states, local governments, and other non- federal entities are affected by the designation of critical habitat only if their actions occur on federal lands; require a federal permit, license, or other authorization, or involve federal funding (ESA 1973).

5.1.1.2 Bald and Golden Eagle Protection Act

The federal Bald and Golden Eagle Protection Act of 1940 (BGEPA; 16 USC 668–668c, as amended) is administered by the USFWS and was enacted to protect bald and golden eagles, their nests, eggs, and parts (e.g., feathers or talons). The BGEPA states that no person shall take, possess, sell, purchase, barter, offer for sale, purchase or barter, transport, export, or import any bald or golden eagle alive or dead, or any part, nest or egg without a valid permit to do so (USFWS, n.d.). The BGEPA also prohibits the take of bald and golden eagles unless pursuant to regulations. Take is defined by the BGEPA as an action "to pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest, or disturb." Disturb is defined in the BGEPA as "to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available: (1) injury to an eagle; (2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior; or (3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior" (USFWS, n.d.). In addition to immediate impacts, this definition also covers impacts that result from human-caused alterations initiated around a previously used nest site during a time when eagles were not present. Permits are issued to Native Americans to possess eagle feathers for religious purposes, and salvaged eagle carcasses can be sent to the National Eagle Repository in Colorado where they are redistributed to Native Americans. This effort is coordinated by a local USFWS office. Although the bald eagle was removed from the Endangered Species List in June 2007, it is still federally protected under the BGEPA and Migratory Bird Treaty Act as described in the following section. In addition, the *National Bald Eagle Management Guidelines* were published in conjunction with delisting by the USFWS in May 2007 to provide provisions to continue to protect bald eagles from harmful actions and impacts.

Under the BGEPA, a final rule was published in May 2008, in the Federal Register (FR) that proposed authorization for take of bald eagles for those with existing authorization under the federal ESA where the bald eagle is covered in a Habitat Conservation Plan (HCP) or the golden eagle is covered as a non-listed species. The final rule also established a new permit category to provide expedited permits to entities authorized to take bald eagles through Section 7 incidental take permits. A proposed rule will later address authorization of take of (1) disturbance-type take of bald and golden eagles due to otherwise lawful activities and (2) eagle nests in rare cases where their location poses a risk to human safety or the eagles themselves.

In 2009, the USFWS issued a final rule on new permit regulations that would allow some disturbance of eagles "in the course of conducting lawful activities" (74 FR 46836–46879). Physical take of an eagle will only be authorized if every avoidance measure has been exhausted. Removal of nests will generally be permitted only in cases where the nest poses a threat to human health, or where the removal would protect eagles. Take permits may be issued when "necessary for the protection of…other interests in any particular locality" (USFWS 2009). Due to concerns about population declines, permits for take of golden eagles are likely to be restricted throughout the eagle's range (USFWS 2009). Considerations for issuing take permits include the health of the local and regional eagle populations, availability of suitable nesting and foraging habitat for any displaced eagles, and whether the take and associated mitigation provides a net benefit to eagles (74 FR 46836–46879, USFWS 2009). In April 2013, USFWS issued *Eagle Conservation Plan Guidance Module 1: Land-based Wind Energy (Version 2)* to address these new regulatory matters (USFWS 2013).

5.1.1.3 Migratory Bird Treaty Act

The Migratory Bird Treaty Act (MBTA, 16 U.S.C. 703-712)) makes it unlawful to pursue, capture, kill, or possess any migratory bird or part, nest, or egg of any such bird listed in wildlife protection treaties between the United States, Great Britain, Mexico, Japan, and Russia (and other countries of the former Soviet Union). Most birds (outside of introduced species and non-migratory game birds) within the US and the Project area are protected under the MBTA. The birds, occupied nests and the contents of the nest (eggs or chicks) within the Project property are afforded protection pursuant to the MBTA. Unlike ESA and BGEPA, no permits are available to authorize incidental take of birds under the MBTA. Due to the potential for resident and migratory birds within the Project, development of this Bird and Bat Conservation Strategy was prepared to assist in complying with the MBTA.

5.1.2 State Laws

5.1.2.1 Wind Energy Site Permitting

The Wind Siting Act of Minnesota (Minnesota Statute Chapter 216F) requires that a site permit be issued from the PUC to build and operate a large wind energy conversion system (LWECS). According to the Statute, the siting of an LWECS must be compatible with environmental preservation, sustainable development, and the efficient use of resources (Minnesota Statute Section 216F.03). Further, the criteria considered by the PUC in designating LWECS sites must include the impact of the LWECS on humans and the environment (Minnesota Statute Section 216F.05). Palmer's Creek is designing the Project to comply with the PUC's wind turbine setback and siting guidelines, and other requirements set forth in Minnesota Rules Chapter 7854.

5.1.2.2 State Threatened and Endangered Species Laws

Per Minnesota Statute Section 84.0895, the MNDNR has adopted rules designating species meeting the statutory definitions of Endangered, Threatened, and Special Concern Species (ETSC). The resulting List of Endangered, Threatened, and Special Concern Species is codified as Minnesota Rules Chapter 6134. The Endangered Species Statute also authorizes the MNDNR to adopt rules regulating the treatment of species designated as endangered and threatened. These regulations are codified as Minnesota Rules, Parts 6212.1800 to 6212.2300. MNDNR defines endangered, threatened, and special concern species as follows:

- *Endangered (E)* – a plant or animal species that is threatened with extinction throughout all or a significant portion of its range in Minnesota.
- *Threatened (T)* – a plant or animal species that is likely to become endangered within the foreseeable future throughout all or a significant portion of its range in Minnesota.
- *Special Concern (SC)* – species that are not endangered or threatened, but are extremely uncommon in Minnesota, or have unique or highly specific habitat requirements and deserve careful monitoring of their status. Species on the periphery of their range that are not listed as threatened may be included in this category along with those species that were once threatened or endangered but now have increasing or protected, stable populations.

5.2 AGENCY GUIDANCE AND CONSULTATION

As part of the planning and design of the Project, Palmer's Creek consulted public and private available guidance materials including:

- Avian and Bat Protection Plan white paper (USFWS 2010)
- Avian Protection Plan Guidelines (APLIC and USFWS 2005)
- Suggested Practices for Avian Protection on Power Lines (APLIC 2006)
- Reducing Avian Collisions with Power Lines (APLIC 2012)
- Odell Wind Farm: Wildlife Assessment and Field Studies Tier 3 Report (Dunlap et al. 2013)
- Wildlife Baseline Studies for the Highmore Wind Resource Area, Hughes, Hyde and Hand Counties, South Dakota (Derby et al. 2010)
- Avian Collisions with Wind Turbines: A Summary of Existing Studies and Comparisons to other Sources of Avian Collision Mortality in the United States (Erickson et al. 2001)
- Synthesis and Comparison of Baseline Avian and Bat Use, Raptor Nesting and Mortality Information from Proposed and Existing Wind Developments (Erickson et al. 2002)
- An Assessment of Direct Mortality to Avifauna from Wind Energy Facilities in North Dakota and South Dakota (Graff 2015)
- A Review of Bat Mortality at Wind Energy Developments in the United States (Johnson 2005)
- U.S. Fish and Wildlife Service Land-Based Wind Energy Guidelines (USFWS 2012)
- Wind Turbine Interactions with Birds, Bats, and their Habitats: A Summary of Research Results and Priority Questions (NWCC)
- Acoustic Bat Summary Report: Palmer's Creek Wind Farm (*interim report*) (NCE 2017)
- Wind Turbine Effects on Avian Activity, Habitat Use, and Mortality in Altamont Pass and Sollano County Resource Areas (Orloff and Flannery 1992)
- Towards Reliable Bird Surveys: Accounting for Individuals Present but not Detected (Thompson 2002)
- Upper Great Plains Wind Energy Final Programmatic Environmental Impact Statement (Western 2015)
- Bald Eagle Management Guidelines and Conservation Measures (USFWS, n.d.)
- National Bald Eagle Management Guidelines (USFWS 2007a)
- Eagle Permits; Take Necessary to Protect Interests in Particular Localities (USFWS 2009)
- Draft Eagle Conservation Plan Guidance (USFWS 2011)
- Eagle Conservation Plan Guidance: Land-based Wind Energy (Vers. 2) (USFWS 2013)
- Information for Planning and Conservation (IPaC) (USFWS 2017)
- Palmer's Creek Wind Farm, LLC.: Avian Point Count Survey Preliminary Results (Wenck 2017)
- Wild Birds and Avian Influenza: An Introduction to Applied Field Research and Disease Sampling Techniques (Whitworth et al. 2007)
- Willow Creek Wind Project: Bird and Bat Conservation Strategy

A public scoping meeting was held on December 1, 2016, in Granite Falls, Minnesota. The public and Federal, State, and local agencies were invited to the meeting and to provide comments regarding the Project. The public was invited through newspaper and radio announcements, and residents near the Project were invited to comment. The public scoping meeting documentation is included in Appendix I of the EA. Comments received regarding the proposed Project from agencies and the public are included in Appendix J of the EA.

The local, state and federal agencies were contacted during the evaluation of the Project to determine potential impacts, identify avoid, minimization, and mitigation measures, and for guidance on permitting and approvals needed for the Project. These agencies included:

- Federal Aviation Administration
- U.S. Fish and Wildlife Service
- Minnesota Department of Transportation
- Minnesota Department of Natural Resources
- Minnesota Public Utilities Commission
- Minnesota State Historic Preservation Office
- Upper Minnesota Regional Development Commission
- Chippewa County
- City of Granite Falls

Palmer's Creek has met with and exchanged correspondence a number of times throughout the course of designing and reviewing the Project. This included conference calls and meeting with the MNDNR, USFWS, DOC, and WAPA to discuss concerns regarding turbine placement and other Project design features. Survey protocols, monitoring requirements, specific species, and biological assessment requirements were also discussed at several meetings and through correspondence.

Following these agency discussions, turbines were shifted to minimize potential impacts to the Sparta Wildlife Management Area, and survey protocols for bald eagles and other avian species were updated. The bat surveys were also discussed and modified to suit agency requests. The January 18, 2017 meeting with WAPA, DOC, and USFWS resulted in agreement to use the Consistency Evaluation Forms in place of a biological assessment since a programmatic BA had already been completed as part of the Upper Great Plains Wind Energy Final Programmatic EIS.

6.0 Pre-Construction Site Specific Wildlife Surveys & Risk Assessments

6.1 AVIAN USE SURVEYS

Wenck Associates, Inc. was contracted by Fagen, Inc. to conduct several studies. The data from these studies were used to identify species, species groups or species of concern that are present in the project area and that may be at a higher risk of mortality and/or displacement. Passerine species have been the most abundant bird fatality at wind energy facilities outside California (Erickson et al. 2001 and Erickson et al. 2002), often comprising more than 80% of the bird fatalities. Both migrant and resident passerine fatalities have been observed (Erickson et al. 2001 and Erickson et al. 2002). Data are presented in several categories, and highlight federally listed species, state listed species, and species of concern (See Wenck 2017 *in-prep*, and **Appendix A, Avian Point Count Results As Of Feb 24 2017**, available at Fagen, Inc.).

6.1.1 Diurnal Fixed-Point and Incidental Avian Use

Avian surveys focus on inventory and monitoring with specific objectives that include: 1) an inventory of bird species in a specific project area; 2) determining the relative abundance of species; and 3) monitoring seasonal changes in species composition and relative abundance (Whitworth et al. 2007). Diurnal fixed-point surveys are one of the most common methods used to determine avian composition and abundance. Point counts not only focus on visual cues but also on auditory cues to give the observer an advantage in rough terrain. For some species, vocal cues may be the only reliable means of detection (Whitworth et al. 2007).

A total of 36 surveys will be conducted over four seasons with seasons defined as summer (June 27, 2016–August 31, 2016 and May 14, 2017-June 17, 2017 [8 point count surveys]), fall (September 1, 2016–November 30, 2016 [12 point count surveys]), winter (December 1, 2016–February 25, 2017 [6 point count surveys]), and spring (February 26, 2017–May 15, 2017 [10 point count surveys]).

Survey data was used to evaluate avian use, behavior, and species composition during Spring and Fall migration and to determine Summer resident species at the project area.

Point counts were selected to capture a diverse range of habitats and at locations with the best possible viewshed. Eight point count locations were selected for the avian point count surveys (Refer to **Figure 6, Point Count Locations**).

All observations within an 800-meter radius at each point count were recorded; any observations outside the 800-meter radius were considered incidental. Each point count survey lasted for 20 minutes; all audio and visual observations were recorded. Surveys were conducted by an experienced ornithologist. Surveys were rotated to cover all daylight hours to ensure each point count was surveyed at various times of the day. Data recorded for each observation included species, number of individuals, time, height above ground, behavior, and flight direction. A range finder and topographic maps were used as references to determine bird distances to the observer and flight heights. Birds not easily identifiable due to low light conditions and distance were identified to the lowest taxonomic level possible.

Twenty-minute survey periods provide adequate time to detect both raptors and non-raptors. Double counting may occur during the 20-minute survey because individuals may appear and disappear from view. Double-counting of birds is not problematic for this type of survey because the objective is to document use in terms of number of birds noted per 20-minute survey, not number of distinct individual birds.

The ability to detect all species within the 800-meter survey radius varies among species and potentially not all individuals within the survey area are counted. This variation in detectability results in an overestimate of mean use in conspicuous species and an underestimate of mean use in reclusive species (Thompson 2002).

Incidental avian surveys are used to obtain bird distribution and composition information between point count locations. Larger birds, such as game birds, raptors, and waterfowl, large flocks of smaller birds, and birds that are a rarity in the area are typically recorded during incidental surveys.

Incidental observations included observations that occurred while traveling between point count locations, pre-and post-point count survey time period, and outside the 800-meter radius circular plot. These observations were recorded but not used in the formal analysis.

Flight behavior was evaluated by calculating the proportion of flying birds that were observed flying below, within, or above the turbine rotor sweep area (RSA). The Project is comprised of two (2) 2.3-MW and sixteen (16) 2.5-MW horizontal axis wind turbines. Each will have an anticipated hub height between 80 and 90 meters and a rotor diameter of approximately 116 meters. Therefore, an RSA between 22 and 148 meters above the ground was used.

The encounter rate is the rate in which a species was observed flying through the RSA during the avian point count surveys at the project area and suggests potential mortality risk from flight behavior.

To estimate the rate at which a species flies through the RSA, the following equation was applied to every species observed in the PCWF:

Encounter Rate = A*P*f**P*t*

- A is the mean use of birds/20 minutes for a given species
- P*f* is the proportion of all activity observations for a given species that were flying
- P*t* is the proportion of flying observations that were within the turbine RSA

The encounter rate index is relative to the observations of species during the surveys and within the study area and cannot be extrapolated to the species that may use the project area in the future. The encounter rate index from this study does not take into consideration behavior (e.g. foraging, courtship), habitat use, and turbine avoidance differences between species.

Please refer to **Appendix A, Avian Point Count Results (as of Feb. 24, 2017)**. Also, refer to **Section 4.2.1** of this BBCS.

6.1.1.1 Eagle/Raptor Use and Encounter Rate – As of February 24, 2017

Surveys were completed through February 24, 2017. Based on these surveys, the raptor annual mean use rate in the project area of 0.33 raptors/20 min was compared with 37 other wind energy facilities that implemented similar protocols. The raptor annual mean use at these wind-energy facilities ranged from 0.09 to 2.34 raptors/20 min survey. Based on the results from these wind energy facilities, as summarized by Derby et al. 2010, a ranking of seasonal raptor mean use was developed: low (0-0.5 raptors/20 min. survey); low to moderate (0.5-1.0 raptors/20 min); moderate (1.0-2.0 raptors/20 min); high (2.0-3.0 raptors/20 min); and very high (> 3.0 raptors/20 min). Under this ranking, mean raptor use in the project area is low. The annual raptor use in the project area would rank 11th out of the 37 other wind energy facilities (Derby et al. 2010).

Based on surveys completed through February 24, 2017, raptor encounter rates were 0.09 individuals flying within the RSA/20 min. Approximately twenty-eight (28) percent of all raptor observations were within the RSA. The highest raptor encounter rate was red-tailed hawk and turkey vulture with 0.03 individuals flying within the RSA/20 min. The raptor encounter rate calculated is relatively low, however the percentage of raptor observations within the RSA during the surveys and the low annual mean use rate (raptors/20 minutes) does not eliminate the potential for mortality in the project area.

Bald eagles are frequent in the area as reported during the avian point count surveys completed thru February 24, 2017. Ten (10) bald eagles have been observed during the avian point count surveys with thirty-three (33) percent of the them observed flying through the RSA. Most of these eagles have been observed within one mile of the Minnesota River.

High numbers of raptor fatalities have been documented at wind energy facilities (e.g. Altamont Pass), however other studies at wind energy facilities in the United States suggest that 3.2% of the total casualties were raptors (Erickson et al. 2001). Results from Altamont Pass in California suggest that species mortality is not all related to abundance (Orloff and Flannery 1992). Golden eagles, red-tailed hawks and American kestrels were casualties more often than predicted based on abundance. Based on species occurrence/abundance within PCWF, red-tailed hawk and turkey vultures may constitute the highest proportion of raptor fatalities in the project area.

6.1.1.2 Non-raptor Use and Encounter Rate – As of February 24, 2017

Passerines make up a large proportion (61%), of the birds observed during the avian surveys in the project area and would be expected to make up the largest proportion of fatalities at the PCWF. Encounter rates indicate that unidentified blackbirds (0.22 birds/20 min) and red-winged blackbirds (0.14 birds/20 min) are most likely to be exposed to collisions from wind turbines in the project area. Other passerine and waterfowl species that flew through the RSA during the surveys include; unknown duck (0.250 birds/20 min) and American crow (0.13 birds/20 min). Refer to **Appendix A, Avian Point Count Results Through Feb 24 2017**.

6.1.1.3 Sensitive Species - As of February 24, 2017

A total of nine (9) endangered, two (2) threatened and twenty-one (21) special concern species are found in Minnesota (MNDNR 2013). One (1) special concern species (American white pelican, *Pelecanus erythrorhynchos*) has been observed during the field surveys. One observation consisted of four individuals. Refer to **Section 4.2.4 Rare and Unique**

Wildlife of this BBCS, and **Appendix A, Avian Point Count Results Through Feb 24 2017**.

6.1.2 Eagle Use Surveys

Following Stage 2 of the Eagle Conservation Plan Guidance (USFWS 2013), eagle point count surveys have been and will continue to be conducted to collect quantitative data on eagle presence that would allow estimation of eagle exposure rate, which forms the basis of a risk assessment model. Eagle use surveys focus exclusively on eagles and occur at the eight (8) point count locations (**Figure 6, Point Count Locations**) used for point count surveys in 2016-2017. The objective of the eagle use survey is to document eagle movements and behavior within and adjacent to the study area in all four seasons to assess risk to eagles (primarily bald eagles). Eagle surveys are conducted by a qualified biologist and will continue for one calendar year to capture temporal variation in eagle use of the study area.

Eagle use data is collected in 1-minute intervals so that the data can the translated into eagle exposure minutes. The data recorded for each survey includes the count start and stop times, eagle species observed, numbers and age classes of eagles seen, minutes of eagle flight in two height categories based on the USFWS Eagle Conservation Plan Guidance (< 200 and > 200 meters [m] above ground), notes on flight and other behaviors, and an individual identifier for each flight observation allowing it to be linked to a flight map. Each eagle flight observed will be drawn on a topographic map or aerial image of the Study Area and digitized using a GIS so that eagle locations and behaviors can be overlaid with Project features. Each sampling point will consist of an 800-meter (0.5-mile) radius circle (0.77 square mile) that provides distant, unobstructed views and allows visual observations of eagles and other large birds at a 2 to 3-mile distance. Numerical data is collected within 800-m-radius plots, but flight lines will be documented across line-of-sight and are not limited to the 800-m-redius survey plot. A detailed protocol study-specific data sheets and data management plan is being adhered to and is utilized in the field.

Surveys are being conducted once a month during the non-migration months (April-August), surveys are conducted at a minimum of twice a month during the migration months (September-March) starting July 2016 and concluding in June 2017. There will be 20 survey weeks in total. Individual surveys consist of a 1-hour observation period at each of the eight point-count locations during each week of the surveys, for a total of 160 hours of observations. Surveys occur in all weather conditions except when visibility is poor. These surveys are conducted outside of the twenty-minute avian point count surveys.

Through February 24, 2017, eagle use surveys documented 11 bald eagles with 37 flight minutes, and 91 percent of the individuals were flying within the RSA. Most of these eagles have been observed within one mile of the Minnesota River (Wenck 2017).

6.1.3 Eagle/Raptor Nest Surveys

Raptors spend much of their time hunting and soaring within elevation ranges that correspond to the wind turbine rotor-sweep-area (RSA), making them susceptible to turbine blades (Erickson et al. 2002). Because raptors are long-lived species with low reproduction rates, potential population impacts from collision-related mortality are of concern (Erickson et al. 2002). Although specific studies are lacking, adults and recently fledged young could be at particular risk of collision with turbines because of their higher use of areas near nest sites. Adult raptors often fly near nest sites during the breeding season to attend to young and deliver prey. After young raptors fledge, fledglings often spend significant amounts of time flying and roosting near nest locations until they become capable flyers and hunters. Additionally, construction activities near active nests during the breeding season may potentially result in disturbance or abandonment of nest sites.

Few raptor species that have been identified as nesting at wind energy facilities have been observed as fatalities at wind-energy facilities (Derby et al. 2010), therefore, the relationship is very low between the number of collision fatalities and raptor nests within or near project facilities. However, it is assumed that raptors nesting close to turbines would likely have a greater chance of being impacted from collision with turbines (Derby et al. 2010), but the data is not available at this time to determine the impact (Wenck 2017, *in-prep*).

A raptor nest survey will be conducted to locate raptor nests and determine nest activity status and the species using those nests during the spring of 2017. The initial surveys will be conducted before trees leaf out, to locate nests and to identify early breeding species. The project area and a 1-mile buffer area will be surveyed from a vehicle using binoculars and spotting scopes. All raptor nest locations will be documented with Global Positioning System (GPS) coordinates. Raptor species, height of nest, nest activity status, nest condition, substrate, and other relevant data will be recorded for each nest. An additional visit will be conducted if nests are found to document the activity status of nests located during the initial survey and to identify nesting attempts by late nesting raptors such as Swainson's hawks. Raptors may use nests intermittently among years as well as re-nest after a nest failure; therefore, early- and late-season nest surveys allow for a more accurate summary of breeding raptors.

A review of historical eagle nest data (MNDNR 2016) within one mile of the Project was completed at the request of Fagen. A bald eagle (*Haliaeetus leucocephalus*) nest has been documented in T116N R40W Section 11 just outside of the project boundary. This nest was active when checked in 2000, 2001, and 2005. It is unknown whether the nest is still active or whether there are additional nests in the area. A nest location map cannot be produced, as requested by the MNDNR.

An additional nest was located the spring of 2016 by Fagen, this nest was active in 2016 and is in T116N R39W Section 20, immediately outside of the project boundary. Fagen staff have been monitoring nest use data in 2016 and will continue monitoring from April thru August 15, 2017 or until all eaglets have fledged (Michael Rutledge, Fagen, Inc., Personal Communication, March 7, 2017).

An aerial (fixed-wing) raptor/eagle nest survey will be conducted in April 2017 that will encompass a 10-mile buffer of the proposed wind farm. For any nests observed, the following will be recorded: GPS location, approximate nest height, nest substrate, nest size, actively used or non-use, and species using nest.

6.1.4 Acoustic Bat Surveys

New Century Environmental, LLC (NCE) initiated acoustic monitoring surveys to capture the diversity/abundance of bat species within the proposed Palmer's Creek Wind Farm, to meet due diligence with regulatory agencies (NCE 2017). Staff of Fagen, Inc. deployed five separate Anabat systems (Anabat® SD-2 ultrasonic detectors) to record bat activity throughout the study area, the first deployment was done with two of the Anabat recorders during the fall of 2015 and continued through 15 October 2016. Three additional Anabat recorders were launched on 03 August 2016. **Refer to Figure 7, Bat Monitor Locations.**

The data collected from Fagen was sent to NCE. NCE then took the data and processed in zero-crossing through Kaleidoscope (Ver. 3.1.8) to confirm presence diversity and abundance of bat species. The software uses a presence/absent indicator by giving each species of bat a p-value. The lower the p-value, the more likely the species of bat is present. Bat presence, in the form of vocalization, was detected, identified by species, and catalogued, thereby allowing estimates of species occurrences, distribution and relative abundance.

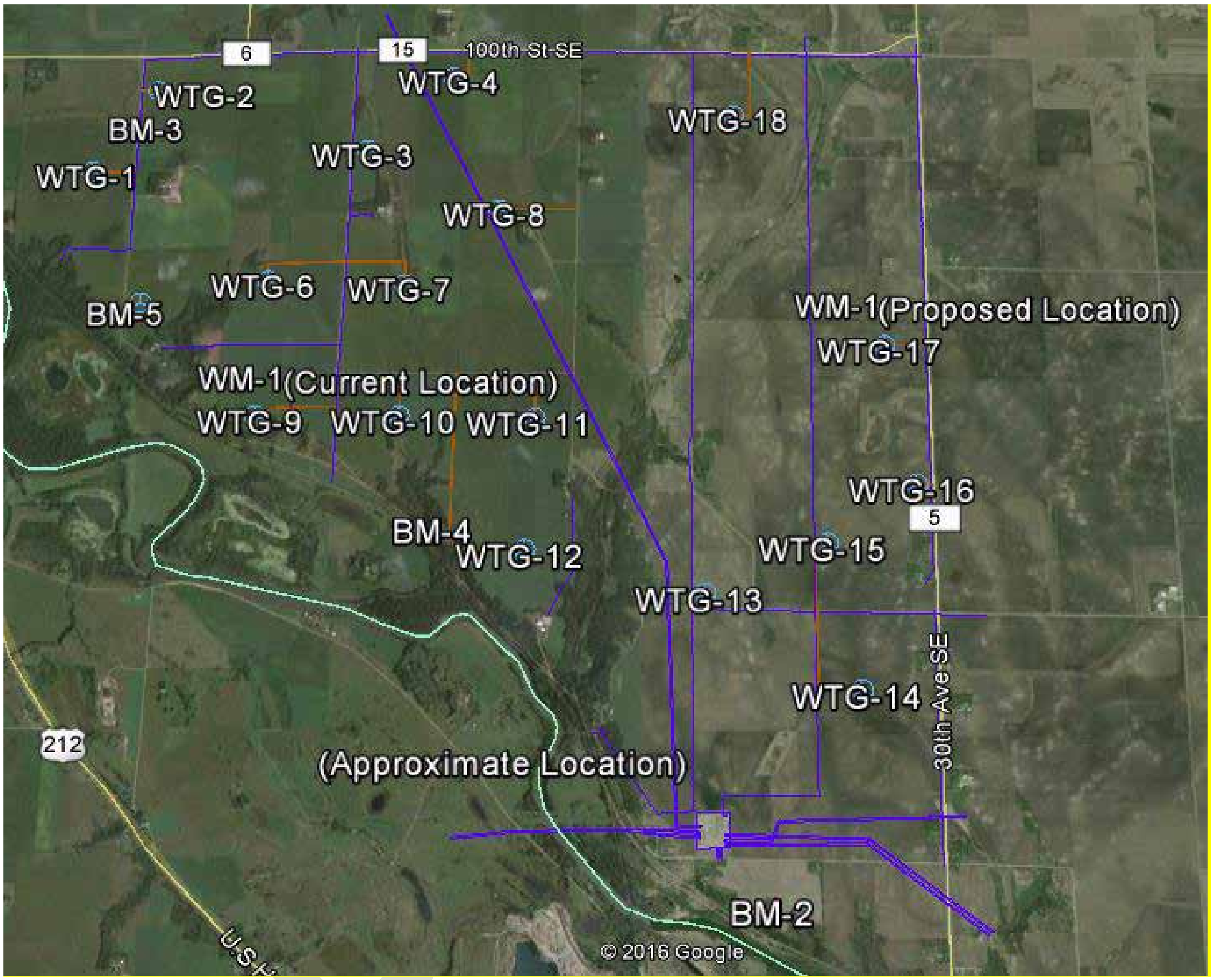


Figure 7. Bat Monitor (BM) Locations. BM-1 is not shown on the map but lies next to BM-2.

Bat Monitors (BM) 1 & 2 gathered data throughout the fall of 2015 and were deployed again in May of 2016. Monitors 3-5 were added in September of 2016.

Monitors 1 & 2 were deployed on September 13, 2015 and removed on October 11, 2015. They were deployed again on April 12, 2016, then removed on October 15. Monitor 3, Monitor 4 and Monitor 5 were deployed on August 3rd, 2016 then removed on October 15, 2016. The monitors were deployed for 287 trap nights.

From the five (5) Anabat recording systems, 232,116 sound files were recorded. Visual examination and filtering of files to eliminate extraneous noise (e.g., wind, insects, etc.) resulted in a total of 14,442 bat detections.

There was a total of six bat species documented throughout the course of the study (September-October 2015 and 2016). The tricolored bat, also known as the eastern pipistrelle (*Pipistrellus sublavus*) was documented at this site and is listed as a species of concern in the state of Minnesota. It was detected in small numbers but was found at every monitor except for monitor 1. The northern long-eared myotis (*Myotis septentrionalis*) is a federally threatened species whose home range lies within the study site. However no confirmed documentation was recorded here. Even though a total of five clicks of which Kaleidoscope classified as MYSE (northern long-eared myotis) the P-value was given a 1 for every monitor indicating the likelihood of presence is near non-existent. All other species documented are of least concern. Of the six species documented, the silver-haired bat (*Lasionycteris noctivagans*), hoary bat (*Lasiurus cinereus*) and big brown bat (*Eptesicus fuscus*) were among the most common followed by the little brown bat (*Myotis lucifugus*) and eastern red bat (*Lasiurus borealis*).

Bat acoustic surveys will continue through the 2017 season.

Assuming that the general relationship between bat activity and bat mortality observed at other sites is broadly applicable to other locations, we expect that levels of turbine-related bat mortality at the Palmer’s Creek Wind Farm will be on the lower end of the spectrum, and on par with others from the region.

