Bird and Bat Conservation Strategy

NOBLES 2 POWER PARTNERS, LLC

Nobles County, Minnesota
Revised July 24, 2018

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Bird and Bat Conservation Strategy

Nobles 2 Wind Project

Nobles County, Minnesota

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ACRONYMS AND ABBREVIATIONS

amsl	above mean sea level
APLIC	Avian Power Line Interaction Committee
APM	Applicant Proposed Measures
BBCS	Bird and Bat Conservation Strategy
BBS	North American Breeding Bird Survey
BCC	Birds of Conservation Concern
BGEPA	Bald and Golden Eagle Protection Act
BMPs	Best Management Practices
DOC-EERA	Dept. of Commerce, Energy Environmental Review and Analysis
ECPG	Eagle Conservation Plan Guidance
ESA	Endangered Species Act
FAA	Federal Aviation Administration
ft	feet
GIS	Geographic Information Systems
GPS	Global Positioning System
kV	kilovolt
IBAs	Important Bird Areas
IPaC	Information, Planning, and Conservation System
LWECS	large wind energy conversion systems
m	meters
MBTA	Migratory Bird Treaty Act
mi^2	square mile(s)
MNDNR	Minnesota Department of Natural Resources
MPUC	Minnesota Public Utilities Commission
MW	megawatt
NHI	Natural Heritage Inventory
Nobles 2	Nobles 2 Power Partners
NPDES	National Pollutant Discharge Elimination System
NWI	National Wetlands Inventory
O&M	operations and maintenance
RD	rotor diameter
ROW	right-of-way
RSA	rotor swept area
SCS	Site Characterization Study
SD	standard deviation
SWPPP	Storm Water Pollution Prevention Plan
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WEG	USFWS Final Land-based Wind Energy Guidelines
Westwood	Westwood Professional Services

WIRS	Wildlife Incident Reporting System
WMAs	Wildlife Management Areas
WPAs	Waterfowl Production Areas
WTG	wind turbine generator

1.0 INTRODUCTION

Nobles 2 Power Partners, LLC (Nobles 2), is dedicated to producing clean, reliable, renewable power while demonstrating respect and stewardship for the natural environment. As the sponsor of the up to 260-megawatt (MW) Nobles 2 wind energy conversion system located in Nobles County, Minnesota (hereafter referred to as "Project" or "proposed Project"), Nobles 2 submits the following Bird and Bat Conservation Strategy (BBCS) as evidence of its approach to responsible wind energy development. Nobles 2 believes that the Project will be a net-benefit to the health and prosperity of the nearby communities of Nobles County, Minnesota.

1.1 Corporate Policy on Bird and Bat Conservation

Nobles 2 recognizes that wind power generation has the potential to impact birds and bats, and is committed to minimizing these impacts for the sake of the ecosystems and the communities on which they depend. Nobles 2 also understands that renewable power generation, as an alternative to fossil fuel energy sources, benefits the environment and its inhabitants. By instituting a comprehensive BBCS, Nobles 2 believes that the benefits of the proposed Project will far outweigh its impacts and will provide significant positive contributions to both the human and natural environments.

In that spirit, Nobles 2 is committed to working cooperatively with the U.S. Fish and Wildlife Service (USFWS), Minnesota Department of Natural Resources (MNDNR), Minnesota Department of Commerce Energy Environmental Review and Analysis (DOC-EERA), Minnesota Public Utilities Commission (MPUC), and non-governmental organizations to promote the reasonable protection of bird and bat species during all phases of the Project's development, construction, and operation. Nobles 2 is dedicated to incorporating the latest, state-of-the-art knowledge and best management practices (BMPs) in the field of bird and bat protection at wind farms and this is reflected in its pre-construction assessments, project design, construction, post-construction monitoring, and long-term adaptive management strategies. Over the course of the Project's operating life, Nobles 2 pledges to design and operate the proposed Project in a manner which provides decades of clean, renewable energy to the public while effectively reducing Project impacts to bird and bat species, thereby balancing the health of the environment with society's growing need for electricity.

1.2 Purpose of the BBCS

In fulfillment of Nobles 2's commitment to environmental stewardship, Nobles 2 has developed this site-specific BBCS to reduce potential impacts to birds and bats as a result of construction and operation of the proposed Project. In formulating the BBCS, Nobles 2 incorporated recommendations and guidance from the following sources: the *USFWS Final Land-Based Wind Energy Guidelines* (WEG) (USFWS 2012); USFWS's *Eagle Conservation Plan Guidance – Module 1 – Land-based Wind Energy, Version 2* (ECPG) (USFWS 2013); USFWS's

Bird Protection Plan Guidelines (APLIC and USFWS 2005); *State Guidance from the Minnesota Department of Natural Resources* (MNDNR 2011); *Avian and Bat Survey Protocols for Large Wind Energy Conservation Systems in Minnesota* (Mixon *et al.* 2014); and the Edison Electric Institute's *Reducing Avian Collisions with Power Lines: The State of the Art in 2012* (APLIC 2012). This BBCS also draws upon the results of pre-construction bird and bat studies conducted at and near the Project site; results from relevant post-construction surveys conducted to date at similar facilities; the latest science regarding options for effectively avoiding and minimizing potential impacts to birds and bats; and comments and recommendations that have been received to date from the USFWS and MNDNR during the Project development process (Appendix A).

The BBCS is structured around an adaptive management framework and includes detailed provisions for avoiding, reducing, and, if warranted, mitigating for potential impacts to birds and bats. The BBCS will be a living document throughout the life of the Project, during which, Nobles 2 will work with USFWS and MNDNR to evaluate the findings of post-construction studies, formulate recommendations and definitions, and incorporate them into the BBCS on an iterative basis. The monitoring, reporting and adaptive management programs described in this BBCS will allow this plan to respond and adapt to both actual results and unforeseen or changing (biological or technological) circumstances over the life of the Project.

1.3 Goals and Objectives

This BBCS has been developed to be consistent with the *Avian and Bat Survey Protocols for Large Wind Energy Conservation Systems in Minnesota* (Mixon *et al.* 2014) and the most recent WEG, dated March 23, 2012 (USFWS 2012). The goal of this BBCS is to minimize the Project's impacts to birds and bats in a scientifically sound, and commercially reasonable manner. Nobles 2 intends to achieve this goal by incorporating into the BBCS the following actions:

- Study baseline mortality and injury rates during the first year of project operation, and work with USFWS and MNDNR to establish management strategies and, if applicable, acceptable mortality thresholds;
- Implement a permanent (for the life of the Project) informal wildlife mortality monitoring and reporting program and an immediate alert procedure for biologically significant events;
- Implement a tiered consultation strategy to guide decision-making and allow for modifications to the BBCS, based on actual results and unexpected events over the life of the Project; and
- Evaluate the feasibility and effectiveness of avoidance and minimization measures and adaptive management on minimizing bird and bat mortality.

This document follows the suggested tiered approach as outlined in the WEG by documenting preliminary site evaluation (Tier 1) and characterization (Tier 2), pre-

construction field studies and impact prediction (Tier 3), and post-construction monitoring studies and impact assessment (Tiers 4 and 5). Tier 1 and 2 analyses were conducted for the Project Area to screen for potential broad-based environmental and site development issues and to guide site design. To that end, a Site Characterization Study (SCS) and a Work Plan for 2016 Pre-Construction Avian and Bat Surveys was prepared and shared with the USFWS, MNDNR, and DOC-EERA as part of early agency coordination efforts. The SCS has been incorporated into this BBCS and the Site Permit Application for the Project. Tier 3 field studies served to inform the Project proponents and regulatory agencies regarding avian and bat species present within the Project boundary, and adjacent to the site. Furthermore, Nobles 2 is committed to an adaptive management strategy, such that as new guidance and information becomes available, the BBCS can be amended to incorporate more effective monitoring, avoidance, minimization and mitigation strategies, if needed.

1.4 Agency Coordination

Correspondence with state and federal agencies, including the MNDNR, USFWS, and DOC-EERA was initiated in January 2016 for information specific to the Project regarding sensitive resources and potential impacts. On February 29, 2016, Nobles 2 met with representatives of the USFWS, MNDNR, and DOC-EERA to discuss results of the SCS prepared for the Project on behalf of Nobles 2. Formal request for comment letters were sent by Nobles 2 to the MNDNR and USFWS on March 18, 2016. Comments received both during the February 29 meeting and from formal comment letters indicate that the MNDNR and USFWS would generally characterize the Project site as low risk for avian and bat species, but because of the overall size of the originally proposed Project, MNDNR believes there may be a moderate risk of impacts to bat species. However, since that time, the overall size of the Project Area has been reduced by more than 30,000 acres (see Section 3.0 below). As such Nobles 2 believes that the overall risk of the Project to bats is demonstrably low.

1.5 Regulatory Framework

This BBCS was prepared to demonstrate efforts to comply with federal and state regulations including the federal Endangered Species Act (ESA), Bald and Golden Eagle Protection Act (BGEPA), Migratory Bird Treaty Act (MBTA), and State of Minnesota regulations.

1.5.1 Endangered Species Act

The federal ESA of 1973 (16 U.S.C. §§1531 et seq.), as amended, provides for the listing, conservation, and recovery of listed threatened and endangered species and conservation of designated critical habitat that the USFWS has determined is required for the survival and recovery of these species. Section 9 of the federal ESA prohibits the "take" of species listed by USFWS as threatened or endangered. " Take is defined as "...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 all federal agencies, including the USFWS, to 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 must undertake programs for the conservation of endangered and threatened species, and are prohibited from authorizing, funding, or carrying out any action that will jeopardize a listed species or destroy or modify its critical habitat.

The siting, design, and operation components of the Project incorporate measures to ensure the potential for impacts to federally listed bird and bat species is reduced or eliminated. These measures are described in this BBCS.

1.5.2 Bald and Golden Eagle Protection Act

The federal BGEPA of 1940 (16 U.S.C. §§ 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. 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". 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. 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 (MBTA 1918), 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. In 2009, new permit rules were created for lawful take of eagles. In April, 2013, USFWS issued *Final Eagle Conservation Plan Guidance, Module 1: Land-based Wind Energy* to address these new regulatory matters (USFWS 2013).

In 2017, a new incidental take permit rule for eagles became effective. Under 50 C.F.R. § 22.26, the USFWS can issue permits that authorize incidental take of bald and golden eagles

when the take is associated with, but not the purpose of an otherwise lawful activity, and cannot practicably be avoided, and is compatible with the preservation of the bald and golden eagle. The 2017 rule requires that the permittee comply with all avoidance and minimization or other mitigation measures specified in the terms of the permit to mitigate for the detrimental effects on eagles, including direct and cumulative effects of the permitted take, which the USFWS must also take into account before it issues the permit. Additional considerations for issuing incidental take permits include determinations of whether: the take is associated with the permanent loss of an important eagle use area; the take is necessary to protect a legitimate interest in a particular locality; or the cumulative authorized take may exceed five percent of the local area population.

1.5.3 Migratory Bird Treaty Act

The MBTA of 1918 (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 United States are protected under the MBTA. In total, more than 1,000 bird species are protected by the MBTA, 58 of which can be legally hunted with a permit as game birds.

The MBTA addresses take of individual birds, not population level impacts. Failure to comply with the MBTA can result in criminal penalties. Although the MBTA does not include a provision authorizing incidental take of migratory birds, the USFWS recognizes that some level of mortality of migratory birds at wind projects can occur even if all reasonable measures to avoid mortality are implemented (USFWS 2010). The USFWS has and continues to provide wind power project developers guidance in making a good-faith effort to comply with the MBTA. The USFWS has indicated that the Department of Justice has exercised discretion in enforcing provisions of the MBTA regarding companies who have made good faith efforts to avoid the take of migratory birds. Due to the potential for resident and migratory birds to be affected by the Project, this BBCS has been developed, in part, as a good faith effort on behalf of Nobles 2 to comply with the MBTA.

1.5.4 State of Minnesota Regulations

Minnesota Statute 84.0895, Protection of Threatened and Endangered Species, and its associated rules (Minnesota Rules, Parts 6212.1800 to 6212.2300) require the MNDNR to designate species meeting the statutory definition of endangered, threatened, or species of special concern, and henceforth adopt rules to regulate the treatment of species identified as such under Minnesota Rules, Chapter 6134. Accordingly, a person may not take, import, transport, or sell any portion of an endangered or threatened species unless by MNDNR permit or designated exemption. In addition, Minnesota Statute 216F.03 requires large wind

energy conversion systems (LWECS) to be sited in a “manner compatible with environmental preservation, sustainable development, and the efficient use of resources.”

2.0 PROJECT DESCRIPTION

Nobles 2 is proposing construction of the Project near the city of Wilmont, Minnesota, which is in the north half of Nobles County (Exhibit 2-1). This part of southwest Minnesota is already home to several operating, utility-scale wind farms and the Project is proposed in an existing gap between Nobles Wind Farm (200 MW), Community Wind South (30 MW), Fenton Wind Power Plant (205 MW), Stoneray (105 MW; not yet constructed), Prairie Rose Wind Farm (200 MW) and Lakefield Wind Farm (205.5 MW) where some of the best Minnesota wind resources exist.

The proposed Project will be constructed on approximately 42,547 acres (66 sq. mi.) of land (Project Area), of which 30,356 are currently leased for the Project. The overall footprint of the Project Area has been modified over time to respond to the identified presence of state and federal lands criteria, environmentally sensitive natural resource areas, airports and landowner input. Nobles 2 has selected the Vestas V136-3.6 MW wind turbine generator as the primary wind turbine model for the Project. If the technology is economical and commercialized, Nobles 2 may elect to utilize Vestas V136-3.45 MW, V136-4.0 MW or V136-4.2 MW turbines instead. These turbine model variants have siting requirements that are equal to or lesser than the V136-3.6 MW. The Project will also include 10 to 21 Vestas V110-2.0 MW wind turbines for the purpose of qualifying for the Federal Production Tax Credit ("PTC"). As a result, the number of turbines installed could range from 65 to 82, depending on the configuration selected.

Associated facilities will include wind turbines mounted on towers, underground electrical collection and communications lines, project substation and interconnection switchyard, an O&M building, permanent meteorological tower(s), and gravel access roads. Each WTG would have a hub height of approximately 80 to 82 meters (m) (262 to 269 feet [ft]) and a rotor diameter of 110 to 136 m (361 to 446 ft). The WTGs would be approximately 135 to 150 m (443 to 492 ft) tall at the maximum extension of the rotor blades (tip height) and mounted on a reinforced concrete foundation.

3.0 STUDY AREA

The Project was initially proposed within an area (hereafter referred to as the Study Area) located on approximately 73,128 acres (114 square miles) of predominantly private land in Nobles and Murray Counties, Minnesota (Exhibit 3-1). The Study Area was initially identified as an area within which the Project could be sited due to its suitability for wind energy development, including, but not limited to, proximity to existing electrical transmission infrastructure, existing wind energy facilities, suitable wind resources and an overall predominance of cultivated and cropped land, which is overall lacking in high quality habitats for wildlife. As depicted in Exhibit 3-2, the Study Area identified at the onset of pre-construction avian and bat surveys is larger than the current Project Area. As such, the Project Area represents that portion of the Study Area that is suitable for wind energy development while minimizing impacts to avian and bat species to the degree practicable. The Project Area boundary represents the same area for which Nobles 2 is seeking approval from the MPUC for a LWECS Site Permit. All of the avian and bat studies subsequently described in this BBCS were conducted within the larger Study Area.

Topography within the Study Area is generally undulating consisting of rolling hills, stream networks, a few lakes and numerous wetlands (Exhibit 3-3). Overall, the Study Area slopes downward from west to east from a high elevation of 1,800 feet above mean sea level (amsl) down to 1,560 feet amsl.

A total of eight land cover types are recognized and mapped within the Study Area. Approximately 89 percent of the Study Area is comprised of cultivated cropland, consisting primarily of corn and soybeans and the remaining nine percent is comprised of hay/pasture, grassland, shrub/scrub, deciduous and coniferous forest, open water, emergent herbaceous and woody wetland, and disturbed/developed areas (Exhibit 3-4) (Table 3-1).

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

Land Cover Type	Total Area (Acres)	Percent of Study Area
Cultivated Crops	65,123	89.0
Hay/Pasture	26	< 0.1
Grassland	2,370	3.0
Deciduous and Coniferous Forest	475	1.5
Shrub/Scrub	61	< 0.1
Open Water	106	0.1
Emergent Herbaceous and Woody Wetland	902	1.1
Disturbed/Developed	4,065	5.3
TOTAL	**73,128**	**100**

In addition, several named waterbodies are mapped within the Study Area, including Willow Lake, Stoderl Slough, and Penning Marsh (Exhibit 3-5). Intermittent and perennial watercourses cover approximately 74 linear miles within the Study Area and include Jack Creek, Kanaranzi Creek, Judicial Ditch 8, and several unnamed watercourses.

