Minnesota Public Utilities Commission
Site Permit Application for a Large Wind Energy Conversion System

Bitter Root Wind Project

Yellow Medicine County, Minnesota

Docket No. IP6984 / WS-17-749

November 9, 2017

Project Name:	Bitter Root Wind Farm
Project Location:	Yellow Medicine County, MN
Applicant:	Flying Cow Wind, LLC
Address:	330 2nd Avenue South, Suite 820, Minneapolis, MN 55401
Authorized Representative:	Sean Flannery, Director, Permitting, Americas
Signature:	
Phone:	(612) 455-8449
Email:	Sean.Flannery@res-group.com

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ACRONYMS

Acronym	Definition
AADT	Annual Average Daily Traffic
ACS	American Community Survey
AM	Amplitude Modulation
AMSL	above mean sea level
Applicant	Flying Cow Wind, LLC
Application	Site Permit Application
BBCS	Bird and Bat Conservation Strategy
BMPs	Best Management Practices
BWSR	Minnesota Board of Water & Soil Resources
Ch.	Chapter
Commission	Minnesota Public Utilities Commission
CON	Certificate of Need
CR	County Roads
CRP	Conservation Reserve Program
CSAH	County State Aid Highways
CSW Permit	Construction Stormwater Permit
CWI	County Well Index
dB	Decibel
dB(A)	A-weighted decibel
db(C)	C-weighted scale
db(G)	G-weighted scale
°	Degree
DOC	Minnesota Department of Commerce
EBH	Environmental Bore Hole
ECPG	Eagle Conservation Plan Guidance
EMF	Electromagnetic fields
FAA	Federal Aviation Administration
FCC	Federal Communications Commission
FEMA	Federal Emergency Management Agency
FM	Frequency Modulation
ft	Ft
GIS	Geographic Information System
Hz	hertz
IBA	important bird area
IRAC	Interdepartment Radio Advisory Committee
kV	Kilovolt
kW	Kilowatt
L_{10}	Sound pressure level exceeded 10 percent of the measurement period
L_{50}	Sound pressure level exceeded 50 percent of the measurement period
LPRWS	Lincoln-Pipestone Rural Water System
LURRMO	Land Use and Related Resource Management Ordinance
LWECS	Large Wind Energy Conversion System

Acronym	Definition
m	Meter
m/s	Meters per second
MDPH	Massachusetts Department of Public Health
MDH	Minnesota Department of Health
Merjent	Merjent, Inc.
MISO	Midcontinent Independent System Operator
Minn. R.	Minnesota Administrative Rules
Minn. Stat.	Minnesota Statutes
MNDNR	Minnesota Department of Natural Resources
MnDOT	Minnesota Department of Transportation
MPCA	Minnesota Pollution Control Agency
MPUC	Minnesota Public Utilities Commission
MW	Megawatt
NA	Not Applicable
NAC	Noise Area Classification
NHIS	Natural Heritage Information System
NPDES	National Pollutant Discharge Elimination System
NRHP	National Register of Historic Places
NTIA	National Telecommunications and Information Administration
NWI	National Wetlands Inventory
O&M	Operations and Maintenance
ORVW	outstanding resource value waters
OSA	Office of the State Archaeologist
PEM	Palustrine Emergent Wetland
people/sq. mi	people per square mile
PFO	Palustrine Forested Wetland
Phase I ESA	Phase I Environmental Site Assessment
PM_{10}	Particulate matter
POI	Point of Interconnection
Project	Bitter Root Wind Farm
PSS	Palustrine Scrub-shrub Wetland
PWI	Minnesota Public Waters Inventory
RD	Rotor Diameter
RES	Renewable Energy Systems Americas Inc.
RIM	Reinvest in Minnesota
rpm	Revolutions per minute
SCADA	Supervisory Control and Data Acquisition
SHPO	State Historic Preservation Office
SNA	Scientific and Natural Area
SPA	Site Permit Application
SPCC	Spill Prevention Control and Countermeasure
SSA	sole source aquifers
STH	State Trunk Highways
subd.	Subdivision

Acronym	Definition
SWPPP	Storm Water Pollution Prevention Plan
TMDL	total maximum daily load studies
UMVRDC	Upper Minnesota Valley Regional Development Commission
USACE	United States Army Corps of Engineers
U.S.C.	United States Code
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	United States Geologic Service
WCA	Wetland Conservation Act
WECS	Wind Energy Conversion System
WEG	Wind Energy Guidelines
WHPA	Wellhead Protection Area
WIA	Walk-In Access
WMA	Wildlife Management Area
WPA	Waterfowl Production Area

1. Introduction

Flying Cow Wind, LLC (Applicant), an affiliate of Renewable Energy Systems Americas Inc. (RES), plans to develop the up to 152 megawatt (MW) Bitter Root Wind Project (Project), located in Yellow Medicine County, Minnesota (Figure 1). The Applicant respectfully submits this Site Permit Application (SPA or Application) to the Minnesota Public Utilities Commission (Commission or MPUC) to construct and operate the Project.

The proposed Project is a large wind energy conversion system (LWECS), as defined in the Wind Siting Act (Minnesota Statues [Minn. Stat.] Chapter [Ch.] 216F), with a Project boundary (Project Area) of approximately 22,888 acres in Yellow Medicine County, Minnesota. The Applicant will develop, design, permit, and construct the Project.

The Project was initially developed in 2008 and permitted by the Commission in 2010 as a 138 MW LWECS in Yellow Medicine and Lincoln counties. Because no power purchase agreement was secured at that time, the Project was never constructed, and the LWECS site permit was revoked by the Commission at the request of the previous applicant on May 1, 2013.

The Applicant acquired the Project in 2015 and resumed landowner agreements, environmental studies, and other development activities. The Project is scheduled to begin construction in the first quarter of 2019, with an anticipated in-service and commercial operation date in fourth quarter of 2019, pending Commission and related approvals.

The Project also includes an approximately 10-mile 345 kilovolt (kV) overhead transmission line, which will be entirely located in South Dakota. The Project Substation will be located near the Minnesota/South Dakota border in Deuel County, South Dakota, and will continue west/south in Deuel County until the point of interconnection (POI) located at a planned Otter Tail Power substation, tentatively named the Astoria Substation, anticipated to be built by the end of 2019 in southeastern Deuel County. The transmission line and Project Substation will be permitted separately by the South Dakota Public Utilities Commission and Deuel County.

The Project will interconnect to the Big Stone South to Brookings County 345 kV transmission line that is in-service as of September 2017. This transmission line was energized on September 8, 2017.[1] The Project's queue position in the Midcontinent Independent System Operator, Inc. (MISO) interconnection process is J493. The interconnection details will be determined as a result of studies, discussions, and agreements with the MISO and Otter Tail Power, the transmission owner.

[1] See http://capx2020.com/bss/BigStone-factsheet-Sept-2017.pdf.

2. Applicant Information

RES, through its affiliates, develops renewable energy projects throughout the United States and Canada. RES is one of the top renewable energy companies in North America. The RES group of companies has constructed over 160 renewable energy projects with a global portfolio that exceeds 12 gigawatts. RES has been active in North America since 1997, has a renewable energy and energy storage construction portfolio that exceeds 10,000 MW and over 100 projects, and has constructed more than 1,000 miles of overhead transmission lines.

In addition, RES has a robust development pipeline of wind, solar, and energy storage projects across North America, and the company currently operates more than 250 MW of renewable energy and storage projects. RES designs, constructs, and operates its facilities in an environmentally-sound and responsible manner. RES developed and constructed the 200 MW Pleasant Valley Wind Farm in Dodge and Mower counties, Minnesota, which achieved substantial completion in 2015.

3. Certificate of Need

A Certificate of Need (CON) from the MPUC is required for all "large energy facilities," defined to include generators greater than 50 MW in size. The Applicant proposes to construct a LWECS of up to 152 MW in Minnesota; therefore, a CON is required prior to issuance of a site permit and construction of the Project. The Applicant filed for a variance and exemptions from certain CON application requirements on September 15, 2017. The CON application was filed on September 8, 2017 in MPUC Docket number IP6984/CN-17-676.

4. State Policy

LWECS site permit applications are governed by the Wind Siting Act (Minn. Stat. Ch. 216F) and Minnesota Rules (Minn. R.) Ch. 7854. The Wind Siting Act also requires an application for an LWECS site permit to meet the criteria in Minn. Stat. Ch. 216E.03 subdivision (subd.) 7. This SPA provides information necessary to demonstrate compliance with these criteria and Minn. R. Ch. 7854. In addition, this SPA has been organized following the Minnesota Department of Commerce (DOC) Application Guidance for Site Permitting of Large Wind Energy Conversion Systems (WECS) in Minnesota (August 2010, LWECS Application Guidance).

LWECS are to be sited in an orderly manner compatible with environmental preservation, sustainable development, and the efficient use of resources (Minn. Stat. Ch. 216F.03). As discussed in this SPA, the Applicant is designing the Project to comply with the Commission's wind turbine setback and siting guidelines.

5. Project Description and Overview

The Project is located in Yellow Medicine County. The Project Area was selected based upon review and analysis of wind resources, economic considerations, landowner interest, availability of easements, access to transmission routes, interconnection of the Project to existing transmission facilities and lines, geographic features, and environmental resources. Overall, there has been

positive landowner support in Yellow Medicine County for the Project, and the Applicant has worked closely with the Minnesota Department of Natural Resources (MNDNR) and the U.S. Fish and Wildlife Service (USFWS) to avoid impacts to critical environmental resources. The Project is located in an area with a strong wind resource, where a CON and SPA had previously been issued, and is situated near electric transmission infrastructure that recently completed construction and is energized (the Big Stone South-Brookings County 345 kV transmission line was energized and is in-service as of September 8, 2017).

The Applicant initially reviewed an area of approximately 41,000 acres (Study Area) for critical issues and sensitive resources within which to site the Project. The Applicant has revised the initial footprint of the Project Area numerous times, taking into account landowner participation, regulatory agency and public comments, airport needs and airspace concerns, efficient and effective use of wind energy, minimization of environmental impacts, and applicable setback requirements.

The Project Area is approximately 22,888 acres and includes areas where the Applicant has negotiated, and continues to negotiate, easements with landowners for development of the Project. Of the 22,888 acres within the Project Area, approximately 21,000 acres (92% of the Project Area) are currently under lease for the Project (see Section 8 below for additional wind rights information).

Figure 1 shows the Project's location, and Table 1 provides the townships and sections location within the Project Area.

Table 1: Project Location

County Name	Township Name	Township	Range	Sections
Yellow Medicine	Florida	115N	46W	29,30,31,32,33,34
Yellow Medicine	Fortier	114N	46W	3,4,5,6,7,8,9,10,11,13,14,15,16,17,18,19,20, 21,22,23,24,25,26,27,28,29,30,31,32,33,34, 35,36
Yellow Medicine	Norman	114N	45W	30,31

The Project is located in a predominately agricultural area of southwestern Minnesota. Wind turbines and associated facilities are therefore primarily sited on agricultural lands. The Project Area consists of approximately 46.5% cropland and 26.2% pasture/grassland.

The Project is to include a nameplate capacity of up to 152 MW, with up to 37 turbine sites (40 proposed turbine locations are included in the Project layout to allow for 3 alternate turbine locations). The Applicant proposes to use a combination of two turbine types for the Project: the Vestas V136 3.45 MW and V136 4.2 MW models (see Section 6.2.2 for additional discussion of the turbine characteristics). These two turbine models both have a hub height of 345 feet (ft) (105 meters [m]) and a total tip height of 568 ft (173 m). The use of larger turbines results in fewer turbines for the same total nameplate capacity and less overall land disturbance.

Permanent Project facilities will include:

- Wind turbines,
- Gravel access roads to turbine sites and necessary modifications to existing roads,
- Buried electrical collection lines,
- A Project Substation (to be located in Deuel County, SD),
- An operations and maintenance (O&M) building,
- Up to two permanent meteorological towers; and
- An overhead transmission line (connection the Project Substation to the POI [to be located in Deuel County, SD]).

Temporary facilities required during construction include improvements to public and private roads for delivery of materials and equipment and a staging/laydown area. Temporary crane paths will also be used during construction.

The Applicant has been conducting public outreach for the Project since September 2016, and renewed its outreach efforts in mid-2017. Such outreach includes meeting with individual landowners and landowner groups, regulatory agencies, and local governmental units to discuss the Project; identifying support or constraints for the Project; and gathering comments to address in Project planning, design, permitting, and operation.

The following is a brief summary of stakeholder outreach efforts:

- Landowners – In the summer of 2016, the Applicant, in coordination with a local land agent, held a landowner dinner at the PK Egan's Family Restaurant in Canby. Over 100 local residents attended. The Applicant is planning a follow-up event in November or December of this year.
- Regulatory Agencies – meetings and discussions with staff from the USFWS, U.S. Army Corps of Engineers (USACE), DOC Energy Environmental Review and Analysis, and MNDNR.
- Local Governmental Units – meetings and discussions with Yellow Medicine County representatives (County Commissioners, Administration, Highway Department, Environmental Services), as well as representatives of Florida, Fortier, and Norman townships.

Additionally, on August 7, 2017, the Applicant sent letters to regulatory agencies and local governments to describe the Project, request comments, and provide an update on permitting status (see Appendix A for the mailing lists and sample notice letter). A number of responses were received by the Applicant, a summary list and copy of these are included in Appendix A. Responses are also summarized in applicable sections of this SPA. The Applicant is using information and comments received to optimize and refine the Project design, identify and resolve issues, and address concerns brought forward by stakeholders prior to submitting this SPA.

6. Project Design

The Applicant is taking into account landowner concerns, as well as internal design standards and regulatory, environmental, and cultural resources in the Project design. The Project design has been optimized based on wind resource and the factors noted above. This section provides more detailed Project layout information and applicable setbacks. Micrositing for the Project layout and field surveys of the construction corridors for wetlands/waterbodies and cultural resources are scheduled for the fall of 2017 to incorporate minor site-specific engineering, construction, environmental and natural resources, and landowner-necessitated adjustments.

6.1 Description of Layout and Setbacks

In designing the Project layout, the Applicant incorporated the wind energy conversion facility siting criteria outlined in the Commission's Order Establishing General Wind Permit Standards, Docket No. E, G999/M-07-1102 (January 11, 2008) (MPUC General Permit Standards), DOC Site Permit Application Guidance, Yellow Medicine County Land Use and Related Resource Management Ordinance (Section XVI Renewable Energy, Setbacks Part 1.6 and Requirements and Standards Part 1.7), setback standards, and RES standards and best practices. The Applicant also incorporated avoidance and setback recommendations from the USFWS and the MNDNR. Where setbacks differ for the same feature, the Applicant used the most stringent setback distance. Table 2 summarizes these setbacks, and Figure 2 illustrates them. Proposed Project facilities within the Project Area are shown in Figures 3a and 3b.

Implementation of a wind access buffer setback is intended to reduce disruption of the normal wind flow and to protect the wind rights of non-participating landowners. It requires turbines to be set back from the property line of a non-participating parcel at least 5 rotor diameters (RD) in the prevailing wind direction and 3 RD in the non-prevailing wind direction. Similarly, the MPUC General Permit Standards require internal turbine spacing setbacks of at least 5 RD in the prevailing wind direction and 3 RD in the non-prevailing wind direction.

For the Vestas V136 turbine model, the RD is 446 ft (136 m), so 5 RD is 2,231 ft (680 m), and 3 RD is 1,339 ft (408 m). Per the DOC LWECS Application Guidance and a conversation between the DOC and the Applicant, 20% of the spaces between turbines may be closer. Two spaces (affecting a total of four turbines[2]) are closer in the proposed layout (see Figure 2). In the event that minor adjustments need to be made to turbine locations due to micrositing or other layout constraints, fewer than 20% of the turbine spaces will be less than the required 3x5 RD spacing and will be subject to wake loss review and approval by the turbine manufacturer.

[2] Turbines T3, T4, T15, and T16.

Table 2: Wind Turbine Setbacks for the Project

Turbine Setbacks	Distance for Setback	Authority
Permitting Standards		
Wind Access Buffer – Prevailing Wind Directions	5 x RD (2,231 ft [680 m]) to the North and South	PUC General Permit Standards; note Yellow Medicine County Ordinance distance from property lines is 1.1 times the total height (625 ft [191 m]).
Wind Access Buffer – Non-Prevailing Wind Directions	3 x RD (1,339 ft [408 m]) to the east and west	PUC General Permit Standards; note Yellow Medicine County Ordinance distance from property lines is 1.1 times the total height (625 ft [191 m]).
Residences	500 ft (152 m)	MPUC General Permit Standard is 500 ft (152 m), or the distance required to meet the state noise standard of 50 A-weighted decibels (dB[A])
Noise Requirements	Distance must meet the state noise standard of 50 dB(A)	Minnesota Pollution Control Agency (MPCA), Site Permit condition; Yellow Medicine County has same standard.
Public Roads	250 ft (76 m)	PUC General Permit Standards.
Public Lands	5 x RD downwind, 3 x RD crosswind	PUC General Permit Standards.
Public Lands Managed as Grasslands	5 x RD (2,231 ft [680 m]) to the North and South, and 3 x RD (1,339 ft [408 m]) to the East and West	Yellow Medicine County Ordinance requires 600-foot (183 m) setback, but MPUC General Permit Standards of 5 x 3 RD for non-participating properties is larger.
USFWS Grassland and Conservation Easements	Avoid ground disturbance impacts on these parcels	USFWS Madison Wetland Management District.
USFWS Wetland Easements	Avoid impacts to wetland basins within easement parcels	USFWS Madison Wetland Management District.

Table 2: Wind Turbine Setbacks for the Project

Turbine Setbacks	Distance for Setback	Authority
Permitting Standards		
Internal turbine spacing	5 x RD downwind, 3 x RD crosswind, except closer in a few instances[3]	PUC General Permit Standards and Site Permit Application Guidance; Yellow Medicine County has same standard.
Additional RES Design Standards		
Residences	1,500 ft (457 m)	RES internal standard; note that the MPUC General Permit Standard is 500 ft (152 m), or the distance required to meet the state noise standard of 50 dB(A); Yellow Medicine County Ordinance distance is 1,000 ft (305 m).
Existing Uninhabited Structures	400 ft (122 m)	RES internal standard.
Public Roads and Trails	500 ft (152 m)	RES internal standard. MPUC General Permit Standards are 250 ft (76 m); Yellow Medicine County Ordinance distance is 1 times total height (568 ft [173 m]).
Microwave Beam Paths	Blade avoidance of Fresnel zone	RES internal standard.
Overhead Transmission Lines	500 ft (152 m)	RES internal standard.
Pipelines and Wells	400 ft (122 m)	RES internal standard.
Railroads	500 ft (152 m)	RES internal standard.
Communication Towers	254 ft (77.5 m)	Recommendation from Comsearch.

As noted above, where setbacks differ, the Applicant used the more restrictive setback. For example, the Applicant has sited turbines at least 1,500 ft (457 m) from residences in all cases. Geographic Information System (GIS) analysis of the closest occupied residence to each turbine determined that the minimum distance from a turbine to the nearest residence is 1,649 ft (503 m). Micrositing for the Project layout is scheduled for the fall of 2017 to incorporate minor site-specific engineering, construction, and landowner-necessitated adjustments.

[3] Per the DOC LWECS Application Guidance and a conversation between the DOC and the Applicant, 20% of the spaces between turbines may be closer. Two spaces (affecting a total of four turbines; T3, T4, T15, and T16) are closer in the proposed layout (Figure 2). Internal turbine spacing could be compressed at additional turbines due to micrositing or other layout constraints, but in all cases fewer than 20% of the turbine spaces will be less than the required 3x5 RD spacing and will be subject to wake loss review and approval by the turbine manufacturer.

From the original 41,000-acre Study Area, the Applicant has revised the Project footprint a number of times to the 22,888-acre Project Area due to landowner participation, regulatory agency and public comments, airport needs and airspace concerns, efficient and effective use of wind resources, minimization of environmental impacts, and applicable setback requirements. The Project Area includes areas where the Applicant has negotiated, and continues to negotiate, easements with landowners for development of the Project.

6.2 Description of Turbines and Towers

6.2.1 Wind Turbine Design and Operation

As the wind passes over the blades of a wind turbine, it creates lift and causes the rotor to turn. The rotor is connected by a hub and main shaft to a system of gears, which are connected to a generator. The Applicant is proposing to install up to 37 wind turbines totaling up to 152 MW of nameplate capacity. The current layout includes Vestas V136 3.45 and 4.2 MW turbines[4]. As stated previously, these two turbine models both have a hub height of 345 ft (105 m) and will measure 568 ft (173 m) from the base of the tower to the tip of the upright blade. The Applicant is seeking flexibility from the Commission to select the most appropriate technology for the proposed Project at the time of construction to ensure optimization of wind and land resources and cost efficiency, although a change in turbine model will not change the height or span of the turbine, and therefore will not affect any required setbacks. Additionally, selection of the proposed, larger turbine nameplate capacity models will require fewer turbines (of lesser nameplate capacity), which in turn will create fewer Project impacts. The use of fewer turbines for the same total nameplate capacity addresses a number of resource agency concerns and increases the effectiveness and efficiency in use of the wind resource.

6.2.2 Turbine Model Selection and Types

The Vestas V136 turbine was selected due to wind resource analysis, siting, setbacks, and availability of turbines for use in the Project. The 3.45 MW and 4.2 MW models are the same turbine, except the latter has a higher nameplate capacity due to improvements in the gearbox. The Vestas V136 utility-grade wind turbine has a nominal nameplate rating of 3.45 to 4.2 MW. Characteristics of each turbine type are provided in Table 3 below.

Table 3: Wind Turbine Characteristics

Characteristic	Turbine Model	
	V136-3.45	V136-4.2
Nameplate capacity (kW)	3,450	4,200
Hub height (ft / m)	345 / 105	345 / 105
Rotor Diameter (ft / m)	446 / 136	446 / 136
Total height (ft / m)[1]	568 / 173	568 / 173
Cut-in wind speed (m/s)[2]	3.0	3.0
Rated capacity wind speed (m/s)[3]	13.0	13.5

[4] Although unlikely, exact turbine models may change to ensure selection of a turbine that is both cost effective and optimizes land and wind resources.

Table 3: Wind Turbine Characteristics

Characteristic	Turbine Model	
	V136-3.45	V136-4.2
Cut-out wind speed (m/s) [4]	22.5	22.5
Maximum sustained wind speed(m/s)[5]	59.5	59.5
Wind Swept Area (m^2)	14,527	14,527
Maximum Rotor speed (rpm)	16.3	14.0

[1] Total height = the total turbine height from the ground to the tip of the blade in an upright position.
[2.] Cut-in wind speed = wind speed at which turbine begins operation
[3] Rated capacity wind speed = wind speed at which turbine reaches its rated capacity
[4] Cut-out wind speed = wind speed above which turbine shuts down operation
[5] Maximum sustained wind speed = wind speed up to which turbine is designed to withstand (3 second gust)
m/s = meters per second
rpm = revolutions per minute
kW = kilowatt

6.2.2.1 Turbine

Each tower will be secured by a concrete foundation that can vary in design depending on soil conditions. A control panel inside the base of each turbine tower houses communication and electronic circuitry. Each turbine is equipped with a wind speed and direction sensor that communicates with the turbine's control system to signal when sufficient winds are present for operation. Turbines feature variable-speed control and independent blade pitch to ensure aerodynamic efficiency.

Each turbine will be grounded and shielded to protect against lightning. The grounding system will be installed during foundation work, will be designed for local soil conditions, and will be in accordance with local utility or code requirements. Lightning receptors are placed in each rotor blade and in the turbine tower. The electrical components are also protected.

6.2.2.2 Nacelle

The turbines have active yaw and pitch regulation and asynchronous generators. The turbines use a bedplate drivetrain design, where all nacelle components are joined on common structures to improve durability.

6.2.2.3 Rotor

The rotor consists of three blades mounted to a rotor hub. The hub is attached to the nacelle, which houses the gearbox, generator, brake, cooling system, and other electrical and mechanical systems. The turbines have a 446-ft (136 m) RD, with a swept area of 156,364 ft^2 and a rotor speed between 5.9 and 16.3 revolutions per minute (rpm) for the V136-3.45 turbine, and between 5.6 and 14.0 rpm for the V136-4.2 MW turbine.

6.2.2.4 Tower

The portion of the foundation that is above ground is 15 to 16 ft wide at the base of the tower. The turbine towers, on which the nacelle is mounted, consist of four sections manufactured from certified steel plates. All welds are made by automatically controlled power welding machines and

ultrasonically inspected during manufacturing per American National Standards Institute specifications. All surfaces are sandblasted and multi-layer coated for protection against corrosion. Access to the turbine is through a lockable steel door at the base of the tower.

The wind turbines' freestanding 345-foot tubular towers will be connected by anchor bolts to an underground concrete foundation. Geotechnical surveys, turbine tower load specifications, and cost considerations will dictate final design parameters of the foundations. Foundations for similarly sized turbines are generally circular, approximately 65 to 70 ft across at the base, and extend 7 to 10 ft below grade. The wind turbine foundation will be designed by a registered professional engineer licensed to practice in the State of Minnesota.

6.3 Description of Electrical and Fiber Optic Communication System

The electricity generated by each turbine is raised (stepped up) to power collection line voltage of 34.5 kV. The electricity is collected by a system of underground power collection lines within the Project Area. A fiber optic communication system will also be installed between each turbine site and the Project Substation. The fiber optic lines will provide communication between the wind turbines, Project Substation, and the O&M facility.

Both power collection lines and fiber optic communication cables will be buried on private property or public right-of-way. The fiber optic communication cables will be collocated with the power collection lines and are used to connect the turbines and other Project components to the supervisor control and data acquisition (SCADA) system that will monitors and control the wind farm operations. Proposed Project facilities within the Project Area, including power collection lines and fiber optic communication cables, are shown in Figure 3a.

7. Description and Location of Associated Facilities

7.1 Transmission Line and Project Substation

The Project Substation and overhead transmission line is proposed to be located in Deuel County, South Dakota, immediately across the Minnesota/South Dakota state line from the western edge of the Project Area (Figures 3a and 3b).

The POI is the proposed Astoria Substation in Deuel County, SD. The Project includes a proposed aboveground 345 kV transmission line, approximately 10 miles in length to connect the Project Substation and the POI (Figure 3b). Because the overhead transmission line is planned to be located entirely within South Dakota, it will be permitted separately from Project facilities included this Application. As applicable, the Applicant will seek approval from Deuel County and the South Dakota Public Utilities Commission for the proposed transmission line.

The Project Substation is proposed to be located south of 189th Street immediately west of the Minnesota/South Dakota state line in the northeast corner of Section 34 in Township 141 North, Range 47 West in Deuel County, SD (Figures 3a and 3b). The Project Substation site is planned to be approximately 5 acres, which would be a gravel area enclosed with a chain link fence and equipped with a lockable gate. The Project Substation will consist of switch gear, metering, transformers, electrical control and communications systems, and other high voltage equipment

needed to transform the electricity generated by the Project from 34.5 kV to 345 kV. Final specification of the substation will be determined by the agreements the Applicant has with MISO, as well as the transmission owner.

The Project Substation will collect and interconnect approximately seven underground cable feeders in a straight bus configuration. The Project Substation will also consist of circuit breakers and switches required for the protection and control of the wind turbines and a main power transformer to step up the 34.5 kV output to 345 kV so that it may interconnect to Otter Tail Power's proposed Astoria Substation. Because of the Project Substation is planned to be located entirely within South Dakota, it will be permitted separately from Project facilities included in this Application. As applicable, the Applicant will seek approval from Deuel County and the South Dakota Public Utilities Commission for the proposed Project Substation.

7.2 Collector Lines and Feeder Lines

The power from step-up transformers located in the nacelle will be run through an underground collection system consisting of buried cables of varying size. Collection lines and fiber optic lines will be installed within the same trench, and will be buried to greater than 42 inches deep so as not to affect or be impacted by farming equipment. The lines will be accessible as necessary via aboveground junction boxes. All the collection system and fiber optic cables will terminate at the proposed Project Substation, where additional substation equipment will be installed to accommodate the proposed Project.

Generally, the electrical collection and fiber optic lines will be buried in trenches. Where necessary to avoid impacts to USFWS easements, wetlands, other sensitive lands, or existing public roads and infrastructure, the lines will be installed via directional bores.

All utility protection and metering equipment will meet the Applicant's and National Electrical Safety Code standards for parallel operations.

7.3 Additional Associated Facilities

7.3.1 Meteorological Towers

Up to two SCADA meteorological (SCADA MET) towers will be installed during the construction phase of the Project and remain in place for the life of the Project (Figure 3a). The purpose of the SCADA MET is to monitor real-time wind data during the operation of the Project to ensure it is generating electricity at expected levels.

The SCADA METs will stand at the hub height of the chosen turbine (approximately 345 ft) and will sit on a single caisson foundation and be self-supporting (i.e., no guy wires). Additional engineering details are dependent on owner and supplier requirements not known at this time. Based on the height of the SCADA METs, the Applicant is required to file with the Federal Aviation Administration (FAA) and it is anticipated to be artificially lit for nighttime visibility.

7.3.2 Operation and Maintenance Office

An O&M building will be constructed within the Project Area. The facility will be approximately 10,000 ft^2 and will house equipment to operate and maintain the Project. The building will be surrounded by an approximately 3-acre fenced-in gravel area that will be used for parking and storage.

7.3.3 Remote Control Monitoring

The turbines will have SCADA communication technology to allow control and monitoring of the wind farm. The SCADA communications system permits automatic, independent operation and remote supervision, thus allowing the simultaneous control of many wind turbines. Operations, maintenance, and service for the proposed Project will be structured so as to provide for timely and efficient operations. The computerized data network will provide detailed operating and performance information for each wind turbine. The Applicant will maintain a computer program and database for tracking each wind turbine's operational history.

7.3.4 Temporary Construction Areas and Facilities

The Applicant proposes to locate a temporary staging and construction laydown yard, including possibly a concrete batch plant, adjacent to the proposed O&M building for the Project (see Figure 3a).

7.3.5 Access Roads

Each wind turbine will be accessible via all-weather, aggregate-surfaced roads that will connect with public roads. The roads will be low-profile to allow farm equipment to cross. Roads will initially be approximately 40 ft wide to accommodate transportation of heavy construction equipment, however, once turbine construction is complete, the roads will be reduced to a permanent width of approximately 20 ft. Total access road length will be approximately 11.4 miles.

The access road network was designed to efficiently serve the Project, incorporate landowner input to create the least interference with farming operations, and avoid impacts to sensitive environmental and cultural resources.

7.4 Permitting for Associated Facilities

As stated previously, the Project Substation and transmission line will be permitted through South Dakota Public Utilities Commission and Deuel County, as applicable. The Applicant will work with the FAA to secure necessary approvals for installation of the SCADA METs. The Applicant will secure county approvals as needed (e.g., building permits, road use agreement, driveway permits, etc.) once an LWECS Permit is secured. See Table 35 for a summary of permits and approvals that may be required.

8. Wind Rights

Since 2008, the Applicant and its predecessors have been working with landowners in Yellow Medicine County to obtain appropriate land lease and wind easement or setback easement agreements to bring this Project to fruition. All Project facilities will be constructed on leased land. The current set of land agreements is sufficient to accommodate construction and operation of proposed facilities and meets required buffers. Figures 2 and 4 illustrate the proposed Project facilities and underlying parcels required to site the Project following applicable setbacks. As stated above, as of the filing of this SPA, the Applicant has approximately 21,000 acres of the 22,888 acres (92%) within the Project Area under lease. RES is continuing to work with landowners to obtain additional participation agreements as necessary within the Project Area.