7.0 Best Management Practices

7.1 WILDLIFE CONSERVATION MEASURES

Palmer's Creek has committed to implement several Best Management Practices (BMPs) and conservation measures for wildlife, derived from the Upper Great Plains Wind Energy Final Programmatic EIS (WAPA 2015). To implement these BMPs, several project plans and guidance documents will be developed for the Project prior to construction and operation. These plans will provide detailed information and implementation steps for BMPs that will benefit birds, bats, and their habitat. These plans are summarized in **Table 7-1, Summary of Project Plans and BMPs for Bird/Bat Protection**. Specific best management practices and conservation measures for birds and bat as they relate to the Project are identified in **Appendix B**. For the Project and Palmer's Creek to comply with the Site Permit Application and environmental assessment (EA), a detailed and complete list of BMPs were consulted on with DOC, MNDNR, USFWS and WAPA. This complete list is *appended by reference* and provided as an appendix in both the Site Permit Application and the EA for the Project.

Table 7-1: Summary of Project Plans and BMPs for Bird/Bat Protection.

Plan	Project BMPs Identified by Plan	Avian and Bat Protection Accomplished
Site Design Plans · Layout · Controlled Inspection/Cleaning Area · Excess Cut/Fill Placement · Profile · Erosion Control · Meteorological Towers · Re-fueling Areas · Engineered controls (e.g., fencing) · Drainage · Avoidance of important areas for wildlife · Utilize existing clearings in forests/shrublands · Consolidate facilities · Slope Stability Analysis · Co-location of t-lines, roads with existing/shared ROWs · Avoid aquifer conduits · Utilize dikes, swales, and lined ditches · Lighting guidelines	· Dust control · Erosion control · Site drainage · Ground disturbance · Use existing natural features (rocks, vegetation, drainage features) · Guy wires · Contamination · Safety · Fragmentation · Sediment transport · Lighting	· Dust control to minimize impacts to insects for forage. · Minimize impacts to habitat loss. · Guy wire marking to minimize avian/bat collision. · Engineered barriers prevent injury/death to unauthorized wildlife. · Avoidance of important wildlife areas minimizes direct/indirect impacts to birds/bats. · Fragmentation removes natural wildlife corridors/patterns. · Timed shut-off minimize light drawing insects, thus minimizes likelihood of birds/bats. · Downward-facing lights minimized horizontal and skyward illumination making unnatural light. Could confuse birds/bats.

Construction Plan · Explosives · Maintenance Activities	· Litter control · Ground disturbance	· Minimize impacts to habitat loss.
Decommission Plan · Contour · Hazardous Materials and Waste · Well removal · Subsoil decompaction	· Ground disturbance · Structure removal · Contamination · Vegetation establishment	· Contouring creates natural landscape to minimize fragmentation. · Minimize impacts to habitat. · Soil decompaction allows easy vegetation establishment!
Noxious Weed & Invasive Plant Control Plan · Facility Monitoring · Certified weed-free mulch · Surface Disturbance · Fill Materials · Clean vehicles · Blading avoidance of native vegetation	· Invasive species · Spread of invasive species · Revegetation	· Minimize impacts to habitat. · Invasive species out-compete natural species, can change ecological function.
Hazardous Materials Plan · Vehicle Maintenance · Excess excavation materials · Waste storage facilities · Storage, Use & Transportation · Drip pans	· Contamination · Erosion control	· Minimize impacts to terrestrial and aquatic habitat of birds/bats.
Integrated Pest & Vegetation Management Plan · Pesticides/herbicides	· Contamination	· Minimize impacts to terrestrial and aquatic habitat of birds/bats.
Site Restoration Plan · Restoration Timing · Temporary Use Areas · Contours · Weed-free native grasses, forbs, and shrubs · Road-cuts · Preserve specimen trees · Preserve nonhazardous rock outcroppings · Topsoil segregation and spread · Planting pockets	· Erosion control · Invasive weed control · Contours · Revegetation	· Minimize impacts to terrestrial and aquatic habitat of birds/bats. · Invasive species out-compete natural species, can change ecological function. · Contouring creates natural landscape to minimize fragmentation. ·

8.0 Monitoring Studies

Two years of avian and bat fatality monitoring, one year of acoustic bat monitoring and one year of eagle nest monitoring will be conducted after Palmer's Creek Wind Farm is operational. The fatality monitoring protocol is outlined in **Appendix C, Protocol: Post-Construction Avian and Bat Studies.** The eagle nest monitoring protocol is currently *in preparation* (Palmer's Creek Wind Farm, LLC). These protocols will adhere to the Land-based Wind Energy Guidelines (USFWS 2012).

9.0 References

Arnett, E. B., W. K. Brown, W. P. Erickson, J. K. Fieldler, B. I. Hamilton, T. H. Henry, A. Jain, G. D. Johnson, J. Kerns, R. R. Koford, C. P. Nicholson, T. J. O'Connell, M. D. Piorkowski, R. D. Tankersley Jr. 2008. Patterns of Bat Fatalities at Wind Energy Facilities in North America. Journal of Wildlife Management. 72: 61-78.

Avian Power Line Interaction Committee (APLIC) and USFWS. 2005. Avian Protection Plan Guidelines. APLIC and USFWS. Washington D.C.

Avian Power Line Interaction Committee (APLIC). 2006. Suggested Practices for Avian Protection on Power Lines: The State of the Art in 2006. Edison Electric Institute, APLIC, and the California Energy Commission. Washington, D.C. and Sacramento, CA.

Avian Power Line Interaction Committee (APLIC). 2012. Reducing Avian Collisions with Power Lines: The State of the Art in 2012. Edison Electric Institute and APLIC. Washington, D.C. 34 pp.

Bald and Golden Eagle Protection Act (BGEPA). 1940. 16 United States Code (USC) § 668-668d. June 8, 1940.

Coffin, B. and L. Pfannmueller. 1988. Minnesota's Endangered Flora and Fauna. A report of the Minnesota Endangered Species Technical Advisory Committee. Minnesota Department of Natural Resources. University of Minnesota Press, Minneapolis, MN.

Derby, C., T. Thorn, K. Bay. 2010. Wildlife Baseline Studies for the Highmore Wind Resource Area, Hughes, Hyde and Hand Counties, South Dakota. Technical Report prepared by West, Inc. for NextEra Energy, Juno Beach, FL.

Endangered Species Act (ESA). 1973. 16 United States Code (USC) § 1531-1544, Public Law (PL) 93-205, December 28, 1973, as amended, PL 100-478 [16 USC 1531 *et seq.*]; 50 Code of Federal Regulations (CFR) 402.

Erickson, W.P., G.D. Johnson, M.D. Strickland, D.P. Young, K.J. Sernka, and R.E. Good. 2001. Avian Collisions with Wind Turbines: A Summary of Existing Studies and Comparisons to other Sources of Avian Collision Mortality in the United States. National Wind Coordination Committee Publication. http://www.national wind.org/pubs/default.htm.

Erickson, W.P., G. Johnson, D. Young, D. Strickland, R. Good, M. Bourassa, K. Sernka. 2002. Synthesis and Comparison of Baseline Avian and Bat Use, Raptor Nesting and Mortality Information from Proposed and Existing Wind Developments. Technical report prepared by WEST, Inc., for Bonneville Power Administration, Portland, Oregon.

Evans R.M. and F.L. Knopf. 1993. American White Pelican. In The Birds of North America, No. 57 (A. Poole, P. Stettenheim, and F. Gill, Eds.). Philadelphia: The Academy of Natural Sciences; Washington, DC: The American Ornithologists Union.

Graff, B. J. 2015. An assessment of direct mortality to avifauna from wind energy facilities in North Dakota and South Dakota. Theses and Dissertations. 1148.

Johnson, G. D. 2005. A review of bat mortality at wind energy developments in the United States. Bat Research News. 46: 45-49.

Migratory Bird Treaty Act (MBTA). 1918. 16 United States Code (USC) § 703-712. Available online: https://www.fws.gov/laws/lawsdigest/MIGTREA.HTML (Accessed March 2017).

MNDNR. 2013. Minnesota's List of Endangered, Threatened, and Special Concern Species. Effective Aug 19 2013. Available Online: http://files.dnr.state.mn.us/natural_resources/ets/endlist.pdf (Accessed March 2017).

MNDNR. 2016. Natural Heritage Information System Correspondence #ERDB 20160322-0002, July 5, 2016.

National Land Cover Database (NLCD). 2011. From Homer et al. 2015 Completion of the 2011 National Land Cover Database for the conterminous United States-Representing a decade of land cover change information. *Photogrammetric Engineering and Remote Sensing*, v. 81, no. 5, p. 345-354. Accessed online February 2015 at: http://www.mrlc.gov/nlcd2011.php.

National Wind Coordinating Collaborative (NWCC). 2010. Wind Turbine Interactions with Birds, Bats, and their Habitats: A Summary of Research Results and Priority Questions. Available online: http://www1.eere.energy.gov/wind/pdfs/birds_and_bats_fact_sheet.pdf.

New Century Environmental, LLC (NCE). 2017. Acoustic bat summary report; Palmer's Creek Wind Farm. *Interim* Technical Report prepared by NCE for Fagen, Inc.

Orloff, S., and A. Flannery. 1992. Wind turbine effects on avian activity, habitat use, and mortality in Alamont Pass and Sollano County Resource Areas, 1989-1991. Final report prepared by Biosystems Analysis, Inc. for Alameda, Contra Costa, and Solano Counties and the California Energy Commission.

Stantec Consulting Ltd. (Stantec). 2012. Wolfe Island Wind Plant Post-Construction Follow-up Plan. Bird and Bat Resources Monitoring Report No. 6: July-December 2011. File No. 160960494. Prepared for TransAlta Corporation's wholly owned subsidiary, Canadian Renewable Energy Corporation. Prepared by Stantec Consulting Ltd., Guelph, Ontario. July 2012.

Thompson, W. L. 2002. Towards Reliable Bird Surveys: Accounting for Individuals Present but not Detected. Auk 119:18-25.

U.S. Department of Energy, Western Area Power Administration and U.S. Department of the Interior, U.S. Fish and Wildlife Service (Western) 2015. Upper Great Plans Wind Energy Final Programmatic Environmental Impact Statement. Billings, MT. April 2015. Available online: https://www.wapa.gov/regions/UGP/Environment/Pages/ugp-nepa.aspx. Accessed September 2016.

U.S. Fish and Wildlife Service (USFWS). n.d. Federal Endangered Species Act. Available online at: http://www.fws.gov/Endangered/pdfs/esaall.pdf.

U.S. Fish and Wildlife Service (USFWS). n.d. “Bald Eagle Management Guidelines and Conservation Measures: Bald and Golden Eagle Protection Act.” Available online: http://www.fws.gov/midwest/Eagle/guidelines/bgepa.html.

US Fish and Wildlife Service (USFWS). 2007a. National Bald Eagle Management Guidelines. May 2007. Available online: http://www.fws.gov/pacific/eagle/NationalBaldEagleManagement Guidelines.pdf.

U.S. Fish and Wildlife Service (USFWS). 2009. United States Fish and Wildlife Service, Department of the Interior. 50 CFR 13 and 22. Eagle Permits; Take Necessary to Protect Interests in Particular Localities. 74 FR 46836. September 11, 2009.

U.S. Fish and Wildlife Service (USFWS). 2010. Service white paper providing guidance for the development of project-specific avian and bat protection plans for renewable energy facilities. Available online: https://www.blm.gov/style/medialib/blm/nv/information/laws__regs____poli cies/ibs___ims/20100/ims.Par.95018.File.dat/NV-IM-2010-063.pdf (Accessed March 2017).

U.S. Fish and Wildlife Service (USFWS). 2011. Draft Eagle Conservation Plan Guidance. January 2011. Available online: http://www.fws.gov/windenergy/docs/ECP_draft_guidance 2_10_final_clean_omb.pdf.

U.S. Fish and Wildlife Service (USFWS). 2012. Land-Based Wind Energy Guidelines. U.S. Fish & Wildlife Service.

U.S. Fish and Wildlife Service (USFWS). 2013. Eagle Conservation Plan Guidance: Land-based Wind Energy (Vers. 2). April 2013. Available online: http://www.fws.gov/windenergy/PDF/Eagle%20Conservation%20Plan%20Guidance-Module%201.pdf.

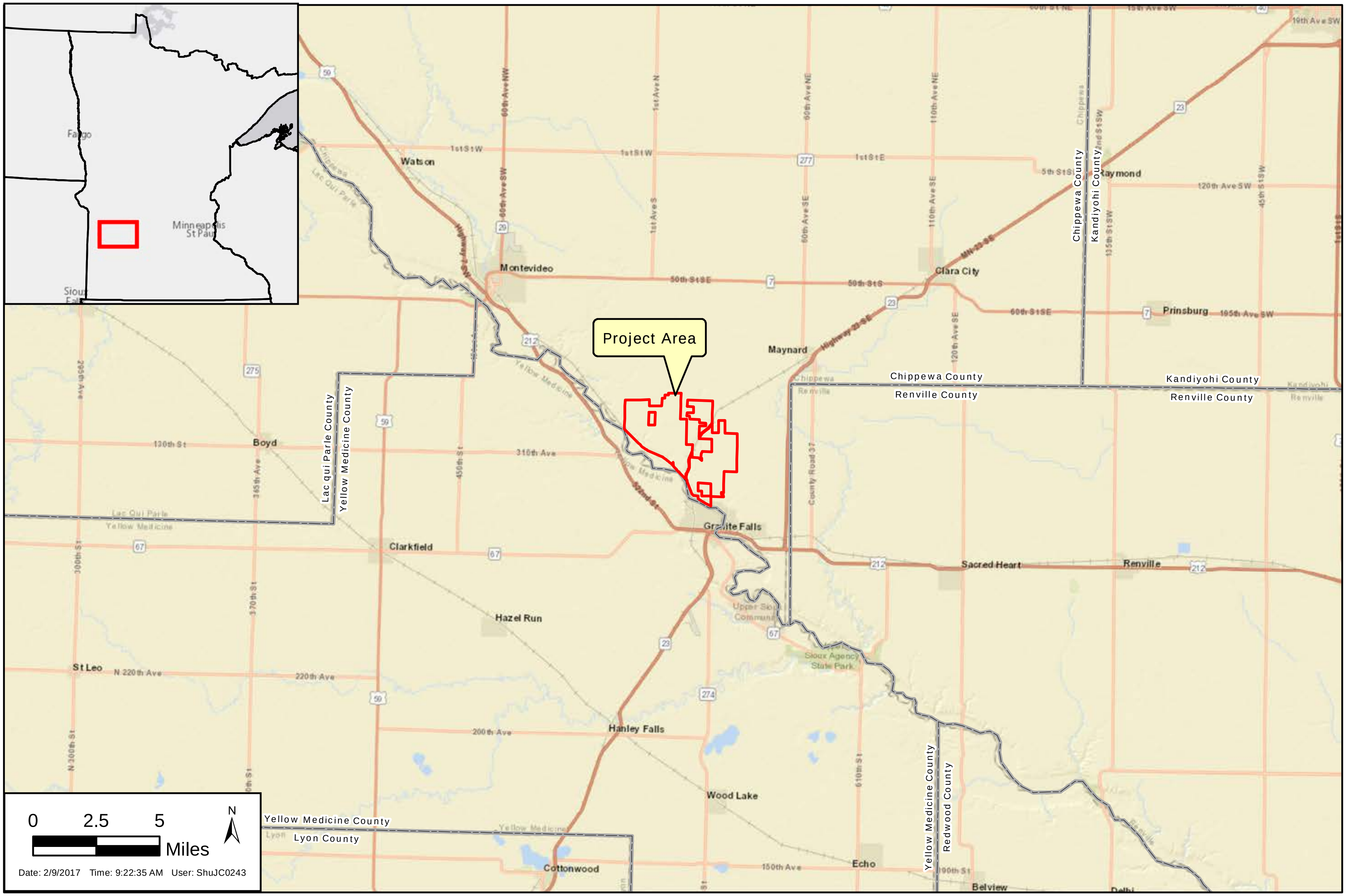
U.S. Fish and Wildlife Service (USFWS). 2017. Information for Planning and Conservation (IPaC). Available online: https://ecos.fws.gov/ipac/ (Accessed March 2017).

Wenck. 2017. Palmer’s Creek Wind Farm, LLC.: Avian Point Count Survey Preliminary Results. February 24, 2017.

Whitworth, D., S. H. Newman, T. Mundkur, and P. Harris. 2007. Wild Birds and Avian Influenza: an introduction to applied field research and disease sampling techniques. FAO Animal Production and Health Manual, No. 5. Rome. (also available at http://www.fao.org/docrep/010/a1521e/a1521e00.HTM).

Wires, L.R., K.V. Haws, and F.J. Cuthbert. 2005. The double-crested cormorant and American white pelican in Minnesota: a statewide status assessment. Final report submitted to the Nongame Wildlife Program. 28 pp. Available online: http://www.dnr.state.mn.us/eco/nongame/projects/research_reports/abstracts/birds/wires_etal2005.html (Accessed March 2017).

Figures



Path: L:\2759\05 Palmers Creek Wind Farm\09 Site Permit Application\MXD\Site Location.mxd

PALMER'S CREEK WIND FARM, LLC

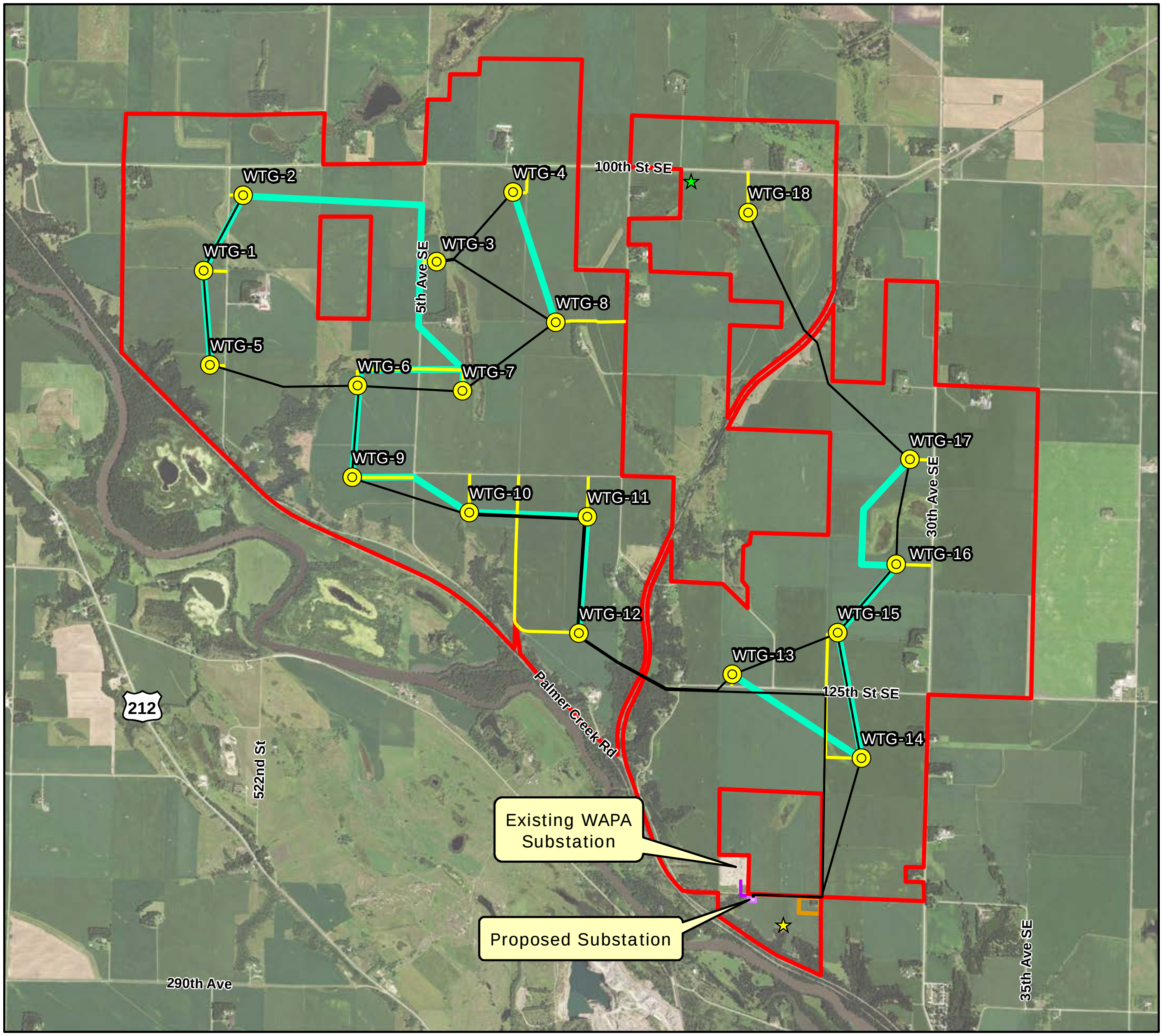
Site Location Map

WENCK ASSOCIATES

Responsive partner. Exceptional outcomes.

FEB 2017

Figure 1



Legend

- Project Boundary
- Turbine Locations
- Collector Lines
- Access Roads
- Temporary Crane Path
- Permanent MET Station
- Temporary MET Station
- Proposed Substation
- Transmision Lines
- O&M Building and Laydown Area

Note:
Project features are approximate. Once final design is completed, area will be surveyed prior to construction for Project feature placement.

N

4,000 2,000 0 4,000
Feet

Path: L:\2759\05 Palmers Creek Wind Farm\09 Site Permit Application\MXD\Site Detail.mxd
Date: 2/9/2017 Time: 1:36:17 PM User: ShuJC0243

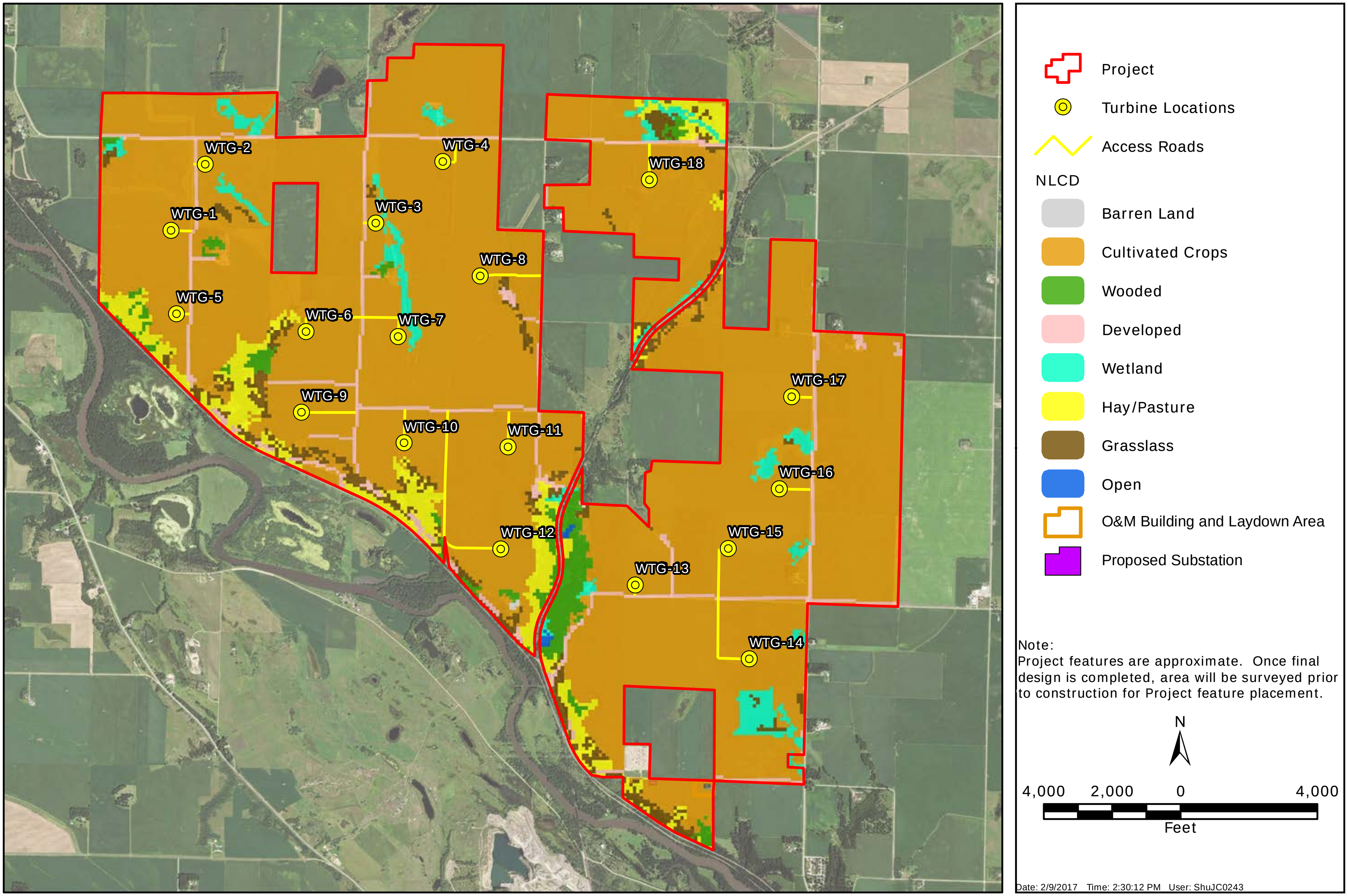
PALMER'S CREEK WIND FARM, LLC

Site Detail Map

WENCK ASSOCIATES
Responsive partner. Exceptional outcomes.

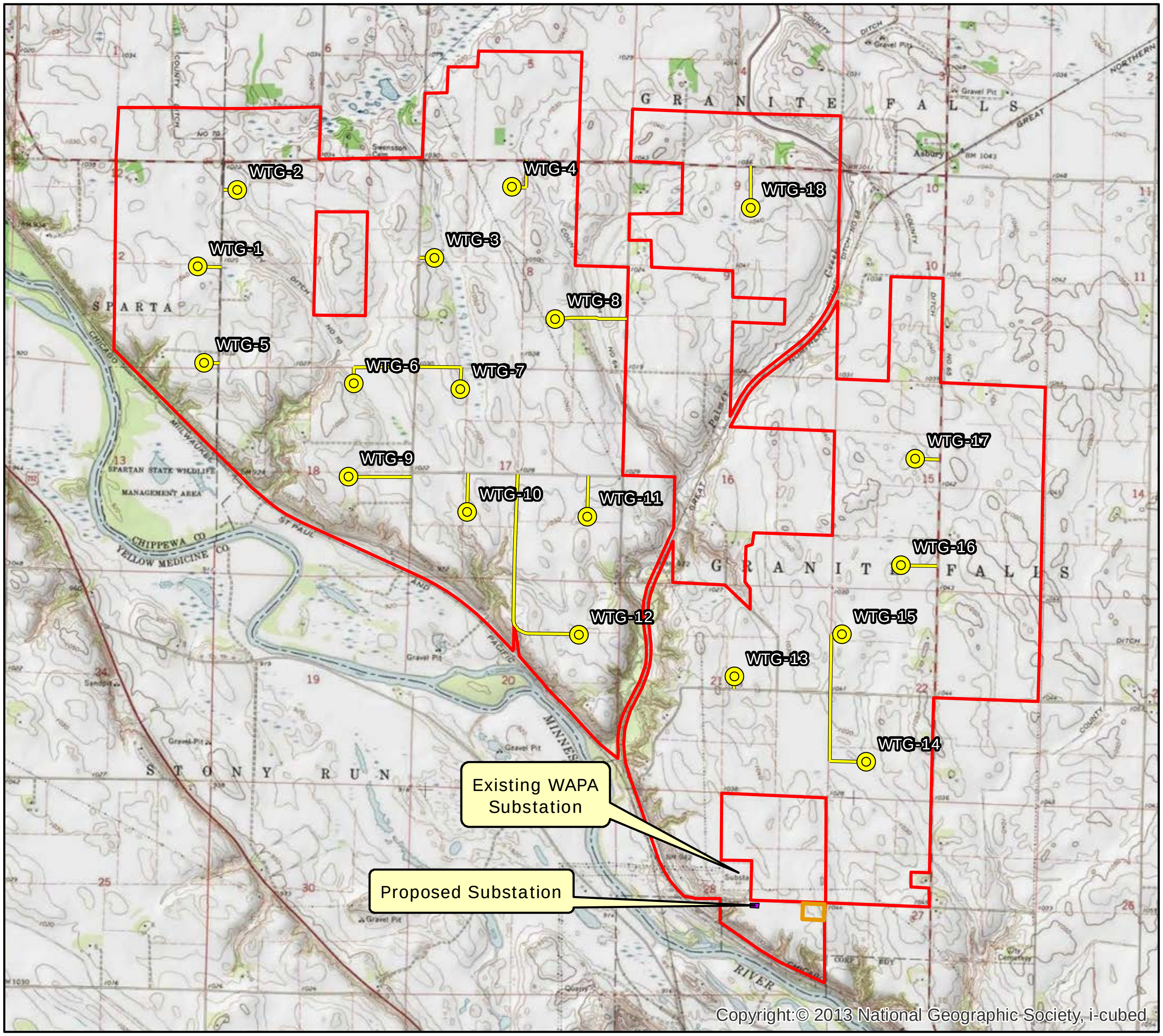
FEB 2017

Figure 2



PALMER'S CREEK WIND FARM, LLC	FEB 2017
Land Cover	Figure 3

WENCK ASSOCIATES
Responsive partner. Exceptional outcomes.



Legend

- Project Location
- Turbine Locations
- Access Roads
- Proposed Substation
- O&M Building and Laydown Area

Note:
Project features are approximate. Once final design is completed, area will be surveyed prior to construction for Project feature placement.