4.0 PRE-CONSTRUCTION ASSESSMENT AND SITING

The following sections summarize the results of Tier 1 and Tier 2 studies completed within the Study Area by Westwood on behalf of Nobles 2. As recommended by the WEG, these studies involved considerable effort related to landscape-level and desktop environmental review to inform Project location, siting, and individual locations of turbines.

4.1 Tier 1 – Preliminary Site Screening

The Study Area and Project Area are primarily comprised of row crop agricultural land and, as such, is ecologically suited for wind development. Nobles 2 completed considerable desktop environmental review and siting analysis to determine where the Project Area should be located and to create a preliminary turbine layout that avoids sensitive resources in the Project Area. Turbine siting, spacing, and setbacks adhere to the wind energy conversion facility siting criteria outlined in the Commission's *Order Establishing General Wind Permit Standards*, Docket No. E,G-999/M-07- 1102 (January 11, 2008) (PUC General Permit Standards) and incorporates information from discussions with DOC-EERA, MNDNR, and USFWS. A map showing buildable and non-buildable land as determined by this data was developed to minimize impacts to the environment. Other constraints used in determining Project siting included the presence of jurisdictional wetlands; designated critical habitat for state and federal protected species, sensitive and unique ecosystems identified by the MNDNR, and the presence of existing wind generation infrastructure. Specific criteria in determining buildable areas also included a wind access buffer of five rotor diameters (RD) in the prevailing wind direction and three RD in the non-prevailing wind direction from non-participating parcels and state and federal conservation lands; a noise setback from residences meeting Minnesota Noise Standards, Minnesota Rules Chapter 7030; and a minimum setback from residences of 1,600 ft, and a setback of 1x turbine height from road rights-of-way (ROW). Final turbine locations are subject to change based on final turbine model selection and results of other environmental and geotechnical investigations.

4.2 Tier 2 – Site Characterization

In Tier 2 studies, available site-specific information is gathered to further characterize sites identified as potentially suitable in the Tier 1 evaluation. As such, a SCS was prepared for the Project in February 2016 (Westwood 2016a). Site-specific information was obtained from publicly available sources to identify the likelihood of occurrence of wildlife species of concern. Based on areas identified in the Tier 1 evaluation, the evaluation was further focused to identify areas that could present particular risk to particular species or species groups, such as known or suspected bat hibernacula, areas of known avian migratory corridors or raptor nesting sites, or records of special status bird or bat species. Ecological resources near the Study Area were also identified through analysis of existing data sources. These sources included MNDNR Natural Heritage Inventory (NHI) geographic information system (GIS) data; USFWS Information, Planning, and Conservation System (IPaC) federally listed species;

MNDNR Wildlife Management Areas (WMAs); USFWS Natural Wildlife Refuges and Waterfowl Production Areas (WPAs), Audubon Society Important Bird Areas (IBAs), North American Breeding Bird Survey (BBS) data, National Wetlands Inventory (NWI) maps, and other readily available databases, public records, GIS data, and websites. The results of the study are summarized below.

Mapping resources indicate there are several areas of public and private conservation land, native plant communities and sites of biodiversity significance within the Study Area that may also support wildlife. In general, these areas are concentrated in the central and north-central parts of the Study Area, and to a lesser degree, in the southeast part. Larger concentrations of sensitive habitats are located outside of the Study Area, particularly to the northwest along Champepadan Creek.

Nesting habitat for raptors is poor in quality within the Study Area, particularly for bald eagles, and no IBA's are located within 12 miles of the Study Area. No eagle species have been sighted along the three BBS routes closest to the Study Area, while three state- listed species, the loggerhead shrike (*Lanius ludovicianus*), Henslow's sparrow (*Ammodramus henslowii*), and Wilson's phalarope (*Phalaropus tricolor*) were listed on at least one of these BBS routes.

It is anticipated that the Study Area will be incidentally used for a variety of migrating birds; however, due to the lack of suitable habitat, eagle and rare/sensitive species are unlikely to utilize the Study Area for nesting purposes. Available data from avian surveys and pre-and post-construction monitoring of operating wind farms in the region indicate there is a low likelihood for federal and state-listed avian species of concern to occur within the Study Area and that the Project presents a low risk regarding impacts to birds (Table 4-1). Because of the overall similarity of the Nobles 2 Study Area to other wind farms in the area, avian fatalities are anticipated to be consistent with other nearby wind farms; e.g., approximately 0.4-1.07 birds/MW/study period.

Five of the seven bat species present in Minnesota have the potential to utilize wooded stream corridors and wetland areas within the Study Area for foraging and roosting habitat; however, no mines, caves, karst, or pseudokarst formations are known to occur within or near the Study Area or surrounding region that would provide hibernaculum or night-roosting habitat for bats (Table 4-1). Bat fatality within the Nobles 2 Wind Project is not anticipated to exceed fatality rates of neighboring wind farms which range from 3.09-20.2 bats/MW/ study period.

4.3 Tier 1 & Tier 2 – USFWS WEG Questions and Responses

Except for public and private conservation lands, the Study Area offers very little quality habitat. Publicly available bird occurrence data sources and state and federal rare species and critical habitat databases suggest the occurrence of rare avian species is generally

unlikely and, according to those data sources, no state or federally listed bird or bat species are known to occur within the Project Area. Based on Project intentions to avoid sensitive habitat and resources, it is unlikely Project development will have significant adverse effects on avian and bat populations or habitat availability (Table 4-1).

Table 4-1: Nobles 2 Tier 1 and 2 Evaluation Summary

Tier Question	Tier Question Summary
Are there species of concern present on the potential site or is habitat present for these species?	NHIS records indicate no bird or bat species of special concern, state threatened and federally endangered are mapped within the Project Area. No federally- or state-listed species were determined to have a high potential to utilize the Project Area. Bald eagles (de-listed) and trumpeter swans (state species of concern) may utilize the Project Area for stopover habitat but occurrences will likely be limited to areas near high quality habitat and water features. Little brown bats, big brown bats, and tri-colored bats, all of which are state species of concern, may also occur within the Project Area. They will likely congregate near high quality water resources and tree corridors.
Which bird and bat species are likely to use proposed site?	Most likely species include common birds found in agricultural areas such as red-winged blackbirds, killdeer, and horned larks. Bat species most likely to utilize the Project Area include the little brown bat, big brown bat, silver haired bat, hoary bat, and eastern red bat.
Is there potential for adverse effects to species of concern?	Unlikely, given the agricultural nature of the Project Area and overall general lack of suitable habitat identified within Tier 1 and Tier 2 studies.

4.4 Tier 3 – Field Studies to Document Site Wildlife Conditions and Predict Project Impacts

The purpose of the pre-construction field studies is to evaluate the Project's potential to result in adverse impacts to biological resources, including passerine birds, raptors, bats, and natural communities. The specific investigations that have been conducted are outlined below and include one year of multiple field surveys in accordance with the USFWS WEG (USFWS 2012), USFWS ECPG (USFWS 2013), and *Avian and Bat Survey Protocols for Large Wind Energy Conversion Systems in Minnesota* (Mixon *et al.* 2014).

With information from the SCS, the Project Area was evaluated against the four Tier 2 decision point outcomes contained in the USFWS WEG (USFWS 2012) to provide a general framework for determining the duration and intensity of study needed for Project siting, Project permitting and operations monitoring. For the purposes of this effort, it has been assumed that the proposed Project will be considered a Category 2 project in terms of biological study requirements under the Tier decision point outcomes. According to the

USFWS WEG (USFWS 2012), a Category 2 project consists of sites with little existing information and no indicators of high wildlife impacts. Projects in Category 2 have no obvious "red flags" that emerge from the preliminary site assessment (for example, "red flags" might be known occurrences of special-status species or high levels of fatalities at nearby wind facilities). More than 1,600 staff-hours were dedicated in 2016 and 2017 to avian and bat field studies, and the results of this effort are summarized below.

4.4.1 Pre-Construction Avian Surveys

Pre-construction avian surveys were initiated in mid-January 2016, and were completed in late-March 2017, for one full year of avian use data collection. Data collected from these studies were used to identify species or species groups that may be at risk from Project development and may provide additional information for micro-siting wind facilities to minimize impacts to birds. The avian baseline studies conducted for the proposed Project consisted of general avian point count surveys, eagle point count surveys, and ground-based raptor nest surveys (Table 4-2).

Table 4-2: Avian Survey Efforts to Date for the Nobles 2 Project

Study	Taxa	Dates Conducted	Type of Survey
General avian point count surveys	All birds	January 15 – November 15, 2016 (Completed)	Variable circular-plot point counts
Eagle point count surveys	Bald eagles	February 4, 2016 – January 19, 2017 (Completed)	Fixed circular-plot point counts
Ground-based raptor nest surveys	Eagles and other raptors	March 16-18 and 28, 2016 and March 25-27, 2017 (Completed)	Driving existing roads

The geographic coverage of each study may differ due to changes in the anticipated turbine layout at the time when the studies were initiated. Detailed descriptions of survey methods, results, and discussion can be found in the *2016 Annual Pre-construction Avian Survey Report* (Westwood 2016b). A summary of the results of each survey is provided below.

4.4.1.1 General Avian Point Count Surveys

Winter general avian point count surveys were conducted twice per month from January 15, 2016 to March 31, 2016, spring general avian point surveys were conducted weekly from April 1, 2016 to June 15, 2016, summer general avian point count surveys were conducted twice per month from June 16, 2016 to August 31, 2016 and fall general avian point count surveys were conducted weekly from September 1 to November 15, 2016. Surveys were conducted in accordance with standard variable circular-plot point count survey methods

(Reynolds *et al*. 1980; Ralph *et al*. 1995) to measure species composition, relative abundance, and spatial and temporal use of the site by migrating and resident birds.

Avian Use

A total of 2,467 birds representing 35 species and seven species groups were identified during the 186 winter general avian fixed-point count surveys (Table 4-3) and 5,428 birds representing 80 species and eight species groups were identified during the 341 spring general avian fixed point count surveys (Table 4-4). Some 2,077 birds representing 53 species and nine species groups were identified during the 186 summer general avian fixed point count surveys (Table 4-5) and 6,768 birds representing 48 species and eight species groups were identified during the 248 fall general avian fixed point count surveys (Table 4-6).

The most commonly observed birds during the winter survey effort were the red-winged blackbird (*Agelaius phoeniceus*) (28.37 percent of all birds observed), European starling (*Sturnus vulgaris*) (15.24 percent), Canada goose (*Branta canadensis*) (10.50 percent), horned lark (*Eremophila alpestris*) (8.84 percent), mallard (*Anas platyrhynchos*) (6.61 percent), and American robin (*Turdus migratorius*) (3.77 percent). The remaining 29 species comprised 26.67 percent of the total number of birds observed (Table 4-3).

The most commonly observed birds during the spring survey effort were the common grackle (*Quiscalus quiscula*) (22.57 percent of all birds observed), red-winged blackbird (17.48 percent), unidentified duck (9.10 percent), barn swallow (*Hirundo rustica*) (5.40 percent), greater white-fronted goose (*Anser albifrons*) (5.16 percent), and American robin (4.37 percent). The remaining 75 species comprised 35.92 percent of the total number of birds observed (Table 4-4).

During summer, the most commonly observed birds were the cliff swallow (*Petrochelidon pyrrhonota*) (29.32 percent of all birds observed), barn swallow (7.80 percent), house sparrow (*Passer domesticus*) (7.41 percent), and unidentified swallow (6.50 percent). The remaining 50 species comprised 48.97 percent of the total number of birds observed during summer (Table 4-5).

During fall, the most commonly observed birds were the horned lark (29.02 percent of all birds observed), red-winged blackbird (15.43 percent), common grackle (11.69 percent), brown-headed cowbird (*Molothrus ater*) (11.45 percent), and Canada goose (8.38 percent). The remaining 43 species comprised 24.03 percent of the total number of birds observed during fall (Table 4-6).

Overall mean bird use within the Study Area during the winter survey period was 13.263 birds/5 min, ranging from 0 to 500 birds/5 min point count. Among all species groups, mean use was highest for passerines (9.016 birds/5 min). The most commonly observed species, red-winged blackbird, accounted for 41.74 percent of individuals in this species group. Among waterfowl, the second highest species group (2.925 birds/5 min), the most

Table 4-3: Avian Species by Species Group Observed during Winter 2016 General Avian Point Count Surveys

Species Group	Overall Rank	Number of Birds	Number of Occurrences	Mean Use (No. Birds/5 Min)	Frequency (% of Surveys Detected)	Species Composition (%)	
						Group	Overall
Passerines							
American Crow	16	29	13	0.156	6.45	1.73	1.18
American Robin	6	93	17	0.500	8.60	5.55	3.77
American Tree Sparrow	14	35	1	0.188	0.54	2.09	1.42
Blue Jay	22	3	2	0.016	1.08	0.18	0.12
Chipping Sparrow	23	2	1	0.011	0.54	0.12	0.08
Common Grackle	9	73	6	0.392	2.69	4.35	2.96
European Starling	2	376	11	2.022	5.91	22.42	15.24
Horned Lark	4	218	26	1.172	13.44	13.00	8.84
House Sparrow	10	60	8	0.323	4.30	3.58	2.43
Lapland Longspur	24	1	1	0.005	0.54	0.06	0.04
Red-winged Blackbird	1	700	17	3.763	6.99	41.74	28.37
Snow Bunting	8	75	2	0.403	1.08	4.47	3.04
Song Sparrow	19	8	1	0.043	0.54	0.48	0.32
Western Meadowlark	21	4	3	0.022	1.08	0.24	0.16
Total	**--**	**1,677**	**109**	**9.016**	**--**	**100.00**	**67.98**
Waterfowl							
Canada Goose	3	259	10	1.392	4.30	41.37	10.50
Canvasback	13	40	2	0.215	1.08	6.39	1.62
Greater White-fronted Goose	21	4	1	0.022	0.54	0.64	0.16
Mallard	5	163	5	0.876	2.15	26.04	6.61
Northern Pintail	15	30	1	0.161	0.54	4.79	1.22
Northern Shoveler	15	30	1	0.161	0.54	4.79	1.22
Ring-necked Duck	18	10	1	0.054	0.54	1.60	0.41
Trumpeter Swan [4]	23	2	1	0.011	0.54	0.32	0.08
Unidentified Duck	7	82	2	0.441	1.08	13.10	3.32
Wood Duck	20	6	1	0.032	0.54	0.96	0.24
Total	**--**	**626**	**25**	**3.366**	**--**	**100.00**	**25.37**

Species Group	Overall Rank	Number of Birds	Number of Occurrences	Mean Use (No. Birds/5 Min)	Frequency (% of Surveys Detected)	Species Composition (%)	
						Group	Overall
Upland Gamebirds							
Gray Partridge	17	12	2	0.065	1.08	20.34	0.49
Ring-necked Pheasant	12	43	7	0.231	3.23	72.88	1.74
Wild Turkey	21	4	1	0.022	0.54	6.78	0.16
Total	**--**	**59**	**10**	**0.317**	**--**	**100.00**	**2.39**
Pigeons and Doves							
Eurasian Collared-Dove	24	1	1	0.005	0.54	1.85	0.04
Rock Pigeon	11	53	6	0.285	2.69	98.15	2.15
Total	**--**	**54**	**7**	**0.290**	**--**	**100.00**	**2.19**
Shorebirds							
Killdeer	15	30	17	0.161	8.06	90.91	1.22
Ring-billed Gull	22	3	1	0.016	0.54	9.09	0.12
Total	**--**	**33**	**18**	**0.177**	**--**	**100.00**	**1.34**
Raptors							
American Kestrel	22	3	3	0.016	1.61	27.27	0.12
Great Horned Owl	23	2	2	0.011	1.08	18.18	0.08
Red-tailed Hawk	20	6	5	0.032	2.69	54.55	0.24
Total	**--**	**11**	**10**	**0.059**	**--**	**100.00**	**0.45**
Woodpeckers							
Hairy Woodpecker	22	3	2	0.016	1.08	42.86	0.12
Northern Flicker	21	4	2	0.022	1.08	57.14	0.16
Total	**--**	**7**	**4**	**0.038**	**--**	**100.00**	**0.28**
Grand Total	**--**	**2,467**	**183**	**13.263**	**--**	**--**	**100.00**

[1]Minnesota State Endangered Species, [2]Minnesota State Threatened Species, [3]USFWS Bird of Conservation Concern, [4]Minnesota Special Concern Species

