Draft Environmental Impact Statement

NOBLE FLAT HILL WINDPARK I

In the Matter of the Noble Flat Hill Windpark I, LLC Applications for a 201 Megawatt Large Wind Energy Conversion System Site Permit, a 230 Kilovolt High Voltage Transmission Line Route Permit and a Certificate of Need for the Noble Flat Hill Windpark I Project in Clay County.

PUC Docket Nos. IP6687/WS-08-1134, TL-08-988, CN-08-951

Prepared by Wenck Associates, Inc. for

office of energy security

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ABSTRACT

Noble Flat Hill Windpark I, LLC, a subsidiary of Noble Environmental Power, proposed the construction of a Large Wind Energy Conversion System (LWECS) with an associated, new 230 kV high voltage transmission line (HVTL) expected to be approximately 11.5 miles long. The Proposed Project is located in Clay County, Minnesota and would be up to 201 MW in size.

Noble Flat Hill Windpark I, LLC is required to obtain a Certificate of Need (CON), an LWECS Site Permit and a Route Permit for the 230 kV HVTL from the Minnesota Public Utilities Commission (Commission).

The CON requires an Environmental Report (ER) and the HVTL Route Permit Application requires an Environmental Impact Statement (EIS). However, the Director of the Office on Energy Security (OES), in consultation with the Commission and Noble Flat Hill Windpark I, LLC, allowed the joining of the EIS and ER into one document, per Minnesota Rules 7849.7100, subpart 2. The resulting EIS covers the environmental review requirements of both the CON and HVTL processes.

The project applications, listed as references in this EIS, provide additional information on the Noble Flat Hill Windpark I, LLC LWECS/HVTL project. Other materials related to these dockets are available at http://www.energyfacilities.puc.state.mn.us/Docket.html?Id=19714.

DRAFT EIS COMMENTS DUE BY SEPTEMBER 10, 2009

Formal comments on the accuracy and completeness of the Draft EIS will be accepted until September 10, 2009. Please refer to PUC Docket No. IP6687/WS-08-1134 or TL-08-988 or CN-08-951 in all correspondence. Comments should be sent by e-mail, fax or U.S. mail to Mr. David Birkholz (contact information above).

A copy of this Draft Environmental Impact Statement can be reviewed at the Glyndon City Hall, 36 3rd Street S.E., Glyndon, MN 56547.

PUBLIC INFORMATION MEETINGS AND HEARING SCHEDULED

The Office of Energy Security will be holding public information meetings on this Draft EIS on August 31, 2009, in the city of Glyndon. Public comments on the Draft EIS can be submitted for an additional 10 days after the public meeting, until September 10, 2009.

A public hearing on the project will also be held as a separate proceeding. The Commission has turned the process over to the Office of Administration Hearings to hold the hearing. The hearing will be conducted by Administrative Law Judge (ALJ) Beverly Jones Heydinger, who will ensure that the record created at the hearing is preserved and transmitted to the Commission. The ALJ will prepare a report that will include proposed findings of fact and conclusions and a recommendation. The public hearing will be held on October 12, 2009, at 1:00 p.m. and 6:00 p.m. in the city of Glyndon

Additional sessions may be provided if necessary to hear all interested parties wishing to testify. It is not necessary to attend more than one session to have your input heard and included in the record. All members of the public are welcome to attend any public hearing sessions.

FINAL EIS

After the comment period, the Office of Energy Security Energy Facility Permitting staff will prepare a Final EIS. The Final EIS will include revisions to the draft as well as staff responses to substantive comments on the draft. The Final EIS will be completed on October 8. 2009, and included in the compiled record turned over to the PUC by the ALJ.

LIST OF PREPARERS/CONTRIBUTORS

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- Wenck Associates, Inc.

- Supplemental information not contained in the Applications was provided by the Applicant through Tetra Tech, Inc.

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APPENDICES

Acronyms

Applicant	Noble Flat Hill Windpark I, LLC
AST	Aboveground Storage Tank
BMPs	Best Management Practices
BNSF	Burlington Northern Santa Fe
CO_2	Carbon Dioxide
CON	Certificate of Need
dB(A)	Decibels
DLI	Department of Labor and Industry
DOC	Department of Commerce
EAW	Environmental Assessment Worksheet
EIS	Environmental Impact Statement
ER	Environmental Report
EQB	Minnesota Environmental Quality Board
FAA	Federal Aviation Administration
FERC	Federal Energy Regulatory Commission
GE	General Electric
HAPs	Hazardous Air Pollutants
Hg	Mercury
HVTL	High Voltage Transmission Line
L_p	Representative Sound Power Level
LEF	Large Energy Facility
LWECS	Large Wind Energy Conversion System
MAAQS	Minnesota Ambient Air Quality Standards
MCBS	Minnesota County Biological Survey
MDH	Minnesota Department of Health
MDNR	Minnesota Department of Natural Resources
MDOT	Minnesota Department of Transportation
MFRC	Minnesota Forest Resource Council
MPCA	Minnesota Pollution Control Agency
MW	Megawatts
NAAQS	National Ambient Air Quality Standards
NPDES	National Pollutant Discharge Elimination System
NO_x	Nitrogen Oxides
OES	Office of Energy Security
OTP	Otter Tail Power
PM	Particulate Matter
PM_{10}	Particulate Matter Less Than 10 Microns
$PM_{2.5}$	Particulate Matter Less Than 2.5 Microns
PUC	Minnesota Public Utilities Commission (PUC or Commission)
RD	Rotor Diameter
REO	Minnesota Renewable Energy Objective
RES	Minnesota Renewable Energy Standard
SHPO	State Historic Preservation Office
SNCR	Selective Non-Catalytic Reduction
SO_2	Sulfur Dioxide
tpy	Tons Per Year
USACE	U.S. Army Corps of Engineers
VOCs	Volatile Organic Compounds
WCA	Wetland Conservation Act

Definitions

Agricultural Biomass: Surplus agricultural products or waste that can be burned a fuel in a biomass facility including corn stalks or livestock bedding.

Ambient Air Quality Standards: An ambient air quality standard sets legal limits on the level of an air pollutant in the outdoor (ambient) air necessary to protect public health. The U.S. Environmental Protection Agency (USEPA) is authorized to set ambient air quality standards.

BACT (Best Available Control Technology): An emission limitation (including a visible emission standard) based on the maximum degree of reduction for each pollutant subject to regulation under the Act which would be emitted from any proposed major stationary source or major modification.

BMPs – Best Management Practices: The schedule of activities, prohibition of practices, maintenance procedures, and other management practices to avoid or minimize pollution or habitat destruction to the environment. BMPs can also include treatment requirements, operating procedures and practices to control runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage.

Capacity Factor: The ratio of the amount of electrical energy generated during a designated period by a particular generating facility to the maximum amount of electrical energy that could have been generated during the period by the facility had it been operating continuously at its rated capacity.

Carbon Dioxide (CO_2): Is a chemical compound composed of tow oxygen atoms covalently bonded to a single carbon atom. In general, it is exhaled by animals and utilized by plants during photosynthesis Additional carbon dioxide is created by the combustion of fossil fuels or vegetable matter, among other chemical processes.

