

**Attachment A. Grand Meadow and Pleasant  
Valley Project Eagle Conservation Plan  
March 2020**

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# Final Draft Eagle Conservation Plan for the Grand Meadow and Pleasant Valley Wind Farms

Prepared for

Northern States Power Company – Minnesota dba Xcel Energy



Prepared by



2001 Killebrew Drive, Suite 141  
Bloomington, MN 55425

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## TABLE OF CONTENTS

1.0	INTRODUCTION AND PURPOSE.....	1
2.0	REGULATORY FRAMEWORK.....	2
2.1	Migratory Bird Treaty Act .....	2
2.2	Bald and Golden Eagle Protection Act.....	3
2.3	National Environmental Policy Act.....	3
3.0	FACILITY DESCRIPTIONS.....	3
3.1	Location and Facilities.....	3
3.2	Development and Ownership History.....	4
3.3	Land Cover.....	13
4.0	SITE ASSESSMENT (ECPG STAGE 1).....	14
4.1	Preliminary Site Evaluation.....	15
4.1.1	GMWF.....	15
4.1.2	PVWF .....	15
4.2	Site-specific Characterization and Decisions .....	15
4.2.1	GMWF.....	15
4.2.2	PVWF .....	16
5.0	SITE-SPECIFIC PRE-CONSTRUCTION SURVEYS.....	16
5.1	Avian Point Count Surveys .....	17
5.2	Nest Surveys .....	18
5.2.1	2013 Aerial Raptor Nest Surveys .....	18
5.2.2	2014 Ground-based Raptor Nest Surveys.....	19
5.3	Eagle Risk Evaluation Based on Pre-construction Survey Data.....	19
6.0	AVOIDANCE AND MINIMIZATION OF RISKS IN PROJECT DESIGN .....	20
7.0	AVOIDANCE AND MINIMIZATION OF RISKS DURING CONSTRUCTION .....	21
8.0	POST-CONSTRUCTION MONITORING.....	22
8.1	Eagle Use and Nest Surveys.....	23
8.1.1	Eagle Use Surveys.....	24
8.1.2	Nest Surveys .....	26
8.2	Prey Assessment.....	29
8.3	Fatality Surveys.....	30

8.3.1	2013 – 2014 Fatality Monitoring at GMWF.....	30
8.3.2	2016 – 2017 Fatality Monitoring at PVWF .....	30
8.4	Permits.....	31
8.4.1	Collection Permits .....	31
8.4.2	Nest Removal Permits .....	31
8.4.3	Depredation Permit .....	32
8.4.4	Eagle Trapping .....	32
8.5	Eagle Risk Evaluation Based on Post-Construction Data.....	32
8.5.1	Collision Risk Assessment .....	32
8.5.2	Disturbance Risk Assessment.....	33
8.5.3	Eagle Risk Categorization.....	33
9.0	PREDICTING EAGLE FATALITIES .....	34
9.1	Fatality Model.....	34
9.1.1	Fatality Inputs.....	38
9.1.2	Fatality Predictions .....	38
10.0	AVOIDANCE AND MINIMIZATION OF RISKS DURING OPERATION INCLUDING CONSERVATION MEASURES.....	39
10.1	Operational BMPs .....	39
10.2	Operational Monitoring .....	41
10.2.1	Fatality Monitoring.....	41
10.2.2	Ongoing Baseline Monitoring .....	41
10.2.3	Permit Compliance Monitoring .....	41
10.3	Additional Surveys .....	49
10.3.1	Nest Monitoring .....	49
10.3.2	Adaptive Management.....	50
11.0	REPORTING .....	52
11.1	USFWS Eagle Fatality Reporting .....	52
11.2	State Reporting .....	52
11.3	Permit Compliance Reporting.....	53
12.0	LITERATURE CITED .....	53

## **TABLES**

Table 1. Chronology of Resource Agency Contact for the Wind Farms .....	4
Table 2. Habitat Types within the GMWF and PVWF Footprints .....	13
Table 3. Pre-construction Surveys at the PVWF .....	17
Table 4. Eagle Specific Avian Point Count Survey Results for PVWF, 2009- 2010 .....	18
Table 5. Post-construction Surveys at the GMWF .....	22
Table 6. Post-construction Surveys at the PVWF .....	23
Table 7. Eagle Use Survey Results, 2016- 2017.....	25
Table 8. 2016 Eagle Nest Survey Data for the Wind Farms.....	27
Table 9. Variables Used in the USFWS Bayesian Collision Risk Model.....	35
Table 10a. Data Inputs for the USFWS Bayesian Eagle Fatality Model – Exposure Rate .....	38
Table 10b. Data Inputs for the USFWS Bayesian Eagle Fatality Model – Hazardous Area .....	38
Table 11. Predicted Take for Bald Eagles at the Wind Farms .....	39
Table 12. Parameters in the Predictive Power Analysis of Fatality Monitoring Design.....	47
Table 13. Bald Eagle Adaptive Management at Yearly Compliance Checks .....	51

## **APPENDIX A: FIGURES**

Figure 1. Wind Farm Vicinity
Figure 2a. Grand Meadow Wind Farm Facilities
Figure 2b. Pleasant Valley Wind Farm Facilities
Figure 3. Land Cover
Figure 4. 2009-2010 Avian and Eagle Point Count Locations at PVWF
Figure 5a. 2016-2017 Grand Meadow Eagle Point Count Locations
Figure 5b. 2016-2017 Pleasant Valley Eagle Point Count Locations
Figure 6a. Bald Eagle Flight Paths Below 200 meters with Survey Locations, Grand Meadow Wind Farm
Figure 6b. Bald Eagle Flight Paths Above 200 meters with Survey Locations, Grand Meadow Wind Farm
Figure 7a. Bald Eagle Flight Paths Below 200 meters with Survey Locations, Pleasant Valley Wind Farm
Figure 7b. Bald Eagle Flight Paths Above 200 meters with Survey Locations, Pleasant Valley Wind Farm
Figure 8. Aerial Survey Boundary and Identified Nests
Figure 9. Output from Evidence of Absence Design Tradeoffs Module
Figure 10 - Bald Eagle Nests 2016-01 and 2017-01

## **APPENDIX B: GUIDELINE FOR DISPOSAL OF ANIMAL CARCASS**

## **APPENDIX C: TECHNICAL ASSISTANCE LETTERS**

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## 1.0 INTRODUCTION AND PURPOSE

Northern States Power Company – Minnesota (NSPM), doing business as Xcel Energy (Xcel), currently owns and operates the 100.5-megawatt (MW) Grand Meadow Wind Farm (GMWF) and the 200-MW Pleasant Valley Wind Farm (PVWF) (hereafter to be referred to collectively as the “Wind Farms”) located approximately 10 miles east and northeast, respectively, of Austin in Dodge and Mower Counties, Minnesota. The GMWF footprint contains approximately 13,080 acres of land in central Mower County. The PVWF footprint contains approximately 31,176 acres of land in Dodge and Mower Counties (Figure 1). The Wind Farms interconnect to the Great River Energy Pleasant Valley 161/345 kilovolt (kV) substation, located approximately 6 miles north of Dexter, Minnesota. GMWF and PVWF connect via approximately 6-mile long and 5-mile long overhead transmission lines and transmit power into the Midcontinent Independent System Operator (MISO) grid. GMWF began commercial operation in 2008 and PVWF began commercial operation in 2015.

This Eagle Conservation Plan (ECP) serves as a supporting document for a formal application for an eagle incidental take permit (ETP) for the Wind Farms under regulations cited in the Bald and Golden Eagle Protection Act (BGEPA) of 2009. Xcel has decided to pursue an ETP based on the 2009 regulations rather than the recently revised 2016 regulations. After submittal of the formal ETP application, the U.S. Fish and Wildlife Service (USFWS) will complete their own National Environmental Policy Act (NEPA) analysis to consider issuance of a permit using the most current version of the ECP.

Xcel contracted Tetra Tech, Inc. (Tetra Tech) to create this ECP to summarize the environmental conditions reported in the Wind Farm footprints and eagle studies to date; develop an assessment of impacts to bald eagles (*Haliaeetus leucocephalus*) and golden eagles (*Aquila chrysaetos*) from operation of the Wind Farms; develop avoidance and minimization measures; and describe Advanced Conservation Practices for unavoidable impacts. The decision by Xcel to pursue an ETP was directed largely, in coordination with the USFWS, as a result of the discovery of a bald eagle nest at PVWF in early 2016. Xcel has worked closely with the USFWS in the development of this ECP, as reflected in the chronology of agency coordination (Section 3.2; Table 1).

Due to the status of the Wind Farms as operating facilities with somewhat complex development histories, this ECP is arranged in chronological order from pre-construction assessments, consultation, and eagle avoidance and minimization efforts during the Wind Farm design and construction (Sections 4 through 7) to the completed and ongoing post-construction studies (Section 8). Section 9 of this ECP presents the eagle fatality modeling that will form the basis for the take level requested in the ETP application and Section 10 highlights operational avoidance and minimization measures. Section 11 describes the current permit compliance

reporting for the Wind Farms and anticipated reporting under an ETP, and Section 12 provides references of documents cited.

## **2.0 REGULATORY FRAMEWORK**

Eagles are protected under federal laws and regulations. Relative to the Wind Farms, these include the Migratory Bird Treaty Act (MBTA) and BGEPA. These statutes and implementing regulations are described in the following subsections.

### **2.1 Migratory Bird Treaty Act**

The MBTA is the cornerstone of migratory bird conservation and protection in the United States. The MBTA implements four treaties that provide for international protection of migratory birds. It is a strict liability statute, meaning that proof of intent, knowledge, or negligence is not an element of an MBTA violation. The statute's language is clear that actions resulting in a "taking" or possession (permanent or temporary) of a protected species, in the absence of a U.S. Fish and Wildlife Service (USFWS) permit or regulatory authorization, are a violation of the MBTA.

The MBTA states, "Unless and except as permitted by regulations ... it shall be unlawful at any time, by any means, or in any manner to pursue, hunt, take, capture, kill ... possess, offer for sale, sell ... purchase ... ship, export, import ... transport or cause to be transported ... any migratory bird, any part, nest, or eggs of any such bird .... [The Act] prohibits the taking, killing, possession, transportation, import and export of migratory birds, their eggs, parts, and nests, except when specifically authorized by the Department of the Interior" (16 U.S.C. 703). The word "take" is defined by regulation as "to pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to pursue, hunt, shoot, wound, kill, trap, capture, or collect" (50 CFR 10.12).

The MBTA provides criminal penalties for persons who commit any of the acts prohibited by the statute in section 703 on any of the species protected by the statute. See 16 U.S.C. 707. The USFWS maintains a list of all species protected by the MBTA (50 CFR 10.13). This list includes over 1,000 species of migratory birds, including eagles and other raptors, waterfowl, shorebirds, seabirds, wading birds, and passerines.

A December 22, 2017 memorandum from the U.S. Department of the Interior's Office of the Solicitor clarified that the prohibitions of take under the MBTA apply only to "affirmative actions that have as their purpose the taking or killing of migratory birds, their nests, or their eggs." An April 11, 2018 memorandum from the USFWS provided guidance to "clarify what constitutes prohibited take". The USFWS memo stated that the "take of birds, eggs or nests" was not prohibited when the purpose of the activity was not to conduct take.

For eagles, the BGEPA takes authorization (see Section 2.2 below) serves as authorization under MBTA, per 50 Code of Federal Regulations (CFR) 22.11(b) (USFWS 2013). Xcel has been coordinating with USFWS to develop this ECP to represent best management practices (BMPs) and good-faith efforts to minimize impacts to eagles and to comply with the MBTA. This ECP provides specific eagle avoidance, minimization, mitigation, monitoring, and adaptive management.

## **2.2 Bald and Golden Eagle Protection Act**

The BGEPA prohibits the take of any bald or golden eagle, alive or dead, including any part, nest, or egg. “Take” is defined as “pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb” a bald or golden eagle. “Disturb” means to agitate or bother an eagle to a degree that causes, or is likely to cause, (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. Under 50 CFR §22.26, ETPs are available for incidental take associated with otherwise lawful activities (USFWS 2009, USFWS 2016). The USFWS Eagle Conservation Plan Guidance, which outlines the recommended steps for ETPs, was used in the development of this ECP (USFWS 2013).

## **2.3 National Environmental Policy Act**

The National Environmental Policy Act (NEPA) applies to issuance of ETPs because issuing such a permit is a federal action (USFWS 2013). Where no federal nexus exists other than an ETP, the USFWS must complete a NEPA analysis before it can issue the permit. Eagle take permits may be issued only in compliance with the conservation standards of BGEPA. This means that the take must be “compatible with the goal of stable or increasing breeding populations.” To ensure that any authorized take of eagles does not exceed this standard, the USFWS has set regional take thresholds for each species, using methodology contained in the NEPA Final Environmental Assessment developed for the new eagle permit rules. The USFWS analyzed regional populations of eagles and set take thresholds for each species (upper limits on the number of eagle mortalities allowed under a permit each year in these regional management areas) (USFWS 2013). Project developers may provide assistance that can expedite the NEPA process in accordance with 40 CFR §1506.5.

# **3.0 FACILITY DESCRIPTIONS**

## **3.1 Location and Facilities**

Xcel is currently operating the Wind Farms, which are located approximately 10 miles east-northeast of Austin in Dodge and Mower County, Minnesota (Figure 1). GMWF has a capacity

of 100.5 MW of wind energy and PVWF has a capacity of 200 MW of wind energy. The GMWF footprint (turbines and a 1-kilometer buffer) contains approximately 13,080 acres of land, while the PVWF footprint contains approximately 31,175 acres of land (Table 2, Figures 2a and 2b). The Wind Farms are located adjacent to one another, with Interstate 90 running between the two facilities.

The Wind Farm facilities include: (1) 67 GE SLE wind turbines at GMWF; 100 Vesta V100 wind turbines at PVWF; (2) gravel access roads; (3) underground electrical collection lines; (4) a shared operations and maintenance (O&M) building; (5) a collector substation; and (6) one permanent meteorological tower (Figures 2a and 2b). The Wind Farms interconnect to the Great River Energy Pleasant Valley 161/345 kilovolt (kV) substation, located approximately 6 miles north of Dexter via approximately 6-mile long (GMWF) and 5-mile long (PVWF) overhead transmission lines, and transmit power into the Midcontinent Independent System Operator (MISO) grid. All of the Wind Farm facilities are located on privately owned land.

## 3.2 Development and Ownership History

Development of GMWF was initiated in 2001 by enXco Development Corporation (enXco). GMWF was considered to be the first phase in the larger Wapsipinicon Wind Project, which was designed and built by enXco. Ownership of GMWF was transferred to Xcel in May 2008. Commercial operation of the wind farm began in December 2008. PVWF was developed by Renewable Energy Systems-Americas, Inc. (RES) beginning in 2008. In November 2015, Xcel acquired PVWF and began commercial operation of the wind farm. For simplicity within this document Xcel will be used to refer to all coordination and communication activities with USFWS after NSPM's acquisition of the Wind Farms. Detailed chronologies of agency communications for the Wind Farms are presented in Table 1. Additional details on pre-construction assessments of the projects, conducted during their development, are presented in Sections 4 and 5.

**Table 1. Chronology of Resource Agency Contact for the Wind Farms**

Date	Purpose	Participants
4/5/2007	enXco contacted USFWS regarding information on wildlife and habitat for GMWF.	enXco, USFWS
4/5/2007	enXco contacted the Minnesota Department of Natural Resources regarding information on wetlands, flooding, or significant habitat for GMWF.	enXco, MNDNR
4/5/2007	enXco contacted the Mower County Soil and Water Conservation District regarding information on wetlands, soils, prime farmland, and other environmental issues for GMWF.	enXco, Mower County SWCD
4/17/2007	Letter response from the MNDNR regarding wetlands, public waters, wildlife, and appropriate contacts and permits.	MNDNR, enXco

Date	Purpose	Participants
5/25/2007	Letter response from MNDNR regarding the Minnesota Natural Heritage database with information on threatened and endangered wildlife and plants for GMWF.	MNDNR, enXco
11/25/2008	USFWS responded to a request from PVWF about information on threatened and endangered species at PVWF.	USFWS, PVWF
7/16/2009	MNDNR response to PVWF about preliminary assessment of wind farm overview.	MNDNR, PVWF
1/12/2010	PVWF submits an Application for Large Wind Energy Conversion System Site Permit to the MPUC.	PVWF, MPUC
3/5/2010	MNDNR response to PVWF Site Permit Application.	MNDNR, PVWF, MOES
7/16/2010	MNDNR follow up requests from previous response to the Site Permit Application.	MNDNR, PVWF, MOES
9/29/2010	Transmittal of the interim avian use report.	WEST, Inc., PVWF
6/5/2011	Transmittal of the wildlife baseline studies report.	WEST, Inc., PVWF
11/16/2012	MNDNR response to PVWF Site Permit Amendment Petition.	MNDNR, PVWF, MPUC
11/26/2012	Transmittal of fall bat acoustic survey report.	WEST, Inc., PVWF, MPUC
1/7/2013	MNDNR response to the fall bat acoustic survey report.	MNDNR, PVWF, DOC-EFP
5/23/2013	Transmittal of the raptor and bald eagle nest survey final report.	WEST Inc., PVWF
5/23/2013	Meeting at DOC-EFP office to reacquaint staff with PVWF, review past survey efforts from the site, and discuss the Bird and Bat Conservation Strategy (BBCS) document that will be developed for the PVWF.	PVWF, RES, MNDNR, DOC-EFP, WEST, Inc.
12/13/2013	MNDNR response to review of the PVWF draft BBCS.	MNDNR, RES, PVWF
12/20/2013	DOC-EERA response to review of the PVWF draft BBCS.	DOC-EERA, RES, PVWF
1/21/2014	USFWS response to review of the PVWF draft BBCS.	USFWS, RES, PVWF
1/21/2014	Memo from USFWS to RES with recommendations for updates to the BBCS.	USFWS, RES, PVWF
1/28/2014	PVWF completed an Environmental Assessment for the transmission line and substation for PVWF.	PVWF
4/28/2014	PVWF completed a final draft of the BBCS for PVWF.	PVWF
5/6/2014	HDR Engineering completed a Site Vegetation Management Plan for the proposed transmission line for PVWF.	HDR Engineering, PVWF
5/15/2014	WEST, Inc. completed a Prairie Protection and Management Plan for PVWF.	WEST, Inc., PVWF
5/20/2014	WEST, Inc. completed a Biological and Resource Inventory report for PVWF.	WEST, Inc., PVWF
6/9/2014	WEST, Inc. completed the 2014 Raptor and Bald Eagle Nest Survey report for PVWF.	WEST, Inc., PVWF
10/30/2014	WEST, Inc. completed a NLEB Presence/Absence Acoustic Survey final report for PVWF.	WEST, Inc., PVWF
3/10/2016	Memo from Xcel Energy to USFWS about the discovery of an eagle nest within the PVWF footprint.	Xcel, PVWF, USFWS