Table 4-4: Avian Species by Species Group Observed during Spring 2016 General Avian Point Count Surveys

Species Group	Overall Rank	Number of Birds	Number of Occurrences	Mean Use (No. Birds/5 minutes)	Frequency (% of Surveys Detected)	Species Composition (%)	
						Group	Overall
Passerines							
American Crow	25	23	19	0.067	4.69	0.61	0.42
Common Grackle	1	1,225	233	3.592	48.97	32.30	22.57
Red-winged Blackbird	2	949	154	2.783	32.26	25.03	17.48
Yellow-headed Blackbird	39	6	3	0.018	0.88	0.16	0.11
European Starling	6	257	67	0.754	17.30	6.78	4.73
American Goldfinch	34	12	9	0.035	2.64	0.32	0.22
American Robin	7	237	135	0.695	29.91	6.25	4.37
Brown Thrasher	41	4	3	0.012	0.59	0.11	0.07
Swainson's Thrush	44	1	1	0.003	0.29	0.03	0.02
Brown-headed Cowbird	9	144	65	0.422	17.60	3.80	2.65
Baltimore Oriole	37	9	8	0.026	2.05	0.24	0.17
Eastern Kingbird	31	15	9	0.044	2.35	0.40	0.28
Eastern Wood-Pewee	43	2	2	0.006	0.59	0.05	0.04
Blue Grosbeak	44	1	1	0.003	0.29	0.03	0.02
Blue Jay	33	13	12	0.038	2.64	0.34	0.24
Horned Lark	10	130	30	0.381	8.50	3.43	2.39
Western Meadowlark	23	28	26	0.082	7.62	0.74	0.52
Lapland Longspur	12	83	4	0.243	1.17	2.19	1.53
Bobolink	27	21	13	0.062	3.81	0.55	0.39
Dickcissel [3]	37	9	8	0.026	2.35	0.24	0.17
Loggerhead Shrike [1]	44	1	1	0.003	0.29	0.03	0.02
Chipping Sparrow	40	5	5	0.015	1.47	0.13	0.09
Grasshopper Sparrow	44	1	1	0.003	0.29	0.03	0.02
Harris's Sparrow	42	3	1	0.009	0.29	0.08	0.06
House Sparrow	35	12	7	0.035	2.05	0.32	0.22
Le Conte's Sparrow	44	1	1	0.003	0.29	0.03	0.02

Species Group	Overall Rank	Number of Birds	Number of Occurrences	Mean Use (No. Birds/5 minutes)	Frequency (% of Surveys Detected)	Species Composition (%)	
						Group	Overall
Savannah Sparrow	30	16	11	0.047	3.23	0.42	0.29
Song Sparrow	33	13	12	0.038	3.52	0.34	0.24
Vesper Sparrow	17	46	39	0.135	10.85	1.21	0.85
White-crowned Sparrow	44	1	1	0.003	0.29	0.03	0.02
Unidentified Sparrow	41	4	4	0.012	1.17	0.11	0.07
Red-eyed Vireo	43	2	1	0.006	0.29	0.05	0.04
Common Yellowthroat	31	15	14	0.044	4.11	0.40	0.28
Yellow Warbler	41	4	3	0.012	0.88	0.11	0.07
Yellow-rumped Warbler	42	3	3	0.009	0.88	0.08	0.06
Unidentified Warbler	44	1	1	0.003	0.29	0.03	0.02
House Wren	40	5	2	0.015	0.59	0.13	0.09
Chimney Swift	39	6	3	0.018	0.88	0.16	0.11
Barn Swallow	4	293	58	0.859	16.42	7.73	5.40
Cliff Swallow	16	55	8	0.161	2.35	1.45	1.01
Tree Swallow	21	37	12	0.109	3.52	0.98	0.68
Unidentified Swallow	15	58	5	0.170	1.47	1.53	1.07
Unidentified Bird	20	41	9	0.120	2.64	1.08	0.76
Total	**--**	**3, 792**	**1,004**	**11.120**	**--**	**100.00**	**69.86**
Waterfowl							
Canada Goose	22	35	12	0.103	3.52	2.84	0.64
Greater White-fronted Goose	5	280	1	0.821	0.29	22.73	5.16
Mallard	8	163	26	0.478	7.62	13.23	3.00
American Wigeon	36	10	1	0.029	0.29	0.81	0.18
Blue-winged Teal	11	84	15	0.246	4.40	6.82	1.55
Green-winged Teal	19	44	6	0.129	1.76	3.57	0.81
Gadwall	36	10	1	0.029	0.29	0.81	0.18
Northern Pintail	43	2	1	0.006	0.29	0.16	0.04
Northern Shoveler	13	82	7	0.240	2.05	6.66	1.51
Ring-necked Duck	26	22	2	0.065	0.59	1.79	0.41
Wood Duck	40	5	3	0.015	0.88	0.41	0.09

Species Group	Overall Rank	Number of Birds	Number of Occurrences	Mean Use (No. Birds/5 minutes)	Frequency (% of Surveys Detected)	Species Composition (%)	
						Group	Overall
Double-crested Cormorant	44	1	1	0.003	0.29	0.08	0.02
Unidentified Duck	3	494	6	1.449	1.76	40.10	9.10
Total	**--**	**1,232**	**82**	**3.613**	**--**	**100.00**	**22.70**
Raptors							
American Kestrel	38	7	7	0.021	2.05	14.85	0.13
Red-tailed Hawk	29	19	17	0.056	4.40	39.58	0.35
Northern Harrier	39	6	6	0.018	1.76	12.50	0.11
Cooper's Hawk	44	1	1	0.003	0.29	2.08	0.02
Swainson's Hawk [3]	43	2	2	0.006	0.59	4.17	0.04
Turkey Vulture	33	13	8	0.038	2.35	27.08	0.24
Total	**--**	**48**	**41**	**0.141**	**--**	**100.00**	**0.88**
Upland Gamebirds							
Ring-necked Pheasant	25	23	20	0.067	5.87	100.00	0.42
Total	**--**	**23**	**20**	**0.067**	**--**	**100.00**	**0.42**
Pigeons/Doves							
Mourning Dove	18	45	28	0.132	7.92	42.86	0.83
Eurasian Collared Dove	43	2	2	0.006	0.59	1.90	0.04
Rock Pigeon	15	58	12	0.170	3.52	55.24	1.07
Total	**--**	**105**	**42**	**0.308**	**--**	**100.00**	**1.93**
Shorebirds							
Killdeer	14	79	65	0.232	18.77	40.51	1.46
American Golden Plover	42	3	1	0.009	0.29	1.54	0.06
Greater Yellowlegs	44	1	1	0.003	0.29	0.51	0.02
Least Sandpiper	36	10	1	0.029	0.29	5.13	0.18
Pectoral Sandpiper	28	20	1	0.059	0.29	10.26	0.37
Semipalmated Sandpiper	24	25	1	0.073	0.29	12.82	0.46
Solitary Sandpiper [3]	37	9	4	0.026	1.17	4.62	0.17
Upland Sandpiper [3]	38	7	5	0.021	1.47	3.59	0.13
Common Snipe	39	6	3	0.018	0.88	3.08	0.11
Ring-billed Gull	23	28	1	0.082	0.29	14.36	0.52

Species Group	Overall Rank	Number of Birds	Number of Occurrences	Mean Use (No. Birds/5 minutes)	Frequency (% of Surveys Detected)	Species Composition (%)	
						Group	Overall
Bonaparte's Gull	43	2	1	0.006	0.29	1.03	0.04
Wilson's Phalarope [2]	40	5	3	0.015	0.88	2.56	0.09
Total	**--**	**195**	**87**	**0.572**	**--**	**100.00**	**3.59**
Woodpeckers							
Northern Flicker	32	14	13	0.041	3.81	70.00	0.26
Red-headed Woodpecker [3]	39	6	6	0.018	1.47	30.00	0.11
Total	**--**	**20**	**19**	**0.059**	**--**	**100.00**	**0.37**
Herons/Egrets/Cranes/Rails							
American Coot	39	6	1	0.018	0.29	46.15	0.11
Cattle Egret	44	1	1	0.003	0.29	7.69	0.02
Great Egret	44	1	1	0.003	0.29	7.69	0.02
Great Blue Heron	42	3	3	0.009	0.88	23.08	0.06
Sandhill Crane	43	2	2	0.006	0.59	15.38	0.04
Total	**--**	**13**	**8**	**0.038**	**--**	**100.00**	**0.24**
Grand Total	**--**	**5,428**	**1,303**	**15.918**	**--**	**--**	**100.00**

[1]Minnesota State Endangered Species, [2]Minnesota State Threatened Species, [3]USFWS Bird of Conservation Concern, [4]Minnesota Special Concern Species

Table 4-5: Avian Species by Species Group Observed during Summer 2016 General Avian Point Count Surveys

Species Group	Overall Rank	Number of Birds	Number of Occurrences	Mean Use (No. Birds/5 Min)	Frequency (% of Surveys Detected)	Species Composition (%)	
						Group	Overall
Passerines							
American Crow	20	10	5	0.054	2.69	0.56	0.48
American Goldfinch	12	36	27	0.194	13.98	2.00	1.73
American Robin	8	64	35	0.344	14.52	3.56	3.08
Baltimore Oriole	28	1	1	0.005	0.54	0.06	0.05
Barn Swallow	2	162	51	0.871	25.81	9.01	7.80
Brown-headed Cowbird	14	29	14	0.156	6.99	1.61	1.40
Blue Grosbeak	26	3	3	0.016	1.61	0.17	0.14
Blue Jay	27	2	2	0.011	1.08	0.11	0.10
Bobolink	27	2	2	0.011	1.08	0.11	0.10
Chipping Sparrow	20	10	9	0.054	4.84	0.56	0.48
Cliff Swallow	1	609	43	3.274	19.36	33.85	29.32
Common Grackle	6	112	33	0.602	15.05	6.23	5.39
Common Yellowthroat	17	19	19	0.102	9.68	1.06	0.91
Dickcissel [3]	10	53	42	0.285	19.36	2.95	2.55
Eastern Kingbird	13	32	19	0.172	8.60	1.78	1.54
European Starling	11	51	11	0.274	5.38	2.83	2.46
Great Crested Flycatcher	25	4	3	0.022	1.61	0.22	0.19
Gray Catbird	28	1	1	0.005	0.54	0.06	0.05
House Finch	27	2	2	0.011	1.08	0.11	0.10
Horned Lark	21	9	8	0.048	4.30	0.50	0.43
House Sparrow	3	154	21	0.828	11.29	8.56	7.41
House Wren	27	2	1	0.011	0.54	0.11	0.10
Indigo Bunting	27	2	1	0.011	0.54	0.11	0.10
Orchard Oriole	26	3	2	0.016	1.08	0.17	0.14
Purple Martin [4]	28	1	1	0.005	0.54	0.06	0.05
Red-winged Blackbird	6	112	33	0.602	15.59	6.23	5.39

Species Group	Overall Rank	Number of Birds	Number of Occurrences	Mean Use (No. Birds/5 Min)	Frequency (% of Surveys Detected)	Species Composition (%)	
						Group	Overall
Sedge Wren	28	1	1	0.005	0.54	0.06	0.05
Song Sparrow	16	25	23	0.134	10.75	1.39	1.20
Tree Swallow	5	116	6	0.624	2.69	6.45	5.58
Unidentified Sparrow	28	1	1	0.005	0.54	0.06	0.05
Unidentified Swallow	4	135	4	0.726	1.08	7.50	6.50
Vesper Sparrow	15	26	25	0.140	11.83	1.45	1.25
White-crowned Sparrow	27	2	1	0.011	0.54	0.11	0.10
Western Meadowlark	24	5	4	0.027	2.15	0.28	0.24
Yellow-headed Blackbird	26	3	2	0.016	1.08	0.17	0.14
Total	**--**	**1,799**	**456**	**9.672**	**--**	**100.00**	**86.62**
Shorebirds							
Killdeer	7	91	19	0.489	9.68	91.92	4.38
Upland Sandpiper [3]	22	8	4	0.043	1.61	8.08	0.39
Total	**--**	**99**	**23**	**0.532**	**--**	**100.00**	**4.77**
Pigeons and Doves							
Mourning Dove	9	57	40	0.306	19.89	69.51	2.74
Rock Pigeon	16	25	9	0.134	4.84	30.49	1.20
Total	**--**	**82**	**49**	**0.441**	**--**	**100.00**	**3.95**
Waterfowl							
Canada Goose	16	25	4	0.134	2.15	60.98	1.20
Mallard	18	16	2	0.086	1.08	39.02	0.77
Total	**--**	**41**	**6**	**0.220**	**--**	**100.00**	**1.97**
Raptors							
American Kestrel	19	13	10	0.070	5.38	50.00	0.63
Northern Harrier	27	2	2	0.011	0.54	7.69	0.10
Red-tailed Hawk	25	4	3	0.022	1.61	15.38	0.19
Swainson's Hawk [3]	27	2	1	0.011	0.54	7.69	0.10
Turkey Vulture	24	5	5	0.027	2.15	19.23	0.24
Total	**--**	**26**	**21**	**0.140**	**--**	**100.00**	**1.25**
Gamebirds							

Species Group	Overall Rank	Number of Birds	Number of Occurrences	Mean Use (No. Birds/5 Min)	Frequency (% of Surveys Detected)	Species Composition (%)	
						Group	Overall
Gray Partridge	23	6	1	0.032	0.54	50.00	0.29
Northern Bobwhite	27	2	2	0.011	1.08	16.67	0.10
Ring-necked Pheasant	25	4	4	0.022	2.15	33.33	0.19
Total	--	**12**	**7**	**0.065**	--	**100.00**	**0.58**
Woodpeckers							
Downy Woodpecker	28	1	1	0.005	0.54	9.09	0.05
Northern Flicker	25	4	4	0.022	2.15	36.36	0.19
Red-headed Woodpecker [3]	23	6	6	0.032	2.69	54.55	0.29
Total	--	**11**	**11**	**0.059**	--	**100.00**	**0.53**
Cranes, Herons, and Egrets							
American White Pelican [4]	27	2	1	0.011	0.54	33.33	0.10
Great Blue Heron	25	4	4	0.022	2.15	66.67	0.19
Total	--	**6**	**5**	**0.032**	--	**100.00**	**0.29**
Swifts and Hummingbirds							
Chimney Swift	28	1	1	0.005	0.54	100.00	0.05
Total	--	**1**	**1**	**0.005**	--	**100.00**	**0.05**
Grand Total	--	**2,077**	**579**	**11.167**	--	--	**100.00**

[1]Minnesota State Endangered Species, [2]Minnesota State Threatened Species, [3]USFWS Bird of Conservation Concern, [4]Minnesota Special Concern Species

Table 4-6: Avian Species by Species Group Observed during Fall 2016 General Avian Point Count Surveys

Species Group	Overall Rank	Number of Birds	Number of Occurrences	Mean Use (No. Birds/5 Min)	Frequency (% of Surveys Detected)	Species Composition (%)	
						Group	Overall
Passerines							
American Crow	8	155	9	0.625	3.63	2.80	2.29
American Goldfinch	23	13	6	0.052	2.42	0.23	0.19
American Robin	10	81	14	0.327	5.24	1.46	1.20
American Tree Sparrow	21	18	4	0.073	1.61	0.33	0.27
Barn Swallow	23	13	3	0.052	1.21	0.23	0.19
Brown-headed Cowbird	4	775	3	3.125	1.21	14.00	11.45
Blue Jay	9	123	13	0.496	4.44	2.22	1.82
Clay-colored Sparrow	28	7	2	0.028	0.81	0.13	0.10
Common Grackle	3	791	12	3.190	4.84	14.29	11.69
Common Yellowthroat	29	6	1	0.024	0.40	0.11	0.09
Dark-eyed Junco	15	57	7	0.230	2.82	1.03	0.84
Eastern Wood-Pewee	33	1	1	0.004	0.40	0.02	0.01
European Starling	7	189	9	0.762	3.63	3.41	2.79
Golden-crowned Kinglet	32	2	1	0.008	0.40	0.04	0.03
Harris's Sparrow	29	6	3	0.024	1.21	0.11	0.09
Horned Lark	1	1,964	29	7.919	10.89	35.48	29.02
House Sparrow	19	28	3	0.113	1.21	0.51	0.41
House Wren	33	1	1	0.004	0.40	0.02	0.01
Le Conte's Sparrow	32	2	1	0.008	0.40	0.04	0.03
Lincoln's Sparrow	14	63	5	0.254	2.02	1.14	0.93
Marsh Wren	33	1	1	0.004	0.40	0.02	0.01
Red-winged Blackbird	2	1,044	21	4.210	6.85	18.86	15.43
Savannah Sparrow	28	7	3	0.028	1.21	0.13	0.10
Sedge Wren	30	5	3	0.020	0.81	0.09	0.07
Snow Bunting	22	16	1	0.065	0.40	0.29	0.24
Song Sparrow	16	51	7	0.206	2.82	0.92	0.75