Depending upon the landowner and Project need, the Applicant has secured necessary land rights from each participating landowner, which may vary from parcel to parcel. These rights include, but are not limited to, the rights to construct wind turbines and associated Project facilities, and also include rights to wind and buffer easements.

9. Environmental Impacts

9.1 Demographics

9.1.1 Description of Resources

The Project is located in southwestern Minnesota in Yellow Medicine County. The county is predominantly rural with an agricultural economic base. In 2012, approximately 81% (395,027 acres) of the land in Yellow Medicine County was occupied by farms. As with population trends in the county, the number of individual farms and number of acres in agricultural production have declined over a five-year period. In 2007, there were a reported 986 operating farms in the county with 409,223 acres in production. In 2012, the number of farms had dropped by 9% to 885. While the number acres in production dropped by over 3% over that five-year period, the average size of the individual farms increased from 415 acres to 446 acres.

The population of the county in 2010 was recorded at 10,438. This represents a nearly 6% decrease from the reported 2000 population figure of 11,080. The U.S. Census American Community Survey (ACS) estimates the population of Yellow Medicine County in 2015 was 10,092. This is a 4% drop from 2010 and indicates the population Yellow Medicine County is continuing to decline.

The estimated household size for Yellow Medicine County, based on the 2011-2015 ACS data was 2.42 people, with 4,196 rented or owned housing units. As shown in Figures 2 and 3a, there are approximately 108 homes located within the Project Area.

The Project includes portions of Florida, Fortier, and Norman townships and is situated in the southwestern corner of Yellow Medicine County. Table 4 presents data from the U.S. Census Bureau 2011-2015 ACS demographic profile data of Yellow Medicine County and townships included in and adjacent to the Project. The demographic data summarizes some of the population and economic characteristics of the county and townships.

Table 4: U.S. Census Bureau 2011-2015 ACS Demographics of Yellow Medicine County

	Total Population (2015 ACS)	Total Number of Housing Units	Median Household Income (2015 ACS)	Per Capita Income (2015 ACS)	Percentage of Population below Poverty Level	Population Density per Square Mile
State of Minnesota	5,419,171	2,373,884	61,492	$32,157	11.3%	62.33
Yellow Medicine County, Minnesota	10,092	4,754	$53,041	$26,885	11.9%	13.22
Florida Township	132	65	$47,500	$28,158	0.0%	3.66
Fortier Township	122	51	$53,333	$21,543	26.2%	3.38
Norman Township	240	100	$76,094	$34,800	0.8%	6.66
Hammer Township	212	102	$71,964	$28,291	1.4%	5.88
Lincoln County, Minnesota	5,808	3,126	$49,575	$26,910	9.3%	10.59
Hansonville Township	95	61	$53,214	$23,421	4.2%	2.64
Marble Township	129	63	$58,750	$24,860	5.5%	3.58

Township level population densities within 5 miles of the Project boundary range from 2.6 people per square mile (people/sq. mi.) in Hansonville Township in Lincoln County to the south of the Project Area to 7.3 people/sq. mi. in Norman Township, also in Yellow Medicine County. For the townships within the Project boundary, Florida Township has a density of 3.6 people/sq. mi., Fortier Township has 3.4 people/sq. mi., and Norman Township has 7.3 people/sq. mi.

9.1.2 Impacts

There is no indication that any minority or low-income population is concentrated in any one area of the Project, or that the wind turbines will be placed in an area occupied primarily by any minority population. The Project is being developed to provide economic benefit for individual landowners, local governments, and communities. Construction and operation of the Project will increase tax revenues. Lease and wind easement agreements made with landowners include payments that offset potential financial losses due to small areas of land being removed from agricultural production. All participating landowners will receive compensation for Project facilities constructed on their land; landowners that signed a setback waiver will also receive compensation. This payment model provides an inclusive community-based economic benefit.

Agricultural lands surrounding turbines can continue to be farmed or grazed. On average, 1.5 acres to 2 acres of land per turbine is taken out of agricultural production for the turbine foundation and access road. The use of larger turbines results in fewer turbines for the same total nameplate capacity and less overall land disturbance. Annual lease payments provided to participating landowners positively compensate for land removed from agricultural production and the inconvenience of farming around the new obstacles in the farm fields.

No substantial effects on permanent housing are anticipated. Throughout construction and operation of the Project, wages will be paid and expenditures will be made to local businesses and landowners. During construction, approximately 150-200 construction site workers will likely use lodging facilities nearby. The operations and maintenance of the facility will require four to six staff. The Applicant anticipates that sufficient permanent housing will be available in or near the Project to accommodate these laborers.

9.1.3 Mitigative Measures

No mitigative measures will be required as no impacts are expected and because socioeconomic impacts associated with the Project will be positive.

9.2 Land Use

The Project Area is located entirely within Yellow Medicine County and within portions of three townships (Florida, Fortier, and Norman) as indicated in Figure 1. The Project Area is adjacent to Hammer Township in Yellow Medicine County and Hansonville Township in Lincoln County. The Applicant used applicable local zoning, comprehensive plan, and conservation easement information as a guide to site wind turbines and associated facilities as described below. As discussed herein, Section XVI (Renewable Energy) of the Yellow Medicine County Land Use and Related Resource Management Ordinance (LURRMO) does not apply to the Project because the Project is subject to siting and oversight by the State of Minnesota pursuant to Minn. Stat. Ch. 216F, WECS, which preempts local zoning, building, and land use ordinances (see Sections 1, 4, and 6.1 above).[5]

9.2.1 Local Zoning and Comprehensive Plans

None of the townships within or adjacent to the Project Area have adopted zoning regulations. Two cities, Canby and Gary, are near but not within the Project Area and have adopted zoning regulations. Zoning code for these two cities apply only within their municipal boundaries, and the Applicant is not aware of any orderly annexation agreements or other plans that would expand these zoning regulations into the Project Area (Northwest Minnesota Foundation, 2015) (Upper Minnesota Valley Regional Development Commission).

In preparing this Application, the Applicant reviewed other comprehensive plans, zoning ordinances, and land use controls completed for municipalities within and adjacent to the proposed

[5] See Yellow Medicine County LURRMO at http://www.co.ym.mn.gov/index.asp?SEC=C3C725AC-DAA1-4C6C-A5D2-F07B9F71C951&DE=E9B7F1EC-BFDB-456D-B8C3-EF50E8B75C23&Type=B_BASIC.

Project Area. A summary of the plans reviewed are provided in Table 5. Figure 5 depicts municipal zoning established within the Project Area.

Table 5: Land Use Plans Relevant to the Project Area

Agency	Name of Plan	Year Adopted
Yellow Medicine County	Yellow Medicine County Comprehensive Plan	2006
	Yellow Medicine County Land Use and Related Resource Management Ordinance	2013
Lincoln County	Lincoln County Comprehensive Land Use Plan	2000
	Lincoln County Comprehensive Development Ordinance	2009
Yellow Medicine County and Soil & Water Conservation District	Yellow Medicine County Comprehensive Local Water Plan	2016
Florida Township	NA	NA[1]
Fortier Township	NA	NA[1]
Norman Township	NA	NA[1]
Hammer Township (adjacent to Project Area)	NA	NA[1]
Hansonville Township (adjacent to Project Area)	NA	NA
City of Canby	City of Canby Comprehensive Plan	Draft
City of Gary	City of Gary Comprehensive Plan	2015

[1] While these townships have not adopted their own local code/ordinance or comprehensive plan, they are included in the 2006 Yellow Medicine County Code Comprehensive Plan and Land Use and Related Resource Management Ordinance.

NA = not applicable

9.2.2 Yellow Medicine County Comprehensive Plan

Yellow Medicine County, and jurisdictions within, contracted with the Upper Minnesota Valley Regional Development Commission (UMVRDC) to facilitate and create the Yellow Medicine County Comprehensive Plan. A Comprehensive Plan Task Force was established to provide input into creating the Comprehensive Plan. Task force members included representatives from the Yellow Medicine County Board of Commissioners, Planning Commission, County staff, and township officials. As part of the planning process, a survey was distributed to every township homestead property and a random sample of 20% of the homestead properties in the cities located in the County (UMVRDC, 2006).

The Yellow Medicine County Comprehensive Plan "establishes a vision for the future" and is a guide to identify what citizens value, do not want changed, and feel should be improved. This provides day-to-day direction for the County in making decisions. The Comprehensive Plan serves many purposes, including but not limited to, providing a basis for County land use controls and a

link to the County's ordinances that should be consistent with the Comprehensive Plan. The Comprehensive Plan identifies key issues expressed by residents through public input, addresses planning areas of housing, agriculture, business/economic development, transportation, natural resources/parks/recreation and County services, considers social and economic issues, and guides County staff and others making decisions related to development in the County.

The Yellow Medicine County Comprehensive Plan identifies that agriculture remains the County's key industry and base of the economy. One of the plan's goals is to "support agricultural strategies and opportunities that encourage economic growth, diversity and rural preservation in the County including alternative agricultural options (value-added agriculture and renewable energy) for economic growth that are viable and sustainable" (UMVRDC, 2006). Business and economic development strategies outlined in the plan include direction to "[t]ake steps to promote renewable energy opportunities in the County including, but not limited to, ethanol, biodiesel and wind energy in an effort to encourage economic growth" (UMVRDC, 2006).

9.2.3 Yellow Medicine County Land Use and Related Resource Management Ordinance

The Yellow Medicine LURRMO includes management directives related to floodplains, shoreland, rural preservation, and renewable energy. Section XVI, Subd. 1.0 of the LURRMO was established to regulate the installation and operation of WECS within Yellow Medicine County not otherwise subject to siting and oversight by the State of Minnesota pursuant to Minn. Stat., Ch. 216F, WECS, as amended. The LURRMO defines "WECS" as a device such as a wind charger, windmill, or wind turbine and associated facilities that converts wind energy to electric energy (Section XVI, Part 1.3). Commercial WECS are defined under the ordinance as a WECS of equal to or greater than 100 kilowatt (kW) in total nameplate generating capacity. Because the proposed Project is greater than 100 kW in total nameplate generating capacity, the Project is considered a commercial WECS under the ordinance.

By its terms, the ordinance applies only to systems that are not otherwise subject to siting and oversight by the MPUC and therefore does not apply to the Project (see Sections 4 and 6.1 above). Nonetheless, the Project has been designed to comply with Setbacks (Part 1.6 of Section XVI) and Requirements and Standards (Part 1.7 of Section XVI) of this ordinance. Table 6 summarizes setback requirements for wind turbines and meteorological towers set forth by the ordinance.

Table 6: LURRMO Wind Turbine and Meteorological Tower Setbacks

Feature	Wind Turbine – Commercial WECS	Meteorological Towers
Property Lines	1.1 times the total height	The fall zone[1], as certified by a professional engineer, +10 ft or 1.1 times the total height.
(Neighboring) Dwellings[2]	1,000 ft	The fall zone, as certified by a professional engineer, +10 ft or 1.1 times the total height.

Table 6: LURRMO Wind Turbine and Meteorological Tower Setbacks

Feature	Wind Turbine – Commercial WECS	Meteorological Towers
Noise Standard	Minn. R. 7030	N/A
Road Rights-of-Way	1 times the total height, may be reduced for minimum maintenance roads or a road with an Average Daily Traffic Count of less than 10.	The fall zone, as certified by a professional engineer +10 ft or 1 times the total height.
Other Rights-of-Way (railroads, power lines, etc.)	To be considered by the planning commission	The fall zone, as certified by a professional engineer, +10 ft or 1 times the total height.
Public conservation lands managed as grasslands	600 ft	600 ft
Internal Turbine Spacing	5 Rotor diameters downwind spacing 3 RD apart for crosswind spacing	NA
Other Structures	To be considered	NA
Other Existing WECS	To be considered based on: · Relative size of the existing and proposed WECS · Alignment of the WECS relative to the predominant winds · Topography · Extent of wake interference impacts on existing WECS · Property line setback of existing WECS · Other setbacks required · Waived for internal setbacks in multiple turbine projects including aggregated projects.	NA

[1] Fall Zone – The area, defined as the furthest distance from the tower base, in which a guyed tower will collapse in the event of a structural failure. This area is less than the total height of the structure.

[2] The setback for dwellings shall be reciprocal in that no dwelling shall be constructed within 1000 ft of a commercial wind turbine.

Note: The Applicant is exceeding the above setbacks in almost all cases by applying the MPUC setbacks or additional RES internal setbacks, whichever are greater.

9.2.3.1 Floodplain Management Ordinance

The Floodplain Management Ordinance (Section II of the LURRMO) applies to all lands within the jurisdiction of Yellow Medicine County shown on the Official Zoning Map located within the boundaries of the Floodway, Flood Fringe, or General Flood Plain Districts. Approximately 320 acres (1.4%) of the land within the Project Area is within Federal Emergency Management Agency (FEMA) designated 100-Year floodplain area (Figure 17). These areas occur along Florida, Lazarus, and Canby creeks. No FEMA designated 500-Year floodplain area occurs within the Project Area (FEMA, 2015).

9.2.3.2 Shoreland Management Ordinance

The provisions of the Shoreland Management Ordinance (Section III of the LURRMO) apply to the shorelands of the public waterbodies as classified in Subdivision 4.0 of this ordinance, of which Victors Slough and unnamed basin 41-109 lies within the Project Area. The Shoreland Ordinance also includes watercourses shown on the Protected Waters Inventory Map for Yellow Medicine County.

Under Subdivision 2.747 of the ordinance, "shoreland" means land located within the following distances from public waters:

- 1,000 ft from the ordinary high-water level of a lake, pond, or flowage; and
- 300 ft from a river or stream, or the landward extent of a floodplain designated by ordinance on a river or stream, whichever is greater.

The limits of shorelands may be reduced whenever the waters involved are bounded by topographic divides which extend landward from the waters for lesser distances and when approved by the Commissioner. The "Shore impact zone" means land located between the ordinary high-water level of a public water and a line parallel to it at a setback of 50% of the structure setback. Unless otherwise exempt, as applies to this Project and Application, a Land Use Permit is required from the County for the placement of fill or excavation of materials within the floodplain or shoreland. The Applicant has completed field surveys for wetlands and water resources in fall 2017 (see Appendix F), and will coordinate with the DOC and Yellow Medicine County to avoid and minimize impacts to shore impact zones.

9.2.3.3 Yellow Medicine County Comprehensive Local Water Plan

In 2005, Yellow Medicine County updated its Comprehensive Local Water Plan in accordance with Minn. Stat. 103B, and was later amended in 2016. The Comprehensive Local Water Plan serves two primary purposes: 1) to identify existing and potential issues and opportunities related to the protection, management, and development of water and land resources; and 2) to outline an implementation program that will guide the County in water resource management. The plan also identifies four priority issues: 1) groundwater protection; 2) erosion and sediment control; 3) reducing priority pollutants; and 4) surface water, drainage management, and flooding. Objectives and action items for each of these priority issues is detailed in the Local Water Plan.

9.2.3.4 Lincoln County Comprehensive Land Use Plan and Lincoln County Comprehensive Development Ordinance

As previously discussed, the Project is located entirely within Yellow Medicine County for the Minnesota portion of the Project, and the Project Area borders Lincoln County, MN to the south. In addition to reviewing Yellow Medicine County ordinances, the Applicant also reviewed Lincoln County comprehensive plan and ordinances due to the proximity of the Project to Lincoln County and to ensure Lincoln County regulations do not apply to the Project. (Lincoln County Environmental Office, 2009; Lincoln County Environmental Office and SRDC, 2000). As previously stated, the Project is subject to State of Minnesota siting and oversight and not Lincoln County ordinances.

These two plans identify that wind project development in Lincoln County promotes sustainable energy, highlights wind as an additional tax-dollar generating activity, and notes that the most compatible land use around wind turbines is agricultural. Buffer zones are specified as the primary technique to maintain safety and aesthetics of wind projects within the county. Facilities proposed for this Project are nearly 0.5-mile from the Lincoln County/Yellow Medicine County border on the southern boundary of the Project Area.

9.2.4 Conservation Easements

Conservation easements are voluntary legal agreements between a landowner and a land trust or other qualified organization which places use restrictions on the land to protect its natural value. Conservation easements may be sold or donated by a landowner to state, federal, or non-governmental organizations to meet conservation objectives. Conservation easements may or may not require public access as part of the easement agreement; they are flexible and tailored to meet a landowner's needs and vision for the land. The landowner retains ownership of the property and all rights and privileges for its use, except for the uses restricted under the easement.

Yellow Medicine County offers conservation programs that compensate landowners for setting aside wetlands and grasslands for conservation purposes, or employing conservation practices on their land. These programs provide another source of income for local farms and landowners. Some of these programs include the Conservation Reserve Program (CRP), Reinvest in Minnesota (RIM), Wetland Reserve Program (WRP), and the Environmental Quality Incentive Program (EQIP), the Conservation Stewardship Program (CSP) and the Vegetative Management & Enhancement Cost Share Program. These programs vary in their requirements, payments, and the length of time for which a piece of property must be enrolled. Some of these easements are perpetual in nature. Figures 6a and 6b indicates the location of lands enrolled in these programs within the Project Area.

The Minnesota Board of Water & Soil Resources (BWSR) administers the RIM conservation program. The program is a critical component of the state's efforts to improve water quality by reducing soil erosion and phosphorus and nitrogen loading, and improving wildlife habitat and flood attenuation on private lands. The Applicant reviewed available public data for conservation easements and identified three RIM easements within the Project Area (see Figures 6a and 6b).

Based on publicly available information (U.S. Geological Survey [USGS] Protected Areas Database, 2016), there are 15 USFWS wetland or grassland easements in the Project Area. The Applicant also coordinated with the USFWS Windom Wetland Management District to identify any new USFWS easements or fee-title properties enrolled since 2016 in the Project Area. No additional easements were identified by the USFWS. Also, review of the Minnesota BWSR Wetland Banking Tool confirmed that there are no wetland bank easements in the Project Area at this time (BWSR, 2017).

The Applicant continues to review land title records of participating properties to identify conservation easements that are not recorded in other public databases on properties within the Project Area. As of this date, no other easements have been identified. If additional easements are found, the Applicant will review them and assess whether the Project layout is impacted.

9.2.5 Impacts

Project impacts to local zoning, land use plans, and conservation easement lands are expected to be minimal. To the extent practicable, the Applicant sited Project turbines and routed access roads, collection lines, and associated facilities in compliance with applicable requirements of the Comprehensive Plan, LURRMO, and the Comprehensive Local Water Management Plan. Field surveys were completed in October 2017 (Appendix F), and minor layout adjustments will be made to further avoid or minimize impacts.

The Project has been designed to avoid impacts to known conservation easements. No impacts are anticipated to federally owned lands or grassland easements, and no impacts are anticipated to state conservation lands such as RIM. In the event that potential impacts occur to CRP lands, the Applicant will work with the landowner and CRP easement holder to identify options to minimize and mitigate Project impacts (e.g., reimburse for taking land out of CRP). The Applicant will continue to review land title information to identify conservation lands and review the Project layout to avoid or minimize potential impacts.

The Applicant will coordinate with Yellow Medicine County to secure required permits as necessary (e.g., building permits). Project impacts to resources such as groundwater and surface water, and issues such as erosion and sediment control, pollutants, drainage management, and flooding are discussed in Section 9.15 (Geologic and Groundwater Resources) and Section 9.16 (Surface Water and Floodplain Resources). The Project will allow for continued agricultural use of the Project Area and will improve the local economy by providing revenue for landowners, potential temporary jobs for local residents, and local government tax benefits.

9.2.6 Mitigative Measures

As described in Section 6.1, in designing the Project layout, the Applicant incorporated the MPUC General Permit Standards as well as additional county setbacks, requirements and standards, and best practices developed by the Applicant. The Applicant also incorporated avoidance and setback recommendations from the USFWS and the MNDNR. Where setbacks differ for the same feature, the Applicant used the most stringent setback distance. Table 2 summarizes setbacks applied to the Project, and Figure 2 illustrates them.

The Applicant will coordinate with Yellow Medicine County and Florida, Fortier and Norman townships to address local concerns related to development, road use, and drainage systems through a development, road use, and drainage agreement. The agreements will include protocol for use and repair of public infrastructure, as well as adherence to local zoning and siting in effect at the time of filing this SPA. The Applicant has begun preliminary discussions with local officials and plans to enter into such agreements prior to the start of construction.

On September 6, 2017, the Yellow Medicine County Zoning Coordinator submitted a comment letter to the Applicant regarding County permit requirements for the Project (Appendix A). The Applicant contacted the County regarding the comment and clarified that the County will not require a Conditional Use Permit for the Project. However, the County indicated that any construction that is not a part of the permit issued by the MPUC for the Project would require a County land use permit. The Applicant will work with the County to address any County-required land use permit not covered by the Site Permit that would be issued by the MPUC for the Project (Table 35). At this time, however, all construction contemplated for the Project in the State of Minnesota will be covered as part of the Site Permit.

On August 22, 2017, representatives from the Fortier Township Board sent the Applicant a letter with comments regarding the Project (Appendix A). The Board indicated their support for the Project, and stated its concerns over new access roads and improvements to existing roads. The Board requested that a qualified representative of the Applicant accompany the Township in a joint inspection of Township infrastructure before and after construction of the Project. The Board requested that all infrastructure be returned to the same or better condition than before construction begins within the Township and that the cost be the responsibility of the Applicant. The Board also requested that the Applicant be responsible for placing barricades and/or other warning devices where appropriate for public safety. The Applicant will work with Fortier Township to address these concerns.

Additionally, the Applicant plans to avoid and minimize impacts to lands enrolled in RIM, WRP, and EQIP, CSP, Vegetative Management & Enhancement Cost Share Program or other public or private conservation easement land, and to avoid impacts to lands enrolled in CRP to the extent possible. If public or private conservation easement land is impacted, the Applicant will work with the applicable landowner and regulatory agency to identify and implement appropriate mitigation or, if necessary, remove the impacted portion of the parcel from that conservation program.

Measures to avoid, minimize, and mitigate any potential impacts to resources such as groundwater and surface water, and issues such as erosion and sediment control, pollutants, drainage management and flooding are discussed in Sections 9.15 and 9.16.

9.3 Noise

Noise is measured in units of decibels (dB) on a logarithmic scale. The audible range of humans spans from 20 hertz (Hz) to 20,000 Hz. Human hearing is not equally sensitive to all frequencies of sound and certain frequencies are given more or less “weight” than others.

The A-weighted decibel scale (dBA) is commonly used to measure the selective sensitivity of human hearing. This scales the physical sound levels that are measured as a pressure wave to

match an equivalent "loudness" level across the audible spectrum that more closely resembles what a human ear would perceive. The A-weighted scale effectively puts more relative weight on the range of frequencies that the average human ear perceives clearly (e.g., mid-level frequencies) and less weight on those that humans do not perceive as well (e.g., very high and lower frequencies).

The C-weighted scale (dBC) is used to measure human sensitivity at louder levels. C-weighted decibels are often used as a proxy to estimate the impact of low frequency noise. This scale puts more weight on the lower frequencies than the A-weighted scale.

The G-Weighted scale (dBG) is designed for sound or noise whose spectrum lies partly or wholly within the frequency band of 1 Hz to 20 Hz.

The numerical value of the results will, in general, differ between the A-weightings, C-weightings and G-weightings. Numerical values across weightings should be compared with caution, since the respective results relate to different frequencies of the noise spectrum. Measurement programs for wind turbine noise have documented a significant correlation between dBA and dBC levels. Additionally, measurements comparing A-weighted noise levels and G-weighted noise levels show a significant correlation between the dBA and dBG as well. Hessler et al. (2011) recently concluded that, pending some additional research, "no other infrasound or low frequency noise criteria are required beyond an acceptable A-weighted level".

Low frequency noise is considered audible but only at high amplitudes. Low frequency noise is commonly considered to be in the range of 20-200 Hz. Infrasound occurs in even lower frequency ranges (less than 20 Hz), and is generally inaudible to the human ear. However, it may still interact with the body and may be felt as vibrations. Studies have shown that pain from infrasound can result when sound levels are 165 dB or above at 2 Hz and 145 dB or above at 20 Hz. (Massachusetts Department of Public Health [MDPH] 2012). The magnitude of existing background low frequency noise/infrasound levels vary, but can be of sufficient strength to mask the low frequency noise and infrasound contributions from wind turbines. Common background sound sources of LFN and IS include wind interacting with vegetation, agricultural machinery and roadway noise.

Noise from wind turbines occurs from the blades interacting with the atmosphere and cooling systems located outside of the turbine nacelle. Noise produced by the blades depends on their design, rotational speed, blade pitch and a variety of factors, with maximum noise emissions typically occurring at 85-95% of rated power.

In Minnesota, noise reaching adjacent properties to a wind farm must meet statutory limits (see Minn. R. Ch. 7030.0040), and noise level limits are established according to the land use activity at the location of the receiver. Under Minn. R. Ch. 7030.0040, land uses are divided into four categories referenced as noise area classifications (NACs):

- NAC-1: Residential housing, religious activities, camping and picnicking areas, health services, hotels, educational services;
- NAC-2: Retail, business and government services, recreational activities, transit passenger terminals;

- NAC-3: Manufacturing, fairgrounds and amusement parks, agricultural and forestry activities; and
- NAC-4: Undeveloped and unused land.

Table 7 below provides the established daytime and nighttime noise standards for each NAC category (Minn. R. Ch. 7030.0040, Noise Standards). The standards are expressed as a range of permissible dB(A) within a one-hour period.

Table 7: State of Minnesota Noise Limits

Noise Area Classification	Daytime (7:00 am – 10:00 pm)		Nighttime (10:00 pm – 7:00 am)	
	1-Hour L_{10} (dB(A))	1-Hour L_{50} (dB(A))	1-Hour L_{10} (dB(A))	1-Hour L_{50} (dB(A))
1	65	60	55	**50**
2	70	65	70	65
3	80	75	80	75
4	None	None	None	None

In Minnesota, statistical sound levels (L Level Descriptors) are used to evaluate sound levels and identify noise impacts within a time period of interest (here, one hour). The L_{50} is defined as the sound level exceeded 50% of the time, or for 30 minutes in an hour. The L_{10} is the sound level exceeded 10% of the time, or for 6 minutes in an hour, also expressed in dB(A). These are called statistical noise levels.

As indicated above, land areas such as picnic areas, churches, or commercial spaces are assigned to an activity category based on the type of activities or use occurring in the area. Activity categories are then categorized based on their sensitivity to traffic noise. The NAC is listed in the Minnesota Pollution Control Agency (MPCA) noise regulations to distinguish the categories.[6] The discussion below provides a description of the resource and results of noise modeling of the Project. The Applicant is required to show through field measurements and modeling that the Project noise levels will meet statutory requirements at all times during construction and operation.

9.3.1 Description of Resources

The Project Area is located in a predominately rural agricultural landscape. The ground cover is primarily farmland and open fields, with residential dwellings interspersed throughout the Project Area. Typical agricultural noise pollution sources include farm machinery, agricultural vehicle operations, recreational activities, (such as hunting and all-terrain vehicles), motor vehicle traffic, and road construction activities. The City of Canby and the Canby Airport, which are another source of noise, are located approximately 3.5 miles northeast of the Project.

[6] For reference, in Deuel County, South Dakota, the noise level from a Wind Energy System (WES) shall not exceed 45 dBA average A-Weighted Sound pressure at the perimeter of existing residences, for non-participating residences. See Deuel County Zoning Ordinance, Ordinance B2004-01-23B (May 23, 2017), Section 1215.03(13)(a).

A total of 259 receptors were considered as sound receptors in the analysis (Figure 7). Receptors confirmed to be uninhabited were excluded. Of the total number of identified receptors, there were 61 receptors in Minnesota and 14 receptors in South Dakota within 1 mile of a proposed turbine or transformer location. An additional 184 receptors, located along the shores of Lake Cochrane, in the adjacent Deuel County, South Dakota, were included, regardless of distance to a turbine. Coordinates for the center point of each receptor are presented in Appendix B.

9.3.2 Impacts

Construction and operation of the Project will contribute to sound levels in the area. Noise levels depend on the distance from the noise source and the attenuation of the surrounding environment. Table 8 below provides an estimate of decibel levels of common noise sources.

Table 8: Common Noise Sources and Levels

Sound Pressure Level (dBA)	Common Indoor and Outdoor Noise Sources
100-110	Rock band (at 16.4 ft [5 m]) Jet flyover (at 984.3 ft [300 m])
90-100	Gas lawnmower (at 3.28 ft [1 m])
80-90	Food blender (at 3.28 ft [1 m])
70-80	Shouting (at 3.28 ft [1 m]) Vacuum cleaner (at 9.84 ft [3 m])
60-70	Normal speech (at 3.28 ft [1 m])
50-60	Large business office Dishwasher next room, quiet urban daytime
40-50	Library, quiet urban nighttime
30-40	Quiet suburban nighttime
20-30	Bedroom at night
10-20	Quiet rural nighttime Broadcast recording studio
0	Threshold of hearing

Source for Common Indoor/Outdoor Noise Sources: *A Guide to Noise Control in Minnesota*, Minnesota Pollution Control Agency (November 2015)

Noise related to wind turbine operation is often cited as a concern when LWECS are developed in rural areas. Some earlier wind turbine designs did not consider noise impacts and sited turbines too close to residential receivers. With improvements in turbine engineering, new equipment, such as the serrated trailing edges, and the use of sufficient setbacks to residences, many of the historic impact issues have been resolved.

To evaluate the potential impacts of the Project, the Applicant conducted a preliminary noise assessment for the Project Area and the surrounding region. A model was developed, using the software program Cadna-A 4.2, to determine the sound levels at each of the identified receptors.

The simulation was run for all turbines operating in Noise Mode 0 with serrated trailing edges, the wind speed corresponding with the maximum sound power level of the turbines (20 meters per second [m/s]), and the maximum sound power level of the transformer. The hub height of the turbines is 344 ft (105 m). The Bitter Root transformer was modeled as a point source at a height of 15 ft (4.5 m) above ground level. All receptors were modeled at a height of 4.9 ft (1.5 m). A summary report regarding the study methodologies and assessment results is provided in Appendix B.

The Project layout considered in this sound assessment consists of 40 turbines. While two different turbine models are being considered for the final Project (Vestas V136 4.2 MW and V136 3.45 MW) the analysis modeled only the Vestas V136 3.45 MW for each turbine location. This turbine model has the highest sound power level of the two turbines being considered. The analysis also included all 40 turbine locations, although only 37 turbines will be constructed. The resulting noise levels reported for each receptor can, therefore, be considered conservative.

The analysis accounted for all noise generating elements associated with the proposed wind turbine types and designed layout for the Project. All proposed wind turbines and the transformer (noise sources) were modeled in Cadna-A and Project-related noise levels were calculated at 259 noise-sensitive receptors. Appendix B presents the results of this analysis. The baseline noise isopleths (a line or curve of equal values) are depicted in Figure 7.

The maximum expected noise level, based on assumptions incorporated into the Cadna-A model, and the most current turbine and transformer layout, results in a 45.5 dBA L50 at the nearest noise-sensitive receptor in Minnesota (maximum Project related L_{50} range from 35.3 to 45.5 dBA)[7]. As depicted in the multi-turbine constraint maps, all proposed conceptual turbine layouts comply with MPCA noise guidelines at residential receptors. Maximum calculated noise levels at all residential receptors for all turbine models are below the nighttime L_{50} noise limit of 50 dBA. The modeling included 35 dBA ambient noise in addition to the Project noise contribution for "total noise" compared with the limits. A summary report regarding the results of assessment results is provided in Appendix B.