Certificate of Need (CON): An assessment that is conducted under Minnesota Rules 7849.0020 by the Minnesota Public Utilities Commission to determine the need for a proposed large energy facility.

Corn Stover: Consists of leaves and stalks of corn plants left in the field after harvest.

Electric Field: An electric field is produced by voltage and is made up of invisible lines that surround any electrical device that is plugged in and turned on. The strength of the electric field increases with increasing voltage and changes in the strength of an electric field generates a magnetic field.

Final Scoping Decision Document (FSDD): A Scoping Decision Document was prepared for the EIS as part of the public information and scoping process at the beginning of the Environmental Review process for the Proposed Project.

Fuel Source: A fuel source is any substance containing energy that can be converted into a different form of energy to be used for work.

Hazardous Air Pollutants (HAPs): Those air pollutants known or suspected to cause cancer or other serious health effects, such as reproductive effects or birth defects or other adverse environmental effects.

Hazardous Waste: Potentially toxic waste materials that can cause harm or contamination within the environment and must be handled and disposed of according to Minnesota regulations.

High Voltage Transmission Line: A conductor of electricity and associated facilities designed for and capable of operation at a nominal voltage of 100 kilovolts or more and is greater than 1,500 feet in length.

Magnetic Field: Invisible lines that surround any electrical device that is plugged in and turned on created by the flow of current through wires. Magnetic fields increase in strength with increasing current and exert forces on moving electric charges. Changes in magnetic fields cause electric fields.

Main Power Grid: The distribution system of electrical transmission lines that delivers electrical power from power generating sources to local distribution lines and systems when the electrical power is utilized.

Maximum Electric Field Density: The maximum electric field strength allowed surrounding a transmission line or other source of electric. The maximum was established by the Minnesota Environmental Quality Board in order to prevent serious shocks.

Mercury (Hg): A poisonous metallic element that can be emitted into the air through combustion.

Mitigation: The practice of lessening, moderating, or offsetting project related impacts.

Nameplate Capacity: The maximum rated output of a power generating facility.

Definitions (cont.)

NO_2: Nitrogen dioxide

NPDES Permit: National Pollutant Discharge Elimination System permit means the national program for issuing, modifying, revoking and reissuing, terminating, monitoring and enforcing permits, and imposing and enforcing pretreatment requirements, under sections 307, 402, 318, and 405 of Clean Water Act.

NPDES/SDS Permit: An NPDES/SDS Permit is a document that establishes the terms and conditions that must be met when a facility discharges wastewater to surface or groundwaters of the state. The permit is jointly issued under two programs. The National Pollutant Discharge Elimination System (NPDES) is a federal program established under the Clean Water Act, aimed at protecting the nation's waterways from point and nonpoint sources. In Minnesota, it is administered by the Minnesota Pollution Control Agency (MPCA) under a delegation from the U.S. Environmental Protection Agency. The State Disposal System (SDS) is a state program established under Minn. Stat. § 115. In Minnesota, when both permits are required they are combined into one NPDES/SDS Permit administered by the state. The permits are issued to permittees discharging to a surface water of the state.

Ozone: An unstable, poisonous allotrope of oxygen, O_3, that is formed naturally in the ozone layer from atmospheric oxygen by electric discharge or exposure to ultraviolet radiation. Also produced in the lower atmosphere by the photochemical reaction of certain pollutants.

PM_{10}: Particulate matter less than 10 microns in aerodynamic diameter

$PM_{2.5}$: Particulate matter less than or equal to 2.5 microns in aerodynamic diameter

ppm: parts per million

Primary Pollutant Emissions: Pollution emissions that are injected directly into the atmosphere during electric power generation. Primary pollutants include: carbon monoxide, nitrogen oxides, sulfur oxides, volatile organic compounds, and particulate matter.

Proposed Project Area: The combined Noble Flat Hill Windpark area and the 230 kV HVTL alignments. The windpark area includes 20,000 acres covering portions of 40 sections of land. The HVTL route alignments are two defined routes ranging between 9.9 and 11.5 miles long covering a proposed easement 300 feet wide.

Reactive Organic Gases are chemicals that are precursors to formation of ground-level ozone

SO_2: Sulfur dioxide

VOC: Volatile organic compound

Summary

Noble Flat Hill Windpark I, LLC (Applicant), a subsidiary of Noble Environmental Power, is proposing to construct a Large Wind Energy Conversion System (LWECS) with an associated, new 230 kV high voltage transmission line (HVTL). According to the Certificate of Need (CON) application, the purpose of the Proposed Project is to "provide a cost-competitive renewable energy resource to Minnesota utilities." The Proposed Windpark qualifies as an "eligible energy technology" which would help to satisfy the Minnesota Renewable Energy Objective (REO) and the Renewable Energy Standard (RES) as set forth in Minnesota Statutes 216B.1691. The purpose of the Proposed HVTL is to transmit power generated by the Proposed Windpark to the existing power grid.

REGULATORY FRAMEWORK

The Minnesota Public Utilities Commission (Commission or PUC) is responsible for permitting power plants, transmission lines, pipeline and wind turbine siting. A one year permitting process is required for HVTL lines that are over 200 kV.

The permits required for the Proposed Project include: a site permit, CON, and Route Permit. An application for a Site Permit was filed by the Applicant on October 17, 2008. The Site Permit application was accepted on December 23, 2008 with the PUC issuing a draft permit on the same day. A CON is required by the Minnesota PUC to build a transmission line in Minnesota over 200 kV and 1,500 or more feet long. The Applicant filed an application for a CON on October 17, 2008 with the PUC. The CON was accepted as complete by the PUC on January 14, 2009. On August 29, 2008, the Applicant applied for a Route Permit for the Proposed HVTL. The Route Permit was accepted as complete on September 26, 2008.

The CON typically requires an Environmental Report (ER), and the HVTL Route Permit application typically requires an Environmental Impact Statement (EIS). However, in consultation with the PUC and the Applicant, the Director of the Office of Energy Security (OES) allowed joining of the EIS and ER into one document, per Minnesota Rules 7849.7100, subpart 2. The EIS covers the environmental review requirements of both the CON and HVTL processes. The EIS Final Scoping Decision Document (Final SDD), ordered by the Director of OES, outlines the topics and extent of analysis addressed in this Draft EIS.

PROJECT DESCRIPTION

The Applicant is proposing to construct a 201 megawatt (MW) wind energy conversion system, or windpark, which would be located in Clay County, Minnesota, in Moland and Spring Prairie Townships. The Applicant is proposing to construct a 230 kV high voltage transmission line (HVTL), which would transmit the electricity generated by the windpark to the power grid. The Proposed Project includes the 201 MW Windpark, 230 kV HVTL, and associated facilities.

The Proposed Windpark would include up to 134 General Electric (GE) 1.5 MW, 60 hertz wind turbines to achieve the stated nameplate generating capacity of 201 MW. Supporting infrastructure would also be constructed within the Proposed Windpark area, which covers approximately 20,000 acres. The Proposed Windpark area is located approximately two miles north of the city of Glyndon and approximately 10 miles northeast of the city of Moorhead.

The Applicant is also proposing to construct a 230 kV HVTL to transmit the power generated from the Proposed Windpark to the power grid. The 230 kV HVTL would carry power generated by the windpark to the existing Otter Tail Power (OTP) 230 kV regional transmission line located approximately 6.5 miles south of the Proposed Project Area.