Species Group	Overall Rank	Number of Birds	Number of Occurrences	Mean Use (No. Birds/5 Min)	Frequency (% of Surveys Detected)	Species Composition (%)	
						Group	Overall
Tennessee Warbler	33	1	1	0.004	0.40	0.02	0.01
Unidentified Warbler	33	1	1	0.004	0.40	0.02	0.01
Vesper Sparrow	17	49	24	0.198	9.68	0.89	0.72
Western Meadowlark	13	64	11	0.258	4.03	1.16	0.95
Yellow-rumped Warbler	33	1	1	0.004	0.40	0.02	0.01
Total	--	**5,535**	**201**	**22.319**	--	**100.00**	**81.78**
Waterfowl							
Canada Goose	5	567	6	2.286	2.42	93.41	8.38
Trumpeter Swan [4]	26	10	1	0.040	0.40	1.65	0.15
Unidentified Duck	18	30	2	0.121	0.81	4.94	0.44
Total	--	**607**	**9**	**2.448**	--	**100.00**	**8.97**
Shorebirds							
Franklin's Gull [4]	6	384	12	1.548	3.63	82.94	5.67
Killdeer	11	79	5	0.319	2.02	17.06	1.17
Total	--	**463**	**17**	**1.867**	--	**100.00**	**6.84**
Pigeons and Doves							
Mourning Dove	28	7	3	0.028	1.21	9.33	0.10
Rock Pigeon	12	68	11	0.274	4.03	90.67	1.00
Total	--	**75**	**14**	**0.302**	--	**100.00**	**1.11**
Raptors							
American Kestrel	30	5	5	0.020	2.02	8.77	0.07
Bald Eagle [3]	32	2	2	0.008	0.81	3.51	0.03
Northern Harrier	23	13	12	0.052	4.84	22.81	0.19
Red-tailed Hawk	20	25	22	0.101	8.47	43.86	0.37
Turkey Vulture	24	12	5	0.048	2.02	21.05	0.18
Total	--	**57**	**46**	**0.230**	--	**100.00**	**0.84**
Cranes, Herons, and Egrets							
American White Pelican[4]	25	11	2	0.044	0.81	73.33	0.16
Great Blue Heron	31	4	4	0.016	1.61	26.67	0.06
Total	--	**15**	**6**	**0.060**	--	**100.00**	**0.22**

Species Group	Overall Rank	Number of Birds	Number of Occurrences	Mean Use (No. Birds/5 Min)	Frequency (% of Surveys Detected)	Species Composition (%)	
						Group	Overall
Woodpeckers							
Downy Woodpecker	31	4	4	0.016	1.61	26.67	0.06
Hairy Woodpecker	33	1	1	0.004	0.40	6.67	0.01
Northern Flicker	27	9	5	0.036	2.02	60.00	0.13
Red-headed Woodpecker [3]	33	1	1	0.004	0.40	6.67	0.01
Total	**--**	**15**	**11**	**0.060**	**--**	**100.00**	**0.22**
Gamebirds							
Ring-necked Pheasant	33	1	1	0.004	0.40	100.00	0.01
Total	**--**	**1**	**1**	**0.004**	**--**	**100.00**	**0.01**
Grand Total	**--**	**6,768**	**305**	**27.290**	**--**	**--**	**100.00**

[1]Minnesota State Endangered Species, [2]Minnesota State Threatened Species, [3]USFWS Bird of Conservation Concern, [4]Minnesota Special Concern Species

commonly observed species included the Canada goose (1.392 birds/5 min) and mallard (0.876 birds/5 min) (Table 4-3).

Overall mean bird use within the Study Area during the spring was 15.918 birds/5 min, ranging from 1 to 400 birds/5 min point count. Among all species groups, mean use was highest for passerines (11.120 birds/5 min).

The most commonly observed species, common grackle, accounted for 32.30 percent of individuals in this species group. Among waterfowl, the second highest species group (3.613 birds/5 min), the most commonly observed species included the unidentified duck (1.449 birds/5 min) and greater white-fronted goose (0.821 birds/5 min) (Table 4-4).

Overall mean bird use within the Study Area during the summer survey period was 11.167 birds/5 min, ranging from 1 to 100 birds/5 min point count. Among all species groups, mean use was highest for passerines (9.672 birds/5 min). The most commonly observed species, cliff swallow, accounted for 33.85 percent of individuals in this species group. Among shorebirds, the second highest species group (0.532 birds/5 min), the most commonly observed species was the killdeer (*Charadrius vociferus*) (0.489 birds/5 min) (Table 4-5).

Overall mean bird use within the Study Area during the fall survey period was 12.496 birds/5 min, ranging from 0 to 650 birds/5 min point count. Among all species groups, mean use was highest for passerines (22.319 birds/5 min). The most commonly observed species, the horned lark and red-winged blackbird, accounted for 35.48 percent and 18.86 percent of individuals in this species group, respectively. Among waterfowl, the second highest species group (2.448 birds/5 min), the most commonly observed species was the Canada goose (2.286 birds/5 min) (Table 4-6).

Raptors are a group of special interest because of their propensity to fly at heights similar to those encompassed by the rotor swept area (RSA) of a turbine. Overall winter, spring, summer, and fall mean use for raptors was 0.059 birds/5 min, 0.141 birds/5 min, 0.140 birds/5 min, and 0.230 birds/5 min respectively. The raptors with the highest mean use for all seasons combined were the red-tailed hawk (*Buteo jamaicensis*) (0.053 birds/5 min) and the American kestrel (*Falco sparverius*) (0.032 birds/5 min) (Tables 4-3 to 4-6).

Species Composition and Frequency of Occurrence

Passerines were the most commonly observed species group during winter, spring, summer, and fall surveys. For the winter survey season, the horned lark was observed most frequently (13.98 percent of all surveys), followed by the American robin (9.14 percent), red-winged blackbird (8.60 percent), American crow (*Corvus brachyrhynchos*) (6.99 percent), and European starling (*Sturnus vulgaris*) (5.91 percent of all surveys). The remaining nine species in this group were detected in 13.44 percent of surveys (Table 4-3) (Exhibit 4-1). Waterfowl were the second most commonly observed species group during winter surveys. Among

waterfowl, Canada goose (5.38 percent of all surveys) and mallard (2.69 percent) were detected most frequently.

For the spring survey season, the common grackle was observed most frequently (51.61 percent of all surveys), followed by the red-winged blackbird (35.48 percent), American robin (33.23 percent), and brown-headed cowbird (19.03 percent of all surveys). Shorebirds were the second most commonly occurring species group during surveys. Among shorebirds, the killdeer (20.65 percent of all surveys) was detected most frequently (Table 4-4) (Exhibit 4-2). For the summer survey season, the barn swallow was observed most frequently (25.81 percent of all surveys), followed by the cliff swallow (19.36 percent), dickcissel (*Spiza americana*) (19.36 percent), and red-winged blackbird (15.59 percent of all surveys). Pigeons/doves were the second most commonly occurring species group during surveys. Among pigeons/doves, the mourning dove (9.68 percent of all surveys) was detected most frequently (Table 4-5) (Exhibit 4-3).

For the fall survey season, the horned lark was observed most frequently (10.89 percent of all surveys), followed by the vesper sparrow (*Pooecetes gramineus*) (9.68 percent), and red-winged blackbird (6.85 percent). Raptors were the second most commonly observed species group, with the red-tailed hawk and northern harrier (*Circus cyaneus*) detected at 8.47 percent and 4.84 percent of all surveys, respectively (Table 4-6) (Exhibit 4-4).

Spatial Use

Mean bird use and species richness (total number of species per survey) estimates by survey point were mapped across the Study Area for all survey seasons combined (Exhibits 4-5 and 4-6). Overall mean bird use was highest at sample points 15, 13, 12, and 29 in the central portions of the Study Area, and lowest at sample points 19, 21, 22, 23, 24, and 27 in the southwestern portion of the Study Area (Exhibit 4-5). The number of species per survey point was greatest at sample points 10, 12, 15, 29, 30, and 25 in the central and western portions of the Study Area and lowest at sample points 20, 21, 31, 5, 7, 8, and 11 along the northwestern and eastern portions of the Study Area (Exhibit 4-6).

A qualitative comparison of mean bird use and species richness, as shown in Exhibits 4-5 and 4-6, with the land cover types in Exhibit 3-2, suggests that locations with the highest mean use and species richness are generally associated with non-agricultural herbaceous vegetation and open water areas; whereas locations with the lowest mean use are located predominately in agricultural areas. Other confounding factors also accounted for relatively high mean bird use levels at some locations. For example, numbers at sample point 2 are skewed due to several large flocks of common grackles (over 600 individuals), mean bird use at sample point 5 are skewed due to several large flocks of horned larks and Franklin's gulls, while mean use numbers at sample point 13 are skewed due to more than 400 Canada geese migrating through the area. Regardless, the data strongly suggest that siting turbines in the predominantly agricultural areas will minimize the risk to avian species that are concentrated in higher quality habitats within the Study Area.

Seasonal Abundance and Species Richness

Survey data was categorized into 31 survey periods to evaluate bird use and species richness across the winter, spring, summer, and fall survey seasons. A total of 16,895 birds representing 106 species and 10 species groups were identified during the 961 combined fixed general avian point count surveys. Some of the species observed were recorded throughout the year, while others use the Study Area for only one or two seasons. The birds with the highest mean use for all surveys combined were the red-winged blackbird (2.919 birds/5 min), horned lark (2.416 birds/5 min), common grackle (2.291 birds/5 min), brown-headed cowbird (0.986 birds/5 min), Canada goose (0.922 birds/5 min), and European starling (0.908 birds/5 min).

Among all species groups, mean use showed an increasing trend throughout the spring survey season and then declined through the summer months. Mean bird use increased again sharply during the peak of the fall migration period during late September through October as migratory flocks begin to move through the Study Area (Exhibit 4-7a).

While the overall mean use for all bird species combined showed a decreasing trend throughout the summer survey season, the number of species per survey period showed an increasing trend for the winter, spring, and early summer survey periods, peaking in late June, then declining throughout the remaining summer months and through the fall survey period (Exhibit 4-7b). This pattern was likely attributed to resident bird species entering the Study Area during the late spring and early summer month periods and consistent loss of summer resident bird species leaving the Study Area again during the fall migration period.

Flight Height and Encounter Rates

For all four survey seasons combined, behavioral data were collected for all birds observed within the Study Area. Approximately 46.68 percent of all birds were observed flying and flight height data was collected for these species during the study (Exhibit 4-8). The proportion of observations of a bird species flying at heights that correspond with the RSA of turbines provides a rough estimate of the risk of collision for that species. The space occupied by turbine blades (i.e., anticipated RSA) typically ranges from 30 to 110 meters (approximately 98 to 360 feet) above the ground, which is approximately the estimated distance between the bottom of the tip of the blade when pointed straight down and the maximum height of a turbine blade when pointed straight up.

For all species observed flying, 71.30 percent flew below the anticipated RSA, 16.20 percent flew within the anticipated RSA, and 12.50 percent flew above the anticipated RSA (Exhibit 4-8). A total of 7,690 birds of 34 species were identified flying within the RSA (Table 4-7). The red-winged blackbird had the highest encounter rate (0.382 birds flying at RSA height/5 min), followed by the cliff swallow (0.196 birds flying at RSA height/5 min), horned lark (0.179 birds flying at RSA height/5 min), and blue jay (0.110 birds flying at RSA height/5 min) (Table 4-7).

Table 4-7: Flight Characteristics and Encounter Rates for Avian Species Flying within the Turbine Rotor Swept Area (RSA) for all Avian Point Count Surveys Combined

Species	Number of Birds	Mean Use (No. Birds/5 minutes)	Frequency (% Flying)	Percent within RSA	Encounter Rate
Red-winged Blackbird	2,801	2.915	34.06	38.47	0.382
Cliff Swallow	664	0.691	89.46	31.65	0.196
Horned Lark	2,271	2.363	76.44	9.91	0.179
Blue Jay	129	0.134	93.02	88.33	0.110
Unidentified Swallow	197	0.205	100.00	44.16	0.091
Canada Goose	883	0.919	70.78	6.72	0.044
Barn Swallow	468	0.487	100.00	8.33	0.041
American Tree Sparrow	53	0.055	66.04	100.00	0.036
Franklin's Gull [4]	384	0.400	100.00	7.81	0.031
Mallard	342	0.356	9.94	76.47	0.027
Western Meadowlark	238	0.248	84.45	9.95	0.021
Turkey Vulture	30	0.031	93.33	64.29	0.019
Unidentified Bird	41	0.043	97.56	42.50	0.018
Brown-headed Cowbird	946	0.984	37.21	3.69	0.014
Red-tailed Hawk	52	0.054	75.00	30.77	0.012
American Robin	458	0.477	18.56	14.12	0.012
Common Grackle	2,191	2.280	27.20	2.01	0.012
American Crow	210	0.219	87.62	3.26	0.006
Rock Pigeon	204	0.212	38.24	7.69	0.006
Swainson's Hawk [3]	4	0.004	100.00	100.00	0.004
Northern Harrier	21	0.022	85.71	22.22	0.004
Tree Swallow	153	0.159	43.79	5.97	0.004
Unidentified Duck	606	0.631	18.98	2.61	0.003
American Kestrel	28	0.029	42.86	25.00	0.003
Chimney Swift	7	0.007	100.00	42.86	0.003
Mourning Dove	99	0.103	56.57	5.36	0.003
Bald Eagle [3]	2	0.002	100.00	100.00	0.002
European Starling	869	0.904	34.52	0.67	0.002
American White Pelican [4]	13	0.014	84.62	9.09	0.001
Cooper's Hawk	1	0.001	100.00	100.00	0.001
Double-crested Cormorant	1	0.001	100.00	100.00	0.001
Sandhill Crane	2	0.002	100.00	50.00	0.001
Unidentified Warbler	2	0.002	100.00	50.00	0.001
American Goldfinch	46	0.048	73.91	2.94	0.001
Killdeer	249	0.259	16.87	2.38	0.001
Solitary Sandpiper [3]	9	0.009	88.89	12.50	0.001
Common Snipe	6	0.006	16.67	100.00	0.001
Great Blue Heron	11	0.011	54.55	16.67	0.001

[1]Minnesota State Endangered Species, [2]Minnesota State Threatened Species, [3]USFWS Bird of Conservation Concern, [4]Minnesota Special Concern Species

It should be noted that these estimates only represent the proportion of observations within the anticipated RSA and do not directly equate to the probability of a bird colliding with a turbine blade. Species with a high encounter rate are at a higher risk of collision than species with a low encounter rate, but it does not mean that mortality is certain. Other factors such as turbine location or a species ability to detect turbine blades, flight maneuverability, and habitat selection also influence mortality. Values are sensitive to large flocks of birds flying within the RSA; that is, a species will have a high encounter rate even if only seen a few times in large flying flocks. Encounter rate also does not account for migrating behavior of nocturnal migrants.

Special Status Avian Species

Twelve of the 106 avian species identified during winter, spring, summer and fall general avian point count surveys (10.4 percent) are classified as special-status species. Special-status avian species include those listed as threatened or endangered under the federal Endangered Species Act (ESA) of 1973, as amended (0 species found); those listed as threatened or endangered under Minnesota's Endangered Species statute (2 species found); species classified by the USFWS as Birds of Conservation Concern (BCC)[1] (6 species found), and other species identified by the Minnesota Department of Natural Resources (MNDNR) as Special Concern Species (4 species found). These species, including their status, number of individuals, mean use, and frequency within the Study Area are presented in Table 4-8.

A total of 521 individuals of 12 special-status avian species were identified during the winter, spring, summer, and fall general avian point count surveys (Table 4-8). The most numerous avian species were Franklin's gull (comprising 73.70 percent of all special-status birds observed) and dickcissel (11.90 percent). The remaining ten species comprised 14.40 percent of the total number of special-status birds observed (Table 4-8). The dickcissel was the most frequently observed special-status species (documented at least once in 4.58 percent of all surveys), followed by the red-headed woodpecker (*Melanerpes erythrocephalus*) (1.04 percent), Franklin's gull (0.94 percent), and upland sandpiper (*Bartramia longicauda*) (0.83 percent of all surveys) (Table 4-8).