Date	Purpose	Participants
3/19/2016	Follow-up memo from Xcel Energy to USFWS, MNDNR, and DOC-EERA concerning eagle nest 150 meters south of Turbine 17 at PVWF. Tetra Tech observed that the nest was active with two adults. Xcel Energy also curtailed Turbines 16, 17, and 18, all within 800 meters of the nest.	Xcel, USFWS, MNDNR, DOC-EERA, PVWF
3/21/2016	Response from DOC-EERA to Xcel Energy about availability for meeting to discuss eagle nest at PVWF.	DOC-EERA, Xcel
3/21/2016	Response from USFWS to Xcel Energy about availability for meeting to discuss eagle nest at PVWF.	USFWS, Xcel
4/4/2016	Meeting to review monitoring and mitigation options for the bald eagle nest near Turbine 17 at PVWF.	Xcel, Tetra Tech, USFWS, DOC-EERA
4/14/2016	Xcel Energy letter to MPUC with the 2016 quarterly audit report of avian and bat protection plan for PVWF.	Xcel, MPUC
4/20/2016	Email from Xcel Energy presenting the meeting notes from the 4/4/2016 meeting.	Xcel, USFWS, Tetra Tech, DOC-EERA, MNDNR
4/25/2016	MNDNR response to Xcel Energy about meeting notes.	MNDNR, Xcel
4/28/2016	USFWS response to Xcel Energy about meeting notes and questions about eagle risk.	Xcel, USFWS, Tetra Tech, DOC-EERA, MNDNR
5/3/2016	Email from Xcel Energy to MNDNR to discuss PCMM work at PVWF.	Xcel, MNDNR
5/3/2016	MNDNR memo to DOC-EERA stating that Turbines 16, 17, and 18 at PVWF do not need to be surveyed in post construction fatality monitoring, as long as they are curtailed.	MNDNR, DOC-EERA
5/10/2016	Email from Xcel Energy to USFWS with pre-construction eagle use data and discussion of moving forward with a programmatic take permit.	Xcel, USFWS, Tetra Tech
5/12/2016	Email from Xcel Energy to Tetra Tech regarding a request from USFWS for raw data from post-construction eagle use surveys.	Xcel, Tetra Tech, USFWS
5/18/2016	Email from Xcel Energy to MNDNR proposing alterations in PCMM work at PVWF due to the active nest near Turbines 16, 17, and 18.	Xcel, MNDNR, USFWS, DOC-EERA, Tetra Tech
5/18/2016	Email response from DOC-EERA to Xcel Energy regarding PCMM work at PVWF.	DOC-EERA, Xcel, USFWS, Tetra Tech, MNDNR
5/23/2016	Email response from MNDNR to Xcel Energy regarding changes in PCMM work at PVWF.	MNDNR, Xcel, USFWS, DOC-EERA, Tetra Tech
5/24/2016	Email response from MNDNR to Xcel Energy presenting options moving forward with PCMM work at PVWF.	MNDNR, Xcel, USFWS, DOC-EERA, Tetra Tech
5/24/2016	Email from USFWS to MNDNR giving recommendations and risk-assessment options along with a template for data.	USFWS, MNDNR, Xcel, DOC-EERA, Tetra Tech
5/24/2016	Email from Xcel Energy to MNDNR regarding locations of eagle nests within PVWF footprint.	Xcel, MNDNR, USFWS, DOC-EERA, Tetra Tech
5/26/2016	Email from USFWS to Tetra Tech requesting raw data from eagle use surveys at GMWF and PVWF. Also requested a shapefile of all eagle nests around the GMWF and PVWF.	USFWS, Tetra Tech, DOC-EERA
5/26/2016	Email from Xcel Energy to USFWS with shapefile of eagle nest locations.	Xcel, USFWS, DOC-EERA, Tetra Tech



Date	Purpose	Participants
6/10/2016	Email from Xcel Energy to USFWS providing meeting notes from 5/25 and reformatted eagle use survey data. Xcel Energy requested a letter from USFWS and inquired about an ECP format.	Xcel, USFWS, MNDNR, DOC-EERA, Tetra Tech
6/20/2016	Email from Xcel Energy requesting a response from previous email on 6/10.	Xcel, USFWS, MNDNR, DOC-EERA, Tetra Tech
7/5/2016	Xcel Energy invitation to USFWS to participate in a meeting about the eagle models being used at PVWF.	Xcel, USFWS, Tetra Tech
7/14/2016	Email from Xcel Energy providing a meeting agenda along with model run results and maps.	Xcel, USFWS, Tetra Tech
7/14/2016	Meeting between Xcel Energy, USFWS, and Tetra Tech regarding eagle take permitting for the PVWF, Bayesian risk model, and ECP development.	Xcel, USFWS, Tetra Tech
7/18/2016	Email from Xcel Energy to USFWS requesting guidance for the start of road construction near the nest in PVWF footprint.	Xcel, USFWS, Tetra Tech
7/18/2016	Email response from USFWS stating no objections to the road work taking place as planned.	Xcel, USFWS, Tetra Tech
7/18/2016	Email from Xcel Energy to USFWS with DOC-EERA quarterly results of avian and bat mortality reporting.	Xcel, USFWS, Tetra Tech
7/18/2016	Email from Xcel Energy to USFWS providing meeting notes from the 7/14 meeting.	Xcel, USFWS, Tetra Tech
7/18/2016	Email from Xcel Energy to USFWS providing mean inter-nest distance for PVWF.	Xcel, USFWS, Tetra Tech
7/19/2016	Email from Xcel Energy to USFWS providing preliminary fatality model results for PVWF using pre-construction data and post-construction 60-minute eagle use surveys conducted from 4/16/2016-6/16/2016. Xcel Energy also included two additional model run scenarios, including GMWF pre-construction only and GMWF and PVWF pre-construction data combined.	Xcel, USFWS, Tetra Tech
8/3/2016	Email from USFWS to Tetra Tech requesting shapefiles of both the GMWF and PVWF turbine layouts. USFWS also requested survey point locations for both the pre-construction and post-construction eagle use surveys.	USFWS, Tetra Tech, Xcel
8/4/2016	Email from USFWS to Xcel Energy and Tetra Tech requesting clarification of dataset sent on 5/12/16.	USFWS, Xcel, Tetra Tech
8/4/2016	Email from Tetra Tech to USFWS and Xcel Energy with most recent data used for calculating Bayesian model.	USFWS, Xcel, Tetra Tech
8/4/2016	Email from Tetra Tech to Xcel Energy and USFWS with shapefiles for the turbine locations and eagle point locations for the GMWF.	Tetra Tech, Xcel, USFWS
8/4/2016	Email from Tetra Tech to Xcel Energy and USFWS providing turbine locations, pre-construction avian point count locations, and post-construction eagle point count locations for PVWF.	Tetra Tech, USFWS, Xcel
8/5/16	Email from Xcel Energy to USFWS requesting conference call on 8/11/16.	Xcel, USFWS, Tetra Tech
8/9/2016	Email from Tetra Tech to USFWS providing the combined GMWF and PVWF data used in the eagle fatality model that Tetra Tech ran.	Tetra Tech, USFWS, Xcel

Date	Purpose	Participants
8/10/2016	Email from Xcel Energy to USFWS with a summary of Tetra Tech's recent observations of the eagle nest at PVWF. Xcel Energy also presented a list of important dates regarding the eagle nest.	Xcel, USFWS, Tetra Tech
8/11/2016	Conference call to discuss ECP and Bayesian risk model.	Xcel, USFWS, Tetra Tech
8/11/2016	Email from Xcel Energy to USFWS with notes from 8/11/16 conference call.	Xcel, USFWS, Tetra Tech
8/11/2016	Email from USFWS to Xcel Energy stating draft technical assistance letter will be sent later that day and providing guidance on ECP.	Xcel, USFWS, Tetra Tech
8/11/2016	Email from USFWS to Xcel Energy and Tetra Tech sending application forms for eagle nest removal and eagle depredation permits.	USFWS, Xcel, Tetra Tech
8/12/2016	Email from Xcel Energy to USFWS in response to the application forms for eagle nest removal and eagle depredation permits.	Xcel, USFWS, Tetra Tech
8/15/2016	Email from Xcel Energy to USFWS inquiring about the status of the technical assistance letter.	Xcel, USFWS, Tetra Tech
8/15/2016	Email from USFWS to Xcel Energy and Tetra Tech regarding the status of the technical assistance letter, response of questions about the nest removal permit, and answers to tribal review for the permit.	USFWS, Xcel, Tetra Tech
8/15/2016	Email from Xcel Energy to MNDNR to discuss the potential of a nest removal permit for the nest at PVWF.	Xcel, MNDNR, USFWS, Tetra Tech, DOC-EERA
8/16/2016	Email from Xcel Energy to Tetra Tech regarding Harassment Permit Form 37 from USDA.	Xcel, Tetra Tech
8/16/2016	Email from USFWS to Xcel Energy with the draft technical assistance letter for the GMWF and PVWF.	USFWS, Xcel, Tetra Tech
8/17/2016	Email from Xcel Energy to USFWS with comments on the technical letter for the GMWF and PVWF.	Xcel, USFWS, Tetra Tech
8/17/2016	Email from Tetra Tech to MNDNR regarding the eagle nest removal permit for the nest at PVWF.	Tetra Tech, MNDNR, Xcel
8/17/2016	Email from Xcel Energy to USFWS with comments about the permitting process and follow-up items.	Xcel, USFWS, Tetra Tech
8/18/2016	Email from Xcel Energy to MNDNR with information on the nest removal permit, including the first page of the draft USFWS permit application and a more detailed nest location.	Xcel, MNDNR, USFWS, Tetra Tech
8/22/2016	Communication between Xcel Energy and USFWS about starting up the curtailed turbines.	Xcel, USFWS, Tetra Tech
8/29/2016	Email from USFWS to Xcel Energy and Tetra Tech with the updated technical assistance letter.	USFWS, Xcel, Tetra Tech
8/30/2016	Email from Xcel Energy to USFWS with suggested edits to the technical assistance draft letter.	Xcel, USFWS, Tetra Tech
9/6/2016	Email from Xcel Energy to USFWS discussing Tetra Tech's model justification for fatality modeling scenarios for PVWF.	Xcel, USFWS, Tetra Tech
9/8/2016	Final technical assistance letter sent to Xcel Energy from USFWS.	USFWS, Xcel



Date	Purpose	Participants
9/12/2016	Xcel Energy call with USFWS regarding fatality model runs, nest removal permit, and duration of eagle point count surveys.	Xcel, USFWS
9/15/2016	Email from Xcel Energy to Tetra Tech discussing model code for the fatality model runs in comparison to what was presented by USFWS.	Xcel, Tetra Tech, USFWS
9/19/2016	Email from Xcel Energy to USFWS regarding results for the second model code.	Xcel, USFWS, Tetra Tech
9/21/2016	Email from USFWS to Xcel Energy and Tetra Tech with comments on the nest removal permit.	USFWS, Xcel, Tetra Tech
9/22/2016	Xcel Energy phone call with USFWS regarding mitigation measures with the nest removal permit.	Xcel, USFWS, Tetra Tech
9/27/2016	Email from Xcel Energy to USFWS discussing updates to the nest removal permit regarding USFWS comments on the permit.	Xcel, USFWS, Tetra Tech
9/27/2016	Email response from USFWS to Xcel Energy discussing the revised nest removal permit and additional information on the harassment permit.	USFWS, Xcel, Tetra Tech
9/29/2016	Email from Xcel Energy to USFWS with attached nest removal permit application.	Xcel, USFWS, Tetra Tech
12/6/2016	Discussion between Xcel Energy and USFWS about amendments to the nest removal permit.	Xcel, USFWS
1/12/2017	Meeting notes on the call between Xcel Energy and USFWS about the draft ECP, review schedule for the ECP, ETP application schedule, and the NEPA process	Xcel, USFWS, Tetra Tech
1/13/2017	Email from USFWS regarding missed conference call	Xcel, USFWS
2/15/2017	Notification of the removal of a partially built eagle nest at the PVWF	Xcel, USFWS, DOC, MNDNR
2/22/2017	Meeting notes from call regarding PVWF eagle nest, ECP status, timing for the ETP, and NEPA discussion, and reimbursement agreement.	Xcel, USFWS, Tetra Tech
2/24/2017	Notification of two nest building attempts that were removed from the PVWF	Xcel, USFWS, DOC, MNDNR
3/7/2017	Email from Xcel Energy to MNDNR requesting amended version of nest removal permit	Xcel, MNDNR, USFWS, Tetra Tech
3/7/2017	Email from MNDNR to Xcel Energy extending the nest removal permit expiration date	MNDNR, Xcel, USFWS
3/8/2017	Notification of a nest building attempt that was removed from the PVWF	Xcel, USFWS, MNDNR, Tetra Tech
3/14/2017	Meeting notes from call regarding PVFW eagle nest, ECP status, ETP application, NEPA template, and reimbursement agreement	Xcel, USFWS, Tetra Tech
3/16/2017	Email from Xcel Energy to USFWS regarding the draft of PVWF and GVWF ECP and figures	Xcel, USFWS, Tetra Tech
3/17/2017	Email from Xcel Energy to USFWS responding to question about PVWF nests	Xcel, USFWS, Tetra Tech
3/29/2017	Email from USFWS to Tetra Tech regarding new applications for eagle take permits	USFWS, Tetra Tech

Date	Purpose	Participants
3/29/2017	Email from USFWS to Tetra Tech responding to question about new applications for eagle take permits	USFWS, Tetra Tech
4/3/2017	Notification of nest building attempt that was removed from the PVWF	Xcel, USFWS, MNDNR, APHIS, Tetra Tech
4/18/2017	Meeting notes from call regarding eagle activity, APHIS relocation, ECP review, ETP application status, filing under new regulations, and NEPA status	Xcel, USFWS, Tetra Tech
5/3/2017	Email from USFWS to Xcel Energy regarding meeting scheduling conflict	USFWS, Xcel, Tetra Tech
5/9/2017	Meeting notes from call regarding PVWF eagle activity, ECP status, ETP application completion, and NEPA process	Xcel, USFWS, Tetra Tech
5/9/2017	Email from USFWS to Xcel Energy regarding meeting notes	USFWS, Xcel, Tetra Tech
5/10/2017	Email from USFWS to Xcel Energy regarding USFWS comments on ECP, and the results of the USFWS LAP analysis for PVWF	USFWS, Xcel, Tetra Tech
5/11/2017	Email from USFWS to Xcel Energy with updated Bald Eagle turbine death numbers.	USFWS, Xcel, Tetra Tech
5/11/2017	Email from Xcel Energy to USFWS including Tetra Tech's interim PCMM report for PVWF	Xcel, USFWS, Tetra Tech
5/23/2017	Email from Tetra Tech to USFWS regarding draft schedule for ECP submittal and action items	Tetra Tech, USFWS, Xcel
5/26/2017	Email from Tetra Tech to USFWS scheduling conference call	Tetra Tech, USFWS, Xcel
5/30/2017	Email from Xcel Energy to MNDNR regarding Eagle Take Permit cover page and permit fee	Xcel, MNDNR, USFWS, Tetra Tech
6/1/2017	Email from Tetra Tech to USFWS scheduling conference call and including model	Tetra Tech, USFWS
6/13/2017	Email from USFWS to Xcel Energy regarding an estimate of eagle rehabilitation costs	USFWS, Xcel, Tetra Tech
6/22/2017	Email from USFWS to Tetra Tech including USFWS comments on the revised ECP	USFWS, Tetra Tech, Xcel
6/26/2017	Email from USFWS to Tetra Tech including USFWS comments on EACP stepwise table and Carcass Disposal appendices	USFWS, Tetra Tech, Xcel
6/26/2017	Email from Xcel Energy to USFWS response to USFWS comments on ECP draft	Xcel, USFWS, Tetra Tech
6/26/2017	Email from Xcel Energy to DOC including the final version of the PCMM report 2016-2017	Xcel, DOC, Tetra Tech
6/27/2017	Email from USFWS to Tetra Tech including comments on permit compliance	USFWS, Tetra Tech, Xcel
7/12/2017	Email from Tetra Tech to USFWS regarding submittal of eagle incidental take permit application	Tetra Tech, USFWS, Xcel
7/12/2017	Email from Tetra Tech to USFWS regarding final draft of Pleasant Valley/Grand Meadow ECP and comment log	Tetra Tech, USFWS, Xcel
7/14/2017	Email from Xcel Energy to DOC following up on voicemail about PCMM report	Xcel, DOC, Tetra Tech

Date	Purpose	Participants
7/19/2017	Email from Tetra Tech to USFWS following up on submittal of eagle incidental take permit application	Tetra Tech, USFWS, Xcel
7/26/2017	Email from USFWS to Tetra Tech verifying completion of eagle incidental take permit application	USFWS, Tetra Tech
7/26/2017	Email from Xcel Energy to USFWS inviting them to PV/GM NEPA conference call	Xcel, USFWS, Tetra Tech
7/26/2017	Email from Tetra Tech to USFWS regarding confirmation of eagle incidental take permit application, and scheduling PV/GM NEPA	Tetra Tech, USFWS, Xcel
8/9/2017 to 04/22/2019	Meeting summary notes for regular USFWS/Tetra Tech/Xcel Energy Pleasant Valley Grand Meadow meetings scheduled bi-weekly	USFWS, Xcel, Tetra Tech
8/10/2017	Email from USFWS to Tetra Tech and Xcel Energy confirming items USFWS has completed	USFWS, Tetra Tech, Xcel
8/10/2017	Email from Xcel Energy to Tetra Tech regarding the Reimbursable Agreement with USFWS	Xcel, Tetra Tech
8/17/2017	Email from Tetra Tech to USFWS including meeting notes and example tribal consultation letter	Tetra Tech, USFWS, Xcel
9/12/2017	Email from Tetra Tech to USFWS containing the GIS shapefiles of Project Footprints for PVWF and GMWF	Tetra Tech, USFWS, Xcel
10/4/2017	Email from USFWS to Tetra Tech regarding scheduling conflict for biweekly call	USFWS, Tetra Tech, Xcel
10/6/2017	Email from Tetra Tech to USFWS containing GIS shapefiles of the Project footprint, LAP boundary, LAP map, and fact sheet	Tetra Tech, USFWS, Xcel
10/11/2017	Email from USFWS to Tetra Tech regarding use of LAP map for tribal liaison outreach letters	USFWS, Tetra Tech
11/1/2017	Email from Xcel Energy to USFWS following up on voicemail regarding eagle pair nest building at PVWF	Xcel, USFWS
11/21/2017	Email from USFWS to Tetra Tech regarding convex hull GIS data and LAP analysis	USFWS, Tetra Tech, Xcel
11/22/2017	Email from Xcel Energy to USFWS and DNR regarding the extension of PVWF eagle nest removal permits	Xcel, USFWS, MNDNR, Tetra Tech
11/22/2017	Email from USFWS to Tetra Tech regarding update to PVWF eagle nest removal permit	USFWS, Tetra Tech, Xcel
12/5/2017	Email from Tetra Tech to USFWS including EA Fact Sheet and regarding LAP analysis with convex hull	Tetra Tech, USFWS, Xcel
12/5/2017	Email from Xcel Energy to USFWS regarding PVWF eagle nest removal permit question	Xcel, USFWS, Tetra Tech
12/5/2017	Email from USFWS to Tetra Tech regarding EA Fact Sheet map with convex hull	USFWS, Tetra Tech, Xcel
12/6/2017	Email from Tetra Tech to USFWS including a revised tribal letter template	Tetra Tech, USFWS, Xcel
12/12/2017	Email from Xcel Energy to USFWS confirming the submission of PVWF eagle nest removal permit	Xcel, USFWS, MNDNR, Tetra Tech
12/13/2017	Email from USFWS to Tetra Tech regarding tribal consultation letter template review	USFWS, Tetra Tech