PROJECT ALTERNATIVES AND ANALYSIS

Alternatives to the Proposed Project are addressed in two ways in the EIS. The first analysis satisfies Minnesota Rules 7849.7060, which governs the content of the ER. These rules state that an analysis of alternatives to the Proposed Project must be included for projects requesting a CON. For the Proposed Project, the contents of the ER have been combined into the EIS under a joint proceeding. The EIS analysis reviews feasibility, general impacts and mitigation measures for those alternatives that would otherwise be required in an ER for the CON.

Alternatives considered for that analysis include a set of alternatives that deliver an equal amount of energy and capacity as the project proposed by the Applicant. These alternatives may reduce, mitigate or eliminate the need for the Proposed Project, while contributing toward Minnesota REO and RES compliance. The alternatives to the Proposed Project that were considered include: 1) the No Build alternative; 2) Construction of a 200 MW windpark at an alternate location; 3) Construction of a 77 MW biomass facility; and 4) the Proposed Project.

The main purpose of the Proposed Project is to meet the energy needs of Minnesota and the region. Based on Draft EIS analysis, the alternatives to the Proposed Project would produce energy for the region, however they are not feasible in regard to cost and/or size. Additionally, the No Build alternative does not contribute to availability of energy in the region. Finally, none of the alternatives analyzed for this Draft EIS have lower impacts than the Proposed Project.

A description of the alternatives to the Proposed Project is provided in Chapter 3 of this Draft EIS. Analysis of the alternatives is provided in Chapter 4, and Chapter 5 provides a feasibility analysis of the alternatives.

The second analysis provided in this Draft EIS is detailed under Minnesota Rules 7849.0260, which govern the content of a Route Permit Application for a proposed HVTL. The Route Permit Application must include at least two proposed routes for the HVTL. The Applicant has provided two potential routes for the Proposed HVTL, a preferred route (Route 1) and an alternate route (Route 2). Additionally, the Final SDD states that one additional route will be analyzed, which avoids the city of Glyndon.

The EIS route analysis indicates that the Applicant's preferred route offers the least impact to the environment and the people in the area. The preferred route travels mainly along existing right-of-ways and does not pass through a city, where more residents would be impacted.

Discussion of the potential environmental impacts and mitigations for the Proposed Project route alternatives is provided in Chapter 6.

1.0 Introduction – Summary of the Noble Flat Hill Windpark and 230 kV HVTL Project

This Draft Environmental Impact Statement (Draft EIS) has been prepared for the Proposed Noble Flat Hill Windpark I and 230 kilovolt (kV) High Voltage Transmission Line Project (Proposed Project). This document was prepared by the Minnesota Department of Commerce – Office of Energy Security (OES) in accord with the Power Plant Siting Act (Minnesota Statutes 216E).

1.1 DRAFT EIS DOCUMENT LAYOUT

This Draft EIS includes an analysis of the potential for significant environmental effects from various aspects of the Proposed Project. Proposed energy projects require multiple levels of environmental review and analysis. The analysis contained within an Environmental Report (ER) for a certificate of need for a proposed energy project includes an examination of potential alternatives to the proposed action and compares potential environmental impacts across alternatives. Analysis contained within an EIS for a proposed energy project includes the potential environmental impacts that would result from a proposed action at the proposed location, as well as examination of alterative routes for proposed high voltage transmission lines. This Draft EIS contains the environmental review components required for both the ER and the EIS.

This Draft EIS document consists of a summary and nine chapters, as well as tables, figures and appendices. The information provided in each chapter of this Draft EIS includes:

- Chapter 1 – Introduction: provides an introduction to the Proposed Project including description, location, purpose and alternatives
- Chapter 2 – Regulatory Framework: describes Minnesota Rules and requirements governing the various levels of environmental review and permitting required for the Proposed Project.
- Chapter 3 – Alternative to the Project: an ER level analysis that defines the alternatives to Proposed Project.
- Chapter 4 – Potential Human and Environmental Impacts: an ER level analysis that compares general potential environmental impacts for the alternatives described in Chapter 3.
- Chapter 5 – Feasibility and Availability of Alternatives: an ER level analysis that summaries the potential environmental impacts described for the project alternatives in Chapter 4.
- Chapter 6 - Impacts of the proposed Windpark and HVTL Route Alternatives: an EIS level, detailed analysis that includes specific, detailed description of the existing environment within and around the Proposed Project Area, assesses the potential for environmental impacts from the proposed project and recommends necessary or suggested levels of mitigation to offset project impacts. This level of analysis is completed for the Proposed Windpark and for the Proposed HVTL route alternatives.
- Chapter 7: Other Considerations: An EIS level analysis of the unavoidable impacts and commitment of resources from the Proposed Project.
- Chapter 8 – Permits and Approvals: An EIS level analysis detailing the permits and approvals that would be required to construct and operate the Proposed Project.
- Chapter 9 – References: includes a list of references for the entire document.

In summary, Chapters 1 and 2 of this Draft EIS provide the introduction to the Proposed Project and the regulatory framework governing environmental review and permitting for the project. Chapters 3, 4 and 5 of this Draft EIS provide environmental review analysis included as part of an ER including alternatives

to the Proposed Project and comparison of the general environmental impacts for the defined alternatives. Chapters 6, 7 and 8 provide the specific detailed analysis of the potential impacts from the Proposed Project and alternative HVTL routes.

1.2 PROJECT DESCRIPTION

Noble Environmental Power, LLC (Applicant) is an independent power developer based in Essex, Connecticut. Noble Environmental Power was founded in 2004 and focuses on supplying renewable sources of energy. Noble Environmental Power has approximately 3,850 Megawatts (MW) of windparks in operation or under development in eight states. The Applicant is an indirect wholly-owned subsidiary of Noble Environmental Power. The Applicant has proposed to construct a 201 megawatt (MW) wind energy conversion system (windpark) to be located in Clay County, Minnesota. The Applicant has also proposed to construct a 230 kV HVTL, which would transmit the electricity generated by the windpark to the power grid. The Proposed Project is the combined 201 MW Windpark, 230 kV HVTL, and associated facilities (i.e. access roads, underground collection system, and operation and maintenance facility).

The Applicant would construct up to 134 General Electric (GE) 1.5 MW, 60 hertz wind turbines to achieve the stated nameplate generating capacity of 201 MW of the Proposed Windpark. Within the windpark project area, supporting infrastructure would also be constructed including access roads, an underground collection system and an operation and maintenance facility. The total Proposed Project Area for the windpark covers approximately 20,000 acres across portions of 40 sections of land (Figure 1). The Applicant has secured land leases for approximately 11,500 acres within in the 20,000 acre project area. A preliminary turbine array for the windpark has been developed by the applicant (Figure 2); however, the final alignment of wind turbines, access roads and the underground collections system has not been finalized.

The Applicant has also proposed to construct a 230 kV HVTL to transmit the power generated from the windpark to the power grid. The HVTL would originate at a proposed substation that would be constructed in the center of the windpark (Figure 1). The 230 kV HVTL would carry power generated by the windpark from the substation to the existing Otter Tail Power (OTP) 230 kV regional transmission line located approximately 6.5 miles south of the Proposed Project Area. Two route alternatives were proposed by the Applicant for the 230 kV HVTL in the Route Permit Application.