N

4,000 2,000 0 4,000
Feet

Path: L:\2759\05 Palmers Creek Wind Farm\09 Site Permit Application\MXD\Topo.mxd
Date: 2/9/2017 Time: 1:36:35 PM User: ShuJC0243

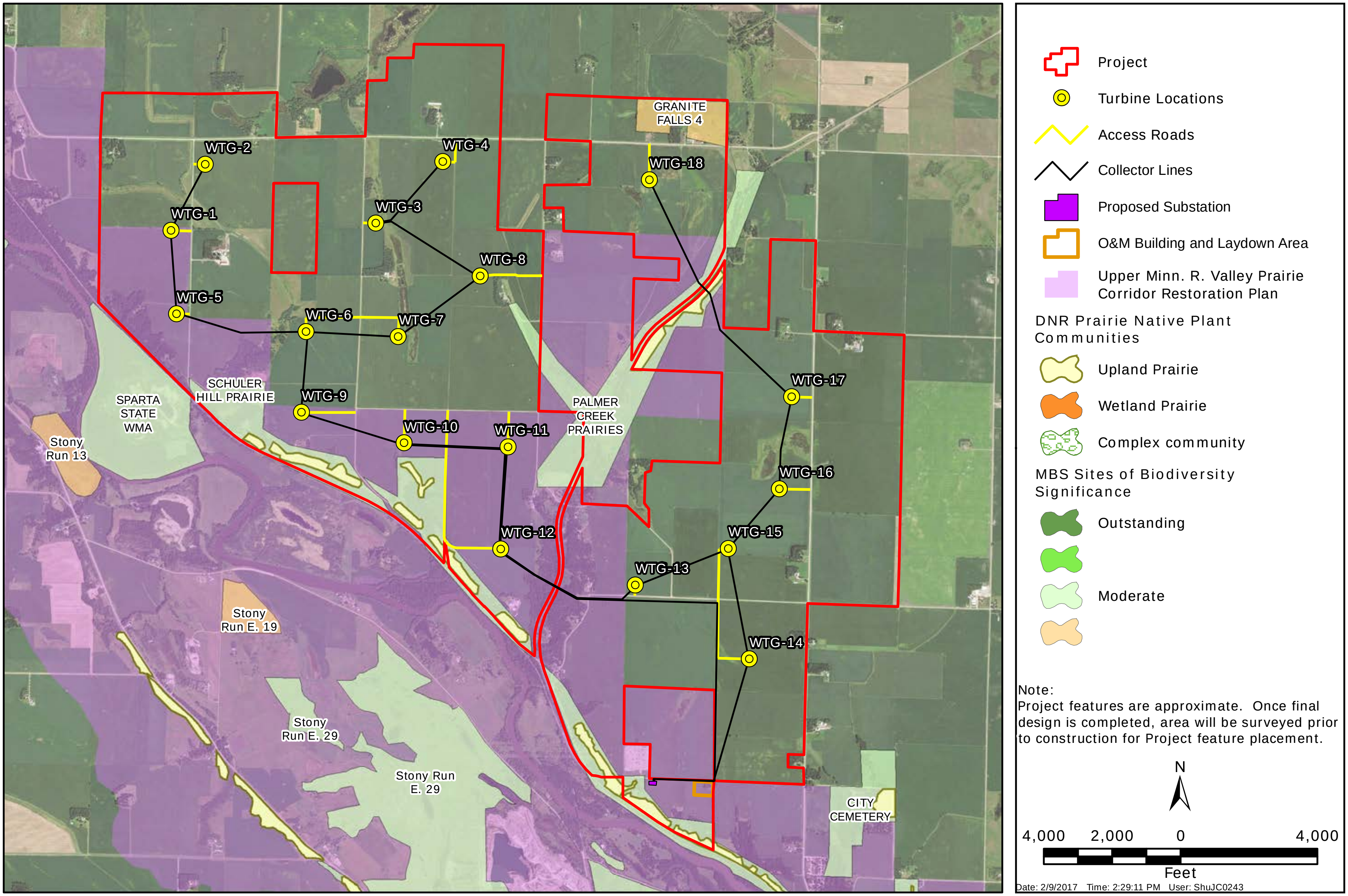
PALMER'S CREEK WIND FARM, LLC

Topographic Map

WENCK ASSOCIATES
Responsive partner. Exceptional outcomes.

FEB 2017

Figure 4



Path: L:\2759\05 Palmers Creek Wind Farm\09 Site Permit Application\MXD\Ecologically Significant Areas.mxd

PALMER'S CREEK WIND FARM, LLC	WENCK ASSOCIATES Responsive partner. Exceptional outcomes.	FEB 2017
Ecologically Significant Areas		Figure 5

Palmer's Creek Wind Farm

Point Count Locations

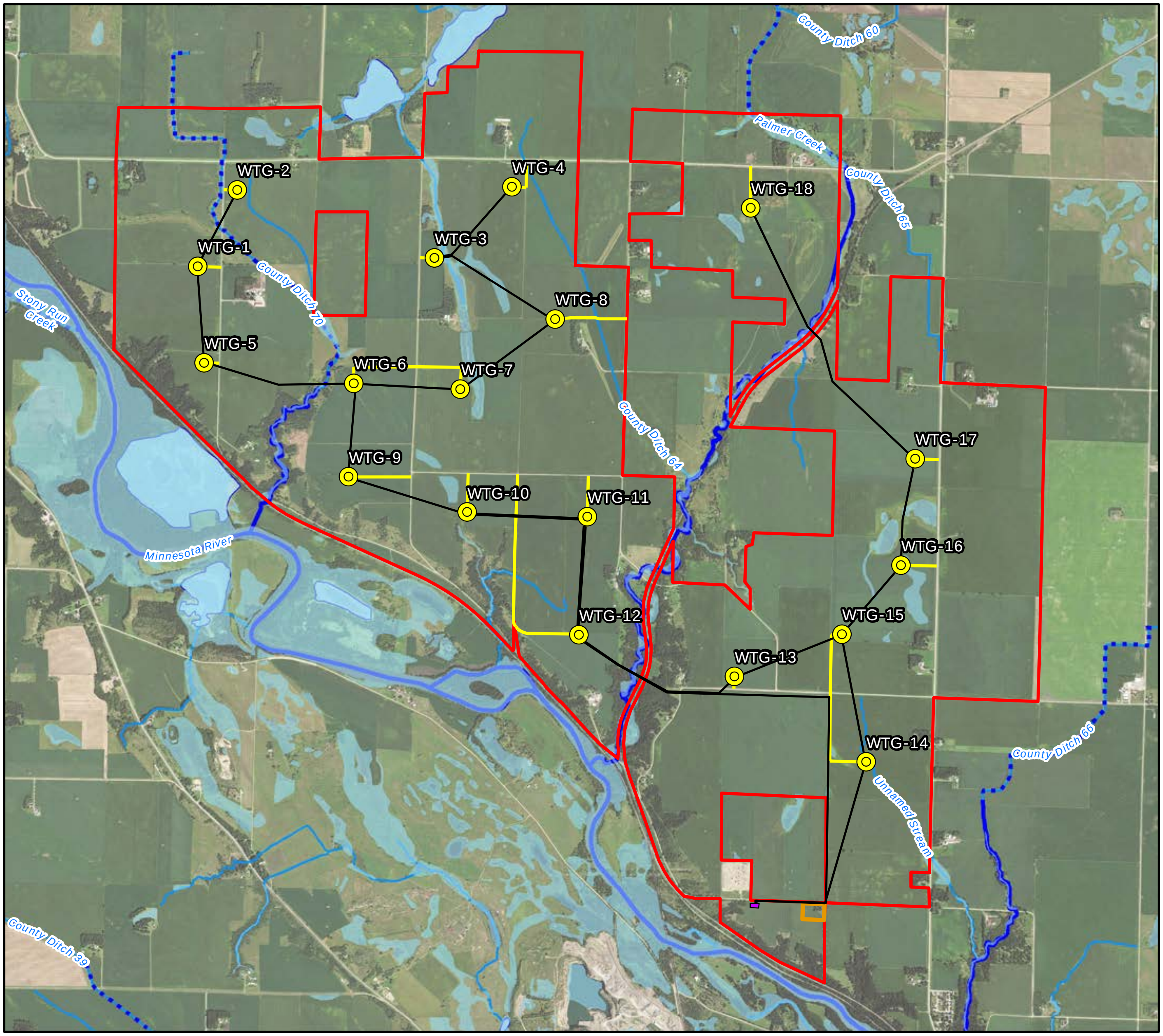
WENCK ASSOCIATES

Responsive partner. Exceptional outcomes.

JUL 2016

Figure 6

Path: J:\GIS\2759\05 Palmers Creek Wind Farm\01 Avian PC Surveys\MXD\F1-Site Location.mxd



Project
Turbine Locations
Access Roads
Collector Lines
National Wetlands
Public Stream
Public Ditch/Altered Stream
Public Waters Basins
Rivers and Streams
O&M Building and Laydown Area
Proposed Substation

Note:
Project features are approximate. Once final design is completed, area will be surveyed prior to construction for Project feature placement.

N

4,000 2,000 0 4,000
Feet

Date: 2/9/2017 Time: 2:31:28 PM User: ShuJC0243

Path: L:\2759\05 Palmers Creek Wind Farm\09 Site Permit Application\MXD\NWI and PWI.mxd

PALMER'S CREEK WIND FARM, LLC

Waterbodies and Wetlands

WENCK ASSOCIATES
Responsive partner. Exceptional outcomes.

FEB 2017

Figure 8

Appendix A – Avian Point Count Results Thru Feb. 24, 2017

PALMER'S CREEK WIND RESOURCE AREA - Summer 2016- Winter 2017

Survey #1 (6/29/16) - Survey #23 (2/24/17)

Species	Group	Obs	Ind	Fly	Mean Use per 20 min	Percent Composition	No. Surveys Species Observed	Frequency (% Surveys)	Proportion Ind. Flying	Proportion Ind. Flying Below RSA	Proportion Ind. Flying Within RSA	Proportion Ind. Flying Above RSA	Encounter Rate	N	NE	E	SE	S	SW	W	NW	Var
European Starling	SB	15	438	384	2.38	15.02%	5	2.72%	87.7%	100.0%	0.0%	0.0%	0.00	8.1%	0.0%	0.0%	0.0%	11.5%	0.0%	0.0%	0.0%	80.5%
American Crow	C	44	323	127	1.76	11.08%	25	13.59%	39.3%	81.9%	18.1%	0.0%	0.13	22.8%	2.4%	0.0%	15.7%	11.8%	7.9%	0.8%	13.4%	25.2%
Red-winged Blackbird	SB	27	270	258	1.47	9.26%	27	14.67%	95.6%	89.9%	10.1%	0.0%	0.14	0.4%	1.6%	0.0%	20.9%	19.0%	14.7%	0.4%	0.0%	43.0%
Brown-headed Cowbird	SB	20	239	203	1.30	8.20%	19	10.33%	84.9%	100.0%	0.0%	0.0%	0.00	5.9%	0.0%	0.5%	7.4%	9.4%	26.1%	23.6%	6.9%	20.2%
Barn Swallow	SB	22	180	180	0.98	6.17%	22	11.96%	100.0%	100.0%	0.0%	0.0%	0.00	0.0%	0.0%	1.1%	0.0%	0.0%	0.0%	0.0%	0.0%	98.9%
American Goldfinch	SB	34	132	132	0.72	4.53%	32	17.39%	100.0%	98.5%	1.5%	0.0%	0.01	9.8%	1.5%	34.8%	11.4%	18.9%	6.1%	2.3%	0.8%	14.4%
Blue Jay	SB	41	114	66	0.62	3.91%	32	17.39%	57.9%	100.0%	0.0%	0.0%	0.00	9.1%	15.2%	16.7%	6.1%	12.1%	10.6%	15.2%	6.1%	9.1%
Snow Bunting	SB	6	109	109	0.59	3.74%	0	0.00%	100.0%	100.0%	0.0%	0.0%	0.00	0.0%	15.6%	0.0%	0.0%	15.6%	0.0%	18.3%	0.0%	50.5%
Rock Pigeon	PD	28	105	105	0.57	3.60%	18	9.78%	100.0%	98.1%	1.9%	0.0%	0.01	22.9%	0.0%	11.4%	0.0%	1.9%	0.0%	11.4%	13.3%	39.0%
Wild Turkey	GB	5	93	0	0.51	3.19%	1	0.54%	0.0%	0.0%	0.0%	0.0%	0.00	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Field Sparrow	SB	33	84	51	0.46	2.88%	33	17.93%	60.7%	100.0%	0.0%	0.0%	0.00	7.8%	0.0%	3.9%	0.0%	3.9%	3.9%	2.0%	0.0%	78.4%
Canada Goose	WF	8	71	65	0.39	2.43%	7	3.80%	91.5%	46.2%	0.0%	53.8%	0.00	1.5%	0.0%	0.0%	13.8%	56.9%	27.7%	0.0%	0.0%	0.0%
Dark-eyed Junco	SB	9	70	70	0.38	2.40%	5	2.72%	100.0%	100.0%	0.0%	0.0%	0.00	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	5.7%	7.1%	87.1%
Unknown Duck	WF	5	60	46	0.33	2.06%	3	1.63%	76.7%	0.0%	100.0%	0.0%	0.25	30.4%	0.0%	0.0%	69.6%	0.0%	0.0%	0.0%	0.0%	0.0%
Black-capped Chickadee	SB	12	58	54	0.32	1.99%	7	3.80%	93.1%	100.0%	0.0%	0.0%	0.00	0.0%	0.0%	3.7%	0.0%	0.0%	14.8%	0.0%	0.0%	81.5%
Horned Lark	SB	11	57	50	0.31	1.95%	10	5.43%	87.7%	100.0%	0.0%	0.0%	0.00	0.0%	0.0%	0.0%	0.0%	30.0%	0.0%	50.0%	0.0%	20.0%
Unknown Blackbird	SB	1	40	40	0.22	1.37%	1	0.54%	100.0%	0.0%	100.0%	0.0%	0.22	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Unidentified Sparrow	SB	4	35	34	0.19	1.20%	0	0.00%	97.1%	100.0%	0.0%	0.0%	0.00	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.9%	0.0%	97.1%
Common Grackle	SB	7	32	32	0.17	1.10%	7	3.80%	100.0%	100.0%	0.0%	0.0%	0.00	0.0%	12.5%	3.1%	6.3%	59.4%	15.6%	0.0%	3.1%	0.0%
American Robin	SB	16	29	17	0.16	0.99%	16	8.70%	58.6%	100.0%	0.0%	0.0%	0.00	11.8%	0.0%	5.9%	23.5%	11.8%	11.8%	0.0%	17.6%	17.6%
Red-tailed Hawk	RVO	24	27	25	0.15	0.93%	17	9.24%	92.6%	56.0%	24.0%	20.0%	0.03	16.0%	0.0%	4.0%	24.0%	24.0%	12.0%	8.0%	4.0%	8.0%
Mourning Dove	PD	15	25	19	0.14	0.86%	15	8.15%	76.0%	100.0%	0.0%	0.0%	0.00	42.1%	0.0%	15.8%	0.0%	5.3%	5.3%	31.6%	0.0%	0.0%
Ring-billed Gull	GT	6	25	25	0.14	0.86%	6	3.26%	100.0%	32.0%	68.0%	0.0%	0.09	0.0%	0.0%	0.0%	4.0%	8.0%	0.0%	8.0%	12.0%	68.0%
Common Yellowthroat	SB	12	22	0	0.12	0.75%	12	6.52%	0.0%	0.0%	0.0%	0.0%	0.00	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Cedar Waxwing	SB	6	21	19	0.11	0.72%	6	3.26%	90.5%	100.0%	0.0%	0.0%	0.00	0.0%	0.0%	42.1%	36.8%	21.1%	0.0%	0.0%	0.0%	0.0%
Yellow Warbler	SB	4	20	13	0.11	0.69%	3	1.63%	65.0%	100.0%	0.0%	0.0%	0.00	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%
Ring-necked Pheasant	GB	10	19	6	0.10	0.65%	6	3.26%	31.6%	100.0%	0.0%	0.0%	0.00	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%
American Tree Sparrow	SB	2	19	18	0.10	0.65%	2	1.09%	94.7%	100.0%	0.0%	0.0%	0.00	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
Clay-colored Sparrow	SB	12	16	0	0.09	0.55%	12	6.52%	0.0%	0.0%	0.0%	0.0%	0.00	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Northern Flicker	WP	6	15	15	0.08	0.51%	6	3.26%	100.0%	100.0%	0.0%	0.0%	0.00	0.0%	26.7%	0.0%	20.0%	33.3%	20.0%	0.0%	0.0%	0.0%
Western Meadowlark	SB	3	14	14	0.08	0.48%	3	1.63%	100.0%	100.0%	0.0%	0.0%	0.00	0.0%	0.0%	0.0%	50.0%	35.7%	0.0%	14.3%	0.0%	0.0%
Turkey Vulture	RVO	9	12	12	0.07	0.41%	9	4.89%	100.0%	33.3%	50.0%	16.7%	0.03	0.0%	0.0%	25.0%	33.3%	8.3%	0.0%	16.7%	0.0%	16.7%
Tree Swallow	SB	5	12	12	0.07	0.41%	5	2.72%	100.0%	100.0%	0.0%	0.0%	0.00	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
Bank Swallow	SB	1	12	12	0.07	0.41%	1	0.54%	100.0%	100.0%	0.0%	0.0%	0.00	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
Downy Woodpecker	WP	11	11	8	0.06	0.38%	9	4.89%	72.7%	100.0%	0.0%	0.0%	0.00	12.5%	0.0%	12.5%	25.0%	12.5%	12.5%	25.0%	0.0%	0.0%
Killdeer	SH	7	10	5	0.05	0.34%	7	3.80%	50.0%	100.0%	0.0%	0.0%	0.00	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
Vesper Sparrow	SB	6	10	0	0.05	0.34%	6	3.26%	0.0%	0.0%	0.0%	0.0%	0.00	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Bald Eagle	RVO	8	10	9	0.05	0.34%	6	3.26%	90.0%	11.1%	33.3%	55.6%	0.02	0.0%	33.3%	0.0%	44.4%	11.1%	0.0%	0.0%	0.0%	11.1%
Savannah Sparrow	SB	1	8	0	0.04	0.27%	0	0.00%	0.0%	0.0%	0.0%	0.0%	0.00	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Chipping Sparrow	SB	7	8	4	0.04	0.27%	7	3.80%	50.0%	100.0%	0.0%	0.0%	0.00	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
Song Sparrow	SB	5	7	0	0.04	0.24%	5	2.72%	0.0%	0.0%	0.0%	0.0%	0.00	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Eastern Bluebird	SB	2	6	6	0.03	0.21%	2	1.09%	100.0%	100.0%	0.0%	0.0%	0.00	16.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	83.3%	0.0%
Swainson's Hawk	RVO	4	5	3	0.03	0.17%	3	1.63%	60.0%	66.7%	33.3%	0.0%	0.01	0.0%	0.0%	0.0%	33.3%	33.3%	33.3%	0.0%	0.0%	0.0%
Mallard	WF	2	5	0	0.03	0.17%	2	1.09%	0.0%	0.0%	0.0%	0.0%	0.00	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Least Flycatcher	SB	4	5	1	0.03	0.17%	4	2.17%	20.0%	100.0%	0.0%	0.0%	0.00	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Sedge Wren	SB	5	5	0	0.03	0.17%	5	2.72%	0.0%	0.0%	0.0%	0.0%	0.00	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
American White Pelican	WB	1	4	4	0.02	0.14%	1	0.54%	100.0%	0.0%	100.0%	0.0%	0.02	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%
Rough-legged Hawk	RVO	3	4	4	0.02	0.14%	2	1.09%	100.0%	25.0%	25.0%	50.0%	0.01	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Eastern Wood-Pewee	SB	3	3	0	0.02	0.10%	3	1.63%	0.0%	0.0%	0.0%	0.0%	0.00	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Eastern Kingbird	SB	2	3	1	0.02	0.10%	2	1.09%	33.3%	100.0%	0.0%	0.0%	0.00	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Belted Kingfisher	SB	2	2	1	0.01	0.07%	2	1.09%	50.0%	100.0%	0.0%	0.0%	0.00	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%
Snow Goose	WF	1	2	2	0.01	0.07%	1	0.54%	100.0%	100.0%	0.0%	0.0%	0.00	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%
Grasshopper Sparrow	SB	2	2	0	0.01	0.07%	2	1.09%	0.0%	0.0%	0.0%	0.0%	0.00	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Yellow-headed Blackbird	SB	2	2	1	0.01	0.07%	2	1.09%	50.0%	100.0%	0.0%	0.0%	0.00	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
Northern Harrier	RVO	1	1	1	0.01	0.03%	0	0.00%	100.0%	100.0%	0.0%	0.0%	0.00	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
American Kestrel	RVO	1	1	1	0.01	0.03%	1	0.54%	100.0%	100.0%	0.0%	0.0%	0.00	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%
Wilson's Snipe	SH	1	1	0	0.01	0.03%	1	0.54%	0.0%	0.0%	0.0%	0.0%	0.00	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Bobolink	SB	1	1	0	0.01	0.03%	1	0.54%	0.0%	0.0%	0.0%	0.0%	0.00	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Willow Flycatcher	SB	1	1	0	0.01	0.03%	1	0.54%	0.0%	0.0%	0.0%	0.0%	0.00	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Marsh Wren	SB	1	1	0	0.01	0.03%	1	0.54%	0.0%	0.0%	0.0%	0.0%	0.00	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		547	**2,916**	**2,264**	**15.85**	**100.0%**			**77.6%**				**0.96**	**8.48%**	**2.12%**	**4.20%**	**8.83%**	**13.12%**	**7.07%**	**6.27%**	**3.22%**	**46.69%**

Appendix B: Applicable Bird/Bat Best Management Practices and Conservation Measures

Best Management Practices (BMPs)	References	Project Application
Construction: Communication and other local utility cables shall be buried, where feasible.	VR-26, VRP 5-194	See Design Plans-Layout Plans.
Construction: Construction debris shall be removed from the site.	LU-3,LUP 5-14	X
Construction: Excess cut/fill materials shall be hauled in or out to minimize ground disturbance and impacts from fill piles.	VR-22, VRP 5-193	X
Construction: If needed during construction, only use explosives within specified times and at specified distances from sensitive wildlife or surface waters as established by the appropriate Federal and State agencies.	ER-7, ERP 5-130	X
Construction: Litter must be controlled and removed regularly during construction.	VR-30, VRP 5-194	X
Construction: Minimize the area disturbed during the installation of meteorological towers (i.e., the footprint needed for meteorological towers and associated laydown areas).	ER-2, ERP 5-129	See Design Plans-Layout Plans.
Construction: Schedule the installation of meteorological towers and other characterization activities to avoid disruption of wildlife reproductive activities or other important behaviors (e.g., do not install towers during periods of sage-grouse nesting).	ER-3, ERP 5-129	See Design Plans-Layout Plans.
Decommissioning: All aboveground and near-ground structures, including turbines and ancillary structures, shall be removed from the site during decommissioning.	ER-23, ERP 5-132, VR-39, VRP 5-195	See Decommission Plan.
Decommissioning: Facilities constructed on Federal lands should follow the decommissioning recommendations provided in the USFWS's Land-Based Wind Energy Guidelines (USFWS 2012b).	ERP 5-132	See Decommission Plan.
Decommissioning: Salvage and reapply topsoil excavated during decommissioning activities to disturbed areas during final restoration activities.	ER-24, ERP 5-132	See Decommission Plan.
Decommissioning: When decommissioning sites, ensure that any wells are properly filled and capped.	WR-10, WRP 5-33	See Decommission Plan.
Design: Existing rocks, vegetation, and drainage patterns shall be preserved to the maximum extent possible.	VR-12, VRP 5-193	See Design Plans.
Design: Minimize the use of guy wires on permanent meteorological towers or use designs for towers that do not require guy wires. If guy wires are necessary, they shall be equipped with line marking devices.	ER-8, ERP 5-130	See Design and Layout Plans.
Design: Power collection cables or lines on the site should be buried in a manner that minimizes additional surface disturbance (e.g., collocating them with access roads).	VR-26, VRP 5-194, ERP 5-129	See Design, Layout and Construction Plans.
General: Conduct construction and maintenance activities when the ground is frozen or when soils are dry and native vegetation is dormant.	SR-5, SRP 5-25	See Construction Plan.
General: Facilities and off-site surrounding areas shall be kept clean of debris, "fugitive" trash or waste, and graffiti. Scrap heaps and materials dumps shall be prohibited and prevented. Materials storage yards, even if thought to be orderly, shall be kept to an absolute minimum. Surplus, broken, disused materials and equipment of any size shall not be allowed to accumulate.	VR-35, VRP 5-194	X
Haz. Materials: Dispose of excess excavation materials in approved areas to control erosion and minimize leaching of hazardous materials.	SR-8, SRP 5-26	See Hazardous Material Plan and Erosion Control Plan.
Haz. Materials: Hazardous materials and waste storage areas or facilities shall be formally designated and access to them restricted to authorized personnel. Construction debris, especially treated wood, shall not be disposed of or stored in areas where it could come in contact with aquatic habitats.	HM-16, HM 5-249	See Hazardous Material Plan and Design Plans.
Wildlife/Vegetation: If pesticides/herbicides are to be used on the site, develop an integrated pest and vegetation management plan to ensure that applications will be conducted within the framework of managing agencies and will entail the use of only EPA-registered pesticides/herbicides that are (1) nonpersistent and immobile and (2) applied by licensed applicators in accordance with label and application permit directions, following stipulations regarding suitability for terrestrial and aquatic applications.	HM-3, HMP 5-247	See Integrated Pest & Vegetation Management Plan.
Haz. Materials: Limit herbicide and pesticide use to nonpersistent, immobile compounds and apply them using a properly licensed applicator in accordance with label requirements.	WR-6, WRP 5-33	See Integrated Pest & Vegetation Management Plan.

Refernces: Palmer's Creek Project Best Management Practices and Conservation Measures adopted from Western (2015).

Best Management Practices (BMPs)	References	Project Application
Haz. Materials: Prepare a hazardous materials and waste management plan that addresses the selection, transport, storage, and use of all hazardous materials needed for construction, operation, and decommissioning of the facility for local emergency response and public safety authorities and for the regulating agency, and that addresses the characterization, on-site storage, recycling, and disposal of all resulting wastes. The plan shall include a comprehensive hazardous materials inventory; Material Safety Data Sheets (MSDSs) for each type of hazardous material; emergency contacts and mutual aid agreements, if any; site map showing all hazardous materials and waste storage and use locations; copies of spill and emergency response plans (see below), and hazardous materials-related elements of a decommissioning/ closure plan. The waste management plan shall identify the waste streams that are expected to be generated at the site during construction and operation and address hazardous waste determination procedures, waste storage locations, waste-specific management and disposal requirements (e.g., selecting appropriate waste storage containers, appropriate off-site treatment, storage, and disposal facilities), inspection procedures, and waste minimization procedures. The plan shall address solid and liquid wastes that may be generated at the site in compliance with CWA requirements if a NPDES permit is needed.	HM-1, HMP 5-247	See Hazardous Materials Plan.
Maintenance: Promptly dispose of all garbage or human waste generated on site in order to avoid attracting nuisance wildlife.	ER-15, ERP 5-131	X
Maintenance: Clean and maintain catch basins, drainage ditches, and culverts regularly.	WR-5, WRP 5-33	X
Maintenance: Refueling areas shall be located away from surface water locations and drainages and on paved surfaces; features shall be added to direct spilled materials to sumps or safe storage areas where they can be subsequently recovered.	HM-12, HMP 5-248	See Design Plan-Refueling Areas.
Maintenance: Wind facilities and sites shall be actively and carefully maintained during operation. Wind energy projects shall evidence environmental care, which would also reinforce the expectation and impression of good management for benign or clean power.	VR-32, VRP 5-194	X
Minimize ground-disturbing activities, especially during the rainy season.	SR-1, SRP 5-25	X
Restoration: A site restoration plan shall be in place prior to construction. Restoration of the construction areas shall begin immediately after construction to reduce the likelihood of visual contrasts associated with erosion and invasive weed infestation and to reduce the visibility of affected areas as quickly as possible.	VR-9, VRP 5-192	See Site Restoration Plan.
Safety: Drip pans shall be used under the fuel pump and valve mechanisms of any bulk fueling vehicles and during on-site refueling to contain accidental releases.	HM-13, HMP 5-248	X
Safety: Use proper signage and/or engineered barriers (e.g., fencing) to limit access to electrically energized equipment and conductors in order to prevent access to electrical hazards by unauthorized individuals or wildlife.	HS-9, HSP 5-257	X
Siting: Avoid locating wind energy developments in areas of unique or important recreation, wildlife, or visual resources. When feasible, a wind energy development should be sited on already altered landscapes.	LUP 5-14	See Design-Layout Plan.
Siting: Consolidate infrastructure wherever possible to maximize efficient use of the land and minimize impacts. Existing transmission and market access should be evaluated and use of existing facilities should be maximized.	LUP 5-14	See Design-Layout Plan.
Siting: Consult with Federal, State, and county agencies; tribes; property owners; and other stakeholders as early as possible in the planning process to identify potentially significant land use conflicts and issues and State and local rules that govern wind energy development.	LUP 5-14	This Bird & Bat Conservation Strategy is part of the Site Permit Application (requirement for MN Dept. of Commerce and associated agencies).
Siting: Minimize the extent of land disturbance to the extent possible.	WRP 5-33	See Design-Layout Plan. Total Land Disturbance is x.xx acres.
Siting: Through site design, the number of structures required should be minimized. Activities should be combined and carried out in one structure, or structures should be collocated to share pads, fences, access roads, lighting, etc.	VRP 5-190	See Design-Layout Plan.
Vegetation: Reduce habitat disturbance by keeping vehicles on access roads and minimizing foot and vehicle traffic through undisturbed areas.	ER-4, ERP 5-130	X
Wetlands/Vegetation: For wetland and grassland easements, coordinate closely with the USFWS or USDA during initial project planning to ensure that wetland and grassland easements are avoided to the extent practicable.	LUP 5-15	Coordinated as part of the Site Permit Application.
Wildlife/Vegetation: Contact appropriate Federal and State agencies (including State entities responsible for permitting energy development projects) early in the planning process to identify potentially sensitive ecological resources known to be present or likely to be present in the vicinity of the wind energy development.	WRP 5-128	Coordinated as part of the Site Permit Application.

References: Palmer's Creek Project Best Management Practices and Conservation Measures adopted from Western (2015).