9.3.3 Impacts of Low Frequency Noise and Infrasound

The issue of low frequency noise and infrasound has been debated at state, local and international levels. In 2010 the Australian National Health and Medical Research Council released "rapid review of the evidence" on "Wind Turbines and Health". The evidence collected from peer reviewed research led to the conclusion that: "there are no direct pathological effects from wind farms and that any potential impact on humans can be minimized by following existing planning guidelines". This conclusion has been supported by detailed studies and measurements programs in Vermont (2010), Massachusetts (2012), Wisconsin (Walker, 2012), Japan (2014, 2016), Canada (2015), and Germany (2016).

[7] Noise levels were modeled as maximum LAeq (average acoustic energy in the A weighted scale over a given period of time), which is a conservative estimate of the expected L50 during operation.

Infrasound from wind turbines consists of acoustic energy at the blade pass frequency of approximately 1 Hz, and its harmonic components out to about 10 Hz. However, the levels are detectible by instruments only, and below the threshold of human hearing.

The German study (Ministry for the Environment, Climate and Energy of the Federal State of Baden-Wurttemberg, Germany, 2016) mentioned above, which spanned 2 years and examined six different sized wind turbines by different manufacturers, covering a power range from 1.8 MW to 3.2 MW, concluded that: "Infrasound is caused by a large number of different natural and technical sources. It is an everyday part of our environment that can be found everywhere. Wind turbines make no considerable contribution to it. The infrasound levels generated by them lie clearly below the limits of human perception. There is no scientifically proven evidence of adverse effects in this level range."

The German study also found that levels of wind turbine infrasound are lower than or equivalent to that which would be experienced inside a moving car, at the beach due to waves, inside a house near an operating washing machine, or outside on a windy day.

Similarly, the Ministry of the Environment of Japan's 2016 study entitled "Investigation, Prediction, and Evaluation of Wind Turbine Noise in Japan" states that "super-low (<20 Hz) frequency range components of wind turbine noise are at imperceptible levels. Therefore, wind turbine noise is not an issue caused by super-low frequency range."

Low frequency noise from wind turbines, from 20 to 200 Hz, is audible, but at levels that are generally less than those produced by other sources, such as traffic, wind, and other methods of power generation. Hessler et al. (2011) recently concluded that, pending some additional research they feel is warranted, "no other infrasound or low frequency noise criteria are required beyond an acceptable A-weighted level".

In 2010, the Vermont Department of Health concluded that "there is no direct health effect from sound associated with wind turbine facilities." A 2012 study conducted by the Massachusetts Department of Environmental Protection concluded that "none of the limited epidemiological evidence reviewed suggests an association between noise from wind turbines and pain and stiffness, diabetes, high blood pressure, tinnitus, hearing impairment, cardiovascular disease, and headache/migraine."

In 2015, Health Canada presented the results of a large-scale epidemiological study to address the issue of wind turbine noise and possible health effects. This is the most extensive direct health study ever conducted on this issue. While the study did find a correlation between wind turbine noise and annoyance, with regard to fatigue, tinnitus, vertigo, nausea, dizziness, cardiovascular diseases, and diabetes it found "the evidence for a causal association is largely lacking for these other effects."

In summary, modern wind turbine noise research has demonstrated the existence of measurable infrasound and low frequency noise produced by wind turbines, and that infrasound in particular has a distinct signature for wind turbines in the 1 Hz to 10 Hz range. However, measured infrasound frequencies are below the human hearing threshold and have not been shown to cause health effects. Low frequency noise from wind turbines can at times be audible at residences, but

is adequately controlled by accepted A-weighted limits. Accordingly, the Project's compliance with the Minnesota state noise standard adequately minimizes potential impacts related to infrasound and low frequency noise.

9.3.4 Mitigative Measures

Impacts to nearby residents and other potentially affected parties in terms of noise will be taken into consideration during all subsequent turbine siting effort and Project design iterations. Unless other arrangements have been made with specific residents, the Applicant proposes siting turbines the minimum 1,500 ft from residences and any additional distance required to comply with the MPCA limit of a 50 dBA L50 noise level (MPCA, 2014). The preliminary layout has been modeled to help ensure cumulative impacts from all wind turbines, and maximum calculated noise levels for both turbine models, are below the MPCA's L_{50} noise limit of 50 dBA at residential receptors.

If changes are made to the turbine layout the Applicant wishes to use a louder turbine model or operating mode, then the noise analysis will be updated and compliance again demonstrated. If needed, mitigative measures available to the Project to reduce noise levels at any given residence may include the use of low noise blades on select turbine(s) and operation of select turbine(s) in low noise mode (reduced rotational speed and power output).

9.4 Visual Impacts

9.4.1 Description of Resources

The topography of the Project Area is glaciated, gently rolling plains with elevations ranging from 1,384 ft to 1,745 ft (422 to 532 m) above sea level (Figure 8). Agricultural fields, farmsteads, and gently rolling topography visually dominate the Project Area. The landscape can be classified as rural open space.

Within the Project Area, the local vegetation cover is dominated by agricultural crops (Figure 12). Most prevalent crops are corn, soybeans, forage, and wheat, which visually create a low uniform cover (U.S. Department of Agriculture, 2012). A mix of deciduous and coniferous trees planted for windbreaks surround many of the regional farmsteads. Typically, these isolated windrows have been established and maintained by the landowners to limit wind erosion and shelter dwellings.

The level of development in this area of southwestern Minnesota consists predominantly of residential properties and farm buildings (both inhabited and uninhabited). From a visual perspective, these residential clusters are focal points in the sparse, open space of the region.

9.4.2 Visual Impacts on Public Resources

The turbine models to be installed for the Project appear identical. They feature a tubular tower topped with a single hub with three blades attached to the nacelle. The primary differences between the two proposed turbine models are the internal gearbox and nameplate capacity.

The Project is designed to produce a nameplate capacity of up to 152 MW. The current layout proposes using Vestas V136 3.45 and 4.2 MW turbines located on up to 37 sites. While the Applicant proposes to use 3.45 MW and 4.2 MW turbines for this Project, if 2.0 MW wind turbines

were selected, 76 turbines would be required to be installed for the Project instead of the proposed 37 turbines. Wind turbines with a larger nameplate capacity generally create less visual impact because fewer turbines would be installed.

Some Project proposed turbines will be located within the viewshed of MNDNR-managed Wildlife Management Areas (WMAs), Scientific and Natural Area (SNA), or other natural areas and may be seen by people using those areas. Figures 6a and 6b identifies recreation and wildlife areas within the Project's vicinity.

As shown in Figures 6a and Figure 6b, there are 33 WMAs, 27 Waterfowl Production Area (WPAs), and one SNA within 10 miles of the Project Area. Further information regarding recreational lands in relation to the Project Area is found in Section 9.7. While wind turbines will impact the visual surroundings of the Project Area, the degree and nature of the visual impact will vary based upon personal perceptions and preferences. Additionally, several wind turbines associated with other commercial wind energy generation projects exist south and southwest of the Project Area in Deuel and Brookings counties, SD and Lincoln County, MN, and at least two wind projects (Blazing Star and Red Pine) were recently permitted by the MPUC in Lincoln County which are located south and southeast of the Project Area (Figure 18). These existing and permitted wind energy projects also impact the visual surroundings of the Project Area, so the Project would not be introducing a new feature into the landscape.

9.4.3 Visual Impacts on Private Lands and Homes

The construction of wind turbines will impact the visual surroundings of the Project Area. The perceived degree of visual impact will vary based on personal preferences and subjective human responses. For some viewers, the Project may be perceived as a visual intrusion; others may view the Project as a positive aesthetic feature on the landscape. The operation of the wind farm will generate minimal vehicle traffic and will not significantly increase day-to-day human activity in the area. The Project Area will retain its basic rural character. While the form and purpose of the Project is associated with energy generation technology, the turbines are compatible with the rural and agricultural heritage of the area, which includes other high-profile – although smaller – vertical features such as windmills, silos, and grain elevators.

The topography in the vicinity is relatively flat, and the agricultural vegetation has a low profile, which makes objects with comparably high profiles potentially viewed as visual disruptions. Visual impacts will be most evident to people who live in and near the Project and to people traveling through the Project Area. While people living in or traveling through the area are accustomed to viewing wind turbines, the Project will add to the cumulative visual impacts by adding up to 37 new turbines in the area.

The FAA requires obstruction lighting or marking of structures more than 200 ft above ground to provide safe air navigation (FAA, 2015). The Applicant will apply to the FAA for approval of a lighting plan that is compliant with FAA requirements. It is anticipated that 31 of the 37 proposed turbines will be lit, pending FAA approval of the lighting plan. FAA requires synchronized flashing of red lights for wind turbines. See Section 9.8.2.2 for information on the FAA permitting process for turbines over 499 ft tall.

The number of turbines with visibility lighting will be minimized, according to FAA requirements. FAA-approved lighting uses the shortest allowable flash duration and the minimum allowed flashes per minute. All lights will flash at the same time so that nocturnal migrating birds are not disoriented by lights. Lighting at the O&M facility, Project Substation, and other installations will be minimized and designed so that light is directed downward (toward the access or work area) and will be hooded to prevent light from shining into the sky and attracting or disorienting nocturnal migrants. Motion or heat-activated lighting will be used where practicable.

9.4.4 Shadow Flicker

Shadow flicker is the modulation of light levels resulting from the periodic passage of a rotating wind turbine blade between the sun and a viewer. Shadow flicker may occur under certain combination of circumstances with regard to the sun's position and wind direction – when the sun passes behind the rotating blades of a wind turbine, a moving shadow is cast in front of or behind the turbine. When viewed from a stationary position, the moving shadows cause periodic "flickering" of the sunlight, otherwise known as the "shadow flicker" phenomenon.

It is generally experienced in areas near wind turbines where the distance between the wind turbine blade and the observer is short enough that shadows are not diffused by the atmosphere. The effect is most noticeable inside buildings where the flicker appears through a window opening. The flickering effect can be experienced both inside a building and outdoors, but the effect outdoors is typically less intense. Shadow flicker becomes less intense at greater distance from the wind turbine causing the flicker, or at an orientation where flicker is less likely to exist (i.e., directly south of a turbine).

The likelihood and duration of the effect depends on a number of variables, including (but not limited to), the orientation of the building relative to the turbine, wind direction, distance from the turbine, turbine height and RD, time of year and day, weather conditions, vegetation and other obstacles that mask shadows, and operational status of the turbines.

While the State of Minnesota has no requirements concerning exceedance limits of shadow flicker impacts from wind projects, the DOC LWECS Application Guidance requires an analysis and discussion of shadow flicker and include isopleths for 100, 50, and 25 hours per year of potential shadow flicker.[8] The DOC guidance also requires a listing of methods and assumptions used in the analysis, but it does not prescribe a specific method to use for the analysis. DOC guidance also requires a figure illustrating the likely hours of shadow flicker per year at 1,000 ft (305 m) and a table showing potential shadow durations per day at 1,000 ft (305 m). There are no LWECS shadow flicker requirements in applicable Yellow Medicine County ordinances.

[8] For reference, in Deuel County, South Dakota, the limit for allowable shadow flicker from a Wind Energy System (WES) at existing residences is to be no more than 30 hours annually. See Deuel County Zoning Ordinance, Ordinance B2004-01-23B (May 23, 2017), Section 1215.03(13)(b).

9.4.5 Impacts

For this Project, the Applicant conducted a shadow flicker assessment on the proposed Project layout (see Shadow Flicker Report in Appendix C) to determine impacts. The Shadow Flicker Report provides details regarding the methodology and results of the assessment in accordance with the DOC LWECS Application Guidance.

The assessment was conducted for a total of 40 Vestas V136 wind turbines and a hub height of 344 ft (105 m) and a RD of 446 ft (136 m). A total of 357 possible receptors were identified within or near the Project Area, of which 91 potentially affected receptors (i.e., inhabited) were identified within 10 times the tip height, or 5,676 ft (1,730 m) of a turbine and were included in the assessment. Of the 91 receptors, 60 are located in Minnesota and 31 are located in South Dakota (adjacent to the Project Area). The analysis used a conservative distance of 10 times the hub height plus the rotor radius (5,676 ft [1,730 m]) as distance beyond which shadow flicker does not occur (or the distance that a shadow can be cast).

The shadow flicker analysis/simulation was completed with a resolution of 1 minute (i.e., if shadow flicker occurs in any 1-minute period, the model registers this as 1 minute of shadow flicker) using the WindFarmer Analyst software developed by DNV GL with Project site-specific distribution of wind direction and sunshine probability (see Table 9 for site-specific wind directional frequencies and Table 10 below for cloud cover percentages used in the shadow flicker modeling).

Table 9: Site-Specific Directional Frequencies (%)

Sector (º)	0	30	60	90	120	150	180	210	240	270	300	330
Percentage	12.5	5.2	3.5	3.9	6.4	6.6	11.4	12.0	7.1	8.4	10.0	13.0

Table 10: Monthly Cloud Cover Percentage (%) Reduction

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Percentage	61.3	64.0	67.7	63.1	60.3	52.5	42.9	43.6	46.7	51.6	65.0	63.9

The number of hours of shadow flicker at a given location was calculated using this geometric model which takes into account the sun's position, topography of the wind Project site, and proposed wind turbine specifications. Shadow flicker was calculated at residences at a height of 6.5 ft (2 m) to represent ground floor windows that were simulated as horizontal planes (e.g., "greenhouse" scenario where receptors experience shadow flicker over 360º, or the worst-case scenario).

The Shadow Flicker Report presents calculated annual hours of shadow flicker based upon scenarios for a worst case and an expected case. The expected case can still be considered conservative because the analysis does not take into account vegetation or other shielding effects around each shadow receptor, nor does it consider turbine operational shut-downs. The calculated shadow flicker duration may overestimate the annual number of hours of shadow flicker experienced at a given location due to the following factors: 1) modeling turbine blades as discs rather than individual blades results in overestimation of shadow flicker duration; 2) orientation of

windows on a given residence was not taken into account (model assumes a window is always facing the turbine(s)); 3) aerosols (e.g., moisture, dust, smoke, etc.) may impact shadows cast by a turbine and was not taken into account; 4) vegetation or other physical barriers around a shadow receptor location, which may shield the view of the turbine and thus reduce the incidence of shadow flicker, were not taken into account; and 5) periods when the turbine is not operating, which will reduce shadow flicker occurrence, were not taken into account. Additionally, the Applicant modelled all 40 turbines, including the proposed 37 turbines and three alternate turbines, which also results in more conservative results.

The results of the shadow flicker assessment are shown graphically in Figure 9, and additional details are included in the Shadow Flicker Report in Appendix C. The maximum predicted hours of shadow flicker in one year occurs at a residence in Minnesota, receptor MN355 at 52 hours/year. This takes into account long-term average monthly cloud cover and annual wind rose information. The worst case result at MN355 is 201 hours/year. The predicted duration of shadow flicker on the worst day of the year at MN355 without considering cloud cover and wind rose statistics is 66 minutes (on June 18). It should be noted that receptor MN355 is a town hall facility and is not considered to be inhabited.

Results for receptor MN321 indicate expected case shadow flicker of 38 hours/year, taking into account cloud cover and wind rose statistics. The worst case day at this receptor is 66 minutes (expected on January 1). It should be noted that receptor MN321 is a Project participant.

The highest predicted shadow flicker at a non-participating residence in Minnesota is 14 hours/year at receptor MN273.

The receptor in South Dakota that is predicted to experience the most hours of shadow flicker in one year, as well as the highest number of minutes in a single day is receptor SD313 (a non-participating residence). The predicted duration in one year at SD313 is 29 hours and takes into account long-term average monthly cloud cover and annual wind rose information. The predicted duration of shadow flicker in a single day at this receptor is 59 minutes (expected to occur on May 21), not taking into account cloud cover and wind rose statistics.

Receptor MN283 is expected to have the longest duration of flicker shadow in a single day, 74 minutes (expected to occur on April 27). It should be noted that receptor MN283 is a Project participant.

Shadow flicker from the proposed turbines is not harmful to the health of photosensitive individuals, including those with epilepsy. The frequency of shadow flicker due to wind turbines is a function of the rotor speed and number of blades. The V136's maximum operational speed is 17.5 revolutions per minute (rpm). Each revolution would yield three "flickers"; thus, 17.5 revolutions per minute times 3 flickers per revolution, divided by 60 seconds per minute equals 0.88 flickers per second. The Epilepsy Foundation has determined that, generally, the frequency of flashing lights most likely to trigger seizures is between 5 and 30 flashes per second (Epilepsy Foundation, 2013).

9.4.6 Mitigative Measures

The Applicant is working with landowners, regulatory agencies, community stakeholders, and interested parties to identify concerns related to Project aesthetics and to address potential visual impacts through Project design or siting efforts. To avoid and/or minimize potential visual impacts of the Project, the Applicant proposes these mitigation measures:

- For construction and operation/maintenance of the Project, access roads associated with Project facilities will be located to limit the amount of grading required for construction and to facilitate erosion control during construction and operation/maintenance;
- Areas disturbed during construction or during operation and maintenance efforts will, as applicable, be restored to cropland or otherwise reseeded with appropriate and regulatory agency approved native seed mixes, and in accordance with landowner preferences;
- During construction, existing roads will be used as much as possible to limit the number of new roads required to be built or modified within the Project Area;
- Electric collection lines will be buried to minimize the quantity of aboveground facilities associated with the Project;
- All wind turbines will be uniform in color;
- Wind turbines will be illuminated to meet the minimum FAA requirements for obstruction lighting associated with wind turbine projects (e.g., reduce number of lights on turbines and synchronized red strobe lights); and
- The Applicant will provide details of its lighting plan prior to construction at the time 7460-1 forms are submitted to the FAA for final approval.

To avoid and minimize potential shadow flicker impacts to receptors, the Applicant has sited the proposed turbines a minimum of 1,500 feet from inhabited residences. The Applicant will mitigate shadow flicker impacts and concerns specifically with stakeholders if a residence is experiencing more flicker than anticipated in the modeling. Mitigation efforts will be considered for each individual circumstance of shadow flicker and may include:

- Communication with adjacent landowners on when shadow flicker is possible and how to minimize shadow flicker effects;
- Installation of indoor screening, such as curtains or blinds in windows, where appropriate and reasonable; and
- Providing exterior screening, such as a vegetation buffer or awnings over windows, where appropriate and reasonable.

9.5 Public Services and Infrastructure

The Project is located in a lightly populated, rural/farming area in southwestern Minnesota. Public services to farmsteads and rural residences within the Project Area include transportation/roadways, electric, and the Lincoln Pipestone Rural Water System water treatment

plant (although most farmsteads appear to have their own potable water supply and onsite domestic waste systems as discussed below).

The closest city to the Project Area is the City of Canby (City), located approximately 3.5 miles northeast of the Project Area. The City provides sanitary sewer, water, cable television, telephone, and library services to its residents. Additionally, the City's emergency services include a volunteer fire department, an ambulance service, and a police department. There are no active railroad lines in the Project Area.

9.5.1 Roads

9.5.1.1 Description of Resources

Existing roadway infrastructure in and around the Project Area consists of county and township roads that generally follow section lines, in addition to private unpaved farmstead driveways and farming access roads. Various County State Aid Highways (CSAHs), State Trunk Highways (STHs), County Roads (CRs), and township roads provide access to the Project Area, which are either two-lane paved or gravel roads.

There are no U.S. Trunk Highways or federal roads within the Project Area. U.S. Trunk Highway 75 (U.S. 75) is the only federal highway near the Project Area. U.S. 75 is approximately 2.5 miles east of the eastern edge of the Project Area and runs north/south through the City of Canby.

There are a number of CSAHs within the Project Area. Three CSAHs are paved asphalt (1, 30, and 36) and the remaining roads are dirt and gravel. CSAH 20 runs through the southern end of the Project Area on the county line between Yellow Medicine and Lincoln Counties. In Yellow Medicine County, STH 68 runs east-west along the northern portion of the Project Area. CRs in the Project area include 140th St and 200th Ave. There are also 12 township roads in the Project Area, such as 130th St and 210th Ave. The mileage of road types within the Project Area is summarized in Table 11.

Table 11: Miles of Roads in the Project Area

Road Type	Miles in the Project Area
Federal	0
State	3.57
County State Aid Highway	15.63
County	5.56
Township	26.09
Total	**50.85**

The existing traffic volumes on the area's county roads and highways are documented in Table 12. For purposes of comparison, the functional capacity of a two-lane paved rural highway is in excess of 5,000 vehicles per day, or Annual Average Daily Traffic (AADT). The highest existing AADT in or near the Project Area is 1,150 vehicles per day along STH 68. Along the remaining county highways, the AADT is at or below 700 vehicles per day.

Table 12: Average Annual Daily Traffic for Roads in the Project Vicinity

Roadway Segment Description	Existing Annual Average Daily Traffic
STH 68 between 150th St and 120th St	1150
120th St North of STH 68	235
120th St South of STH 68	255
150th St North of STH 68	260
150 St South of STH 68	50
200th Ave between 140th St and 120th St	350
200th Ave Between 120th St and the MN/SD boarder	120

Sources: Minnesota Department of Transportation (MnDOT). 2017a. Traffic Volume General Highway Map, Yellow Medicine County, MN; MnDOT

9.5.1.2 Impacts

Impacts to traffic will be short-term, intermittent, and occur during the construction phase of the Project. Impacts will be from the transport of Project components to the Project Area and from the movements of construction workers. Equipment and materials used in construction of wind farms can be extremely heavy and/or oversized loads. Therefore, increased wear and tear of local roads may be expected from delivery of Project materials and equipment. Possible weight related impacts to roads include physical damage to the structure of the road itself and/or damage to culverts and bridges.

Approximately 11.4 miles of new gravel access roads will be constructed for the Project. These access roads will be used during construction and will continue to be used during operation of the Project by O&M crews for gaining access to inspect and service the wind turbines. In general, the access roads will be located between the wind turbines. During construction, the roads will be approximately 40 ft in width to allow for cranes and equipment delivery. After construction is completed, the roads will be approximately 20 ft wide and low profile to allow cross-travel by farm equipment.

The maximum construction traffic is expected to be approximately 500 additional vehicle trips per day, with an estimated daily average of about 200 vehicles. The functional capacity of a two-lane paved rural highway is in excess of 5,000 vehicles per day. As indicated above, the heaviest traffic is on STH 68 along the northern edge of the Project Area at approximately 1,150 AADT. Most of the county roads and CSAH in the Project Area have AADT at or well below 700. Since many of the area roadways have AADT currently well below capacity, the addition of an average 100 vehicle trips would be perceptible, but similar to seasonal traffic increases such as observed during autumn crop harvest. Truck access to the northern portion of the Project Area is generally served by STH 68. Once the Project is completed, maintenance crews consisting of four to six full-time employees will periodically drive through the Project Area to monitor and maintain the wind turbines. Turbines and substations will occasionally require repair, which will create a temporary slight increase in area traffic.

Construction traffic will use the existing road systems for access to the Project Area. Current traffic levels on the affected roadways in the Project Area are well below roadway capacities, and construction traffic will be perceptible but similar to seasonal variations in traffic, such as autumn harvest. Therefore, construction activities are not expected to affect traffic levels. O&M activities will also not noticeably increase traffic within the Project Area.

9.5.1.3 Mitigative Measures

The Applicant will work with Fortier, Florida, and Norman townships, Yellow Medicine County, and Minnesota Department of Transportation (MnDOT) regarding roadway concerns, right-of-way work (if any), and setbacks during construction of the Project. As stated previously, the Applicant will work with Yellow Medicine County and the affected townships to enter into a Road Use Agreement prior to construction of the Project. The Applicant will also work closely with the landowners in the placement of access roads to minimize land-use disruptions during construction and operation of the Project to the extent possible.

The Applicant will obtain, file and submit all required MnDOT permits, including permits to complete the necessary work in MnDOT's right-of-way, such as transportation of turbines and equipment to and from the site. All roads, bridges, culverts, approaches, and intersections will be left in as good or better condition than before construction of the Project.

9.5.2 Telecommunications

9.5.2.1 Description of Resources

Telecommunications, also known as telecom, is the exchange of information over significant distances by electronic means and refers to all types of voice, data, and video transmission. This is a broad term that includes a wide range of information transmitting technologies such as telephones (wired and wireless), microwave communications, fiber optics, satellites, radio and television broadcasting, the internet, and telegraphs.

Telecommunication providers in the Project Area include Frontier Communications of Minnesota, Inc., Frontier Communication of South Dakota Inc., and Interstate Telecommunications Cooperative, Inc. (Minnesota Geospatial Commons, 2016). Comsearch performed a communication tower study in the vicinity of the Project Area in 2016 to identify tower structures and Federal Communications Commission (FCC)-licensed communication antennas (Appendix D). There is one cell tower located approximately 1 mile north of the Project Area. There are four communication antennas within the Project Area and two communication antennas within 1.5 miles of the Project Area that are used for land mobile services (Figure 10).

Emergency services in the Project Area were assessed by Comsearch in 2016 (Appendix D). The study evaluated frequencies for first responder entities including: police, fire, emergency medical services, emergency management, hospitals, public works, transportation, and other state, county, and municipal agencies. Industrial and business land mobile radio and commercial Emergency 911 operators were also identified in the Project Area. There are six land mobile and emergency service sites in the Project Area. There are 21 licensees that operate on the bands for area-wide first responders in the Project Area. Additionally, there are 10 mobile phone carriers with Emergency 911 service in the Project Area.

Telephone

Telephone service is provided by CenturyLink and other local telephone companies to farmsteads, rural residences, and businesses in the area. Mobile phone carriers include AT&T, Sprint, T-Mobile, and Verizon.

Radio

Comsearch performed an Amplitude Modulation (AM) and Frequency Modulation (FM) radio analysis in 2016 on the Project Area (Appendix D). There were no AM radio stations located within 18.6 miles (30 kilometers [km]) of the Project Area. There was one FM radio station, KDBX, located 8.9 miles (14.29 km) from the Project Area.

Television

According to a 2016 study by Comsearch, Appendix D, there are 11 off-air (i.e., not broadcasting) television stations within 46.6 miles (75 km) of the Project Area. Of these stations, seven are currently licensed and operating, five of which are low-power stations or translators. Translator stations are low-power stations that receive signals from distant broadcasters and retransmit the signal to a local audience. The 11 off-air television stations are listed in Table 13.

Table 13: Off-Air TV Stations within 75 km of Project Area

Call Sign	Channel	Distance to Project Area (km)
K19KH-D	19	44.97
K20KZ-D	20	44.97
K22KF-D	22	44.98
K23LI-D	23	44.98
KWCM-TV	10	53.70
K14OL-D	14	58.80
K16CP-D	16	58.80
K21LF-D	21	58.80
K22DO-D	22	58.80
K24CS-D	24	58.80
KESD-TV	8	66.46

Microwave Beam Path

Microwave bands are a telecommunication system that provides long-distance and local telephone service, backhaul for cellular and personal communication service, data interconnects for mainframe computers and the Internet, network controls for utilities and railroads, and various video services. The Applicant retained Comsearch to complete a microwave search and interference study on existing non-federal government microwave telecom systems. This 2016

study is located in Appendix D. Comsearch identified no microwave paths that intersect the Project Area. One microwave beam path was identified northeast of the Project Area (Figure 10).

9.5.2.2 Impacts

Construction of the Project could impact existing telecommunications infrastructure buried underground during construction activities, such as site grading, excavation, and trenching. Gopher State One Call will be contacted prior to construction to locate and avoid impacts to all underground communication system facilities. Once operational, the Project would not impact these resources.

First responder, industrial and business land mobile sites, area-wide public safety, and commercial Emergency 911 communications are typically unaffected by operation of wind turbines. These networks operate in a non-line-of-sight environment. Many land mobile systems are designed with multiple base transmitter stations covering a large geographic area with overlap between adjacent transmitter sites so that the end user is likely to receive signals from multiple transmitter locations. Therefore, any signal blockage caused by the wind turbines would not perceptibly degrade the reception. Additionally, the frequencies of operation for these services have characteristics that allow the signal to propagate through wind turbines. Therefore, very little, if any, change in their coverage should occur because of the Project.

Telephone

As stated above, many land mobile systems are designed with multiple base transmitter stations. Therefore, any signal blockage caused by the wind turbines would not perceptibly degrade their reception. Construction and operation of the proposed wind farm is not expected to impact telephone service to the Project Area.

Radio

The exclusion distance for AM broadcast stations varies as a function of the antenna type and broadcast frequency. For directional antennas, the exclusion distance is calculated by taking the lesser of 10 wavelengths or 1.9 miles (3 km). For non-directional antennas, the exclusion distance is simply equal to 1 wavelength. Potential problems with AM broadcast coverage are only anticipated when AM broadcast stations are located within their respective exclusion distance limit from wind turbine towers. As there were no stations found within 18.6 miles (30 km) of the Project, which is the maximum possible exclusion distance based on a directional AM antenna broadcasting at 1000 kilohertz or less, the Project should not impact the coverage of local AM stations (Comsearch, 2016).

Wind turbines do not typically cause interference with FM broadcast stations. KDBX is over 8.7 miles (14 km) away from the Project Area, which is sufficient distance to avoid radiation pattern distortion. No microwave beam paths intersect the Project Area, therefore, no detrimental impacts to radio reception are anticipated.

The Applicant submitted a letter to the United States Department of Commerce National Telecommunications and Information Administration (NTIA) dated August 23, 2016 requesting review of the Project (Appendix A). NTIA provided the Project information to the Interdepartment

Radio Advisory Committee (IRAC) which reviewed the Project for potential radio related impacts. The IRAC consists of the following:

- Department of Agriculture;
- Air Force, Army, and Navy;
- Broadcasting Board of Governors;
- Coast Guard;
- Department of Commerce;
- Department of Energy;
- FAA;
- Department of Homeland Security;
- Department of the Interior;
- Department. of Justice;
- National Aeronautics and Space Administration;
- National Science Foundation;
- Department of State;
- Department of Transportation;
- Department of the Treasury;
- United States Postal Service; and
- Department of Veterans Affairs.

The NTIA responded on October 25, 2016, that after a 45+ day period of review, no federal agencies represented by the IRAC identified any concerns with turbine placement regarding radio related issues (Appendix A).

Television

Two full-power digital stations, KWCM-TV and KESD-TV, may have their reception disrupted primarily in TV service locations within 6.2 miles (10 km) of the Project that have clear line-of-sight to a proposed wind turbine but not to the respective station. Multipath interference to a television receiver occurs when television signals are scattered by reflecting off the rotating wind turbine blades and mast. Modern digital TV receivers have undergone significant improvements to mitigate the effects of signal scattering. When used in combination with a directional antenna, it becomes even less likely that signal scattering from wind farms will cause interference to digital TV reception.

Microwave Beam Path

No microwave beam paths intersect the Project Area, therefore, no detrimental impacts to television reception are anticipated. Direct cable and broadcast satellite services do not operate on line-of-sight and would therefore not be affected by the Project.

9.5.2.3 Mitigative Measures

The Applicant has designed the Project to comply with the Commission's wind turbine setback and siting guidelines, which include setback requirements for communication towers, microwave beam paths, and overhead transmission lines, as described in Table 2. Further, Gopher State One

Call will be contacted prior to construction to locate and avoid impacts to all underground communication system facilities.