No federally listed species were observed during any of the general avian point count surveys. However, two bald eagles were observed flying within the Study Area during the fall survey period. One of the special-status avian species, the loggerhead shrike (*Lanius ludovicianus*), is listed as a Minnesota State Endangered Species and one, the Wilson's phalarope (*Phalaropus tricolor*), is listed as a Minnesota State Threatened Species. Six of the

[1] The formal BCC list was developed by USFWS as a result of a 1988 amendment to the Fish and Wildlife Conservation Act. This Act mandated that USFWS "identify species, subspecies, and populations of all migratory nongame birds that, without additional conservation actions, are likely to become candidates for listing under the Endangered Species Act (ESA) of 1973." The goal of the BCC list is to prevent or remove the need for additional ESA bird listings by implementing proactive management and conservation actions and to consult on these species in accordance with Executive Order 13186, Responsibilities of Federal Agencies to Protect Migratory Birds.

special-status avian species; dickcissel, red-headed woodpecker, solitary sandpiper (*Tringa solitaria*), bald eagle, Swainson's hawk **(***Buteo swainsoni*), and upland sandpiper are listed as USFWS BCC, while the remaining four species: American white pelican (*Pelecanus erythrorhynchos*), trumpeter swan (*Cygnus buccinator*), purple martin (*Progne subis*), and Franklin's gull are listed as Minnesota State Special Concern Species.

Table 4-8: Special-Status Avian Species Observed during Winter, Spring, Summer, and Fall General Avian Point Count Surveys

Species	Number of Birds	Number of Occurrences	Mean Use (No. Birds/5 minutes)	Frequency (% of Surveys Detected)	Species Composition (%)
Dickcissel [3]	62	50	0.065	4.58	11.90
American White Pelican [4]	13	3	0.014	0.31	2.50
Red-headed Woodpecker [3]	13	13	0.014	1.04	2.50
Trumpeter Swan [4]	12	2	0.012	0.21	2.30
Solitary Sandpiper [3]	9	4	0.009	0.42	1.73
Wilson's Pharalope [2]	5	3	0.005	0.31	0.96
Purple Martin [4]	1	1	0.001	0.10	0.19
Bald Eagle [3]	2	2	0.002	0.21	0.38
Loggerhead Shrike [1]	1	1	0.001	0.10	0.19
Swainson's Hawk [3]	4	3	0.004	0.31	0.77
Upland Sandpiper [3]	15	9	0.016	0.83	2.88
Franklin's Gull [4]	384	12	0.400	0.94	73.70
Total	**521**	**103**	**0.543**	**--**	**100.00**

[1]Minnesota State Endangered Species, [2]Minnesota State Threatened Species, [3]USFWS Bird of Conservation Concern, [4]Minnesota Special Concern Species

Incidental Observations

During spring avian surveys, biologists documented 10 additional species that were not detected during general avian point count surveys. These included the western kingbird (*Tyrannus verticalis*), lesser yellowlegs (*Tringa flavipes*), white-throated sparrow (*Zonotrichia albicollis*), eastern bluebird (*Sialia sialis*), warbling vireo (*Vireo gilvus*), orange-crowned warbler (*Vermivora celata*), Nashville warbler (*Leiothlypis ruficapilla*), hermit thrush (*Catharus guttatus*), ruby-throated hummingbird (*Archilochus colubris*), and pine warbler (*Setophaga pinus*).

One species, the belted kingfisher (*Megaceryle alcyon*) was observed incidentally during the summer general avian point count surveys, and two species, the cedar waxwing (*Bombycilla*

cedrorum) and pied-billed grebe (*Podilymbus podiceps*) were observed incidentally during fall general avian point count surveys.

4.4.1.2 Eagle Point Count Surveys

Over the winter, spring, summer, and fall eagle point count survey seasons, surveys were conducted at each of the 21 fixed-point count stations twice per month from February through April and again in October through November, and once per month in September and December 2016 for a total of 269 hours of survey effort. Surveys were not conducted from May through August since no active or inactive eagle nests were found in the Study Area and activity of nesting birds, immature birds, floaters, and migrants is generally reduced during this period. Therefore, survey efforts were focused on the periods of peak eagle activity in the early spring and late fall months.

A total of five bald eagles were observed during the fall eagle point count survey period for a mean use of 0.001 eagles per hour. All observations were of individuals in flight. These observations consisted of three adult eagles and two sub-adult eagles. All were observed within the Study Area for a combined total of 17 minutes, and four of the five were observed within the elevation range of 0-200 m (Table 4-9). Eagle observations were recorded from point count locations 30, 9, 19, 26, and 25, which are generally located in the western half of the Study Area.

Table 4-9: Summary of Eagle Point Count Surveys Conducted to Date[2]

Eagle Survey Period	Number Minutes/ (Hours)	No. Eagles Observed	Point ID	Total Time Observed within 800m Radius (Min)	Time Observed >200 m Elevation (Min)	Time Observed 0-200 m Elevation (Min)	Notes
2/4-2/6	1020/(17)	--	--	--	--	--	
2/23 – 2/25	1260/(21)	--	--	--	--	--	
3/9 – 3/11	1260/(21)	--	--	--	--	--	
3/24 – 3/26; 3/29	1260/(21)	--	--	--	--	--	
4/5, 4/6, 4/8	1260/(21)	--	--	--	--	--	
4/20 – 4/22; 4/28	1260/(21)	--	--	--	--	--	
9/19 – 9/21	1260/(21)	--	--	--	--	--	
10/5 – 10/7	1260/(21)	1	30	4	0	4	Adult
10/18 – 10/20	1260/(21)	1	9	3	0	3	2nd Year
		1	19	3	3	0	Adult

[2] Additional eagle point counts are being conducted in 2017. Data from the 2017 point counts will be incorporated into this BBCS upon the completion of the 2017 surveys.

		1	26	2	1	1	Adult
11/1 – 11/3	1260/(21)	1	25	5	0	5	3rd year
11/16-11/17	1260/(21)	--	--	--	--	--	
12/28-12/29	1260/(21)	--	--	--	--	--	
1/18-1-19	1260/(21)	--	--	--	--	--	
TOTAL	**16,140/(269)**	**5**	**--**	**17**	**4**	**13**	

Mean use of 0.001 eagles per hour

One additional bald eagle was observed on September 28, 2016 during general avian point count surveys. Incidental sightings are those made outside of formal eagle sampling plots or times; although they are used to detect presence of birds, incidental sightings are not included in the analysis of the eagle point count data.

4.4.1.3 Ground-Based Raptor Nest Surveys

During the initial ground-based raptor nest survey conducted in March 2016, surveys for general raptor nests were conducted within the general avian Survey Area boundary and a 2-mile buffer around potential turbine locations, while surveys for bald eagle nests were conducted within a 10-mile buffer around potential turbine locations. Incidental observations of other tree nesting raptors outside the 2-mile and 10-mile buffer were recorded while conducting nest surveys for bald eagles. During the 2017 survey effort, surveys focused only on bald eagle nests within the Project site and associated 10-mile buffer.

While nesting density and distribution for all raptor species were of interest, bald eagles were a focus of the survey effort due to their special protection under the BGEPA (16 U.S.C. § 668) and continued agency interest in their populations.

Nesting Species Composition and Frequency of Occurrence

During the 2016 survey effort, a total of 37 raptor nests and one great blue heron (*Ardea herodias*) rookery site were recorded (Table 4-10, Exhibit 4-9). Fourteen (38 percent) of the raptor nests were active and the remaining 23 (62 percent) nests were identified as inactive. Of the 14 nests documented as active, 10 (72 percent) were occupied by red-tailed hawks, three (21 percent) were occupied by bald eagles, and one (7 percent) was occupied by a great horned owl (*Bubo virginianus*) (Table 4-10). Four of the active raptor nests (29 percent) (all red-tailed hawks) were located within the 2-mile buffer. The remaining 10 active nests (71 percent) were located outside of the 2-mile buffer, but within or adjacent to the 10-mile buffer (Exhibit 4-9). Of the 23 nests identified as inactive, two (9 percent) of the nests belonged to bald eagles, one (4 percent) belonged to a red-tailed hawk, and the

Table 4-10: 2016-2017 Raptor Nest Survey Results for the Nobles 2 Wind Project

Nest ID	Species	Nest Status		Nest Condition	Substrate	Location		Notes
		2016	2017			Latitude	Longitude	
1	Red-tailed hawk	Active	--	Good	DLT	43.77530	-95.98643	
2	Unknown species	Inactive	--	Poor	DLT	43.75479	-95.99274	
3	Red-tailed hawk	Active	--	Good	DLT	43.81177	-95.95809	
4	Red-tailed hawk	Inactive	--	Fair	DLT	43.77923	-95.95494	Recently predated
5	Red-tailed hawk	Active	--	Fair	DLT	43.81405	-95.93355	2 nestlings present
6	Red-tailed hawk	Active	--	Good	DLT	43.65565	-95.92731	
7	Great blue heron	Active	--	Good	DLT	43.60994	-96.01926	Rookery, 46 adults and 18 nests present
8	Red-tailed hawk	Active	--	Good	DLT	43.64365	-96.11288	RTHA seen in nest and flying to nest with nesting material
9	Red-tailed hawk	Active	--	Good	DLT	43.82963	-95.89899	
10	Unknown species	Inactive	--	Good	DLT	43.82272	-95.91498	
11	Unknown species	Inactive	--	Fair	DLT	43.80563	-96.12712	
12	Red-tailed hawk	Active	--	Good	DLT	43.84601	-96.13284	
13	Unknown species	Inactive	--	Poor	DLT	43.80211	-95.90633	
14	Unknown species	Inactive	--	Good	DLT	43.78017	-95.87837	
15	Unknown species	Inactive	--	Good	DLT	43.75999	-95.75466	
16	Unknown species	Active	--	Good	DLT	43.81100	-95.87359	
17	Unknown species	Active	--	Poor	DLT	43.84562	-95.81557	
18	Unknown species	Active	--	Poor	DLT	43.74813	-95.86681	
19	Unknown species	Active	--	Fair	DLT	43.71650	-95.73398	Smaller nest, likely ANCR or COHA
20	Unknown species	Active	--	Poor	DLT	43.71547	-95.63230	

Nest ID	Species	Nest Status		Nest Condition	Substrate	Location		Notes
		2016	2017			Latitude	Longitude	
21	Unknown species	Active	--	Poor	DLT	43.80437	-95.70530	Nest is falling apart
22	Unknown species	Inactive	--	Poor	DLT	43.79352	-95.75353	
23	Red-tailed hawk	Active	--	Good	DLT	43.93770	-96.02601	Adult RTHA in nest
24	Unknown species	Inactive	--	Poor	DLT	43.93295	-95.93887	
25	Red-tailed hawk	Active	--	Good	DLT	43.90277	-95.73534	Adult RTHA in nest
26	Great horned owl	Active	--	Good	DLT	43.77989	-95.59444	
27	Unknown species	Inactive	--	Good	DLT	43.79192	-95.54214	
28	Red-tailed hawk	Active	--	Good	DLT	43.66292	-95.44210	
29	Unknown species	Inactive	--	Good	DLT	43.79897	-95.50654	
30	Unknown species	Inactive	--	Poor	DLT	43.73001	-95.74568	
31	Unknown species	Inactive	--	Good	DLT	43.79715	-95.98387	
32	Unknown species	Inactive	--	Poor	DLT	43.77616	-95.90876	
33	Unknown species	Inactive	--	Poor	DLT	43.79175	-95.73934	
34	Bald Eagle	Inactive	Active	Good	DLT	43.81016	-96.13546	
35	Bald Eagle	Active	Inactive	Good	DLT	43.55453	-95.56396	Adult eagle in nest
36	Bald Eagle	Inactive	Active	Good	DLT	43.57165	-95.59420	
37	Bald Eagle	Active	Active	Good	DLT	43.93279	-95.68051	Adult eagle in nest
38	Bald Eagle	Active	Active	Good	DLT	43.83187	-95.47168	Adult eagle in nest

DLT = Deciduous Live Tree

remaining 20 inactive nests (87 percent) could not be identified as to species, although most were likely constructed by red-tailed hawks (Table 4-10).]

Red-Tailed Hawk. Red-tailed hawk nests were the most commonly occurring raptor nests recorded and were observed at 11 locations within the 10-mile buffer, five having been found in or directly adjacent to the Study Area (Exhibit 4-9). Ten of the nests were active with an adult in the incubation position, and one was inactive and been recently depredated. The density of occupied red-tailed hawk nests within a 2-mile buffer was estimated at approximately 0.027 nests/square miles (mi^2).

Six of the 10 active red-tailed hawk nests were located outside the 2-mile buffer around the proposed turbines and were recorded incidentally during eagle nest surveys. Eight of the 10 active nests identified (80 percent) were located within the western half of the Survey Area (Exhibit 4-9). Despite the presence of transmission powerlines in the Survey Area, all the red-tailed hawk nests identified were located in deciduous trees and most were associated with wooded shelterbelts near farmsteads and other residences. While 20 of the total 37 nests (54 percent) identified were inactive and could not be identified to species, most were likely previously constructed and occupied by red-tailed hawks.

Bald Eagle. Bald eagles were the second most commonly occurring raptor nest identified with a total of five nests recorded, including three active nests (Exhibit 4-9). All were located in large cottonwood trees near perennial water sources. Four of the five nests identified were in the eastern half of the Survey Area. The nearest active nest (Nest ID 37) was located approximately 8.9 miles to the northeast of the originally-defined Project Area and the remaining two active nests (Nest ID 38 and 35) were located outside the 10-mile buffer approximately 12.2 miles to the east and 12.8 miles to the southeast of the Project Area, respectively (Exhibit 4-9). All the inactive bald eagle nests identified were in good condition suggesting that they may have been occupied in the last several years. The density of occupied bald eagle nests within a 10-mile buffer of the proposed turbine locations was estimated at approximately 0.001 nests/mi^2.

Five incidental observations of bald eagles were also recorded during the survey period. Four of the observations were located near Ocheda Lake to the southeast of the Study Area (Exhibit 4-9). Two of these observations were of a mating pair of eagles sitting in a tree (ID 40 and 41), one observation was of a single adult sitting in a tree (ID 42), and one observation was of a single juvenile soaring (ID 39). The remaining observation was that of a single juvenile eagle soaring near Lime Lake to the northeast of the Study Area (ID 39) (Exhibit 4-9).

Great Horned Owl. A single occupied great horned owl nest (ID 26) was observed approximately 4 miles east of the Study Area adjacent to Jack Creek (Exhibit 4-9). Although great horned owls do not build their own nest, they typically use the nests of other raptor species such as red-tailed hawks.

Great Blue Heron. An active great blue heron rookery was also identified approximately 9.4 miles south of the Study Area (ID 7) (Exhibit 4-9). Some 46 adults and 18 nests were observed in this rookery, with numerous other nests under active construction. As the survey period generally corresponded to the peak of nest building for great blue herons, no eggs or young were observed in this rookery.

During the 2017 survey effort, a total of five bald eagle nests were recorded (Table 4-10, Exhibit 4-10). Four of the five nests (80 percent) identified were active. Two of the active nests were located within the 10-mile Survey Area and the remaining two active nests were located outside the 10-mile Survey Area. Nest ID 37 and 38 were active in both 2016 and 2017, Nest ID 34 was active in 2016 but not in 2017, and the activity status of Nest ID 35 and 36 switched between 2016 and 2017 (Exhibits 4-9 and 4-10).

Ten incidental observations of bald eagles were also recorded during the 2017 survey effort. Observations were generally distributed evenly throughout the Survey Area and nearly all were located near perennial water sources such as lakes or streams.

4.4.2 Acoustic Bat Surveys

Passive acoustic bat surveys were conducted using broadband full-spectrum Song Meter SM2BAT+ and SM3BAT+ detectors (Wildlife Acoustics, Inc.) from May 17 through October 31, 2016 for one full season of data collection. Because of unusually high precipitation and saturated soil conditions during the spring season and associated access issues, initial monitoring efforts could not start until May 17, 2016. Surveys were conducted in accordance with current agency guidelines (Mixon *et al.* 2014) for bat wind farm screening to determine general bat presence, activity levels, and species composition in the proposed Study Area. Single duel channel detectors were deployed at each of three meteorological towers in the Study Area. As recommended by agency guidelines, one microphone for each detector was placed approximately 5 meters above ground level and a second microphone was placed at a height of at least 45 meters at each met tower.

Detailed descriptions of survey methods, results, and discussion can be found in the *Bat Monitoring at the Proposed Nobles 2 Wind Energy Project, Nobles County, Minnesota Final Report – Spring-Fall 2016* (Zotz 2016). A summary of the results of the acoustic monitoring is provided below.