Best Management Practices (BMPs)	References	Project Application
Wildlife/Vegetation: Do not locate individual meteorological towers in or adjacent to sensitive habitats or in areas where ecological resources known to be sensitive to human activities are present.	WRP 5-129	See Design-Layout Plan.
Wildlife/Vegetation: Review existing information on species and habitats in the project area. Identify important, sensitive, or unique habitat (including large contiguous tracts of grassland habitat) and biota in the project site and vicinity, and design the project to avoid, minimize, or mitigate potential impacts on these resources. Avoidance is the typically the most effective, and therefore preferred, choice for minimizing impacts. The design and siting of the facility should follow appropriate guidance and requirements from Western and the USFWS (as specified for each species in the selected alternative in the Final PEIS) as well as those required by State permitting agencies, and other resource agencies, as available and applicable. For birds specifically, attention should be given to project placement that may be within or near Important Bird Areas (http://netapp.audubon.org/iba) or Hemispheric or Regional Western Hemisphere Shorebird Reserve Network sites (http://www.whsrn.org/whsrn-sites), or where bird species or habitats of conservation concern are known to occur. The IBA Program has identified the most essential areas for birds, and conservation of these areas will provide for long-term protection of biodiversity. Sources of information on these important habitats can be found at http://ecos.fws.gov/ipac, http://www.avianknowledge.net, and http://web4.audubon.org/bird/iba.	WRP 5-127	This Bird & Bat Conservation Strategy is part of the Site Permit Application (requirement for MN Dept. of Commerce and associated agencies).
Wildlife: Avoid constructing turbines in areas of concentrated prey base for raptors (e.g., prairie dog towns).	ERP 5-130	Aerial raptor nest surveys will be conducted in Spring 2017. Avian point count surveys are continuing until mid-summer 2017. Avian use data will be updated in this document after surveys are completed.
Wildlife: Consult with the appropriate natural resource agencies to avoid scheduling construction activities during important periods for wildlife courtship, breeding, nesting, lambing, or calving that are applicable to sensitive species within the project area.	ERP 5-130	This Bird & Bat Conservation Strategy is part of the Site Permit Application (requirement for MN Dept. of Commerce and associated agencies).
Wildlife: Establish buffer zones around known raptor nests, bat roosts, and biota and habitats of concern if site evaluations show that proposed construction activities would pose a significant risk to avian or bat species of concern.	ER-6, ERP 5-130	This Bird & Bat Conservation Strategy is part of the Site Permit Application (requirement for MN Dept. of Commerce and associated agencies).
Wildlife: Evaluate potential avian and bat use (including the locations of active nest sites, colonies, roosts, and migration corridors) of the project and use data to plan turbine (and other structure/infrastructure) locations to minimize impacts.	ERP 5-128	Aerial raptor nest surveys will be conducted in Spring 2017. Avian point count surveys are continuing until mid-summer 2017. Avian use data will be updated in this document after surveys are completed. Acoustic bat surveys will continue through October 2017. Bat data will be updated in this document after surveys are completed.
Wildlife: Evaluate the potential for the wind energy project to adversely affect bald and golden eagles in a manner consistent with the Eagle Conservation Plan Guidance (USFWS 2013a). Early in the planning of transmission interconnection and wind farm location, coordination with USFWS Field Offices regarding the guidance is highly recommended. Documented occurrence of eagles can be acquired from the local USFWS Ecological Services office, State wildlife agencies, or State natural heritage databases in some cases, although on-site surveys may be needed. In accordance with the USFWS's Land-Based Wind Energy Guidelines (USFWS 2012b), surveys during early project development should identify all important eagle use areas (nesting, foraging, and winter roost areas) within the project's footprint. If recent data are available on the spacing of occupied eagle nests for the project-area nesting population, these data can be used to delineate an appropriate boundary for the project area. If appropriate survey data are unavailable, the USFWS suggests that the project area, for the purpose of evaluating potential effects on eagles, be defined as the project footprint together with areas within 10 mi (16 km) of the footprint boundary. As described in the USFWS's Land-Based Wind Energy Guidelines (USFWS 2012b), project developers should evaluate the need to develop an ECP.	ERP 5-128	Eagle Use Surveys, Eagle Nest Use Monitoring, Aerial Raptor Nest Surveys are continuing through 2017. Data will be updated in this document once surveys are completed.
Wildlife: Follow the recommendations provided in the USFWS's Land-Based Wind Energy Guideline (USFWS 2012b) and, as appropriate, the Eagle Conservation Plan Guidance (USFWS 2013a). In addition, follow guidelines or recommendations developed by individual States (e.g., IDNR 2011; Kempema 2009; Nebraska Wind and Wildlife Working Group 2011) to address potential effects of wind energy development on ecological resources.	WRP 5-126	Eagle Use Surveys, Eagle Nest Use Monitoring, Aerial Raptor Nest Surveys are continuing through 2017. Data will be updated in this document once surveys are completed.
Wildlife: If appropriate, conduct surveys for presence of Federal- and State-protected species and other species of concern and the habitats for such species that have a reasonable potential to occur within the project area based on habitat characteristics. Consult with the USFWS and/or appropriate State agency to identify species likely to be present and appropriate survey techniques, determine permit needs, and identify/apply species-specific avoidance and minimization measures.	WRP 5-128	Coordination with Federal and State agencies is occuring as this document is included in the Site Permit Application process.
Wildlife: If significant impacts on Important Bird Areas (IBAs) or similar ecologically important avian areas are not avoided, minimized, or mitigated, then this Final PEIS would not apply and a separate project specific NEPA evaluation must be developed and approved by the appropriate responsible federal agency prior to project construction.	WRP 5-128	This Project adheres to the Final PEIS.

References: Palmer's Creek Project Best Management Practices and Conservation Measures adopted from Western (2015).

Best Management Practices (BMPs)	References	Project Application
Wildlife: In the absence of long-term mortality studies, monitor regularly for potential wildlife problems including wildlife mortality. Report observations of potential wildlife problems, including wildlife mortality, to the appropriate State or Federal agency in a timely manner, and work with the agencies to utilize this information to avoid/minimize/offset impacts. The Ecological Services Division of the USFWS shall be contacted. Development of additional mitigation measures may be necessary.	ER-22, ERP 5-131	See this document, Bird & Bat Conservation Strategy.
Wildlife: Increasing turbine cut-in speeds (i.e., prevent turbine rotation at lower wind velocity) in areas of bat conservation concern during times when active bats may be at particular risk from turbines.	ER-20, ERP 5-131	Cut-in speeds = 6.7 mph (3 m/s) for both GE 2.3 and GE 2.5 turbines.
Wildlife: Instruct employees, contractors, and site visitors to avoid harassment and disturbance of wildlife, especially during reproductive (e.g., courtship and nesting) seasons. Pets shall not be allowed on the project area.	ER-21, ERP 5-131	X
Wildlife: Place marking devices on any newly constructed or upgraded transmission lines, where appropriate, within suitable habitats for sensitive bird species.	ER-14, ERP 5-131	X
Wildlife: Prepare a Bird and Bat Conservation Strategy (BBCS). The overall goal of such a plan is to reduce or eliminate avian and bat mortality; implementation of a BBCS builds support for a FONSI when projects tier from the PEIS. The wind energy facility developer should work closely with the USFWS and the appropriate State wildlife agencies to identify protective measures to include in the plan. These would include project design measures, construction phase measures, operational phase measures, and decommissioning phase measures. A minimum of 1 yr of post-construction monitoring is needed to validate the preconstruction risk assessment and allow the facility owner to adjust operations based on identified problems. Based on project location in proximity to occupancy, habitat, and other ttributes that may increase the risk to birds and bats, multiyear post-construction monitoring may be necessary at some project sites. It is of paramount importance that post-construction surveys are accurate estimates of fatality at wind power facilities. Simple carcass counts at wind energy facilities are inaccurate and underestimate the total number of fatalities because not all carcasses are found due to factors such as unsearchable terrain, carcass removal by scavengers, and less than perfect searcher efficiency. Post-construction surveys for mortality must be robust and standardized to provide reliable results upon which to base adaptive management decisions. For these reasons, using a fatality estimator model is critical. The USFWS recommends a model like the Evidence of Absence model developed by Huso et al. (2014). The user's guide and software developed to estimate bird and bat fatalities at wind-power facilities (Dalthorp et al. 2014) can be found at http://pubs.usgs.gov/ds/0881. The Evidence of Absence software provides for comparison of various combinations of search coverage, search interval, and searcher efficiency that all produce the same overall level of carcass detection probability. Results of monitoring activities shall be reported to the appropriate State or Federal agencies in a timely manner. If bat monitoring is appropriate for the site, installation of bat acoustic monitors should be considered at the time meteorological towers are installed to reduce costs and minimize delays by collecting data early during the site review process.	WRP 5-126	See this document, Bird & Bat Conservation Strategy.
Wildlife: The transmission lines shall be designed and constructed with regard to the recommendations in Avian Protection Plan Guidelines (APLIC and USFWS 2005), in conjunction with Suggested Practices for Avian Protection on Power Lines (APLIC 2006) and Reducing Avian Collisions with Power Lines (APLIC 2012), to reduce the operational and avian risks that result from avian interactions with electric utility facilities.	ER-1, ERP 5-128	See this document, Bird & Bat Conservation Strategy.
Wildlife: Tier to the Final Programmatic EIS. The responsible federal agency will use a tiered NEPA evaluation to document avoidance, minimization, or mitigation of impacts to important bird habitat (e.g., established private, State, or federal special management areas for birds, IBAs, Regional Western Hemisphere Shorebird Reserve Network, [http://www.whsrn.org/whsrn-sites], etc.) to achieve no significant impact to avian resources. On a project-by-project basis, developers should contact local USFWS offices early in the planning process to identify areas of conflict with specific avian species or important bird habitat. Developers shall work with USFWS and Western to develop avoidance, minimization, or mitigation measures to adequately demonstrate their project will have no significant impact on avian resources. In these cases, individual projects determined to be consistent with the selected alternative in the Final PEIS will require a FONSI to document consistency.	ER 5-127	X
Wildlife: Turn off unnecessary lighting at night to limit attraction of migratory birds. Follow lighting guidelines, where applicable, from the Wind Energy Guidelines Handbook. This includes using lights with timed shutoff, downward-directed lighting to minimize horizontal or skyward illumination, and avoidance of steady-burning, high-intensity lights.	ER-19, ERP 5-131	X

References: Palmer's Creek Project Best Management Practices and Conservation Measures adopted from Western (2015).

Appendix C – Protocol: Post-Construction Avian and Bat Studies

April 7, 2017

Protocol - Post Construction Avian and Bat Studies
Palmer's Creek Wind Farm

This document is prepared in conformance with the **U.S. Fish and Wildlife Service Land-Based Wind Energy Guidelines** and serves as the Post Construction Avian and Bat Study Protocol for the Palmer's Creek Wind Farm (PCWF), located north of Granite Falls, Chippewa County, Minnesota. The purpose of the proposed protocol is to satisfy the requirements of the PCWF Bird and Bat Conservation Strategy. The anticipated tasks include:

- Post-Construction Fatality Monitoring, including Searcher Efficiency Trials and Carcass Removal Trials

Post Construction Fatality Monitoring

Post Construction fatality monitoring will be conducted for the first two years of operation in accordance with Tier 4 of the U.S. Fish and Wildlife Service' Land-Based Wind Energy Guidelines and designed to answer the following questions:

- What are the fatality rates for the project?
- What are the fatality rates for species of concern?
- How do the estimated fatality rates compare to the predicted rates?
- Do fatalities vary within the project site in relation to site characteristics?
- How do the fatality rates compare to other projects in similar landscapes?
- What is the composition of fatalities in relation to migrating vs. resident birds/bats?
- Do the data suggest the need to employ measures to reduce impacts?
- All eighteen turbines will be monitored.

Carcass searches will be conducted for two full years, commencing within 60 days of COD, as allowed by weather conditions and safety considerations.

- Weekly from March through September
- Twice per month from October through February

The following information will be recorded at each turbine site:

- Weather conditions
- Ground cover conditions
- Start and finish times of survey
- Potential prey species, other than birds, observed within the survey area

Potential scavenge items, other than birds, will be either buried or removed.

All eighteen turbines will be included in the carcass searches. The survey area will be a 60-meter radius around each turbine.

Searches will take place at 10-meter transects out to 60 meters with a search area of 10 m centered on the transect centerline (5 m on each side). During periods of snow cover or other unsafe conditions, search patterns and methods may be modified to include different transect patterns and/or road and pad searches. Modified search methods will be documented in the permanent field notes.

All searches, with or without fatalities, shall be recorded on an Incident Report Form (Attached).

The USFWS, MNDOC, MNPUC and MNDNR (Interested Parties) shall be notified if:

- 5 or more dead or injured non-listed avian or bat species are discovered within a survey week, or;
- 1 or more dead or injured state threatened or endangered species or species of special concern, or;
- 1 or more dead or injured federally listed species, or;
- 1 or more dead or injured bald or gold eagle.

The specimen(s) shall be geo-located and the coordinates provided to Interested Parties.

Searcher Efficiency Trials

Searcher Efficiency Trials shall be conducted to estimate the proportion of carcasses found by searchers.

A minimum of 100 carcasses/year will be used for the trials.

Trials will be conducted during each season (spring, summer, fall, winter).

Carcasses representing small, medium and large birds will be used.

Carcasses will be discreetly marked before placement.

The location of all placed carcasses will be marked with GPS.

All field personnel involved in Fatality Monitoring will be involved in Searcher Efficiency Trials.

A carcass missed by the searcher but found by the trial conductor shall be considered “Available-Not Detected”.

A carcass missed by the searcher and not found by the trial conductor shall be considered “Unavailable”. It will be assumed that this carcass was scavenged or otherwise removed.

At the end of each trial, the searcher efficiency will be calculated.

Unless being used for Carcass Removal Trials, all carcasses placed will be removed after Searcher Efficiency Trials have concluded.

Carcass Removal Trials

Carcass Removal Trials will be conducted to estimate the average length of time a carcass remains in the area and is potentially detectable.

Removal can be by scavenging or by other means, such as being buried or concealed during cultivation.

Carcasses will be placed in various locations under turbines and their location recorded by GPS.

The carcasses will be checked every day for the first four days, and then on day 7, 10, and 14, after which all remains will be removed and disposed of.

Reporting

An Annual Report shall be submitted to the Interested Parties by March 30 of the following year. The Annual Report shall:

1. Identify fatalities, including location and date of discovery;
2. List Total number of fatalities for each Quarter;
3. Include adjusted fatality estimates for each season and for small, medium and large birds, as well as bats
4. Include an analysis of spatial, seasonal and habitat relationships to the fatalities
5. Present standardized results using accepted statistical analyses

Personnel

Post Construction Avian and Bat Studies performed at Palmer’s Creek Wind Farm will be supervised by Michael Rutledge, a qualified biologist. All team members participating in the surveys will receive a minimum of 6 hours of classroom and field training.

Palmer's Creek Wind Farm Fatality Monitoring Survey Data Form
Site Summary

Observer Name: ______________________ Survey Start Time: ______________

Date: ______________________ Survey End Time: ______________

Turbine ID: ______________________

Weather:

¨ Clear

¨ Partly Cloudy

¨ Overcast

¨ Fog

¨ Rain

Temperature (Beginning of survey): ______________________

Ground Cover/Visibility Class: **¨ A** **¨ B** **¨ C** **¨ D**

Prey Species On-Site: ¨ No ¨ Yes, Complete below

Species: ____

Distance from Turbine ______________

Direction from Turbine ______________

Fatalities Discovered: ¨ No ¨ Yes, Complete Incident Report Form for each fatality

Total Fatalities: ______________

Injuries Discovered: ¨ No ¨ Yes, Complete Incident Report Form for each injury

Total Injuries: ______________

Notes:

***Ground Cover Type/Visibility Class:**
A-More than 90% bare ground, sparse vegetation less than 6" tall
B-More than 25% bare ground, mostly sparse vegetation less than 6" tall
C-Less than 25% bare ground, less than 25% of vegetation is more than 12" tall or ground is rocky/scrubby
D-Less than 25% bare ground, more than 25% of vegetation is more than 12" tall

Incident Report Form

¨ Bird ¨ Bat Identification Number________________________________

Species (If known)____

Carcass : ¨ Complete ¨ Dismembered ¨ Partial

Carcass Condition: ¨ Fresh ¨ Decomposing ¨ Desiccated

Time Since Death: ¨ < 1 day ¨ < 1 week ¨ > 1 week ¨ Unknown

Notes:____

¨ Bird ¨ Bat Identification Number________________________________

Species (If known)____

Carcass : ¨ Complete ¨ Dismembered ¨ Partial

Carcass Condition: ¨ Fresh ¨ Decomposing ¨ Desiccated

Time Since Death: ¨ < 1 day ¨ < 1 week ¨ > 1 week ¨ Unknown

Notes:____

¨ Bird ¨ Bat Identification Number________________________________

Species (If known)____

Carcass : ¨ Complete ¨ Dismembered ¨ Partial

Carcass Condition: ¨ Fresh ¨ Decomposing ¨ Desiccated

Time Since Death: ¨ < 1 day ¨ < 1 week ¨ > 1 week ¨ Unknown

Notes:____

¨ Bird ¨ Bat Identification Number________________________________

Species (If known)____

Carcass : ¨ Complete ¨ Dismembered ¨ Partial

Carcass Condition: ¨ Fresh ¨ Decomposing ¨ Desiccated

Time Since Death: ¨ < 1 day ¨ < 1 week ¨ > 1 week ¨ Unknown

Notes:____

***Procedure for Carcass Marking**

Photograph carcass front and back with pen or other item in picture for size reference. Save Images.

From Main Screen, tap “Mark Waypoint”. Tap on “Edit” on the next screen. Tap on numeric field at top of screen. Enter Carcass Identifier using the following format: Two digit Turbine # (ex. OT01, CC01), dash, six digit date, dash, four digit sample number. Tap the checkmark at the bottom of the screen to save your entries. Tap on the three lines icon at the bottom of the screen and select “Change Photo”. Select the best photo of the carcass in question and then select “Use” from the bottom of the screen. Tap “Save” at the bottom of the screen and you are done.

APPENDIX F – CONSISTENCY EVALUATION FORMS

Programmatic Biological Assessment Project Consistency Evaluation Form*
Upper Great Plains Region Wind Energy Development Program

(for USFWS Internal Use Only) *TAILS S7 Bundle #:* ______
Individual TAILS Log #: ______

Project Proponent

Project Name:	Palmer's Creek Wind Farm	Developer:	Palmer's Creek Wind Farm, LLC.
State:	Minnesota	City:	Granite Falls
County:	Chippewa	State:	Minnesota
Township, Range & Sections:	T116N-R39W-Secs. 3-10, 15-22,27,28 and 29 T116N-R40W-Secs. 1, 12 and 13	POC:	Kate Carlton
		Phone:	320-564-5392

Federal Agency/Point of Contact

Fish & Wildlife Service Ecological Services Field Office		Western Area Power Administration	
City:	Bloomington	City:	Billings
State:	Minnesota	State:	Montana
POC:	Margaret Rheude	POC:	Lou Hanebury
Phone:	952-252-0092 ext. 202	Phone:	406-255-2812

For actions involving USFWS Land interests:

USFWS Wetland Management District: ______
City: ______ State: ______
POC: ______
Phone: ______

	Y	N
USFWS Property Interest	☐	☒
Grassland Easement Exchange	☐	☒

Project Description Overview with Best Estimates

Construction Initiation Date:	7/1/2017	Max. Turbine Ht:	148 meters	Project Area Size:	6,150 acres
Construction Completion Date:	2/28/2018	Turbine Pad Size:	0.65 acres	Wind Reserve Area Size:	
Number Turbines:	18	Miles (km) of New Road:	4.7 miles	Power Generating Initiation Date:	3/1/2018
Turbine Tower Height (ft/m):	80-90m	Miles (km) Improved Road:	0.8 miles	Project Termination Date:	3/31/2058
Turbine RSA:	10,568 sq. meters	Miles (km) Existing County Rd:	6.2 miles		

Turbine Size (MW), Make & Model: GE 2.3MW-116; GE 2.5MW-116

Collector Lines from Turbine to Substation: Miles Buried: 14 miles Miles Overhead: 0.19 miles (1,000 feet)

To help demonstrate compliance with the BMPs, Species Specific Avoidance and Minimization Measures, a complete application must include maps of the project area and associated species/habitat/buffer zones. Maps attached Yes ☒ No ☐

Land Cover Types Affected *NLCD, 2011.

	Yes	No	Private	State	Federal	Subtotal	% Total	Description/Comments
Native Grass	☒	☐	192				3.12	Small patches along streams and narrow drainages that can't be tilled.
Tame Grass	☒	☐	284				4.62	Mixed species assemblages of intermediate wheatgrass, alfalfa, quackgrass, smooth brome, and some native component. Hayed but not necessarily each year.
Agricultural	☒	☐	5,157				83.85	Tillable, cropped farm land.
Wetland	☒	☐	165				2.68	Freshwater emergent wetland, freshwater forested/shrub wetland, freshwater pond, riverine (Palmer's Creek, Minnesota River, and County ditches.
Riparian	☐	☒	0				0	
Trees	☒	☐	138				2.24	Native trees in woody drainages, decadent shelterbelts around farmsteads, shrub/scrub.
Other	☒	☐	214				3.48	Barren land (rocks/sand/clay), developed (roads, houses).
Total			6,150				100%	See also the attached Table (Temporary and Permanent Land Disturbance).

ESA Listed (L), Proposed (P) and Candidate (C) Species Affected (Check Boxes)

Plants	Invertebrates	Fish	Reptiles	Birds	Mammals
☐ EP Fringed Orchid (L)	☐ American Burying Beetle (L)	☐ Bull Trout (L)	☐ Eastern Massasauga (C)	☐ G. Sage Grouse (C)	☐ Black-footed Ferret (L)
☐ Mead's Milkweed (L)	☒ Dakota Skipper (L)	☐ Pallid Sturgeon (L)		☐ Int. Least Tern (L)	☐ Canada Lynx (L)
☐ Prairie Bush Clover (L)	☐ Higgins Eye (L)	☐ Topeka Shiner (L)		☐ Piping Plover (L)	☐ Gray Wolf (L)
☐ Ute Ladies'-Tresses (L)	☒ Poweshiek Skipperling (L)			☐ Rufa Red Knot (L)	☐ Grizzly Bear (L)
☐ WP Fringed Orchid (L)	☐ Salt Creek Tiger Beetle (L)			☐ Sprague's Pipit (C)	☐ Indiana Bat (L)
☐ Whitebark Pine (C)	☐ Scaleshell Mussel (L)			☐ Whooping Crane (L)	☒ N. Long-Eared Bat (L)

[X] **Project proponent has reviewed the Programmatic Wind Energy EIS and BA, Appendix B of the BA relating to Species Consistency Evaluation Forms, and the U.S. Fish and Wildlife Service Land-Based Wind Energy Guidelines.**

Commitment to incorporate applicable BMPs and Species-Specific Avoidance & Minimization Measures into the project plan:

Kate Carlton

Project Proponent (Point of Contact)	Signature	Date

Agency Verification of Compliance with the Programmatic Wind Energy Biological Assessment:

Matthew Marsh

Western Area Power Administration (Point of Contact)	Signature	Date

Margaret Rheude

U.S. Fish & Wildlife Service (Point of Contact)	Signature	Date

NA

U.S. Fish & Wildlife Service (ES Field Office Lead Biologist)	Signature	Date

***Version 3: March 2015**

Programmatic Biological Assessment Species Consistency Evaluation Form
Upper Great Plains Region Wind Energy Development Program
Impact Information and Consistency Determination

Dakota skipper (*Hesperia dacotae*)

Project Name: Palmer's Creek Wind Farm

Company: Palmer's Creek Wind Farm, LLC.

Best Management Practices

- [X] All general BMPs, as stated in the final *Programmatic Environmental Impact Statement for the Upper Great Plains Region Wind Energy Program* and table 4.5-1 of the final *Programmatic Biological Assessment for the Upper Great Plains Region Wind Energy Program,* will be implemented where appropriate, during each phase of the project (i.e., site characterization, construction, operations, and decommissioning). Although not all-inclusive, several of the more important BMPs for the conservation of this species follow.
    - [X] Projects shall be designed to utilize existing roads and utility corridors to the maximum extent feasible, and to minimize the number and length/size of new roads, laydown areas, and borrow areas.
    - [X] Locate stationary construction equipment (e.g., compressors or generators) outside of and as far as practical from Dakota skipper occupied habitat and proposed critical habitat.
    - [X] Minimize the size of areas in which soil would be disturbed or vegetation would be removed.
    - [X] When disturbed areas are reclaimed, reseed with obligate plant species of suitable habitat.

Species-Specific Avoidance Measures

- [X] Conduct preconstruction evaluations and/or surveys in areas of potential occurrence to identify suitable habitat and areas of occurrence within project boundaries.
- [X] Do not site turbines, access roads, transmission line towers, or other project facilities in occupied habitat or suitable habitat within 0.6 mi (1 km) of occupied habitat.
- [X] Do not site turbines, access roads, transmission line towers, or other project facilities in proposed critical habitat or within a 0.6 mi (1 km) buffer zone.

Species-Specific Minimization Measures

For projects that encompass suitable, but unoccupied, habitat farther than 0.6 mi (1 km) from occupied habitat:

- [ ] Obtain a grassland easement of native prairie, equal to the amount disturbed that contains obligate plant species to minimize additional loss of suitable habitat, or improve existing nearby grassland easements to incorporate obligate plants to provide additional suitable habitat.
- [X] Avoid broadcast applications of pesticides or herbicides that may be harmful to Dakota skippers or their nectar plants in Dakota skipper habitat. Ensure that field crews recognize target weeds to avoid adverse effects on important native species. Applications should be made by appropriately licensed applicators where required and applied only in accordance with label and application permit directions and stipulations for terrestrial and aquatic applications. Limit pesticide use to non-persistent immobile pesticides.

Impact Information

Project within county with recorded Dakota skippers?	[X] Yes	[ ] No	
Preconstruction evaluations conducted with USFWS?	[ ] Yes	[X] No	Dates:
Parties involved:			
Suitable habitat in or near project footprint?	[ ] Yes	[X] No	
Distance from suitable habitat:	25.9	Miles	
Distance from proposed critical habitat?	25.9	Miles	
Has habitat been surveyed to protocol?	[ ] Yes	[X] No	Dates of survey:
Result of survey:	[ ] Occupied (species detected)		[ ] Not occupied (species not detected)
If occupied, 0.6 mi (1km) buffer zones delineated?	[ ] Yes	[ ] No	
Map of project footprint and species habitat attached?	[X] Yes	[ ] No	

Dakota skipper (*Hesperia dacotae*)

Effects—Explanation of consistency determination with programmatic effects determination of "may affect, not likely to adversely affect" or "no effect":

The Dakota skipper is a small butterfly found in the tallgrass and mixed-grass prairies of the Northern Great Plains. It is federally listed as a threatened species with designated critical habitat. Dakota skippers have a single flight per year occurring from the middle of June through the end of July (Dana 1991). Eggs hatch after incubating for 7–20 days; larvae shelter and forage at the bases of grass plants, overwintering at or below the ground surface (Dana 1991). Current data suggests that dispersal of Dakota skipper is very limited (USFWS 2014, 79 FR 63672), and individuals may be incapable of moving greater than one kilometer (0.6 miles) between patches of prairie habitat separated by structurally similar habitats (Cochrane and Delphey 2002). Roads and crop fields have been suspected to impede movements between patches, and movements are more likely along ridges than across valleys (Dana 1991). The Dakota skipper requires native prairie habitat for reproduction, foraging, and overwintering at or below ground, and do not typically move great distances between native prairie areas.

The project has been designed to avoid native prairie, where Dakota skippers complete their life cycle, by following established utility corridors along active roadways and previously disturbed areas, such as cultivated or managed agricultural areas. The project area has 192 acres (3.12% of project area) of herbaceous grassland, and 284 acres (4.62%) of pasutre/hay land (NLCD 2011). However, these habitats are mostly associated with dense woody drainages and have abundant shrubs and invasive vegetative species present. Refer to Figure 3, Land Cover. The disturbance to these habitats is minimal, 0.5 acres and 1.2 acres. Refer to Table 1, Temporary and Permanent Land Disturbance. Therefore, the project would not cause additional fragmentation of habitat, new barriers to dispersal, loss of connectivity, changes in distribution or isolation of known populations. The habitats are not anticipated to be that of suitable habitat for the species. The grassland patches are separated by roads, woody draws, and cropped fields. Further, the project area is located 25.9 miles from the nearest designated critical habitat. Refer to Figure 5, Dakota Skipper Map. There is no indication that the project would result in biologically meaningful or measurable changes to the existing habitat, individuals, or population of Dakota skipper.

Palmer's Creek has committed to implement the conservation measures identified in the Programmatic BA applicable to species in the project area and the conservation measures identified in the PBO for the Dakota skipper. With implementation of these measures, the Palmer’s Creek Project and WAPA’s transmission line **may affect, but is not likely to adversely effect**, the Dakota skipper.

REFERENCES

Cochrane, J. F., and P. Delphey. 2002. Status assessment and conservation guidelines: Dakota Skipper, Hesperia dacotae (Skinner) (Lepidoptera: Hesperiidae), Iowa, Minnesota, North Dakota, South Dakota, Manitoba, and Saskatchewan. Department of the Interior, U.S. Fish and Wildlife Service, Twin Cities Field Office, Minneapolis, Minnesota. 92 pp.

Dana, R. P. 1991. Conservation management of the prairie skippers Hesperia dacotae and Hesperia ottoe. Station Bulletin 594-1991 (AD-SB-5511-S), Minnesota Agricultural Experiment Station, University of Minnesota, St. Paul, Minnesota.

Federal Register 79:206 (24 October, 2014) pp. 63672-63748.

National Land Cover Database (NLCD). 2011. From Homer et al. 2015 Completion of the 2011 National Land Cover Database for the conterminous United States-Representing a decade of land cover change information. Photogrammetric Engineering and Remote Sensing, v. 81, no. 5, p. 345-354. Accessed online February 2015 at: http://www.mrlc.gov/nlcd2011.php.

U.S. Fish and Wildlife Service (USFWS). 2014. (79 FR 63672) Endangered and Threatened Wildlife and Plants; Threatened Species Status for Dakota Skipper and Endangered Species Status for Poweshiek Skipperling.

Programmatic Biological Assessment Species Consistency Evaluation Form
Upper Great Plains Region Wind Energy Development Program
Impact Information and Consistency Determination

Poweshiek skipperling (*Oarisma poweshiek*)

Project Name: Palmer's Creek Wind Farm

Company: Palmer's Creek Wind Farm, LLC.

Best Management Practices

- [X] All general BMPs, as stated in the final *Programmatic Environmental Impact Statement for the Upper Great Plains Region Wind Energy Program* and table 4.5-1 of the final *Programmatic Biological Assessment for the Upper Great Plains Region Wind Energy Program,* will be implemented where appropriate, during each phase of the project (i.e., site characterization, construction, operations, and decommissioning). Although not all-inclusive, several of the more important BMPs for the conservation of this species follow.
  - [X] Projects shall be designed to utilize existing roads and utility corridors to the maximum extent feasible, and to minimize the number and length/size of new roads, laydown areas, and borrow areas.
  - [X] Locate stationary construction equipment (e.g., compressors or generators) outside of and as far as practical from Poweshiek skipperling occupied habitat and proposed critical habitat.
  - [X] Minimize the size of areas in which soil would be disturbed or vegetation would be removed.
  - [X] When disturbed areas are reclaimed, reseed with obligate plant species of suitable habitat.