The Project's turbines will have a setback distance greater than the maximum height of the turbine to ensure a fall safety zone so as to not directly impact any surrounding communication structures in the unlikely event that a turbine would collapse as described in Section 9.2.3.

The Applicant will operate the wind farm to avoid microwave, radio, telephone, television, or navigation interference to meet FCC regulations and other requirements. The required separation distance between the wind turbines and communication towers is based on the characteristics of the communication systems and varies depending on the type of communication antennas that are installed on the tower. The Applicant will site the wind turbines to maintain a setback distance that will allow for normal broadcast coverage.

To the extent Project facilities cross or otherwise affect existing telecommunications equipment or transmission, the Applicant will coordinate with applicable service providers to avoid interference with these facilities. If it is determined that the Project will negatively impact telecommunication services, the Applicant will provide a specific mitigation plan and take the necessary steps to restore all impacted services at the expense of the Project. If a public safety entity finds that its coverage has been compromised by the Project, use of a nearby base station or adding a repeater site may be used to improve signal coverage to the area. Utility towers, meteorological towers, or the wind turbine towers can serve as the platform for a base station or repeater site.

Telephone

The Applicant will not locate any turbines within 254 ft (77.5 m) of land mobile fixed-base stations to avoid any possible impact to the communications services provided by these stations. This distance is based on FCC interference emissions from electrical devices in the land mobile frequency bands.

Radio

There were no AM stations found within 18.6 miles (30 km), or FM stations found within 8.7 miles (14 km), of the Project.

Television

In the unlikely event that interference is observed in any of the TV service areas, the Applicant will provide a specific mitigation plan and take the necessary steps to restore all impacted services at the expense of the Project. A modern digital television receiver, which reduces the effects of signal scattering, may be used in combination with a directional antenna to mitigate potential television interference due to the Project. Where available, cable or direct broadcast satellite service may be installed to mitigate impacts if necessary.

Microwave Beam Path

No microwave beam paths are crossed, and no impacts are anticipated. Therefore, no mitigation is proposed.

9.5.3 Other Infrastructure and Services

There is currently one existing electric transmission line within the Project Area. Otter Tail Power Company has a 115 kV transmission line running across the north, central and southwestern portions of the Project Area (see Figure 3a). This transmission line does not have adequate capacity to interconnect the energy from the proposed Project.

There are no existing railroads in the Project Area (Yellow Medicine County, 2006).

Townships within the Project Area have limited public infrastructure services. Homes and farmsteads in this area typically utilize on-site water wells and septic systems for individual household and farming needs. The Lincoln-Pipestone Rural Water System (LPRWS) operates a water treatment plant and associated water wells in the northwest corner of the Project Area, as well as associated buried water distribution lines (Figure 5). An existing water pipeline currently runs along the eastern edge of the Project Area, which is also operated by LPRWS and the Applicant is working with LPRWS to understand the specific pipeline location relative to the Project (Figure 5).

9.5.3.1 Impacts

Certain proposed Project access roads and collection lines in the northern portion of the Project Area cross or are adjacent to LPRWS buried pipelines (Figure 5). The Applicant will coordinate with, and obtain crossing agreements from, LPRWS for Project facilities that will be located near or cross LPRWS infrastructure and ensure the LPRWS system is not impacted by the Project.

The Applicant also will work with owners of other existing infrastructure and services as necessary to ensure that there are no impacts from construction and operation of the Project to existing electric transmission, railroads, pipelines, or other public infrastructure that exists in the Project Area.

9.5.3.2 Mitigative Measures

The Applicant will obtain crossing agreements from LPRWS for Project facilities that cross existing LPRWS system infrastructure before beginning construction. Prior to construction, the Applicant will request that LPRWS mark the location of its facilities within the Project construction corridor. The Applicant will review with LPRWS the construction methods it will use to install Project facilities near LPRWS infrastructure.

No other impacts are anticipated for other infrastructure and, therefore, no other mitigation is proposed. If impacts to other existing infrastructure and services are identified later, the Applicant will work with the affected providers to discuss mitigative measures.

9.6 Cultural and Archaeological Resources

9.6.1 Description of Resources

The Minnesota State Historic Preservation Officer (SHPO) and the Office of the State Archaeologist (OSA) were contacted in March 2017 to initiate Project coordination (Appendix A). Minnesota SHPO recommended that a Phase 1A Cultural Resources Background Literature Review be conducted to assess the need and provide potential scope definition for a Phase I Cultural Resource Reconnaissance Survey to be completed prior to Project construction. Cultural resource specialist staff at Merjent, Inc. (Merjent), on behalf of the Applicant, conducted a literature review based on the Project Area and a 1-mile (1.6 km) buffer.

The Project is located within the Prairie Lake South archaeological sub-region, which includes Brown, Cottonwood, Jackson, Lac Qui Parle, Lyon, Martin, Redwood, Watonwan, and Yellow Medicine counties, and portions of Blue Earth, Faribault, Lincoln, Murray, Nobles, and Pipestone counties (Anfinson, 1990). According to Gibbon, Johnson, and Hobbs (2002) archaeological resource sites are hypothesized to be numerous in this region and generally located on lakeshores and along river terraces.

Cultural resource specialist staff at Merjent conducted a background literature review of the Project Area and a surrounding, 1-mile (1.6 km) buffer. Merjent collected cultural resource data from the SHPO site files in St. Paul, Minnesota regarding documented archaeological sites, standing historic structures, and previously executed cultural resource surveys. This information is then used to identify site types that may be encountered and landforms or areas that have a higher potential for containing significant cultural resources. Collected data includes archaeological site files, architecture inventory files, and previous cultural resources studies and reports.

The literature review revealed the presence of eight previously reported archaeological sites within the Project Area (Table 14; Figure 11b). All eight of the sites are prehistoric. Five of the sites are artifact scatters, two are prehistoric stone features, and one is a single artifact find spot. None of the sites have been evaluated for eligibility for the National Register of Historic Places (NRHP).

Table 14: Previously Reported Archaeological Sites within the Project Area

State Site Number	Site Type	Cultural Affiliation	NRHP Status
21YM0026	Stone Ring	Pre-Contact	Unevaluated
21YM0027	Artifact Scatter	Pre-Contact	Unevaluated
21YM0030	Stone Ring	Pre-Contact	Unevaluated
21YM0051	Lithic Scatter	Pre-Contact	Unevaluated
21YM0052	Single Lithic Tool	Pre-Contact	Unevaluated
21YM0069	Lithic Scatter	Pre-Contact	Unevaluated
21YM0070	Lithic Scatter	Pre-Contact	Unevaluated
21YM0071	Lithic Scatter	Pre-Contact	Unevaluated

Merjent retrieved information from the Minnesota Historical Society regarding previously inventoried historic structures located within a 1-mile-wide (1.6 km) buffer review area, including and surrounding the Project Area. Merjent's review of the information obtained at Minnesota Historical Society identified nine previously inventoried historic structures within 1-mile (1.6 km) of the proposed Project Area (see Figure 11b and Table 15).

Table 15: Previously Inventoried Historic Structures within One Mile of the Project Area

County	State Site Number	Site Type	Historic Context	NRHP Status
Yellow Medicine	YM-FLD-005	Old Times Paradise Museum	Recreation and Culture	Unevaluated
Yellow Medicine	YM-FLD-006	Frank E, Millard Farmstead	Agriculture	Unevaluated
Yellow Medicine	YM-FOR-001	District School No. 48	Education	Unevaluated
Yellow Medicine	YM-FOR-002	District School No. 63	Education	Unevaluated
Yellow Medicine	YM-FOR-003	District School No. 55	Education	Unevaluated
Yellow Medicine	YM-FOR-004	Rock Wall	Landscape	Unevaluated
Yellow Medicine	YM-FOR-005	MN Hwy 68 State Line Marker	Transportation	Considered Eligible
Yellow Medicine	YM-FOR-006	Bridge No. L7935	Transportation	Unevaluated
Yellow Medicine	YM-FOR-007	Bridge No. L7986	Transportation	Unevaluated
Yellow Medicine	YM-NOR-002	Frank G. Olson Farmstead	Agriculture	Unevaluated

Only one of the previously inventoried historic structures (YM-FOR-005) has been subject to initial evaluation for eligibility for the NRHP.

Between May 31 and June 1, 2016 and August 16 and 17, 2016, an archaeological survey was conducted for an earlier Project design. The survey included a total of 1,285 acres (520 hectares). Seven archaeological sites were identified during the survey, but all sites were recommended not eligible, and it was further recommended that the Project, as designed at that time, would have no effect on archaeological resources eligible for listing in the NRHP.

Archaeological survey of the current Project design and construction corridors within the Project Area was completed in between October 19 and 25, 2017. No additional cultural resource sites were identified during the survey and the recommendation the Project would have no effect on archaeological resources eligible for listing in the NRHP is maintained. A report summarizing the results of the combined survey efforts will be compiled, submitted to MN SHPO for review, and filed by December 15, 2017.

9.6.2 Impacts

Archaeological resources may be impacted directly during the construction of a wind energy facility because construction within the turbine footprint, cable trenching, access roads, and borrow areas could impact unknown archaeological resources. In addition, construction of turbines or other protruding structures may impact viewshed integrity from existing architecture inventory resources.

9.6.3 Mitigative Measures

The Project Area has the potential to contain archaeological resources. These archaeological resources would most likely be located on or near elevated landforms and areas near permanent water sources. The Applicant recently conducted a Phase I Cultural Resources Reconnaissance Survey (report to be submitted by December 15, 2017) and is working cooperatively with SHPO and OSA.

The archaeological resources inventory will focus on areas proposed for Project construction, including wind turbine locations, associated access roads, electrical cable routes, and other construction elements. These investigations will be conducted by a professional archaeologist meeting the Secretary of the Interior's Standards for Archaeology as published in Title 36 Code of Federal Regulations Part 6. Survey strategies (pedestrian and/or shovel probing and/or deep testing) for the archaeological resource inventory will depend on surface exposure and the characteristics of the landforms proposed for development. After receiving the proposed turbine, access road, and electrical cable layouts, archaeologists will design an appropriate survey strategy for archaeological resources. This proposed survey strategy will be shared with SHPO to gather their input on the methodology prior to completing the study.

It is anticipated that the Phase I Archaeological Survey will be conducted during late fall 2017, when ground surface visibility is optimum for visual survey. It is anticipated that the Phase I Cultural Resources Reconnaissance Survey would incorporate the results of the previous investigations. The goal of the archaeological investigation will be to identify previously undocumented cultural resources located within the current construction footprint of the Project Area. Should such resources be identified, the Applicant will make efforts to alter the Project design to avoid impacts to both previously documented and newly recorded cultural resources.

Should previously undocumented cultural resources be identified during the Phase I Reconnaissance Survey, field staff will delineate the boundaries of the resource and record metric coordinates so that Project design and/or construction plans can be adjusted. Project modifications may include alterations in turbine siting, cable routes, access roads, and the application of construction practices focused on minimizing impacts (i.e., construction matting). If Project construction plans cannot be adjusted, additional investigation of the resource may be required and further coordination with SHPO and possibly OSA will be required. In the event that human remains are encountered, work in the immediate vicinity of the find will be stopped. In accordance with Minn. Stat. 307.08, the Private Cemeteries Act, local law enforcement must be notified and a professional archaeologist will evaluate the find and recommend treatment in consultation with the Minnesota SHPO. Work should not resume until all issues are resolved.

9.7 Recreation

9.7.1 Description of Resource

Recreational opportunities in Yellow Medicine County include hiking, biking, boating, fishing, camping, swimming, horseback riding, snowmobiling, hunting, and nature viewing. Figures 6a and 6b show the locations of state and county parks, WMAs, SNAs, and WPAs near the Project Area.

Minnesota WMAs are managed to provide wildlife habitat, improve wildlife production, and provide public hunting and trapping opportunities. These MNDNR lands were acquired and developed primarily with hunting license fees. WMAs are closed to all-terrain vehicles and horses. There are five WMAs within the Project Area. WMAs located within 10 miles of the Project Area boundary are listed in Table 16.

Table 16: Wildlife Management Areas within Ten Miles of the Project Area

Distance from Project Area (miles)	WMA Name	General Location	WMA Area (acres)
Within	Saum Memorial WMA	Within	81
Within	Sioux Nation WMA	Within	487
Within	Tatley WMA	Within	324
Within	Bohemian WMA	Within	665
Within	Penthole WMA	Within	31
Adjacent	Archerville WMA	Southeast	237
Adjacent	Minn-kota WMA	Southwest	138
1.0	Colinoso WMA	South	81
1.1	Platyrchnchos WMA	South	85
2.0	Mound Springs WMA	North	196
2.3	Hansonville WMA	South	35
2.5	Clare Johnson WMA	South	120
2.9	Prairie Dell WMA	South	200
3.3	Richard J. Dorer WMA	South	339
3.5	Boone Slough WMA	South	71
3.7	Pato WMA	South	19
4.7	Sokota WMA	South	144
6.0	Plantation WMA	North	69
6.5	Bossuyt WMA	South	82
6.7	Benjamin Thovson Memorial WMA	East	151
6.9	Reserve WMA	East	133
7.1	Indigo WMA: Main Unit	North	39
7.3	Indigo WMA: East Unit	North	21
7.8	Ten Soughs WMA	South	50

Table 16: Wildlife Management Areas within Ten Miles of the Project Area

Distance from Project Area (miles)	WMA Name	General Location	WMA Area (acres)
7.9	Collaris WMA	South	73
7.9	Pothole WMA	South	50
8.1	Hendricks WMA	South	114
8.2	Upper Antelope Valley WMA	East	161
8.8	Middle Antelope Valley WMA	East	380
8.8	Bail Out WMA	Northeast	155
9.0	Sweetwater WMA: Southwest Unit	North	132
9.1	Antler WMA	East	174
9.2	Christine WMA	South	41
9.3	Kvernmo WMA	South	102
9.7	Florida Creek WMA: Southeast Unit	Northeast	493
9.8	Poposki WMA	South	288
9.8	Legacy WMA	South	165
9.9	Expectation WMA	South	47

SNAs are areas designed to protect rare and endangered species habitat, unique plant communities, and significant geologic features that pose exceptional scientific or educational values. There is one SNA located within 10 miles of the Project. The Mound Spring Prairie SNA is located 0.25 mile north of the Project.

WPAs are managed to protect breeding, forage, shelter, and migratory habitat for waterfowl or wading birds, such as ducks, geese, herons, and egrets. WPAs provide opportunities for viewing wildlife and intact ecosystems. WPAs located within 10 miles of the Project Area are shown in Table 17.

Table 17: Waterfowl Production Areas within 10 Miles of the Project Area

Distance from Project Area (miles)	WPA Name	General Location	WMA Area (acres)
Within	Dakota WPA (2 parcels)	Within	272
Within	Kontz WPA	Within	30
0.8	Unnamed WPA	Southeast	162
1.9	Severson WPA	West	158
2.0	Anderson WPA	South	57
2.2	Johnson I (W)	West	69
2.7	Fox Lake WPA	West	118
4.3	Milton WPA	Southwest	30
4.6	Mundahl WPA (2 parcels)	West	147
4.7	Johnson II (H) (3 parcels)	South	119

Table 17: Waterfowl Production Areas within 10 Miles of the Project Area

Distance from Project Area (miles)	WPA Name	General Location	WMA Area (acres)
4.8	Kloos WPA	Northwest	45
5.0	Bailey Slough WPA	North	63
5.6	Black Slough WPA	South	281
5.8	Unnamed WPA	Southeast	161
6.1	Eilen WPA	Northwest	150
6.1	Johnson	Southwest	104
6.2	Bjornlie WPA (9 parcels)	Southwest	540
6.3	Elmore WPA	Southwest	19
6.5	Adams WPA (3 parcels)	Southwest	68
6.9	Montgomery WPA	Southwest	30
7.2	Quail WPA	Southwest	33
7.5	Pearson WPA (4 parcels)	North	366
7.5	Thompson WPA	Northwest	30
7.7	Rottum WPA	Southwest	83
7.9	Nordquist WPA (2 parcels)	West	325
9.3	Taylor WPA	North	181
9.5	Farrell WPA (5 parcels)	North	403

The MNDNR offers a Walk-In Access (WIA) Program for public hunting on private land. There are two WIA parcels within the Project Area totaling 308 acres. WIA areas are shown on Figures 6a and 6b. The WIA Program includes walk-in agreements with the landowner that typically last 1 to 3 years.

There are no snowmobile trails within 9 miles of the Project Area (Figures 6a and 6b). The closest snowmobile trail is located south of Hendricks, approximately 10 miles south of the Project Area.

9.7.2 Impacts

The Project will avoid all WMAs, WPAs, WIAs, and snowmobile trails and has been designed to maintain the 3 x 5 RD wind access buffer from all public lands. In general, recreational impacts will be visual in nature, affecting individuals using public land near the Project Area for recreation. See Section 9.4 for additional discussion of visual impacts and proposed mitigative measures.

9.7.3 Mitigative Measures

Project turbines and associated access roads, collection lines, and crane paths will avoid WMAs, WPAs, WIAs, and snow mobile trails. Turbines will be set back from public lands based on a minimum of the 3 RD by 5 RD setbacks from all non-leased properties per the MPUC siting guidelines (MPUC, 2008). Therefore, no mitigative measures are proposed.

9.8 Public Health and Safety

9.8.1 Electromagnetic Fields and Stray Voltage

9.8.1.1 Description of Resource

Electromagnetic fields (EMF) are electric and magnetic fields present around all electrical devices. Electric field strength is proportional to the line's voltage, and magnetic fields are due to the flow of electrical current that travels along transmission lines, power collection lines, substation transformers, house wiring, electrical appliances, WiFi, cell phones, etc.

Stray voltage is a natural phenomenon that results from low levels of electrical current flowing between two points that are not directly connected.

9.8.1.2 Impacts

EMF from underground electrical collection lines dissipates close to the lines because they are installed below ground, geometrically close to each other, and wound with copper wires in their jackets. The electrical fields around these lines are negligible and the small magnetic field directly above the lines dissipates within 20 ft (6.1 m) on either side of the installed cable, based on engineering analysis. Collection lines will be buried underground to a depth of at least 42 inches (with the exception of junction boxes) and will be located no closer than 110 ft (34 m) from a residence. EMF associated with the transformers within the nacelle dissipates within 5 ft (1.5 m), so the 1,500-foot (457 m) turbine setback from residences will be adequate to avoid any EMF exposure to homes. The proposed 345kV interconnection transmission line associated with the Project would originate at the Project substation in Deuel County, SD, southwest of the proposed turbines. Wind turbine interconnection cables will be setback from residences in excess of state standards at least 110 ft (34 m), where EMF will be at background levels.

There are no dairy farms within the Project Area. Potential impacts from stray voltage can result from a person or animal coming in contact with neutral-to-earth voltage. Stray voltage does not cause electrocution and is not related to ground current, EMF, or earth currents. Where distribution lines have been shown to contribute to the propagation of stray voltage on farm facilities, the distribution system was either directly under or parallel to an existing transmission line. These factors are considered in design and installation of transmission lines and can be readily mitigated.

Problems related to distribution lines are also readily managed by correctly connecting and grounding electrical equipment. To address stray voltage, electrical systems, including farm systems and utility distribution systems, must be adequately grounded to the earth to ensure continuous safety and reliability, and to minimize this current flow. Wind energy collection systems mitigate any such issue by running a continuous bare ground conductor from the furthest turbine to the substation.

9.8.1.3 Mitigative Measures

No dairy farms are located within the Project Area and, therefore, no impacts or mitigation is proposed for such. The Applicant has designed the Project with the goal of siting turbines and associated facilities to avoid impacts to health and safety. The Applicant will design, construct,

and operate all electrical equipment, including turbines, transformers, collection lines, and transmission lines in accordance with applicable codes, manufacturer specifications, and required setbacks. Because no impacts due to EMF or stray voltage are anticipated, no mitigation is proposed.

9.8.2 Air Traffic

9.8.2.1 Description of Resource

There is one airport within 10 miles (16 km) of the Project Area (Figure 1). The nearest airport is the Myers Field Airport, located approximately 4.0 miles (6.4 km) east/northeast of the Project Area in Canby, Minnesota. Airport setbacks must be in accordance with MnDOT, Office of Aeronautics, and FAA requirements.

9.8.2.2 Impacts

The Applicant has coordinated with the Myers Field Airport, and will obtain the required permits from the FAA and the MnDOT Office of Aeronautics and Aviation prior to construction of the proposed turbines.

In addition to commercial flights associated with the above listed airports, air traffic associated with the crop dusting of agricultural fields may occur near the Project Area. Crop dusting is generally conducted during the day by highly maneuverable airplanes or helicopters. Installing wind turbine towers, aboveground transmission lines, or other associated aboveground facilities in active croplands would create a potential for collisions with crop-dusting aircraft.

However, the aboveground transmission line associated with the Project that will be constructed in Deuel County, SD is anticipated to be routed along edges of fields, roadways, or other existing linear infrastructure, similar to existing distribution lines.

Setbacks to airport facilities must be in accordance with MnDOT Office of Aeronautics and FAA requirements. The Project turbines must each receive a Determination of No Hazard from the FAA, and all turbines over 499 ft tall must also obtain an Airspace Obstruction Permit from the MnDOT Aeronautics Division prior to construction and additional FAA review (see below). Further, the Applicant will appropriately mark and light the turbines and meteorological towers to comply with FAA guidelines.

The Applicant proposes to use wind turbines with a tip height of 568 ft (173 m). Because structures taller than 499 ft (152 m) may have an adverse physical or electromagnetic interference effect upon navigable airspace or air navigation, FAA conducts additional review of these proposed structures. Further study entails distribution to the public for comment, and may extend the study period up to 120 days.

It is anticipated that the FAA review of the Project will result in a “No Hazard” issuance determination because the Applicant has prescreened the Project Area with consultant Aviation Systems Incorporated and has designed the turbine layout to receive No Hazard determinations. Both turbines and meteorological towers will have lighting to comply with applicable FAA requirements.

9.8.2.3 Mitigative Measures

The Applicant will notify local airports about the Project and new towers in the area to reduce the risk to crop dusters. The Applicant will coordinate with landowners within and proximal to the Project regarding crop dusting activities. Permanent meteorological towers will be freestanding with no guy wires. Temporary meteorological towers had supporting guy wires which were marked with alternating red and white paint at the top and colored marking balls on guy wires for increased visibility.

9.8.3 Safety and Security

9.8.3.1 Description of Resource

The Project is located in a rural, agricultural environment. The Applicant is coordinating with applicable emergency and non-emergency response staff for the area, such as local law enforcement agencies, Emergency 911 services, fire departments, and ambulance services. Construction and operation of the Project is anticipated to have minimal impacts on the security and safety of local residents and the general public.

9.8.3.2 Impacts

Construction and operation of the Project is not anticipated to have any significant impact to security and safety of the local population. Current turbine technology, proactive maintenance, and regular facility inspections have reduced the risk to insignificant rates.

In the event that emergency services are needed at local residences during construction, construction activities will be stopped and relocated so that emergency vehicles may have unfettered access to the emergency site.

9.8.3.3 Mitigative Measures

The Applicant will coordinate with regional air ambulance, sheriff's offices, and fire services to develop a safety plan during construction and operations of the Project. The Applicant will provide information about the Project and answer any questions first response teams may have regarding Project plans and details.

As discussed in other sections of this SPA, the following security measures will be enacted to reduce personal injury or property damage:

- All Project facilities will be equipped with sufficient security measures throughout construction and during operation of the Project. These measures may include temporary and/or permanent fencing, warning signs, and secure locks on equipment and facilities;
- Security measures will be constructed where deemed necessary by the Applicant at the request of landowners;
- Necessary safety training will be provided to construction and operation staff;
- Regular maintenance and inspections of the turbines and associated facilities will be conducted to assess potential blade failures and minimizing blade throw potential; and

- Setbacks from roads, property lines, homes, and other infrastructure have been included in Project design. The applied setback distances promote safety and mitigate potential damage from any unanticipated and unlikely tower or blade failures.

9.9 Hazardous Materials

9.9.1 Description of Resources

The Project Area is primarily rural and used for agriculture. Potential hazardous materials within the Project Area may be associated with agricultural activities and material uses, including herbicides, pesticides, petroleum products (fuel and lubricants), solid and liquid waste disposal, and water supply wells (domestic and agricultural). Farmstead facilities may also contain lead-based paint, asbestos (shingles, insulation, etc.), and polychlorinated biphenyls (in electrical transformers). Trash and farm equipment dumps are also common in rural settings and may be present in the Project Area.

The Applicant conducted a preliminary review of the MPCA "What's in My Neighborhood?" (2016) database to identify state listed sites that may have environmental impacts. Review of this information indicates the following designated sites are located within the Project Area:

- 22 feedlot sites;
- 1 tank site; and,
- 1 stormwater site.

The above-listed sites will be avoided by the Project, and no proposed Project facilities will be located at these sites.

9.9.2 Impacts

The Applicant will conduct a Phase I Environmental Site Assessment (Phase I ESA) in accordance with American Society for Testing and Materials E1527-13 on properties acquired for the Project. The Phase I ESA will identify known recognized environmental conditions or historical recognized environmental conditions that may require additional action prior to or during construction. The Phase I ESA will be conducted prior to construction to locate and avoid hazardous waste sites.

During construction of the Project, equipment and vehicles used in construction will use petroleum products and related lubricants. During construction, some solid and fluid wastes will be generated from construction activities. These wastes will be properly contained and disposed of following applicable state and local requirements.

Spill-related impacts from construction are primarily associated with fuel storage, equipment refueling, and equipment maintenance. To avoid spill-related impacts, the Applicant will develop a Spill Prevention, Control and Countermeasures (SPCC) Plan that will outline measures that will be implemented to prevent accidental releases of fuels and other hazardous substances and describes response, containment, and cleanup procedures.

Operation of the Project turbines will include use of petroleum products including gear box oil (either mineral based or synthetic based upon manufacturer and application), hydraulic fluid, and gear grease. The turbines will be regularly serviced and any waste fluids that are generated with this service will be managed and disposed of (if needed) or recycled in compliance with applicable waste disposal laws and regulations.

During operation of the Project, turbine hydraulic oils and lubricants will be contained within the wind turbine nacelle and within service vehicles. The turbine transformers in the nacelle are the dry type (i.e., cooled by air). The Project will monitor fluids during maintenance at each turbine and transformer. A small volume of hydraulic oil, lube oil, grease, and cleaning solvent will be stored in the O&M building. When fluids are replaced, the used products will be handled according to applicable regulations and disposed of or recycled through an approved waste disposal firm.

9.9.3 Mitigative Measures

Because the Project will avoid identified hazardous waste sites, no mitigative measures are proposed. Wastes, fluids, or pollutants that are generated during construction and operation of the Project will be handled, processed, treated, stored, and disposed of in accordance with Minn. R. Ch. 7045 and local requirements.

9.10 Land-Based Economies

9.10.1 Agriculture/Farming

9.10.1.1 Description of Resources

The majority of the Project Area is agricultural (see Figure 12). Cultivated land comprises approximately 10,636 acres (46.5%) of the Project Area. Pasture land comprises approximately 5,990 acres (26.2%) of the Project Area.

Corn, soybean, wheat, and forage crops are grown throughout Yellow Medicine County and represent 74% of the agricultural market for the County. Raising livestock and dairy farming are major sources of income, representing a combined 26% of the county agricultural market. Within the Project Area, the trend has been toward fewer individual farms and an increase in farms of greater acreage (see Section 9.1.1 above) (U.S. Department of Agriculture [USDA], 2012). Converting cropland to the CRP and the RIM program is another source of farm income. CRP and RIM lands are cropland planted to conserve grasses and legumes to protect and improve the soil with limited harvesting or pasturing allowed on CRP land. CRP land is generally enrolled for 10-year periods, whereas RIM conservation easements are permanent.

Approximately 41% of the soil within the Project Area is prime farmland. The USDA Natural Resource Conservation Service identifies prime farmland as land that has the best combination of both physical and chemical characteristics for the production of food, livestock feed and forage, fiber, and oilseed crops and is available for these agricultural uses. Important farmlands consist of prime farmland, unique farmland, and farmland of statewide or local importance (USDA, 2016).

9.10.1.2 Impacts

The construction and operation of the Project will not significantly impact the current agricultural land use or character of the area.

Small portions of land will be removed from agricultural production at turbine locations and along proposed access roads (1-2 acres per turbine). The use of larger turbines results in fewer turbines for the same total nameplate capacity and less overall land disturbance. Individual landowners will be able to continue to plant crops and graze livestock up to the turbine pads. In some instances, agricultural practices may be impacted by creating altered maneuvering areas for agricultural equipment around turbine structures and access roads, but access roads have been designed with landowner input for minimal agricultural impact. For example, access roads are placed along fencelines wherever possible, and if they do go through fields, they are generally oriented in parallel with farming directions. In many cases, access roads are longer than absolutely necessary so as to minimize agricultural impact via selection of a route that minimizes agricultural equipment maneuvering changes.

If construction activities are executed outside of winter months, temporary impacts to agriculture fields may occur. These temporary impacts may include limited planting opportunity, crop damage, drain tile damage, and soil compaction.

As stated above, 41% of the soil within the Project Area is considered prime farmland. The loss of agricultural land resulting from the construction of the wind farm will reduce the amount of land that can be cultivated. Approximately 0.002% of the Project Area will be converted to non-agricultural land use. Similarly, approximately 43.82 acres (less than 0.004%) will be converted out of prime farmland. This will not significantly alter crop production in the Project Area or Yellow Medicine County.

Negotiations with property owners have produced land agreements mutually agreeable to both parties that address agricultural impacts such as crop damage, soil compaction, and drain tile repairs. Drain tile will be repaired according to the agreement between the Applicant and the owner of any damaged tile. The Applicant will strive to avoid impacts to RIM lands and avoid or minimize impacts to CRP lands where practicable.

Potential impacts from stray voltage are discussed in Section 9.8.1 above.

9.10.1.3 Mitigative Measures

Only areas occupied by turbines, the Project Substation, O&M facility, and access roads will be removed from crop production. All land surrounding the constructed facilities can still be farmed. The permanent loss of up 68.32 acres of agricultural land will not result in the loss of any agriculture-related jobs or any net loss of income. Revenue lost from the removal of land from agricultural production will be more than offset by lease payments to landowners hosting the Project facilities. As a result of land payments to landowners hosting facilities and landowners without facilities but with wind rights agreements, significant new agricultural income will enter the county from the Project.

The Applicant will coordinate with property owners to identify features on their property, including drain tile, which can be avoided. The Applicant recognizes that the excavation and heavy equipment associated with construction may cause damage to known or unknown drain tiles. In the event that there is damage to drain tile as a result of construction activities or operation of the Project, the Applicant will work with affected property owners to repair the damaged drain tile in accordance with the easement agreements between the Applicant and the landowners.

The Applicant will avoid or minimize impacts to mapped CRP lands. If CRP land is impacted, the Applicant will work with the landowner and the Natural Resource Conservation Service to remove the impacted portion of the enrolled parcel from the CRP program. There will be no impacts to RIM land; therefore, no mitigation will be necessary.

9.10.2 Forestry

9.10.2.1 Description of Resources

According to the MNDNR Division of Forestry (MNDNR, 2016) commercial or industrial forestry resources are not located within the Project Area. Local forested land within the Project Area is generally associated with homes in the form of shelterbelts or woodlots and gallery forests along the water courses. These, however, are not considered economically significant forest resources.

9.10.2.2 Impacts

Shelterbelts and woodlots associated with residential areas will not be impacted during construction or operation of the Project. No commercial or industrial quality forestry resources are located within the Project Area.