From all detector locations, a total of 2,717,563 sound files were recorded during the period of 17 May 2016 to 1 November 2016. Filtering and visual examination of files to eliminate extraneous noise (e.g., wind, insects, etc.) resulted in a total of 4,022 call files containing 4,024 bat passes (Table 4-11). More bat passes than call files can be the result of multiple bat species occurring in the same call file. Of these bat passes, 631 bat passes were detected at Met Tower 6, 462 bat passes at Met Tower 7, 23 bat passes at Met Tower 7 Temp (temporary location), and 2,908 bat passes at Met Tower 0734. Six species and six species

groups were documented. The hoary bat composed the greatest proportion of bat passes (Exhibit 4-11). This was followed by the UNKLOW group (which was composed of potential calls by the silver-haired, big brown, hoary bat, and the big brown bat).

4.4.2.1 Met Tower 6

Monitoring was conducted over 122 nights from 16 June 2016 to 23 October 2016 (the last night a bat pass was recorded). Among the 631 bat passes detected at Met Tower 6, the hoary bat composed the greatest proportion of bat passes (42.31 percent) followed by the UNKLOW group (16.16 percent) and the big brown bat (13.47 percent). On average, the greatest number of bat passes per night ($\bar{x}$ =4.19 ± 0.56 bat passes/night) was recorded at the 45-m height.

Met Tower 6, 45m

Among 122 nights, a total of 511 bat passes were recorded yielding an average of 4.19 ± 0.56 bat passes per night (Table 4-11). Most bat passes were those of the hoary bat (n=250) and the UNKLOW group (n=91). The majority of bat passes was by the hoary bat (n=250) and the UNKLOW group (n=91). Among all 122 nights, activity was greatest on 30 July 2016 (n=32), followed by 9 August 2016 (n=29), and 11 August 2016 (n=25) (Exhibit 4-12a). Activity on these nights was largely attributed to hoary bats. Average hourly activity was greatest at 2100 hrs ($\bar{x}$ = 1.14 ± 0.29 bat passes/hour) followed by 2300 hrs ($\bar{x}$ = 0.47 ± 0.13 bat passes/hour) and 0100 hrs ($\bar{x}$ = 0.44 ± 0.10 bat passes/hour) (Exhibit 4-13a).

Met Tower 6, 5m

Among 122 nights, a total of 120 bat passes were recorded yielding an average of 0.98 ± 0.23 bat passes per night (Table 4-11). Most bat passes were those of the big brown bat (n=35) and the hoary bat (n=26). Among all 122 nights, activity was greatest on 19 August 2016 (n=18), followed by 17 August 2016 (n=15), and 23 August 2016 (n=10) (Exhibit 4-12b). Activity on these nights was largely attributed to hoary bats, silver-haired bats, eastern red bats, and big brown bats. Average hourly activity was greatest at 0200 hrs ($\bar{x}$ = 17 ± 0.07 bat passes/hour) followed by 0000 hrs ($\bar{x}$ = 0.13 ± 0.05 bat passes/hour) and 2100 hrs ($\bar{x}$ = 0.12 ± 0.05 bat passes/hour) (Exhibit 4-13b).

4.4.2.2 Met Tower 7 Temporary

Monitoring was conducted over 26 nights from 17 May 2016 and the last bat pass recorded on 15 June 2016. Among the 23 bat passes detected at the temporary location near Met Tower 7, the majority of bat passes were made by the big brown bat (n=7), the UNKLOW group (n=6), and the hoary bat (n=4). Among 26 nights, an average of 0.88 ± 0.37 bat passes per night was calculated (Table 4-11). Among all 26 nights, activity was greatest on 27 May 2016 (n=9) and 4 June 2016 (n=3). Activity on these nights was largely attributed to the big

brown bat and the UNKLOW group. Average hourly activity was greatest at 2200 hrs ($\bar{x}$ = 0.42 ± 0.21 bat passes/hour), followed by the remaining hours of the night, 2300–0400 hrs

Table 4-11: Species Composition and Activity (Number of Bat Passes) Recorded During the Period of May Through October 2016 at Heights of 45 and 5 Meters at Met Towers within the Study Area

	Number of Bat Passes								
Species/Species Group	Met 6		Met 7 Temp	Met 7		Met 0734		Total	Percent of Total
	45 m	5 m		45 m	5 m	45 m	5 m		
Big brown bat	50	35	7	33	98	64	355	642	15.95%
Eastern red bat	50	18	2	30	25	137	139	401	9.97%
Hoary bat	250	17	4	91	8	379	227	976	24.25%
Silver-haired bat	47	26	2	38	19	167	167	466	11.58%
Little brown bat	0	0	0	0	1	2	3	6	0.15%
Tri-colored bat	0	0	0	0	0	1	2	3	0.07%
EPFULANO	14	3	1	4	10	65	186	283	7.03%
LABOPESU	0	0	0	0	0	2	25	27	0.67%
LACILANO	2	0	0	0	0	61	13	76	1.89%
UNKHIGH	4	8	1	7	16	19	98	153	3.80%
UNKMED	3	2	0	2	3	12	22	44	1.09%
UNKLOW	91	11	6	47	30	407	355	947	23.53%
Total	**511**	**120**	**23**	**252**	**210**	**1,316**	**1,592**	**4,024**	
No. of Nights	**130**		**26**	**122**		**144**			
Average ± Standard Error	**3.93 ± 0.54**	**0.92 ± 0.22**	**0.88 ± 0.37**	**2.07 ± 0.28**	**1.72 ± 0.29**	**9.14 ± 1.12**	**11.06 ± 1.16**		
Overall Bat Passes/Detector Night (BDPN)								**4.92 ***	

* BDPN = 4,024 passes ÷ (422 nights × 2 detectors per Met)

($\bar{x}$ = 0.08 ± 0.05 or 0.08 bat passes/hour).

4.4.2.3 Met Tower 7

Monitoring was conducted over 112 nights from 15 June 2016 to 15 October 2016 (the last night a bat pass was recorded). Among the 462 bat passes detected at Met Tower 7, the big brown bat composed the greatest proportion of bat passes (28.35 percent) followed by the hoary bat (21.43 percent) and the UNKLOW group (16.67 percent). On average, the greatest number of bat passes per night ($\bar{x}$ = 2.25 ± 0.29 bat passes/night) was recorded at the 45-m height.

Met Tower 7, 45m

Among 112 nights, a total of 252 bat passes were recorded yielding an average of 2.25 ± 0.29 bat passes per night (Table 4-11). Most bat passes were those of the hoary bat (n=91) and the UNKLOW group (n=47). Among all 112 nights, activity was greatest on 20 September 2016 (n=18) followed by 20 July 2016 (n=10), 27 July 2016 (n=10) and 10 August 2016 (n=10) (Exhibit 4-14a). Activity on these nights was largely attributed to hoary and silver-haired bats. Average hourly activity was greatest at 2100 hrs ($\bar{x}$ = 0.33 ± 0.08 bat passes/hour), followed by 0100 hrs ($\bar{x}$ = 0.30 ± 0.08 bat passes/hour), and 0000 hrs ($\bar{x}$ = 0.26 ± 0.07 bat passes/hour) (Exhibit 4-15a).

Met Tower 7, 5m

Among 112 nights, a total of 210 bat passes were recorded yielding an average of 2.25 ± 0.29 bat passes per night (Table 4-11). Most bat passes were those of the big brown bat (n=98) and the UNKLOW group (n=30). Among all 122 nights, activity was greatest on 29 August 2016 (n=16) followed by 17 August 2016 (n=15) and 23 August 2016 (n=12) (Exhibit 4-14b). Activity on these nights was largely attributed to the big brown bat. Average hourly activity was greatest at 2100 hrs ($\bar{x}$ =0.41 ± 0.12 bat passes/hour), followed by 2300 hrs ($\bar{x}$ = 0.29 ± 0.07 bat passes/hour), and 2200 hrs ($\bar{x}$ = 0.24 ± 0.06 bat passes/hour) (Exhibit 4-15b).

4.4.2.4 Met Tower 0734

Monitoring was conducted over 143 nights from 17 May 2016 to 7 October 2016 (the last night a bat pass was recorded). Among the 2,908 bat passes detected at Met Tower 0734, the UNKLOW group composed the greatest proportion of bat passes (26.20 percent) followed by the hoary bat (20.84 percent) and the big brown bat (14.41 percent). On average, the greatest number of bat passes per night ($\bar{x}$ = 11.06 ± 1.16 bat passes/night) was recorded at the 5-m height.

Met Tower 0734, 45m

Among 143 nights, a total of 1,316 bat passes were recorded yielding an average of 9.20 ± 1.13 bat passes per night (Table 4-11). Most bat passes were those of the UNKLOW group (n=407) and the hoary bat (n=379). Among all 143 nights, activity was greatest on 21 July 2016 (n=68) followed by 22 July 2016 (n=59), and 2 August 2016 (n=52) (Exhibit 4-16a). Activity on these nights was largely attributed to the UNKLOW group, hoary bats, eastern red bats, and silver-haired bats. Average hourly activity was greatest at 2200 hrs ($\bar{x}$ = 1.66 ± 0.28 bat passes/hour), followed by 2300 hrs ($\bar{x}$ = 1.52 bat passes/hour), and 2100 hrs ($\bar{x}$ = 1.38 ± 0.23 bat passes/hour) (Exhibit 4-17a).

Met Tower 0734, 5m

Among 143 nights, a total of 1,592 bat passes was recorded yielding an average of 11.13 ± 1.17 bat passes per night (Table 4-11). Most bat passes were those of the UNKLOW group (n=355) and the big brown bat (n=355). Among all 143 nights, activity was greatest on 21 July 2016 (n=67) followed by 23 July 2016 (n=52), and 22 July 2016 (n=51) (Exhibit 4-16b). Activity on these nights was largely attributed to the big brown bat, the hoary bat, and the UNKLOW group. Average hourly activity was greatest at 2200 hrs ($\bar{x}$ = 2.15 ± 0.32 bat passes/hour), followed by 2300 hrs ($\bar{x}$ = 2.03 ± 0.27 bat passes/hour), and 0100 hrs ($\bar{x}$ = 1.27 ± 0.23 bat passes/hour) (Exhibit 4-17b).

4.4.2.5 Comparison of Bat Activity between Met Towers and Heights

Nightly bat activity varied significantly by met tower location ($F_{2,747}$ = 71.396, P < 0.001) and the interaction of microphone height and met tower location (i.e., the combined effects of microphone height and met tower location on bat activity) ($F_{2,747}$ = 5.352, P < 0.010) but not by microphone height alone ($F_{1,747}$ = 0.696, P = 0.404). Post hoc comparisons showed that at Met Tower 6 bat activity was nearly significantly different between the 5 m and 45 m detector heights (Tukey's HSD test, P = 0.061, Exhibit 4-18), bat activity at Met Tower 7 did not significantly differ between the 5 m and 45 m detector heights (Tukey's HSD test, P = 1.00, Exhibit 4-19), and bat activity at Met Tower 0734 did not significantly differ between the 5 m and 45 m detector heights (Tukey's HSD test, P = 0.458, Exhibit 4-20).

4.4.2.6 Comparison of Bat Activity for Species between Heights

Met Tower 6

Average bat activity differed significantly between the 5 m and 45 m heights for two species and three species groups at Met Tower 6 (Table 4-12). Bat activity was significantly greater at 45 m compared to 5 m for the eastern red bat, hoary bat, big brown/silver-haired bat group, hoary/silver-haired bat group, and the UNKLOW group.

Met Tower 7

Average bat activity differed significantly between the 5 m and 45 m heights for three species at Met Tower 7 (Table 4-13). Bat activity was significantly greater at 5 m compared to 45 m for the big brown bat. Bat activity was significantly greater at 45 m compared to 5 m for the hoary bat and the little brown bat.

Table 4-12: Results of Paired T-test Analyses Comparing Activity by Each Species or Species Group Between 45 and 5 Meter Heights at Met Tower 6

Species/Species Group	45 m Avg. ± SE	5 m Avg. ± SE	*t* statistic	Degrees of Freedom (df)	*P* value
Big brown bat	0.41 ± 0.09	0.29 ± 0.07	1.22	121	0.22
Eastern red bat	0.41 ± 0.08	0.15 ± 0.05	3.16	121	0.00
Hoary bat	2.05 ± 0.39	0.14 ± 0.06	5.29	121	0.00
Silver-haired bat	0.39 ± 0.11	0.21 ± 0.09	1.61	121	0.11
EPFULANO	0.11 ± 0.05	0.02 ± 0.02	2.15	121	0.03
LACILANO	0.02 ± 0.02	--	--	--	--
UNKHIGH	0.03 ± 0.02	0.07 ± 0.03	1.42	121	0.16
UNKMED	0.02 ± 0.02	0.02 ± 0.01	0.38	121	0.71
UNKLOW	0.75 ± 0.10	0.09 ± 0.03	6.74	121	0.00

Table 4-13: Results of Paired T-test Analyses Comparing Activity by Each Species or Species Group Between 45 and 5 Meter Heights at Met Tower 7

Species/Species Group	45 m Avg. ± SE	5 m Avg. ± SE	*t* statistic	Degrees of Freedom (df)	*P* value
Big brown bat	0.29 ± 0.07	0.88 ± 0.21	2.63	111	0.01
Eastern red bat	0.27 ± 0.06	0.22 ± 0.07	0.51	111	0.61
Hoary bat	0.81 ± 0.14	0.07 ± 0.03	5.43	111	0.00
Silver-haired bat	0.34 ± 0.13	0.17 ± 0.06	1.17	111	0.24
Little brown bat	0.01 ± 0.01	--	--	--	--
EPFULANO	0.04 ± 0.02	0.09 ± 0.03	1.51	111	0.13
UNKHIGH	0.06 ± 0.03	0.14 ± 0.05	1.38	111	0.17
UNKMED	0.02 ± 0.01	0.03 ± 0.02	0.45	111	0.66
UNKLOW	0.42 ± 0.07	0.27 ± 0.07	1.69	111	0.09

Met Tower 0734

Average bat activity differed significantly between the 5 m and 45 m heights for two species and four species groups at Met Tower 0734 (Table 4-14). Bat activity was significantly greater at 5 m compared to 45 m for the big brown bat, the big brown/silver-haired bat group, the eastern red/tri-colored bat group, and the UNKHIGH group. Bat activity was significantly greater at 45 m compared to 5 m for the hoary bat and the hoary/silver-haired bat group.

Table 4-14: Results of Paired T-test Analyses Comparing Activity by Each Species or Species Group Between 45 and 5 Meter Heights at Met Tower 0734

Species/Species Group	45 m Avg. ± SE	5 m Avg. ± SE	*t* statistic	Degrees of Freedom (df)	*P* value
Big brown bat	0.45 ± 0.11	2.48 ± 0.36	5.68	142	0.00
Eastern red bat	0.96 ± 0.16	0.97 ± 0.14	0.09	142	0.93
Hoary bat	2.65 ± 0.40	1.59 ± 0.27	3.03	142	0.00
Silver-haired bat	1.17 ± 0.17	1.17 ± 0.19	0.00	142	1.00
Little brown bat	0.01 ± 0.01	0.02 ± 0.01	0.38	142	0.71
Tri-colored bat	0.01 ± 0.01	0.01 ± 0.01	0.45	142	0.66
EPFULANO	0.45 ± 0.10	1.30 ± 0.17	5.21	142	0.00
LABOPESU	0.01 ± 0.01	0.17 ± 0.04	3.97	142	0.00
LACILANO	0.43 ± 0.11	0.09 ± 0.02	3.09	142	0.00
UNKHIGH	0.13 ± 0.04	0.69 ± 0.11	4.73	142	0.00
UNKMED	0.08 ± 0.03	0.15 ± 0.04	1.55	142	0.12
UNKLOW	2.85 ± 0.37	2.48 ± 0.29	0.90	142	0.37

4.4.2.7 Species of Special Concern

The big brown, little brown, and tri-colored bats which are listed as Species of Special Concern by the MNDNR were detected during the monitoring period. The big brown bat, one of Minnesota's four species of cave-hibernating bats, was documented among 15.95 percent of total calls (Table 4-11) (Exhibit 4-21) and 98.62 percent among Species of Special Concern found in this study (Exhibit 4-22). Activity by this species was greatest from late July to late August 2016.

The little brown bat, one of Minnesota's four species of cave-hibernating bats, was documented among 0.15 percent of total calls (Table 4-11) and 0.92 percent among Species of Special Concern found in this study (Exhibit 4-22). The little brown bat was documented on 17 May 2016, 22 July 2016, 20 August 2016, and 23 August 2016.

The tri-colored bat, one of Minnesota's four species of cave-hibernating bats, was listed as a Species of Special Concern by the MNDNR in 1984 (MNDNR 2016d). The tri-colored bat was documented among 0.07 percent of total calls (Table 4-11) and 0.46 percent among Species of Special Concern found in this study (Exhibit 4-22). The tri-colored bat was documented on 23 May 2016 and 30 August 2016.