Species-Specific Avoidance Measures

- [X] Conduct preconstruction evaluations and/or surveys in areas of potential occurrence to identify suitable habitat and areas of occurrence within project boundaries.
- [X] Do not site turbines, access roads, transmission line towers, or other project facilities in occupied habitat or suitable habitat within 0.6 mi (1 km) of occupied habitat.
- [X] Do not site turbines, access roads, transmission line towers, or other project facilities in proposed critical habitat or within a 0.6 mi (1 km) buffer zone.

Species-Specific Minimization Measures

For projects that encompass suitable, but unoccupied habitat farther than 0.6 mi (1 km) from occupied habitat:

- [ ] Obtain a grassland easement of native prairie, equal to the amount disturbed that contains obligate plant species to minimize additional loss of suitable habitat, or improve existing nearby grassland easements to incorporate obligate plants to provide additional suitable habitat.
- [X] Avoid broadcast applications of pesticides or herbicides that may be harmful to the Poweshiek skipperling or their nectar plants in Poweshiek skipperling habitat. Ensure that field crews recognize target weeds to avoid adverse effects on important native species. Applications should be made by appropriately licensed applicators where required and applied only in accordance with label and application permit directions and stipulations for terrestrial and aquatic applications. Limit pesticide use to non-persistent immobile pesticides.

Impact Information

Project within county with recorded Poweshiek skipperlings?	[X] Yes	[ ] No	
Preconstruction evaluations conducted with USFWS?	[ ] Yes	[X] No	Dates:
Parties involved:			
Suitable habitat in or near project footprint?	[ ] Yes	[X] No	
Distance from suitable habitat:	25.9	Miles	
Distance from proposed critical habitat:	25.9	Miles	
Has habitat been surveyed to protocol?	[ ] Yes	[X] No	Dates of survey:
Result of survey:	[ ] Occupied (species detected)		[ ] Not occupied (species not detected)
If occupied, 0.6 mi (1 km) buffer zones delineated?	[ ] Yes	[ ] No	
Map of project footprint and species habitat attached?	[X] Yes	[ ] No	

Poweshiek skipperling (*Oarisma poweshiek*)

Effects—Explanation of consistency determination with programmatic effects determination of "may affect, not likely to adversely affect" or "no effect":

The Poweshiek skipperling is a small butterfly that requires high quality tallgrass prairie in both upland, dry areas as well as low, moist areas. It is federally-listed as an endangered species with designated critical habitat. Similar to the Dakota skipper, the Poweshiek skipperling larvae (caterpillars) hibernate during winter on the ground; they resume activity in spring and continue developing until they pupate and emerge as adult butterflies, which have a short lifespan of only one to two weeks between mid-June and mid-July. Adult butterflies feed on nectar from prairie flowers such as purple coneflower (*Echinacea angustifolia*), blackeyed susan (*Rudbeckia hirta*) and palespike lobelia (*Lobelia spicata*) (USFWS 2016).

Historically, Poweshiek skipperlings were found in tallgrass prairie and prairie fens from Manitoba to Iowa, with populations also found in Michigan and Wisconsin. According to the USFWS, the Poweshiek skipperling may have been extirpated from the Dakotas, Minnesota and Iowa within the last 10 years. During surveys in 2014, the species could be found only at a few limited sites in Michigan, Wisconsin, and in Manitoba (USFWS 2016).

The project area contains relatively small areas of native prairie, which are outside of the construction limits of the project, and would therefore not be disturbed. The project has been designed to avoid native prairie, where Poweshiek skipperlings complete their life cycle, by following established utility corridors along active roadways and previously disturbed areas, such as cultivated or managed agricultural areas. The project area has 192 acres (3.12% of project area) of herbaceous grassland, and 284 acres (4.62%) of pasutre/hay land (NLCD 2011). However, these habitats are mostly associated with dense woody drainages and have abundant shrubs and invasive vegetative species present. Refer to Figure 3, Land Cover. The disturbance to these habitats is minimal, 0.5 acres and 1.2 acres. Refer to Table 1, Temporary and Permanent Land Disturbance. Therefore, the project would not cause additional fragmentation of habitat, new barriers to dispersal, loss of connectivity, changes in distribution or isolation of known populations. The habitats are not anticipated to be that of suitable habitat for the species. The grassland patches are separated by roads, woody draws, and cropped fields. Further, the project area is located 25.9 miles from the nearest designated critical habitat. Refer to Figure 5, Dakota Skipper Map. There is no indication that the project would result in biologically meaningful or measurable changes to the existing habitat, individuals, or population of Poweshiek skipperling.

Palmer's Creek has committed to implement the conservation measures identified in the Programmatic BA applicable to species in the project area and the conservation measures identified in the PBO for the Poweshiek skipperling. With implementation of these measures, the Palmer's Creek Project and WAPA's transmission line **may affect, but is not likely to adversely effect**, the Poweshiek skipperling.

REFERENCES

National Land Cover Database (NLCD). 2011. From Homer et al. 2015 Completion of the 2011 National Land Cover Database for the conterminous United States-Representing a decade of land cover change information. Photogrammetric Engineering and Remote Sensing, v. 81, no. 5, p. 345-354. Accessed online February 2015 at: http://www.mrlc.gov/nlcd2011.php.

U.S. Fish and Wildlife Service (USFWS). 2016. Poweshiek skipperling. Available online: https://www.fws.gov/midwest/endangered/insects/posk/index.html. Updated December 5, 2016. Accessed March 2017.

Programmatic Biological Assessment Species Consistency Evaluation Form
Upper Great Plains Region Wind Energy Development Program
Impact Information and Consistency Determination

Northern long-eared bat *(Myotis septentrionalis)*

Project Name: Palmer's Creek Wind Farm

Company: Palmer's Creek Wind Farm, LLC.

Best Management Practices

☒ All general BMPs, as stated in the final *Programmatic Environmental Impact Statement for the Upper Great Plains Region Wind Energy Program* and table 4.5-1 of the final *Programmatic Biological Assessment for the Upper Great Plains Region Wind Energy Program,* will be implemented where appropriate, during each phase of the project (i.e., site characterization, construction, operations, and decommissioning). Although not all-inclusive, several of the more important BMPs for the conservation of this species follow.

- ☒ Activities with continuous periods (i.e., longer than 24 hours) of noise disturbances greater than 75 db measured on the A scale (e.g., loud machinery) should be avoided within a 1-mi (1.6-km) radius of known or assumed northern long-eared bat hibernacula.
- ☒ Restrict use of herbicides for vegetation management near known or assumed northern long-eared bat hibernacula to those specifically approved for use in karst (e.g., sinkholes) and water (e.g., streams, ponds, lakes, wetlands).
- ☒ Avoid clearing of suitable habitat (spring staging, fall swarming, summer roosting) within a 5-mile (8.0 km) radius of known or assumed northern long-eared bat hibernacula. Retain snags, dead/dying trees, and trees with exfoliating (loose) bark ≥3-in. (7.6-cm) diameter at breast height (dbh) in areas ≤1 mi (1.6 km) from water.
- ☒ Develop and implement a Bird and Bat Conservation Strategy (BBCS) as described in the *Land-Based Wind Energy Guidelines* that includes survey protocols acceptable to the USFWS in the project area during the spring and fall bird and bat migration seasons. Mortality monitoring will help to identify individual turbines that contribute to avian and bat mortality. This information could be used to provide design layout information for future wind development projects and to reduce the potential for future avian and bat mortality.

Species-Specific Avoidance Measures

☒ Throughout the range of the northern long-eared bat within the UGP Region, conduct preconstruction evaluations and/or surveys to identify suitable foraging, roosting, and commuting habitat within project boundaries and to identify the distance from project boundaries to hibernacula known/presumed used by northern long-eared bats. Disturbance of hibernacula is prohibited throughout the year.

☒ Avoid all suitable habitat (do not site turbines) in areas within 5 mi (8 km) of hibernacula used by northern long-eared bats or within 0.5 mi (0.8 km) of known or presumed occupied foraging, roosting, and commuting habitat. Habitat evaluations should be coordinated with the local USFWS Ecological Services Office prior to or during turbine site planning.

Species-Specific Minimization Measures

☒ A robust survey developed and implemented as part of the BBCS program, consistent with the Wind Energy Guidelines and approved by the USFWS during the preconstruction evaluation and survey stage, will be implemented for a minimum of 1 yr preconstruction.

☒ The need for implementation of cut-in speeds higher than manufacturers' recommendations during the fall bat migration period will be based on the following site-specific, project-by-project risk assessments by the State Ecological Services Field Office of the USFWS:

- During the preconstruction evaluation and survey stage, and based on a collision risk assessment of location of the project, proximity to potential summer habitat, distance to known occurrences, distance to known hibernacula, and suspected migration patterns, the applicant will coordinate with Western, Refuges, and the local Ecological Services Field Offices of the USFWS to determine if the risk of injury or mortality is sufficiently high to warrant higher cut-in speeds.
- In the event that preconstruction surveys indicate species occurrence or occupancy of habitat adjacent to the project area, higher turbine cut-in speeds will be required to offset the increased risk for injury or mortality. The monitoring must be rigorous enough to meet standards acceptable to the local USFWS State office.
- When warranted by either of the two aforementioned conditions for specific projects, turbine cut-in speeds will be increased to 16.4 ft/sec (5.0 m/sec) or greater from 0.5 hour before sunset to 0.5 hour after sunrise during the fall migration period (generally August 15–October 15, but consult with the USFWS for the established migration dates in each State) for northern long-eared bats in the western and central areas of the UGP Region. In the eastern fringe of the UGP Region, a minimum cut-in speed of 22.6 ft/sec (6.9 m/sec) from 0.5 hour before sunset to 0.5 hour after sunrise during the fall migration period (generally August 15–October 15, but consult with the USFWS for established migration dates in each State) for northern long-eared bats is required. Areas within the UGP Region that occur east of the western borders of Minnesota and Iowa will be used as the line of demarcation where the minimum cut-in speed of 22.6 ft/sec (6.9 m/sec) will be used. Use of feathering below the respective cut-in speed of 16.4 ft/sec (5.0 m/sec) or 22.6 ft/sec (6.9 m/sec) will also be implemented at night during the fall migration season to eliminate turbine rotation and avoid mortality of migrating northern long-eared bats. Increased cut-in speed and feathering can be suspended from 0.5 hour after sunrise to 0.5 hour before sunset.

☒ Immediately report observations of northern long-eared bat mortality to the appropriate USFWS office.

Programmatic Biological Assessment Species Consistency Evaluation Form
Upper Great Plains Region Wind Energy Development Program
Impact Information and Consistency Determination

Northern long-eared bat *(Myotis septentrionalis)*

Impact Information

Project within county with recorded northern long-eared bat? ☐ Yes ☒ No

Preconstruction evaluations conducted with USFWS? ☒ Yes ☐ No Dates: 1/18/2017

Parties involved: WAPA, USFWS, MNDNR, MNDOC, Fagen, Wenck, New Century Env., Palmer's Creek Wind Farm, LLC

Suitable foraging or roosting habitat in or near project footprint? ☒ Yes ☐ No

Distance from suitable habitat: 0.0 Miles

Distance from hibernacula: 80.4 Miles

Has habitat been surveyed to protocol? ☒ Yes ☐ No Dates of survey:

Result of survey: ☐ Occupied (species detected) ☒ Not occupied (species not detected)

Turbine cut-in speed: 3.0 m/sec

Map of project footprint and species habitat attached? ☒ Yes ☐ No

Effects—Explanation of consistency determination with programmatic effects determination of "may affect, not likely to adversely affect" or "no effect":

The northern long-eared bat (NLEB), also known as the Northern *Myotis*, is widely distributed in Canada and throughout the eastern half of the United States. It was designated a species of special concern in Minnesota in 1984, at which time it was known from only a few widely-distributed localities in the state. Subsequent survey work has documented additional locations in Minnesota and confirmed that the species can be found in the state in both summer and winter. A large hibernaculum was discovered in St. Louis County, and NLEBs have been found in most other caves and mines surveyed in Minnesota, though typically in low numbers (Bowman 2016). The project area is located in an area of Minnesota with no documented NLEB hibernacula. Refer to Figure 4, Townships Containing Documented Northern Long-Eared Bat Maternity Roost Trees and/or Hibernacula Entrances.

Bat surveys during summer involve documenting foraging bats and locating maternity colonies. Bats within the WRA (wind resource area) were surveyed using a bat detector and laptop computer. The ultrasonic calls of foraging bats are displayed on the computer screen and permanently stored in electronic files. The NLEB myotis was not documented at the Palmer's Creek Wind Farm study site. Even though a total of eight clicks were identified by Kaleidoscope Pro as MYSE (NLEB myotis), its p-value was 1 for every bat detector on site, indicating absence of the NLEB myotis from the site and any matching calls being in error. As discussed in the wildlife report and above, no northern long-eared bats were observed during acoustical surveys for the Project (NCE 2017). However, suitable habitat can be found in the project area. Refer to Figure 3, Land Cover.

Old buildings and hollow trees are potential hibernacula sites during the winter, but caves and mines are the favored choice for hibernating bats, especially for the NLEB. NLEBs have been found in the winter in Minnesota in natural caves, sand mines, and deep iron mines. Hibernacula are shared between both sexes and often multiple species of bat. Preferred sites typically have high humidity levels, minimal airflow, and a constant temperature (Fitch and Shump 1979). Based on the preferred sites criteria, hibernacula sites within the study area are unlikely. The study area contains none to very little hibernacula sites specific to NLEB. After spring emergence, bats migrate to summer roosting and foraging grounds.

In summer, the NLEB is often associated with forested habitats (Fire-Dependent Forests, Mesic Hardwood Forests, and Floodplain Forests) where they make use of tree roosts, especially near water sources. Loose bark, broken tree limbs, cavities, and cracks in a tree can all be utilized by bats as roosting sites. The sexes tend to roost separately, with females forming small (~30 individuals) maternity colonies to bear and rear their offspring. Males often roost alone, as they do not have the same high temperature needs as maternity colonies.

Summer roosting and foraging grounds are more of a possibility to house NLEB within the study area (Bowman 2016). According to the surveys conducted in 2015/2016, the NLEB is extremely unlikely to be present even during the spring/summer/autumn times. Acoustic bat monitoring was conducted from the fall of 2015 through mid-October of 2016. Acoustic bat monitoring will continue in 2017 starting in April.

The project has been designed to avoid impacting forested habitats (Figure 3, Land Cover) with only 1 acre of temporary disturbance expected. Refer to Table 1, Temporary and Permanent Land Disturbance.

Palmer's Creek has committed to implement the conservation measures identified in the Programmatic BA applicable to species in the project area. With zero NLEB documented onsite, implementation of applicable conservation measures, and continuance of monitoring for the species, the Palmer's Creek Project and WAPA's transmission line **may affect, but is not likely to adversely effect**, the northern long-eared bat.

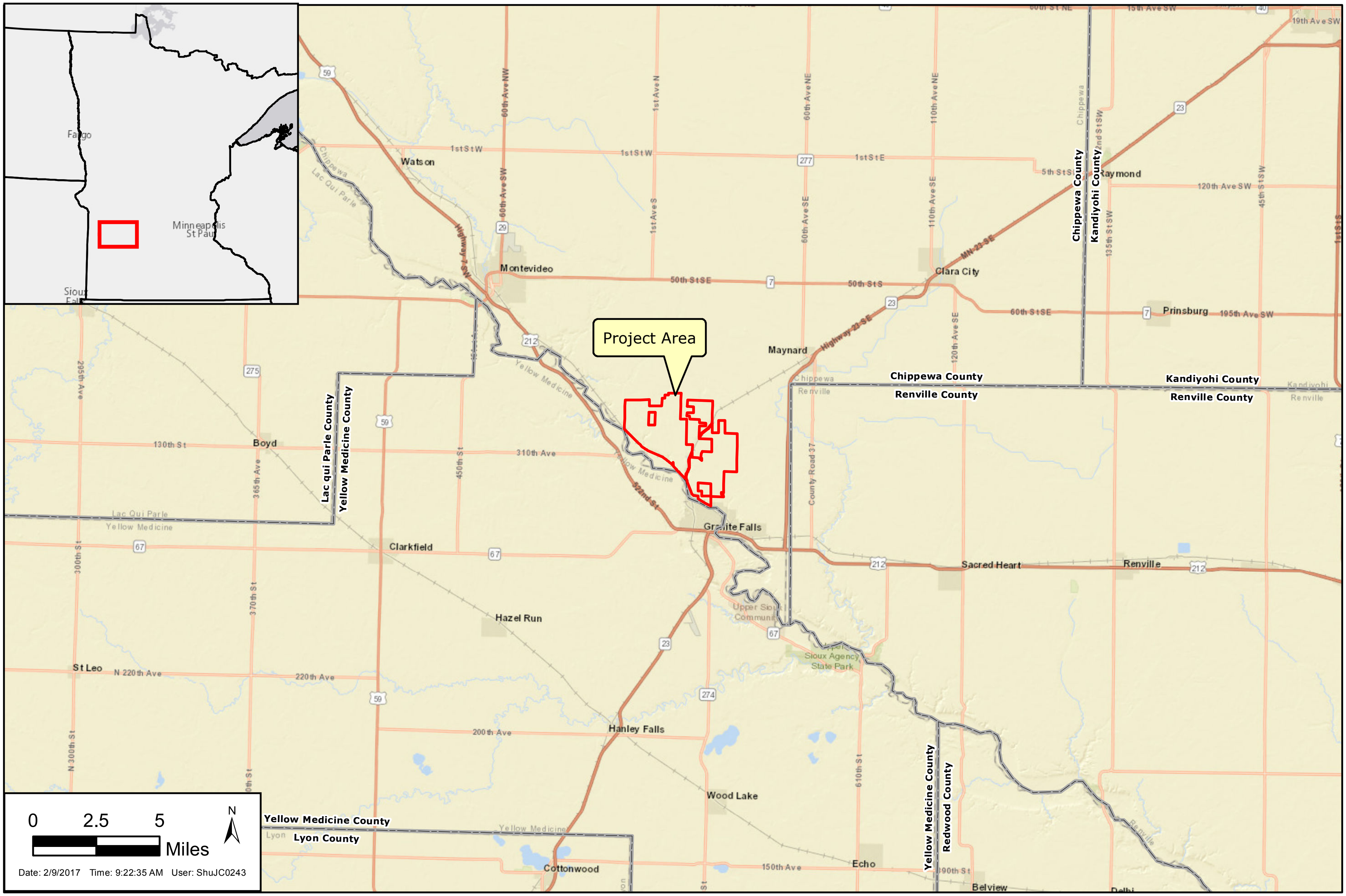
REFERENCES

Bowman, Melissa. 2016. Rare Species Guide. Minnesota Department of Natural Resources. Available online: <http://www.dnr.state.mn.us/>.

Fitch, J. H. and K. A. Shump, Jr. 1979. Myotis keenii. Mammalian Species 121:1-3.

New Century Environmental. 2017. Palmer's Creek Wind Farm Northern long-eared bat overview/background, draft report. April 5 2017.

Figures



Path: L:\2759\05 Palmers Creek Wind Farm\09 Site Permit Application\MXD\Site Location.mxd

PALMER'S CREEK WIND FARM, LLC

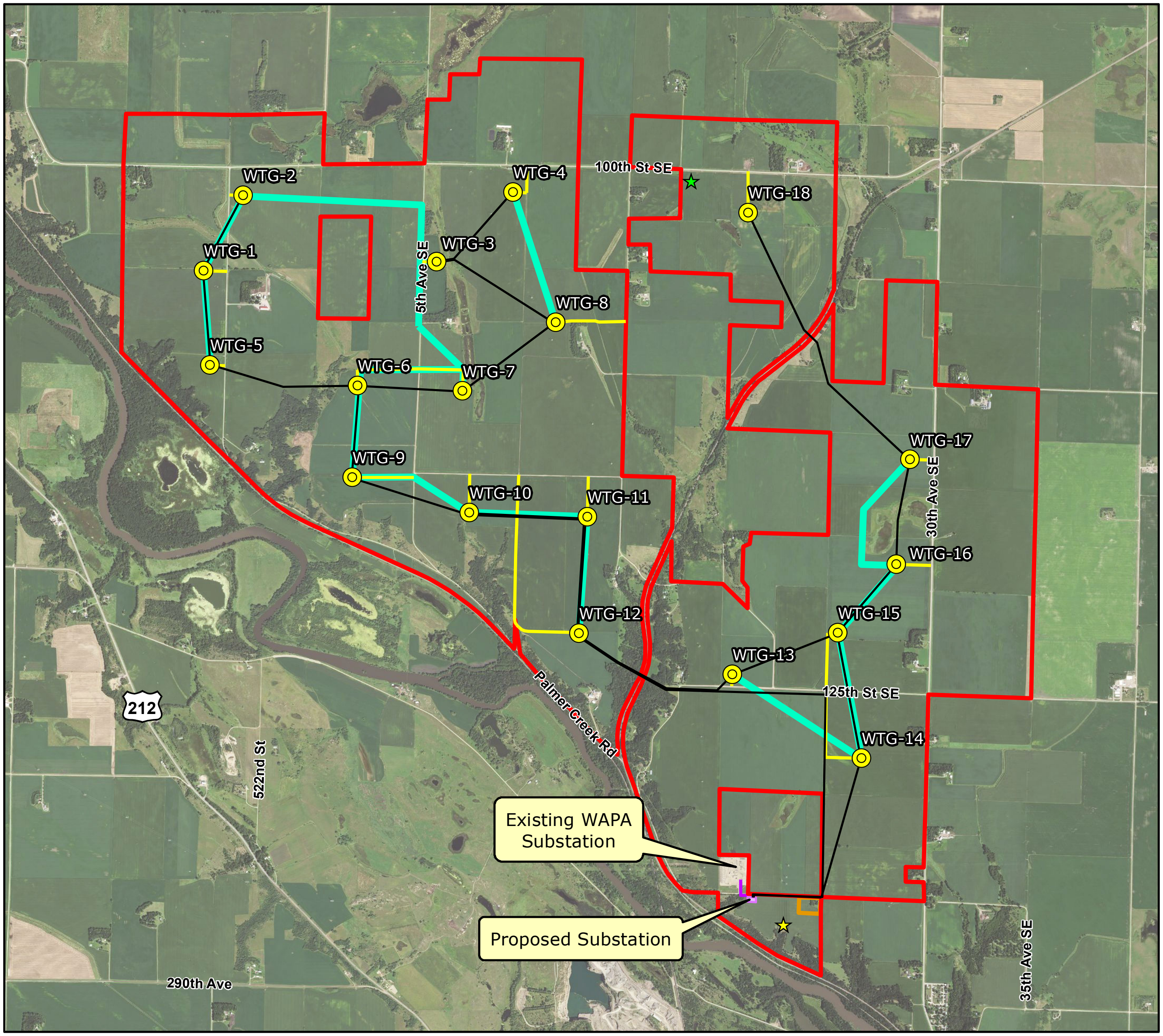
Site Location Map

WENCK ASSOCIATES

Responsive partner. Exceptional outcomes.

FEB 2017

Figure 1



Legend

Project Boundary

Turbine Locations

Collector Lines

Access Roads

Temporary Crane Path

Permanent MET Station

Temporary MET Station

Proposed Substation

Transmission Lines

O&M Building and Laydown Area

Note:
Project features are approximate. Once final design is completed, area will be surveyed prior to construction for Project feature placement.

N

4,000 2,000 0 4,000
Feet

Path: L:\2759\05 Palmers Creek Wind Farm\09 Site Permit Application\MXD\Site Detail.mxd
Date: 2/9/2017 Time: 1:36:17 PM User: ShuJC0243

PALMER'S CREEK WIND FARM, LLC

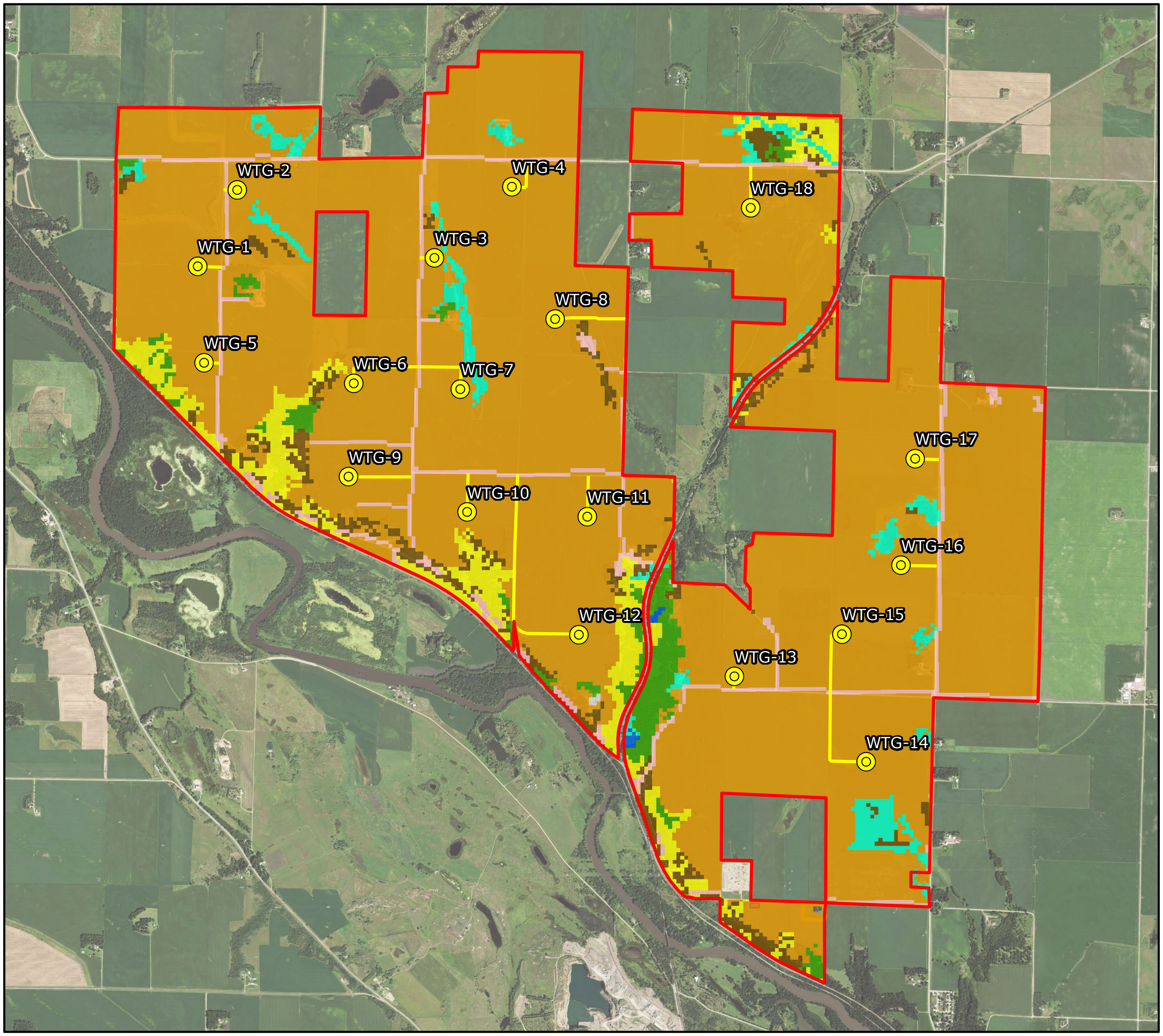
Site Detail Map

WENCK ASSOCIATES

Responsive partner. Exceptional outcomes.

FEB 2017

Figure 2



Project

Turbine Locations

Access Roads

NLCD

Barren Land

Cultivated Crops

Wooded

Developed

Wetland

Hay/Pasture

Grasslass

Open

O&M Building and Laydown Area

Proposed Substation

Note:
Project features are approximate. Once final design is completed, area will be surveyed prior to construction for Project feature placement.

N

4,000 2,000 0 4,000

Feet

Date: 2/9/2017 Time: 2:30:12 PM User: ShuJC0243

Path: L:\2759\05 Palmers Creek Wind Farm\09 Site Permit Application\MXD\Land Cover.mxd

PALMER'S CREEK WIND FARM, LLC

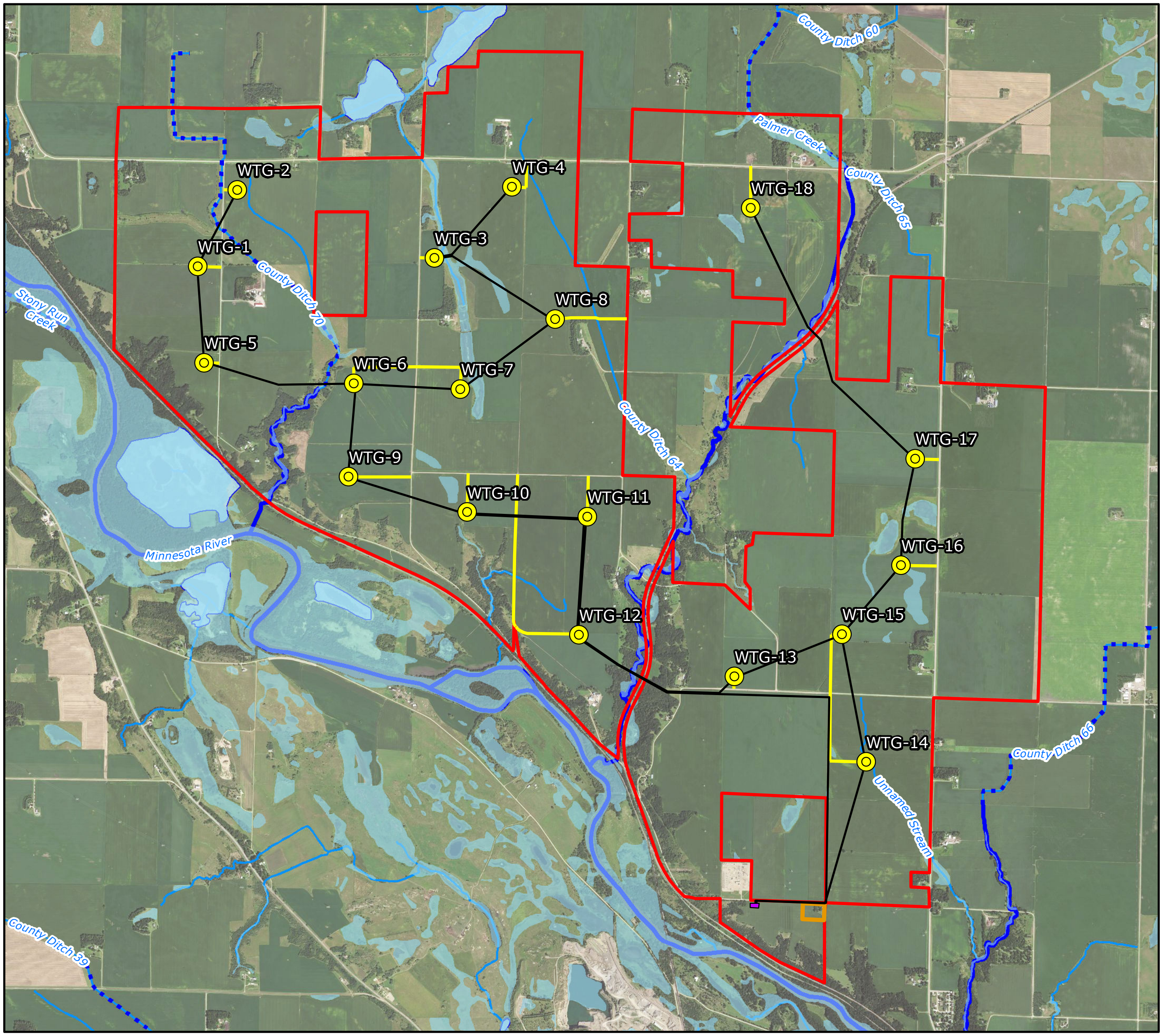
Land Cover

WENCK ASSOCIATES

Responsive partner. Exceptional outcomes.