Route 1 is the Applicant's preferred route and would begin at the substation and proceed east along 70th Avenue for two and a half miles to State Highway 9. At State Highway 9, the HVTL would proceed south for nine miles, crossing the Buffalo River and US Highway 10, to 50th Avenue where a switching station would be constructed to join the HVTL to the OTP regional transmission line (Figure 1). The total length of Route 1 would be approximately 11.5 miles. The HVTL along Route 1 would generally be placed within existing road right-of-way. The total proposed width for Route 1 is 300 feet.

Route 2 would also begin at the substation in the Proposed Project Area and proceed southwest following the former Burlington Northern Santa Fe (BNSF) Railroad right-of-way (Figure 1). Route 2 would continue southwest along the BNSF Railroad right-of-way for four and a half miles, crossing the Buffalo River, to the city of Glyndon. Once it reaches the city limits of Glyndon, Route 2 would proceed south and east for one and a half miles jogging through the city and crossing US Highway 10. At the southeast corner of Glyndon, Route 2 would proceed south for one mile and southeast for two and a quarter miles to 50th Avenue where a switching station would be constructed to join the HVTL to the OTP regional transmission line (Figure 1). The total length of Route 2 would be approximately 9.9 miles. The total proposed width for Route 2 is 300 feet.

Route 2 that has been proposed by the Applicant would travel through the city of Glyndon based on the route defined in the Route Permit Application. During the public comment and EIS scoping period, comments were received indicating that the Applicant running the alternate route (Route 2) through Glyndon is not properly analyzed as the best alternative to the Applicant's preferred route (Route 1). The

Final EIS Scoping document committed that the EIS would review the possibility of adapting the alternate route (Route 2) to run west of Glyndon.

Through a review of aerial photographs, a sub-alignment for Route 2 was developed to avoid the HVTL traveling through the center of the city of Glyndon. The sub-alignment for Route 2 has been designated as Route 2A and would alter approximately 3.6 miles of Route 2 in the center portion of the alignment to avoid traveling through the city of Glyndon. The north and south portions of Route 2 proposed by the Applicant would not be altered.

Route 2A would deviate from the proposed Route 2 approximately 0.1 miles west of the intersection of County Highway 19 and County Road 84 (Figure 1). This is approximately 0.5 miles south of where Route 2 crosses the Buffalo River along County Highway 19 and approximately 0.5 miles north of where Route 2 would enter the city limits of Glyndon. The Route 2A alignment would proceed west from the County Highway 19 and County Road 84 intersection for approximately 0.5 miles to a gravel road and proceed south for one mile. Route 2A would need to be located on the east side of the gravel road to avoid two existing farms on the west side of the road. Route 2A would then continue south and cross US Highway 10 and an intermittent stream. South of US Highway 10, the route would follow County Highway 17 for approximately 1.25 miles. The gravel road and County Highway 17 comprise the west boundary of the city limits of Glyndon. Route 2A would be located on the east side of County Highway 17 to avoid an existing residence on the west side of the road. Approximately 0.25 miles south of 12th Street, Route 2A would turn east. At this point the HVTL would be located along the southern boundary of the Glyndon city limits. Route 2A would travel approximately 0.5 miles to the center of the section, where it would encounter the former BNSF railroad right-of-way. Route 2A would travel southeast for approximately 1.0 miles where it would intersect Route 2 as proposed by the Applicant. Route 2 would then be unchanged from what was proposed by the Applicant in the Route Permit Application.

The total length of Route 2A would be 10.5 miles. This is approximately 0.6 miles longer than the length of Route 2 proposed by the Applicant in the Route Permit Application. The total length of Route 2A, is not significantly different than length of the Applicants preferred route, which is approximately 11.5 miles for Route 1.

The potential impacts associated with Route 2A will be described separately from Route 2 in the appropriate sections of Chapter 6, where potential differences are described between the two alignments.

1.3 PROJECT LOCATION

The Proposed Windpark would be located in Clay County, Minnesota, in Moland and Spring Prairie townships (Figure 3). The city of Glyndon, located approximately two miles south of the Proposed Windpark, is the community closest to the Proposed Project. The Proposed HVTL would run either to the east of Glyndon (Riverton Township), through Glyndon or to the west of Glyndon (Glyndon Township) to reach the OTP regional transmission line to the south, depending on the route alternative selected.

1.4 PROJECT PURPOSE

A CON Application for the Proposed Windpark and for the Proposed HVTL was submitted by the Applicant to the PUC. The CON Application states that the purpose of the Proposed Project is to "provide a cost-competitive renewable energy resource to Minnesota utilities." The Proposed Windpark qualifies as an "eligible energy technology" for the purposes of satisfying the REO and RES as set forth in Minnesota Statutes 216B.1691. The purposes of the Proposed Project as listed in the CON Application include:

1) Assist Minnesota utilities in meeting the REO and the RES by providing energy from a qualified renewable resource.
2) Meet a significant portion of Minnesota's demand for additional energy at a low cost.
3) Provide a facility that will enhance the diversity of Minnesota's electrical supply portfolio.

4) Provide an efficient, economical, reliable and environmentally acceptable solution for meeting Minnesota's and the region's energy needs.

The purpose of the Proposed HVTL is to transmit power generated by the Proposed Windpark to the power grid. Without the HVTL line, the Proposed Project would have no means of transporting/distributing the power generated by the Proposed Windpark. Without the Proposed Windpark, the Proposed HVTL would not be necessary.

1.5 PROJECT ALTERNATIVES

Alternatives to the Proposed Project are addressed in this Draft EIS. The first level of alternatives analysis is detailed under Minnesota Rules 7849.7060 governing the content of the ER, stating that an analysis of alternatives to the Proposed Project must be included for projects requesting a CON. For the proposed Noble Flat Hill Windpark and 230 kV HVTL project, the contents of the ER have been combined into this Draft EIS.

The project alternatives analysis is a general analysis of potential environmental impacts that would occur for each identified alternative. The alternatives to the Proposed Project that were considered include: 1) the No Build alternative; 2) Construction of a 200 MW windpark at an alternate location; 3) Construction of a 77 MW biomass facility; and 4) the Proposed Project. A description of the alternatives considered is provided in Chapter 3. The analysis of the alternatives is provided in Chapter 4 and an analysis of the feasibility of the alternatives is provided in Chapter 5.

The second level of alternatives analysis provided in this Draft EIS is described under Minnesota Rules 7649.0260 governing the content of a Route Permit Application for a proposed HVTL. The Route Permit Application must include at least two proposed routes for the HVTL. The Applicant has provided two potential routes for the proposed 230 kV HVTL, a preferred route (Route 1) and an alternate route (Route 2). A third route, Route 2A was developed as a result of public comments. A description of the proposed routes is provided in Section 1.2 of this Draft EIS. A discussion of the potential environmental impacts of the three route alternatives is provided in Chapter 6. A summary table comparing the potential impacts between the three alternative routes in provided in Chapter 7.