Date	Purpose	Participants
12/21/2017	Email from USFWS to Tetra Tech and Xcel Energy concerning the take estimate for PVWF/GMWF	USFWS, Tetra Tech, Xcel
12/21/2017	Email for USFWS to Tetra Tech regarding update on administrative record for public and tribal comment	USFWS, Tetra Tech, Xcel
1/9/2018	Email from USFWS to Tetra Tech with LAP analysis for PVWF/GMWF	USFWS, Tetra Tech, Xcel
1/16/18	Email from Tetra Tech to USFWS following up on discussion, including the final draft EA submitted to USFWS region 6	Tetra Tech, USFWS, Xcel
1/29/2018	Email from USFWS to Tetra Tech regarding LAP maps	USFWS, Tetra Tech
2/28/2018	Email from Xcel Energy to USFWS and DNR regarding the end of APHIS eagle baiting and trapping efforts for the time being	Xcel, USFWS, MNDNR, APHIS
3/22/2018	Email from USFWS to Tetra Tech regarding tribal notification letter update and update to regional eagle call agenda	USFWS, Tetra Tech
4/17/2018	Email from USFWS to Tetra Tech regarding tribal notification letter mailing and updates to draft LAP analysis	USFWS, Tetra Tech, Xcel
4/19/2018	Email from Xcel Energy to USFWS with picture from camera install near PVWF eagle nest	Xcel, USFWS, Tetra Tech
4/25/2018	Meeting notes from call regarding eagle nest updates, plan for curtailment, technical assistance letter, banding, and ECP adaptive management of nests	Xcel, USFWS, Tetra Tech
5/31/2018	Email from Tetra Tech to USFWS including monitoring summary for a nest at PVWF	Tetra Tech, USFWS, Xcel
6/6/2018	Email from Xcel Energy to USFWS regarding eagle camera footage at PVWF	Xcel, USFWS, Tetra Tech
7/26/2018	Email from Tetra Tech to USFWS including draft of EA for PV and GM WF	Tetra Tech, USFWS, Xcel
7/30/2018	Email from USFWS to Tetra Tech including the latest version of the EA template with tiering	USFWS, Tetra Tech, Xcel
8/3/2018	Email from Tetra Tech to USFWS regarding EOA compliance standard interpretation	Tetra Tech, USFWS, Xcel
8/3/2018	Email from USFWS to Tetra Tech regarding response to EOA compliance standard interpretation	USFWS, Tetra Tech, Xcel
8/3/2018	Email from USFWS to Tetra Tech regarding timeline of EA review	USFWS, Tetra Tech, Xcel
8/22/2018	Notification of PVWF eagle death	USFWS, Xcel
8/22/2018	Email from Xcel Energy to USFWS responding to PVWF eagle death	Xcel, USFWS
8/22/2018	Email from Tetra Tech to Xcel Energy responding to PVWF eagle death	Tetra Tech, USFWS
8/24/2018	Email from USFWS to Xcel Energy with USFWS comments on the EA	USFWS, Xcel, Tetra Tech
9/6/2018	Email from Xcel Energy to USFWS regarding MidAmerican HCP example	Xcel, USFWS, Tetra Tech
9/6/2018	Email from USFWS to Xcel Energy responding to MidAmerican HCP example	USFWS, Xcel, Tetra Tech

Date	Purpose	Participants
9/10/2018	Issues to be resolved for PV/GM Wind Farm Eagle Permit	Xcel, USFWS, Tetra Tech
9/28/2018	Email from Xcel Energy to USFWS regarding revised adaptive management table	Xcel, USFWS, Tetra Tech
10/15/2018	Email from USFWS to Tetra Tech regarding meeting schedule	USFWS, Tetra Tech, Xcel
10/22/2018	Email from Tetra Tech to USFWS following up to call and including PVWF ECP monitoring document	Tetra Tech, USFWS, Xcel
10/22/2018	Email from Xcel Energy to USFWS with attached revised adaptive management table and text for ECP	Xcel, USFWS, Tetra Tech
4/30/2019	Email from Xcel Energy to USFWS with attached 2019 technical assistance letter and timeline	Xcel, USFWS, Tetra Tech

## Notes:

DOC-EERA: Department of Commerce-Energy Environmental Review and Analysis

DOC-EFP: Department of Commerce-Energy Facility Permitting

MNDNR: Minnesota Department of Natural Resources

MOES: Minnesota Office of Energy Security

MPUC: Minnesota Public Utilities Commission

PCMM: Post-Construction Mortality Monitoring

USDA: United States Department of Agriculture

WEST, Inc.: Western EcoSystems Technology, Inc.

### 3.3 Land Cover

The Wind Farms are located within the Level IV Eastern Iowa and Minnesota Drift Plains of the Western Corn Belt Plains Ecoregion (USEPA 2007). The Eastern Iowa and Minnesota Drift Plains Ecoregion consists of a combination of nearly level to gently rolling glaciated till plains and hilly loess plains. Historically, the Wind Farm footprints predominantly consisted of tall-grass prairie, which left rich, deep topsoil deposits and abundant organic material. Because of the productive soil and relatively level topography, the Wind Farm footprints are almost entirely cultivated and tilled (Table 2; Figure 3). Trees and shrubs can be found around farmsteads, with planted shelter belts, and along creeks and drainages. As a result of historical agricultural drainage for cultivation practices, very little standing water is found in the Wind Farm footprints.

**Table 2. Habitat Types within the GMWF and PVWF Footprints**

National Land Cover Database (NLCD) Category	GMWF	PVWF
	Total Acres (Percent of footprint)	Total Acres (Percent of footprint)
Cultivated Crops	11,692.96 (89.39)	28,095.33 (90.12)
Developed, Open Space	743.35 (5.68)	1,752.38 (5.62)
Herbaceous	333.3 (2.55)	487.34 (1.56)
Developed, Low Intensity	148.34 (1.13)	301.5 (0.97)

National Land Cover Database (NLCD) Category	GMWF	PVWF
	Total Acres (Percent of footprint)	Total Acres (Percent of footprint)
Pasture/Hay	9.58 (0.07)	286.4 (0.92)
Deciduous Forest	88.41 (0.68)	170.51 (0.55)
Developed, Medium Intensity	43.32 (0.33)	60.72 (0.19)
Developed, High Intensity	2.22 (0.02)	8.89 (0.03)
Woody Wetlands	0 (0.0)	6.0 (0.02)
Barren Land	2.44 (0.02)	4.0 (0.01)
Emergent Herbaceous Wetlands	9.11 (0.07)	1.4 (0.0)
Evergreen Forest	5.78 (0.04)	1.33 (0.0)
Open Water	1.33 (0.01)	0 (0.0)
<b>Total</b>	<b>13,080.16 (100)</b>	<b>31,175.80 (100)</b>

The Wind Farm footprints currently consist primarily of cultivated cropland with principal crops being soybeans, corn, wheat, alfalfa and other small grains. Scattered farmsteads (accounting for the “developed, open space” and “developed, low intensity, medium intensity, and high intensity” categories in Table 2) are present along the roadways within the Wind Farm footprints. Forested windbreaks (accounting for the “deciduous forest” and “evergreen forest” categories in Table 2) are present around most farmsteads (Homer et al. 2015). No other significant wooded areas are present within the Wind Farm footprints.

## 4.0 SITE ASSESSMENT (ECPG STAGE 1)

According to the ECP Guidance, the first step of the project evaluation process, Stage 1, involves consideration of “broad geographic areas to assess the relative importance of various areas to resident breeding and non-breeding eagles, and to migrant and wintering eagles” (USFWS 2013). During Stage 1, the project developer gathers existing information from publicly available literature, databases, and other sources and uses those data to judge the appropriateness of various potential project sites, balancing suitability for development with potential risk to eagles.

Both GMWF and PVWF were developed prior to issuance of the ECP Guidance, so preliminary assessment of the project sites did not directly align with the ECP Guidance process; however, project developers conducted an early assessment of both projects for potential wildlife impacts.



## **4.1 Preliminary Site Evaluation**

### **4.1.1 GMWF**

GMWF was developed, permitted, and constructed prior to the USFWS issuance of the Wind Energy Guidelines (WEGs; USFWS 2012) and ECP Guidance (USFWS 2013). As a part of their Large Wind Energy Conversion System (LWECS) Site Permit Application, enXco Development Corporation (project developer) conducted an environmental analysis through desktop evaluations of multiple databases, maps, and datasets (enXco 2007). In addition, request letters were sent to various agencies to determine whether additional information or knowledge of the proposed location was available to assist in determining potential environmental impacts for the project. Letters were sent to the Department of Agriculture (DOA), USFWS, MNDNR, Mower County Soil and Water Conservation District, U.S. Army Corps of Engineers, and Mower County Planning and Zoning (Table 1).

From these analyses and correspondence documents, enXco determined that the GMWF project site did not provide high-quality wildlife habitat due to the lack of significant woodland cover, greenway corridors, and waterfowl habitat (enXco 2007). The lack of significant habitat within or near the study area was assumed to reduce the potential for negative impacts to wildlife in the area (enXco 2007).

### **4.1.2 PVWF**

PVWF was developed and permitted prior to USFWS issuance of the final WEGs; however, the efforts completed in siting, studying, analyzing, reviewing, and coordinating with state and federal officials align with the WEG-tiered approach. A desktop analysis was completed for PVWF by RES (project developer) that identified existing wildlife and rare animals within and adjacent to the project (RES 2010). The preliminary desktop analysis was based on available datasets, maps, and correspondence documents with both the MNDNR and USFWS (RES 2010). Through their desktop review, RES determined that use of the area by migratory birds was limited due to the dominance of row crops and the lack of suitable foraging and breeding habitat (RES 2010). RES also stated that, due to the existing agricultural practices at the project, minimal wildlife habitat was present and impacts to these areas were expected to be minimal (RES 2010).

## **4.2 Site-specific Characterization and Decisions**

Additional pre-construction site-specific evaluations of GMWF and PVWF were performed by enXco and are described below.

### **4.2.1 GMWF**

As a part of the LWECS permitting process, enXco performed additional pre-construction evaluations, and prepared a biological preservation survey in coordination with the MNDNR

(enXco 2007). The biological survey was required in order to reduce the potential of any detrimental impacts to existing natural resources as a result of the construction and operation of GMWF and; the survey also aided enXco in micro-siting the facility's turbines. The biological preservation survey concluded that the project area contained a negligible amount of native plant communities and a minimal amount of significant wildlife habitat (enXco 2007). Three locations were identified with biological significance, and these areas were avoided during construction to reduce impacts (enXco 2007).

The biological preservation survey also included a discussion of potential avian and bat mortality for the GMWF, which was based on a review of relevant literature and regional avian and bat fatality studies. The review concluded that avian and bat fatalities at GMWF were likely to be similar to those documented at nearby wind farms and would be localized, with no significant impact on overall populations (enXco 2007).

#### **4.2.2 PVWF**

A Fatal Flaw Analysis was performed by RES at PVWF in January 2009 (RES 2009). The Fatal Flaw Analysis included a field reconnaissance to evaluate in greater detail the habitats existing and resources available in the project area. The Fatal Flaw Analysis also included a more detailed view of onsite vegetation and habitat mapping, rare and unique natural resources, and permitting processes for the project.

Based on a letter from the MNDNR, one potential avian species of concern was identified for the general project area: loggerhead shrike (*Lanius ludovicianus*) – a state-threatened species (RES 2009). A more up-to-date review of the MNDNR, Minnesota Natural Heritage Inventory System was conducted in early 2014 and again identified the loggerhead shrike. The Fatal Flaw Analysis concluded that the project is well-suited for a LWECS, with a low risk of physical or environmental constraints to development (RES 2009). Avian and bat surveys conducted for similar wind energy projects in the area (including the Buffalo Ridge study and Top of Iowa study) concluded minimal impacts to bird and bat populations (RES 2009). The information from databases, agency communications, and field review was used to identify environmental constraints for siting of the project facilities, and to develop a scope for further field studies.

## **5.0 SITE-SPECIFIC PRE-CONSTRUCTION SURVEYS**

Pre-construction wildlife surveys were not conducted by enXco at GMWF. This was due, in part, to the fact that GMWF was developed prior to the issuance of USFWS guidance in the WEGs and ECP Guidance (USFWS 2012, USFWS 2013). Pre-construction studies at PVWF were conducted by Western EcoSystems Technology, Inc. (WEST) and included avian use surveys and aerial and ground-based raptor nest surveys (Table 3; WEST 2011). Although pre-construction surveys were conducted at PVWF in general accordance with the WEGs, the



survey methods did not follow all of the recommendations listed in the ECP Guidance (Stage 2) because these surveys were conducted before the ECP Guidance was issued (USFWS 2013).

**Table 3. Pre-construction Surveys at the PVWF**

Study	Taxa	Survey Dates	Results Summary
Avian Point Count Use Surveys (WEST 2011)	All Birds	September 2009-August 2010	Four bald eagles were observed (see Section 5.1) accounting for three eagle use minutes (one eagle was perched and did not account for any eagle use minutes).
Aerial Raptor Nest Survey (WEST 2013a)	Raptors	March 2013	Three occupied active bald eagle nests (Nest 1, 11, and 12) were identified within a 2-mile buffer of the project boundary. One occupied active red-tailed hawk nest (Nest 5) was identified within a 1-mile buffer of the project boundary. Ten unoccupied inactive raptor nests were identified within a 1-mile buffer of the project boundary (see Section 5.2.1).
Ground-based Raptor Nest Survey (WEST 2014a)	Raptors	April 2014	One occupied active great horned owl nest (Nest 04) and one occupied active red-tailed hawk nest (Nest 06) were identified within the project boundary. One occupied active bald eagle nest (Nest 09) was identified within a 1-mile buffer of the project boundary. Seven unoccupied inactive raptor nests were identified within a 2-mile buffer of the project boundary (see Section 5.2.2).

## 5.1 Avian Point Count Surveys

Pre-construction, 20-minute, fixed-point count avian use surveys were conducted at PVWF in 2009 and 2010 to help predict potential impacts to bird species, particularly raptors, as a result of project development. These fixed-point avian use surveys were conducted before the ECP Guidance was issued. Point count locations were established based on the preliminary, generalized project boundary (hereafter “project boundary”) and were not specific to the turbine layout. Locations were selected at 15 point counts to survey representative habitats and topography of the project boundary, while also providing relatively even coverage across the project boundary (Figure 4). However, the percent coverage of the turbine footprint was not recorded (WEST 2011). Surveys were conducted weekly between September 1, 2009, and November 15, 2009 (fall surveys) and between March 1, 2010, and May 15, 2010 (spring surveys); every other week between May 16, 2010, and August 31, 2010 (summer surveys); and once a month between November 16, 2009, and February 28, 2010 (winter surveys). Each point count location consisted of an 800-meter radius circular plot, and individual surveys were conducted for 20 minutes at each location. A total of 7,800 survey minutes (130.2 hours) were recorded during fall, winter, spring, and summer fixed-point avian surveys (Table 4).

A total of four bald eagles were observed during the avian use surveys with a reported mean use of less than 0.02 eagle/20-minute survey. Bald eagles were observed during avian use surveys during winter and summer (3 bald eagles in winter, 1 in summer) at Survey Points 1 and 12. The three bald eagles observed at Survey Point 12 were migrating as a group, north to south, while the lone bald eagle at Survey Point 1 was perched, south of Survey Point 1. Three bald eagles and one golden eagle were observed incidentally outside of the standardized avian use surveys. These incidental observations of bald and golden eagles were outside the area of the turbines. Based on the results of the avian point count surveys described above, use of the PVWF by bald eagles (during pre-construction) was considered low compared to other raptor species at PVWF and was concluded to be low overall (WEST 2011).

**Table 4. Eagle Specific Avian Point Count Survey Results for PVWF, 2009- 2010**

Season and Year	Total survey (min)	Count duration (min)	Total counts	Eagle observations <sup>1</sup>
Fall 2009	2,400	20	120	0
Winter 2009-2010	1,200	20	60	3
Spring 2010	2,100	20	105	0
Summer 2010	2,100	20	105	1
<b>Total</b>	<b>7,800</b>	<b>NA</b>	<b>390</b>	<b>4</b>

<sup>1</sup> All observations were of bald eagles; no golden eagles were observed during surveys.

## 5.2 Nest Surveys

### 5.2.1 2013 Aerial Raptor Nest Surveys

On March 20, 2013, WEST conducted an aerial raptor and eagle nest survey within the PVWF project boundary and the 2-mile buffer. The survey was conducted by an experienced raptor ecologist from a helicopter before leaf out, when most raptors would be actively tending to a nest or incubating eggs. The eagle nest survey focused on locating eyries (large, stick nest structures) in suitable eagle nesting substrate within the PVWF project boundary. The locations of all potential bald eagle and raptor nests were recorded using a hand-held Global Positioning System (GPS) tracker (this included all potential nests regardless of their activity status). To determine the status of a nest, the biologist relied on clues that included behavior of adults and presence of eggs, young, whitewash, or nesting material. Attempts were made to identify the species of raptor associated with each active nest. The date, nest condition, and habitat were recorded (WEST 2013a).