Although the two call analysis software programs (Kaleidoscope and EchoClass) each classified three call files to the northern long-eared bat, there was no agreement on the classification of a single call (i.e., each of the six call files were a different call file). Manual review suggested these calls were approach phase calls (i.e., unclassifiable to a certain species) or calls produced by another species. The echolocation calls produced by the northern long-eared bat can overlap in characteristics with other species such as the little brown bat, making identification and differentiation of calls by these species difficult. Differentiation of calls is especially problematic in open (low clutter) environments (Broders *et al*. 2004), i.e. similar to the areas where the met towers are situated. In cluttered habitats (e.g., forests), however, the echolocation call of the northern long-eared bat is more easily distinguished due to its feeding specialization in these habitats. Additionally, likelihood of presence analyses based on the 6 call files initially classified to the northern long-eared bat suggest that this species does not likely occur in the Study Area.

5.0 RISK ASSESSMENT

This section provides a qualitative risk assessment for direct impacts to birds and bats related to the construction and operation of the proposed Project. The intention is not to predict the number of fatalities due to turbine collision and other sources of direct mortality, because recent studies have shown that there is little correlation between pre-construction risk assessments and actual documented mortality of bird and bat species at wind farms (de Lucas *et al.* 2008; Ferrer *et al.* 2011; Sharp *et al.* 2010). As such, it is difficult to predict expected mortality rates at a proposed facility from pre-construction survey data alone. Post construction data from nearby and regional operational wind projects is likely a more reliable and accurate predictor of risk. In response to these findings, this BBCS is designed to allow Nobles 2 to work continuously with the USFWS and MNDNR to adapt to actual results and unknown circumstances, so that unexpected events and changes over time may be addressed.

5.1 Birds

5.1.1 Non-Raptor Avian Species

The avian community documented within the Study Area during the winter, spring, summer, and fall survey seasons was characteristic of species associated with typical mid-western agricultural and grassland habitat. The majority of the Project Area and surrounding region has been developed for agricultural use, specifically crops such as wheat, soybeans, sunflower, alfalfa, and corn, with additional developed lands devoted to pastureland with a few remnants of native grassland.

Area wind farms that currently have publicly available detailed pre-construction avian data include the Odell and Stoneray wind projects, which are approximately 36 and 10 miles from the Nobles 2 Project, respectively. Both projects have highly similar land cover types to those of Nobles 2, with between 82 and 91 percent of the project areas comprised of cultivated cropland, and the remaining areas comprised of developed land, woodland, grassland, and isolated wetland areas (Exhibit 5-1).

Annual pre-construction bird surveys conducted for the Project generally indicate that avian species composition and mean use is comparable with, but less than that of the Odell and Stoneray wind projects. (Table 5-1) (Exhibit 5-2). For example, overall mean bird use for the Nobles 2 Project during the spring survey season was 17.61 birds/10 min and overall mean bird use for the Odell and Stoneray wind project was 22.82 birds/10 min and 36.29 birds/10 min, respectively (Table 5-1). Among all species groups, passerines accounted for the greatest difference among sites, while the remaining species groups; waterfowl raptors, upland gamebirds, pigeons/doves, shorebirds, woodpeckers, and herons/egrets/cranes/rails have very similar mean use values among sites (Table 5-1) (Exhibit 5-2).

While both the Odell and Stoneray wind projects have strong similarities to the Nobles 2 Project regarding land use and overall avian species composition and mean use, there currently is no formal post-construction fatality data for these projects to make direct inferences to avian fatality rates for the Nobles 2 Project. However, bird mortality documented during post-construction studies at 26 other wind energy facilities in the Midwest is comparatively low, with a mean mortality rate of 2.84 fatalities/MW/year, with a range from 0.48 fatalities/MW/year to 8.20 fatalities/MW/year (Exhibit 5-3).

Table 5-1: Comparison of Mean Bird Use by Species for Nobles 2, Odell, and Stoneray Wind Projects

Species Group	Mean Use (No. Birds/10 minutes)		
	Nobles 2	Odell	Stoneray
Passerines			
American Crow	0.08	0.28	0.83
American Goldfinch	0.04	1.01	0.56
American Robin	0.87	1.04	0.94
Baltimore Oriole	0.03	0.07	--
Barn Swallow	1.07	0.75	0.58
Belted Kingfisher	--	0.01	--
Black-capped Chickadee	--	0.01	0.01
Blue Grosbeak	<0.01	--	--
Blue Jay	0.05	0.10	0.05
Bobolink	0.08	0.26	0.25
Brown Thrasher	0.02	0.03	--
Brown-headed Cowbird	0.53	0.92	2.45
Cedar Waxwing	--	0.11	--
Chimney Swift	0.02	0.01	--
Chipping Sparrow	0.02	0.07	0.03
Clay-colored Sparrow	--	0.05	0.13
Cliff Swallow	0.20	1.46	0.01
Common Grackle	4.49	1.96	3.93
Common Yellowthroat	0.06	0.36	0.20
Dickcissel [3]	0.03	0.02	0.35
Eastern Kingbird	0.06	0.02	0.08
Eastern Phoebe	--	0.01	0.01
Eastern Towhee	--	--	0.01
Eastern Wood-Pewee	0.01	0.01	--
European Starling	0.94	0.44	3.35
Field Sparrow	--	0.05	--
Grasshopper Sparrow [3]	<0.01	0.07	0.28
Gray Catbird	--	0.03	--
Harris's Sparrow	0.01	0.33	--
Horned Lark	0.48	0.21	0.49
House Finch	--	0.01	0.04

Species Group	Mean Use (No. Birds/10 minutes)		
	Nobles 2	Odell	Stoneray
House Sparrow	0.04	0.24	0.10
House Wren	0.02	--	--
Lapland Longspur	0.30	--	--
Least Flycatcher	--	0.01	--
Le Conte's Sparrow	<0.01	--	--
Loggerhead Shrike [1]	<0.01	--	--
Marsh Wren	--	0.19	0.40
Nashville Warbler	--	0.01	--
Northern Cardinal	--	0.01	0.01
Northern Mockingbird	--	--	0.01
Northern Rough Wing Swallow	--	--	0.86
Orchard Oriole	--	0.01	--
Purple Martin	--	0.01	--
Red-eyed Vireo	0.01	--	--
Red-winged Blackbird	3.48	5.87	12.24
Rose-breasted Grosbeak	--	0.01	--
Ruby-throated Hummingbird	--	0.01	--
Savannah Sparrow	0.06	0.32	0.05
Sedge Wren	--	--	0.05
Song Sparrow	0.05	0.53	0.31
Swainson's Thrush	0.03	--	--
Swamp Sparrow	--	0.03	--
Tennessee Warbler	--	0.01	--
Tree Swallow	0.14	1.05	--
Vesper Sparrow	0.17	0.25	--
Warbling Vireo	--	0.03	--
Western Kingbird	--	--	0.01
Western Meadowlark	0.10	0.10	1.64
White-breasted Nuthatch	--	0.01	--
White-crowned Sparrow	<0.01	--	--
Wood Thrush	--	0.02	--
Yellow Warbler	0.02	0.07	0.01
Yellow-rumped Warbler	0.01	--	--
Yellow-headed Blackbird	0.02	0.19	--
Total	**13.58**	**18.68**	**30.25**
Waterfowl			
American Wigeon	0.04	--	--
Blue-winged Teal	0.31	0.03	0.78
Canada Goose	0.02	0.73	0.39
Double-crested Cormorant	<0.01	--	0.26
Gadwall	0.04	--	0.03
Greater White-fronted Goose	1.03	--	--
Green-winged Teal	0.16	--	--
Hooded Merganser	--	--	0.04

Species Group	Mean Use (No. Birds/10 minutes)		
	Nobles 2	Odell	Stoneray
Mallard	0.60	0.64	0.21
Northern Pintail	0.01	--	--
Northern Shoveler	0.30	0.07	--
Pied-billed Grebe	--	0.03	--
Redhead	--	--	0.01
Ring-necked Duck	0.08	--	--
Trumpeter Swan	--	0.01	--
Wood Duck	0.02	0.03	0.39
Total	**2.59**	**1.54**	**2.10**
Raptors			
American Kestrel	0.03	0.01	0.01
Cooper's Hawk	--	--	--
Northern Harrier	0.02	0.01	0.01
Red-tailed Hawk	0.07	0.04	0.16
Rough-legged Hawk	--	--	0.01
Swainson's Hawk [3]	0.01	--	--
Turkey Vulture	0.05	0.01	--
Total	**0.18**	**0.07**	**0.20**
Upland Gamebirds			
Greater Prairie-chicken [4]	--	--	0.01
Ring-necked Pheasant	0.08	0.49	0.73
Total	**0.08**	**0.49**	**0.74**
Pigeons/Doves			
Mourning Dove	0.17	0.75	0.54
Eurasian Collared Dove	<0.01	--	-
Rock Pigeon	0.21	0.07	0.79
Total	**0.38**	**0.82**	**1.33**
Shorebirds			
American Golden Plover	0.01	--	--
Black Tern	--	0.01	--
Bonaparate's Gull	<0.01	--	--
Common Snipe	0.02	--	0.11
Greater Yellowlegs	<0.01	--	--
Killdeer	0.29	0.85	1.16
Least Sandpiper	0.04	--	--
Lesser Yellowlegs	--	0.01	--
Pectoral Sandpiper	0.07	--	--
Ring-billed Gull	0.10	0.01	--
Semipalmated Plover	--	--	0.01
Semipalmated Sandpiper	0.09	--	--
Short-billed Dowitcher [3]	--	--	0.01
Solitary Sandpiper [3]	0.03	--	--
Spotted Sandpiper	--	--	0.01
Upland Sandpiper [3]	0.03	0.07	0.03

Species Group	Mean Use (No. Birds/10 minutes)		
	Nobles 2	Odell	Stoneray
Wilson's Phalarope [2]	0.02	--	--
Total	**0.70**	**0.95**	**1.34**
Woodpeckers			
Downy Woodpecker	--	0.01	0.01
Hairy Woodpecker	--	0.01	--
Northern Flicker	0.05	0.04	0.20
Red-bellied Woodpecker	--	0.03	--
Red-headed Woodpecker [3]	0.02	0.01	0.01
Yellow-bellied Sapsucker	--	--	0.01
Total	**0.07**	**0.10**	**0.24**
Herons/Egrets/Cranes/Rails			
American Bittern [3]	--	--	0.01
American Coot	0.02	0.15	0.05
Cattle Egret	<0.01	--	--
Great Egret	<0.01	--	--
Great Blue Heron	0.01	0.01	0.03
Green Heron	--	0.01	--
Sandhill Crane	<0.01	--	--
Total	**0.03**	**0.17**	**0.09**
Grand Total	**17.61**	**22.82**	**36.29**
Number Species Observed	**80**	**78**	**62**

[1]Minnesota Endangered Species, [2]Minnesota Threatened Species, [3]USFWS Bird of Conservation Concern, [4]Minnesota Special Concern Species

Bird risk within the Study Area is likely highest during the spring and fall migration seasons, as has been observed at most wind energy facilities (NWCC 2010). Passerines, both resident and migrant, are likely at highest risk in the Study Area, as this avian group represents the majority (75 percent) of mortalities at wind turbines nationwide (Johnson *et al.* 2007; Strickland and Morrison 2008) and was by far the most frequently observed species group during both winter and spring avian point count surveys within the Study Area. It is estimated that less than 0.01 percent of migrant songbirds that pass over wind farms are killed, based on radar data and mortality monitoring (Erickson 2007) and no studies to date indicate or suggest a level of fatality that rises to a level of concern, relative to population-level impacts. Night-migrating passerines may be at a higher risk, as this group has accounted for over 50 percent of avian fatalities at certain sites, but no particular species or group of species has been identified as incurring in greater numbers of fatalities (Erickson *et al.* 2002).

Locally breeding songbirds and other passerines may experience lower mortality rates than migrants because many of these species tend to fly below the RSA during the breeding season. However, some breeding songbird species have behaviors that increase their risk of collisions with turbines. Birds taking off at dusk or landing at dawn, or birds traveling in low

cloud or fog conditions, for example, are likely at the greatest risk of collision (Kerlinger 1995).

Collision risk is likely to be much lower for other non-raptor bird groups in the Study Area. While waterfowl were the second highest species group observed during pre-construction avian surveys, waterfowl are considered to have low risk for turbine-related fatalities either due to demonstrated avoidance behavior and/or few documented fatalities at other wind energy facilities. Research has demonstrated that waterfowl rarely collide with wind turbines (Kingsley and Whittam 2007; Gehring 2011). The only sites experiencing regular waterfowl fatalities have been those located on the shores of large, open expanses of water (Erickson *et al.* 2002).

The remaining non-raptor species groups detected during winter surveys have low risk for turbine collisions within the Study Area to a combination of relatively low mean use rates, infrequent flight within the height of the RSA, and/or few to no records of fatalities at other wind facilities with publicly available results of mortality studies.

5.1.2 Raptors

Despite the observation that most avian fatalities at wind farms are passerines, raptor fatality (including eagles) historically has received the most attention. Raptor fatality at newer wind projects has been low relative to older-generation wind farms, although there is substantial regional variation in raptor fatality rates (Erickson *et al.* 2002; Johnson *et al.* 2002; Kerns and Kerlinger 2004; Jain *et al.* 2007). Raptors constitute approximately 6 percent of reported bird fatalities, but generally have a smaller percentage of birds observed using wind farms during pre-construction surveys (Strickland *et al.* 2011).

High raptor use (greater than 2.0 birds/20 min) has been associated with high raptor mortality at wind farms (Strickland *et al.* 2011). Conversely, raptor mortality 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 winter, spring, summer, and fall raptor use within the Study Area. Mean raptor use within the Study Area for the all the surveys seasons was low (range of 0.096 – 0.373 birds/20 min), suggesting that raptor fatality will be low as well.

Raptor use of the Project Area was observed to be relatively low during the pre-construction surveys and is comparable to that of the Odell and Stoneray wind projects. As shown in Table 5-1, the mean spring raptor use rate for the Nobles 2 Project was 0.18 birds/10 min as compared with 0.07 birds/10 min and 0.20 birds/10 min for the Odell and Stoneray wind projects, respectively. What little data that is available for wind farms in the Midwest, suggests that fatality rates of raptors at these wind energy facilities are low (Exhibit 5-4). The lowest reported raptor fatality rate was 0.06 fatalities/MW/year for the NPPD Ainsworth Wind Farm in Nebraska and rates for the remaining three other studies: Buffalo Ridge, South Dakota; Moraine II, Minnesota; and Winnebago, Iowa reported 0.20, 0.37, and 0.27

fatalities/MW/year, respectively.

The red-tailed hawk, turkey vulture, American kestrel, and northern harrier were the raptor species with the highest mean use and were also among the most frequently detected raptor species in the Study Area during general avian point count surveys. All three species are commonly associated with agricultural and grassland habitats which provide opportunities for foraging, an activity associated with susceptibility to turbine-collisions (Thelander *et al.* 2003). Red-tailed hawks, turkey vultures, American kestrels, and northern harriers have all been recorded fatalities at other wind projects (Kingsley and Whittman 2005), although northern harriers have few documented mortalities, even in areas with high northern harrier use (Erickson *et al.* 2002). This could possibly be because the species generally flies below the RSA, which is consistent with the observation of few northern harriers within the RSA during Project general avian point count surveys.

Risks to non-eagle raptors are expected to be low for the Project because topographic features that encourage risky behaviors like slope-soaring and kiting are limited and discontinuous (observed mostly in the northwest portion of the Study Area when occurring). In addition, any project-related fatalities are unlikely to have population-level impacts because red-tailed hawks and turkey vultures are common nationwide (Sauer *et al.* 2012).

Three species of raptors; red-tailed hawks, bald eagles, and a great horned owl, were documented nesting in the overall Survey Area, but the red-tailed hawk was the only raptor species documented nesting within one mile of potential turbine locations. A total of three active bald eagle nests were recorded within the surrounding region. The nearest nest (Nest ID 37) was located approximately 8.9 miles northeast of the Project Area boundary (see Exhibits 4-9 and 4-10).

Data on the collision risks of red-tailed tailed hawks and other raptors at wind energy facilities are well documented; however, currently few data concerning the collision risk of bald eagle nesting near wind energy developments are available. In general, bald eagles have been rarely documented as casualties at wind energy facilities and a recent study shows that bald eagles exhibit a high rate of avoidance of operational wind turbines (Sharp *et al.* 2011). As of 2012, six substantiated bald eagle fatalities or injuries were documented at wind turbines in the United States and two were reported in Ontario, Canada (Allison 2012; Pagel *et al.* 2013). At least one additional bald eagle fatality was recently reported in publicly available reports in fall 2015 at the Oliver III Wind Farm in Mercer County, North Dakota, although the exact cause of the eagle's death is undetermined (Thompson 2015).