FEB 2017

Figure 3



Project

Turbine Locations

Access Roads

Collector Lines

National Wetlands

Public Stream

Public Ditch/Altered Stream

Public Waters Basins

Rivers and Streams

O&M Building and Laydown Area

Proposed Substation

Note:
Project features are approximate. Once final design is completed, area will be surveyed prior to construction for Project feature placement.

N

4,000 2,000 0 4,000

Feet

Date: 2/9/2017 Time: 2:31:28 PM User: ShuJC0243

Path: L:\2759\05 Palmers Creek Wind Farm\09 Site Permit Application\MXD\NWI and PWI.mxd

PALMER'S CREEK WIND FARM, LLC

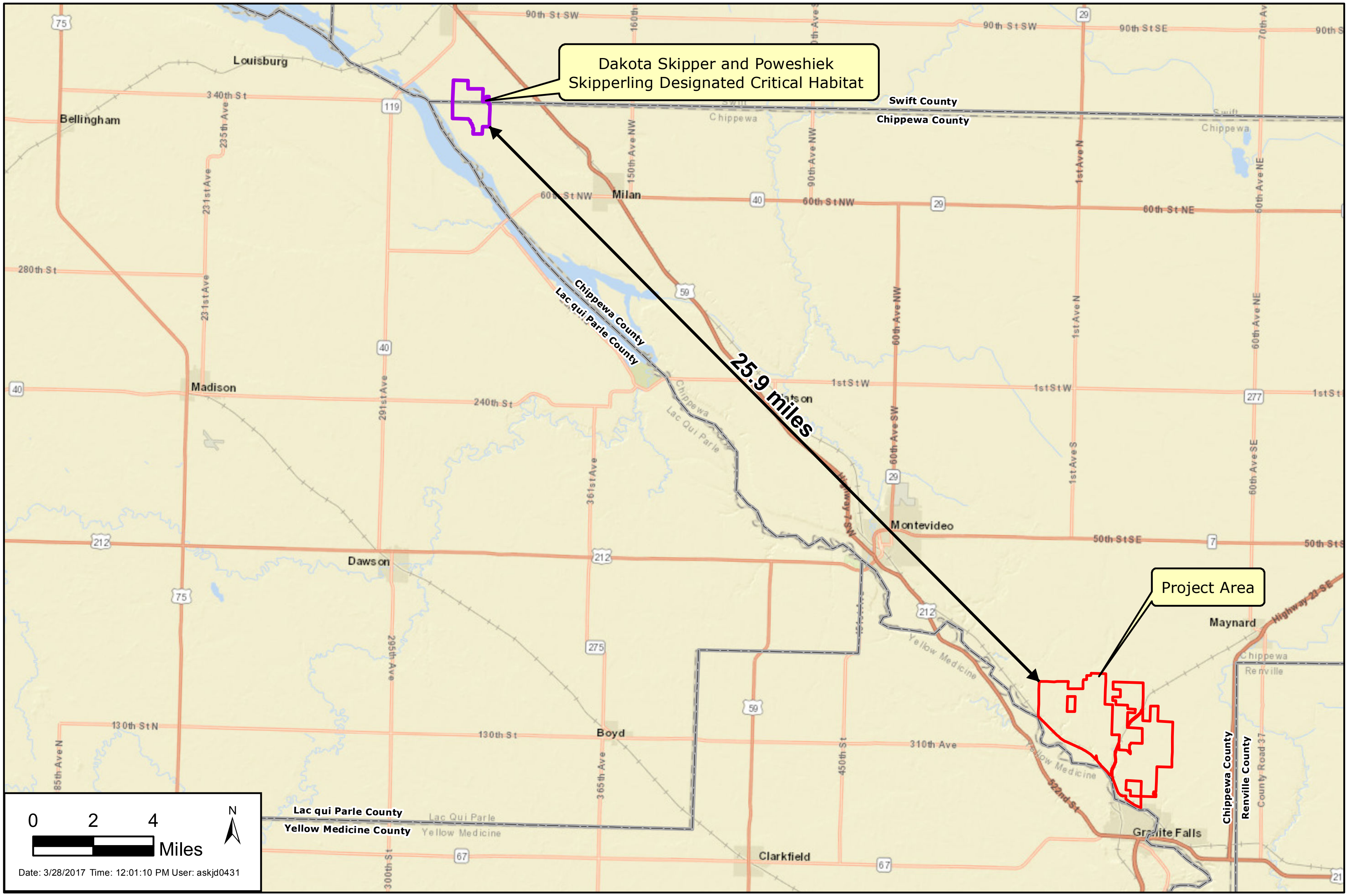
Waterbodies and Wetlands

WENCK ASSOCIATES

Responsive partner. Exceptional outcomes.

FEB 2017

Figure 4



Path: J:\GIS\2759\05 Palmers Creek Wind Farm\09 Site Permit Application\MXD\Dakota Skipper.mxd

PALMER'S CREEK WIND FARM, LLC

Dakota Skipper

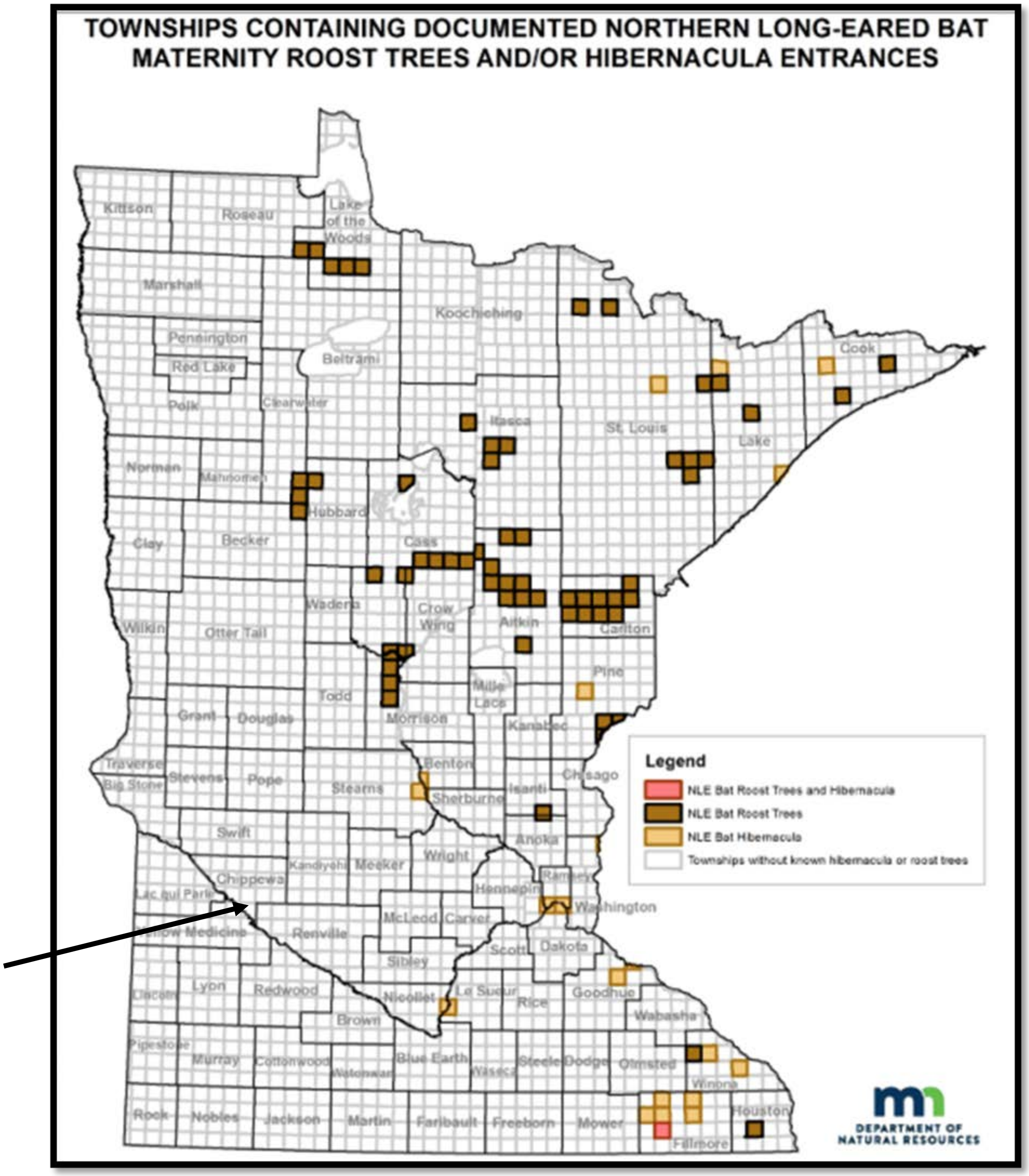
WENCK ASSOCIATES

Responsive partner. Exceptional outcomes.

MAR 2017

Figure 5

Figure 6. Documented Northern Long-Eared Bat Maternity Roost Trees and/or Hibernacula Entrances.



Tables

Table 1: Temporary and Permanent Land Disturbance

Cover Types	Temporary Disturbance	Permanent Disturbance
Barren Land (Rock/Sand/Clay)	0	0
Cultivated Crops	161	10
Deciduous Forest	1	0
Developed	7	0.6
Emergent Herbaceous Wetlands	1.1	0
Grassland/Herbaceous	0.5	0.1
Open Water	0	0
Pasture/Hay	1.2	0.6
Shrub/Scrub	0.1	0.1
Total	**171.9**	**11.4**

Source: NLCD, 2011.

APPENDIX G – BEST MANAGEMENT PRACTICES AND CONSERVATION MEASURES

BMP	References	Socio (7.1)	Land-Based Econ (7.2)	Rec & Tourism (7.3)	Land Use (7.4)	Noise (7.5)	Visual Impacts (7.6)	Public Service & Infra. (7.7)	Public Health & Safety (7.8)	Haz. Mat. (7.9)	Soils & Topo (7.10)	Ground-water Resources (7.11)	Surface Water & Flood-plains (7.12)	Wetlands (7.13)	Veg. (7.14)	Wildlife (7.15)	Rare & Unique Natural Resources (7.16)	Cultural & Archae (7.17)	Air
Air: Dust abatement measures shall be implemented in arid environments to minimize the impacts of vehicular and pedestrian traffic, construction, and wind on exposed surface soils.	VR-31, VRP 5-194						X	X			X								X
Air: Install wind fences around disturbed areas if windborne dust is likely to impact sensitive areas beyond the site boundaries (e.g., nearby residences).	AQ-9, AQP 5-44				X		X	X			X			X					X
Air: Limit idling of diesel equipment to no more than 10 minutes unless necessary for proper operation.	AQ-6, AQP 5-43								X										X
Air: Minimize potential environmental impacts from the use of dust palliatives by taking the necessary measures to keep the chemicals out of sensitive terrestrial habitats and streams. The application of dust palliatives must comply with Federal, State, and local laws and regulations.	AQ-3, AQP 5-43						X			X		X	X	X					X
Air: Post and enforce lower speed limits on dirt and gravel access roads to minimize airborne fugitive dust.	AQ-2, AQP 5-43							X	X		X								X
Air: Use surface access roads, on-site roads, and parking lots with aggregates or that maintain compacted soil conditions to reduce dust generation.	AQ-1,AQP 5-43							X	X		X								X
Air: Water unpaved roads, disturbed areas (e.g., scraping, excavation, backfilling, grading, and compacting), and loose materials generated during project activities as necessary to minimize fugitive dust generation.	AQ-8, AQP 5-44																		X
Construction: Clean (e.g., through street vacuum sweeping) visible trackout or runoff dirt from the construction site off public roadways.	AQ-14, AQP 5-44							X	X										
Construction: Communication and other local utility cables shall be buried, where feasible.	VR-26, VRP 5-194						X		X										
Construction: Construct drainage ditches only where necessary; use appropriate structures at culvert outlets to prevent erosion.	WR-3, WR 5-33							X			X								
Construction: Construction activities shall be coordinated with landowners to minimize interference with farming or livestock operations. Issues that would need to be addressed could include installation of gates and cattle guards where access roads cross existing fencelines, access control, signing of open range areas, traffic management (e.g., vehicle speed management), and location of livestock water sources.	LU-2, LUP 5-14				X			X	X										
Construction: Construction debris shall be removed from the site.	LU-3,LUP 5-14				X				X										
Construction: Cultural resources discovered during construction shall immediately be brought to the attention of the responsible Federal agency. Work shall be immediately halted in the vicinity of the find to avoid further disturbance to the resources while they are being evaluated and appropriate mitigation plans are being developed.	CR-1, CRP 5-224				X													X	
Construction: Drainage problems caused by construction shall be corrected to prevent damage to agricultural fields.	LU-7, LUP 5-14				X								X						
Construction: Employ fuel diesel engines in facility construction and maintenance that use ultra-low sulfur diesel, with a maximum 15 ppm sulfur content.	AQ-5, AQ 5-43								X										X

BMP	References	Socio (7.1)	Land-Based Econ (7.2)	Rec & Tourism (7.3)	Land Use (7.4)	Noise (7.5)	Visual Impacts (7.6)	Public Service & Infra. (7.7)	Public Health & Safety (7.8)	Haz. Mat. (7.9)	Soils & Topo (7.10)	Ground-water Resources (7.11)	Surface Water & Flood-plains (7.12)	Wetlands (7.13)	Veg. (7.14)	Wildlife (7.15)	Rare & Unique Natural Resources (7.16)	Cultural & Archae (7.17)	Air
Construction: Establish a controlled inspection and cleaning area for trucks and construction equipment are arriving from locations with known invasive vegetation problems. Visually inspect construction equipment arriving at the project area and remove and contain seeds that may be adhering to tires and other equipment surfaces.	ER-12, ERP 5-130														X	X			
Construction: Excess cut/fill materials shall be hauled in or out to minimize ground disturbance and impacts from fill piles.	VR-22, VRP 5-193						X				X				X				
Construction: Excess fill material shall not be disposed of downslope in order to avoid creating color contrast with existing vegetation/soils.	VR-21, VRP 5-193				X			X	X										
Construction: For road construction, excess fill shall be used to fill uphill-side swales to reduce slope interruption that would appear unnatural and to reduce fill piles.	VR-15, VRP 5-193				X		X				X								
Construction: If needed during construction, only use explosives within specified times and at specified distances from sensitive wildlife or surface waters as established by the appropriate Federal and State agencies.	ER-7, ERP 5-130					X			X				X			X			
Construction: In the unlikely event that blasting or pile driving would be needed during the construction period, notify nearby residents in advance.	NI-8, NIP 5-57				X			X	X										
Construction: Inspect and clean tires of construction-related vehicles, as necessary, so they are free of dirt prior to entering paved public roadways.	AQ-13, AQP 5-44						X	X											
Construction: Litter must be controlled and removed regularly during construction.	VR-30, VRP 5-194			X			X	X											
Construction: Locate stationary construction equipment (e.g., compressors or generators) as far as practical from nearby sensitive receptors.	NI-7, NIP 5-57						X									X			
Construction: Minimize the area disturbed during the installation of meteorological towers (i.e., the footprint needed for meteorological towers and associated laydown areas).	ER-2, ERP 5-129				X		X												
Construction: Schedule noisy activities to occur at the same time whenever feasible, since additional sources of noise generally do not greatly increase noise levels at the site boundary. Less frequent but noisy activities would generally be less annoying than lower-level noises occurring more frequently.	NI-3, NIP 5-57					X		X	X										
Construction: Schedule the installation of meteorological towers and other characterization activities to avoid disruption of wildlife reproductive activities or other important behaviors (e.g., do not install towers during periods of sage-grouse nesting).	ER-3, ERP 5-129															X			
Construction: Slash from vegetation removal shall be mulched and spread to cover fresh soil disturbances (preferred) or shall be buried. Slash piles shall not be left in sensitive viewing areas.	VR-13, VRP 5-193						X								X				

BMP	References	Socio (7.1)	Land-Based Econ (7.2)	Rec & Tourism (7.3)	Land Use (7.4)	Noise (7.5)	Visual Impacts (7.6)	Public Service & Infra. (7.7)	Public Health & Safety (7.8)	Haz. Mat. (7.9)	Soils & Topo (7.10)	Ground-water Resources (7.11)	Surface Water & Flood-plains (7.12)	Wetlands (7.13)	Veg. (7.14)	Wildlife (7.15)	Rare & Unique Natural Resources (7.16)	Cultural & Archae (7.17)	Air
Construction: Soil borrow areas, cut-and-fill slopes, berms, waterbars, and other disturbed areas shall be contoured to approximate naturally occurring slopes, thereby avoiding form and line contrasts with the existing landscapes. Contouring to rough texture would trap seed and discourage offroad travel, thereby reducing associated visual impacts.	VR-40, VRP 5-195						X				X				X				
Construction: Spray stockpiles of soils with water, cover with tarpaulins, and/or treat with appropriate dust suppressants, especially when high wind or storm conditions are likely. Vegetative plantings may also be used to limit dust generation for stockpiles that will be inactive for relatively long periods.	AQ-10, AQP 5-44														X				X
Construction: Stabilize disturbed areas that are not actively under construction using methods such as erosion matting or soil aggregation, as site conditions warrant.	SR-6, SRP 5-26										X			X					
Construction: Stage construction activities to limit the area of disturbed soils exposed at any particular time.	AQ-7, AQP 5-44				X						X								
Construction: The burning of trash shall be prohibited during construction; trash shall be stored in containers and/or hauled off-site.	VR-29, VRP 5-194						X												
Construction: When possible, limit noisy construction activities to times when nearby sensitive receptors are least likely to be disturbed.	NI-5, NIP 5-57					X		X	X										
Cultural Resources: If a development is within the viewshed of a national historic trail eligible for listing on the NRHP, the developer should evaluate the potential visual impacts on the trail associated with the proposed project. If impacts were to occur, mitigation measures such as vegetation or landscape screening could be employed.	CRP 5-224						X											X	
Cultural resources: If an area has a strong potential for containing fossil remains and those remains are exposed on the surface for potential collection, steps should be taken to educate workers and the public on the consequences of unauthorized collection.	CRP 5-217																	X	

BMP	References	Socio (7.1)	Land-Based Econ (7.2)	Rec & Tourism (7.3)	Land Use (7.4)	Noise (7.5)	Visual Impacts (7.6)	Public Service & Infra. (7.7)	Public Health & Safety (7.8)	Haz. Mat. (7.9)	Soils & Topo (7.10)	Ground-water Resources (7.11)	Surface Water & Flood-plains (7.12)	Wetlands (7.13)	Veg. (7.14)	Wildlife (7.15)	Rare & Unique Natural Resources (7.16)	Cultural & Archae (7.17)	Air
Cultural resources: If cultural resources are known to be present at the site, or if areas with a high potential to contain cultural material have been identified, consultation with the SHPO should be undertaken by the appropriate Federal agency (e.g., Western, USFWS, USFS, or BLM). In instances where Federal oversight is not appropriate, developers can interact directly with the SHPO. Avoidance of these resources is always the preferred mitigation option. Other mitigation options include archaeological survey, excavation, data recovery, and monitoring (as warranted). If an area exhibits a high potential but no artifacts are observed during an archaeological survey, monitoring by a qualified archaeologist could be required during all excavation and earthmoving in the high-potential area. A report should be prepared documenting these activities. Other steps include the identification and implementation of measures to prevent potential looting/vandalism or erosion impacts, as well as educating workers and the public to make them aware of the consequences of unauthorized collection of artifacts.	CRP 5-224																	X	
Cultural Resources: If human remains are found on a development site, work shall cease immediately in the vicinity of the find. The appropriate law enforcement officials and the appropriate Federal agency shall be contacted. No material shall be removed from the find location. Once it is determined that the remains belong to an archaeological site, the appropriate SHPO shall be contacted to determine how the remains shall be addressed.	CR-2, CRP 5-224								X									X	
Cultural Resources: Placement of wind energy structures in fossil-rich areas, such as outcrops, should be avoided.	CRP 5-217																	X	
Cultural resources: Significant cultural resources can be affected by soil erosion. Minimization of soil erosion would protect important resources from damage.	CRP 5-224																	X	
Cultural Resources: The appropriate Federal agency should consult with federally recognized Native American governments early in the planning process for a wind energy development to identify issues and areas of concern. Consultation is required under the NHPA. Consultation is necessary to establish whether the project is likely to disturb traditional cultural properties, affect access rights to particular locations, disrupt traditional cultural practices, affect trust resources such as eagles, and/or visually impact areas important to the tribe(s).	CRP 5-223																	X	
Cultural Resources: The presence of archaeological sites and historic properties in the area of potential effect should be determined on the basis of a records search of recorded sites and properties in the area and/or an archaeological survey. The SHPO is the primary repository for cultural resource information. The National Register of Historic Places could also be consulted at http://www.nps.gov/nr/research/index.htm.	CRP 5-223																	X	

BMP	References	Socio (7.1)	Land-Based Econ (7.2)	Rec & Tourism (7.3)	Land Use (7.4)	Noise (7.5)	Visual Impacts (7.6)	Public Service & Infra. (7.7)	Public Health & Safety (7.8)	Haz. Mat. (7.9)	Soils & Topo (7.10)	Ground-water Resources (7.11)	Surface Water & Flood-plains (7.12)	Wetlands (7.13)	Veg. (7.14)	Wildlife (7.15)	Rare & Unique Natural Resources (7.16)	Cultural & Archae (7.17)	Air
Cultural Resources: Whether paleontological resources exist in a project area should be determined on the basis of the sedimentary context and soil surveys of the area, a records search of Federal, State, and local inventories for past paleontological finds in the area, review of past paleontological surveys, and/or a paleontological survey.	CRP 5-217																	X	
Decommissioning: Soil borrow areas, cut-and-fill slopes, berms, waterbars, and other disturbed areas should be contoured to approximate naturally occurring slopes, thereby avoiding form and line contrasts with the existing landscapes. Contouring to rough texture would trap seed and discourage off-road travel, thereby reducing associated visual impacts.	VR-40, VRP 5-195		X	X	X		X		X		X				X				
Decommissioning: All aboveground and near-ground structures, including turbines and ancillary structures, shall be removed from the site during decommissioning.	ER-23, ERP 5-132, VR-39, VRP 5-195				X				X										
Decommissioning: During facility decommissioning, the following shall occur: emergency response capabilities shall be maintained throughout the decommissioning period as long as hazardous materials and wastes remain on-site, and emergency response planning shall be extended to any temporary material and equipment storage areas that may have been established; temporary waste storage areas shall be properly designated, designed, and equipped; hazardous materials removed from systems shall be properly containerized and characterized, and recycling options shall be identified and pursued; off-site transportation of recovered hazardous materials and wastes resulting from decommissioning activities shall be conducted by authorized carriers; hazardous materials and waste shall be removed from on-site storage and management areas, and the areas shall be surveyed for contamination and remediated as necessary.	HM-20, HMP 5-249				X					X									
Decommissioning: Facilities constructed on Federal lands should follow the decommissioning recommendations provided in the USFWS's Land-Based Wind Energy Guidelines (USFWS 2012b).	ERP 5-132						X				X					X			
Decommissioning: Salvage and reapply topsoil excavated during decommissioning activities to disturbed areas during final restoration activities.	ER-24, ERP 5-132										X								
Decommissioning: When decommissioning sites, ensure that any wells are properly filled and capped.	WR-10, WRP 5-33				X			X	X										
Decommissioning; Excess concrete (excluding below ground portions of decommissioned turbine foundations intentionally left in place) shall not be buried or left in active agricultural areas.	LU-4, LUP 5-14				X				X	X									
Design: Color selections for turbines shall be made to reduce visual impact and shall be applied uniformly to tower, nacelle, and rotor, unless gradient or other patterned color schemes are used.	VR-2, VRP 5-191						X												

BMP	References	Socio (7.1)	Land-Based Econ (7.2)	Rec & Tourism (7.3)	Land Use (7.4)	Noise (7.5)	Visual Impacts (7.6)	Public Service & Infra. (7.7)	Public Health & Safety (7.8)	Haz. Mat. (7.9)	Soils & Topo (7.10)	Ground-water Resources (7.11)	Surface Water & Flood-plains (7.12)	Wetlands (7.13)	Veg. (7.14)	Wildlife (7.15)	Rare & Unique Natural Resources (7.16)	Cultural & Archae (7.17)	Air
Design: Commercial messages and symbols (such as logos, trademarks) on wind turbines shall be avoided and shall not appear on sites or ancillary structures of wind energy projects. Similarly, billboards and advertising messages shall also be discouraged.	VR-8, VRP 5-192						X												
Design: Culvert ends shall be painted or coated to reduce color contrasts with existing landscape.	VR-27, VRP 5-194						X												
Design: Electricity transmission projects associated with wind energy facilities should utilize nonspecular conductors and nonreflective coatings on insulators.	VRP 5-192						X	X											
Design: Existing rocks, vegetation, and drainage patterns shall be preserved to the maximum extent possible.	VR-12, VRP 5-193						X				X				X				
Design: For ancillary buildings and other structures, low-profile structures shall be chosen whenever possible to reduce their visibility	VR-1, VRP 5-190						X												
Design: For ancillary facilities, multiple-color camouflage technology applications should be considered for projects within sensitive viewsheds and with a visibility distance between 0.25 to 2 mi (0.4 to 3.2 km).	VRP 5-191						X												
Design: For ancillary structures, materials and surface treatments shall repeat and/or blend with the existing form, line, color, and texture of the landscape. If the project will be viewed against an earthen or other non-sky background, appropriately colored materials shall be selected for structures, or appropriate stains/coatings shall be applied to blend with the project's backdrop.	VR-4, VRP 5-191						X	X			X								
Design: Grouped structures shall all be painted the same color to reduce visual complexity and color contrast.	VR-3, VRP 5-191						X												
Design: Minimize the use of guy wires on permanent meteorological towers or use designs for towers that do not require guy wires. If guy wires are necessary, they shall be equipped with line marking devices.	ER-8, ERP 5-130						X	X	X							X			
Design: Power collection cables or lines on the site should be buried in a manner that minimizes additional surface disturbance (e.g., collocating them with access roads).	VR-26, VRP 5-194, ERP 5-129						X	X											
Design: Surface new roads with aggregate materials, wherever appropriate.	SR-2, SRP 5-25							X			X								
Design: The geometry of road ditch design shall consider visual objectives; rounded slopes are preferred to V-shaped and U-shaped ditches.	VR-16, VRP 5-193						X												
Design: The use of monopole structures is recommended. Truss or lattice-style wind turbine structures with lacework or pyramidal or prismatic shapes should be avoided. Monopole structures present a simpler profile, and less complex surface characteristics and reflective/shading properties.	VIP 5-191						X												
During construction, operations and maintenance, and decommissioning phases, traffic shall be restricted to designated project roads. Use of other unimproved roads shall be restricted to emergency situations.	LU-14, LUP 5-16							X											

BMP	References	Socio (7.1)	Land-Based Econ (7.2)	Rec & Tourism (7.3)	Land Use (7.4)	Noise (7.5)	Visual Impacts (7.6)	Public Service & Infra. (7.7)	Public Health & Safety (7.8)	Haz. Mat. (7.9)	Soils & Topo (7.10)	Ground-water Resources (7.11)	Surface Water & Flood-plains (7.12)	Wetlands (7.13)	Veg. (7.14)	Wildlife (7.15)	Rare & Unique Natural Resources (7.16)	Cultural & Archae (7.17)	Air
Erosion: Apply erosion controls relative to possible soil erosion from vehicular traffic.	WR-2, WRP 5-33							X				X	X						
Erosion: Apply standard erosion control BMPs to all construction activities and disturbed areas (e.g., sediment traps, water barriers, erosion control matting) as applicable to minimize erosion and protect water quality.	WR-1, WRP 5-33						X					X	X	X					
Erosion: Dispose of excess excavation materials in approved areas to control erosion.	WR-7, WRP 5-33						X				X		X	X	X				
Erosion: Facilities, structures, and roads should be located in stable fertile soils to reduce visual contrasts from erosion and to better support rapid and complete regrowth of affected vegetation. Site hydrology should also be carefully considered in siting operations to avoid visual contrasts from erosion. Strip, stockpile, and stabilize topsoil from the site before excavating earth for facility construction.	VRP 5-190										X		X	X	X				
Erosion: Where feasible, construction on wet soils shall be avoided to reduce erosion.	VR-25, VRP 5-194						X				X			X					
General: Conduct construction and maintenance activities when the ground is frozen or when soils are dry and native vegetation is dormant.	SR-5, SRP 5-25				X										X				
General: Ensure that all pieces of heavy equipment meet emission standards specified in the State Code of Regulations, and conduct routine preventive maintenance, including tune-ups to manufacturer specification to ensure efficient combustion and minimum emissions. If possible, equipment with more stringent emission controls should be leased or purchased.	AQ-4, AQP 5-43					X													X
General: Facilities and off-site surrounding areas shall be kept clean of debris, "fugitive" trash or waste, and graffiti. Scrap heaps and materials dumps shall be prohibited and prevented. Materials storage yards, even if thought to be orderly, shall be kept to an absolute minimum. Surplus, broken, disused materials and equipment of any size shall not be allowed to accumulate.	VR-35, VRP 5-194						X												
General: Gravel and other surface treatments shall be removed or buried.	VR-43, VRP 5-195						X												
General: Pollution prevention opportunities shall be identified and implemented, including material substitution of less hazardous alternatives, recycling, and waste minimization.	HM-5, HMP 5-248								X	X									