9.10.2.3 Mitigative Measures

No forestry resource mitigation efforts will be required as no impacts to forestry resources are anticipated.

9.10.3 Mining

9.10.3.1 Description of Resources

Sand and gravel resources are regularly exploited in areas dominated by glacial till and outwash deposits. Many pits in the area are inactive, abandoned, or their use is limited to the landowner. Based on MnDOT County Pit Maps and topographic maps, there are three active gravel pits located within the Project Area (MnDOT, 2016) (see Figure 14).

9.10.3.2 Impacts

No impacts to mining are anticipated.

9.10.3.3 Mitigative Measures

As no impacts to mining resources are anticipated, no mitigation efforts will be necessary.

9.11 Tourism

9.11.1 Description of Resources

According to the Western Minnesota Prairie Waters Convention and Visitors Bureau, tourism in Yellow Medicine County focuses primarily on promoting the area's natural history, parks, historical sites, game and wildlife, lakes, farms, and small towns. Also publicized are cultural (museums, art, and antiques) and recreational activities (parks, hiking trails, camping, canoeing, horseback riding, fishing, wildlife refuges, snowmobiling, golf courses, swimming pools, tennis courts, and skiing). Parks within Yellow Medicine County include Upper Sioux Agency State Park, Wood Lake and Oraas county parks, and Stonehill Regional Park, Canby Triangle Park Campground, and Central Park in Canby. The nearest park is Stonehill Regional Park, which is located approximately 2 miles east of the Project Area.

Yellow Medicine County also hosts a variety of festivities and cultural events throughout the year. These include the Yellow Medicine County Fair, Hanley Falls Good Ole' Days & Threshing Show, and Clarkfield Cardinal Days. Gross sales related to leisure and hospitality industry in Yellow Medicine County totaled $13,895,629 in 2015 (Minnesota Department of Revenue, 2017).

9.11.2 Impacts

Because all Project facilities will generally be located on private lands, there will be no direct impacts to recreational facilities, public lands, or other tourism-related activities. Proposed setbacks from recreational trails, public roads, and non-leased properties (including public lands) are summarized in Table 2 and will minimize any indirect impacts. The Project is not anticipated to have a significant effect on area tourism. See Section 9.4.3 which discusses recreational resources and visual impacts.

9.11.3 Mitigative Measures

Because no significant impacts are anticipated, no mitigation beyond the turbine setbacks is proposed.

9.12 Local Economies

9.12.1 Description of Resources

According to Minnesota's Quarterly Census of Employment and Wages, the main industries in the Project Area include education and health services (schools and hospitals), wholesale and retail trade, leisure and hospitality (accommodation and food services), public administration, construction and manufacturing, and natural resources and mining (agriculture). Many of the industries listed above are concentrated in municipal areas external to the Project Area. Agriculture is the dominant facets of the local economy within the Project Area (Minnesota Department of Employment and Economic Development, 2012).

9.12.2 Tax Payments and Property Values

The Project will have a positive impact on both the tax base and local economy. Landowners and farmers will have an opportunity to increase land and agricultural profitability, and a more diverse source of income, from the Project. Wind energy generation provides a long-term, annual benefit to participating landowners. Landowners involved with the Project, as well as those who have leased their wind rights to the Project, will receive a royalty or lease payment annually for the life of the Project.

In addition to creating jobs and supplementing personal income, the Project will pay a wind energy production tax to local units of government. This production tax credit is $1.20 per MWh of electricity produced, which will result in an estimated annual wind energy production tax payment of approximately $690,000.[9]

Project facilities will be located on leased lands; therefore, there will be no unmitigated impacts to the property values of participating landowners. Concerns of non-participating landowners regarding adverse impacts to their property values has been studied and the findings of a nationwide study that reviewed the sale of over 50,000 home sales in nine separate states found that sale prices/property values were not impacted by wind development actions (Hoen et al., 2013).

9.12.3 Impacts

The Project provides landowners and farmers with opportunities for additional land and agricultural profitability and offers an opportunity for a more diverse revenue source. Wind energy production is a long-term income-generating opportunity that will provide an annual benefit to participating landowners.

Local contractors and suppliers will be used for portions of the construction. Wages and salaries paid to contractors and local workers will supplement personal income of the region. Additional income will be generated for the county and state economy through the circulation and recirculation of dollars paid out by the Applicant for business expenditures and for state and local taxes. Payments for equipment, fuel, operating supplies, and other products and services benefit local and regional businesses. Landowners with turbine or other Project facilities on their land will receive a royalty or lease payment annually for the life of the Project. These payments will have a positive effect that will diversify and strengthen the local economy.

Participating landowners will be compensated for the use of their property for the Project. Landowners that signed setback waivers will also be compensated. Non-participating landowners are not expected to see any impacts to their property values because the Project will adhere to required setbacks from homes, as well as state-mandated sound and shadow flicker restrictions.

[9] 80% of the production tax goes to the county and 20% goes to the townships.

9.12.4 Mitigative Measures

No economic impacts are anticipated from the Project, and therefore no mitigation is proposed. Economic impacts associated with the Project will be primarily positive with an influx of wages and expenditures made at local businesses during Project construction and an increase in the counties' tax bases from the construction and operation of the wind turbines.

The Project is not anticipated to create negative impacts on property values within or near the Project, and therefore no mitigation is proposed.

9.13 Topography

9.13.1 Description of Resources

The Project Area is located within the Coteau Moraine Subsection (251Bb), a subsection within the North Central Glaciated Plains Section (251B) of the biogeographic province known as the Prairie Parkland Province under the Ecological Classification System developed by the MNDNR and the U.S. Forest Service (Figure 8). Subsection boundaries delineate a significant regional change in geology, topography, and vegetation. The Coteau Moraine Subsection is a wedge-shaped bedrock plateau that covers eastern South Dakota and southwestern Minnesota and consists of an area of transition from shallow deposits of windblown silt (loess) over glacial till to deeper deposits of loess.

A topographic map of the Project Area is shown in Figure 8. Topography within the Project Area is gently rolling moraine. Steeper relief occurs in valleys along the eastern edge of the Project Area formed by Lazarus and Canby creeks. Lazarus Creek flows east across the northern third of the Project Area, and Canby Creek flows east in the southern portion of the Project Area. At their steepest, valleys are cut into the landscape up to 60 ft (18 m).

From the southwest corner of the county to the edge of the Coteau, near Canby, the descent in elevation is more than 450 ft (137 m) above mean sea level (AMSL). The elevation in the southwest corner of the Project Area is the highest at 1,714 ft (522 m) AMSL and is lowest in the northeast corner at 1,400 ft (427 m) AMSL. The higher elevation is caused by thick deposits of pre-Wisconsin age glacial till (up to 800 ft [244 m] thick).

9.13.2 Impacts

Siting and construction of the turbines, associated facilities, access roads, and collection/transmission lines will require some grading. However, significant impacts to topography are not anticipated because the layout and siting will minimize cut and fill requirements by utilizing existing topographic contours as much as possible.

9.13.3 Mitigative Measures

Because significant impacts to topography are not anticipated, no mitigative measures are proposed.

9.14 Soils

9.14.1 Description of Resources

Two soil associations are found within the Project Area (Table 18 and Figure 13). A soil association consists of a set of individual soils that exhibit distinctive patterns of soil distribution, topographic relief, and drainage characteristics. Each is a unique natural landscape consisting of one or more major soils and other minor soils. The association is named after its major soils.

Table 18: Soil Associations

Soil Association	Project Area (acres)
Flom-Barnes (s3542)	22,076.0
Forman-Buse-Aastad (s6894)	807.2
Total	**22,883.2**

The Flom-Barnes Association – Flom soils are silty clay loams, on glacial till plains with a slope of 1%, in cultivated fields. Flom soils are very deep, poorly drained, and very poorly drained soils formed in loamy glacial till or glacial lacustrine sediments on moraines. Barnes soils are fine loamy soils. Barnes soils are very deep, well drained soils that formed in loamy till. These soils are on till plains and moraines and have slopes ranging from 0 to 25%. (USDA, 2017).

The Forman-Buse-Aastad Association – Forman soils are clay loams in cultivated fields. Forman soils are very deep, well drained soils that formed in loamy till. These soils are on till plains and moraines and have slopes ranging from 0 to 25%. Buse soils are loams with a convex slope of 5% on a glacial moraine in cultivated fields. Buse soils are very deep, well drained soils that formed in loamy glacial till on moraines. They have slopes of 3 to 60%. Aastad soils are clay loams on a nearly level slope in cultivated fields. Aastad soils are very deep, moderately well drained soils that formed in calcareous till on moraines and till plains. Slopes range from 0 to 6% (USDA, 2017).

9.14.2 Impacts

Construction and operation of wind turbines and associated Project facilities may increase the potential for soil erosion or compaction. In some locations, some prime farmland may be converted from conventional agricultural uses to wind energy generation use. It is anticipated that the Project will convert up to 68.32 acres out of agricultural production for Project facilities (turbines, access roads, Project Substation, and O&M facility). See Section 9.10.1 for a discussion of impacts to farmland.

9.14.3 Mitigative Measures

A National Pollutant Discharge Elimination System (NPDES) permit to discharge stormwater from construction facilities will be obtained by the Applicant from the MPCA. Best Management Practices (BMPs) will be used during construction and operation of the Project to protect topsoil and adjacent resources and to minimize soil erosion. Practices may include containment of excavated material, protection of exposed soil, and stabilization of restored material. A stormwater

pollution prevention plan (SWPPP) will be developed prior to construction that will include BMPs such as silt fencing, revegetation plans, and management of exposed soils to prevent erosion. Following completion of construction, all impacted property not required for continuing operations of the Project facilities will be restored to a reasonably similar condition to its original condition. Reclamation efforts will include restoration actions to eliminate areas of soil compaction and to replace removed topsoil to its original location. Except for de minimus amounts that are removed as a consequence of construction, topsoil shall not be removed from the property without the consent of the landowner.

On August 31, 2017, the MPCA submitted a letter to the Applicant with comments on the Project (Appendix A). The MPCA Environmental Review Unit indicated that if the total Project area will disturb a total of 1 acre or more of land, a NPDES/State Disposal System Construction Stormwater Permit (CSW Permit) is required from the MPCA, along with a detailed SWPPP. The MPCA indicated that CSW Permit coverage is required prior to commencing land disturbing activities (i.e., clearing, grading, filling, or excavating) relating to a project. Additionally, the MPCA indicated that any project that will result in over 50 acres of disturbed area and has a discharge point within 1 mile of a special or impacted water is required to submit their SWPPP to the MPCA for a review at least 30 days prior to commencement of land disturbing activities. The MPCA encouraged the Applicant to meet with staff at preliminary points to avoid delays in these approvals.

The Applicant will review Project impacts and prepare information needed for securing the CSW Permit from the MPCA. The Applicant will coordinate with the MPCA regarding the CSW Permit prior to initiating construction. A SWPPP will be prepared and a construction NPDES permit will be obtained from the MPCA prior to the construction of the Project. Disturbed surface soils will be stabilized at the completion of the construction process to minimize the potential for subsequent effects on surface water quality. The turbine areas will be disconnected from one another and separated by vegetation which will reduce the impact of the small amount of increased storm water volume.

9.15 Geologic and Groundwater Resources

9.15.1 Description of Resources

9.15.1.1 Surficial Geology

Surficial geology of the Project Area is Altamont Moraine of stagnation type associated with the Pleistocene Late Wisconsinan age Des Moines Lobe (Hobbs and Goebel, 1982) (Figure 14). The glacial drift and sedimentary deposits are derived from Manitoba and eastern North Dakota, are 600 to 800 ft (183 to 244 m) thick, are gray in color and calcareous. Shale and limestone clasts are generally common and the combined silt and clay typically exceeds 50% of the till.

9.15.1.2 Bedrock Geology

Bedrock underlying the Project Area is of Cretaceous age and consists of undifferentiated conglomerate, sandstone, mudstone, shale, marlstone, siltstone, and minor lignite, deposited in marine and non-marine settings (Jirsa, 2011). Depth to bedrock within the Project Area is 600 to

800 ft (183 to 244 m). The bedrock elevation varies from 1,100 ft (335 m) AMSL in the northeast to 900 ft (274 m) AMSL in the southwest (Figure 14).

9.15.1.3 Aquifers and Wells

Minnesota is divided into six groundwater provinces based on bedrock and glacial geology. The Project Area lies within the Western Province, which is comprised of clayey glacial drift overlying Precambrian and Cretaceous bedrock. The aquifers within this province occur in two general geologic settings: a) bedrock; and b) unconsolidated sediments deposited by glaciers, streams, and lakes. The glacial drift and Cretaceous bedrock contain limited extend sand and sandstone aquifers, respectively (MNDNR, 2001). Recharge to the water table occurs throughout the region via infiltration of precipitation, surface water runoff from areas of lower to higher infiltration, and subsurface groundwater movement from adjacent areas. Sources of recharge include some lakes and wetlands and short reaches along stream segments. The Lincoln-Pipestone Rural Water System operates a water treatment plant, associated water wells, and a water pipeline within the Project Area.

The Applicant has reviewed the Project Area for U.S. Environmental Protection Agency (USEPA) designated sole source aquifers (SSA), wells listed on the Minnesota County Well Index (CWI), and Minnesota Department of Health (MDH) wellhead protection areas. A brief summary of this review follows.

USEPA Sole Source Aquifers

The USEPA defines a SSA or principal source aquifer area as one that supplies at least 50% of the drinking water consumed in the area overlying the aquifer, where contamination of the aquifer could create a significant hazard to public health, and where there are no alternative water sources that could reasonably be expected to replace the water supplied by the aquifer (USEPA, 2016). There are currently no USEPA-designated SSAs crossed by the Project (USEPA, 2017).

County Well Index

The CWI is the most complete record of well construction and location in Minnesota and is kept up-to-date and maintained by the Minnesota Geological Survey, in cooperation with the MDH. A search of the CWI (Minnesota Geological Survey, 2017) identified ten domestic wells, three monitoring wells, four observation wells, eight test wells, seven abandoned wells, and two wells of unknown type. One well is located within the construction workspace, however according to the CWI, this well has been sealed and is no longer in use. One well is located approximately 15 ft from construction workspace, and one is approximately 40 ft from construction workspace. The remaining wells are more than 50 ft from the construction workspace.

Most of the wells listed in the CWI are screened in buried outwash deposits which are at least 20 ft thick. Approximately 12% of the wells in the CWI are screened in the Cretaceous sandstones ranging in depth from 50 to over 400 ft below ground surface. Yields from Cretaceous wells range from a few gallons-per-minute to several tens of gallons-per-minute (Olcott, 1992). Domestic groundwater supply appears to be fairly accessible in the Project Area. Yields may vary significantly depending on source.

Wellhead Protection Areas

Under the Safe Drinking Water Act 42 United States Code (U.S.C.) §300f et seq. (1974), each state is required to develop and implement a Wellhead Protection Program in order to identify the land and recharge areas contributing to public supply wells and prevent the contamination of drinking water supplies. The Safe Drinking Water Act was updated in 1986 with an amendment, 100 Stat. 642. "Safe Drinking Water Act Amendments of 1986." 1986-06-19, requiring the development of a broader-based Source Water Assessment Program, which includes the assessment of potential contamination to both groundwater and surface water through a watershed approach. A Wellhead Protection Area (WHPA) encompasses the area around a drinking water well where contaminants could enter and pollute the well.

Public and non-public community water supply source-water protection in Minnesota is administered by the MDH through the Wellhead Protection Program under Minn. R. Parts 4720.5100 to 4720.5590. WHPAs for public and community water-supply wells are delineated on the basis of a zone of capture for 10-year groundwater time-of-travel to the well and are available through a database maintained by MDH (2017). A search for WHPAs in the MDH database indicated that two WHPAs are located within the Project Area; the Lincoln-Pipestone Rural Water Supply – Burr North; and the Lincoln-Pipestone Rural Water Supply – Burr South (see Figure 5).

9.15.2 Impacts

No impacts to geologic and groundwater resources are anticipated as a result of construction or operation of the Project. Water supply needs for the Project are limited and relate to water needed during construction (e.g., temporary concrete batch plant, etc.) and domestic water supply for the O&M facility. RES has not yet determined the source or amount of water necessary to support construction activities, but this will be done through subcontractor arrangements for local water sources. If any new wells are necessary to support the construction activities, they will be permitted in accordance with MDH well requirements. Water supply for the proposed O&M facility will be satisfied with either an on-site well or rural water service (if available).

As the Project proceeds, Lincoln-Pipestone Rural Water System will be consulted to avoid any impacts to its system from the development of this Project. Construction dewatering may be required at certain locations of the Project and, if needed, the Applicant will conduct dewatering in accordance with applicable rules and regulations (i.e., Applicant will obtain an MNDNR Water Appropriation Permit). Wells and borings are regulated in Minnesota and any borings drilled for this Project will likely be an Environmental Bore Hole (EBH), which is subject to MDH regulation.

Wells in the area range from 2 to 724 ft (221 m) deep with most of the wells screened in buried outwash deposits which are at least 20 ft (6 m) thick. Structure foundations will generally range from 7 ft to 10 ft in depth. This is above the typical minimum depth of the bedrock aquifers underlying the Project facilities and is generally expected to be above the water table in surficial aquifers. Shallow surficial aquifers are typically comprised of relatively permeable alluvial sands and gravels that respond rapidly to changes in water level elevations or groundwater flow. If excavation occurs below the water table, the resulting changes in water levels and/or turbidity in these aquifers are expected to be localized and temporary because water levels quickly re-establish equilibrium and turbidity levels rapidly subside.

Although unlikely, the introduction of contaminants into groundwater due to accidental release of construction related chemicals, fuels, or hydraulic fluid during construction could have an adverse effect on groundwater quality, most notably near shallow water wells.

Spill-related impacts from construction are primarily associated with fuel storage, equipment refueling, and equipment maintenance. To avoid spill-related impacts, the Applicant will develop a SPCC Plan that will outline measures that will be implemented to prevent accidental releases of fuels and other hazardous substances and describes response, containment, and cleanup procedures. By implementing the protective measures set forth in the SPCC Plan, long-term contamination due to construction activities is not anticipated.

Also, as further detailed in Section 9.14.3, the Applicant will obtain a NPDES permit to discharge stormwater from construction facilities from the MPCA and BMPs will be used during construction and operation of the Project to protect topsoil and adjacent resources and to minimize soil erosion.

9.15.3 Mitigative Measures

If a water supply well is needed for the O&M facility (in place of water being supplied from the Lincoln-Pipestone Rural Water System), the Applicant will obtain the required permits and approvals for such and contract with a licensed well driller to construct the well. If water can be supplied by the Lincoln-Pipestone Rural Water System, the Applicant will work with system staff for installation of a water supply line to the O&M facility.

The Applicant will follow MDH regulations concerning EBHs, if any, for the Project and applicable requirements for construction dewatering, if needed.

All foundation materials would be non-hazardous materials. The Applicant does not anticipate any impacts to groundwater resources during construction or operation of the Project as groundwater resources in the Project Area are at depths greater than proposed foundation depths. If shallow depths to groundwater resources are identified during geotechnical investigations, specialty structures requiring wider, but shallower, excavation for foundations may be used. The Applicant will continue to work with the landowners to identify springs and any additional wells near the Project. If construction adversely affects a well, the damaged well will be restored to its former quality, to the extent practicable, or replaced. The Applicant will provide water to the landowner if a well is adversely affected during construction.

The Applicant will develop a SPCC Plan that will outline measures that will be implemented to prevent accidental releases of fuels and other hazardous substances. In the unlikely event that undocumented sites with contaminated soils or groundwater are encountered, containment measures will be implemented to isolate and contain the suspected soil or groundwater contamination and collect and test samples of the substrate or groundwater to identify the contaminants. Once the type, magnitude, and extent of the contamination are determined, a response plan will be developed for crossing or avoiding the site.

9.16 Surface Water and Floodplain Resources

9.16.1 Description of Resources

The Applicant reviewed National Hydrography Dataset waterbody data, MNDNR lake data (MNDNR, 2017a), and MnDOT basemap lake delineations (MnDOT, 2017b) to assess the presence of lakes within the Project Area. The USGS National Hydrography Dataset and USGS 7.5-minute quadrangle maps were reviewed to assess the presence of streams and rivers classified as perennial and intermittent within the Project Area.

Field surveys for the presence of waterbodies were conducted for the then current Project design in September 2016. The Project facility layout has changed since the time of the 2016 field survey. Approximately 20% of the current construction corridor has been surveyed. Field surveys for the remaining portion of the construction corridor are scheduled to be completed in November 2017.

The Project Area is within the Minnesota River Watershed. Furthermore, the Project Area lies within the Lac qui Parle River major watershed, the Florida Creek, Judicial Ditch No. 1, Upper Lazarus Creek, Canby Creek, South Slough and Twin Lake minor watersheds. Surface water within the Project Area flows northeast towards the Minnesota River. Major waterbodies in the Project Area include the Florida Creek, Lazarus Creek, and Canby Creek (Figure 15). Table 19 identifies waterbodies within the Project Area and state waterbody classifications.

Table 19: Waterbodies Within the Project Area

Waterbody Name	Kittle Number	Classifications[1]
Rivers and Streams		
Canby Creek	M-055-166-010	Trout Stream T.114, R.46, S.13, 14, 21, 22, 23: 1B, 2A, 3B; South Dakota border to mouth, excluding trout waters: 2C, 3C
Lazarus Creek	M-055-166-010-007	303(d); 2C, 3C
Florida Creek	M-055-166-006-006	303(d); 2C, 3C
Unnamed Intermittent Stream[2]	M-055-166-010-009	2B, 3C, 4A, 4B, 5, and 6
Unnamed Intermittent Stream[2]	M-055-166-010-013	2B, 3C, 4A, 4B, 5, and 6
Unnamed Intermittent Stream[2]	M-055-166-010-013.1	2B, 3C, 4A, 4B, 5, and 6
Unnamed Intermittent Stream[2]	M-055-166-010-013.2	2B, 3C, 4A, 4B, 5, and 6
Unnamed Intermittent Stream[2]	M-055-166-010-013.3	2B, 3C, 4A, 4B, 5, and 6
Unnamed Intermittent Stream[2]	M-055-166-010-013.4	2B, 3C, 4A, 4B, 5, and 6

Table 19: Waterbodies Within the Project Area

Waterbody Name	Kittle Number	Classifications[1]
Unnamed Intermittent Stream[2]	M-055-166-010-013.6	2B, 3C, 4A, 4B, 5, and 6
Unnamed Intermittent Stream[2]	M-055-166-010-013.7	2B, 3C, 4A, 4B, 5, and 6
Unnamed Intermittent Stream[2]	M-055-166-010-013.9	2B, 3C, 4A, 4B, 5, and 6
Unnamed Intermittent Stream[2]	M-055-166-010-015	2B, 3C, 4A, 4B, 5, and 6
Unnamed Intermittent Stream[2]	M-055-166-010-016	2B, 3C, 4A, 4B, 5, and 6
Unnamed Intermittent Stream[2]	M-055-166-010-007-003	2B, 3C, 4A, 4B, 5, and 6
Unnamed Intermittent Stream[2]	M-055-166-010-007-004	2B, 3C, 4A, 4B, 5, and 6
Unnamed Intermittent Stream[2]	M-055-166-010-007-005	2B, 3C, 4A, 4B, 5, and 6
Unnamed Intermittent Stream[2]	M-055-166-010-013-001	2B, 3C, 4A, 4B, 5, and 6
Unnamed Intermittent Stream[2]	M-055-166-012-000.5	2B, 3C, 4A, 4B, 5, and 6
Unnamed Intermittent Stream[2]	MAJ-070219598	2B, 3C, 4A, 4B, 5, and 6
Unnamed Intermittent Stream[2]	MAJ-070219637	2B, 3C, 4A, 4B, 5, and 6
Unnamed Intermittent Stream[2]	MAJ-070219647	2B, 3C, 4A, 4B, 5, and 6
Unnamed Intermittent Stream[2]	MAJ-070219655	2B, 3C, 4A, 4B, 5, and 6
Unnamed Intermittent Stream[2]	MAJ-070219732	2B, 3C, 4A, 4B, 5, and 6
Unnamed Intermittent Stream[2]	MAJ-070219892	2B, 3C, 4A, 4B, 5, and 6
Unnamed Intermittent Stream[2]	MAJ-070219931	2B, 3C, 4A, 4B, 5, and 6
Unnamed Intermittent Stream[2]	MAJ-070219942	2B, 3C, 4A, 4B, 5, and 6
Unnamed Intermittent Stream[2]	MAJ-070219983	2B, 3C, 4A, 4B, 5, and 6
Unnamed Intermittent Stream[2]	MAJ-070220072	2B, 3C, 4A, 4B, 5, and 6

Table 19: Waterbodies Within the Project Area

Waterbody Name	Kittle Number	Classifications[1]
Unnamed Intermittent Stream[2]	MAJ-070220179	2B, 3C, 4A, 4B, 5, and 6
Unnamed Intermittent Stream[2]	MAJ-070220514	2B, 3C, 4A, 4B, 5, and 6
Unnamed Intermittent Stream[2]	MAJ-070220804	2B, 3C, 4A, 4B, 5, and 6
Unnamed Intermittent Stream[2]	MAJ-070220814	2B, 3C, 4A, 4B, 5, and 6
Unnamed Intermittent Stream[2]	MAJ-070220849	2B, 3C, 4A, 4B, 5, and 6
Unnamed Intermittent Stream[2]	MAJ-070220861	2B, 3C, 4A, 4B, 5, and 6
Unnamed Intermittent Stream[2]	MAJ-070220974	2B, 3C, 4A, 4B, 5, and 6
Unnamed Intermittent Stream[2]	MAJ-070221051	2B, 3C, 4A, 4B, 5, and 6
Unnamed Intermittent Stream[2]	MAJ-070221097	2B, 3C, 4A, 4B, 5, and 6
Unnamed Intermittent Stream[2]	MAJ-070221144	2B, 3C, 4A, 4B, 5, and 6
Unnamed Intermittent Stream[2]	MAJ-070221264	2B, 3C, 4A, 4B, 5, and 6
Unnamed Intermittent Stream[2]	MAJ-070221300	2B, 3C, 4A, 4B, 5, and 6
Unnamed Intermittent Stream[2]	MAJ-070221593	2B, 3C, 4A, 4B, 5, and 6
Unnamed Intermittent Stream[2]	MAJ-070221600	2B, 3C, 4A, 4B, 5, and 6
Unnamed Intermittent Stream[2]	MAJ-070221605	2B, 3C, 4A, 4B, 5, and 6
Unnamed Intermittent Stream[2]	MAJ-070222379	2B, 3C, 4A, 4B, 5, and 6
Unnamed Intermittent Stream[2]	MAJ-070223434	2B, 3C, 4A, 4B, 5, and 6
Unnamed Intermittent Stream[2]	MAJ-070223794	2B, 3C, 4A, 4B, 5, and 6
Unnamed Intermittent Stream[2]	MAJ-070223795	2B, 3C, 4A, 4B, 5, and 6
Unnamed Intermittent Stream[2]	MAJ-070223796	2B, 3C, 4A, 4B, 5, and 6

Table 19: Waterbodies Within the Project Area

Waterbody Name	Kittle Number	Classifications[1]
County Ditch 55	M-055-166-010-014	7
Ditch (s-114n46w27-a[3])	NA	7
Stream (s-114n46w16-a[3])	NA	2B, 3C, 4A, 4B, 5, and 6
Ditch (s-144n46w35-a[3])	NA	7
Lakes		
Culver Lake		2B, 3C, 4A, 4B, 5, and 6
Victors Slough		2B, 3C, 4A, 4B, 5, and 6

Source: USFWS National Wetlands Inventor, MNDNR Public Waters Inventory, MNDNR 24K, National Hydrography Dataset, Minn. R. 7050.0470

1 State Water Classification: Class 1 = Domestic Consumption. Class 2 = Aquatic Life and Recreation; A=coldwater, B=warmwater. Class 3 = Industrial Consumption; A - D refers to chlorides standards. Class 4 = Agriculture and Wildlife; A = applies to irrigation purposes, B = applies to use by livestock and wildlife. Class 5 = Aesthetic Enjoyment and Navigation. Class 6 = Other Uses and Protection of Border Waters. Class 7 = Limited Resource Value Waters. 303(d) = impaired.

2 Streams that are not perennial (i.e. intermittent and ephemeral) are not named.

3 Waterbody field delineated 2016.

Navigable waters are defined by 33 Code of Federal Regulations Part 329 as those waters that are subject to the ebb and flow of the tide and/or are presently used, have been used in the past, or may be susceptible for use to transport interstate or foreign commerce. Navigable waters are designated by the USACE and regulated under Section 10 of the Rivers and Harbors Act of 1899. No Section 10 waters are present within the Project Area. The nearest Section 10 water is the Lac Qui Parle River, located approximately 1 mile east of the Project Area at its closest point.

9.16.1.1 Outstanding Resource Value Waters

Minnesota designates some surface waters as outstanding resource value waters (ORVWs) because of their exceptional qualities, and these waters are under purview of the MPCA. According to Minn. R. 7050.0180, ORVWs are defined as waters within the Boundary Waters Canoe Area Wilderness; Voyageur's National Park; MNDNR designated scientific and natural areas, wild, scenic, and recreational river segments; Lake Superior; specific portions of the Mississippi River; and other waters of the state with high water quality, wilderness characteristics, unique scientific or ecological significance, exceptional recreational value, or other special qualities which warrant stringent protection from pollution. As specified in Minnesota Rules, wild, scenic, and recreational river segments comprise a part of the definition of ORVWs. No waterbodies within the Project Area are listed as a state wild, scenic, or recreational river (USFWS, 2016; MDNR, 2016).

Trout and the gravel stream-bed habitats they need are sensitive to environmental impacts such as sedimentation, and trout streams receive additional protections under rules administered by the MNDNR and USACE. Minn. R. 6264.0050, Subpart 4, which provides a list of designated trout streams in Minnesota, was reviewed for trout streams within the Project Area. Results of this review show that Canby Creek and its tributaries are designated trout streams and are located in the southern half of the Project Area as shown in Figure 15. A description of Project facilities in relation to designated trout streams is provided in Section 9.16.2. The Applicant will continue to minimize impacts to the extent practicable after completing field surveys in fall 2017.

9.16.1.2 Floodplain

Approximately 320 acres (1.4%) of the land within the Project Area is within FEMA designated 100-Year floodplain area. These areas occur along Florida, Lazarus, and Canby creeks. No FEMA designated 500-Year floodplain area occurs within the Project Area (Figure 17).

9.16.1.3 Public Waters Inventory

In Minnesota, rivers, streams, and lakes may be designated as Public Waters (Minn. Stat. § 103G.005, Subdivision 15). These waters are listed in the Public Waters Inventory (PWI) and meet the criteria set forth in Minn. Stat., Section 103G.005, Subd. 15. Six PWI basins are located within the Project Area, the largest being Victors Slough, located within Bohemian State WMA on the southern boundary of the Project Area (Figures 15 and 6b).

Eighteen PWI watercourses and one county ditch are within the Project Area. Most notable watercourses include Canby, Lazarus, and Florida creeks. Table 20 provides a summary of PWI waterbodies present within the Project Area (see also Figure 15). PWI wetlands are discussed in Section 9.17.