During the aerial survey, 14 raptor nests were documented. Three were identified as occupied bald eagle nests; one was an occupied red-tailed hawk nest; and 10 were determined to be unoccupied, inactive raptor nests. The three bald eagle nests were classified as occupied and

active, with one adult observed sitting low on the nest. All three bald eagle nests were located outside of the PVWF project boundary, but within the 2-mile buffer (WEST 2013a).

### **5.2.2 2014 Ground-based Raptor Nest Surveys**

On April 22, 2014, WEST conducted a ground-based raptor nest survey within the PVWF project boundary and 2-mile buffer. An experienced raptor ecologist surveyed all potential bald eagle and raptor nest habitat from public roads throughout the PVWF project boundary and associated buffer. The locations of all potential bald eagle and raptor nests, regardless of their activity status, were recorded on aerial maps and transferred to shapefiles in ArcGIS. Nest type, species, nest size, and nest status and notes were recorded at each nest (WEST 2014a).

During the ground-based survey, ten stick nests representing three species were documented. Of these nests, one was identified as an occupied bald eagle nest; one was an occupied red-tailed hawk nest; one was an occupied great-horned owl nest; and seven were identified as unoccupied, inactive raptor nests (WEST 2014a). The bald eagle nest was occupied and active with one adult observed sitting low on the nest; the next was located outside of the project boundary, but within the 1-mile buffer. This same nest was documented in the 2013 aerial nest survey.

Two occupied bald eagle nests (documented outside the project boundary but within the 2-mile buffer during the 2013 aerial survey) were not observed during the ground-based survey. It was not clear whether these nests were no longer present or were not visible from the nearby public roads.

## **5.3 Eagle Risk Evaluation Based on Pre-construction Survey Data**

During avian use surveys conducted between September 2009 and August 2010 at PVWF, a total of four bald eagle observations were recorded (WEST 2011). No surveys were conducted that were specifically designed to assess the presence of roosting habitat within the project boundary; however, trees are present within the project boundary (see Sections 3.0 and 8.2). No active bald eagle nests were present within the project boundary, although three active bald eagle nests were found within a 2-mile buffer of the project boundary during the 2013 aerial surveys. Based on the ECP Guidance, the Wind Farm could fall into *Category 2 – High or moderate risk to eagles, potential to avoid or mitigate impacts*, because of eagle use near the project boundary. The ECP Guidance states that the risk category of a project could change as measures to reduce risk are applied. Thus, the risk category is reevaluated after consideration of Avoidance and Minimization measures included in Sections 6.0, 7.0, and 10.0.

## 6.0 AVOIDANCE AND MINIMIZATION OF RISKS IN PROJECT DESIGN

The project developers took measures to avoid and minimize impacts to eagles during the planning and design phase of project development; these measures are described below.

- The Wind Farms were sited in heavily cultivated landscapes to avoid impacts to eagles and their habitats.
- Wind turbines at the Wind Farms were designed with tubular towers and no external ladders or platforms on the towers or nacelles were used to minimize eagle perching and nesting opportunities.
- The electrical collection systems for the Wind Farms were designed so that the electricity generated at each turbine would be collected by underground power collection lines within the Wind Farm footprints. Burying collection lines diminishes the risk of eagle collision with or electrocution from this equipment.
- The Wind Farm meteorological (met) towers were designed to minimize collision risks for eagles by installing the minimum number of met towers needed and constructing met towers without permanent guy wires. Temporary guyed met towers were removed within 1 year of operation.
- Above-ground electrical lines (transmission lines), transformers, and conductors at the Wind Farms follow guidance from the Avian Power Line Interaction Committee (APLIC 2006, APLIC 2012) to avoid and minimize risk of potential eagle and other avian species collisions or electrocutions.
- The PVWF footprint and overall project size was significantly reduced from the original LWECS Site Permit (301 MW, up to 188 turbines on 72,800 acres) to the current Wind Farm size of 200 MW (100 turbines) on approximately 31,176 acres, reducing the potential collision risk to eagles. The project developer reduced the overall footprint, moved the project away from larger portions of potential habitat such as the Root River corridor, and minimized the presence of turbines near wetlands, thereby lowering the potential impact to eagles using these habitats to forage.
- The originally permitted PVWF required up to three substations and two overhead transmission lines, totaling more than 14 miles of overhead line. The updated configuration for the Wind Farm consists of a single project substation and a single overhead transmission line to connect to the substation, thus reducing the potential collision risk to eagles.

## 7.0 AVOIDANCE AND MINIMIZATION OF RISKS DURING CONSTRUCTION

This section identifies impact avoidance and minimization measures (BMPs) specific to eagles, which were incorporated by the project developers during construction. Parallel measures considered during siting and operations are described in Sections 6.0 and 10.0, respectively. General avoidance and minimization measures that benefit wildlife in general are described in the BBCS documents (WEST 2014b and WEST 2016). Both Wind Farms evaluated the BMPs listed in the USFWS WEGs, and decided to implement the following BMPs based on their potential benefit to eagles:

- Native species were used when seeding or planting non-cropped fields during restoration. USFWS and the Natural Resource Conservation Service (NRCS) were consulted regarding native species to use for restoration because this provided a general benefit for eagle habitat. Restored areas were monitored to determine reestablishment, and reseeded or replanted in areas where reestablishment did not occur.
- Accumulation of outdoor storage or waste was addressed immediately so it did not attract birds or rodents, which could serve as prey for eagles.
- Site personnel were required to receive training on the wildlife incident reporting system in the event that an injured eagle or eagle remains were discovered during construction.
- The Construction Monitoring Plan focused on instilling an awareness of construction activities that affected bird species of concern, including eagles, to identify opportunities to minimize those effects where warranted.
- All construction-related traffic within the sites was limited to a maximum speed limit of 25 mph, unless a lower speed limit was posted, to reduce the risk of vehicle/eagle collisions.
- The electrical collection lines connecting the turbines to the Wind Farm substation were buried underground to reduce the risk of electrocution of bald eagles.
- To the maximum extent practicable, roads, power lines, fences, and other infrastructure associated with the Wind Farms were minimized.
- Tubular towers of best available technology were used to reduce the ability of birds to perch and reduce the risk of collision.
- Employees, contractors, and site visitors were instructed on how to avoid harassing or disturbing wildlife, particularly during reproductive seasons.

In late July 2016, road work was conducted at PVWF on the Turbine 17 access road near Nest 2016-01. After consulting with USFWS, it was decided that a disturbance permit was not necessary for this work, as the eaglet had fledged the nest and would likely not be disturbed. Xcel maintained an avoidance buffer of 660 feet from the nest until road work activities were completed. Although the road work was completed during operation of the Wind Farm, it is listed as a construction activity due to its inclusion in the construction timeline.

## 8.0 POST-CONSTRUCTION MONITORING

This section provides a brief overview of all post-construction avian monitoring for the Wind Farms and explains in detail the monitoring that has been and will be conducted. These studies were designed to provide Xcel with information on the use of the Wind Farms by eagles, the presence of eagle nests, and the rate of facility-related fatalities to better understand risk to eagles and inform adaptive management practices, if necessary. Although post-construction eagle use data were not intended for modeling purposes, Xcel believed the resulting data would address data gaps and be informative of eagle spatial and temporal use at the operational Wind Farms. Pre-construction eagle use data were collected at PVWF from September 2009 through August 2010; however, the surveys were only 20 minutes in length (see Section 5.1) and were not specific to eagles. No pre-construction eagle use data were collected at GMWF.

In 2016 and 2017, Tetra Tech conducted post-construction studies at GMWF, which included eagle use surveys and aerial eagle nest surveys (Table 5). Tetra Tech also conducted post-construction studies at PVWF, which included eagle use surveys, aerial and ground-based eagle nest surveys, ground-based eagle nest monitoring, and standardized carcass searches (Table 6).

**Table 5. Post-construction Surveys at the GMWF**

Study	Taxa	Survey Dates	Results Summary
Standardized Carcass Searches (WEST 2013b, WEST 2015)	Bats and Incidental Birds	July 2013-October 2013 and July 2014-October 2014	No injured or dead bald eagles were discovered during standardized carcass searches (see Section 8.3.1 of this ECP). <sup>1</sup>
Aerial Eagle Nest Survey (Tetra Tech 2016a)	Eagles	April 2016	Five occupied active bald eagle nests (Nests 2016-03, 2016-05, 2016-06, 2016-07, and 2016-11) and two unoccupied inactive bald eagle nests (Nest 2016-09 and 2016-10) were identified outside the Wind Farm footprint within the 10-mile buffer (see Section 8.1.2.2 and Figure 8).
Eagle Use Surveys (Tetra Tech, 2017a)	Eagles	March 2016-February 2017	16 eagle use minutes recorded out of 5,760 minutes (96 hrs.) surveyed during eagle use surveys (see Section 8.1.1 and Figures 6a and 6b).

<sup>1</sup> The study was focused on bats; recording bird fatalities was a secondary goal. As such, species-specific details or estimators were not included.



**Table 6. Post-construction Surveys at the PVWF**

Study	Taxa	Survey Dates	Results Summary
Aerial Eagle Nest Survey (Tetra Tech 2016b)	Eagles	April 2016	Two occupied active bald eagle nests (Nests 2016-01 and 2016-02) were identified within the Wind Farm footprint. Six occupied, active bald eagle nests (Nests 2016-03 – 2016-08) and two occupied inactive nests (Nests 2016-09 and 2016-10) were identified within a 10-mile buffer of the Wind Farm footprint (see Section 8.1.2.2 and Figure 8).
Ground-based Eagle Nest Observations (Tetra Tech 2016c)	Eagles	June 2016	Nests 2016-01 and 2016-02 were both observed to be occupied and active (see Section 8.1.2.3).
Ground-based Eagle Nest Monitoring (Tetra Tech 2016d)	Eagles	March 2016-September 2016	Nest 2016-01 produced one eaglet that fledged the nest in June (See Section 8.1.2.1).
Standardized Carcass Searches (Tetra Tech 2016e)	All Birds and Bats	May 2016- May 2017	A total of 12 avian fatalities were recorded during the summer and fall 2016 searches. No eagle fatalities were documented during the summer and fall seasons (see Section 8.3.2).
Eagle Use Surveys (Tetra Tech, 2017b)	Eagles	March 2016-February 2017	24 eagle use minutes recorded out of 13,680 (228 hrs.) minutes surveyed during eagle use surveys (see Section 8.1.1 and Figures 7a and 7b).

## 8.1 Eagle Use and Nest Surveys

In March 2016, one occupied bald eagle nest (currently referred to as Nest 2016-01) was documented in the PVWF footprint during routine O&M activities. Xcel immediately communicated the discovery of the bald eagle nest to USFWS and MNDNR. Xcel recognized the importance of better understanding eagle use patterns and the risks to eagles at the two facilities. In spring 2016, Xcel began post-construction field surveys at both PVWF and GMWF using methodology from the ECP Guidance, Stage 2.

Nest 2016-01 was discovered in an agricultural area that is representative of the land cover as a whole. Nest 2016-01 was located in a cottonwood tree in a tree row within a small pasture surrounded by row crop fields. Generally, bald eagles select habitats along major rivers, lakes, and reservoirs. Nests are typically built in tall, large trees in mature forests (Buehler 2000). However, with increasing bald eagle populations, nesting eagles have also been found in areas away from major waterbodies, such as the location of Nest 2016-01. Bald eagles may also be found during migration and winter periods in areas away from major rivers if sufficient forage is available. Fish is the primary food source of bald eagles; however, the bald eagle may also feed on birds, mammals, and carrion. Golden eagles are occasional migrants in most counties in Minnesota, mainly during spring, fall, and winter (MOU 2016). They do not breed in the state, but a wintering population exists along the Upper Mississippi River (NEC 2016).

All avian and eagle surveys at the Wind Farms were conducted cognizant of the possibility that either species could be found. Surveys for eagles included ground and aerial nest surveys, eagle surveys, avian point count surveys, nest monitoring, and standardized carcass searches. Methodologies and results are presented in Sections 5.1, 5.2.1 and 5.2.2 in chronological order of their occurrence. Full details about methods, specific areas covered, and the locations and numbers of eagles detected during the surveys can be found within the original reports for the respective studies. Tables 3, 4, 5 and 6 provide a summary of relevant eagle results.

### **8.1.1 Eagle Use Surveys**

Tetra Tech began conducting eagle use surveys at both Wind Farms in March 2016 in order to estimate the seasonal, spatial, and temporal use of the Wind Farms and a 1-kilometer [km] buffer around the existing turbines by bald eagles, and to provide data input sufficient for an eagle risk assessment consistent with the ECP Guidance. Eagle use survey locations (8 at GMWF and 19 at PVWF) were distributed throughout the 1km buffer around the turbines at each Wind Farm, providing spatial coverage of over 30 percent of each Wind Farm footprint as recommended in the ECP Guidance (Figures 5a and 5b). Surveys were conducted at each location once per month and were distributed across daylight hours, with the survey schedule varying between visits so that each survey location was surveyed at all periods of the day. Each survey location consisted of an 800-meter radius circular plot, and individual surveys were conducted for 60 minutes at each survey location.

Eagle use surveys were developed to follow the protocol described in the ECP Guidance. However, these surveys were conducted post-construction, while the turbines were operational, not pre-construction as assumed in the ECP Guidance. Preconstruction surveys are discussed in Section 5.0 of this ECP. Data collected included; flight paths of individual eagles, recorded minutes of flight categorized by flight height (i.e., minutes at or below 200 meters above ground [the conservative approximation of the maximum height of blade tip of the tallest turbine] and within 800 meters of the count location), and species and age class of eagles observed. Flight observation minutes were rounded up to the nearest minute (e.g., one-minute ten seconds rounded up to 2 minutes) prior to analysis, for a conservative record of eagle flight at or below 200 meters above ground.

From March 2016 through February 2017, Tetra Tech completed 228 hours of surveys at PVWF and 96 hours of surveys at GMWF (Tetra Tech 2017a, Tetra Tech 2017b). During this time period, four bald eagles were observed at GMWF and twelve were recorded at PVWF, with a total of 40 minutes of bald eagle flight at or below 200 meters and within 800 meters of the point locations (Figures 6a, 6b, 7a, and 7b). No golden eagles were observed during eagle use surveys. Table 7 provides a summary of eagle use survey results by season for both GMWF and PVWF.



Table 7. Eagle Use Survey Results, 2016- 2017

GMWF					
Season and Year	Month	Total survey (min)	Count duration (min)	Total counts	Eagle minutes below 200m <sup>1</sup>
Spring 2016	March	480	60	8	0
	April	480	60	8	14
	May	480	60	8	0
Summer 2016	June	480	60	8	0
	July	480	60	8	0
	August	480	60	8	0
Fall 2016	September	480	60	8	0
	October	480	60	8	0
	November	480	60	8	0
Winter 2016-2017	December	480	60	8	0
	January	480	60	8	0
	February	480	60	8	2
<b>Total</b>		<b>5,760</b>	<b>NA</b>	<b>96</b>	<b>16</b>
PVWF					
Season and Year	Month	Total survey (min)	Count duration (min)	Total counts	Eagle minutes below 200m <sup>1</sup>
Spring 2016	March	1,140	60	19	3
	April	1,140	60	19	6
	May	1,140	60	19	2
Summer 2016	June	1,140	60	19	0
	July	1,140	60	19	1
	August	1,140	60	19	0
Fall 2016	September	1,140	60	19	0
	October	1,140	60	19	0
	November	1,140	60	19	0
Winter 2016-2017	December	1,140	60	19	6
	January	1,140	60	19	0
	February	1,140	60	19	6
<b>Total</b>		<b>13,680</b>		<b>228</b>	<b>24</b>
<b>Combined Total<sup>2</sup></b>		<b>19,440</b>	<b>NA</b>	<b>324</b>	<b>40</b>

<sup>1</sup> All recorded minutes are of bald eagles; no golden eagles observed during surveys

<sup>2</sup> Combined total for both GMWF and PVWF; data not used in model run; however, was used to inform qualitative risk

## 8.1.2 Nest Surveys

### 8.1.2.1 2016 Ground-based Eagle Nest Monitoring

On March 10, 2016, Xcel operations staff discovered an active bald eagle nest at PVWF, approximately 150 meters from Turbine 17 (Nest 2016-01; Figure 8). Upon discovery of the nest, Xcel notified the USFWS and MNDNR; curtailed Turbines 16, 17, and 18; and authorized Tetra Tech to begin weekly nest monitoring following the ECP Guidance. The nest was monitored for 4 hours weekly from March 17 through September 28, 2016, by an experienced avian biologist. Surveys were conducted from a turbine access road approximately 150 meters north of the nest and were staggered weekly to cover all daylight hours. Aerial maps were used to document flight paths of the eagles and all activity was recorded by the biologist in a field notebook.

On March 17, 2016, a Tetra Tech biologist observed the nest to be occupied by two adult bald eagles. Both eagles took turns sitting on the nest and both displayed behaviors of repositioning eggs. On April 21, 2016, an eaglet was spotted in the nest and the adult eagles were observed bringing food to the nest. The eaglet was first spotted branching (i.e. out of the nest) on June 22, 2016, moving to branches in the nest vicinity and was also heard vocalizing. On June 29, 2016, the eaglet was first observed flying, as it flew from the nest and perched in a nearby tree, then returned to the nest shortly after. Throughout the next month of surveys, the eaglet and adult bald eagles were observed in the general vicinity of the nest. During the August 2, 2016 survey, neither an adult eagle nor the eaglet were observed; this was the first time no eagles were seen near the nest. After consultation with USFWS, Turbines 16, 17, and 18 were put back into production on August 24, 2016. Nest monitoring concluded on September 28, 2016, because the nest was no longer being used by the adult bald eagles or the eaglet. Nest monitoring was then reinitiated in December 2016 as part of the nest removal process (MB09066C-0) (see Section 8.4.2).

### 8.1.2.2 2016 Aerial Eagle Nest Surveys

From April 7 through April 9, 2016, Tetra Tech conducted an aerial eagle nest survey of the GMWF and PVWF footprints and a 10-mile buffer around the footprints to inventory eagle nests.

The primary objective for the aerial eagle nest survey was to document nesting bald eagles within a 10-mile radius of the Wind Farm footprints in accordance with the ECP Guidance. The survey was conducted from a Bell 206BIII Jet Ranger helicopter (Double M Helicopters) that was flown approximately 200 feet above ground level at an approximate speed of 50 miles per hour. The survey included searches of north-south transects spaced 1.0 mile (1.6 km) apart within the Wind Farm footprints and 10-mile buffer for a total of approximately 831 transect-miles (Figure 8). Deviations from transects were needed in order to survey suitable nesting habitat and low visibility areas.