1.6 SOURCES OF INFORMATION

A variety of data and information sources were utilized to complete this Draft EIS. Data relating to the Proposed Project was gathered from the Site Permit Application and CON Application for the windpark and the Route Permit Application prepared and submitted by the Applicant. Special studies and surveys were also provided by the Applicant including a Cultural Resources Summary and a Biological Assessment for the Proposed Project Area. Publicly available data for the project area relating to items such as land use, land cover, zoning, natural resources, water bodies, floodplains, geology, soils, wetlands, noise, cultural resources and human health was also gathered from a variety of public sources. Those sources include Clay, Lincoln and Pipestone counties in Minnesota, the PUC, the Minnesota Department of Commerce (DOC), the Minnesota Department of Natural Resources (MDNR), the Minnesota Department of Health (MDH), the State Historic Preservation Office (SHPO), and the Minnesota Pollution Control Agency (MPCA). Various literature and internet based searches were also conducted to gather information related to windparks, wind turbines and high voltage transmission lines. A reference list detailing all information sources is provided in Chapter 9.

2.0 Regulatory Framework

The Minnesota Public Utilities Commission is the regulatory agency responsible for the review, permitting, and approval for construction of new energy facilities such as Noble Flat Hill Windpark I. There are several rules and statutes under Minnesota Law that define various levels of required review for the proposed project including: 1) analysis of project need; 2) permitting; and 3) environmental review. The Proposed Project requires a Certificate of Need (CON), an LWECS Site Permit and an HVTL Route Permit. A description of the regulatory framework governing the requirements for the CON, Site Permit, Route Permit, Scoping of Environmental Impacts, Analysis of Alternatives and Draft EIS for the Proposed Project is provided.

2.1 PUC CERTIFICATE OF NEED

The Applicant proposes to construct a Project that includes a wind park with associated transmission. The wind park would have a nameplate capacity of up to 201 MW in size. The Proposed Windpark is classified as a Large Energy Facility (LEF) under Minnesota Statutes 216B.2421, subdivision 2, which states that a LEF is "any electric power generating plant or combination of plants at a single site with a combined capacity of 50,000 kilowatts or more…" The 230 kV transmission line is classified as a LEF under the same statute.

A CON is required for the construction of new LEFs under Minnesota Statutes 216B.243, which states "No large energy facility shall be sited or constructed in Minnesota without the issuance of a certificate of need by the Commission."

The Applicant filed an application for a CON with the Commission for the Proposed Windpark and HVTL on October 17, 2008. The CON application was accepted as complete by the Commission on January 14, 2009.

2.2 PUC SITE PERMIT

The Proposed Project, with a nameplate capacity of up to 201 MW in size, is considered a Large Wind Energy Conversion System (LWECS), under Minnesota Rules 7836.0100 which states that "Large wind energy conversion system or "LWECS" means a combination of wind energy conversion systems with a combined nameplate capacity of 5,000 kilowatts (5 MW) or more."

Minnesota Rules 7836.0300 defines the permit requirements for LWECS. Subpart 1 states "No person may construct an LWECS without a site permit from the Commission. No person may commence construction of an LWECS until the commission has issued a site permit for the LWECS."

The Applicant filed an application for a Site Permit with the Commission for the Proposed Windpark on October 17, 2008. The Site Permit application was accepted as complete by the Commission on December 23, 2008.

2.3 PUC ROUTE PERMIT

The Applicant proposes to build a new single circuit 230 kV transmission line to capture energy generated by the Proposed Windpark. The Proposed HVTL would extend a distance of 9.9 to 11.5 miles depending on the route selected.

The Proposed 230 kV transmission line classifies as an HVTL under Minnesota Statutes 216E.01, subdivision 4: "High voltage transmission line means a conductor of electricity and associated facilities designed for and capable of operation at a nominal voltage of 100 kilovolts or more and is greater than 1,500 feet in length." Minnesota Statutes 216E.03, subdivision 2 states that "No person may construct a high-voltage transmission line without a route permit from the Commission." The permit requirements for a HVTL route permit are further defined under Minnesota Rules 7849.5040, subpart 2, which states "No person may construct a high voltage transmission line without a route permit from the commission. High voltage transmission line may be constructed only within a route approved by the Commission."

The proposed HVTL is over 200 kV and therefore is being reviewed under the Full Permitting Process as found in Minnesota Rules 7849.5200-5340.

The Applicant filed an application for a Route Permit for the Proposed HVTL with the Commission on August 29, 2008. The application was accepted as complete by the Commission on September 26, 2008.

2.4 ENVIRONMENTAL REPORT AND PROJECT ALTERNATIVES

An Environmental Report is required to be prepared by the Office of Energy Security (OES) for projects that require a CON based on Minnesota Rules 7849.7030, which states that "The [director] shall prepare an environmental report on a proposed high voltage transmission line or proposed large electric generating power plant at the need stage."

The Environmental Report must contain "information on the human and environmental impacts of the proposed project associated with size, type and timing of the project, system configurations and voltage" and "contain information on the alternatives to the proposed project and shall address mitigating measures for anticipated adverse impacts," as defined under Minnesota Rules 7849.7030.

The Director of the Office of Energy Security of the Department of Commerce (DOC), in consultation with the Applicant and the Commission, decided to combine the environmental review requirements of the various permits into one document, as allowed under Minnesota Rules 7849.7100, subpart 2. The OES will complete an EIS for the combined Noble Flat Hill Windpark and the Noble Flat Hill HVTL projects in lieu of the Environmental Report normally required under the CON proceeding. The EIS will contain the analysis of alternatives required for the project under Minnesota Rules 7849.7060.

2.5 ENVIRONMENTAL IMPACT STATEMENT

An EIS is required to be prepared for the proposed 230 kV transmission line project under Minnesota Rules 7849.5300, subpart 1, which states "The [director] shall prepare an environmental impact statement on each proposed large electric power generating plant and high voltage transmission line for which a permit application has been accepted by the [commission]." The Rule also lays out the procedures and the required review of alternatives for the draft EIS.

2.6 PUBLIC SCOPING AND PARTICIPATION PROCESS

For projects that require preparation of an EIS, there must be an opportunity for public participation in the scoping of the EIS as described under Minnesota Rules 7849.5300. OES has provided the public with an opportunity to participate in the development of the scope of the environmental impact statement by holding a public meeting and by soliciting public comments.

As stated above in Section 2.4, the environmental review process for the proposed Noble Flat Hill Windpark project and the associated HVTL project has been combined . A combined public information and scoping meeting for the Noble Flat Hill Windpark and the Noble Flat Hill HVTL projects was held by the OES Energy Facility Permitting (EFP) staff in Glyndon, Minnesota, on Wednesday, February 4, 2009. Approximately 120 residents attended the meeting. Comments relating to both the Windpark and the HVTL were received at the meeting. A public comment period on the proposed project was open until Wednesday, February 25, 2009. Written comments were submitted by 14 residents and one government agency, the Minnesota Department of Natural Resources.

The scoping decision for this Draft EIS was issued by the Director of the Office of Energy Security on April 27, 2009 (Appendix A).