Table 20: PWI Features Within Project Area

PWI Type	PWI Feature Name (Kittle Number)	Miles/Acres Within Project Area[1]
PWI Watercourse	Canby Creek (M-055-166-010)	2.39 miles
PWI Watercourse	Lazarus Creek (M-055-166-010-007)	6.25 miles
PWI Watercourse	Florida Creek (M-055-166-006-006)	2.54 miles
PWI Watercourse	MAJ-070223796	0.18 mile
PWI Watercourse	Unnamed Stream (M-055-166-010-013.3)	0.78 mile
PWI Watercourse	Unnamed Stream (M-055-166-010-013.6)	0.99 mile
PWI Watercourse	Unnamed Stream (M-055-166-010-015)	0.88 mile
PWI Watercourse	Unnamed Stream (M-055-166-010-013.1)	0.743 mile
PWI Watercourse	Unnamed Stream (M-055-166-010-013-001)	0.53 mile
PWI Watercourse	Unnamed Stream (M-055-166-010-007-004)	4.75 miles
PWI Watercourse	Unnamed Stream (M-055-166-010-013)	0.77 mile
PWI Watercourse	Unnamed Stream	0.65 mile

Table 20: PWI Features Within Project Area

PWI Type	PWI Feature Name (Kittle Number)	Miles/Acres Within Project Area[1]
	(M-055-166-010-013.2)	
PWI Watercourse	Unnamed Stream (M-055-166-010-013.4)	0.92 mile
PWI Watercourse	Unnamed Stream (M-055-166-010-013.9)	1.07 miles
PWI Watercourse	Unnamed Stream (M-055-166-012-000.5)	2.68 miles
PWI Watercourse	Unnamed Stream (M-055-166-010-007-005)	3.48 miles
PWI Watercourse	Unnamed Stream (M-055-166-010-016)	0.27 mile
PWI Watercourse	Unnamed Stream (M-055-166-010-013.7)	0.75 mile
PWI Ditch	County Ditch 55 (M-055-166-010-014)	0.49 mile
PWI Basin	Victors Slough	122.11 acres
PWI Basin	Culver	10.38 acres
PWI Basin	Unnamed	10.34 acres
PWI Basin	Unnamed	15.29 acres
PWI Basin	Unnamed	20.80 acres
PWI Basin	Unnamed	32.48 acres

[1] Presence of watercourses are reported in miles. Presence of basins are reported in acres.

9.16.1.4 Impaired Waters

Under Section 303(d) of the Clean Water Act, states are required to assess all waters of the state to determine if they meet water quality standards, list waters that do not meet standards and update the list biannually, and conduct total maximum daily load studies (TMDL) to set pollutant-reduction goals needed to restore waters to the extent that they meet water quality standards for designated uses. Florida Creek, which flows west to east across the northwest corner of the Project Area, as shown in Figure 8, is listed as impaired on the 2016 303(d) list for pathogens, turbidity, and impaired biota. No TMDLs have been developed. Lazarus Creek, which flows southwest to northeast across the central portion of the Project Area, as shown in Figure 8, is also listed based on fish bioassessments. No TMDL has been developed for Lazarus Creek. A description of proposed Project facilities in relation to impaired waters is provided in Section 9.16.2.

9.16.1.5 Wildlife Lakes in and Adjacent to Project Boundary

The MNDNR Commissioner may formally designate lakes for wildlife management under the authority of Minn. Stat. 97A.101 subd. 2. This designation allows the MNDNR to temporarily lower lake levels periodically to improve wildlife habitat and regulate motorized watercraft and

recreational vehicles on the lake. No designated Wildlife Lakes are present within the Project Area (MNDNR, 2014).

9.16.2 Impacts

The Project has been designed to avoid impacts to waterbodies and watercourses to the extent possible. The wind turbines and access roads will be built on higher elevations and ridges, which will avoid impacts to lakes, streams, basins, and wetlands located in the lower elevation areas of the Project Area. Underground electric feeder and collector lines and crane paths will cross waterbodies. However, these impacts will be temporary during construction of the Project and will be minimized to the extent possible. Impacts are expected to be minimal. If access roads cross waterbodies, they will be designed to maintain stream flow by using culverts.

Potential impacts to surface water resources from construction of access roads, turbine sites, and collection lines when the ground is disturbed by excavation, grading, and construction traffic could include erosion from increased surface water runoff, sedimentation, discharges of dewatering to groundwater, and diversion of watercourses.

Canby Creek and portions of its tributaries are designated as trout streams under Minn. R. Ch. 6264.0050. There are two locations that are indicated to be designated trout streams where proposed access roads cross. However, wetland/waterbody field surveys conducted for the Project in October 2017 identified that these areas are currently cultivated cropland and no waterbody is present. The Applicant will coordinate with the MNDNR to identify whether any permits or approvals are required for these features. No turbines will be placed in designated trout stream areas. Electric feeder and collector lines will be installed under Canby Creek and its tributaries by directional boring, and no work will be conducted within the ordinary high watermark or would affect the course, current, or cross-section of designated trout streams (Figure 15).

No turbines or access roads will be placed in any PWI waters or watercourses. Electric feeder and collector lines will be installed by directional drill method under Canby and Lazarus creeks and an unnamed tributary to Lazarus Creek, which are designated as PWI. No work will be conducted within the ordinary high watermark or would affect the course, current, or cross-section of any PWI waters or watercourses (Figure 15).

No turbines, turbine access roads, or substations are located within a FEMA designated 100-year floodplain. Electric feeder and collector lines will cross the 100-year floodplain area associated with Lazarus, and Canby creeks (Figure17). As stated in Section 9.2, the Applicant will maintain setbacks and obtain permits required by Sections II and III of the Floodplain and Shoreland Management Ordinances respectively, set forth by the Yellow Medicine County LURRMO.

No turbines or access roads will be placed in any 303(d) impaired waters or watercourses. Electric feeder and collector lines will be installed by directional drill method under Lazarus Creek where Lazarus Creek crosses 120th Street in the northcentral portion of the Project Area.

9.16.3 Mitigative Measures

The MPCA regulates construction activities that may impact storm water under the Clean Water Act. A NPDES permit is required for owners or operators for any construction activity disturbing: 1) 1 acre or more of soil; 2) less than 1 acre of soil if that activity is part of a "larger common plan of development or sale" that is greater than 1 acre; or 3) less than 1 acre of soil, but the MPCA determines that the activity poses a risk to water resources.

As discussed in Section 9.14.3, the MPCA submitted a comment letter to the Applicant that discussed NPDES/State Disposal System and CSW permit requirements, including development of a SWPPP. The Applicant will review Project impacts and prepare information needed for securing the CSW Permit from the MPCA. The Applicant will coordinate with the MPCA regarding the CSW Permit prior to initiating construction. A SWPPP will be prepared and a construction NPDES permit will be obtained from the MPCA prior to the construction of the Project. Disturbed surface soils will be stabilized at the completion of the construction process to minimize the potential for subsequent effects on surface water quality. The turbine areas will be disconnected from one another and separated by vegetation which will reduce the impact of the small amount of increased storm water volume.

Access roads constructed adjacent to streams and drainageways will be designed and constructed to have a low-profile that will not impede natural drainage patterns. If construction occurs across drainage ways or drain tiles, it will be conducted in a manner to avoid adverse impacts. If necessary, culverts will be installed within access roads that are constructed in drainageways to allow cross drainage and prevent impoundment of water. Collection/transmission lines will be installed underground, which will not alter drainage patterns. If needed, drain tile lines will be located in the field and the drainage functions provided by these lines will be maintained.

The MNDNR Division of Waters requires a Public Waters Work Permit for any alteration of the course, current, or cross-section below the ordinary highwater level of a Public Water or Watercourse. No such alterations are anticipated. Minn. Stat. Section 84.415 requires a Minnesota Utility Crossing License from the MNDNR Division of Lands and Minerals for the passage of any utility over, under, or across any state land or public waters. A Utility Crossing License will be applied for crossings of PWI by electric feeder and collector lines. The Applicant will coordinate with the MNDNR regarding the crossings of Canby Creek and its tributaries in designated trout stream areas during this process.

9.17 Wetlands

9.17.1 Description of Resources

The USFWS National Wetlands Inventory (NWI), as updated by the MNDNR, was reviewed to assess the presence of wetlands within the Project Area (Figure 16). The MNDNR PWI was also

reviewed to identify Public Wetlands within the Project Area (Figure 15) further discussed in Section 9.17.1.1. Table 21 summarizes NWI wetlands within the Project Area.

Table 21: NWI Wetlands in the Project Area

NWI Type[1]		Acreage Within Project Area
Palustrine Freshwater Emergent (PEM)	PEM1A	917.45
	PEM1B	883.58
	PEM1C	415.57
	PEM1K	1.70
	Subtotal	**2,218.30**
Palustrine Forested Wetland (PFO)	PFO1A	65.26
	PFO1B	70.45
	PFO1C	4.54
	Subtotal	**140.25**
Palustrine Scrub-shrub Wetland (PSS)	PSS1A	0.56
	PSS1B	1.08
	Subtotal	**1.64**
Freshwater Lake/Pond/Riverine	PUBF	116.98
	PUBH	72.63
	PUSA	0.23
	PUSK	3.18
	R2UBH	13.74
	L1UBH	22.56
	L2UBH	230.87
	Subtotal	**460.19**
Wetland Total		**2,818.74**

[1] Cowardin, et al. 1979.

Field surveys for the presence of wetlands and waterbodies were initially conducted for the Project in September 2016. The Project facility layout has changed since the time of the 2016 field survey. Therefore, field surveys for the revised construction corridor were completed in October 2017. A copy of the Wetland & Waterbody Field Survey Report (2017) is included in Appendix F. See Section 9.17.2 for details regarding temporary and permanent impacts to wetlands based on wetland/waterbody field surveys conducted for the Project.

9.17.1.1 Public Waters Inventory

Eight PWI wetlands are within the Project Area, the largest being associated with Culver Lake on the northwest corner of the Project Area. Table 22 provides a summary of PWI wetlands present within the Project Area (see also Figure 15).

Table 22: PWI Wetlands Within Project Area

PWI Type	PWI Feature Name (Kittle Number)	Acres Within Project Area
PWI Wetland	Bencks Marsh	16.59 acres
PWI Wetland	Unnamed	10.04 acres
PWI Wetland	Unnamed	17.99 acres
PWI Wetland	Unnamed	17.23 acres
PWI Wetland	Unnamed	21.15 acres
PWI Wetland	Unnamed	10.55 acres
PWI Wetland	Unnamed	19.21 acres
PWI Wetland	Unnamed	38.74 acres

The MNDNR has record of seven calcareous fen features in the Project Area (Appendix E). Based upon discussions with the MNDNR, the Applicant commissioned a study of calcareous fens within the Project Area in 2016 and 2017 which included both desktop and field analysis. The results of this analysis are summarized in the following section and additional details provided in Appendix E.

9.17.2 Impacts

Wind turbines will be built on higher elevation and ridges and will avoid wetlands on the lower positions in the landscape. Access roads and operations facilities will be designed to minimize impacts on wetlands. Temporary impacts associated with electric feeder and collector lines, and crane paths will also be minimized. Installation of underground utilities is expected to avoid impacts by boring under PWI as necessary and will minimize impacts to wetlands or where possible make them coincident with other impacts (e.g., crane walks). The Applicant will minimize tree clearing in wetlands to the extent practicable. Estimated impacts to wetlands based on completed field surveys of proposed turbine sites, access roads, and the Project O&M site and desktop review of NWI data of collection lines and crane path areas associated with the Project are shown in Table 23 (see Appendix F for the 2017 Wetland & Waterbody Field Survey Report). There are no impacts to mapped PWI wetlands.

To the maximum practicable extent, the Applicant will continue to minimize temporary and permanent impacts using the wetland/waterbody field survey and desktop results with slight modifications to access roads, collection lines and crane paths of the Project layout. For example, the impacts indicated in Table 23 below do not take into account locations where collections lines may be bored, which would further reduce impacts. Additionally, the temporary impacts are based on a conservative construction corridor; temporary impacts are expected to be less than those reflected in the table below.

Table 23: Summary of Wetlands Impacted by the Project

Wetland Data Source	Wetland Type	Temporary Impact (Acres)	Permanent Impact (Acres)
Field Delineation[1]	PEM	12.35	0.13
	PSS	0.91	0.09
Desktop Review[2]	PEM	9.61	0.00
	PFO[3]	0.10	0.00
Wetland Total		**22.97**	**0.22**

[1] Field Delineations were conducted for access road and turbine pad locations.
[2] Desktop review was conducted for wetlands within the construction corridor for crane paths and collection lines.
[3] PFO wetland would likely be bored, resulting in no impact to PFO wetlands.

As indicated in the previous section, the Applicant is working in consultation with the MNDNR to avoid and minimize impacts to calcareous fens to the extent practicable. The results of all fen field surveys have been provided in three reports to the MNDNR, as well as impact avoidance and minimization strategies that have been implemented (Appendix E). The Applicant anticipates that all impacts to identified calcareous fens can be avoided and has requested MNDNR concurrence for these areas. The following summarizes work that the Applicant has conducted to analyze calcareous fens within the Project Area relative to the Project layout.

In 2016, analysis was conducted on the initial site layouts which were then modified with the results of this work. Two reports were prepared and submitted to the MNDNR for the 2016 analysis (Appendix E). Over the winter and spring of 2016-2017, the Project layout was modified using this information and the current Project layout relative to fens was reviewed in August 2017. A final compiled calcareous fen report was submitted to the MNDNR in October 2017. The findings indicated that two fens were located within the 500-foot buffer area/survey corridor, which is considered the closest approach from the boundary of the Project footprint beyond which impacts are considered avoided, further discussed below.

One planned Project access road (which consists of an existing field access road) to a turbine site near 210th Avenue was located within the 500-foot buffer near MNDNR fen Fortier 5/BR32 (see Appendix E, Combined Calcareous Fen Report, Table 1 and Figures 2 and 5). The access road is proposed because it follows an existing field access road and is the most direct route to the turbine site which minimizes impacts to land use and other environmental features in this area. On July 31, 2017, the MNDNR informed the Applicant that it reviewed the planned access road relative to the fen, and determined that the planned access road should not impact this fen and avoidance of potential impacts to the fen has been achieved (Appendix E, Agency Correspondence).

Upon subsequent design and review, the Applicant determined that a proposed collection line disturbance corridor would be within approximately 218 feet of another fen, BR25 (Appendix F, Combined Calcareous Fen Report, Table 1 and Figures 2 and 5). This fen is located on the north side of 180th Avenue, whereas the proposed collection line would be trenched along the south side of 180th Avenue. On September 29, 2017, MNDNR informed the Applicant that it reviewed the planned collection line relative to the fen, and determined that locating the planned collection line

on the south side of 180th Avenue would not be considered an impact to this fen (Appendix E, Agency Correspondence).

During construction, there is the possibility of sediment reaching wetlands as the ground is disturbed by excavation, grading, and construction traffic.

9.17.3 Mitigative Measures

The Applicant will design the Project to avoid or minimize wetland impacts, and will apply erosion control measures identified in the MPCA Stormwater BMPs Manual, such as using silt fence to minimize impacts to adjacent water resources. Disturbed surface soils will be stabilized at the completion of the construction process to minimize the potential for sedimentation in wetlands.

According to Section 404 of the Clean Water Act, any discharge of dredged or fill materials into jurisdictional waters of the U.S. requires a permit from the USACE. Many of the wetlands crossed by the Project are likely to be jurisdictional waters of the United States. Wetlands permits and licenses, letters of no jurisdiction, or exemptions may be required from the USACE, MNDNR Division of Waters, and local units of government that administer the Wetland Conservation Act. If necessary, authorization from the USACE would likely fall under Nationwide Permit 51 or the utility line discharge provision of a Regional General Permit (RGP-3-MN).

9.18 Vegetation

9.18.1 Description of Resources

9.18.1.1 Land Cover

The Project falls in the Northern Glaciated Plains Level III Ecoregion and the Prairie Couteau Level IV Ecoregion (USEPA, 2016). The Northern Glaciated Plains ecoregion is a flat to gently rolling landscape of glacial drift. The region is transitional between tallgrass and shortgrass prairie and high concentrations of temporary and seasonal wetlands. This region, previously dominated by shortgrass and tallgrass prairies, seasonal and semi-permanent wetlands, mixed tall shrubs, and riparian and oak-aspen groves, has been extensively converted to farmland and cropland, livestock production, and pasture lands (USEPA, 2016).

Based on the USGS National Land Cover Database, land cover in the Project Area is primarily cultivated crops, which make up 46.5% of the Project (Homer et al., 2015). Hay/pasture and grassland/herbaceous make up an additional 44%. All other land cover types make up less than 5% of the Project Area. Table 24 and Figure 12 display the land cover types in the Project Area.

Table 24: Land Cover Types and their Relative Abundance in the Project Area

Land Cover	Sum of Area (acres)	Percent of Project Area
Cultivated Crops	10,636.7	46.5%
Hay/Pasture	5,990.7	26.2%
Grassland/Herbaceous	4,066.2	17.8%

Table 24: Land Cover Types and their Relative Abundance in the Project Area

Land Cover	Sum of Area (acres)	Percent of Project Area
Developed, Open Space	821.7	3.6%
Emergent Herbaceous Wetlands	538.3	2.4%
Open Water	474.9	2.1%
Deciduous Forest	308.7	1.3%
Woody Wetlands	25.1	0.1%
Developed, Low Intensity	11.4	<0.1%
Shrub/Scrub	6.9	<0.1%
Barren Land	5.8	<0.1%
Developed, Medium Intensity	0.9	<0.1%
Developed, High Intensity	0.2	<0.1%
Total	**22,888**	**100%**

9.18.1.2 Native Prairie and Native Plant Communities

As defined in Minn. Stat. Section 84.02 (subd. 5), "native prairie" means land that has never been plowed where native prairie vegetation originating from the site currently predominates or, if disturbed, is predominantly covered with native prairie vegetation that originated from the site. Unbroken pasture land used for livestock grazing can be considered native prairie if it has predominantly native vegetation originating from the site and conservation practices have maintained biological diversity. Therefore, planted grasslands such as CRP, which are typically planted in previously tilled fields, are not considered native prairie. However, agricultural grasslands such as pasture and hayfields may be considered native prairie if the land has not previously been tilled and still includes predominate native prairie vegetation. The MNDNR recommends that all grasslands, including hayfields, pastures, and fallow lands be evaluated as potentially harboring native prairie (MNDNR, 2011).

MNDNR maps native prairie and native plant communities in Yellow Medicine County. Native prairies are also included in the native plant community data. In addition to the native plant community types that make up native prairie, the native plant community data also identifies several other native plant communities (e.g., pin oak–bur oak woodland, basswood–bur oak–(green ash) forest, marsh system, prairie bulrush–arrowhead marsh, spikerush–bur reed marsh, calcareous fen, prairie meadow/carr, and seepage meadow/carr). Both native prairie and native plant communities are also designated as MNDNR sites of biodiversity significance. A site's biodiversity rank is based on the presence of rare species populations, the size and condition of native plant communities within the site, and the landscape context of the site. There are four biodiversity significance ranks: outstanding, high, moderate, and below:

- "Outstanding" sites contain the best occurrences of the rarest species, the most outstanding examples of the rarest native plant communities, and/or the largest, most ecologically intact or functional landscapes.

- "High" sites contain very good quality occurrences of the rarest species, high-quality examples of rare native plant communities, and/or important functional landscapes.
- "Moderate" sites contain occurrences of rare species, moderately disturbed native plan communities, and/or landscapes that have strong potential for recovery of native plant communities and characteristic ecological processes.
- "Below" sites lack occurrences of rare species and natural features or do not meet Minnesota Biological Survey standards for outstanding, high, or moderate rank. These sites may include areas of conservation value at the local level, such as habitat for native plants and animals, corridors for animal movement, buffers surrounding higher-quality natural areas, areas with high potential for restoration of native habitat, or open space.

Table 25 identifies the MNDNR native plant communities, including native prairie, and their biodiversity rank within the Project Area. There are nearly 2,600 acres of MNDNR native plant communities in the Project Area, the majority of which are dry hill prairie (78%). There are 330 acres of native plant communities with an outstanding biodiversity rank, 1,061 with a high biodiversity rank, and 1,205 with a moderate biodiversity rank. Additionally, within the Project Area, there are 235 acres identified as below the biodiversity threshold, 936 acres identified as moderate, 330 acres identified as high, and 141 acres identified as outstanding which are not associated with MNDNR mapped native prairie and native plant communities. Rather, the acreage of these sites of biodiversity encompass a larger area around the native prairie or native plant communities or are associated with hay/pasture or grassland herbaceous land cover types. The total acreage of sites of biodiversity significance in the Project Area, including below, is 4,425 acres.

Table 25: Native Prairie and Native Plant Community Types within the Project Area

Source	Native Plant Community Type	Acreage within the Project by Biodiversity Rank			Total Acres
		Outstanding	High	Moderate	
MNDNR Native Prairie	Dry Sand – Gravel Prairie (Southern)	NA	134.1	39.2	**173.3**
	Dry Hill Prairie (Southern)	215.4	737.6	1,080.8	**2,033.8**
	Wet Prairie (Southern)	71.9	6.8	NA	**78.6**
	Wet Saline Prairie (Southern)	NA	NA	4.1	**4.1**
	Subtotals	**287.2**	**878.5**	**1,124.1**	**2,289.8**
MNDNR Native Plant Community	Pin Oak-Bur Oak Woodland	NA	11.0	NA	**11.0**
	Basswood-Bur Oak (Green Ash) Forest	NA	120.5	57.7	**178.2**
	Marsh System	NA	NA	6.5	6.5
	Prairie Bulrush-Arrowhead Marsh	15.6	NA	NA	15.6
	Spikerush-Bur Reed Marsh (Prairie)	NA	0.9	NA	0.9
	Calcareous Fen (Southwestern)	6.7	7.4	5.6	19.6

Table 25: Native Prairie and Native Plant Community Types within the Project Area

Source	Native Plant Community Type	Acreage within the Project by Biodiversity Rank			Total Acres
		Outstanding	High	Moderate	
	Prairie Meadow/Carr	NA	26.6	6.9	33.5
	Seepage Meadow/Carr	3.4	16.1	4.9	24.4
	Subtotals	**45.8**	**182.6**	**75.0**	**303.4**
Grand Total		**333.0**	**1,061.0**	**1,205.6**	**2,599.7**

Records of rare plants are discussed in Section 9.20.

The Applicant is evaluating native prairie to determine if there is suitable habitat for the federally threatened Dakota Skipper and Poweshiek skipperling, which depend on high quality native prairie. This habitat assessment includes a GIS-based desktop analysis to identify areas of grassland that may be native prairie followed by a field review to confirm. Note that while the habitat assessment is focused on prairie characteristics specific to the listed butterflies, it evaluated all potential native prairie. The surveys completed in 2016 (Appendix G) identified no parcels within the Project Area that would qualify as native prairie or listed butterfly habitat; assessed parcels were heavily grazed and/or disturbed lands dominated by non-native or invasive species (see Appendix G). Similar results were also gathered during field reviews in 2017. Results of this assessment will be included in a separate Native Prairie Protection and Management Plan that is currently being developed.

9.18.2 Impacts

Vegetation will be removed for the installation of turbine foundations, access roads, and the O&M facility. These facilities are primarily located in the agricultural landscape, impacting 53.3 acres of cultivated crops, 11.34 acres of hay/pasture, and 1.60 acres of grassland/herbaceous (Table 26). Access roads in the agricultural landscape are expected to impact crop fields, and potentially grassed areas of ditches and roadsides. The use of larger turbines results in fewer turbines for the same total nameplate capacity and less overall land disturbance. Approximately 67 acres of land will be permanently removed from agricultural production (cultivated crops, hay/pasture, grassland/herbaceous), and the areas surrounding each turbine will still be able to be farmed, grazed, or otherwise managed as it was prior to the installation of the wind farm. Less than 0.5% of the Project Area will be permanently converted to sites for wind turbines, access roads, and the O&M facility.

Temporary vegetation impacts will be associated with crane walkways, the installation of underground collection lines, and contractor staging and lay down areas. These areas will be reseeded to blend with existing vegetation. The turbines will avoid wooded areas to maximize turbine output and reduce tree removal. With ground disturbance and equipment deliveries from different regions of the country, the Applicant will work together with all Project construction subcontractors entering the Project Area to control and prevent the introduction of invasive species. Note that estimated impacts to wetlands based on National Land Cover Database data are

less accurate than NWI and/or delineation data. See Section 9.17.2 for a discussion on wetland impacts.

Table 26: Summary of Estimated Permanent Impacts to Vegetation (Acres)

Land Cover Type	Turbine	Access Road	O&M Facility	Total
Cultivated Crops	21.15	28.97	3.18	**53.30**
Hay/Pasture	5.0	6.34	-	**11.34**
Grassland/Herbaceous	0.54	1.06	-	**1.60**
Developed, Open Space	-	1.02	0.50	**1.52**
Emergent Herbaceous Wetlands	-	0.07	-	**0.07**
Woody Wetlands	-	0.07	-	**0.07**
Total	**26.69**	**37.53**	**3.68**	**67.9**

The Project has been designed to avoid permanent impacts to MNDNR mapped native prairie, native plant communities, and all sites of biodiversity significance ranked outstanding, high, moderate, and below. As such, there are no turbines, access roads, or the O&M facility within these natural features.

The construction corridor (temporary workspace) may impact up to 5.75 acres of MNDNR-mapped native prairie (which are also mapped as native plant communities and ranked moderate sites of biodiversity significance). These impacts are associated with the collection lines and crane paths. The Applicant will continue to coordinate with MNDNR on these impacts and appropriate mitigation measures, which may include necking down the workspace, boring collection under native prairie tracts where practicable, and updating the design where practicable. Field reviews were recently conducted in August 2017 to confirm presence of the mapped features and assess the prairie quality. The results of these reviews will be provided to the MNDNR once the report is complete.

9.18.3 Mitigative Measures

The following measures will be used to avoid and minimize potential impacts to land within the Project during siting, construction, and operation, to the extent practicable:

- Conduct a preconstruction inventory of the Project Area for existing WMAs, WPAs, WIAs, other recreation areas, wetlands, native prairie, native plant communities, and forests. These inventories will have varying level of detail with the most specific detail in the construction corridor. These inventories are on-going and have been and will continue to be incorporated into the Project design;
- Exclude established WMAs, WPAs, and WIAs from consideration for Project facilities;
- Avoid disturbance of wetlands during construction and operation of the Project. If jurisdictional wetland impacts are proposed, then the Applicant will obtain applicable wetland permits (see Section 9.17);
- Design the Project to minimize the need to remove trees;
- Prepare a construction SWPPP and obtain and NPDES Permit;

- Implement BMPs during construction and operation of the Project to protect top soils and adjacent resources and to minimize soil erosion. Practices may include containing excavated material, protecting exposed soil and stabilizing restored material, revegetation non-cropland and range areas with wildlife conservation species and, wherever feasible, planting native tall grass prairie species in cooperation with landowners; and
- The Project area may include native prairie, as defined by Minn. Stat. § 84.02, subd. 5. The Applicant will, in consultation with the MNDNR, prepare a prairie protection and management plan. The plan will be submitted to the MPUC and MNDNR after issuance of the site permit and prior to construction. The plan shall address steps to be taken to identify native prairie within the Project Area, measures to avoid impacts to native prairie, and measures to minimize and mitigate for impacts if unavoidable. Wind turbines and all associated facilities, including foundations, access roads, collection lines, and transformers, shall not be placed in native prairie unless addressed in the prairie protection and management plan. Measures to be taken to mitigate unavoidable impacts to native prairie will be agreed to by the Applicant and MNDNR.

9.19 Wildlife

9.19.1 Description of Resources

Migratory Bird Treaty Act

The Migratory Bird Treaty Act of 1918 (16 U.S.C. 703-712) regulates the taking, selling, transporting, and importing of migratory birds, their nests, eggs, parts, or products. The Migratory Bird Treaty Act protects more than 800 species of birds that occur within the U.S. A list of federally protected migratory birds may be found in 50 Code of Federal Regulations Part 10.13. Most birds within the Project Area would be afforded protection under this act.

USFWS Land-Based Wind Energy Guidelines

On March 23, 2012, the USFWS issued the Land-Based Wind Energy Guidelines (WEG; USFWS, 2012). The WEG provide a structured, scientific process for addressing wildlife conservation concerns at all stages of land-based wind energy development. They also promote effective communication among wind energy developers and federal, state, and local conservation agencies and tribes. The WEGs are founded upon a tiered approach for assessing potential impacts to wildlife and their habitats. The tiered approach is an iterative decision-making process for collecting information in increasing detail, quantifying the possible risks of proposed wind energy projects to wildlife and habitats, and evaluating those risks to make siting, construction, and operation decisions. Subsequent tiers refine and build upon issues raised and efforts undertaken in previous tiers. At each tier, a set of questions is provided to help the developer identify potential problems associated with each phase of a project, and to guide the decision process. The tiered approach is designed to assess the risks of project development by formulating questions that relate to site-specific conditions regarding potential species and habitat impacts. The tiers are outlined briefly as:

- Tier I: Preliminary evaluation or screening of sites (landscape-level screening of possible project sites; generally based on readily available public information);

- Tier II: Site characterization (comprehensive characterization of one or more potential project sites; generally based on consulting with the appropriate agencies/authorities and one or more reconnaissance level site visits by a wildlife biologist);
- Tier III: Field studies to document site wildlife conditions and predict project impacts (site-specific assessments at the proposed project site; quantitative and scientifically rigorous studies; e.g., acoustical monitoring, point count avian surveys, raptor nest surveys, lek surveys, etc.);
- Tier IV: Post-construction mortality studies (to evaluate direct fatality impacts); and
- Tier V: Other post-construction studies (to evaluate direct and indirect effects of adverse habitat impacts, and assess how they may be addressed; not done for most projects; e.g., post-construction displacement and/or use studies, curtailment effectiveness studies, etc.).

This tiered approach allows developers to determine whether they have sufficient information, whether and/or how to proceed with development of a project, or whether additional information gathered at a subsequent tier is necessary to make those decisions. The WEG indicate that wind energy developers who voluntarily adhere to these guidelines will be undertaking a robust level of wildlife impact analysis, and have a shared responsibility with the USFWS to ensure that the scientific standards of the guidelines are upheld and used to make wise development decisions.

It is important to note that not all of the five tiers are recommended or necessary for all projects.

At each tier, potential issues associated with developing or operating a project are identified and questions formulated to guide the decision process. The guidelines outline the questions to be posed at each tier, and recommend methods and metrics for gathering the data needed to answer those questions. If sufficient data are available at a particular tier, the following outcomes are possible based on analysis of the information gathered:

- The project is abandoned because the risk is considered unacceptable;
- The project proceeds in the development process without additional data collection; and
- An action, or combination of actions, such as project modification, mitigation, or specific post-construction monitoring, is indicated.

If data are deemed insufficient at a tier, more intensive study is conducted in the subsequent tier until sufficient data are available to make a decision to abandon the project, modify the project, or proceed with and expand the project (USFWS, 2012).

9.19.1.1 Results of Tier I and II Process

Baseline wildlife surveys were conducted in 2008 to support the initial SPA, prior to the WEG development. While the Project Area has changed slightly from the 2008 boundary, based on agency coordination, the Applicant re-initiated Tier 3 studies in 2016 to support this Application without completing the Tier I/II assessment. A formal Tier 1 preliminary site evaluation and Tier 2 site characterization study were not completed for this Project due to the fact that it was previously permitted by MPUC, in coordination with USFWS and MNDNR. However, the Applicant provides a Tier I and II review in the Bird and Bat Conservation Strategy (BBCS) prepared for the Project (see Appendix H). Included below are a summary of the Tier 1 and 2 questions described in the WEG.