When a nest was found, the following data were collected: nest identification number, adult presence (a bird sitting or standing on the nest or near the nest), presence and number of eggs or young, nest substrate (where the nest was located [e.g., elm tree, cut bank, transmission pole, etc.]), nest height (in meters (m), distance from nest to ground). Following the ECP Guidance, nest activity was recorded as “Occupied Active” (nest contains eggs, young, or an adult sitting on the nest indicating incubation or brooding), “Occupied Inactive” (nest does not contain eggs or young but shows evidence of recent use such as fresh lining, droppings, feathers on or underneath, or adults near the nest but not sitting on the nest), or “Unoccupied” (nest shows no evidence of use and adults are not present at the nest), and nest condition was assigned into one of five categories (excellent, good, fair, poor, or remnant) based on observations made of the nest bowls and walls.

The aerial survey was conducted April 7 through April 9, 2016. The survey team located one Occupied Active bald eagle nest (Nest 2016-01) within the Wind Farm footprints (Table 8 and Figure 8). Eight Occupied Active bald eagle nests (Nests 2016-02, 2016-03, 2016-04, 2016-05, 2016-06, 2016-07, 2016-08, and 2016-11) were identified outside the Wind Farm footprints but within the 10-mile buffers (Figure 8). Two Occupied Inactive bald eagle nests (Nests 2016-09 and 2016-10) were identified outside of the Wind Farm footprints but within the 10-mile buffers.

**Table 8. 2016 Eagle Nest Survey Data for the Wind Farms**

Nest	Species <sup>1</sup>	Distance from Wind Farms' nearest turbine (miles)	Adult Present?	Number of Eggs or Young	Activity <sup>2</sup>	Condition	Comments
2016-01	BAEA	0.080	Yes	Unknown	OA	Excellent	Adult BAEA sitting on nest
2016-02	BAEA	0.627	Yes	Unknown	OA	Excellent	Adult BAEA sitting on nest
2016-03	BAEA	3.028	Yes	Unknown	OA	Excellent	Adult BAEA sitting on nest
2016-04	BAEA	5.715	Yes	Unknown	OA	Excellent	Adult female BAEA sitting on nest; adult male BAEA perched nearby
2016-05	BAEA	9.083	Yes	Unknown	OA	Excellent	Adult BAEA sitting on nest
2016-06	BAEA	3.785	Yes	Unknown	OA	Excellent	Adult BAEA sitting on nest
2016-07	BAEA	6.788	Yes	Unknown	OA	Excellent	Adult BAEA sitting on nest

Nest	Species <sup>1</sup>	Distance from Wind Farms' nearest turbine (miles)	Adult Present?	Number of Eggs or Young	Activity <sup>2</sup>	Condition	Comments
2016-08	BAEA	9.132	Yes	2 chicks	OA	Excellent	Adult BAEA perched on nest other adult BAEA perched in tree nearby; chicks appear to be about 1 week old
2016-09	BAEA	5.529	No	None	OI	Good	Nest had a fresh lining in it
2016-10	BAEA	5.660	No	None	OI	Good	Nest had a fresh lining; 2 adults seen flying nearby
2016-11	BAEA	7.468	Yes	Unknown	OA	Excellent	Adult BAEA sitting on nest

<sup>1</sup>BAEA = Bald eagle

<sup>2</sup>OA = Occupied Active; OI = Occupied Inactive

### 8.1.2.3 2016 Ground-based Eagle Nest Surveys

On June 8, 2016 Tetra Tech biologists conducted a ground-based, follow-up eagle nest survey to further evaluate the occupancy, productivity, condition, and other attributes of the eagle nests identified within 2 miles of the Wind Farm turbines. Two nests (Nests 2016-01 and 2016-02) were located during the aerial surveys within 2 miles of the PVWF turbines, both located within the Wind Farm footprint. No nests were identified within 2 miles of the GMWF turbines; therefore, no nests were visited at GMWF. The survey consisted of a 4-hour observation of each nest from the nearest public right-of-way using binoculars and a spotting scope. Tetra Tech biologists recorded nest identification number, species code, adult presence, number of eggs or young, nest substrate, nest height, nest activity, and nest condition. Photographs of each nest were taken and detailed notes of activity at each nest were recorded.

During the June 2016 ground-based follow-up survey, Nests 2016-01 and 2016-02 were located and observed. Nest 2016-01 was observed to be occupied active with one eaglet, approximately 8 to 10 weeks old. Two adult bald eagles were observed perched and flying in the general vicinity of the nest. Nest 2016-02 was observed to be occupied active with two eaglets, approximately 8 to 10 weeks old. One adult bald eagle was observed bringing food to the nest.

#### *8.1.2.4 2017 Ground-based Eagle Nest Surveys*

On February 13, 2017, a new nesting attempt was reported to the west of Turbine 17. Xcel removed the nest on February 15, 2017 (Sect. 8.4.2). A second nesting attempt in the original nest tree line was discovered on February 19, 2017. This nesting attempt was soon abandoned without any further nest improvement attempts by the eagles. The pair was not observed in the area during spring or summer. At the end of October 2017, a pair of bald eagles started building a nest (Nest 2017-01) in the same tree line west of Turbine 17 used previously (Figure 10).

#### *8.1.2.5 2018 Ground-based Eagle Nest Surveys*

On February 22, 2018 technicians from USDA Animal and Plant Health Inspection Services (APHIS), who were attempting to trap the adult eagles (MB09057C-0) (Sect. 8.4.3) noticed behavior by the adult eagles indicating an egg may have been laid in the nest. In mid-April 2018 Xcel installed a camera on Turbine 17 to observe bald eagle activity at the nest. On April 18, 2018 a chick was observed in the nest. An attempt was made to band the chick on May 29, 2018 but access to the nest could not be made. The chick successfully fledged from the nest in June 2018.

#### *8.1.2.6 2019 Ground-based Eagle Nest Surveys*

In spring of 2019 a pair of bald eagles returned to the same nest used in 2018. The camera attached to Turbine 17 recorded incubating behavior by the adults. However, after more than 30 days of incubation the birds abandoned the nest and the nesting attempt failed. Additional details on nesting can be found in Appendix C – Technical Assistance letters.

## **8.2 Prey Assessment**

To better assess eagle use at the Wind Farms and develop management strategies to prevent eagle take, it can be useful to understand the factors that attract eagles to an area. Bald eagles are drawn to concentrated prey resources, particularly in winter, which may occur naturally or be the result of human activities. The diet of bald eagles in this region likely includes fish, upland game birds, small- to medium-sized mammals, and carrion (Buehler 2000). Bodies of water that may potentially support fish populations are not found in the Wind Farm footprints and are rare in the surrounding landscape.

During aerial eagle nest surveys of the Wind Farm footprints (see Section 8.1.2.2), an effort was made to identify areas of potential concentrated prey resources, including poultry or cattle operations. Consistent with NLCD data and the habitat discussion presented in Section 3.3, the land cover within the Wind Farm footprints was observed to be dominated by agricultural land used for row crop production along with developed land (farmsteads), forested windbreaks around farmsteads, and small tracts of grasslands. None of these land uses would lend themselves to any concentrated prey resources. The land cover within the Wind Farm boundaries outside the footprints was generally observed to be similar to that within the

footprints. The typical agricultural landscape supports populations of ring-necked pheasants, small- and medium-sized mammals, and white-tailed deer. However, except for white-tailed deer winter yarding areas, none of these prey sources would concentrate locally. Carrion would be available to bald eagles as road-killed animals, and from agricultural activities.

Based on the habitat assessment of the area, it seems that prey, such as fish, small mammals and occasional carrion, is available to support nesting bald eagles. Prey resources may be available for wintering or migrating eagles in the spring and fall in the forms of fish in water bodies that have thawed, waterfowl using flooded fields, or small mammals and carrion; however, no concentrated prey resources exist that would draw wintering or migrating eagles into the Wind Farm footprints.

## **8.3 Fatality Surveys**

### **8.3.1 2013 – 2014 Fatality Monitoring at GMWF**

In 2013 and 2014, WEST conducted post-construction fatality monitoring at GMWF and two other Minnesota wind farms as a part of a study commissioned by the Minnesota Department of Commerce (DOC) to evaluate the fatality risk to bats at wind facilities in southern Minnesota. Thirteen turbines at GMWF were selected for surveys, with 120-meter by 120-meter square plots searched five days a week. Roads and pads were searched at the remaining turbines at GMWF. Although the study focused on bats, bird fatalities were also documented both within the search plots and as incidental finds. A total of 11 avian fatalities were documented incidentally at GMWF during the 2013 and 2014 standardized carcass searches, and no injured or dead eagles were incidentally discovered (WEST 2013b, WEST 2015). A complete description of the DOC fatality studies can be found in the study report (WEST 2013b, WEST 2015) and within the GMWF BBS (WEST 2016).

### **8.3.2 2016 – 2017 Fatality Monitoring at PVWF**

Avian and bat fatality monitoring at PVWF began in May 2016 and was completed in May 2017 (Tetra Tech 2016e). The objective of fatality monitoring was to accurately estimate the number of avian and bat fatalities at PVWF, with the protocol designed to capture data on large bird fatalities, such as eagles. Because no monitoring protocol can ensure a complete census of fatality events, the PVWF designed the methodology using a probabilistic approach to identify a protocol that produces a high level of statistical confidence in the results of monitoring. The 2016-2017 avian and bat fatality monitoring was conducted at 100 percent of the turbines at the PVWF throughout four seasons and included searcher efficiency and carcass persistence bias trials. No eagle fatalities were detected during these surveys.

## 8.4 Permits

This section provides a brief overview of all permits that have been obtained for the Wind Farms and explains in detail all conditions and compliance measures for each permit.

### 8.4.1 Collection Permits

#### 8.4.1.1 *Special Purpose – Utility (SPUT) Permit*

Xcel obtained USFWS SPUT permits for the Wind Farms (MB02038C-0 and MB99202B-0) for post-construction monitoring. The permit allows Xcel to collect, transport, and temporarily possess carcasses and partial remains of migratory birds for monitoring migratory bird mortality associated with operation of the Wind Farms. For bald and golden eagles and federally listed, threatened, or endangered species, a USFWS Office of Law Enforcement (OLE) special agent must be contacted for instructions and approval before collecting or removing the carcass or remains. For all other migratory birds, additional data must be recorded prior to collecting or moving the carcass or remains.

#### 8.4.1.2 *MNDNR Salvage Permit*

Xcel obtained a Special Permit (21092) from the MNDNR for PVWF allowing the salvage of protected birds and mammals during post-construction monitoring at the Wind Farm. The permit is valid for salvage of migratory birds and bats, but only as authorized under a federal permit issued to the permittee. The permit is valid for salvage of state or federal endangered or threatened species provided the MNDNR and USFWS are notified within 24 hours if any state or federally listed species (endangered, threatened, or special concern) are found dead or injured. The salvage permit is valid for the use of specimens collected from the site and for the collection of road-killed birds to be used for searcher efficiency or carcass removal trials. The Special Permit was renewed in July 2019 and applies to both Wind Farms.

### 8.4.2 Nest Removal Permits

Xcel obtained a USFWS eagle nest take permit (MB09066C-0) for the removal of the inactive Nest 2016-01 approximately 150 meters south of Turbine 17 at PVWF. The permit authorized the removal and destruction of one bald eagle nest (Nest 2016-01) situated near Turbines 16, 17, and 18 to allow unabated use of the three turbines. The permit also required compliance with all avoidance, minimization, or other mitigation measures prescribed by the migratory bird permit office. The permit was amended on December 7, 2016, to allow the permittee to remove any newly constructed bald eagle nests (before eggs are laid) from the turbine(s) vicinity to prevent bald eagle nesting in undesirable areas adjacent to where Nest 2016-01 was previously located.

Xcel also obtained a Special Permit (21671) from the MNDNR for removal of the inactive Nest 2016-01. This permit was effective until March 15, 2017. On February 14, 2017, Xcel obtained verbal approval to remove partially built nests in the vicinity of former Nest 2016-01 within the effective dates.



Details on nest removal efforts can be found in the Technical Assistance letters (Appendix C).

### **8.4.3 Depredation Permit**

Xcel obtained a USFWS eagle depredation permit (MB09057C-0) for use at both Wind Farms. The permit authorizes use of non-lethal scare devices, scare tactics, or frightening devices to move or disperse bald eagles wishing to nest, endangering themselves, and preventing the use of established wind turbines. Devices include airhorns, pyrotechnics, other loud noises, and drive vehicles with horns as necessary to scare eagles. Permittees must make a continuous effort to eliminate attractants and other physical properties that may draw eagles to the Wind Farms' properties. The permit does not authorize the disturbance of eagles at active nest sites that contain eggs or young.

### **8.4.4 Eagle Trapping**

After approval by USFWS and MN DNR, Xcel and APHIS entered into a CSA in December 2017 and under an existing APHIS research permit (MB09057C) agreed to attempt to trap and relocate the adult eagles using Nest 2017-01 near Turbine 17. Baiting efforts began in December 2017 and continued until February 27, 2018 when egg incubation behavior was observed and trapping efforts were discontinued. Additional details can be found in the Technical Assistance letters (Appendix C).

## **8.5 Eagle Risk Evaluation Based on Post-Construction Data**

### **8.5.1 Collision Risk Assessment**

Post-construction eagle use studies performed at the Wind Farms may be used to generate a qualitative assessment of eagle collision risk. Paired with the quantitative assessment of collision risk provided from the USFWS Bayesian collision risk model (see Section 9.1), this information can be used by Xcel to develop appropriate risk minimization measures.

A number of bald eagles were observed at the Wind Farms during post-construction eagle use surveys; no golden eagles were observed (see Section 8.1.1 for details). At PVWF, the seasonal patterns of use varied from those observed pre-construction with spring being the season of highest use, followed by winter and summer. The higher use in the spring was likely related to the presence within the Wind Farm footprint of an in-use bald eagle nest (Figure 8: Nest 2016-01). Adult bald eagles were frequently observed flying in the vicinity of this nest. However, both adults and juveniles were also observed in other portions of the Wind Farm footprint. At GMWF, the seasonal patterns of use were highest in the spring, followed by winter and summer. The timing of the observed eagle use suggests that individuals pass through as migrants in addition to use by breeding residents at the PVWF. Many of the flight paths occurred near operational turbines and at heights that expose them to the spinning blades, suggesting that there is collision risk. No collisions were observed during the eagle use surveys, and no eagle fatalities were detected during standardized carcass searches or incidentally.



In May 2018, during a visit made to Nest 2017-01 near Turbine 17 to band the chick, a dead adult bald eagle was discovered on the ground in the tree line about 25 meters from the nest. An autopsy was conducted by the USFWS and it was determined that the dead eagle had pesticide in its tissues and cause of death was blunt force trauma. It is unknown if the dead adult eagle was part of the pair at this nest, although the successful fledging of the chick may indicate that this bird was not part of the pair. Nonetheless, this fatality indicates that there is some risk to eagles at the Wind Farm from turbine collision. However, the continued attempts at breeding which began in 2016, and the successful fledging of young suggests that the individual eagles flying within the Wind Farm footprints may recognize the turbines as obstacles and navigate accordingly. Taken together with studies that suggest bald eagles demonstrate avoidance behavior at operational turbines (e.g., Sharp et al. 2012) and that collision risk may be a function of specific high-risk behaviors during flight, the bald eagle collision risk at the Wind Farms is likely not directly proportional with post-construction eagle use.

### **8.5.2 Disturbance Risk Assessment**

An analysis to determine disturbance take resulting from construction and initial operation of the Wind Farms is unnecessary because an ETP does not authorize take that has occurred in the past. Therefore, for purposes of this ECP, and Xcel's application for an ETP, potential future disturbance must be assessed relative to the current baseline condition of the fully operating Wind Farms. It is Xcel's position that, unless there are significant changes in operations at the Wind Farms that are materially different from the baseline operational conditions being conducted at the time of potential ETP issuance, there will be no disturbance impacts attributable to Wind Farm operations. Because Xcel does not anticipate any significant operational changes, there should be no material difference in Wind Farm operations during the ETP term that would result in a net increase in disturbance to nesting, roosting, or foraging eagles. Xcel understands that current levels of disturbance in the Wind Farm footprints do not exempt Xcel from liability for disturbance take, due to the Wind Farm activities.

Based upon the documented construction of new nests and their occupancy and success during operations, it appears that territories can continue to be occupied by breeding bald eagles despite operation of the facilities (Section 8.1). Therefore, future disturbance to nesting eagles, as well as roosting or foraging eagles, as a result of operations, is considered unlikely. To address potential future disturbance, Xcel will employ a number of passive conservation measures to minimize risk of disturbance to nesting, roosting, and foraging eagles (Section 10.3.2).

### **8.5.3 Eagle Risk Categorization**

Based on the wide spatial distribution of potential foraging areas, migrating or wintering eagles are unlikely to concentrate in a specific location, as shown in the Wind Farm footprints. Xcel has obtained eagle nest removal and depredation permits to remove new nests close to turbines and prevent re-nesting in the Wind Farm footprints. The fatality model (Section 9.1) predicts a mean

of 0.750 bald eagle fatalities (upper 80 percent CL: 1.122) annually at the Wind Farms. Taking into consideration the avoidance and risk minimization measures (Section 10.0) to accommodate nesting bald eagles and minimize collision risk, based on the ECP Guidance the Wind Farms fall into *Category 2 – High or moderate risk to eagles, opportunity to mitigate impacts*.

## 9.0 PREDICTING EAGLE FATALITIES

This section discusses predicted bald eagle take due to collision with turbines at the Wind Farms and potential impacts associated with disturbance of bald eagles at important eagle-use areas within the Wind Farm footprints. The analyses performed were conducted during operations at the Wind Farms; these operations are described in detail in Section 3.0. GMWF has been operational since 2008 and PVWF since 2015, with no eagle fatalities documented at either wind farm during systematic surveys. One eagle fatality was discovered incidentally on May 29, 2018. This is described in detail in the USFWS draft EA, Section 3.1.5.1, “Project-Specific Mortalities”. Because the Wind Farms are operational, not all aspects of the ECP Guidance are relevant and only analyses applicable to operational wind farms have been included in this section.

Evidence of bald eagle fatalities is not abundant at wind energy facilities, with a total of 20 bald eagle fatalities in the Midwest USFWS Region 3 and a total of 35 recorded fatalities throughout North America as of spring 2017 (USFWS 2017). Golden eagle fatalities resulting from collisions with wind turbines are more numerous than bald eagles, and in general, eagle use prior to construction was higher at wind farms with that later recorded eagle fatalities compared to wind farms that recorded no eagle fatalities (Strickland et al. 2011, Allison 2012). However, there is a weak predictive relationship between eagle use prior to construction and the number of fatalities post-construction. Some researchers have suggested that eagles nesting near turbines are at lower risk of collision because they are familiar with the landscape compared to sub-adults or floaters (i.e., non-breeding individuals), and fatalities recorded at the Altamont Wind Facility in California were highest for these age categories of golden eagles (Hunt 2002).