The public will be given additional opportunities to participate in the environmental analysis process for the Proposed Project. A comment period, as required under Minnesota Rules 7849.5300, subpart 7, will be open from July 31, the date of this Draft EIS, until September 10, 2009. A copy of this Draft EIS will be placed in the Glyndon City offices. A notice of the availability of this Draft EIS will be sent to each person on the project contact list. A notice of the availability of this Draft EIS will also be placed in the *EQB Monitor*.

During the public comment period for this Draft EIS, a public information meeting on the Draft EIS will be held in Glyndon, in accordance with Minnesota Rules 7849.5300, subpart 8. As defined under subpart 8, "The meeting must not be held sooner than 20 days after the draft environmental impact statement becomes available." The public will be given an opportunity to comment on this Draft EIS at the public meeting and throughout the comment period.

A Public Hearing will be held in Clay County before an Administrative Law Judge after the Draft EIS has been issued in accordance with Minnesota Rules 7849.5710. The date and location for the public hearing have been set as October 12, 2009 at 1 p.m. and 6 p.m. in the city of Glyndon.

3.0 Alternatives to the Proposed Project – Project Alternatives Description

Environmental review in a Certificate of Need proceeding is intended to provide the Minnesota Public Utilities Commission and the public with information on the potential environmental impacts of a proposed project and of alternatives to the project that meet the stated need of the project. This chapter covers the feasibility, general impacts and mitigation measures for those alternatives that would be covered in a CON review.

Typically, CON proceedings determine whether additional electricity is needed to serve certain customers in a certain area and the various means by which an increased demand for electricity can be met, including type and size of facility, voltage, and transmission line routes. For the Proposed Project, the need is assumed to be making progress toward achieving the State Renewable Energy Objective (REO) and Renewable Energy Standard (RES). The size, type and timing of this particular project are the main subjects of this review.

Minnesota Rules 7849.7030, subpart 6 indicate that alternatives considered include a set of alternatives that deliver an equal amount of energy and capacity as the project proposed by the Applicant. These alternatives may reduce, mitigate or eliminate the need for the Proposed Project, while contributing toward the Minnesota Utilities' REO and RES compliance. The generally equivalent alternatives that will be discussed in this Draft EIS are a No Build alternative; a generic 200 MW wind generation wind facility located at a different site in Minnesota; a 77 MW biomass plant, considered an "eligible RES technology" that can produce an equivalent amount of energy as the wind facility; and the Proposed Project.

3.1 NO BUILD ALTERNATIVE

The No Build alternative means that no windpark project or associated transmission line would be constructed.

3.2 200 MW LWECS

A 200 MW LWECS could be constructed at a different site in Minnesota, which would contribute toward achieving REO and RES compliance. The 200 MW LWECS could also consist of a combination of smaller dispersed projects. This Draft EIS will describe the impacts associated with a specific location of one 200 MW wind project.

3.3 77 MW BIOMASS FACILITY

Biomass is organic material that can be used as a fuel source to generate heat or electricity. Potential sources of biomass include logging waste, straw, corn stalks, arbor trimmings, sawdust, wood pallets, and prairie grass. A biomass facility generates electricity through combustion of the biomass (organic material). This type of electricity generation is considered an eligible technology and would count toward the State REO and RES.

The Proposed Project has an approximate capacity of 201 MW, but would have an estimated capacity factor of 35 to 40 percent. Based on the Proposed Project capacity information, a 77 MW biomass facility would be an appropriately-sized alternative facility to analyze for this Draft EIS.

An EAW was conducted in 2003 for the NGPP Minnesota Biomass, LLC, electricity generation facility. This EAW evaluated the potential environmental impacts of a 38.5 MW biomass facility, which used a combination of hybrid willow, poplar, and corn stover, along with natural gas as a backup fuel.

This Draft EIS analyzes the potential impacts of a biomass facility twice the size of the NGPP Minnesota Biomass, LLC facility; however, the EAW completed for NGPP provides baseline information for this Draft EIS. Further analysis was completed for a 77 MW biomass facility based on additional available data. Information provided in the EAW for NGPP Minnesota Biomass, LLC, electric generation facility was updated as necessary to match existing standards and/or requirements.

3.4 NOBLE FLAT HILL WINDPARK I PROJECT AND ASSOCIATED 230 KV HVTL

The Proposed Project would be a LWECS with a nameplate capacity of up to 201 MW in size. Turbines and associated facilities for the Proposed Project include:

- 134, 1.5 MW wind turbine generators;
- approximately 27 miles of access roads;
- approximately 30 miles of electrical collection system;
- a new substation;
- a new operations and maintenance building;
- a new single circuit 230 kV transmission line, approximately 10 miles long, to capture energy generated by the wind turbines and to connect to an existing 230 kV transmission line; and
- a new switching station.

4.0 Potential Human and Environmental Impacts of Alternatives to the Project

An analysis of alternatives to a proposed action is included within an ER for projects requiring a CON. Within the ER the alternative analysis examines potential for environmental impacts from the proposed action and other options capable of generating an equal amount of power. The alternatives analysis required in the ER must compare potential environmental impacts for the defined alternative for the following areas of environmental concern: primary pollutant emissions, hazardous air pollutant and volatile organic compound emissions, visibility, ozone, fuel source, associated transmission facilities, water appropriations, wastewater, solid and hazardous waste, and noise. This chapter of the Draft EIS provides the alternatives analysis that would normally be included in the ER, which would be prepared as a result of the CON application submitted for the Proposed Project. The Proposed Project is a 200 MW Windpark and 230 kV HVTL. This Draft EIS analyzes the Proposed Project and three additional alternatives: a 77 MW biomass facility; a 200 MW LWECS at an alternate location in Minnesota and the No Build alternative. A description of the alternatives analyzed is provided in Chapter 3. A comparison of the potential for environmental impacts for the categories listed above is provided for the identified alternatives.

4.1 EMISSIONS

Large-scale wind park projects have the potential to produce air emissions during both construction and operation. Minnesota Rules 7849.7060 subpart 2 requires the following pollutants to be addressed in the ER: sulfur dioxide (SO_2), nitrogen oxides (NO_x), carbon dioxide (CO_2), mercury (Hg), particulate matter (PM) and particulate matter less than 2.5 microns ($PM_{2.5}$). Particulate matter less than 10 microns (PM_{10}) was also included here because it is also assessed with PM and $PM_{2.5}$ in air quality analyses associated with air permit applications, ambient air quality analyses, and other environmental review assessments. These Rules require emissions to be represented as tons per year (tpy) at the maximum rated capacity of the project and as pounds of emissions produced per kilowatt hour (lb/kW-hr).

4.1.1 No Build

If the Proposed Project was not built, the proposed site would remain as it exists today. In this scenario there would be no emissions of the above listed air pollutants and no additional power would be generated.

Impacts
If the Proposed Project was not built, there would not be any additional impact on the environment from emissions because the site would remain as it exists today.

Mitigation
If the Proposed Project was not built, there would be no emissions created. The site would remain as it exists today and therefore mitigation would not be required.

4.1.2 200 MW LWECS

A wind park generates electricity through an assembly of self-contained turbines that do not include emission sources. A 200 MW LWECS constructed in another location would not result in the release of pollutants emissions listed in Section 4.1.

Impacts
A 200 MW LWECS would not result in an impact on the environment because it would not result in the release of pollutant emissions.