Are there known species of concern present on the proposed site, or is habitat (including designated critical habitat) present for these species?

After conducting a desktop analysis of available data, the Applicant found records for two federally listed species, Dakota skipper and Poweshiek skipperling, last observed in 1981 and 1994, respectively. There are also records of two state listed plants and one bird in the Project Area. There is no designated critical habitat within the Project Area (Figure 11a). Cultivated crops and hay/pasture make up approximately 72% of the Project. Intact natural habitat consists of MNDNR mapped native plant communities, sites of biodiversity significance, scattered wetlands, small remnants of woodland areas that are primarily located adjacent to farmsteads, and wildlife managed lands such as WMAs and WPAs. There are seven WMAs and two WPAs within the Project Area. There are no MNDNR Migratory Waterfowl Feeding and Resting Areas within or adjacent to the Project Area (MNDNR, 2011). There is one Audubon Important Bird Area (IBA) within and adjacent to the Project Area (Audubon Minnesota, 2014). This IBA is one of six large blocks that make up the Prairie Coteau Complex IBA, which focuses on prairie, grassland, and marsh birds because of the availability of quality habitats for these species area becoming less common in the southwest region of Minnesota.

Does the landscape contain areas where development is precluded by law or designated as sensitive according to scientifically credible information? Examples of designated areas include, but are not limited to: areas of scientific importance; areas of significant value; federally-designated critical habitat; high-priority conservation areas for Non-Governmental Organizations; or other local, state, regional, federal, tribal, or international organizations.

There are several protected areas within the Project Area, including seven state WMAs, two federal WPAs, and privately-owned conservation areas (Figures 6a and 6b). There will be no direct impacts to the WMAs and WPAs within 1 mile of the Project Area, and setbacks from the Project perimeter will result in a buffer between these resources and any turbines (see Table 2 in Section 6.1).

Are there plant communities of concern present or likely to be present at the site(s)?

As previously mentioned in Section 9.18.1.2, the MNDNR has mapped native prairie and native plant communities in the Project Area. Additionally, there are sites of biodiversity significance ranking below, moderate, high, and outstanding within the Project Area. The Project has been designed to avoid permanent impacts to MNDNR mapped native prairie, native plant communities, and sites of biodiversity significance ranked outstanding, high, moderate, and below. As such, there are no turbines, access roads, or the O&M facility within these natural features.

The Applicant will continue coordination with MNDNR and prepare a Native Prairie Protection and Management Plan, per Minn. Stat. § 84.02, subd. 5.

Are there known areas of congregation of species of concern, including, but not limited to: maternity roosts, hibernacula, staging areas, winter ranges, nesting sites, migration stopovers or corridors, leks, or other areas of seasonal importance?

The Applicant found that there are no Natural Heritage Information System (NHIS) records of maternity roosts or hibernacula within the Project Area or 5 miles of the Project Area. Similarly,

there are no NHIS records of known congregation areas for species of concern in the Project Area or 5 miles of the Project Area. The Applicant has conducted several studies on native prairie, raptors and eagle nests, bat habitat and activity, and avian use (see Sections 9.18.1.2 and 9.19.1.3).

Using best available scientific information, has the developer or relevant federal, state, tribal, and/or local agency independently demonstrated the potential presence of a population of a species of habitat fragmentation concern? If not, the developer need not assess impacts of the proposed project on habitat fragmentation.

Through the consultation process and review of available scientific information, the Applicant found no specific species of habitat fragmentation concern has been identified by the USFWS or MNDNR. The area is already highly fragmented by agricultural uses and much of the mapped grassland is previously disturbed, actively grazed or hayed, and/or inundated with introduced/invasive species. The layout has been designed to avoid permanent impacts to MNDNR-mapped native prairie, native plant communities, and sites of biodiversity significance.

Which species of birds and bats, especially those known to be at risk from wind energy facilities, are likely to use the proposed site based on an assessment of site attributes?

The list of birds observed during pre-construction surveys in the Project Area is included in Appendix G – Tier 3 studies. This list includes birds observed during baseline wildlife surveys in 2008 when the Project was initially permitted and those observed during 2016-2017 avian use surveys for the proposed Project. In 2008, loggerhead shrike (state-listed endangered) and American white pelican (state special concern) were observed. The same two species have been documented in the 2016-2017 avian use and grassland bird surveys. Additionally, during the 2016 Avian Grassland Use surveys, nine additional Species of Greatest Conservation Need were observed (summarized in the BBCS in Appendix H). There are no bald eagle nests in the Project Area. The USFWS Information for Planning and Consultation lists the northern long-eared bat as a species known to occur in Yellow Medicine County. The Applicant has conducted presence/absence acoustic surveys for this species and found them to be absent in 2016. All turbines except one are sited at least 1,000 ft from potentially suitable northern long-eared bat habitat. There is one turbine sited in cropland and approximately 900 ft from the nearest woodlot.

9.19.1.2 Tier 3 Studies

The Applicant conducted several baseline wildlife surveys in 2008 to support the initial SPA. These studies included fixed-point bird use surveys, breeding bird transect surveys, raptor nest surveys, acoustic bat surveys, and prairie grouse lek surveys. Note that these studies were conducted prior to the development of federal and state wind energy guidance frameworks (USFWS *Land Based Wind Energy Guidelines* and *Eagle Conservation Plan Guidance* [ECPG; USFWS, 2012 and USFWS, 2013] and MNDNR's *Avian and Bat Survey Protocols for Large Wind Energy Conversion Systems in Minnesota* and *Guidance for Commercial Wind Energy Projects* [MNDNR, 2011; 2014].

The Applicant re-initiated avian and bat studies for the Project in 2016, which include avian use surveys, raptor nest surveys, avian grassland surveys, bat acoustic surveys, northern long-eared bat presence/absence acoustic surveys, and grassland condition and Dakota skipper/Poweshiek

skipperling habitat assessment (Table 27). These surveys were designed following the WEG and MNDNR Avian and Bat Survey Protocol guidance. Note that the Project boundary has been refined to avoid higher quality natural resource areas where possible; therefore, the Project Area described in some reports is different than the Project boundary being permitted in this SPA. Reports from these studies are included in Appendix G – Tier 3 studies and results of avian and bat studies are summarized in the BBCS (Appendix H). The Applicant has continued to coordinate with both the USFWS and MNDNR and share the results of these studies as they have become available. Table 28 summarizes the dates of natural resource agency consultation meetings since development of the Project resumed in 2016.

Table 27: Summary of Tier 3 Studies at Bitter Root Wind Project

Survey	Dates
Baseline Wildlife Surveys: fixed-point bird use, breeding bird transect, raptor nest, acoustic bat, and prairie grouse lek surveys	March 25 – October 8, 2008
Bat Acoustic Study	April 2 – November 1, 2016
Avian Grassland Survey	June 18 – July 6, 2016
Northern Long-eared Bat Presence/Absence Acoustic Survey	July 26 – July 28, 2016
Grassland Condition and Dakota Skipper/Poweshiek Skipperling Habitat Assessment	August 15 – 17, 2016 and August 14-24, 2017
Raptor Nest Surveys	Spring 2016 and 2017
Avian Use Survey	March 3 – January 23, 2017 and June 2017 – May 2018

Table 28: Summary of Natural Resource Agency Consultations for the Bitter Root Wind Project

Agency Coordination	Dates
Project update and planned study review – USFWS	April 21, 2016
Pre-Application Meeting – DOC, MNDNR, USFWS	April 29, 2016
Email Correspondence (calcareous fens) – MNDNR	May 3, 2016
Letter (Preliminary Review) – MNDNR	May 3, 2016
Request for fee title land and easement locations – USFWS	June 9, 2016
Response to request for information – MN BSWR	June 15, 2016 and June 15, 2016
Initial fen survey report – MNDNR	August 4, 2016
Wetland survey methodology – USACE	August 15, 2016
NHIS review submitted – MNDNR	August 24, 2016
Second fen survey report – MNDNR	November 29, 2016
Email Correspondence (calcareous fens) – MNDNR and DOC	December 16, 2016
Pre-Application Meeting –DOC, MNDNR	July 26, 2017
Email Correspondence (native prairie) – DOC	July 28, 2017
Email correspondence (fen review) – MNDNR	July 31, 2017

Table 28: Summary of Natural Resource Agency Consultations for the Bitter Root Wind Project

Agency Coordination	Dates
Bat call data from 2017 surveys – MNDNR	August 2, 2017
Email correspondence (fen survey approval) - MNDNR	August 22, 2017
Fen survey results – MNDNR	August 30, 2017
NHIS review update submitted – MNDNR	September 18, 2017
2017 fen survey data submitted – MNDNR	September 20, 2017
Email correspondence (second fen review) – MNDNR	September 29, 2017

9.19.1.3 Eagle Conservation Plan Guidelines

Wind energy developers and wildlife agencies have recognized a need for specific guidance to help make wind energy facilities compatible with eagle conservation and the laws and regulations that protect eagles. The USFWS has developed the ECPG, Module 1 – Land-based Wind Energy, Version 2 (USFWS, 2013). The ECPG provides a framework for development that assesses historical information on eagle use or eagle habitat in the geographic region and project area, potential habitat features, presence of known important eagle use areas, presence of foraging areas in a proposed project site, and eagle use in the project area.

The Applicant conducted raptor nest surveys in 2008, 2016, and 2017, which included identification of bald eagle and other raptor nests (see Appendix G – Tier 3 studies). No raptor nests were identified in the 2008 survey, which only included the then Project Area. The 2016 raptor nest survey was conducted for the Project Area and 10-mile buffer, while the 2017 study included the Project Area and 5-mile buffer. The 2016 raptor nest survey did not identify any bald eagle nests in the Project Area, but seven within 10 miles. Two bald eagle nests were identified within approximately 1 mile of the Project: one west of the Project in adjacent Deuel County, South Dakota south of Lake Cochrane and the South Slough Complex and the other east of the Project along the Lac qui Parle River. The survey also identified 24 additional raptor nests, including red-tailed hawk, great-horned owl, and unidentified owl and raptor species.

Similarly, during the 2017 raptor nest survey, no bald eagle nests were identified in the Project Area, and five active bald eagle nests were located within 5 miles of the Project, including the Lac qui Parle nest identified in 2016. The Deuel County bald eagle nest referenced above was occupied by a great-horned owl in 2017; however, a new occupied and active bald eagle nest was located southwest of the 2016 nest and may represent the same territorial pair. An additional 12 raptor nests were located within the Project Area and 5-mile buffer, including red-tailed hawk, great-horned owl, and unidentified raptor.

In addition to raptor and eagle nest surveys, the Applicant also conducted eagle nest monitoring to identify eagle use areas at the two occupied active nests closest to the Project Area in 2016 and 2017. During 2016, 24 hours of observations from three locations around the Deuel County nest showed eagle use to primarily be associated with Lake Cochrane and the South Slough Complex. The Lac qui Parle nest was not monitored in 2016; however, during 2017, 16 hours of observation

between May and mid-July identified eagle use primarily associated with the Lac Qui Parle River corridor.

9.19.1.4 Birds

Various migratory and resident bird species utilize the Project Area as part of their life cycle (see Appendix G – Tier 3 studies). Migratory birds may use the Project Area for resting, foraging, or breeding activities for only a portion of the year. Resident bird species occupy the Project throughout the year. As indicated above, the Applicant has conducted several avian studies to document avian use in the Project Area. Results of these studies are summarized in the BBCS (see Appendix H). The avian community characterized by these studies is consistent with those reported at other wind farms in southern Minnesota during preconstruction studies.

In addition to the preconstruction avian use surveys conducted at the Project, preconstruction avian use study results from other wind energy facilities in the region are informative for assessing regional trends in avian use and species composition. In general, these studies show that common, disturbance-tolerant passerine species are the most-observed species at wind energy facilities in predominantly agricultural landscapes (Derby et al., 2011b; Stantec, 2012; Westwood Professional Services, 2012; Black Oak Wind and Getty Wind Company, 2012; Gasper, 2013). The results of the preconstruction avian use surveys for the Project are consistent with the patterns documented in the regional studies, as well as consistent with the historical knowledge of avian use patterns and behavior in the Midwest and at wind energy facilities throughout the country.

9.19.1.5 Mammals

Mammals that may occur in the Project Area use the food and cover available from agricultural fields, grasslands, farm woodlots, wetland areas, and wooded ravines. Grassland areas and woody vegetation are also habitat for a variety of small mammals. White-tailed deer, raccoons, skunks, coyotes, fox, and squirrels are all common in the Project Area.

Bat species present in Minnesota include the hoary bat, eastern red bat, big brown bat, silver-haired bat, tri-colored bat, little brown bat, northern long-eared bat, and evening bat. The northern long-eared bat is federally listed threatened and state listed as special concern. The big brown bat, little brown bat, and tri-colored bat are also listed as special concern. As previously mentioned in Section 9.19.1.2, the Applicant conducted bat acoustic surveys in 2008 and 2016. In 2008, across all three sampling locations (two ground and one raised), an average of 37.9 bat passes per night were detected, ranging from 5.4 to 66.8 passes per night. In 2016, bat passes per night averaged 9.39 amongst seven detectors (five ground and two raised detectors). Six detectors ranged from 6.05 to 9.21 passes per night, while the seventh detector recorded an average of 21.14 passes per night. While it is unknown why activity was higher at this ground detector, a small wooded lot near the station may have provided attractive maternity habitat. Both the 2008 and 2016 surveys documented predominately low-frequency bats (e.g., big brown bat, silver-haired bat, or hoary bat). In 2016, 91% of the bats recorded were low-frequency bats; this statistic is not available for 2008.

9.19.1.6 Reptiles and Amphibians

Reptile and amphibian species that may be present in the Project Area include many snakes, frogs, and turtles. These species may utilize grasslands, wetlands, and pasture areas.

9.19.1.7 Insects

There are many species of insects and pollinators that may utilize the Project Area. A particularly diverse array of these species inhabit native prairie. Based on NHIS records, there are five species of butterfly that are federal or state listed and have been recorded in the Project Area or 5-mile buffer. These include Poweshiek skippering and Dakota skipper (federally listed endangered and threatened, respectively, and state listed endangered) and regal fritillary, Iowa skipper, and Pawnee skipper (state special concern) (see Section 9.20.1). Records for these species date back between 1967 and 1994.

The Applicant conducted a grassland condition and Dakota skipper/Poweshiek skipperling habitat assessment in 2016 to determine whether prairies in the Project Area are suitable for the federally listed species. Surveys following the same protocols were conducted again in 2017 at grassland sites not previously evaluated. None of the evaluated private land sites where Project infrastructure will be sited were of adequate quality to likely support the presence of Dakota skipper or Poweshiek skipperling. A grassland report is being prepared and will be filed by December 15, 2017.

9.19.2 Impacts

9.19.2.1 Birds

The potential for habitat fragmentation impacts is low because the Project is sited on a previously disturbed landscape. Furthermore, the Project has been designed to avoid placing turbines and access roads in MNDNR-mapped native prairie, native plant communities, and sites of biodiversity significance.

The Project has the potential to cause displacement of some bird species from the Project Area due to increased human activity or the presence of tall structures, though clearing of habitat will be minimal. Many of the most-observed bird species within the Project Area were common, disturbance-tolerant species, similar to the results of surveys at other wind energy facilities in the region (Derby et al., 2011b; Stantec, 2012; Westwood Professional Services, 2012; Black Oak Wind and Getty Wind Company, 2012; Gasper, 2013).

Project operation may result in avian mortality from collision with the Project's turbines or other structures. Based on the results of post-construction monitoring at similar facilities located on agricultural landscapes in southern Minnesota, estimated bird carcass rates at the Project would be expected to be within the range reported from studies at other wind facilities in the region (see Table 29). No single species or group is expected to experience a disproportionate amount of estimated mortality or impacts of a magnitude to affect the local or migratory population, as reflected in studies completed by Erickson et al. (2014).

Table 29: Annual Bird Carcass Rate Results from Post-construction Monitoring Studies in Southern Minnesota

Project Name	State	Estimated Bird Carcasses/ Megawatt/Year	Source
Buffalo Ridge (Phase I; 1996)	MN	4.14	Johnson et al., 2000
Buffalo Ridge (Phase I; 1997)	MN	2.51	Johnson et al., 2000
Buffalo Ridge (Phase I; 1998)	MN	3.14	Johnson et al., 2000
Buffalo Ridge (Phase I; 1999)	MN	1.43	Johnson et al., 2000
Buffalo Ridge (Phase II; 1998)	MN	2.47	Johnson et al., 2000
Buffalo Ridge (Phase II; 1999)	MN	3.57	Johnson et al., 2000
Buffalo Ridge (Phase III; 1999)	MN	5.93	Johnson et al., 2000
Elm Creek	MN	1.55	Derby et al., 2010b
Elm Creek II	MN	3.64	Derby et al., 2012
Moraine II	MN	5.59	Derby et al., 2010c
Lakefield 2012	MN	2.75	Westwood, 2013
Lakefield 2014	MN	1.07	Westwood, 2015
Prairie Rose (2013)	MN	0.44[1]	Chodachek et. al, 2014
Big Blue, Grand Meadow, and Oak Glen (2013)	MN	0.3-0.5[2]	Chodachek et. al, 2014

[1] estimate per study period (April 15 – June 15 and fall August 15 – October 31)

[2] estimate per study period (July – October 31, 2013). Due to the focus of the study on bat fatalities, bird fatality estimates are not comparable with regional or national estimates.

The Project is located within the Prairie Pothole Region, which provides habitat for potentially high concentrations of waterfowl. Waterfowl constituted the most commonly recorded large-bird subtype during the large-bird use study (see Appendix G). However, waterfowl and shorebird carcass rates at wind energy projects have been low, even in areas of high use. Generally, waterfowl and shorebird carcass rates have shown to be insignificant at wind facilities, as compared to the rate of use or incidence of these groups (Erickson et al., 2002).

No turbines are within 1 mile of any eagle nests. While there are two eagle nests within 2 miles of a turbine (1.2 and 2.0 miles), eagle use during March 2016 – January 2017 was low; eight eagles were observed in the spring, two in the summer, 11 in the fall, and five in the winter. In total, bald eagles accounted for 0.2% of large bird observations. (Appendix G). Eagle observations were highest in the spring and fall migration periods and lowest during the summer. The lack of summer eagle observations likely supports the eagle nest monitoring, highlighting eagle use by these breeding pairs along the Lac qui Parle River corridor and Lake Cochrane and South Slough complex, both of which are outside the Project Area. Eagle flights to and from the direction of the Project are not common during the nesting season (Appendix G).

Between the avian grassland survey and the avian use surveys, one state listed endangered species – the loggerhead shrike – was observed during avian grassland surveys (shrikes were observed in the Project Area in both 2008 and 2016). As described in the BBCS (see Appendix H), the Applicant will avoid impacts to loggerhead shrikes by either: 1) timing construction so that any

clearing of isolated trees and shrubs or trees and shrubs within shelterbelts or field/road edges will be done outside of the shrike nesting season (mid-April to mid-July); or 2) contracting a qualified biologist to conduct a survey to confirm shrike nests are not active in trees or shrubs to be removed prior to clearing conducted during the nesting season. If it is not possible to confirm specific nest locations, no trees or shrubs within 0.125 mile of shrike observations (i.e., the maximum expected radius of a shrike nesting territory) will be cleared until after the nesting season is over.

9.19.2.2 Bats

Construction and decommissioning activities are not expected to require the removal of trees or old buildings, making it unlikely that roosting bats would be disturbed or incur mortalities. There are no known hibernacula in southwestern Minnesota.

Seven of the eight bat species known to occur in Minnesota may migrate through the Project Area; however, bat habitat within the Project Area is limited to small groves of trees and fencerows near homesteads and the riparian corridors along a few small streams with fringe wetlands. Outbuildings and other anthropogenic structures may be used as roosting habitat by some species (e.g., little brown myotis and big brown bat). Cultivated crops also may provide marginal foraging habitat for bat species adapted to use such habitat.

Bat carcasses at wind energy facilities in the United States have mostly occurred in the swarming and migration seasons, typically between mid-July and mid-September (Howe et al., 2002; Johnson et al., 2003; Kerlinger et al., 2007; BHE Environmental, Inc., 2010). Post-construction monitoring studies at other wind facilities in southern Minnesota also have reported a similar pattern, with a majority of bat carcasses being found during the fall migration season and consisting primarily of eastern red bats and hoary bats, both migratory tree bat species (Chodachek et al., 2014).

The preconstruction acoustic study for the Project (see Appendix G) recorded activity by low frequency bats (which include hoary bats) and high frequency bats (which include eastern red bats) at all detectors. Activity of both groups was highest in summer (June 1 to July 15), followed by the fall migration period (July 30 to October 14). Therefore, estimated bat carcass rates at the Project would be expected to be within the range reported from studies at other wind facilities in the region (see Table 30). Activity of both groups decreased as wind speeds at the Project increased, and as temperatures at the Project decreased.

Table 30: Annual Bat Carcass Rate Results from Post-construction Monitoring Studies in Southern Minnesota

Project Name	State	Estimated Bat Carcasses/ Megawatt/Year	Source
Buffalo Ridge (Phase I; 1999)	MN	0.74	Johnson et al., 2000
Buffalo Ridge (Phase II; 1998)	MN	2.16	Johnson et al., 2000
Buffalo Ridge (Phase II; 1999)	MN	2.59	Johnson et al., 2000
Buffalo Ridge (Phase III; 1999)	MN	2.72	Johnson et al., 2000

Table 30: Annual Bat Carcass Rate Results from Post-construction Monitoring Studies in Southern Minnesota

Project Name	State	Estimated Bat Carcasses/ Megawatt/Year	Source
Buffalo Ridge (Phase II; 2001/Lake Benton I)	MN	4.35	Johnson et al., 2004
Buffalo Ridge (Phase II; 2002/Lake Benton I)	MN	1.64	Johnson et al., 2004
Buffalo Ridge (Phase III; 2001/Lake Benton II)	MN	3.71	Johnson et al., 2004
Buffalo Ridge (Phase III; 2002/Lake Benton II)	MN	1.81	Johnson et al., 2004
Elm Creek	MN	1.49	Derby et al., 2010b
Elm Creek II	MN	2.81	Derby et al., 2012
Moraine II	MN	2.42	Derby et al., 2010c
Lakefield 2012	MN	19.87	Westwood, 2013
Lakefield 2014	MN	20.19	Westwood, 2015
Prairie Rose (2013)	MN	0.41[1]	Chodachek et. al, 2015
Big Blue (2013)	MN	6.33	Chodachek et. al, 2014
Grand Meadow (2013)	MN	3.11	Chodachek et. al, 2014
Oak Glen (2013)	MN	3.09	Chodachek et. al, 2014

[1] estimate per study period (April 15 – June 15 and fall August 15 – October 31)

The Project is located within the range of the federally listed northern long-eared bat, and individuals may occur within the Project Area during spring through fall migration. The Applicant conducted a northern long-eared bat presence/absence acoustic survey in 2016. No potential northern long-eared bat calls were identified. As such, northern long-eared bats are unlikely to occur in the habitat sampled. Additionally, maternity roost trees or hibernacula sites for this species have not historically been recorded in the area (MNDNR and USFWS, 2017). Nevertheless, all but one turbine is sited at least 1,000 ft from potential northern long-eared bat summer foraging and roosting bat habitat to limit potential risks to this species during construction and operation. The turbine within 1,000 ft is sited in cropland approximately 900 ft from the nearest area of potential northern long-eared bat habitat. This 1,000-foot setback is consistent with recommendations in the USFWS northern long-eared bat guidance (USFWS, 2014).

Note that wooded habitat in the Project is conservative and includes woodlots around farmsteads, shelterbelts, and the riparian corridors associated with Florida, Lazarus, and Canby creeks (Figure 11a). Under the final 4(d) rule published January 14, 2016 (Title 81 Code of Federal Regulations Part 1900), incidental take of the northern long-eared bat from the operation of utility-scale wind-energy turbines is not prohibited.

9.19.3 Mitigative Measures

The Applicant will implement the following measures to the extent practicable to help avoid and minimize potential impacts to wildlife in the Project Area during the selection of turbine locations and subsequent Project development and operation:

- Avoid and minimize siting turbines in MNDNR-mapped native prairie, native plant communities, and sites of biodiversity ranked below, moderate, high, or outstanding;
- Maintain, at a minimum, the three by five times the RD setback from WMAs and WPAs to reduce the risk to waterfowl/waterbirds and grassland-associated birds when siting turbines in the Project Area;
- Avoid and minimize disturbance of wetlands or drainage systems during construction. Wetland delineations have been completed to inform the Project layout; previously unsurveyed areas due to layout changes will be surveyed prior to construction to identify the wetland boundaries within the vicinity of Project infrastructure;
- Protect existing trees and shrubs by avoiding tree removal for turbines, access roads, and collection lines. These will be identified based on aerial photos and during field surveys;
- Maintain sound water and soil conservation practices during construction and operation of the Project to protect topsoil and adjacent resources and minimize soil erosion. To minimize soil erosion during and after construction, BMPs for erosion and sediment control will be used. These practices include silt fencing, temporary seeding, permanent seeding, mulching, filter strips, erosion blankets, grassed waterways, and sod stabilization;
- Construct wind turbines using tubular monopole towers;
- Minimize turbine lighting in accordance with FAA requirements;
- Re-vegetate non-cropland and pasture areas disturbed during construction or operation with an appropriate native seed mix, or as directed by the landowner;
- Inspect and control noxious weeds in areas disturbed by the construction and operation of the Project; and
- Prepare and implement a BBCS during construction and operation of the Project. A draft BBCS is attached to this Application as Appendix H. This BBCS consists of the Applicants' corporate standards for minimizing impacts to avian and bat species during the construction of wind energy projects. It has also been developed based on the USFWS WEG (USFWS, 2012). It includes commitments to wind farm siting, construction practices and design standards, operational practices, permit compliance, construction and operation worker training, and post-construction wildlife monitoring commitments. It also includes additional avoidance and minimization measures that may be implemented in coordination with the USFWS and MNDNR if avian and bat fatalities exceed an acceptable level.

The Applicant is committed to minimizing wildlife impacts within the Project Area and has designed the Project to minimize avian impacts by avoiding high use wildlife habitat, using monopole towers to minimize perching, placing electrical collection lines underground, and minimizing infrastructure. The use of larger turbines results in fewer turbines for the same total nameplate capacity and less overall land disturbance. The Applicant continues to coordinate with MPUC, USFWS, and MNDNR regarding appropriate mitigation measures for wildlife impacts.

9.20 Rare and Unique Natural Resources

9.20.1 Description of Resources

The MNDNR maintains an NHIS database through their Natural Heritage Program and Nongame Research Program, which is the most complete source of data on Minnesota's rare, endangered, or otherwise significant plant and animal species, plant communities, and other rare natural features (MNDNR, 2017b). NHIS data show that there are two state-listed threatened or endangered insects (butterflies, also federally listed) and one plant in the Project Area (Appendix I). There are documented occurrences of one plant and two bird species within 5 miles of the Project Area that are state-listed endangered or threatened (Table 31 and Figure 11a). In addition, there are 17 species of special concern (three insects, one mussel, seven plants, three birds, one amphibian, two mammals, and one fungus) and two watchlist birds that do not have a legal status, but are being tracked by the MNDNR, have been documented within 5 miles of the Project Area.

Table 31: NHIS Species Recorded within Five Miles of the Project Area

Type	State Status [1]	Scientific Name	Common Name	No. of Records within the Project Area	No. of Records within Five Miles of the Project	Year of Most Current Observation
Insect	E	*Oarisma poweshiek*	Poweshiek Skipperling	3	0	1994
	E	*Hesperia dacotae*	Dakota Skipper	2	0	1981
	SPC	*Speyeria idalia*	Regal Fritillary	3	0	1994
	SPC	*Atrytone arogos iowa*	Iowa Skipper	1	0	1975
	SPC	*Hesperia leonardus pawnee*	Pawnee Skipper	0	2	1967
Mussel	SPC	*Lasmigona compressa*	Creek Heelsplitter	0	1	2000
Plant	T	*Viola nuttallii*	Yellow Prairie Violet	0	1	1999
	T	*Rhynchospora capillacea*	Hair-like Beak Rush	4	0	2000
	SPC	*Dalea candida var. oligophylla*	Western White Prairie-clover	5	10	2016

Table 31: NHIS Species Recorded within Five Miles of the Project Area

Type	State Status [1]	Scientific Name	Common Name	No. of Records within the Project Area	No. of Records within Five Miles of the Project	Year of Most Current Observation
	SPC	*Astragalus flexuosus var. flexuosus*	Slender Milk-vetch	2	2	2009
	SPC	*Astragalus missouriensis var. missouriensis*	Missouri Milk-vetch	2	1	2014
	SPC	*Cypripedium candidum*	Small White Lady's-slipper	1	1	2009
	SPC	*Carex annectens*	Yellow-fruit Sedge	0	2	1998
	SPC	*Desmanthus illinoensis*	Prairie Mimosa	0	1	1929
	SPC	*Eleocharis coloradoensis*	Dwarf Spikerush	0	1	1929
Bird	END	*Athene cunicularia*	Burrowing Owl	0	1	1954
	END	*Lanius ludovicianus*	Loggerhead Shrike	0	1	2009
	SPC	*Limosa fedoa*	Marbled Godwit	1	0	1998
	SPC	*Asio flammeus*	Short-eared Owl	1	0	1991
	SPC	*Empidonax virescens*	Acadian Flycatcher	1	0	2006
	W	*Bartramia longicauda*	Upland Sandpiper	6	5	1998
	W	*Botaurus lentiginosus*	American Bittern	1	0	1999
Amphi-bians	SPC	*Anaxyrus cognatus*	Great Plains Toad	1	0	1938
Mamm-al	SPC	*Urocitellus richardsonii*	Richard-son's Ground Squirrel	1	0	1999

Table 31: NHIS Species Recorded within Five Miles of the Project Area

Type	State Status [1]	Scientific Name	Common Name	No. of Records within the Project Area	No. of Records within Five Miles of the Project	Year of Most Current Observation
	SPC	*Microtus ochrogaster*	Prairie Vole	0	1	1999
Fungus	SPC	*Buellia nigra*	A species of Lichen	0	1	1998

Source: MNDNR, 2017b

[1] *E = Endangered; T = Threatened; SPC = Special Concern; W = Watchlist*

As part of its NHIS database, the MNDNR also maps rare and unique plant communities. These records may represent relatively rare habitats (e.g., prairie) or higher quality or good examples of more common plant communities (e.g., wet meadow). While most native plant communities have no legal protection in Minnesota, these areas may have the potential to contain undocumented populations of rare species, which may be protected under Minnesota's state endangered species law (Minn. Stat. 84.0895). Many of these native communities also provide essential habitat for rare species of fauna, such as those listed in Table 31 above.

Table 32 summarizes the native plant communities recorded within 5 miles of the Project Area based on the NHIS data. See Section 9.18.2 for a discussion on other native prairie and native plant communities. Many of the records within the Project Area identified in the table below correspond to native prairie and native plant communities described in Section 9.18.2; calcareous fens are discussed in Section 9.17.

Table 32: NHIS Records of Native Plant Communities Recorded within Five Miles of the Project Area

Native Plant Community Type	No. of NHIS Records in the Project Area	No. of NHIS Records within Five Miles of the Project Area
Calcareous Fen	6	1
Dry Hill Prairie (Southern)	12	8
Mesic Prairie	0	1
Wet Prairie (Southern)	1	0

Source: MNDNR, 2017b

Based on a review of the USFWS Information for Planning and Consultation, the northern long-eared bat is the only federally listed species known to occur in Yellow Medicine County, Minnesota (USFWS, 2017). Northern long-eared bat is described in Section 9.19.2.2.