### 9.1 Fatality Model

The primary objective of this analysis is to predict the baseline annual take of bald eagles at the Wind Farms; analyses were performed for bald eagles only because no golden eagles have been observed at the site. The USFWS Bayesian Collision Risk Model (USFWS 2013) was used to predict the annual take of bald eagles at the Wind Farms. The risk of collision was modeled as the mean number of fatalities per year resulting from a Bayesian analysis using minutes of eagle observations during pre-construction avian point-count surveys as the input data. This analysis assumes that collision risk is proportional to use of the Wind Farms by eagles (USFWS 2013). Bayesian models use existing information to estimate the statistical distribution (called prior distribution in Bayesian analysis) of variables of interest, and then use new data to update the

distribution (referred to as a posterior distribution). Variables incorporated into the USFWS Bayesian collision risk model (version CollisionModelv4) are summarized in Table 9.

**Table 9. Variables Used in the USFWS Bayesian Collision Risk Model**

Symbol	Name	Description (Units)
t	Eagle minutes	Minutes of eagle flight detected at $\leq 200$ m ( $\leq 656$ feet) above ground level while within point-count plots (units = minutes)
N	Number of point counts	The number of point counts performed
$\lambda$	Exposure rate	The number of exposure minutes per hour per km <sup>2</sup> in the sampled area (units = eagle minutes/hours/km <sup>2</sup> )
$\delta$	Hazardous area	Total area within one rotor radius of a turbine (km <sup>2</sup> )
T	Total daylight hours	Total hours of daylight per year at the Wind Farm (units = hours)
$\epsilon$	Expansion factor	Scaling factor used to scale mean exposure minutes to the hazardous area ( $\delta$ ) and total daylight hours (T).
C	Collision probability	The probability, given 1 minute of flight below 200 m (656 feet), of a collision with a turbine
F	Eagle fatalities	Estimated eagle fatalities per year

In the USFWS Bayesian collision risk model, the total annual eagle fatalities (F) as the result of collisions with wind turbines are predicted as the product of the rate of eagle exposure ( $\lambda$ ) to turbine hazards, the probability that eagle exposure will result in a collision with a turbine (C), and an expansion factor ( $\epsilon$ ) that scales the resulting fatality rate to all daylight hours over the entire project (Equation 1).

$$F = \epsilon \lambda C \quad \text{Equation 1}$$

Within the Bayesian estimation framework, prior distributions for exposure rate ( $\lambda$ ) and collision probability (C) are derived by the USFWS from previous studies (see below). The expansion factor ( $\epsilon$ ) is a constant based on the proportion of daylight hours and hazardous area around turbines that is sampled by the point counts. The analysis calculates the exposure posterior distribution from its prior distribution and observed point count data. The expanded product (to the total hazardous area around turbines and total daylight hours) of the posterior exposure distribution and collision probability prior yields the predicted number of annual fatalities.

### General Approach

Xcel coordinated extensively with USFWS to determine appropriate approaches and associated inputs for modeling the eagle fatality predictions at the Wind Farms. Critical decision points included 1) whether or not to include post-construction eagle use data, 2) whether or not to model predicted take at the Wind Farms separately or as one combined project, and 3) how many eagle minutes should be used for each eagle observed pre-construction.

Based on recommendations by the USFWS, the dataset analyzed was limited to eagle observations made prior to construction as these data are the most parsimonious with the assumptions made by the model. Therefore, eagle use data were limited to the pre-construction avian point-count surveys conducted at PVWF from September 2009 through August 2010 (WEST 2011); pre-construction eagle use data were not collected at GMWF. Although some of the PVWF survey points fell outside of the current PVWF footprint, they were included in the analysis because they occurred within the mean inter-nest distance (4 miles) for bald eagles in or near the combined Wind Farm footprints.

Xcel, in consultation with the USFWS, modeled predicted take at the Wind Farms as one wind farm with two different types of turbines. This is consistent with the ECP Guidance which further defines “Project Area” as “the area that includes the project footprint as well as contiguous land that shares relevant characteristics”. Percentages of habitat types for the Wind Farm footprints are similar, as depicted in Table 2 and on Figure 3. At the closest point, the turbines from the Wind Farms are only 1 mile apart. Based on this approach, the eagle minutes recorded pre-construction at PVWF were assumed to be representative of eagle use at GMWF. Similarly, the hazardous area was calculated using all turbines from both Wind Farms to calculate the expansion factor (below).

Because the pre-construction avian surveys did not record eagle minutes, the number of eagle sightings from these surveys were converted to estimated eagle minutes of exposure by assuming that each sighting equaled two minute of exposure. This deviates from recommendations in the ECP Guidance for analyses of point-count data lacking eagle exposure minutes (USFWS 2013); but was recommended by USFWS (Leslie New, Washington State University, Vancouver, Washington, personal communication on June 1, 2017) as the most biologically-supported assumption based on their recent review of eagle use data collected at numerous wind facilities nationwide.

**Exposure rate.** The exposure rate,  $\lambda$ , is the expected number of exposure events ( $\tau$ , eagle minutes) per daylight hour per square kilometer. In the ECP Guidance, the USFWS defined the prior distribution for exposure rate for eagles based on information from a range of projects under USFWS review, as well as others described with sufficient detail (Whitfield 2009). Tetra Tech used the prior distribution for exposure rate published in the ECP Guidance (Gamma [0.97, 2.76] resulting in mean of 0.352 and standard deviation [SD of 0.357]). The posterior distribution for exposure rate is produced using the prior distribution and the minutes of eagle exposure measured during point counts ( $\tau$ ). The new posterior  $\lambda$  parameter is the sum of the mean of the prior distribution and the eagle minutes observed ( $\tau$ ), with the SD of the posterior distribution determined by the number of point counts performed (N).

**Collision probability.** Collision probability (C) is the probability of an eagle colliding with a turbine given an eagle's exposure to turbine collisions (1 minute of flight in the hazardous area). For the purposes of the model, all collisions are assumed fatal and all flight paths are assumed to be independent. In the ECP Guidance, the USFWS provides a prior collision probability distribution for this variable based on the Whitfield (2009) study of avoidance rates of golden eagles from four independent sites (Beta (2.31, 396.69) resulting in mean of 0.0058 and SD of 0.0038). Because there is no comparable empirical distribution for bald eagles in the published literature, USFWS currently recommends predicting bald eagle annual take using the Bayesian collision risk model with the prior collision probability distribution developed for golden eagles. USFWS intends to develop a more accurate estimate of collision probability for bald eagles in the future (USFWS 2016).

**Expansion factor.** The expansion factor ( $\epsilon$ ) scales the resulting per-unit fatality rate ( $\lambda C$ , fatalities per hour  $\times$  km<sup>2</sup>) to the total daylight hours, T, in 1 year (or other time period if calculating and combining fatalities for seasons or stratified areas) and total hazardous area (km<sup>2</sup>) within the wind farm footprint (Equation 2):

$$\epsilon = T \sum_{i=1}^{n_t} \delta_i \quad \text{Equation 2}$$

where  $n_t$  is the number of turbines and  $\delta$  is the hazardous area surrounding a turbine. The model used is constrained to eagle use that occurred at or below 200 meters aboveground and assumes that eagle flights occur only during daylight hours. The hazardous area for the Wind Farms was calculated using two turbine types because the rotor radii of the turbines differ between the two Wind Farms (Table 10b). The two hazardous areas were multiplied by the number of turbines of each respective turbine type and then summed to calculate the total hazardous area. The units for  $\epsilon$  are hour·km<sup>2</sup> per year.

To determine the distribution for the predicted annual fatalities, the exposure and collision risk distributions need to be multiplied by each other and expanded (Equation 1). The resulting distribution cannot be calculated in closed form; therefore, the model generates it through 100,000 simulations.

Following the ECP Guidance, Tetra Tech used the Bayesian collision risk model to predict an annual fatality rate as the mean and upper 80 percent credible limit (CL) of the posterior distribution of F. The upper 80 percent CL represents the fatality rate below which 80 percent of the projected fatality rates fell during the 100,000 simulations (i.e., the 80th percentile). A straightforward interpretation of the 80 percent upper CL is that there is an 80 percent probability that the actual fatality rate will be at or below this limit. The upper 80 percent CL is used by USFWS to manage eagle take permits because it provides a conservative estimate of the fatality rate that may occur at a given facility and helps account for uncertainty.

### 9.1.1 Fatality Inputs

Data inputs for the calculation of exposure rate consisted of minutes of eagle exposure over the combined area of the Wind Farms. As noted above, the pre-construction use data collected at PVWF is assumed to be representative of eagle use at GMWF for which no use data is available. Four bald eagles were observed at PVWF during 130.2 hours of avian point count surveys over all seasons, but the summer 2010 observation was of a perched bald eagle (Table 10a). Only minutes of eagle use while in flight are included in the model per the ECP Guidance; therefore, the observation of the perched eagle was excluded for modelling purposes. As a result, a total of 6 bald eagle minutes, two per eagle observation in flight, were used in the model (Leslie New, Washington State University, Vancouver, Washington, personal communication on June 1, 2017) (Table 10a).

**Table 10a. Data Inputs for the USFWS Bayesian Eagle Fatality Model – Exposure Rate**

Season and Year <sup>1</sup>	Number of Counts <sup>1</sup> (converted to hours)	Number of Bald Eagle Observations <sup>2</sup>	Number of Bald Eagle Minutes <sup>1</sup>
Fall 2009	40.1	0	0
Winter 2009-2010	20.3	3	6
Spring 2010	34.8	0	0
Summer 2010	35	1	0
<b>Annual Total</b>	<b>130.2</b>	<b>4</b>	<b>6</b>

<sup>1</sup> Survey data are from pre-construction avian point counts performed at PVWF; no pre-construction use data are available from GMWF.

<sup>2</sup> Summer 2010 observation was of a perched eagle and did not count as eagle minutes for the model.

**Table 10b. Data Inputs for the USFWS Bayesian Eagle Fatality Model – Hazardous Area**

Daylight Hours Per Year	No. of Turbines, Respective Blade Radius	
	PVWF	GMWF
4,461.55	100 turbines, 50 meters	67 turbines, 38.5 meters

### 9.1.2 Fatality Predictions

The mean predicted baseline annual fatality rate of bald eagles at the Wind Farms is 0.750 bald eagles per year with an upper 80 percent CL of 1.122; (Table 11). Because USFWS uses the upper 80<sup>th</sup> percent CL in determining allowed incidental take, the 1.122 is multiplied by 5 (years) and rounded to the nearest integer which translates to six bald eagles over a 5-year permit period.



**Table 11. Predicted Take for Bald Eagles at the Wind Farms**

Mean Exposure Rate	Standard Deviation of Exposure Rate	Mean Annual Predicted Fatalities	Standard Deviation of Predicted Fatalities	Upper 80 <sup>th</sup> Percent Credible Limit <sup>1</sup>
0.026	0.010	0.750	0.595	1.122

<sup>1</sup> Value of Upper 80<sup>th</sup> Percent Credible Limit will be used in determining final take limit.

The values provided in Table 11 serve as the baseline fatality predictions for the combined Wind Farms. The baseline fatality prediction in Table 11 has not been adjusted to account for the implementation of avoidance and minimization measures (Section 10.0). The predicted annual fatality rate is therefore, upwardly conservative.

## 10.0 AVOIDANCE AND MINIMIZATION OF RISKS DURING OPERATION INCLUDING CONSERVATION MEASURES

### 10.1 Operational BMPs

This section identifies impact avoidance and minimization measures (BMPs) specific to eagles that Xcel has incorporated during operation of the Wind Farms and will further implement going forward. Parallel measures considered during siting and construction are described in Sections 6.0 and 7.0, respectively. General avoidance and minimization measures that will benefit wildlife in general are described in the BBCS documents. Additional details regarding nest removal and curtailment actions can be found in the Technical Assistance letters (Appendix C).

- March – August 2016 - To reduce collision risk of bald eagles, Turbines 16, 17, and 18 were curtailed because of their proximity to nest 2016-01 which was active with one eaglet present in the nest. The turbines were curtailed until the eaglet fledged the nest and limited eagle activity was seen in the vicinity.
- December 2016 - To reduce collision risk to nesting bald eagles and their offspring, Nest 2016-01 was removed in accordance with permits from the USFWS and MNDNR.
- February 2017 - Five subsequent nests built in the location of Nest 2016-01 were removed under permits from USFWS and MNDNR (see Section 8.4.2).
- April 2018 - In order to better document nesting and fledging behavior, and inform possible curtailment and other eagle protection actions, a camera was installed on Turbine 17 in April 2018 which allows views into the nest near the turbine.
- June – September 2018 - To reduce collision risk of bald eagles, Turbine 17 was curtailed



from one hour before dawn to one hour after sunset between the first “branching” activity by the juvenile in Nest 2016-01. This curtailment was agreed to by USFWS and based on experience gained during the curtailment employed in 2016.

- Eagles attempting to build a nest near a turbine will be discouraged by using non-lethal scare devices or tactics. An eagle depredation permit has been obtained for both Wind Farms authorizing this activity, and non-lethal eagle hazing activities were carried out in the vicinity of former Nest 2016-01 in early 2017. USDA APHIS WS has provided O&M staff with training in the proper use of non-lethal hazing techniques (see Section 8.4.3).
- Xcel will develop a policy directing potential curtailment of turbines and other management actions in the event of new eagle nests being built within the Wind Farm footprints and will work with USFWS to determine the appropriateness of nest removal permits and depredation activities.
- Site personnel have received training on avoiding disturbance or harassment of eagles or eagle nests.
- Site personnel have received training on identifying and reporting eagle nests.
- APLIC (2006, 2012) recommendations for overhead utilities maintenance will be followed to reduce risk of eagle electrocution and collision with electrical components.
- All post-construction monitoring (mortality monitoring, eagle use, and nest monitoring) data will be used to help determine both spatial and temporal eagle risk across the Wind Farms, so that any kind of operational minimization can be strategic.
- To reduce the collision risk of bald eagles, guyed temporary meteorological towers were removed and replaced with a non-guyed permanent lattice tower for meteorological monitoring. In the event that temporary towers may be installed as part of an operational assessment of the Wind Farms, guy wires will be marked with marker balls to improve visibility to birds and reduce collision risk for bald eagles.
- Rock and brush piles that could create prey habitat located adjacent to wind turbines will be removed to reduce prey sources for eagles and other raptors, including golden eagles in risk areas. Creation of these features will be prevented, to the extent practicable.
- Road kill or other large carcasses within the public right-of-way at the Wind Farms will be cleared by site personnel within 24 hours of discovery to avoid attracting bald eagles because bald eagles scavenge road-killed animals. Site personnel have developed guidelines for disposal of animal carcasses that are used at the Wind Farms (See Appendix B).

## 10.2 Operational Monitoring

This section provides a brief overview of all operational bald eagle monitoring for the Wind Farms and explains in detail monitoring that will be conducted to document compliance with an eagle incidental take permit.

As previously described, post-construction monitoring for bats occurred at GMWF in 2013-2014 and for all birds and bats at PVWF in 2016-2017 (see Section 8.3). O&M staff have monitored the Wind Farms for eagle fatalities, and as described below, will continue to do so for the life of the Wind Farms. Following the issuance of an ETP, Xcel will conduct eagle fatality monitoring. Xcel will also monitor and record eagle nests in and around the Wind Farms (see Section 10.2.1). As described in Section 10.2.3, permit compliance monitoring will be adaptively managed throughout the life of the Wind Farms to maintain accuracy and precision of the resulting fatality estimates.

### 10.2.1 Fatality Monitoring

The objective of bald eagle fatality monitoring is to accurately estimate the number of bald eagle fatalities, if any, associated with the Wind Farm operations. Because no monitoring protocol can ensure a complete census of fatality events, the methodology has been designed using a probabilistic approach to identify a protocol that produces a high level of statistical confidence in the monitoring results. The following sections describe fatality monitoring for bald eagles to be used at the Wind Farms to measure permit compliance.

### 10.2.2 Ongoing Baseline Monitoring

O&M staff will conduct ongoing baseline monitoring for eagle fatalities each time a turbine is visited (maximum of once per day) as an auxiliary effort to regular operations and maintenance activities. All operations personnel will be trained to identify eagles, eagle nests, and other potential wildlife conflicts and the proper responses. Refresher training will be conducted on an as-needed basis as a response to staff turnover or changes in operations. O&M staff will be directed to an Xcel Environmental Services contact if questions or concerns arise. Incidentally found eagles and other wildlife will be documented for the life of the Wind Farms, and wildlife concerns will also be documented, if necessary.

### 10.2.3 Permit Compliance Monitoring

Following the issuance of an ETP, Xcel will conduct permit compliance monitoring to document compliance with the ETP. Permit compliance monitoring will be adaptively managed throughout the 5-year permit period in coordination with USFWS and will consist of both systematic and incidental monitoring. Two years of systematic monitoring (see Section 10.2.3.1) will be conducted following issuance of the ETP. Systematic monitoring in ETP years 3-5 will be discussed by Xcel and USFWS during Year 2 of systematic monitoring. Incidental monitoring (see Section 10.2.3.2) will be conducted over the entire 5-year period of the ETP.

### *10.2.3.1 Systematic Monitoring*

Xcel will implement systematic monitoring for the first 2 years after issuance of the ETP. The study design detailed below (Sect. 10.2.1.2) will be used for systematic monitoring in Years 1 and 2. The results of the first two years of systematic monitoring will be evaluated by Xcel and USFWS to determine if further systematic monitoring is needed during years 3-5 of the ETP period. If additional systematic monitoring is warranted, the monitoring design will be determined by the results obtained in Years 1 and 2.

Because no monitoring protocol can ensure a complete census of fatality events, the methodology described below was designed based on a power analysis to identify a protocol that produces a high level of statistical confidence in the monitoring results. The appropriate level of precision of the resulting fatality estimates will be developed in consultation with USFWS. After completion of the Years 1 and 2 of systematic monitoring, results will be examined by Xcel, in coordination with USFWS, relative to the assumptions made regarding search parameters and the level of precision of the resulting fatality estimate. Should results from Years 1 and 2 of systematic monitoring 1) differ substantively from the assumed search parameters, 2) not reach the appropriate level of precision, or 3) produce estimates of take greater than anticipated, Xcel will adaptively manage Years 3 -5 as appropriate in coordination with USFWS.