While bald eagles do occur seasonally within the Study Area, their occurrence appeared to be sporadic and in low numbers and indicative of transient bald eagles that may use the Study Area during migratory periods. Mean eagle use within the Study Area was moderately low (0.001 eagles per hour), as a total of five bald eagles were observed, four of which were observed flying within the RSA. Risks to bald eagles are expected to be low for the Project due to a combination of low mean use rates; limited amount of flight within the height of the

RSA; absence of nests within and directly adjacent to the Project Area, , and/or few records of fatalities at other wind facilities with publicly available results of mortality studies.

Habitat quality for nesting bald eagles is lower within the Project Area in comparison to available habitat in areas outside the Project Area that currently support nesting bald eagles. The Project Area contains few large trees suitable for nesting (i.e. large diameter, > 15-20 m in height, adequate crown structure). Where trees are present in the Project Area, most are associated with forested shelterbelts and are located near a residence, less than 25 m tall, are closed canopied and are located far from perennial water sources. In contrast, the six nests identified outside the Project Area but within the 10-mile survey area during 2016-2017 nest surveys were generally located in large super canopy trees, > 25 m in height with large forked branches. In addition, all of the nests were within one (1) mile of a perennial stream or lake, with most located less than 0.5 mile from a perennial water source.

5.1.3 Special-Status Avian Species

No federally listed avian species were observed during winter, spring, summer, or fall avian surveys or as incidental observations within the Study Area. However, 12 of the species identified during general avian point count survey are classified as either Minnesota State listed species, Minnesota Species of Special Concern, or USFWS BCC. While Minnesota Species of Special Concern and USFWS BCC are of interest to the USFWS and MNDNR, they are not afforded legal status or protection under state or federal statutes; they are, however, protected under the MBTA.

The most numerous special-status bird species observed during general avian point count surveys was Franklin's gull followed by the dickcissel. Collectively these two species comprised 85.6 percent of all special-status species observed. Compared to other species documented in this study, Franklin's gull had moderately high mean use rates and encounter rates (0.031 birds flying at the RSA/5 min). Swainson's hawk had low mean use rates and a low encounter rate (0.004 birds flying at the RSA/5 min) and the bald eagle, American white pelican, and solitary sandpiper all had low mean use rates and low encounter rates (0.002, 0.001, and 0.001 birds flying at the RSA/5 min, respectively).

The special-status bird species detected during general avian point count surveys are considered to have a low risk for turbine collision at the Project due to a combination of relatively low mean use rates for most species, infrequent flight within the height of the RSA, and/or few to no records of fatalities at other wind facilities with publicly available results of mortality studies.

5.1.4 Conclusion

The Project has been sited and designed to be a low-risk site for birds. Except for the limited number of WPAs and WMAs located in or directly adjacent to the Study Area, neither the Study Area nor the Project Area contains distinct topography, unique habitats or resources,

or other features that could concentrate birds. No indicators of high avian risk in the Study Area or the Project Area (e.g., presence of federally-listed species, impacts to high quality avian habitat, high volume use as migration stopover habitat, etc.) were discovered during either the SCS (Tier 2 of the WEG) or the annual general avian point count surveys, which were conducted in accordance with Tier 3 of the WEG. Based on available data from operational wind projects in the Midwest, bird collisions at the Project are expected to occur at a low frequency and be comparable with that of other Midwest wind energy facilities. Impacts are not expected to occur to a degree which would adversely affect populations.

5.2 Bats

5.2.1 General Impacts

In the study for the proposed Project, the primary species detected were the hoary and silver-haired bat. Documented bat fatalities of these and other common bat species at previously developed wind farms have been associated almost exclusively with operating turbines. Studies conducted in Minnesota and other wind farms in the United States reported that all dead bats were recovered from turbine locations; none were located at meteorological towers or transmission lines (Johnson *et al.* 2000; Young *et al.* 2003). The prominent proximate causes of bat deaths at wind turbines are direct collision (i.e., blunt-force trauma) (NREL 2013) and barotrauma (Grodsky *et al.* 2011).

Bat fatality at previously developed wind farms has been associated primarily with dispersing and migrating bats. Three species of long-distance migratory bats (hoary bat, eastern red bat, and silver-haired bat) compose the majority of fatalities, and hoary bats alone compose about half of all documented fatalities in North America (Kunz *et al.* 2007). Although the majority of documented bat fatalities at existing wind projects is related to long-distance migratory species, some mortality among resident bat species is also associated with the spring and fall migration periods, and during the summer pup rearing period. At wind farms in the Midwest, where grassland and crop fields accounted for a substantial proportion of the vegetative cover, over 90 percent of the documented bat fatalities occurred between mid-July and mid-September (Erickson *et al*. 2002).

Bat fatalities at wind farms are also known to be affected by other factors, such as weather variables. It has been shown that most bat fatalities tend to occur during low wind speeds over relatively short periods of time (Arnett *et al.* 2008; Hein *et al*. 2013).

As mentioned previously, the Project Area is located on a landscape dominated by agricultural use. The loss of disturbed, agricultural habitat is likely to be of minor consequence for the local bat community due to the demonstrated preference for forested and open water habitat by most bat species that may occur within the Study Area. As with any North American wind energy facility within the range of bat species, the operating WTGs will present a risk of bat mortality due to collisions or barotrauma. Although the Study Area is located in a primarily agricultural landscape, the presence of the WTGs, even in open, non-

forested areas, poses a risk of bat mortality. Bat mortality has been documented at Midwestern wind energy facilities in agricultural areas during the fall migration season, demonstrating that some migrating bats will fly over open land (Johnson *et al*. 2003; Kerlinger *et al.* 2007; Good *et al.* 2011).

Based on data evaluated for the spring, summer, and fall survey periods, bat assemblage and use is expected to be comparable to that of other operational wind projects in the Midwest. Bat mortality documented for 27 post-construction studies at wind energy facilities in the Midwest is variable, with a mean mortality rate of 7.62 bat fatalities/MW/year. Bat fatalities ranged from a low of only 0.10 fatalities/MW/year at the Buffalo Ridge I Project in South Dakota, to a high of 30.61 fatalities/MW/year at the Cedar Ridge Project in Wisconsin (Exhibit 5-5). None of the bat mortalities observed at these facilities was known to consist of northern long-eared bats.

In Minnesota, there have been a number of publicly available studies on the impacts to bats from wind energy developments. These studies report fatality estimates ranging from 1-20 bats/MW/year (1-30 bats/turbine/year) throughout southern Minnesota with the highest fatality rates documented in southwestern Minnesota. The Lakefield Wind Project is nearest to the proposed Nobles 2 Wind Energy Project (approximately 30 miles east in nearby Jackson County) with available post-construction fatality data. During a fatality monitoring study conducted in 2012, an estimate of 19.87 bats/MW (29.80 bats/turbine) was observed with fatalities composed of 27 eastern red bats (48.21%), 13 hoary bats (23.21%), 13 little brown bats (23.21%), and 3 big brown bats (5.36%) (Westwood 2013).

During a second fatality monitoring study conducted in 2014, an estimate of 20.19 bats/MW (30.28 bats/turbine) was observed with fatalities composed of 21 eastern red bats (21.43%), 43 hoary bats (43.88%), 21 little brown bats (21.43%), 12 silver-haired bats (12.24%), and one unidentified bat (1.02%) (Westwood 2015). Conversely, other wind energy facilities in the southwestern Minnesota region report lower fatality estimates ranging from 0.2–2.7 bats/MW/study period (Arnett *et al.* 2008; Johnson *et al.* 2003). Although species composition is not available for these studies, species similar to those found during the Lakefield Wind Project studies have been documented at some of these projects. For instance, at the Buffalo Ridge Wind Project, species included eastern red bats, hoary bats, little brown bats, silver-haired bats, big brown bats, and tri-colored bats (Johnson *et al.* 2003), with the tri-colored bat not documented at the Lakefield Wind Project. The species (especially the hoary, eastern red, and silver-haired bat) found among these studies represent those that have been reported among the greatest numbers of fatalities at wind projects across North America (Arnett *et al.* 2008).

In the present study for the proposed Nobles 2 Wind Project, the primary species detected were the hoary bat, big brown bat, and silver-haired bat. Each of these species have been reported among fatalities at operating wind energy developments across the United States (Arnett and Baerwald 2013; Arnett *et al.* 2008). Furthermore, the majority of fatalities have been reported during the late summer and early fall, which corresponds to the period of

time during which the greatest activity was acoustically recorded in the present study. Activity and subsequent fatalities during the late summer/early fall period is primarily due to the migratory nature of two of these species (i.e., the hoary and silver-haired bat).

5.2.2 Special Status Bat Species

Species (or species groups) that were detected in this study confirmed potential occurrences based on existing distributions (IUCN 2016; MNDNR 2016a; USGS-GAP 2013). The big brown, little brown, and tri-colored bats which are listed as Species of Special Concern by the MNDNR were detected during the monitoring period. A likelihood of presence analyses based on the few call files initially classified to the northern long-eared bat (a federally- and state-listed species), suggest that this species does not likely occur in the Study Area.

The MNDNR (2016) considers the northern long-eared bat to occur throughout the entire State. In Minnesota, the northern long-eared bat is considered to occupy summer roosting habitat during 1 April–30 September and winter hibernacula during 1 October–15 May (USFWS 2014). Suitable summer roosting habitat for the northern long-eared bat primarily consists of a variety of forested and wooded habitats including fencerows, riparian forests, and other wooded corridors. As of April 1, 2016, there are no documented northern long-eared bat maternity roost trees or hibernacula in Nobles County or adjacent counties (MNDNR and USFWS 2016), though the MNDNR stresses this information is limited in determining the distribution of the northern long-eared bat as statewide surveys are incomplete and all known locations were not included to produce this information.

Operating wind turbines have been documented to kill northern long-eared bats, particularly during the fall migratory period (USFWS 2014). Northern long-eared bats have been reported in percentages ranging from 0.7 to 1.3 percent (2-6 individuals) among fatalities at two wind energy facilities in the eastern United States (Arnett *et al*. 2008). More recent data reveals a total of 43 fatalities have been reported throughout North America with the majority found during the fall (1 August–5 October) (Gruver and Bishop-Boros 2015).

5.2.3 Use of Pre-Construction Acoustic Monitoring to Predict Post-Construction Bat Fatalities

To date, it remains unclear whether data acquired from pre-construction acoustic monitoring can predict post-construction fatalities. However, some studies have attempted to correlate post-construction acoustic bat pass rates with fatalities at operating wind energy projects (Baerwald and Barclay 2009; Gruver *et al.* 2009; Johnson *et al.* 2004) with varying degrees of success. One recent and comprehensive study (Hein *et al.* 2013) aimed to address this issue by characterizing bat activity based on acoustic monitoring and post-construction fatality studies across geographic regions. Hein *et al.* (2013) synthesized data from 94 pre-construction bat acoustic surveys and 75 post-construction bat fatality studies at proposed and operating wind energy facilities across four regions in the United States and Canada. From 12 of these facilities, both pre-construction acoustic and post-construction

fatality data were available to examine whether bat acoustic data collected prior to construction can be used to predict fatality. Among the larger synthesis study, both pre-construction acoustic and post-construction fatality data varied considerably both within and among regions. The examination of the 12 facilities with paired pre- and post-construction data suggested a positive relationship but was found to be not significant and pre-construction activity only explained a small portion of the variation in fatalities (Hein *et al.* 2013). However, the authors cited that more data with consistent methodologies could help to tease out a relationship between pre-construction bat acoustic surveys and post-construction fatality studies.

Considering the Hein *et al.* (2013) study, there is a lack of publicly available data on pre-construction acoustic bat pass rates and post-construction fatality rates in Minnesota to make a scientifically plausible prediction of fatalities for any wind energy development in the region. Hence, the acoustic data obtained in the present study may not necessarily indicate bat mortalities at the proposed Nobles 2 Wind Project. However, data obtained from this study can be useful in identifying potential mitigation measures that may be effective in reducing fatalities (Arnett *et al.* 2011; Baerwald *et al.* 2009). For example, the activity recorded during the late summer through early fall period indicates a period of about 8 weeks from late July to late September when bat activity is the highest, and most this activity was within four hours during the first part of the night, 2100—0100 hrs (9:00 pm—1:00 am). If fatalities are detected during post-construction, then this information could be of value when determining a mitigation strategy, such as feathering turbine blades so as to not allow them to "free-wheel" when not operating between 9:00 pm—1:00 am during the 8-week period of July to September. Furthermore, greater efficiency in a mitigation strategy could be gained by modeling environmental variables to predict bat activity throughout the late summer to early fall period (Weller and Baldwin 2011).

5.2.4 Conclusion

Following review of an early iteration of the proposed Project that included up to 150 wind turbines and nameplate capacity of up to 300 MW, MNDNR considered the Project to have a medium risk designation to bat species due to the large size of the Project as proposed at that time (See correspondence dated April 14, 2016; Appendix B). Since that time, the plan has been revised to reduce the overall nameplate capacity of the Project to up to 260 MW and to increase the number of turbines with higher rated power output. The results of these changes reduces the number of turbines required to construct the Project by a minimum of 68 turbines and results in the installation of no more than 82 wind turbines. Nobles 2 operational measures have also been adjusted at the request of MNDNR to provide seasonal feathering of turbine blades when operating below equipment cut-in speeds as explained in Section 6.3. Considering these and other elements, the Project has been sited and designed to be a relatively low-risk site for bats. The Study Area does not contain distinct topography, unique habitats or resources, or other features that could concentrate bats or bat activity. No indicators of high bat risk in the Study Area (e.g., impacts to roost trees or hibernaculum, high volume use as a migration corridor, etc.) were discovered during either the SCS (Tier 2

of the WEG) or the annual passive acoustic bat monitoring, which was conducted in accordance with Tier 3 of the WEG. However, the MNDNR believes that the Project qualifies as a moderate risk site for bats due to the proposed size of the facility. The medium risk designation has been proposed due to the 260 MW nameplate capacity of the facility. At larger sites the bat fatalities can be high even when the fatality rate by MW is low. Based on available data from operational wind projects in Minnesota and elsewhere in the Midwest, bat fatalities at the Project are expected to occur at a low frequency and be comparable with that of other Midwest wind energy facilities. Impacts are not expected to occur to a degree which would adversely affect populations.

6.0 AVOIDANCE AND MINIMIZATION MEASURES

Nobles 2 will implement measures to avoid and minimize impacts to birds and bats in the siting and design, construction, operation, and decommissioning phases of the Project as presented in the following sections.

6.1 Project Siting and Design

Nobles 2 is committed to the development of a project design intended to avoid sensitive habitats to the degree possible. The siting process was initiated with the completion of a SCS (Westwood 2016a) and was further informed by subsequent field studies. Previous studies on wind farms have identified a variety of design measures and BMPs to minimize adverse effects on habitat and wildlife (USFWS 2012). Prudent avoidance and minimization measures have been incorporated into this BBCS and actual Project siting and design to minimize risk to bird and bat species. The following have been, or will be, taken into consideration throughout the planning, design, and construction process.

6.1.1 Avoidance of Migratory Pathways and Other Important Use Areas

The Study Area is broadly located within the Central Flyway although no critical areas of wildlife congregation, staging areas, nesting sites, migration stopovers or corridors, special management areas, or other areas of seasonal importance occur within the Study Area. The nearest major migratory passageway occurs approximately 32 miles east of the Study Area along the Des Moines River. By locating the Project outside of major migratory corridors and other important use areas for wildlife, the siting guidelines recommended by the USFWS regarding the avoidance of migration flyways and other important use areas for birds were followed. There are no known corridors for bats near the Study Area. Furthermore, no winter roosts for any bat species are known to occur within the Study Area, nor are any mines, caves, karst, or pseudokarst formations known to occur within or near the Study Area or surrounding region.

6.1.2 Facilities and Turbine Layout and Design

In order to minimize impacts to wildlife, Nobles 2 has incorporated the following avoidance and minimization measures into siting decisions for the proposed turbines and associated infrastructure currently known and planned for construction.

1) Project siting minimized impacts to habitat used by grassland and riparian birds to the maximum extent practicable;
    a. Turbines were sited in agricultural fields to minimize impacts to grassland bird species.
    b. All ground disturbance (turbines, infrastructure, crane pathways) will avoid native prairie, except when such impacts are included as part of a native prairie