9.20.1 Impacts

Based on preliminary site assessments, the Project Area is mostly cultivated cropland, hayfields, or heavily grazed pasture. There are two state-listed threatened or endangered insect records (butterflies, also federally listed) and one state-listed plant within the Project Area. As discussed in Section 9.18.3, turbines have been sited to avoid MNDNR mapped native prairie, native plant communities, and sites of biodiversity significance.

The Applicant will continue to coordinate with the USFWS and MNDNR on native prairie. Although no impacts to rare or unique natural resources are anticipated by the Project, a pre-construction inventory of existing native prairie, woodlands, and wetland will be conducted in the vicinity of planned facilities. The Applicant will avoid the rare and unique resources identified to the extent practicable.

9.20.2 Mitigative Measures

The Applicant will implement the following measures to avoid potential impacts to federal and state-listed species and rare or sensitive habitat in the area during site selection for wind turbines and access roads and subsequent construction and operation of the Project:

- The Applicant will prepare a prairie protection and management plan in coordination with MNDNR, as defined by Minn. Stat. § 84.02, subd. 5;
- Avoid placement of turbines in high quality native prairie;
- Avoid and minimize disturbance of wetlands or drainage systems during construction. Wetland delineations will be completed prior to construction to identify the wetland boundaries within the vicinity of Project infrastructure;
- Setback the turbines from the WMAs and WPAs by at least the minimum three by five RD; and
- Continue to coordinate with the USFWS and MNDNR as the Project layout is developed.

10. Site Characterization

10.1 Site Wind Characteristics

The Applicant has collected data from three temporary meteorological monitoring stations (Gary 2, 3, and 4) within the Project Area. These temporary towers will be removed during construction, and up to two permanent meteorological towers will be installed (Section 7.3.1; Figure 2). The earliest data collected within the Project Area is from January 2008. Table 33 below describes the meteorological stations. The Applicant used Modern-Era Retrospective analysis for Research and Applications (Version 2) data from National Aeronautics and Space Administration to correlate the data measured on-site and make it representative of the long term.

Table 33: Meteorological Stations

Tower	Easting	Northing	Elevation (m)	Sensor Elevation (m)	Operation Dates
Gary 2	707,818	4,946,144	515	75	29/1/2008 to Present
Gary 3	704,931	4,952,623	497	78.8	7/8/2008 to Present
Gary 4	703,677	4,948,651	509	60.9	9/8/2008 to Present

Computational fluid dynamics and proprietary software models were used to analyze the available wind data and make corrections for the site effects (topography, surface roughness, and obstacles) to produce a wind flow model of the local wind climate. The resulting local wind climate was applied in conjunction with the Project Area site effects to predict the spatial wind variations at the Project Area.

10.1.1 Interannual Variation

Inter-Annual Variation is the expected variation in wind speeds from one year to the next. The Inter-Annual Variation for this site is expected to be 4%.

10.1.2 Seasonal Variation

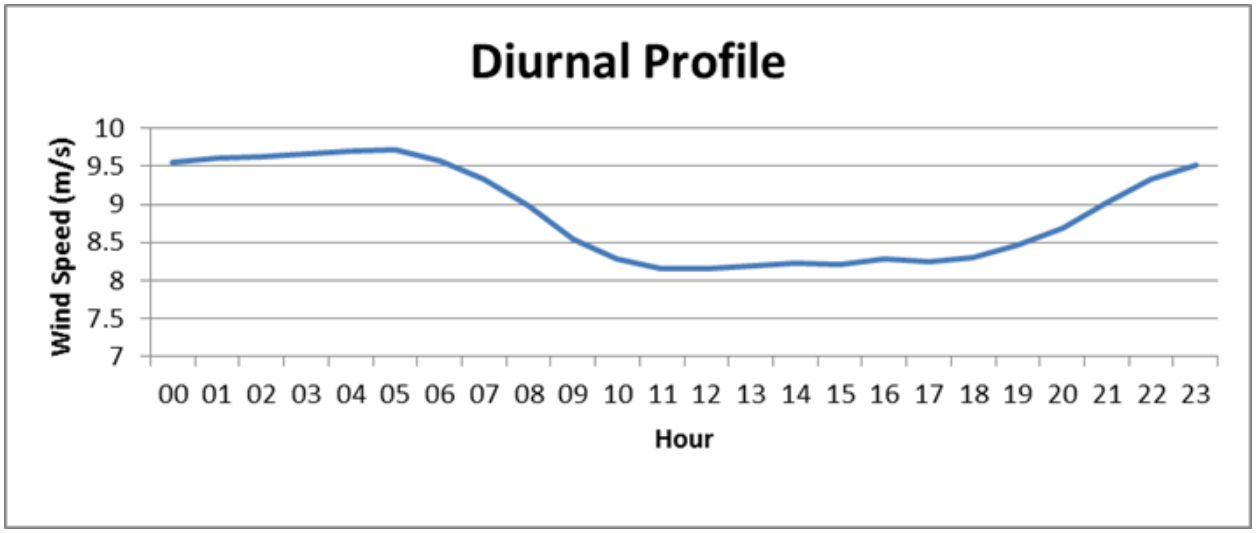
Seasonal variation is how the wind speed changes between seasons. Wind speeds are expected to be higher in the winter and lower in the summer. Table 34 below shows the monthly average wind speeds for the Project Area at the predicted hub height of 345 ft (105 m).

Table 34: Monthly Average Wind Speeds for the Project Area

Month	Wind Speed (m/s)
January	11.14
February	9.79
March	8.79
April	9.25
May	8.21
June	7.69
July	7.96
August	5.96
September	8.74
October	9.28
November	10.20
December	9.80
Annual Average	8.89

10.1.3 Diurnal Conditions

Diurnal variation is how the wind speed changes hourly (day vs. night). Normally wind speeds are lower in the middle of the day and higher at nighttime. The graph below shows the expected variation of wind speeds per hour for the Project Area at a predicted hub height of 345 ft (105 m).



10.1.4 Atmospheric Stability

A stable atmosphere lacks vertical motions while an unstable atmospheric has vertical movement. The lapse rate calculated for the Project Area was 14.8 degrees (°) per km. This is higher than the dry adiabatic lapse rate and therefore considered unstable.

10.1.5 Hub Height Turbulence

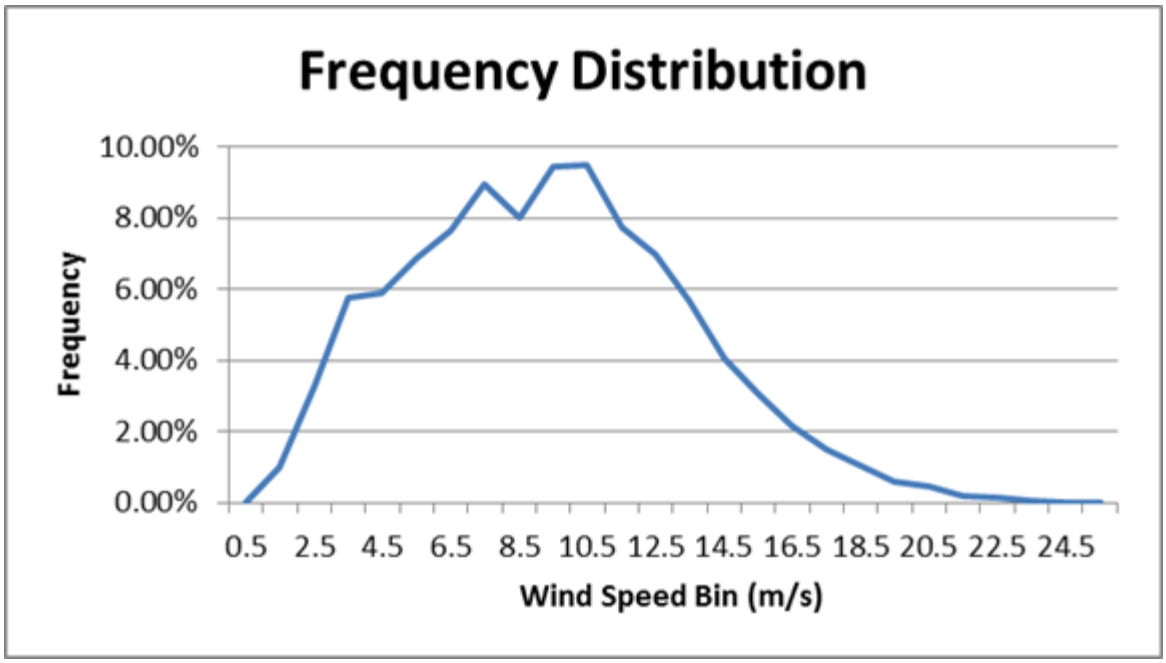
Turbulence Intensity is measured as standard deviation of wind speed over the mean wind speed. Average turbulence for this site is 7.89%, while at 15 m/s the average turbulence is 7.76%.

10.1.6 Extreme Wind Conditions

The maximum hourly wind speed measured at Bitter Root was 31.6 m/s at the predicted hub height of 345 ft (105 m). The site extreme wind speed for a 1 in 50-year event is 37.9 m/s for 345 ft (105 m).

10.1.7 Wind Speed Frequency Distribution

The graph below shows the wind speed frequency distribution calculated from 10-minute data collected on-site scaled to the annual average at a predicted hub height of 345 ft (105 m).



10.1.8 Wind Variation with Height

Wind shear is change in wind speed with height. Shear is calculated using the power law as follows:

$$\alpha = \ln(V/V_0)/\ln(H/H_0)$$

Where:

V is the wind speed,

H is the height,

α is the power shear coefficient.

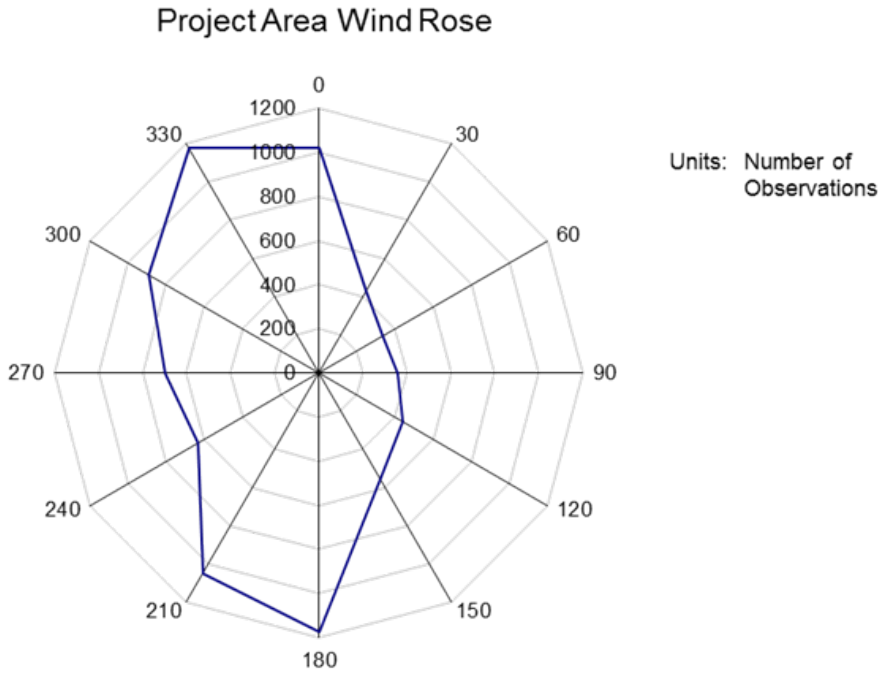
The shear coefficient for the Project Area varies between 0.204 and 0.228.

10.1.9 Spatial Wind Variation

Spatial wind variation over the Project Area will be modeled using commercially available software as well as the applicant's internal, proprietary tools. There are multiple measuring devices around the site to reduce uncertainty. The installed meteorological stations are representative of 71% of the anticipated wind turbines. A remote sensing unit was recently installed on-site and can be moved to increase spatial coverage.

10.1.10 Wind Rose

A wind rose represents the wind speed frequency by which direction the wind is coming from. The long-term representative wind rose from mast "Gary 2" is shown below. The prevailing winds are north/south and the non-prevailing winds are east/west.



10.1.11 Other Meteorological Conditions

10.1.11.1 Average and Extreme Weather Conditions

Long term average temperatures were calculated using the National Climatic Data Center Automated Surface Observing System station at Canby located approximately 8 miles northeast of the Project Area. The minimum temperature is -36.5°C while the maximum temperature is 36.4°C at 345 ft (105 m).

Extreme weather events include tornadoes/funnel clouds, hail, thunderstorms, blizzards, extreme cold/low wind chill, glaze, heavy ice and snow, blowing snow, excessive heat, fog, floods, and flash floods.

10.2 Location of Other Wind Turbines within Ten Miles of Project Boundary

There are several existing wind projects to the south of the Project Area, including Lakota Ridge, MinnDakota, Shaokatan Hills, and Buffalo Ridge II. Buffalo Ridge II is the closest at 9 miles

southwest of the Project Area (see Figure 18). There are two proposed wind farms south of the Project Area in northern Lincoln County, Blazing Star which is directly south, and Red Pine which is approximately 9 miles southeast.

11. Project Construction

Several activities must be completed prior to the proposed commercial operation date. The majority of this activity relates to equipment ordering lead-time, as well as design and construction of the facility. A preliminary schedule of activities necessary to develop the proposed Project is included in Section 11.5. Pre-construction, construction, and post-construction activities for the proposed Project include:

- Ordering of all necessary components including turbine towers, nacelles, blades, foundations, and transformers;
- Complete survey to microsite locations of structures and roadways;
- Soil borings, testing, and analysis for proper foundation design and materials;
- Complete construction of access roads, to be used for construction and maintenance;
- Construction of underground feeder lines;
- Design and construction of the proposed Project Substation facilities;
- Installation of turbine tower foundations;
- Installation of underground and aboveground junction boxes;
- Turbine tower placement and wind turbine setting;
- Acceptance testing of facility; and
- Commencement of commercial operation.

Private turbine access roads will be built adjacent to the turbine towers, allowing access to the turbines during and after construction. Once construction is complete, access roads will typically be up to 20 ft wide (including shoulders), will have an aggregate surface as cover, and will be adequate to support the size and weight of maintenance vehicles. The specific turbine placement will determine the amount of private roadway that will be constructed for the proposed Project.

During the construction phase, several types of light, medium, and heavy-duty construction vehicles will travel to and from the site, as well as private vehicles used by construction personnel. The Applicant estimates that there would be approximately 500 additional trips per day in the area during peak construction periods. That volume would occur during the peak time when the majority of the road, foundation, and turbine tower assembly is taking place. At the completion of each construction phase, construction equipment will be removed from the site or reduced in number.

11.1 Construction Management

RES has performed the engineering and design for the Project, and will serve as general contractor for the construction of the Project. The services of local contractors will be used, where possible, to assist in construction. The general contractor, in coordination with local contractors, will undertake the following activities:

- Securing building, electrical, grading, road, and utility permits;

- Perform detailed civil, structural, and electrical engineering;
- Schedule execution of construction activities; and
- Forecast labor requirements and budgeting.

The general contractor also serves as key contact and interface for subcontractor coordination. The general contractor will oversee the installation of communication and power collection lines, as well as the substation modifications. The general contractor will also oversee the installation of roads, concrete foundations, turbine towers, and blades, as well as the coordination of materials receiving, inventory, and distribution. The Project will be constructed under the direct supervision of an on-site construction project manager with the assistance of local contractors, if necessary. The Project construction consists of the following tasks:

- Site development;
- Access and site road construction;
- Foundation;
- Construction, including concrete placement;
- Turbine erection;
- All electrical collection system and communications installation;
- Substation construction;
- Wind turbine installation; and
- System testing.

The construction team will be on site to oversee safety, materials purchasing, construction, quality control, testing, and start-up. The general contractor will manage local subcontractors (if necessary) to complete all aspects of construction. Throughout the construction phase, ongoing coordination will occur between the proposed Project development and the construction teams. The on-site construction project manager will help to coordinate all aspects of the proposed Project, including ongoing communication with local officials, citizens groups, and landowners. Even before the proposed Project becomes fully operational, the O&M staff will be integrated into the construction phase of the proposed Project. The construction project manager and the O&M manager will work together continuously to ensure a smooth transition from construction through wind farm commissioning and, finally, operations.

11.2 Construction Methods

Completion of the Project will require various types of civil works and physical improvements to the land. These may include the following:

- Improvement of existing public access roads to the Project Area;
- Construction of roads adjacent to the wind turbine strings (turbine access roads) to allow construction and continued servicing of the wind turbines;
- Clearing and grading for wind turbine tower foundation installations;
- Installation of underground cabling for connecting the individual wind turbines;
- Installation of an on-site feeder system for connecting wind turbine strings for delivery to the electricity collection/metering location;
- Installation of any site fencing and security; and
- Restoration and revegetation of disturbed land when construction activities have been completed.

11.2.1 Geotechnical Investigations

Once turbine micro-siting and other field surveys are complete, geotechnical soil borings will be completed at the location of final turbine placement to determine the soil suitability to support turbine foundations.

11.2.2 Site Preparation and Road Construction

Any improvements to existing public access roads would consist of re-grading and filling the surface to allow access in inclement weather. No asphalt or other paving is anticipated. Because of the size of the equipment to be installed and the turning radii of the delivery trucks, some local roadways may require upgrades to improve drivability and access. This typically includes widening select intersections to allow for the long delivery trucks to turn, and upgrading road surfaces with the addition of gravel if necessary. All proposed upgrades will be coordinated in advance with Yellow Medicine County and township authorities.

11.2.3 Access Roads

Turbine access roads will be constructed along turbine strings or arrays. These roads will be sited in consultation with participating landowners and completed in accordance with local building requirements where these roads intersect with public roads. Turbine access roads will be located to facilitate both construction (cranes) and continued operation and maintenance. Siting roads in areas with unstable soil will be avoided wherever possible. All roads will include appropriate drainage and culverts while still allowing for the crossing of farm equipment. Once construction is complete, the roads will be up to 20 ft wide and will be covered with road base designed to allow passage under inclement weather conditions. The roads will consist of graded dirt and will be covered with an aggregate surface and may utilize cement stabilization techniques.

11.2.4 Foundation Construction

The wind turbines' tubular towers will be connected by anchor bolts to a concrete foundation. Turbine foundations consist of anchor bolts and reinforced steel bar that are placed within the excavated portion of the turbine footing and filled with concrete. The turbine base is fastened to the anchor bolts that protrude from the concrete pad surface.

In addition, turbine assembly will require an approximately 60 by 165-ft gravel crane pad extending from the access road to the turbine foundation, in addition to approximately 15,000 square ft (0.3 acre) for component laydown and rotor assembly[10].

11.2.5 Electrical Collection System Construction

The approximate length of collection lines needed for the turbine layout is 46.34 miles. All collection lines will be installed underground via trenching, plowing, or directional bores, as needed. The collection lines will be installed as a network between turbine locations and the Project

[10] These crane pads will most likely remain once construction is complete, and have been included in the permanent impact calculation.

Substation. Generally, the electrical collection lines will be buried in trenches or plowed underground. Where electrical collectors meet public road right-of-way, sensitive environmental resources, or conflicts with underground utility or other infrastructure will be installed with directional bores, where necessary. The collection lines will occasionally require an aboveground junction box, and these will generally be placed along field edges or in the right-of-way, as appropriate.

11.2.6 Wind Turbine Assembly

The towers will consist of three sections bolted together. Once the tower is assembled, the nacelle, rotor, and three blades will be installed using a construction crane.

11.2.7 Plant Energization and Commission (Start-Up)

The Project will be commissioned after completion of the construction phase. The Project will undergo detailed inspection and testing procedures prior to final turbine commissioning. Inspection and testing will occur for each component of the wind turbines, as well as the communication system, meteorological system, obstruction lighting, high voltage collection and feeder system, and the SCADA system.

11.2.8 Construction Clean-Up

Once construction has been completed, the roads will be re-graded, filled, and dressed as needed. Temporary construction areas, such as access road additional width areas, collection line trenching corridors, and laydown yard will also be restored. The temporary disturbance areas will be graded to natural contours and soil will be loosened and seeded if necessary.

11.3 Operation and Maintenance

11.3.1 Project Management, Control, and Service

The Applicant will operate the wind energy facility for the life of the proposed Project. Approximately four to six people will be employed on site to operate and maintain the facility. The O&M staff will have full responsibility for the facility to ensure O&M are conducted consistent with the applicable permits, prudent industry practice, and equipment manufacturer recommendations for the turbines.

The SCADA system offers access to wind turbine generation or production data, availability, meteorological, and communications data, as well as alarms and communication error information. Performance data and parameters for each machine (generator speed, wind speed, power output, etc.) can also be viewed, and machine status can be changed. There is also a “snapshot” facility that collects frames of operating data to aid in diagnostics and troubleshooting of problems.

The primary functions of the SCADA system are to:

- Monitor wind farm status;
- Allow for autonomous turbine operation;
- Alert operations personnel to wind farm conditions requiring resolution;

- Provide a user/operator interface for controlling and monitoring wind turbines;
- Collect meteorological performance data from turbines;
- Monitor field communications;
- Provide diagnostic capabilities of wind turbine performance for operators and maintenance personnel;
- Collect wind turbine and wind farm material and labor resource information;
- Provide information archive capabilities;
- Provide inventory control capabilities; and
- Provide information reporting on a regular basis.

11.3.2 Maintenance Schedule

The on-site operations staff will be responsible for the maintenance of the proposed Project on a daily basis. This monitoring will be accompanied by visual inspections by the on-site operating staff. Several daily checks will be made in the first 3 months of commercial operation to verify that the proposed Project is operating within expected parameters. Once installed, the proposed Project service and maintenance is carefully planned and divided into the following intervals:

First Service Inspection. The first service inspection will take place 1 to 3 months after the turbines have been commissioned. At this inspection, particular attention is paid to tightening all bolts by 100%, a full greasing, and filtering of gear oil.

Semiannual Service Inspection. Regular service inspections commence 6 months after the first inspection. The semiannual inspection consists of lubrication and a safety test of the turbine.

Annual Service Inspection. The annual service inspection consists of a semi-annual inspection plus a full component check. Bolts are checked with a torque wrench. The check covers 10% of every bolt assembly. If any bolts are found to be loose, all bolts in that assembly are tightened 100% and the finding is recorded.

Two-Year Service Inspection. The two-year service inspection consists of the annual inspection, plus checking and tightening of terminal connectors.

Five-Year Service Inspection. The five-year inspection consists of the annual inspection, an extensive inspection of the wind braking system, and checking and testing of oil and grease, balance check, and tightness of terminal connectors.

11.3.3 General Maintenance

O&M field duties include performing all scheduled and unscheduled maintenance, including periodic operational checks and tests, regular preventive maintenance on all turbines, related plant facilities and equipment, safety systems, controls, instruments, and machinery, including:

- Maintenance of the wind turbines and of the mechanical, electrical power, and communications system;
- Performance of all routine inspections;
- Maintenance of all oil levels and changing oil filters;

- Maintenance of the control systems, all proposed Project structures, access roads, drainage systems, and other facilities necessary for the Project operation;
- Maintenance of all O&M field maintenance manuals, service bulletins, revisions, and documentation for the proposed Project;
- Maintenance of all parts, price lists, and computer software;
- Maintenance and operation of Project Substation facilities;
- Provision of all labor, services, consumables, and parts required to perform scheduled and unscheduled maintenance on the wind farm, including repairs and replacement of parts and removal of failed parts;
- Cooperation with avian and other wildlife studies as may be required, to include reporting and monitoring;
- Management of lubricants, solvents, and other hazardous materials as required by local and/or state regulations;
- Maintenance of appropriate levels of spare parts to maintain equipment. Order and maintain spare parts inventory;
- Provision of all necessary equipment including industrial cranes for removal and reinstallation of turbines;
- Hiring, training, and supervision of a work force necessary to meet the general maintenance requirements; and
- Implementation of appropriate security methods.

11.4 Costs

The total Project development and construction cost is anticipated to be $220-230 million, depending on final turbine and construction pricing. This includes siting and design costs, and capital costs to construct the Project. Annual operating costs are anticipated to be approximately $9 million.

11.4.1 Capital and Operational Costs

The Project installed capital costs are estimated to be approximately $210-220 million, including wind turbines, associated electrical and communication equipment and systems, and access roads. This does not include interconnection costs and the Project Substation and transmission line, both of which will be entirely located in South Dakota.

11.4.2 Site and Design Dependent Costs

Site and design dependent costs will be driven primarily by site-specific subsurface conditions as well as avoidance of environmental and cultural resources. This will determine access road design, turbine foundation design, turbine array layout, difficulty of working underground, and electrical collection system cost.

11.5 Schedule

11.5.1 Land Acquisition

Land acquisition for the Project originally began in 2008, and resumed again in 2016 when the Applicant acquired the Project. Approximately 21,000 acres have been secured for lease at the

time of this Application. The Applicant has continued to acquire wind rights leases and setback waivers, as well as transmission easements in 2017.

11.5.2 Permits

The Applicant expects the Site Permit to be issued within approximately 10 months of filing this Application. Preconstruction surveys and studies are currently underway and will continue through at least spring 2018. The Applicant will be responsible for undertaking all required environmental review and will obtain all permits and approvals that are required following issuance of the LWECS Site Permit.

11.5.3 Equipment Procurement, Manufacture and Delivery

The Applicant has purchased turbines for the Project. Turbine deliveries could commence in the first quarter of 2019.

11.5.4 Construction

RES will serve as the general contractor performing onsite Project construction. The construction will take approximately 12 months to complete. The construction will include access road construction, electrical and communication work, turbine installation, and restoration.

11.5.5 Financing

The Applicant is currently negotiating a power purchase agreement for the Project.

11.5.6 Expected Commercial Operation Date

The Applicant anticipates that the Project will begin commercial operation by October 2019.

11.6 Energy Projections

The applicant adheres to all federal, state, and local wind turbine siting and zoning requirements. In most cases the constraints implemented for the layout design are more restrictive that what is required. Examples of constraints include but no limited to distance from roads, overhead transmission lines, residences, other public infrastructure and project non-participants.

In addition to industry turbine siting best practices, other environmental constraints have been identified through third-party consultants and professional surveyors.

11.6.1 Proposed Array Spacing for Wind Turbines

The internal array spacing is a minimum of three RD spacing in the non-prevailing direction and a minimum of five RD spacing in the prevailing direction, with up to 20% of the turbines spaced closer to each other (see Section 6.1 and Figure 2).

11.6.2 Base Energy Projections

The Project will have a nameplate generation capacity of up to 152 MW and a net capacity factor between 40 and 45%. Annual energy production will depend on the final layout and turbine model. Losses in the net calculation include availability, electrical, degradation, environmental, curtailment, and others.

11.7 Decommissioning and Restoration

The Applicant anticipates that the life of the Project will be no less than 30 years and it requests the right to re-apply for a LWECS Site Permit and continue operation of the Project upon expiration of the original LWECS Site Permit. As the Project reaches the design life of the turbines, issues of decommissioning versus repowering will be evaluated.

The Applicant will develop a decommissioning plan in general accordance with the requirements of Minn. R. 7836.0500, Subp. 13. Sufficient funds will be set aside to fund Project decommissioning and site restoration, and will be discussed in detail in the decommissioning plan. Decommissioning efforts will include the removal of all above-ground wind facilities. Additionally, the Applicant has a contractual obligation to the participating landowners to remove the above surface grade wind facilities, including foundations to a depth of 42 inches below ground, when the wind easement expires.

The Applicant also reserves the right to explore alternatives regarding decommissioning at the end of the proposed Project's Site Permit term. For example, retrofitting the turbines and power system with upgrades based on new technology may allow the wind farm to produce efficiently and successfully for many more years. Any retrofitting or repowering that might occur during or after the permit term would be subject to the LWECS Site Permit and could require a new LWECS Site Permit from MPUC at that time.

12. Identification of Other Potential Permits

The Applicant identified known or potentially required permits and approvals for the Project and lists them in Table 35. The Applicant will be responsible for conducting applicable environmental and engineering reviews, and will obtain permits, licenses, and approvals needed and as conditioned upon issuance of the LWECS Site Permit from the Commission. In the event a potential approval is not later determined to be required for the Project, it will be removed from this list.

Table 35: Permits and Approvals

Regulatory Authority	Permit/Approval
Federal Approvals	
Federal Aviation Administration	Notice of Proposed Construction or Alteration (Determination of No Hazard - Form 7460-1)
	Notice of Actual Construction or Alteration (Form 7460-2)
U.S. Army Corps of Engineers	Wetland Delineation Approvals
	Jurisdictional Determination

Table 35: Permits and Approvals

Regulatory Authority	Permit/Approval
	Federal Clean Water Act Section 404 and Section 10 Permit(s)
U.S. Fish & Wildlife Service	Review for threatened & endangered species
	Wetland and easement permits
USEPA Region 5 in coordination with the MPCA	SPCC Plan
Lead Federal Agency (National Historic Preservation Act)	Federal Section 106 Review (Class I Literature Review / Class III Cultural Field Study)
Department of Defense	Federal airways and airspace review near military bases
U.S. Department of Transportation – Federal Highway Administration	Utility line crossing license/approval
FCC	Non-federally licensed microwave study
U.S. Department of Agriculture	Conservation / Grassland / Wetland Reserve Program releases and consents
Federal Energy Regulatory Commission	Exempt wholesale generator certification
	Qualifying Facility certification
	Market-based rate authorization
State of Minnesota Approvals	
Minnesota Public Utilities Commission	Site Permit for LWECS
	Large Electric Generating Facilities Certificate of Need
Minnesota SHPO	Cultural and historic resources review; State and National Register of Historic Sites review and Archeological Survey
MPCA	Section 401 Water Quality Certification
	NPDES – MPCA General Stormwater Permit for Construction Activity
	VSQG License – Hazardous Waste Collection Program
	Aboveground Storage Tank Notification Form (see also USEPA/MPCA SPCC requirement above)
MDH	EBH
	Well Construction Notification (dewatering)
	Water Well Permit
	Plumbing Plan Review
MNDNR	License to Cross Public Lands and Water
	Native Prairie Protection Plan Approval
	Endangered species consultations
	Biological surveys
	General permit for water appropriations (construction dewatering)

Table 35: Permits and Approvals

Regulatory Authority	Permit/Approval
	Well construction preliminary assessment
	Public Waters Work Permit
Minnesota Board of Water and Soil Resources	Wetland Conservation Act (WCA) approval
MnDOT	Utility Accommodation Permit on Trunk Highway Right-of-Way
	Oversize/Overweight Permit for State Highways
	Access/Driveway Permit for MnDOT roads
	Tall Structure Permit (aviation clearance from MnDOT Office of Aeronautics review and approval)
Minnesota Department of Labor and Industry	Electrical plan review, permits, & inspections
Local Approvals	
Yellow Medicine County	Building Permits
	Individual Septic Tank Systems Permit
	Driveway Permit
	Utility Crossing Permit
	Moving Permit
	Overwidth/Overweight Permits
	WCA approvals
Yellow Medicine County Soil and Water Conservation District	WCA approvals
Townships (Florida, Fortier, and Norman)	Right-of-way permits, crossing permits, driveway permits for access roads, oversize/overweight permits for township roads

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