### **Study Design**

The following study design is specific to systematic monitoring during Years 1 and 2 following issuance of the ETP. If systematic monitoring is determined to be warranted in any of the Years 3-5, an appropriate study design, agreed upon by USFWS and Xcel, will be developed specific to that time period. Fatality searches will be conducted at all 160 of the turbines located at the Wind Farms, once every 28 days during Years 1 and 2 of systematic monitoring. If carcass persistence times as estimated from bias trials are not meeting the 30-day expectation, or exceeding the 30-day expectation, Xcel will evaluate the search interval in coordination with USFWS and may adjust the interval to optimize detection probability for eagles.

A circular search plot centered on the turbine with a radius of 115 meters will be used as the basis for carcass searches. The Wind Farms are located in an agricultural landscape dominated by row crops which greatly reduces the accessibility by searchers to walk transects within the plots, and also reduces the visibility of potential eagle remains or other animal carcasses. Additional factors limiting the ability of searchers to walk transects throughout the search plots include: plots which extend onto non-participating properties, wetlands and woodlots which cannot be safely traversed, and the requirement of landowners to avoid damaging crops within plots. Therefore, searches will be done from the road and pads year-round. Searchers will search for eagle remains while walking out and back on each access road within 115 meters of the turbine and walking a circle around the turbine on the turbine pad.

During approximately 7 months of the year when crop height does not interfere with searchers' ability to see potential carcasses (i.e., the vegetation outside of the road and pad is less than approximately 12 inches) searchers will also scan the full extent of the search plot from the edge of the road and pad using binoculars and taking advantage of any elevated platforms (such as a vehicle) available. Snow or other factors may also limit searchers ability to detect eagle remains, but this will be accounted for by bias testing. Eagle remains detected within the search plot by the searcher or other personnel, regardless of whether or not the detection occurs during scheduled searches, will be included in fatality estimation and not considered incidental finds. Eagle remains detected outside of the search plot, regardless of when that occurs, will be treated as incidentals and excluded from analysis. Incidental detections of eagle remains will still be reported to USFWS. The sufficiency of the search plot size to sample the carcass spatial distribution will be evaluated by Xcel in coordination with USFWS after the end of Years 1 and 2 of systematic monitoring and may be adjusted, if further systematic monitoring is warranted, to demonstrate permit compliance.

Bias correction trials will also be performed by Xcel in conjunction with searches during Years 1 and 2. Carcass persistence trials will be conducted at least once per season (spring, summer, fall, and winter) during each year of systematic monitoring to evaluate seasonal differences in carcass persistence. At least 15 carcasses will be used per trial, and carcasses will be selected to best represent the size and persistence of eagles. To this end, Xcel will actively pursue obtaining raptor carcasses, under appropriate federal and state permits, for use in trials. To avoid attracting eagles to areas of collision risk, carcass persistence trials will be conducted in areas away from the turbines with substrates that are representative of those found beneath turbines. Field staff will monitor carcasses at regular intervals over an approximately 42-day period. Field staff will record the date when a carcass disappears. Mean carcass persistence (removal time) will be calculated for each season during Years 1 and 2 of systematic monitoring. Trial carcasses will be discretely marked.

Searcher efficiency trials will be conducted simultaneously with carcass persistence trails at least once during each season of systematic monitoring during Years 1 and 2. Approximately 20 percent of project turbines will be included in searcher efficiency trials in a given year of systematic monitoring, and all searchers participating in the systematic monitoring program will be tested. Trial turbines will be selected to be representative of vegetation conditions and topography at the Project. For each season, approximately 15 representative large bird carcasses (e.g., raptors) will be marked and distributed within search plots by field supervisors immediately prior to searches performed by searchers unaware of the trial. In the event that there are insufficient numbers of representative large bird carcasses to conduct both types of bias correction trials, feathered decoys may be used for searcher efficiency trials. Trial carcasses will be distributed within plots based on the expected spatial distribution of eagle fatalities relative to the turbine as modeled by Hull and Muir (2010). Analysis of searcher efficiency will incorporate a distance-sampling approach to estimate the probability distribution of carcass detection throughout the search plot at each of the trial turbines.

#### *10.2.3.2 Incidental Monitoring*

The objective of incidental monitoring is to supplement systematic monitoring and also provide an opportunity to detect and document eagle fatalities and injuries during years of operations when systematic monitoring is not performed. O&M staff will conduct incidental monitoring for eagle fatalities and injuries each time a turbine is visited (maximum of once per day) as an auxiliary effort to regular operations and maintenance activities. All operations personnel will be trained to identify eagles, eagle nests, and other potential wildlife conflicts and the proper responses. Refresher training will be conducted on an as-needed basis as a response to staff turnover or changes in operations. O&M staff will be directed to an Xcel Environmental Services contact if questions or concerns arise. Incidentally found eagles and other wildlife will be documented for the life of the Wind Farms, and wildlife concerns will also be documented, if necessary.

#### *10.2.3.3 Reporting*

Anytime eagle remains are found, they will be left in place, and covered with a large, weighted container. Searchers will assume that eagle remains found are a result of turbine collisions unless FWS determines the cause of death can be clearly attributed to a non-turbine cause. If an injured eagle is found, Xcel Environmental Services will notify USFWS and contact a licensed eagle rehabilitator. Xcel will arrange transportation of the injured eagle to the licensed rehabilitator unless otherwise instructed by USFWS. The protocol for dealing with eagle remains and injured eagles will be included in the operational monitoring protocol and operations personnel will be trained in its execution. A kit containing the materials necessary for the protocol will be provided in the operations and maintenance building.

Any eagle fatality found will be documented on a data sheet and reported to the designated Xcel Energy Environmental Services contact, who will report eagle fatalities to the USFWS Office of Law Enforcement and Region 3 Migratory Bird Permit Office within 24 hours of identification, or the next business day if a fatality is discovered on a federal holiday or weekend. The data will be logged in a tracking spreadsheet maintained by Environmental Services and will be accessible to the facility.

If an eagle fatality is found during either systematic or incidental monitoring, the following information will be recorded on a fatality data sheet:

- Date
- Species
- Age/sex category when possible
- Band number and notation if wearing a band or auxiliary marker
- Observer name
- Turbine number or other identifying character

- Distance of the remains from the turbine
- Geographic coordinates of the remains and turbine
- Habitat/cover type surrounding the remains
- Condition of the remains (entire, partial, scavenged)
- Description of the remains
- An estimate of the time since death (e.g., <1 day, > a week), and how estimated
- Digital photographs of the remains and key identifying characteristics with a scale object
- Information on remains disposition

During systematic monitoring searchers will collect all of the data recommended in Appendix H of the ECP Guidance, including the following, for each search:

- Date
- Start time
- End time
- Interval since last search
- Observer
- Turbine area searched (e.g., string or turbine numbers)
- Weather data (e.g., cloudiness, precipitation, temperature, wind, snow cover)
- Search path
- Vegetation height/type

#### *10.2.3.4 Power Analysis*

In October 2018, Xcel used the fatality estimation program, Evidence of Absence (version 2.0; Dalthorp et al. 2014) to perform a predictive power analysis using the Design Tradeoffs module. The power analysis was run based on Xcel's requested take of 6 bald eagles for the 5-year permit term. The Evidence of Absence software allows a user to design a fatality monitoring protocol to achieve a pre-determined level of statistical power given a range of search parameters (Table 12). If search parameters, such as carcass persistence and searcher efficiency, are not known for a project, typical values from publicly available literature can be used to design a protocol; subsequent analyses can use updated parameter estimates derived from project data. The software uses a Bayesian statistical approach, and statistical power in this approach is quantified as the credibility of an estimate. In this analysis, Xcel used Evidence of



Absence to quantify the credibility (probability) that the total eagle fatalities estimated to occur in 2 years of monitoring did not exceed a threshold of 2 eagles if 1 or fewer eagle fatalities were detected. The estimated fatality threshold of 2 eagles was selected based on the requested level of annual take in the ETP application (upper 80<sup>th</sup> percent credible limit of 1.122 per year, or 6 eagles for the 5-year permit term; Section 9.1.2).

Each of the search parameters and selected model inputs for the Design Tradeoffs module in Evidence of Absence are summarized in Table 12. The parameters of spatial coverage, searcher efficiency, and search interval (numbers 1, 4, and 7) were modeled using a range of input values. Spatial coverage refers to the proportion of the actual carcass spatial distribution that is searched, and it is a function of both the proportion of the turbines searched and the proportion of the carcass spatial distribution around each turbine that is searched. Xcel used information from fatality monitoring performed at PVWF in 2016-2017 (Tetra Tech 2016e), a large bird carcass spatial distribution estimated from publicly available empirical data (Tetra Tech 2017c unpublished data), and the ballistics distribution models produced by Hull and Muir (2010) to estimate the proportion of the large bird carcass spatial distribution that would be searched by a given plot size. The combined searchable area of road and pads among all turbines at PVWF was estimated to encompass 20 percent of the large bird carcass spatial distribution. In comparison, full square plots extending 113 m from the turbine on each side (total plot size: 226 m x 226 m) were estimated to encompass 98 percent of the large-bird carcass spatial distribution around the “large” rotor diameter search turbines (150 m maximum blade tip height [MBTH]; Hull and Muir 2010). Therefore, a range of 20 - 100 percent spatial coverage was modeled. Large bird searcher efficiency achieved at PVWF in 2016-2017 varied seasonally from 0.95 - 1.00 (90% CI = 0.88 - 1.00 and 1.00-1.00 respectively). To be conservative and encompass alternate search methods (e.g., scanning with binoculars instead of walking transects), a range of 50 - 90 percent searcher efficiency was modeled. Based on typical carcass persistence values for large birds (see below), a range of 14 - 28 days was modeled for the search interval because carcasses would be expected to persist at least as long as the search interval.

The remaining parameters (numbers 2, 3, 5, and 6 in Table 12) were modeled using fixed values that are known or are strongly supported by published research. Temporal coverage was expected to be 99 percent because monitoring will occur continuously over the entire 2 years. For carcass persistence, published data suggest that carcasses of large raptors persist at least 30 days (e.g., NWC and WEST 2007; Gritski et al. 2010), with mean persistence as high as 128 days reported for some projects (Rabie et al. 2014). Xcel used a carcass persistence time of 30 days for the modeling effort because this value is expected to be more indicative of the actual persistence of eagle remains, based on the findings of DeVault et al. (2017) and research cited above, than results of trials at PVWF which had seasonal carcass persistence times up to 10 days using ring-necked pheasant (*Phasianus colchicus*) carcasses (Tetra Tech 2016e). Carcass arrival rate was assumed to be uniform given that eagle fatalities are expected to be a rare event and occur more or less at random. A value of 67 percent was modeled for the rate at which searcher efficiency for a given carcass may change between successive searches based on recommendations by

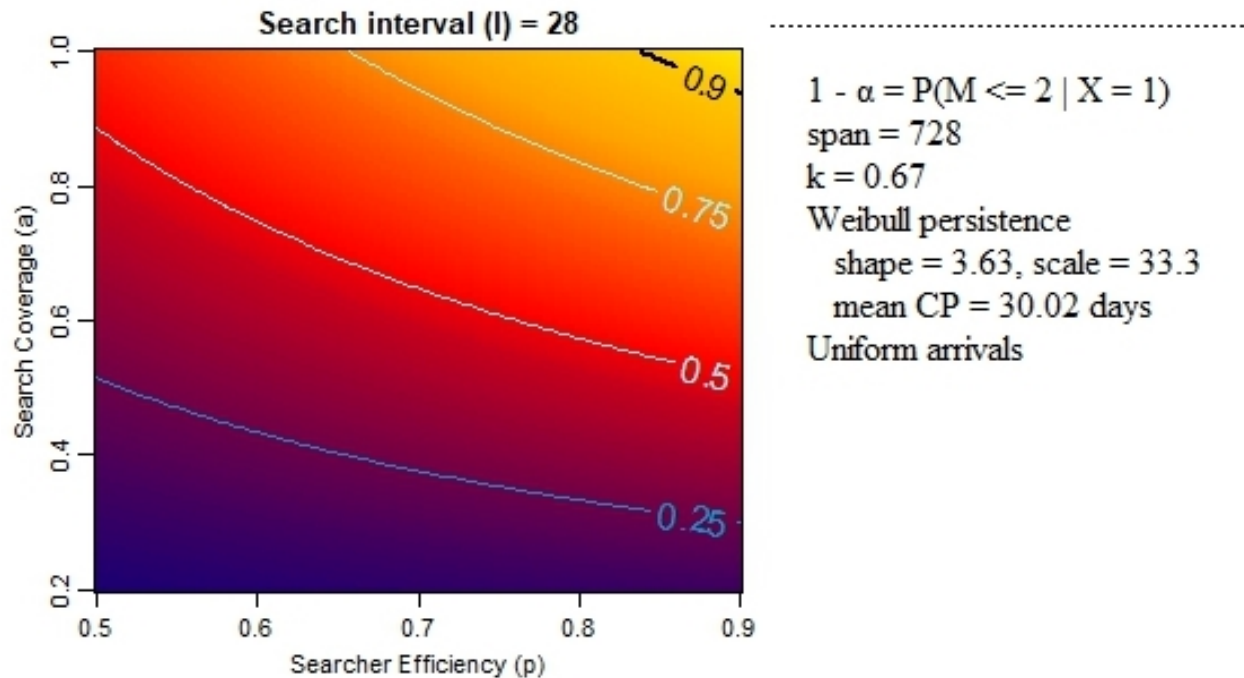


Manuela Huso (pers. comm.).

The predictive power analysis indicated that searching approximately 60 percent of the large bird carcass spatial distribution around turbines at intervals of 28 days will provide 50-percent certainty that no more than two bald eagle fatalities occurred during a 2-year monitoring period if no more than one set of bald eagle remains are found (Figure 9). To ensure sampling of 60 percent of the carcass distribution, it may be necessary to search at all of the turbines given that there are unsearchable areas around some of the turbines. Conclusions regarding search parameters depend on the assumptions that eagle remains persist for an average of 30 days and that searcher efficiency for bald eagles averages at least 80 percent. The assumptions of these parameters will be analyzed for the Wind Farms after the Years 1 and 2 of systematic monitoring.

**Table 12. Parameters in the Predictive Power Analysis of Fatality Monitoring Design**

No.	Key Search Parameters for Fatality Monitoring	Model Input Values
1	Spatial Coverage – proportion of the carcass spatial distribution sampled, a random variable	Varied from 0.2 to 1.0
2	Temporal Coverage – proportion of the year that is monitored	Used 0.99
3	Carcass Persistence – the time a carcass is available for detection, a random variable	Weibull distribution: alpha= 3.6317, beta=33.27656 for mean CP time = 30 days, r (probability of persistence to next search) = 0.9 for a search interval of 28 days.
4	Searcher Efficiency – probability of finding a carcass given that it is available for detection in the searched area	Varied from 0.5 to 0.9
5	Carcass arrival rate, a random variable	Uniform probability model, indicating no expectation of seasonal variation
6	Factor by which searcher efficiency changes between searches, which accounts for decreasing detectability of carcasses not found on the first search	Used 0.67 based on personal communication from M. Huso
7	Search Interval – the interval in days between successive searches, a random variable	Varied from 14-28 days



**Figure 9. Output from Evidence of Absence Design Tradeoffs Module** indicating the probability that no more than 2 eagle fatalities are estimated to have occurred at the Project assuming that 1 fatality is detected during 2 years of systematic searches as a function of search coverage (y-axis) and searcher efficiency (x-axis). Graph displays the probability distribution for a search interval of 28 days. A 50-percent credibility is achieved by all combinations along the line labeled 0.5.

If sample size of observed fatalities is sufficient, fatality rate estimation typically uses a statistical estimator like the Huso estimator (Huso 2011) to calculate the Project-wide fatality rate (eagles/turbine/year and eagles/MW/year). Due to the low anticipated fatality rate at the Project ( $\leq 1.2$  eagles per year) Xcel does not anticipate there will be sufficient sample size of fatalities ( $\geq 5$ ) in any search year to use a standard estimator. Instead, Xcel propose to use the Evidence of Absence estimator (Dalthorp et al. 2014) to produce an estimate of the most probable number of bald eagles killed during each year of monitoring (i.e., the highest probability number of fatalities in the posterior probability distribution). After the completion of the first two years of fatality monitoring, Xcel will evaluate the approach to analysis of monitoring data in coordination with USFWS and modify if warranted. Output from the estimator will also be used to identify the probability that no more than two eagle fatalities occurred during the two-year monitoring program given the parameters of the search protocol. Key inputs to the fatality estimation include the following:

- Search interval;
- Observed number of remains found during standardized searches during the

monitoring program for which the cause of death can be attributed to facility operation;

- Mean carcass persistence in days with confidence interval; and
- Searcher efficiency expressed as the probability of trial carcasses found by searchers during searcher efficiency trials.

Output from Evidence of Absence will resemble the example shown in Figure 9. In the example, the most likely number of fatalities based on the search was 0, which corresponds to a probability value of 0.50. However, there is some probability based on the survey design that the actual number of fatalities was different from 0. The cumulative probability for fatality  $\leq 2$  is 0.90, indicated 90 percent credibility in the statement that fatalities did not exceed 2 during the monitoring period.

#### *10.2.3.5 Searcher Training*

The dedicated searcher (s) will be trained to follow the search procedure, fill out the reporting form, and take appropriate photographs for identification. Training will include searcher efficiency testing on appropriately sized test carcasses. Training will be performed by qualified consultants or qualified in-house environmental staff. Identification and aging of carcasses will be performed by external consultants or species experts. Training specifics will be described within the environmental monitoring program protocol. Further, a detailed monitoring protocol, including instructions for reporting an injured eagle or eagle remains will be provided to all personnel and will be readily available in the O&M building. Any new fatality searchers joining the program will undergo training and periodic searcher efficiency testing to ensure that the rigor of the searches remains sufficient for the permit compliance monitoring.

## **10.3 Additional Surveys**

### **10.3.1 Nest Monitoring**

Eagle nest surveys will be conducted by aircraft within the Project footprint plus a 2-mile buffer each year for the first 2 years after eagle incidental take permit issuance to document the activity of known eagle nests and to locate any eagle nests not documented in 2013, 2014, 2015, 2016, and 2017. Aerial nest searches within the Wind Farm footprints, as well as the 2-mile buffer, will be conducted for eagle nests once in March or April to detect occupancy, at any known eagle nests and detect newly constructed nests. The March-April survey will be followed no less than 30 days later with a ground-based survey to document occupancy, productivity to the degree possible, and nest success of the nests located during the aerial survey. Information gathered during nest monitoring will be used to inform best management practices in consultation with USFWS.