BMP	References	Socio (7.1)	Land-Based Econ (7.2)	Rec & Tourism (7.3)	Land Use (7.4)	Noise (7.5)	Visual Impacts (7.6)	Public Service & Infra. (7.7)	Public Health & Safety (7.8)	Haz. Mat. (7.9)	Soils & Topo (7.10)	Ground-water Resources (7.11)	Surface Water & Flood-plains (7.12)	Wetlands (7.13)	Veg. (7.14)	Wildlife (7.15)	Rare & Unique Natural Resources (7.16)	Cultural & Archae (7.17)	Air
General: Procedures shall be established for fuel storage and dispensing, including shutting off vehicle (equipment) engines; using only authorized hoses, pumps, and other equipment in good working order; maintaining appropriate fire and spill response materials at equipment-fueling stations; providing emergency shutoffs for fuel pumps; ensuring that fueling stations are paved; ensuring that both aboveground fuel tanks and fueling areas have adequate secondary containment; prohibiting smoking, welding, or open flames in fuel storage and dispensing areas; equipping the area with fire suppression devices, as appropriate; conducting routine inspections of fuel storage and dispensing areas; requiring prompt recovery and remediation of all spills, and providing for the prompt removal of all fuel and fuel tanks used to support construction vehicles and equipment at the completion of facility construction and decommissioning phases.	HM-11, HMP 5-248								X	X									
Haz. Materials: All site characterization, construction, operation, and decommissioning activities shall be conducted in compliance with applicable Federal and State laws and regulations, including the Toxic Substances Control Act of 1976, as amended (15 USC 2601, et seq.). In addition, any release of toxic substances (leaks, spills, and the like) in excess of the reportable quantity established by 40 CFR Part 117 shall be reported as required by the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, Section 102b. A copy of any report required or requested by any Federal agency or State government as a result of a reportable release or spill of any toxic substances shall be furnished to the authorized officer concurrent with the filing of the reports to the involved Federal agency or State government.	HM-4, HMP 5-247								X	X									
Haz. Materials: All vehicles and equipment shall be in proper working condition to ensure that there is no potential for leaks of motor oil, antifreeze, hydraulic fluid, grease, or other hazardous materials.	HM-15, HMP 5-249								X	X									
Haz. Materials: Authorized users for each type of hazardous material shall be identified.	HM-10, HMP 5-248									X									
Haz. Materials: Dedicated areas with secondary containment shall be established for off-loading hazardous materials transport vehicles.	HM-7, HMP-5-248								X	X									
Haz. Materials: Design requirements shall be established for hazardous materials and waste storage areas that are consistent with accepted industry practices as well as applicable Federal, State, and local regulations and that include, at a minimum, containers constructed of compatible materials, properly labeled, and in good condition; secondary containment features for liquid hazardous materials and wastes; physical separation of incompatible chemicals; and fire-fighting capabilities when warranted.	HM-17, HMP 5-249								X	X									
Haz. Materials: Dispose of excess excavation materials in approved areas to control erosion and minimize leaching of hazardous materials.	SR-8, SRP 5-26									X	X		X	X					

BMP	References	Socio (7.1)	Land-Based Econ (7.2)	Rec & Tourism (7.3)	Land Use (7.4)	Noise (7.5)	Visual Impacts (7.6)	Public Service & Infra. (7.7)	Public Health & Safety (7.8)	Haz. Mat. (7.9)	Soils & Topo (7.10)	Ground-water Resources (7.11)	Surface Water & Flood-plains (7.12)	Wetlands (7.13)	Veg. (7.14)	Wildlife (7.15)	Rare & Unique Natural Resources (7.16)	Cultural & Archae (7.17)	Air
Haz. Materials: Hazardous materials and waste storage areas or facilities shall be formally designated and access to them restricted to authorized personnel. Construction debris, especially treated wood, shall not be disposed of or stored in areas where it could come in contact with aquatic habitats.	HM-16, HM 5-249									X		X	X	X					
Wildlife/Vegetation: If pesticides/herbicides are to be used on the site, develop an integrated pest and vegetation management plan to ensure that applications will be conducted within the framework of managing agencies and will entail the use of only EPA-registered pesticides/herbicides that are (1) nonpersistent and immobile and (2) applied by licensed applicators in accordance with label and application permit directions, following stipulations regarding suitability for terrestrial and aquatic applications.	HM-3, HMP 5-247								X						X	X			
Haz. Materials: In the event of an accidental release of hazardous substances to the environment, document the event, including a root cause analysis, a description of appropriate corrective actions taken, and a characterization of the resulting environmental or health and safety impacts. Documentation of the event shall be provided to permitting agencies and other appropriate Federal and State agencies within 30 days, as required.	HS-6, HSP 5-256								X	X									
Haz. Materials: Limit herbicide and pesticide use to nonpersistent, immobile compounds and apply them using a properly licensed applicator in accordance with label requirements.	WR-6, WRP 5-33								X					X	X				

BMP	References	Socio (7.1)	Land-Based Econ (7.2)	Rec & Tourism (7.3)	Land Use (7.4)	Noise (7.5)	Visual Impacts (7.6)	Public Service & Infra. (7.7)	Public Health & Safety (7.8)	Haz. Mat. (7.9)	Soils & Topo (7.10)	Ground-water Resources (7.11)	Surface Water & Flood-plains (7.12)	Wetlands (7.13)	Veg. (7.14)	Wildlife (7.15)	Rare & Unique Natural Resources (7.16)	Cultural & Archae (7.17)	Air
Haz. Materials: Prepare a hazardous materials and waste management plan that addresses the selection, transport, storage, and use of all hazardous materials needed for construction, operation, and decommissioning of the facility for local emergency response and public safety authorities and for the regulating agency, and that addresses the characterization, on-site storage, recycling, and disposal of all resulting wastes. The plan shall include a comprehensive hazardous materials inventory; Material Safety Data Sheets (MSDSs) for each type of hazardous material; emergency contacts and mutual aid agreements, if any; site map showing all hazardous materials and waste storage and use locations; copies of spill and emergency response plans (see below), and hazardous materials-related elements of a decommissioning/ closure plan. The waste management plan shall identify the waste streams that are expected to be generated at the site during construction and operation and address hazardous waste determination procedures, waste storage locations, waste-specific management and disposal requirements (e.g., selecting appropriate waste storage containers, appropriate off-site treatment, storage, and disposal facilities), inspection procedures, and waste minimization procedures. The plan shall address solid and liquid wastes that may be generated at the site in compliance with CWA requirements if a NPDES permit is needed.	HM-1, HMP 5-247								X	X									
Haz. Materials: Systems containing hazardous materials shall be designed and operated in a manner that limits the potential for their release, and constructed of compatible materials in good condition (as verified by periodic inspections), including provision of secondary containment features (to the extent practical); installation of sensors or other devices to monitor system integrity; installation of strategically placed valves to isolate damaged portions and limit the amount of hazardous materials in jeopardy of release; and robust inspection and use of repair procedures.	HM-6, HMP 5-248								X	X									
Haz. Materials: To the greatest extent practicable, “just-in-time” ordering procedures shall be employed that would limit the amounts of hazardous materials present on the site to quantities minimally necessary to support continued operations. Excess hazardous materials shall receive prompt disposition.	HM-8, HMP 5-248								X	X									
Haz. Materials: Written procedures for the storage, use, and transportation of each type of hazardous material present shall be provided, including all vehicle and equipment fuels.	HM-9, HMP 5-248								X	X									
Haz. Materials: Written procedures shall be established for inspecting hazardous materials and waste storage areas and for plant systems containing hazardous materials; identified deficiencies and their resolution shall be documented.	HM-18, HMP 5-249								X	X									

BMP	References	Socio (7.1)	Land-Based Econ (7.2)	Rec & Tourism (7.3)	Land Use (7.4)	Noise (7.5)	Visual Impacts (7.6)	Public Service & Infra. (7.7)	Public Health & Safety (7.8)	Haz. Mat. (7.9)	Soils & Topo (7.10)	Ground-water Resources (7.11)	Surface Water & Flood-plains (7.12)	Wetlands (7.13)	Veg. (7.14)	Wildlife (7.15)	Rare & Unique Natural Resources (7.16)	Cultural & Archae (7.17)	Air
Invasive Species: Access roads, utility and transmission line corridors, and tower site areas shall be monitored regularly for the establishment of invasive species, and weed control measures should be initiated immediately upon evidence of the introduction of invasive species.	ER-17, ERP 5-131							X							X				X
Invasive Species: Develop a plan for control of noxious weeds and invasive plants that could occur as a result of new surface disturbance activities at the site. The plan shall address monitoring, weed identification, the manner in which weeds spread, and methods for treating infestations. Require the use of certified weed-free mulching.	ER-11, ERP 5-130								X						X				
Invasive species: Do not use fill materials that originate from areas with known invasive vegetation problems.	E-16, ERP 5-131														X				
Invasive species: Regularly monitor access roads and newly established utility and transmission line corridors for the establishment of invasive species. Initiate weed control measures immediately upon evidence of the introduction or establishment of invasive species.	ER-13, ERP 5-131														X				
Invasive species: Vehicles shall be washed outside of active agricultural areas to minimize the possibility of the spread of noxious weeds.	LU-5, LUP 5-14														X				
Mainteance: Promptly dispose of all garbage or human waste generated on site in order to avoid attracting nuisance wildlife.	ER-15, ERP 5-131								X							X			
Maintenance: Clean and maintain catch basins, drainage ditches, and culverts regularly.	WR-5, WRP 5-33							X					X	X					
Maintenance: Maintain all equipment in good working order in accordance with manufacturer specifications. Suitable mufflers and/or air-inlet silencers should be installed on all internal combustion engines and certain compressor components.	NIP 5-56					X	X												X
Maintenance: Maintenance activities shall include dust abatement (in arid environments), litter cleanup, and noxious weed control.	VR-36, VRP 5-195								X		X				X				X
Maintenance: Nacelles and towers shall be cleaned regularly (yearly, at minimum) to remove spilled or leaking fluids and the dirt and dust that accumulates, especially in seeping lubricants.	VR-34, VRP 5-194						X		X	X									
Maintenance: Refueling areas shall be located away from surface water locations and drainages and on paved surfaces; features shall be added to direct spilled materials to sumps or safe storage areas where they can be subsequently recovered.	HM-12, HMP 5-248									X	X	X	X	X					
Maintenance: Regularly inspect access roads, utility and transmission line corridors, and tower site areas for damage from erosion, washouts, and rutting. Initiate corrective measures immediately upon evidence of damage.	ER-18, ERP 5-131							X	X		X		X	X					
Maintenance: Restrict heavy vehicles and equipment to improved roads to the extent practicable.	SR-3, SRP 5-25							X			X								
Maintenance: Roads serving the site would need to be properly maintained to avoid erosion impacts.	LUP 5-13				X			X			X		X		X				

BMP	References	Socio (7.1)	Land-Based Econ (7.2)	Rec & Tourism (7.3)	Land Use (7.4)	Noise (7.5)	Visual Impacts (7.6)	Public Service & Infra. (7.7)	Public Health & Safety (7.8)	Haz. Mat. (7.9)	Soils & Topo (7.10)	Ground-water Resources (7.11)	Surface Water & Flood-plains (7.12)	Wetlands (7.13)	Veg. (7.14)	Wildlife (7.15)	Rare & Unique Natural Resources (7.16)	Cultural & Archae (7.17)	Air
Maintenance: Schedules shall be established for the regular removal of wastes (including sanitary wastewater generated in temporary, portable sanitary facilities) for delivery by licensed haulers to appropriate off-site treatment or disposal facilities.	HM-19, HMP 5-249								X	X									
Maintenance: Spills shall be immediately addressed per the appropriate spill management plan, and cleanup and removal initiated, if needed. Operations and maintenance personnel shall be trained in spill prevention and containment, and spill containment supplies shall be located on site and be readily available.	HM-14, HMP 5-249								X	X									
Maintenance: Wind facilities and sites shall be actively and carefully maintained during operation. Wind energy projects shall evidence environmental care, which would also reinforce the expectation and impression of good management for benign or clean power.	VR-32, VRP 5-194						X		X										
Maintenance: Inoperative or incomplete turbines cause the misperception in viewers that “wind power does not work” or that it is unreliable. Inoperative turbines shall be repaired, replaced, or removed quickly. Nacelle covers and rotor nose cones shall always be in place and undamaged.	VR-33, VRP 5-194						X												
Minimize ground-disturbing activities, especially during the rainy season.	SR-1, SRP 5-25										X		X	X					
Noise: Establish a process for documenting, investigating, evaluating, and resolving project-related noise complaints.	NI-4, NIP 5-57					X													
Noise: If a transformer becomes a noise issue, a new transformer with reduced flux density generating noise levels as much as 10–20 dB lower than National Electrical Manufacturers Association (NEMA) standard values could be installed. Alternatively, barrier walls, partial enclosures, or full enclosures could be adopted to shield or contain the transformer noise, depending on the degree of noise control needed.	NIP 5-57					X													
Noise: Select equipment with the lowest noise levels available and no prominent discrete tones, when possible.	NI-1, NP 5-56					X													
Cultural Resources: A paleontological resources management plan should be developed for areas where there is a high potential for paleontological material to be present. Management options may include avoidance, removal of the fossils, or monitoring. If the fossils are to be removed, a mitigation plan should be drafted identifying the strategy for collection of the fossils in the project area. Often it is unrealistic to remove all of the fossils, in which case a sampling strategy can be developed. If an area exhibits a high potential, but no fossils were observed during surveying, monitoring could be required. A qualified paleontologist should monitor all excavation and earthmoving in the sensitive area. Whether the strategy chosen is excavation or monitoring, a report detailing the results of the efforts should be produced.	CRP 5-217																	X	
Recreation: Adequate safety measures (e.g., access control and traffic management) shall be established for recreational visitors to adjacent properties.	LU-9, LUP 5-14			X	X				X										X

BMP	References	Socio (7.1)	Land-Based Econ (7.2)	Rec & Tourism (7.3)	Land Use (7.4)	Noise (7.5)	Visual Impacts (7.6)	Public Service & Infra. (7.7)	Public Health & Safety (7.8)	Haz. Mat. (7.9)	Soils & Topo (7.10)	Ground-water Resources (7.11)	Surface Water & Flood-plains (7.12)	Wetlands (7.13)	Veg. (7.14)	Wildlife (7.15)	Rare & Unique Natural Resources (7.16)	Cultural & Archae (7.17)	Air
Restoration: A site restoration plan shall be in place prior to construction. Restoration of the construction areas shall begin immediately after construction to reduce the likelihood of visual contrasts associated with erosion and invasive weed infestation and to reduce the visibility of affected areas as quickly as possible.	VR-9, VRP 5-192						X				X				X				
Restoration: Develop restoration plans to ensure that all temporary use areas are restored.	LU-1, LUP 5-14				X								X	X					
Restoration: Disturbed surfaces shall be restored to their original contours as closely as possible and revegetated immediately after, or contemporaneously with, construction. Prompt action shall be taken to limit erosion and to accelerate restoring the preconstruction color and texture of the landscape.	VR-10, VRP 5-192						X				X				X				
Restoration: Initiate habitat restoration of disturbed soils and vegetation as soon as possible after construction activities are completed. Restore areas of disturbed soil using weed-free native grasses, forbs, and shrubs, in consultation with land managers and appropriate agencies such as State or County extension offices or weed boards.	ER-9, ERP 5-130						X				X				X				
Restoration: Interim restoration shall be undertaken during the operating life of the project as soon as possible after disturbances.	VR-38, VRP 5-195										X				X				
Restoration: Reclaim areas of disturbed soil using weed-free native shrubs, grasses, and forbs. Restore the vegetation cover, composition, and diversity to values commensurate with the ecological setting.	ER-25, ERP 5-132														X				
Restoration: Reseed (non-cropland) disturbed areas with a native seed mix and revegetate disturbed areas immediately following construction.	WR-9, WRP 5-33														X				
Restoration: Reseed disturbed areas with a native seed mix and revegetate disturbed areas immediately following construction.	SR-12, SRP 5-26														X				
Restoration: Road-cut slopes shall be rounded, and the cut/fill pitch shall be varied to reduce contrasts in form and line; the slope shall be varied to preserve specimen trees and nonhazardous rock outcroppings.	VR-17, VRP 5-193						X				X				X				
Restoration: Rocks, brush, and forest debris shall be restored, whenever possible, to approximate preexisting visual conditions.	VR-44, VRP 5-195										X								
Restoration: Salvage topsoil from all excavation and construction activities to reapply to disturbed areas once construction is completed.	SR-7, SRP 5-26										X								X
Restoration; Reestablish the original grade and drainage pattern to the extent practicable.	SR-11, SRP 5-26, WR-8, WRP 5-33										X								

BMP	References	Socio (7.1)	Land-Based Econ (7.2)	Rec & Tourism (7.3)	Land Use (7.4)	Noise (7.5)	Visual Impacts (7.6)	Public Service & Infra. (7.7)	Public Health & Safety (7.8)	Haz. Mat. (7.9)	Soils & Topo (7.10)	Ground-water Resources (7.11)	Surface Water & Flood-plains (7.12)	Wetlands (7.13)	Veg. (7.14)	Wildlife (7.15)	Rare & Unique Natural Resources (7.16)	Cultural & Archae (7.17)	Air
Revegetation: Combining seeding, planting of nursery stock, transplanting of local vegetation within the proposed disturbance areas, and staging of construction shall be considered, enabling direct transplanting. Generally, native vegetation shall be used for revegetation, establishing a composition consistent with the form, line, color, and texture of the surrounding undisturbed landscape. Seed mixes shall be coordinated with local authorities, such as country extension services, weed boards, or land management agencies.	VR-42, VRP 5-195						X				X				X				
Safety: All site characterization, construction, operation, and decommissioning activities must be conducted in compliance with applicable Federal and State occupational safety and health standards (e.g., the Occupational Safety and Health Administration's [OSHA's] Occupational Safety and Health Standards, 29 CFR Parts 1910 and 1926, respectively).	HM-4, HMP 5-247								X	X									
Safety: All vehicles traveling within and around the project area should operate in accordance with posted speed limits.	NI-3, NP 5-57					X		X	X										
Safety: As needed, the health and safety program must address OSHA standard practices for the safe use of explosives and blasting agents (if needed for site development); measures for reducing occupational EMF exposures; the establishment of fire safety evacuation procedures; and required safety performance standards (e.g., electrical system standards and lighting protection standards). The program shall include training requirements for applicable tasks for workers and establish procedures for providing required training to all workers. Documentation of training and a mechanism for reporting serious accidents to appropriate agencies shall be established.	HS-4, HSP 5-256								X	X									
Safety: Conduct a safety assessment to describe potential safety issues and the means that would be taken to mitigate them, covering issues such as site access, construction, safe work practices, security, heavy equipment transportation, traffic management, emergency procedures, and fire control.	HS-2, HSP 5-255							X											
Safety: Control vehicle and equipment speed on unpaved surfaces.	SR-4, SRP 5-25								X										
Safety: Cover vehicles transporting loose materials when traveling on public roads, and keep loads sufficiently wet and below the freeboard of the truck in order to minimize wind dispersal.	AQ-12, AQP 5-44						X												X
Safety: Design all electrical systems to meet all applicable safety standards (e.g., the National Electrical Safety Code) and comply with the interconnection requirements of the transmission system operator.	HS-5, HSP 5-256								X										
Safety: Develop a fire management and protection plan to implement measures to minimize the potential for fires associated with substances used and stored at the site. The flammability of the specific chemicals used at the facility shall be considered.	HS-11, HSP 5-257								X										

BMP	References	Socio (7.1)	Land-Based Econ (7.2)	Rec & Tourism (7.3)	Land Use (7.4)	Noise (7.5)	Visual Impacts (7.6)	Public Service & Infra. (7.7)	Public Health & Safety (7.8)	Haz. Mat. (7.9)	Soils & Topo (7.10)	Ground-water Resources (7.11)	Surface Water & Flood-plains (7.12)	Wetlands (7.13)	Veg. (7.14)	Wildlife (7.15)	Rare & Unique Natural Resources (7.16)	Cultural & Archae (7.17)	Air
Safety: Develop a health and safety program to protect workers during site characterization, construction, operation, and decommissioning of a wind energy project. The program shall identify all applicable Federal and State occupational safety standards and establish safe work practices addressing all hazards, including requirements for developing the following plans: general injury prevention; PPE requirements and training; respiratory protection; hearing conservation; electrical safety; hazardous materials safety and communication; housekeeping and material handling; confined space entry; hand and portable power tool use; gas-filled equipment use; and rescue response and emergency medical support, including on-site first-aid capability.	HS-3, HSP 5-255								X										
Safety: Develop a project health and safety program that addresses protection of public health and safety during site characterization, construction, operation, maintenance, and decommissioning activities for a wind energy project. The program shall establish a safety zone or setback for wind energy facilities and associated transmission lines from residences and occupied buildings, roads, ROWs, and other public access areas that is sufficient to prevent accidents resulting from various hazards during all phases of development. It shall identify requirements for temporary fencing around staging areas, storage yards, and excavations during construction or decommissioning activities. It shall also identify measures to be taken during the operations phase to limit public access to facilities (e.g., equipment with access doors shall be locked to limit public access, and permanent fencing with slats shall be installed around electrical substations).	HS-7, HSP 5-256				X		X		X										
Safety: Drip pans shall be used under the fuel pump and valve mechanisms of any bulk fueling vehicles and during on-site refueling to contain accidental releases.	HM-13, HMP 5-248								X		X								
Safety: Project personnel and contractors shall be instructed and required to adhere to speed limits commensurate with road types, traffic volumes, vehicle types, and site-specific conditions to ensure safe and efficient traffic flow.	LU-13, LUP 5-16							X	X										
Safety: Train workers to comply with speed limits, use good engineering practices, minimize the drop height of excavated materials, and minimize disturbed areas.	AQ-11, AQP 5-44								X										
Safety: Use proper signage and/or engineered barriers (e.g., fencing) to limit access to electrically energized equipment and conductors in order to prevent access to electrical hazards by unauthorized individuals or wildlife.	HS-9, HSP 5-257								X							X			
Siting: Establish sufficient setback distances from sensitive receptors wherever feasible. Based on previous experience, noise complaints seldom exist for people living more than 1–1.5 mi (1.6–2.4 km) from a wind farm (Stewart 2006).	NIP 5-56					X													

BMP	References	Socio (7.1)	Land-Based Econ (7.2)	Rec & Tourism (7.3)	Land Use (7.4)	Noise (7.5)	Visual Impacts (7.6)	Public Service & Infra. (7.7)	Public Health & Safety (7.8)	Haz. Mat. (7.9)	Soils & Topo (7.10)	Ground-water Resources (7.11)	Surface Water & Flood-plains (7.12)	Wetlands (7.13)	Veg. (7.14)	Wildlife (7.15)	Rare & Unique Natural Resources (7.16)	Cultural & Archae (7.17)	Air
Siting: Although wind turbines may sometimes be located on ridgelines, skylining of substations, transmission structures, communication towers, and other structures associated with wind energy developments should be avoided; that is, they should not be placed on ridgelines, summits, or other locations where they will be silhouetted against the sky from important viewing locations. Siting should avoid skylining by taking advantage of opportunities to use topography as a backdrop for views of facilities and structures. The presence of these structures should be concealed or made less conspicuous by siting and designing them to harmonize with desirable or acceptable characteristics of the surrounding environment.	VRP 5-188						X	X											
Siting: As feasible, siting of linear features (ROWs and roads) associated with wind energy developments should follow natural land contours rather than straight lines, particularly up slopes. Fall-line cuts should be avoided. Where it can be accomplished without introducing unacceptable impacts on other resources, following natural contours echoes the lines found in the landscape and often reduces cut-and-fill requirements; straight lines can introduce conspicuous linear contrasts that appear unnatural.	VRP 5-188						X	X			X								
Siting: Avoid altering existing drainage systems, especially in sensitive areas such as erodible soils or steep slopes.	WR-4, WRP 5-33										X	X	X	X					
Siting: Avoid locating wind energy developments in areas of unique or important recreation, wildlife, or visual resources. When feasible, a wind energy development should be sited on already altered landscapes.	LUP 5-14			X	X		X									X	X		
Siting: Avoid placement of wind energy facilities in areas with unsuitable seismic, liquefaction, slope, subsidence, settling, and flooding conditions.	SRP 5-25										X								
Siting: Because the landscape setting observed from national historic sites, national trails, and tribal cultural resources may be a part of the historic context contributing to the historic significance of the site or trail, project siting should avoid locating facilities that would alter the visual setting such as would reduce the historic significance or function.	VRP 5-187																	X	
Siting: Because visual impacts are usually lessened when vegetation and ground disturbances are minimized, where possible, in forested areas or shrublands, siting should take advantage of existing clearings to reduce vegetation clearing and ground disturbance.	VRP 5-189						X				X				X				
Siting: Consolidate infrastructure wherever possible to maximize efficient use of the land and minimize impacts. Existing transmission and market access should be evaluated and use of existing facilities should be maximized.	LUP 5-14							X			X		X	X					

BMP	References	Socio (7.1)	Land-Based Econ (7.2)	Rec & Tourism (7.3)	Land Use (7.4)	Noise (7.5)	Visual Impacts (7.6)	Public Service & Infra. (7.7)	Public Health & Safety (7.8)	Haz. Mat. (7.9)	Soils & Topo (7.10)	Ground-water Resources (7.11)	Surface Water & Flood-plains (7.12)	Wetlands (7.13)	Veg. (7.14)	Wildlife (7.15)	Rare & Unique Natural Resources (7.16)	Cultural & Archae (7.17)	Air
Siting: Consult with Federal, State, and county agencies; tribes; property owners; and other stakeholders as early as possible in the planning process to identify potentially significant land use conflicts and issues and State and local rules that govern wind energy development.	LUP 5-14				X														
Siting: Consult with the DOD during initial project planning to evaluate the potential impact of a proposed development on military airspace in order to identify and address any DOD concerns.	LUP 5-15				X				X										
Siting: Existing roads should be used to the extent possible, but only in safe and environmentally sound locations. If new access roads are necessary, they should be designed and constructed to the appropriate standard necessary to accommodate their intended function (e.g., traffic volume and weight of vehicles) and minimize erosion. Access roads that are no longer needed should be recontoured and revegetated.	LUP 5-15						X	X			X			X	X				
Siting: Identify and avoid unstable slopes and local factors that can cause slope instability (groundwater conditions, precipitation, seismic activity, high slope angles, and certain geologic landforms).	WRP 5-33										X	X	X	X					
Siting: If operation of the wind energy facility and associated transmission lines and substations could cause potential adverse impacts on nearby residences and occupied buildings as a result of noise, sun reflection, or EMF, incorporate recommendations for addressing these concerns into the project design (e.g., establishing a sufficient setback from transmission lines).	HSP 5-257							X	X	X									
Siting: Locations for transmission line and ROW road crossings of other roads, streams, and other linear features within a corridor should be chosen to avoid KOP viewsheds and other visually sensitive areas and to minimize disturbance to vegetation and landforms. The ROWs should cross linear features (e.g., trails, roads, and rivers) at right angles whenever possible to minimize the viewing area and duration.	VIP 5-189						X	X											
Siting: Minimize the extent of land disturbance to the extent possible.	WRP 5-33				X			X			X								
Siting: Minimize the extent of the project footprint, including improved roads and construction staging areas.	SRP 5-25			X	X		X	X			X		X	X	X	X			
Siting: Minimize the number of road miles of new road construction needed for the project.	ERP 5-129							X			X				X				
Siting: Minimize the size of areas in which soil would be disturbed or vegetation would be removed.	ERP 5-129										X				X				
Siting: Plan and site the wind energy development to minimize impacts on other land uses.	LUP 5-14				X														
Siting: Prepare the FAA-required notice of proposed construction during initial project planning in order to identify any air safety issues and required mitigation measures.	LUP 5-15				X				X										
Siting: Project design should provide visual order and unity among clusters of turbines (visual units) to avoid visual disruptions and perceived “disorder, disarray, or clutter.”	VRP 5-189						X												

BMP	References	Socio (7.1)	Land-Based Econ (7.2)	Rec & Tourism (7.3)	Land Use (7.4)	Noise (7.5)	Visual Impacts (7.6)	Public Service & Infra. (7.7)	Public Health & Safety (7.8)	Haz. Mat. (7.9)	Soils & Topo (7.10)	Ground-water Resources (7.11)	Surface Water & Flood-plains (7.12)	Wetlands (7.13)	Veg. (7.14)	Wildlife (7.15)	Rare & Unique Natural Resources (7.16)	Cultural & Archae (7.17)	Air
Siting: Project developers shall work with appropriate agencies (e.g., DOE and TSA) to address critical infrastructure and key resource vulnerabilities at wind energy facilities, and to minimize and plan for potential risks from natural events, sabotage, and terrorism.	HS-12, HSP 5-257							X	X										
Siting: Site and design the project to comply with FAA regulations, including lighting requirements, and to avoid potential safety issues associated with proximity to airports, military bases or training areas, or landing strips.	HS-10, HSP 5-257						X		X										
Siting: Site and design wind energy facilities to eliminate glint and glare effects on roadway users, nearby residences, commercial areas, or other highly sensitive viewing locations, or reduce it to the lowest achievable levels.	HSP 5-257						X		X										
Siting: Site new roads to avoid crossing streams and wetlands and minimize the number of drainage bottom crossings.	SRP 5-25							X					X	X					
Siting: Site new roads to follow natural land contours; excessive slopes should be avoided.	SRP 5-25										X								
Siting: Siting of facilities, especially linear facilities, should take advantage of natural topographic breaks (i.e., pronounced changes in slope), and siting of facilities on steep side slopes should be avoided. Facilities sited on steep slopes are often more visible (particularly if either the project or viewer is elevated); in addition, they may be more susceptible to soil erosion, which could contribute to negative visual impacts.	VRP 5-188						X				X			X					
Siting: Siting should take advantage of both topography and vegetation (where possible) as screening devices to restrict views of projects from visually sensitive areas.	VRP 5-189						X				X				X				
Siting: Spatially accurate and realistic photo simulations of wind turbines in the proposed location should be prepared as part of the siting process. Simulations should show views from sensitive visual resource areas; highly sensitive viewing locations, such as residences; and more representative typical viewing locations. Stakeholders should be involved in selecting KOPs for simulations. Where feasible, simulations should portray a range of lighting conditions and sun angles. Simulations should be based on accurate spatial information, particularly elevation data, and must account for screening vegetation and structures. Simulations should show enough of the surrounding landscape to show the project in the appropriate spatial context and should be reproduced at a large enough size to be comfortably viewed from the appropriate specified distance to accurately depict the apparent size of the facility in a real setting.	VRP 5-188			X			X												
Siting: Structures and roads should be designed and located to minimize and balance cuts and fills. Reducing cut and fill has numerous visual benefits, including fewer fill piles, landforms and vegetation that appear more natural, fewer or reduced color contrasts with disturbed soils, and reduced visual disturbance from erosion and the establishment of invasive species.	VRP 5-190						X	X			X								