Mitigation
A 200 MW LWECS would not result in the need for mitigation of pollutant emissions because no pollutants would be released into the atmosphere.

4.1.3 77 MW Biomass Facility

The emissions estimates for a 77 MW biomass facility were based on NGPP Minnesota Biomass LLC's Environmental Assessment Worksheet (EAW) completed in 2003. The EAW states that the 38.5 MW facility would be fueled by wood, wood waste, and agricultural biomass materials.

Impacts
The heat input capacity for the 38.5 MW boiler firing biomass materials is listed in the EAW as 527.5 MMBtu/hr. The heat input capacity was doubled (1,055 MMBtu/hr) to approximate a 77 MW biomass facility. Emission factors for the pollutants listed in Section 4.1 were taken from AP-42, Section 1.6 "Wood Residue Combustion in Boilers" (last updated September 2003). It is assumed that the plant would be able to operate 8,760 hours per year. The emission calculations for the biomass facility can be seen in Table 1.

Table 1: 77 MW Biomass Facility Emission Calculations

Pollutant	Boiler Emission Factor (lb/MMBtu)	Boiler Heat Input Capacity (MMBtu/hr)	Boiler Pollution Control Efficiency (%)	Boiler Annual Emissions (tpy)	NGPP Ancillary Emission Units (tpy)	Total Biomass Facility Emissions (tpy)	Emissions per kilowatt (lb/kW-hr)
SO_2	0.025	1,055	0%	115.52	0.6	116.12	0.0003
NO_x	0.490	1,055	75%	566.06	21.8	587.86	0.0017
CO_2	195	1,055	0%	901,075	13,490	914,565	2.7117
Hg	3.5E-06	1,055	0%	0.016	0	0.016	4.74E-08
PM	0.560	1,055	90%	258.77	103.4	362.17	0.0011
PM_{10}	0.500	1,055	90%	231.05	103.4	334.45	0.0010
$PM_{2.5}$	0.430	1,055	90%	198.7	103.4	302.10	0.0009

The ancillary emission totals listed in the EAW for the emergency generator and fuel handling equipment were increased by a factor of two to reflect the increase in electrical generation capacity of 77 MW compared with the 38.5 MW capacity of the NGPP Minnesota Biomass LLC plant. Carbon dioxide and mercury emissions were not listed in the EAW. An emission factor for carbon dioxide was taken from AP-42, Section 3.3 "Gasoline and Diesel Industrial Engines" (last updated October 1996) for engines fired with diesel fuel. The NGPP Minnesota Biomass LLC generator is rated at 1000 kW. It was assumed

for this analysis that a 2000 kW emergency generator would be appropriate for a 77 MW biomass plant. No emissions data for mercury is listed in AP-42 for internal combustion sources.

Mitigation
Table 1 contains pollution control efficiencies for NO_x, PM, PM_{10}, and $PM_{2.5}$. NGPP Minnesota Biomass LLC's EAW indicates that biomass boiler would be equipped with a Selective Non-Catalytic Reduction (SNCR) system to control NO_x. The EAW sites a control efficiency of 75 percent for the SNCR system. Based on experience with SNCR systems at similar facilities, a level of at least 75 percent control appears to be a reasonable expectation for control of NO_x emissions at 38.5-77 MW biomass facilities.

The pollution control efficiency for PM, PM_{10}, and $PM_{2.5}$ is listed as 90 percent. The EAW states that the add-on devices for particulate control would include a multi-cyclone followed by a dust collector. Based on experience with these types of control equipment, a level of at least 90 percent control appears to be a reasonable expectation for control of particulate emissions at 38.5-77 MW biomass facilities. Fuel handling equipment is not a source of NO_x, SO_2, CO_2, or Hg emissions.

In addition to the use of control equipment to mitigate pollutant emissions impacts, a 77 MW biomass plant would conduct a Best Available Control Technology (BACT) analysis. The BACT analysis is a requirement of new facilities under Federal New Source Review Prevention of Significant Deterioration (PSD) with net potential emission increases greater than the significant emission thresholds listed in 40 CFR 52.21 (b)(23). For the hypothetical 77 MW biomass facility analyzed here, the pollutants that would be required to go through a BACT analysis include SO_2, NO_x, PM, PM_{10}, and $PM_{2.5}$. A BACT analysis could limit the 77 MW facility to emissions of these five pollutants that are less than the amounts presented in Table 1.

A facility subject to PSD regulation must demonstrate that the new plant would be able to show compliance with the federal National Ambient Air Quality Standards (NAAQS), Minnesota Ambient Air Quality Standards (MAAQS), and the federal Class II increment standards. The effort to demonstrate that the plant's emissions would not exceed these standards would be done through an EPA approved air dispersion model. Emission limits may be necessary to meet NAAQS, MAAQS, or the increment standards.

4.1.4 Noble Flat Hill Windpark Project and Associated 230 kV HVTL

The Proposed Project would not result in the release of pollutants emissions listed in Section 4.1.

Impacts
The Proposed Project would not result in an impact on the environment because it would not result in the release of pollutant emissions.

Mitigation
The Proposed Project would not result in the need for mitigation of pollutant emissions because no pollutants would be released into the atmosphere.

4.2 HAZARDOUS AIR POLLUTANTS AND VOCS

During construction and operation of wind turbines and HVTLs, hazardous materials, such as diesel fuel and hydraulic fluid are used on site during construction. Some of these materials are used in the operation of the wind turbine. Minnesota Rules 7849.7060, subpart 2 requires that anticipated hazardous air pollutants (HAPs) and volatile organic compounds (VOCs) be addressed in the environmental report.

4.2.1 No Build

If the Proposed Project were not built, the proposed site would remain as it exists today and no additional power would be generated. In this scenario there would be no HAP or VOC emissions.

Impacts
If the Proposed Project were not built, there would not be an impact on the environment from HAP or VOC emissions because the site would remain as it exists today.

Mitigation
If the Proposed Project were not built, mitigation of HAP or VOC emissions would not be required because the site would remain as it exists today.

4.2.2 200 MW LWECS

A 200 MW LWECS constructed in another location is not expected to result in the direct release of HAPs or VOCs. There may be indirect emissions of HAPs or VOCs.

Impacts
A wind turbine requires the use of oil, grease, hydraulic fluid, etc. to minimize friction in the mechanical functions of the turbine. The small amounts of these types of materials used in the operation of the turbine would be expected to release little, if any, HAPs or VOCs.

Mitigation
No mitigation actions would be necessary to treat the small amounts of lubricating fluids that would be expected to release little, if any, HAPs or VOCs.

4.2.3 77 MW Biomass Facility

The HAP and VOC emissions for a 77 MW biomass facility were based on NGPP Minnesota Biomass LLC's EAW. HAP and VOC emissions are generated by the combustion of wood, wood waste, and agricultural biomass materials in the biomass boilers. Emissions are also generated by the combustion of diesel fuel in the emergency generator engine.

Impacts
Emission factors for HAPs and VOCs were taken from AP-42, Section 1.6 "Wood Residue Combustion in Boilers" (last updated September 2003). All chemical compounds defined as HAPs by the Clean Air Act were used in this emission calculations. It is assumed that the plant would be able to operate 8,760 hours per year. The emission calculations for the biomass facility can be seen in Table 2.