The choice of a 2-mile nest monitoring buffer is based on the ECP Guidance which recommends using the Project Area  $\frac{1}{2}$ -mean inter-nest distance to identify eagle nests that may potentially be

disturbed by the operation of the Wind Farms, except in cases where this distance might provide a misleading estimate of eagle movement distances, such as in the case where attractant features are closer to nests than the Wind Farm footprints. The Project Area  $\frac{1}{2}$  -mean inter-nest distance is 2 miles and would therefore encompass this distance.

Nest surveys will be conducted consistent with the ECP Guidance (USFWS 2013) so that a conclusion regarding occupancy, productivity, and nest success can be reached. The ground-based nest surveys will be conducted from roadways within the search area and will focus on stands of trees in suitable nesting habitat for bald eagles. Occupancy determinations from ground-based surveys will be based on observations of up to 4 hours each per visit to each nest structure. Xcel will maintain and monitor the camera on Turbine 17 to record eagle nesting activities near that turbine for as long as nesting is attempted at this site. This will allow Xcel and USFWS to document and respond to bald eagle behavior, and adaptively manage to avoid risk to the eagles.

### **10.3.2 Adaptive Management**

The adaptive management protocol presented in Table 13 will be implemented to ensure that Xcel stays within the take authorized by the ETP. Xcel and USFWS will meet on an annual basis to evaluate projected take based on cumulative compliance monitoring results and decide on appropriate response actions, if any. Eagle fatality estimates (projected take) will be generated using a fatality estimator that considers the number of eagles found within the search plot as well as carcass persistence rates, searcher efficiency, and the probability that an eagle would fall into a searched area. It is anticipated that an EoA estimator will be used to predict possible fatality rates; however, an alternative estimator could be used if improved techniques become available and are agreed upon by Xcel and the USFWS.

The first year of monitoring may not provide enough data to allow informed decisions to be made on appropriate adaptive management actions during the first annual compliance check; therefore, Xcel anticipates that the only reasonable response action in year one will be to revise year two monitoring protocol, if warranted. A tiered approach will be utilized for Years 2 through 4 where advances in the stepwise response will be commensurate with the degree to which authorized take is projected to be exceeded and/or the time remaining in the permit term is so short that more significant action is necessary to maintain compliance with the permit conditions. Xcel intends this approach to be flexible, with the potential for more than one tier level to be carried out in response to a single trigger event or for tiers to be skipped if the response is not situation-appropriate. All response actions in the table below will be undertaken in coordination with USFWS using best available science and all project-specific information collected to date.

**Table 13. Bald Eagle Adaptive Management at Yearly Compliance Checks**

<b>Results of Annual Cumulative Take Assessment</b>	<b>Response<sup>1,2</sup></b>
Projected take ≤ Authorized take	No action other than continued implementation of conservation measures outlined in the ECP will be required.
Projected take > Authorized take	<p><i>Tier 1:</i> Evaluate cumulative monitoring effort to date to assess whether take estimate may be inflated by limitations in survey design. If the Service and the Applicant conclude that additional monitoring years and/or revised monitoring results in a lower, more representative take estimate, then the Applicant will design and implement a revised fatality monitoring protocol in coordination with the Service. If changes to monitoring are unlikely to bring projected take below authorized take, then the Applicant will proceed to more advanced tiers.</p> <p><i>Tier 2:</i> Assess available necropsy reports and other information on any observed eagle fatalities to determine if the cause or contributing risk factors can be determined (e.g. lead/rodenticide poisoning, disease, nest proximity, weather, presence of prey/carrion, season, etc.). Evaluate existing survey data or conduct additional surveys (e.g. nest surveys, flight path surveys, etc.), as needed, to assess for potential correlations in risk factors or a change in eagle use that explains the higher than expected take estimate. The Applicant has committed to a cost cap of \$75,000 per year to these additional monitoring efforts.</p> <p><i>Tier 3:</i> Use information collected in previously implemented Tiers regarding potential risk factors to design and implement conservation measures to further avoid or minimize risk to eagles, including but not limited to targeted seasonal turbine curtailment near nests or other areas of assumed eagle risk. Nest removal will also be explored. The Applicant has committed to a cost cap of \$100,000 (including revenue losses from curtailment) to these efforts.</p> <p><i>Tier 4:</i> If previously implemented mitigation/minimization efforts have failed to sufficiently reduce projected take under authorized take levels, a permit amendment to increase the permitted take will be evaluated. Work with the Service to determine if additional environmental analysis is necessary, including a supplemental assessment of proposed increased permitted take. If needed, ETP will be amended as appropriate.</p> <p><i>Tier 5:</i> Use information collected in previous Tiers to design and implement conservation measures to further avoid or minimize risk to eagles, including but not limited to additional turbine curtailment, detection/deterrent technology in conjunction with curtailment, rodenticide reduction/education program, lead abatement and education program for hunters, and/or implementation and testing of a carrion removal program. The Applicant has committed to a cost cap of \$200,000 per year to these efforts.</p>

<sup>1</sup> Nothing in this table authorizes the permittee to exceed the level of take authorized in the programmatic take permit. The purpose of the table is to describe how the permittee will respond to data that indicates additional measures may be needed to ensure compliance with permit conditions.

<sup>2</sup> Thresholds are not intended to be applied cumulatively, i.e., if three eagles are found in a single event, the Wind Farms may

Results of Annual Cumulative Take Assessment	Response <sup>1,2</sup>
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employ Tier 3 measures without having to first employ Tier 1 and 2. Evaluations will be compared to the threshold levels on the table, which are intended to signal rates of take that may lead the Wind Farms to exceed their anticipated permit level of six eagles per 5-year permit term if additional conservation measures are not employed. Conservation measures at each step in the table are intended to be commensurate with the level of impact indicated.

## 11.0 REPORTING

### 11.1 USFWS Eagle Fatality Reporting

Xcel has obtained Special Purpose – Utility (SPUT) permits for GMWF and PVWF (MB02038C-0 and MB99202B-0) to transport and temporarily possess carcasses of migratory birds. These permits require Xcel to notify USFWS of any fatalities of migratory birds and sets requirements for reporting of eagle fatalities and quarterly and annual reports. Xcel will also prepare a written memorandum that contains a summary of fatalities and a discussion of correlations of risk for any eagle fatalities that may occur, as well as a description of any conservation measures implemented to reduce risk. Annual reports will be provided to USFWS for review. Any-eagle fatalities or injuries will be reported within 24 hours of discovery to the USFWS, OLE Resident Agent in charge and the Region 3, Migratory Bird Permit Office.

### 11.2 State Reporting

Per the LWECS Site Permit for GMWF, the Department of Commerce, MNDNR, and USFWS will be notified after the discovery of any of the following extraordinary events: one or more dead or injured state or federally listed species; or one or more dead or injured bald or golden eagles; or five or more dead birds or bats found over a 5-day period.

For PVWF, Xcel will file with the Minnesota Public Utilities Commission (MPUC) an annual report detailing findings of its post-construction monitoring. The annual report will include summarized and raw data of bird and bat fatalities and injuries and will include bird and bat fatality estimates for the Wind Farms using agreed upon estimators from the prior calendar year. The annual report will also identify any deficiencies or recommended changes in the operation of the Wind Farms to reduce avian and bat fatalities and will provide a schedule for implementing the corrective or modified actions. Xcel will provide a copy of the report to the MNDNR and USFWS at the time of filing with the MPUC.

In accordance with the LWECS Site Permit for PVWF, quarterly wildlife incident reports will be provided to the MPUC, MNDNR, and USFWS for the life of the Site Permit. Furthermore, the MPUC, MNDNR, and USFWS will be notified within 24 hours of the discovery of any of the following: five or more dead or injured non-listed or migratory avian or bat species within a 5-



day period; or an incident of one or more dead or injured state threatened, endangered, or species of special concern; or one or more dead or injured federally listed species; or one or more dead or injured bald or golden eagles.

Xcel obtained a Special Permit (21092) from the MNDNR for both Wind Farms allowing the salvage of protected birds and mammals during post-construction monitoring. The permit is valid for salvage of state or federal endangered or threatened species provided the MNDNR and USFWS are notified within 24 hours if any state or federally listed species (endangered, threatened, or special concern) are found dead or injured. This permit sets requirements for annual reporting of activities carried out the previous year.

## 11.3 Permit Compliance Reporting

After ETP issuance, Xcel will prepare yearly reports that provide documentation of the methods and results for the permit compliance monitoring study years at the Wind Farms. Each eagle fatality monitoring report will include an analysis of spatial and temporal information on remains detected along with estimated fatality rates for eagles. Estimated fatality rates will be calculated using the total number of remains found during searches within search plots along with data from searcher efficiency and carcass removal trials, per the Evidence of Absence estimator or other USFWS statistical estimator tool.

## 12.0 LITERATURE CITED

- Allison, T.D. 2012. Eagles and Wind Energy: Identifying Research Priorities. A white paper of the American Wind Wildlife Institute, Washington, DC.
- APLIC (Avian Power Line Interaction Committee). 2006. Suggested practices for raptor protection on power Lines; the State of the Art in 2006. Edison Electric Institute, APLIC and the California Energy Commission Washington, D.C and Sacramento, CA.
- APLIC. 2012. Reducing avian collisions with power lines: the state of the art in 2012. Edison Electric Institute and APLIC. Washington, D.C.
- Buehler, D. A. 2000. Bald Eagle (*Haliaeetus leucocephalus*). In A. Poole and F. Gill (ed.). The Birds of North America. Vol. 506. The Birds of North America, Inc., Philadelphia, PA, USA.
- Dalthorp, D., M. Huso, D. Dail, and J. Kenyon. 2014. Evidence of absence software user guide: U.S. Geological Survey Data Series 881, doi:10.3133/ds881.
- DeVault, T. L., T. W. Seamans, K. E. Linnell, D. W. Sparks and J. C. Beasley 2017. Scavenger removal of bird carcasses at simulated wind turbines: Does carcass type matter? *Ecosphere* 8(11): e01994-n/a.



- enXco. 2007. Site Permit Application for Large Wind Energy Conversion System. PUC Docket No. IP6646/WS-07-839. Wapsipinicon Wind Project, Mower County, Minnesota. Prepared by enXco Development Corporation, Minneapolis, Minnesota.
- Gritski, B., S. Downes, and K. Kronner. 2010. Klondike III (Phase 1) Wind Power Project Wildlife Monitoring Study October 2007–October 2009. Prepared for Iberdrola Renewables, Klondike Wind Power III, LLC, Portland, OR. Prepared by Northwest Wildlife Consultants, Inc. (NWC), Pendleton, Oregon. April 21.
- Homer, C.G., Dewitz, J.A., Yang, L., Jin, S., Danielson, P., Xian, G., Coulston, J., Herold, N.D., Wickham, J.D., and Megown, K., 2015. Completion of the 2011 National Land Cover Database for the conterminous United States-Representing a decade of land cover change information. *Photogrammetric Engineering and Remote Sensing*, v. 81, no. 5, p. 345-354
- Hull, C.L. and S. Muir. 2010. Search areas for monitoring bird and bat carcasses at wind farms using a Monte-Carlo model. *Australasian Journal of Environmental Management* 17: 77-87.
- Hunt, W.G., 2002. Golden eagles in a perilous landscape: predicting the effects of mitigation for wind turbine blade-strike mortality. Consultant report to California Energy Commission under contract P500-02-043F, Public Interest Energy Research. California Energy Commission, Sacramento, USA. Available from: [www.energy.ca.gov/reports/2002-11-04\\_500-02-043F.PDF](http://www.energy.ca.gov/reports/2002-11-04_500-02-043F.PDF)
- Huso, M. M. P. 2011. An estimator of wildlife fatality from observed carcasses. *Environmetrics* 22:318-329.
- MOU (Minnesota Ornithologists' Union). 2016. Golden Eagle Occurrence Maps. Available online at <http://moumn.org/cgi-bin/occurrence.pl?species=GoldenEagle&size=small&group=hawks&season=all>.
- NEC (National Eagle Center). 2016. Golden Eagle Project. Available online at <https://www.nationaleaglecenter.org/golden-eagle-project>.
- NWC (Northwest Wildlife Consultants, Inc.) and WEST (Western EcoSystems Technology, Inc.). 2007. Avian and Bat Monitoring Report for the Klondike II Wind Power Project. Sherman County, Oregon. Prepared for PPM Energy, Portland, Oregon. Managed and conducted by NWC, Pendleton, Oregon. Analysis conducted by WEST, Cheyenne, Wyoming. July 17.
- Rabie, P., K. Adachi, W. Erickson, K. Taylor, K. Bay, T Mattson, E. Hallingstad and J. Roppe. 2014. Efficient and effective eagle monitoring protocols. Paper presented at National Wind Coordinating Collaborative Research Meeting X, Broomfield Colorado.
- RES (Renewable Energy Systems Americas Inc.). 2009. Fatal Flaw Analysis. Pleasant Valley Project, Dodge and Mower Counties, Minnesota. Prepared by McGhie & Betts

Environmental Services, Inc., Rochester, Minnesota for Renewable Energy Systems Americas Inc., Broomfield, Colorado.

RES. 2010. Application for Large Wind Energy Conversion System Site Permit. MPUC Docket No. IP6828/WS-09-1197. Pleasant Valley Wind, LLC., Dodge and Mower Counties, Minnesota. Prepared by McGhie & Betts Environmental Services, Inc., Rochester, Minnesota for Renewable Energy Systems Americas Inc., Broomfield, Colorado.

Sharp, L., C. Herrmann, R. Friedel, C. Farmer, and R. MacIntosh. 2012. Bald eagle behavior before and after construction of the Pillar Mountain Wind Project at Kodiak, Alaska, and its effect on modeled collision risk. Presented at the National Wind Coordinating Collaborative Wind and Wildlife Research Meeting IX, Broomfield, Colorado.

Strickland, M. D., E. B. Arnett, W. P. Erickson, D. H. Johnson, G. D. Johnson, M. L. Morrison, J. A. Shaffer, and W. Warren-Hicks. 2011. Comprehensive Guide to Studying Wind Energy/Wildlife Interactions. Prepared for the National Wind Coordinating Collaborative, Washington, D.C., USA.

Tetra Tech. 2016a. 2016 Aerial Eagle Nest Survey. Grand Meadow Wind Farm, Mower County, Minnesota. April.

Tetra Tech. 2016b. 2016 Aerial Eagle Nest Survey. Pleasant Valley Wind Farm, Dodge and Mower County, Minnesota. April.

Tetra Tech. 2016c. 2016 Ground-based Eagle Nest Survey. Pleasant Valley Wind Farm, Dodge and Mower County, Minnesota. June.

Tetra Tech. 2016d. 2016 Ground-based Eagle Nest Monitoring. Pleasant Valley Wind Farm, Dodge and Mower County, Minnesota. March-September.

Tetra Tech. 2016e. 2016-2017 Post-construction Mortality Monitoring Annual Report. Pleasant Valley Wind Farm, Mower and Dodge counties, Minnesota. June 2017.

Tetra Tech. 2017a. Eagle Use Survey Report. Grand Meadow Wind Farm, Mower County, Minnesota. March 2017.

Tetra Tech. 2017b. Eagle Use Survey Report. Pleasant Valley Wind Farm, Dodge and Mower Counties, Minnesota. April 2017.

Tetra Tech. 2017c. Meta-analysis of bird and bat carcass occurrence by distance from wind turbine from North American wind energy facilities. Unpublished Data

USEPA (U.S. Environmental Protection Agency). 2007. Level III and IV Ecoregions of Minnesota. USEPA, Corvallis, Oregon. Available online at [ftp://newftp.epa.gov/EPADDataCommons/ORD/Ecoregions/mn/mn\\_eco\\_desc.pdf](ftp://newftp.epa.gov/EPADDataCommons/ORD/Ecoregions/mn/mn_eco_desc.pdf)

- USFWS (U.S. Fish and Wildlife Service). 2009. Eagle Permits; Take Necessary to Protect Interests in Particular Localities. Final Rule. Federal Register 74(175): 46836-46879. September 11, 2009.
- USFWS. 2012. Land-based Wind Energy Guidelines. Available online at [https://www.fws.gov/ecological-services/es-library/pdfs/WEG\\_final.pdf](https://www.fws.gov/ecological-services/es-library/pdfs/WEG_final.pdf).
- USFWS. 2013. Eagle Conservation Plan Guidance. Module 1 – Land-based wind energy. Version 2. Available online at [www.fws.gov/windenergy/eagle\\_guidance.html](http://www.fws.gov/windenergy/eagle_guidance.html).
- USFWS. 2016. Eagle Permits; Revisions to Regulations for Eagle Incidental Take and Take of Eagle Nests. Final Rule. Federal Register 81(242): 91494-91554. December 16, 2016.
- USFWS. 2017. USFWS Injury and Mortality Database. Accessed by M. Rheude and M. Sadlowski. May 31, 2017.
- WEST (Western EcoSystems Technology, Inc.). 2011. Wildlife baseline studies for the Pleasant Valley Wind Project Area Mower, Dodge, and Olmsted Counties, Minnesota. Final Report September 2009 – October 2010. Prepared by Clayton Derby, Jeff Gruver, and Ann Dahl, June 15.
- WEST. 2013a. Raptor and Bald Eagle Nest Survey Results for the Pleasant Valley Wind Resource Area, Mower, Dodge, and Olmstead Counties, Minnesota. Final Report: May 2013. Prepared by Kristen Chodachek and Ann Dahl, May 23.
- WEST. 2013b. Bat Fatality Rates and Effects of Changes in Operational Cut-in Speeds at Commercial Wind Farms in Southern Minnesota – Year 1. Prepared for Minnesota Department of Commerce. Final Report: May 23, 2014.
- WEST. 2014a. Raptor and Bald Eagle Nest Survey Results for the Pleasant Valley Wind Resource Area, Mower, Dodge, and Olmstead Counties, Minnesota. Final Report: June 2014. Prepared by Todd Matson, Kristen Klaphake, and Joyce Pickle, June 9.
- WEST. 2014b. Pleasant Valley Wind Energy Project Bird and Bat Conservation Strategy. Pleasant Valley Wind, LLC. Final Report: April 2014.
- WEST. 2015. Bat Fatality Rates and Effects of Changes in Operational Cut-in Speeds at Commercial Wind Farms in Southern Minnesota – Year 2. Prepared for Minnesota Department of Commerce. Final Report: November 13, 2015.
- WEST. 2016. Draft Grand Meadow Wind Energy Facility Bird and Bat Conservation Strategy. Prepared for Northern States Power Company Minnesota. Draft Report: April 2016.
- Whitfield, D. P. 2009. Collision avoidance of golden eagles at wind farms under the 'Band' collision risk model. Report from Natural Research to Scottish Natural Heritage, Banchory, UK