BMP	References	Socio (7.1)	Land-Based Econ (7.2)	Rec & Tourism (7.3)	Land Use (7.4)	Noise (7.5)	Visual Impacts (7.6)	Public Service & Infra. (7.7)	Public Health & Safety (7.8)	Haz. Mat. (7.9)	Soils & Topo (7.10)	Ground-water Resources (7.11)	Surface Water & Flood-plains (7.12)	Wetlands (7.13)	Veg. (7.14)	Wildlife (7.15)	Rare & Unique Natural Resources (7.16)	Cultural & Archae (7.17)	Air
Siting: Structures, roads, and other project elements should be set as far back from road, trail, and river crossings as possible, and vegetation should be used to screen views from crossings, where feasible.	VRP 5-191			X			X	X					X	X					
Siting: Take advantage of topography and the distance to nearby sensitive receptors when positioning potential sources of noise.	NIP 5-56					X													
Siting: The eye is naturally drawn to prominent landscape features (e.g., knobs and waterfalls); thus, projects and their elements should not be sited next to such features, where possible.	VRP 5-187						X				X								
Siting: The eye naturally follows strong natural lines in the landscape, and these lines and associated landforms can “focus” views on particular landscape features. For this reason, linear facilities associated with a wind energy project, such as transmission lines and roads, generally should not be sited so that they bisect ridge tops or run down the center of valley bottoms.	VRP 5-187						X				X								
Siting: The only way to completely avoid any adverse impacts on radar involves methods that avoid locating turbines in the radar line of sight (e.g., achieved by distance, terrain masking, or terrain relief; DOD 2006). An additional solution could be to replace aging radar equipment with modern and flexible equipment that can better distinguish wind farm clutter from aircraft or weather (Brenner et al. 2008). Turbine operations could also be curtailed during significant weather events. Western generally advises developers submitting nterconnection requests to avoid areas that would potentially conflict with radar facilities.	LUP 5-15				X				X										
Siting: The siting and design of facilities, structures, roads, and other project elements should match and repeat the form, line, color, and texture of the existing landscape.	VRP 5-190						X				X								
Siting: Through site design, the number of structures required should be minimized. Activities should be combined and carried out in one structure, or structures should be collocated to share pads, fences, access roads, lighting, etc.	VRP 5-190				X		X												
Siting: To the extent possible, given the terrain of a site, wind turbines should be clustered or grouped when placed in large numbers, but a cluttering effect should be avoided by separating otherwise overly long lines of turbines or large arrays, and breaks or open zones should be inserted to create distinct visual units or groups of turbines.	VRP 5-189						X				X								
Siting: To the extent possible, transmission lines and roads associated with wind energy facilities should be collocated within a corridor to use existing/shared ROWs, existing/shared access and maintenance roads, and other infrastructure in order to reduce visual impacts associated with new construction.	VRP 5-189						X	X											
Siting: Use existing roads and disturbed areas to the extent possible.	SRP 5-25, WRP 5-33				X		X				X		X	X	X	X		X	

BMP	References	Socio (7.1)	Land-Based Econ (7.2)	Rec & Tourism (7.3)	Land Use (7.4)	Noise (7.5)	Visual Impacts (7.6)	Public Service & Infra. (7.7)	Public Health & Safety (7.8)	Haz. Mat. (7.9)	Soils & Topo (7.10)	Ground-water Resources (7.11)	Surface Water & Flood-plains (7.12)	Wetlands (7.13)	Veg. (7.14)	Wildlife (7.15)	Rare & Unique Natural Resources (7.16)	Cultural & Archae (7.17)	Air
Siting: Use existing roads to the maximum extent feasible to access a proposed project area. Install meteorological towers and conduct other characterization activities (e.g., geotechnical testing) as close as practicable to existing access roads.	VR-12, VRP 5-193			X	X		X	X			X				X	X			
Siting: Where possible, developments should be sited in already industrialized and developed landscapes, with due consideration for visual absorption capacity and possible cumulative effects.	VRP 5-187				X		X												
Siting: Wind turbine siting should be sensitive to and respond to the surrounding landscape in a visually pleasing way. For example, in rolling landscapes, a less rectilinear and rigid configuration of turbines that follows local topography may be appropriate. In flatter agricultural landscapes with rectilinear patterns of road and fields, a more geometric or linear wind turbine configuration may be preferred.	VRP 5-189			X			X	X											
Siting: Wind turbines should be sited properly to eliminate shadow flicker effects on nearby residences or other highly sensitive viewing locations, or reduce them to the lowest achievable levels, as calculated using appropriate siting software and procedures. Accurately determined shadow flicker estimates should be made available to stakeholders in advance of project approval. If turbine locations are changed during the siting process, shadow flicker effects should be recalculated and made available to potentially affected stakeholders.	VRP 5-188						X												
Soils: Following completion of construction and during decommissioning, subsoil shall be decompacted.	LU-8, LUP 5-14										X								
Soils: Topsoil from cut/fill activities shall be segregated and spread on freshly disturbed areas to reduce color contrast and aid rapid revegetation. Topsoil piles shall not be left in sensitive viewing areas.	VR-20, VRP 5-193						X				X				X				
Soils: Topsoil shall be stripped from any agricultural area used for traffic or vehicle parking— segregating topsoil from excavated rock and subsoil—and replaced during restoration activities.	LU-6, LUP 5-14				X			X			X				X				X
Topography: Benches shall be provided in rock cuts to accent natural strata.	VR-19, VRP 5-193						X				X								
Topography: Cut slopes shall be randomly scarified and roughened to reduce texture contrasts with existing landscapes and to aid in revegetation.	VR-41, VRP 5-195						X				X								
Topography: Natural or previously excavated bedrock landforms shall be sculpted and shaped when excavation of these landforms is required. A percentage of backslope, benches, and vertical variations shall be integrated into a final landform that repeats the natural shapes, forms, textures, and lines of the surrounding landscape. The earthen landform shall be integrated and transitioned into the excavated bedrock landform. Sculpted rock face angles, bench formations, and backslope need to adhere to the natural bedding planes of the natural bedrock geology. Half-case drill traces from pre-split blasting shall not remain evident in the final rock face. Where feasible, the color contrast shall be removed from the excavated rock faces by color-treating with a rock stain.	VR-24, VRP 5-193						X				X								

BMP	References	Socio (7.1)	Land-Based Econ (7.2)	Rec & Tourism (7.3)	Land Use (7.4)	Noise (7.5)	Visual Impacts (7.6)	Public Service & Infra. (7.7)	Public Health & Safety (7.8)	Haz. Mat. (7.9)	Soils & Topo (7.10)	Ground-water Resources (7.11)	Surface Water & Flood-plains (7.12)	Wetlands (7.13)	Veg. (7.14)	Wildlife (7.15)	Rare & Unique Natural Resources (7.16)	Cultural & Archae (7.17)	Air
Transportation: A traffic management plan shall be prepared for the site access roads to ensure that no hazards would result from increased truck traffic and that traffic flow would not be adversely impacted. This plan shall identify measures that will be implemented to comply with any State or Federal DOT requirements, such as informational signs, flaggers when equipment may result in blocked throughways, and traffic cones to identify any necessary changes in temporary lane configurations. Signs shall be placed along roads to identify speed limits, travel restrictions, and other standard traffic control information. To minimize impacts on local communities, consideration shall be given to limiting construction vehicles on public roadways during the morning and late afternoon commute times.	HS-8, HSP 5-256							X	X										X
Transportation: A transportation plan shall be prepared that identifies measures the developer will implement to comply with State or Federal requirements and to obtain the necessary permits. This will address the transport of turbine components, main assembly crane, and other large pieces of equipment. The plan shall consider specific object size, weight, origin, destination, and unique handling requirements and shall evaluate alternative means of transportation (e.g., rail or barge).	LU-11, LUP 5-15				X			X	X										
Transportation: Access roads shall be designed and constructed to the appropriate standard necessary to accommodate their intended function (e.g., traffic volume and weight of vehicles) and minimize erosion. Access roads that are no longer needed should be recontoured and revegetated.	LU-10, LUP 5-15				X			X			X				X				X
Transportation: Develop a traffic management plan for the site access roads to control hazards that could result from increased truck traffic (most likely during construction or decommissioning), ensuring that traffic flow would not be adversely affected and that specific issues of concern (e.g., the locations of school bus routes and stops) are identified and addressed. This plan shall incorporate measures such as informational signs, flaggers (when equipment may result in blocked throughways), and traffic cones to identify any necessary changes in temporary lane configurations. The plan shall be developed in coordination with local planning authorities.	HS-8, HSP 5-256						X	X	X										
Vegetation: Planting pockets shall be left on slopes, where feasible.	VR-18, VRP 5-193						X								X				
Vegetation: Reduce habitat disturbance by keeping vehicles on access roads and minimizing foot and vehicle traffic through undisturbed areas.	ER-4, ERP 5-130															X			
Vegetation: Road maintenance activities shall avoid blading of existing forbs and grasses in ditches and adjacent to roads; however, any invasive or noxious weeds shall be controlled as needed.	VR-37, VRP 5-195						X	X							X				

BMP	References	Socio (7.1)	Land-Based Econ (7.2)	Rec & Tourism (7.3)	Land Use (7.4)	Noise (7.5)	Visual Impacts (7.6)	Public Service & Infra. (7.7)	Public Health & Safety (7.8)	Haz. Mat. (7.9)	Soils & Topo (7.10)	Ground-water Resources (7.11)	Surface Water & Flood-plains (7.12)	Wetlands (7.13)	Veg. (7.14)	Wildlife (7.15)	Rare & Unique Natural Resources (7.16)	Cultural & Archae (7.17)	Air
Vegetation: The vegetation-clearing design in forested areas should include the feathering of cleared area edges (i.e., the progressive and selective thinning of trees from the edge of the clearing inward) combined with the mixing of tree heights from the edge to create an irregular vegetation outline. These actions would result in a more natural-appearing edge, thereby avoiding the very high linear contrasts associated with straight-edged, clear-cut areas.	VRP 5-190						X								X				
Visual: In addition to mitigation measures that directly reduce the visual resource impacts of wind energy and associated facilities, aesthetic offsets present a mitigation option in some situations. Aesthetic offsets should be considered in situations where visual impacts are unavoidable or where alternative mitigation options are only partially effective or uneconomical. An aesthetic offset is a correction or remediation of an existing condition located in the same viewshed of the proposed development that has been determined to have a negative visual or aesthetic impact. For example, aesthetic offsets could include reclamation of unnecessary roads in the area, removal of abandoned buildings, cleanup of illegal dumps or trash, or the rehabilitation of existing erosion or disturbed areas.	VRP 5-196						X	X											
Visual: In forested areas and shrublands, openings in vegetation for facilities, structures, roads, etc., should mimic the size, shape, and characteristics of naturally occurring openings to the extent possible.	VRP 5-190						X	X							X				
Visual: In forested areas or shrublands, where possible, linear facilities should follow the edges of clearings (where they would be less conspicuous) rather than pass through their center.	VRP 5-189						X				X				X				
Visual: Installation of gravel and pavement shall be avoided where possible to reduce color and texture contrasts with the existing landscape.	VR-14, VRP 5-193						X	X											
Visual: Lighting for facilities shall not exceed the minimum required for safety and security, and full cutoff designs that minimize upward light scattering (light pollution) shall be selected. If possible, site design shall be accomplished to make security lights nonessential. Where they are necessary, security lights shall be extinguished except when activated by motion detectors (e.g., only around the substation).	VR-7, VRP 5-192						X									X			
Visual: Minimize the amount of lighting installed on project turbines; all outdoor lighting on project buildings shall be downshielded.	ER-10, ERP 5-130						X												
Visual: Penalty clauses should be used to protect trees and other sensitive visual resources.	VRP 5-192						X								X				
Visual: Signage shall be minimized; reverse sides of signs and mounts shall be painted or coated to reduce color contrasts with the existing landscape.	VR-28, VRP 5-194						X												
Visual: Soil disturbance shall be minimized in areas with highly contrasting subsoil color.	VR-23, VRP 5-193						X				X								
Visual: The operator shall use nonreflective paints and coatings on wind turbines, visible ancillary structures, and other equipment to reduce reflection and glare.	VR-5, VRP 5-191						X												

BMP	References	Socio (7.1)	Land-Based Econ (7.2)	Rec & Tourism (7.3)	Land Use (7.4)	Noise (7.5)	Visual Impacts (7.6)	Public Service & Infra. (7.7)	Public Health & Safety (7.8)	Haz. Mat. (7.9)	Soils & Topo (7.10)	Ground-water Resources (7.11)	Surface Water & Flood-plains (7.12)	Wetlands (7.13)	Veg. (7.14)	Wildlife (7.15)	Rare & Unique Natural Resources (7.16)	Cultural & Archae (7.17)	Air
Visual: Turbines, visible ancillary structures, and other equipment shall be painted before or immediately after installation.	VR-6, VRP 5-191						X												
Visual: Valuable trees and other scenic elements can be protected by clearing only to the edge of the designed grade manipulation and not beyond through the use of retaining walls, and by protecting tree roots and stems from construction activities. Brush-beating or mowing rather than vegetation removal should be done, where feasible.	VRP 5-193						X								X				
Visual: Visual impact mitigation objectives and activities shall be discussed with equipment operators before construction activities begin.	VR-11, VRP 5-192						X												
Visual: Where possible, projects should be sited outside the viewsheds of key observation points (KOPs), highly sensitive viewing locations, and/or areas with limited visual absorption capability and/or high scenic integrity. When wind energy developments and associated facilities must be sited within view of KOPs, they should be sited as far away as possible, since visual impacts generally diminish as viewing distance increases.	VRP 5-187			X			X												
Visual: Where possible, staging and laydown areas should be sited outside the viewsheds of KOPs and not in visually sensitive areas; they should be sited in swales, around bends, and behind ridges and vegetative screens, where these screening opportunities exist.	VRP 5-192			X			X				X								
Visual: Where screening topography and vegetation are absent, natural-looking earthwork berms and vegetative or architectural screening should be used to minimize visual impacts associated with ancillary facilities. Vegetative screening can be particularly effective along roadways.	VRP 5-190						X				X				X				
Visual: Wind turbines should exhibit visual uniformity in the shape, color, and size of rotor blades, nacelles, and towers.	VRP 5-190						X												
Water Resources: Avoid creating hydrologic conduits between two aquifers (e.g., upper and lower).	WRP 5-33											X	X	X					
Water Resources: Identify areas of groundwater recharge and discharge and evaluate their potential relationship with surface water bodies and groundwater quality.	WRP 5-33											X	X	X					
Water resources: Isolate excavation areas (and soil piles) from surface water bodies using silt fencing, bales, or other accepted appropriate methods to prevent sediment transport by surface runoff.	SR-9, SRP 5-26						X				X								
Water resources: Use earth dikes, swales, and lined ditches to divert local runoff around the work site.	SR-10, SRP 5-26										X		X	X					
Wetlands/Vegetation: For wetland and grassland easements, coordinate closely with the USFWS or USDA during initial project planning to ensure that wetland and grassland easements are avoided to the extent practicable.	LUP 5-15						X							X	X				

BMP	References	Socio (7.1)	Land-Based Econ (7.2)	Rec & Tourism (7.3)	Land Use (7.4)	Noise (7.5)	Visual Impacts (7.6)	Public Service & Infra. (7.7)	Public Health & Safety (7.8)	Haz. Mat. (7.9)	Soils & Topo (7.10)	Ground-water Resources (7.11)	Surface Water & Flood-plains (7.12)	Wetlands (7.13)	Veg. (7.14)	Wildlife (7.15)	Rare & Unique Natural Resources (7.16)	Cultural & Archae (7.17)	Air
Wildlife/Vegetation: Contact appropriate Federal and State agencies (including State entities responsible for permitting energy development projects) early in the planning process to identify potentially sensitive ecological resources known to be present or likely to be present in the vicinity of the wind energy development.	WRP 5-128							X			X								
Wildlife/Vegetation: Do not locate individual meteorological towers in or adjacent to sensitive habitats or in areas where ecological resources known to be sensitive to human activities are present.	WRP 5-129			X	X										X	X			
Wildlife/Vegetation: Review existing information on species and habitats in the project area. Identify important, sensitive, or unique habitat (including large contiguous tracts of grassland habitat) and biota in the project site and vicinity, and design the project to avoid, minimize, or mitigate potential impacts on these resources. Avoidance is the typically the most effective, and therefore preferred, choice for minimizing impacts. The design and siting of the facility should follow appropriate guidance and requirements from Western and the USFWS (as specified for each species in the selected alternative in the Final PEIS) as well as those required by State permitting agencies, and other resource agencies, as available and applicable. For birds specifically, attention should be given to project placement that may be within or near Important Bird Areas (http://netapp.audubon.org/iba) or Hemispheric or Regional Western Hemisphere Shorebird Reserve Network sites (http://www.whsrn.org/whsrn-sites), or where bird species or habitats of conservation concern are known to occur. The IBA Program has identified the most essential areas for birds, and conservation of these areas will provide for long-term protection of biodiversity. Sources of information on these important habitats can be found at http://ecos.fws.gov/ipac, http://www.avianknowledge.net, and http://web4.audubon.org/bird/iba.	WRP 5-127															X			
Wildlife: Avoid constructing turbines in areas of concentrated prey base for raptors (e.g., prairie dog towns).	ERP 5-130															X			
Wildlife: Consult with the appropriate natural resource agencies to avoid scheduling construction activities during important periods for wildlife courtship, breeding, nesting, lambing, or calving that are applicable to sensitive species within the project area.	ERP 5-130				X											X			
Wildlife: Establish buffer zones around known raptor nests, bat roosts, and biota and habitats of concern if site evaluations show that proposed construction activities would pose a significant risk to avian or bat species of concern.	ER-6, ERP 5-130															X			
Wildlife: Evaluate potential avian and bat use (including the locations of active nest sites, colonies, roosts, and migration corridors) of the project and use data to plan turbine (and other structure/infrastructure) locations to minimize impacts.	ERP 5-128															X			

BMP	References	Socio (7.1)	Land-Based Econ (7.2)	Rec & Tourism (7.3)	Land Use (7.4)	Noise (7.5)	Visual Impacts (7.6)	Public Service & Infra. (7.7)	Public Health & Safety (7.8)	Haz. Mat. (7.9)	Soils & Topo (7.10)	Ground-water Resources (7.11)	Surface Water & Flood-plains (7.12)	Wetlands (7.13)	Veg. (7.14)	Wildlife (7.15)	Rare & Unique Natural Resources (7.16)	Cultural & Archae (7.17)	Air
Wildlife: Evaluate the potential for the wind energy project to adversely affect bald and golden eagles in a manner consistent with the Eagle Conservation Plan Guidance (USFWS 2013a). Early in the planning of transmission interconnection and wind farm location, coordination with USFWS Field Offices regarding the guidance is highly recommended. Documented occurrence of eagles can be acquired from the local USFWS Ecological Services office, State wildlife agencies, or State natural heritage databases in some cases, although on-site surveys may be needed. In accordance with the USFWS's Land-Based Wind Energy Guidelines (USFWS 2012b), surveys during early project development should identify all important eagle use areas (nesting, foraging, and winter roost areas) within the project's footprint. If recent data are available on the spacing of occupied eagle nests for the project-area nesting population, these data can be used to delineate an appropriate boundary for the project area. If appropriate survey data are unavailable, the USFWS suggests that the project area, for the purpose of evaluating potential effects on eagles, be defined as the project footprint together with areas within 10 mi (16 km) of the footprint boundary. As described in the USFWS's Land-Based Wind Energy Guidelines (USFWS 2012b), project developers should evaluate the need to develop an ECP.	ERP 5-128															X			
Wildlife: Follow the recommendations provided in the USFWS's Land-Based Wind Energy Guideline (USFWS 2012b) and, as appropriate, the Eagle Conservation Plan Guidance (USFWS 2013a). In addition, follow guidelines or recommendations developed by individual States (e.g., IDNR 2011; Kempema 2009; Nebraska Wind and Wildlife Working Group 2011) to address potential effects of wind energy development on ecological resources.	WRP 5-126				X											X			
Wildlife: If appropriate, conduct surveys for presence of Federal- and State-protected species and other species of concern and the habitats for such species that have a reasonable potential to occur within the project area based on habitat characteristics. Consult with the USFWS and/or appropriate State agency to identify species likely to be present and appropriate survey techniques, determine permit needs, and identify/apply species-specific avoidance and minimization measures.	WRP 5-128															X	X		
Wildlife: If significant impacts on Important Bird Areas (IBAs) or similar ecologically important avian areas are not avoided, minimized, or mitigated, then this Final PEIS would not apply and a separate project specific NEPA evaluation must be developed and approved by the appropriate responsible federal agency prior to project construction.	WRP 5-128															X			

BMP	References	Socio (7.1)	Land-Based Econ (7.2)	Rec & Tourism (7.3)	Land Use (7.4)	Noise (7.5)	Visual Impacts (7.6)	Public Service & Infra. (7.7)	Public Health & Safety (7.8)	Haz. Mat. (7.9)	Soils & Topo (7.10)	Ground-water Resources (7.11)	Surface Water & Flood-plains (7.12)	Wetlands (7.13)	Veg. (7.14)	Wildlife (7.15)	Rare & Unique Natural Resources (7.16)	Cultural & Archae (7.17)	Air
Wildlife: In the absence of long-term mortality studies, monitor regularly for potential wildlife problems including wildlife mortality. Report observations of potential wildlife problems, including wildlife mortality, to the appropriate State or Federal agency in a timely manner, and work with the agencies to utilize this information to avoid/minimize/offset impacts. The Ecological Services Division of the USFWS shall be contacted. Development of additional mitigation measures may be necessary.	ER-22, ERP 5-131															X			
Wildlife: Increasing turbine cut-in speeds (i.e., prevent turbine rotation at lower wind velocity) in areas of bat conservation concern during times when active bats may be at particular risk from turbines.	ER-20, ERP 5-131															X			
Wildlife: Instruct employees, contractors, and site visitors to avoid harassment and disturbance of wildlife, especially during reproductive (e.g., courtship and nesting) seasons. Pets shall not be allowed on the project area.	ER-21, ERP 5-131															X			
Wildlife: Place marking devices on any newly constructed or upgraded transmission lines, where appropriate, within suitable habitats for sensitive bird species.	ER-14, ERP 5-131															X			

BMP	References	Socio (7.1)	Land-Based Econ (7.2)	Rec & Tourism (7.3)	Land Use (7.4)	Noise (7.5)	Visual Impacts (7.6)	Public Service & Infra. (7.7)	Public Health & Safety (7.8)	Haz. Mat. (7.9)	Soils & Topo (7.10)	Ground-water Resources (7.11)	Surface Water & Flood-plains (7.12)	Wetlands (7.13)	Veg. (7.14)	Wildlife (7.15)	Rare & Unique Natural Resources (7.16)	Cultural & Archae (7.17)	Air
Wildlife: Prepare a Bird and Bat Conservation Strategy (BBCS). The overall goal of such a plan is to reduce or eliminate avian and bat mortality; implementation of a BBCS builds support for a FONSI when projects tier from the PEIS. The wind energy facility developer should work closely with the USFWS and the appropriate State wildlife agencies to identify protective measures to include in the plan. These would include project design measures, construction phase measures, operational phase measures, and decommissioning phase measures. A minimum of 1 yr of post-construction monitoring is needed to validate the preconstruction risk assessment and allow the facility owner to adjust operations based on identified problems. Based on project location in proximity to occupancy, habitat, and other ttributes that may increase the risk to birds and bats, multiyear post-construction monitoring may be necessary at some project sites. It is of paramount importance that post-construction surveys are accurate estimates of fatality at wind power facilities. Simple carcass counts at wind energy facilities are inaccurate and underestimate the total number of fatalities because not all carcasses are found due to factors such as unsearchable terrain, carcass removal by scavengers, and less than perfect searcher efficiency. Post-construction surveys for mortality must be robust and standardized to provide reliable results upon which to base adaptive management decisions. For these reasons, using a fatality estimator model is critical. The USFWS recommends a model like the Evidence of Absence model developed by Huso et al. (2014). The user's guide and software developed to estimate bird and bat fatalities at wind-power facilities (Dalthorp et al. 2014) can be found at http://pubs.usgs.gov/ds/0881. The Evidence of Absence software provides for comparison of various combinations of search coverage, search interval, and searcher efficiency that all produce the same overall level of carcass detection probability. Results of monitoring activities shall be reported to the appropriate State or Federal agencies in a timely manner. If bat monitoring is appropriate for the site, installation of bat acoustic monitors should be considered at the time meteorological towers are installed to reduce costs and minimize delays by collecting data early	WRP 5-126															X			
Wildlife: The transmission lines shall be designed and constructed with regard to the recommendations in Avian Protection Plan Guidelines (APLIC and USFWS 2005), in conjunction with Suggested Practices for Avian Protection on Power Lines (APLIC 2006) and Reducing Avian Collisions with Power Lines (APLIC 2012), to reduce the operational and avian risks that result from avian interactions with electric utility facilities.	ER-1, ERP 5-128															X			

BMP	References	Socio (7.1)	Land-Based Econ (7.2)	Rec & Tourism (7.3)	Land Use (7.4)	Noise (7.5)	Visual Impacts (7.6)	Public Service & Infra. (7.7)	Public Health & Safety (7.8)	Haz. Mat. (7.9)	Soils & Topo (7.10)	Ground-water Resources (7.11)	Surface Water & Flood-plains (7.12)	Wetlands (7.13)	Veg. (7.14)	Wildlife (7.15)	Rare & Unique Natural Resources (7.16)	Cultural & Archae (7.17)	Air
Wildlife: Tier to the Final Programmatic EIS. The responsible federal agency will use a tiered NEPA evaluation to document avoidance, minimization, or mitigation of impacts to important bird habitat (e.g., established private, State, or federal special management areas for birds, IBAs, Regional Western Hemisphere Shorebird Reserve Network, [http://www.whsrn.org/whsrn-sites], etc.) to achieve no significant impact to avian resources. On a project-by-project basis, developers should contact local USFWS offices early in the planning process to identify areas of conflict with specific avian species or important bird habitat. Developers shall work with USFWS and Western to develop avoidance, minimization, or mitigation measures to adequately demonstrate their project will have no significant impact on avian resources. In these cases, individual projects determined to be consistent with the selected alternative in the Final PEIS will require a FONSI to document consistency.	ER 5-127															X			
Wildlife: Turn off unnecessary lighting at night to limit attraction of migratory birds. Follow lighting guidelines, where applicable, from the Wind Energy Guidelines Handbook. This includes using lights with timed shutoff, downward-directed lighting to minimize horizontal or skyward illumination, and avoidance of steady-burning, high-intensity lights.	ER-19, ERP 5-131															X			

APPENDIX H – PHASE I RECONNAISSANCE SURVEY OF THE PALMER’S CREEK WIND PROJECT

APPENDIX I – SCOPING MEETING INFORMATION

AFFIDAVIT OF PUBLICATION
Granite Falls – Clarkfield Advocate Tribune
713 Prentice St.
Granite Falls, MN 56241
State of Minnesota, County of Yellow Medicine

Lee Ann Smith, being duly sworn, on oath, says that he/she is the publisher or authorized agent of the newspaper known as the Granite Falls – Clarkfield Advocate Tribune, and has full knowledge of the facts which are stated below:

(A) The newspaper has complied with all of the requirements constituting qualification as a qualified newspaper, as provided by Minnesota Statute 331A.02, 331A.07, and other applicable laws, as amended.

(B) The printed Palmer's Creek Wind farm - Public Notice

which is attached was cut from the columns of said newspaper, and was printed and published once each week, for 1 successive weeks; it was first published on Thurs, the 10 day of Nov, 20 16, and was thereafter printed and published on every ______ to and including ______, the ______ day of ______, 20 ______; and printed below is a copy of the lower case alphabet from A to Z, both inclusive, which is hereby acknowledged as being the size and kind of type used in the composition and publication of the notice.

abcdefghijklmnopqrstuvwxyz

(C) Pursuant to Minnesota Statutes §580.033 relating to the publication of mortgage foreclosure notices: The newspaper's known office of issue is located in Yellow Medicine County. The newspaper complies with the conditions described in §580.33, subd.1, clause (1) or (2). If the newspaper's known office of issue is located in a county adjoining the county where the mortgaged premises or some part of the mortgaged premises described ion the notice are located, a substantial portion of the newspaper's circulation is in the latter county.

By Lee Ann Smith

Title Authorized Agent

Subscribed and sworn to before me on:

this 21 day of Nov, 20 16.

Ashley Finnes
Notary Public

RATE INFORMATION

(1) Lowest classified rate by commercial user for comparable space — $ ______ (Line, word or inch rate)

(2) Maximum rate allowed by law for the above matter — $ ______ (Line, word or inch rate)

(3) Rate actually charged for the above matter — $ ______ (Line, word or inch rate)

PUBLIC NOTICE

Public Input Encouraged!

Public comments are sought to define the scope and alternatives for an Environmental Assessment of a proposed wind facility in Chippewa County, north of Granite Falls, Minnesota. The proposed project, called Palmer's Creek Wind Farm, will include up to 18 wind turbine generators and the associated access roads and underground power collection system. An operations and maintenance facility will also be part of this project. Construction of the Palmer's Creek wind energy project is proposed to begin September 2017.

Western Area Power Administration will hold a public scoping meeting to define the scope of the Palmer's Creek Wind Environmental Assessment. The meeting location is handicapped accessible.

To learn more about this project and to share your ideas, join us at: 5 to 8 p.m. Thursday, December 1, 2016, Kilowatt Comunity Center, 600 Kilowatt Drive, Granite Falls, MN 56241.

For more information about the proposed project or to be added to the project mailing list, please contact:

Tom Atkinson, Environmental Protection Specialist, Western Power Administration, P.O. Box 1173, Bismarck, ND 58102-1173. Phone: (800) 422-0828. Email: tatkinson@wapa.gov

November 10, 2016

ASHLEY C. FINNES
Notary Public-Minnesota
My Commission Expires Jan 31, 2018

APPENDIX J – AGENCY CORRESPONDENCE AND PUBLIC COMMENTS