Table 2: 77 MW Biomass Facility HAP and VOC Emission Calculations

Pollutant	Boiler Emission Factor (lb/MMBtu)	Boiler Heat Input Capacity (MMBtu/hr)	Boiler Pollution Control Efficiency (%)	Boiler Annual Emissions (tpy)	NGPP Ancillary Emission Units (tpy)	Total Biomass Facility Emissions (tpy)
HAPs	3.54E-02	1,055	0%	163.58	0.02	163.60
VOCs	1.70E-02	1,055	0%	78.56	0.8	79.36

The ancillary emission totals listed in the EAW for the emergency generator were increased by a factor of two to reflect the increase in electrical generator capacity of 77 MW compared with the 38.5 MW capacity of the NGPP Minnesota Biomass LLC plant.

Mitigation
NGPP Minnesota Biomass LLC did not state that its biomass boiler would be equipped with any form of HAP or VOC emission control device. Based on experience with similar biomass-fired boilers, this is a reasonable expectation given the relatively small amounts of HAP and VOC emissions compared with the extensive cost of HAP and VOC control equipment. Therefore, a 77 MW biomass facility would not be expected to include HAP and VOC control equipment in its operation.

4.2.4 Noble Flat Hill Windpark Project and Associated 230 kV HVTL

The Proposed Project is not expected to result in the direct release of HAPs or VOCs. There may be indirect emissions of HAPs or VOCs.

Impacts
A wind turbine requires the use of oil, grease, hydraulic fluid, etc. to minimize friction in the mechanical functions of the turbine. The small amounts of these types of materials used in the operation of the turbine would be expected to release little, if any, HAPs or VOCs.

Mitigation
No mitigation actions would be necessary to treat the small amounts of lubricating fluids that would be expected to release little, if any, HAPs or VOCs.

4.3 VISIBILITY IMPAIRMENT AND SHADOW FLICKER

Wind turbines consist of a tall tower with large, rotating blades. These can be visible from a significant distance. The rotating blades can cause shadow flicker at closer distances. Minnesota Rules 7849.7060, subpart 2 requires that anticipated impairment on visibility and shadow flicker effect of the project must be addressed in the environmental report. Shadow flicker is the intermittent change in light intensity due to the rotating wind turbine blades casting shadows on the ground.

4.3.1 No Build

If the Proposed Project was not built the proposed site would remain as it exists today and no additional power would be generated. In this scenario there would be no impact on visibility or shadow flicker.

Impacts
If the Proposed Project were not built there would not be impacted related to visibility or shadow flicker because the site would remain as it exists today.

Mitigation
If the Proposed Project were not built mitigation for environmental impacts related to visibility or shadow flicker would not be required because the site would remain as it exists today.

4.3.2 200 MW LWECS

A 200 MW LWECS would impair visibility and cause shadow flicker to some degree. The LWECS would include industrial-looking structures with the turbine bases and turbine blades protruding from an

otherwise rural countryside. However, an entire field of wind turbines can be described as majestic with their rotor blades spinning in unison at a relative leisurely pace. The wind turbines themselves would not alter the surrounding environment from the standpoint of changing the land use, conducting ongoing industrial activities, or emitting pollution into the atmosphere.

Impacts
A 200 MW LWECS would be sited in a rural area with few obstructions such as trees or buildings. This type of location allows a minimum portion of the wind to be dissipated prior to reaching the wind turbines. In addition to the wind turbines themselves, a substation with transformers and power lines would need to be constructed along with equipment buildings. Equipment buildings would be used for operation and maintenance activities necessary to run the LWECS. Access roads would need to be built as the site is likely to be fairly remote. The site is unlikely to be near many existing roads. Access roads would likely be single-lane, gravel roads.

A 200 MW LWECS would likely require 150-200 acres of land depending on the number of turbines that are constructed. However, due to setback requirements from roads and residences and the necessary spacing required between turbines to properly capture wind resources, the total project area for a 200 MW LWECS would likely include several thousand acres. The number of wind turbines that are constructed is based on the capacity of each turbine. If a 2.3 MW turbine was selected for the LWECS, the approximately 87 turbines would be necessary to reach a total generating capacity of 200 MW. If a 1.5 MW turbine was selected for the LWECS, then roughly 134 turbines would be needed to reach 200 MW.

The wind turbines would be fitted with lights according to the most recent FAA requirements because the turbines would be taller than 200 feet. Lighting may consist of white, flashing lights during the day. The turbines could be fixed with constant red lights at night.

Mitigation
Mitigation of visibility impairment and shadow flicker is best accomplished by remotely locating the LWECS. IF possible the LWECS would be located far from pristine areas such as National Parks, State Parks, wildlife areas, wetlands, etc. However, due to the relatively large overall project area required for a windpark it may not be possible to avoid locating the LWECS near parks or scenic natural areas. The turbines would likely be designed with a uniform off-white color to help the turbines of the LWECS blend in with the horizon. Visual and shadow flicker impacts would be minimized or mitigated through setbacks to individual residences, farmsteads or roads.

4.3.3 77 MW Biomass Facility

A 77 MW biomass facility would impair visibility in all directions. A biomass facility would not cause shadow flicker due to the lack of exterior moving parts that may cast alternating shadows.

Impacts
A biomass facility would be industrial in nature with many buildings, conveyors, wood silos, wood piles and a boiler stack. The building that houses the boiler is likely to be at least 100 feet tall. The conveyors, wood silos, and wood piles could range from 30 to 50 feet in height. The plant buildings, conveyors, silos, and wood piles would likely be lighted to allow for nighttime operation. Lighting would also be necessary for wood fuel loading/unloading points, truck scales, and vehicle parking areas.

The NGPP Minnesota Biomass LLC EAW states that the boiler stack for that facility would be 150 feet tall. A boiler stack for a biomass facility with the twice the generating capacity is likely to require a stack that could exceed 150 feet in height. The particulate matter control devices (multi-cyclone and dust

collector) would capture most of the particulates from the boiler exhaust gas stream. The majority of the plume from the boiler stack would be water vapor. This transparent plume may be seen during cold weather conditions, but would likely be virtually clear during warm weather.

The boiler stack may be fitted with lights according to the most recent FAA requirements because it could be taller than 200 feet. Lighting may consist of white, flashing lights during the day and constant red lights at night.

Mitigation

Mitigation of visibility impairment is best accomplished through selective location of the biomass facility. The site for the biomass facility does not need to be located in a rural, agricultural setting. The biomass facility may be located in an industrial location allowing it to blend in with other industry. However, the biomass facility would need to be located in an area where biomass is readily available in large quantities, such as the northern forested regions of the state. The northern portion of Minnesota has less industrial areas and as a result the biomass facility may also be located at a remote, rural site. At a remote rural site, vegetative screening may be used to block view of the industrial buildings, silos, conveyors, and boiler stack.

4.3.4 Noble Flat Hill Windpark Project and Associated 230 kV HVTL

The Proposed Project would impair visibility and cause shadow flicker to some degree. The Project Windpark would include industrial looking structures with the turbine bases and turbine blades protruding from an otherwise rural countryside. The wind turbines themselves would not alter the surrounding environment from the standpoint of changing the land use, or emit pollution into the atmosphere.

Impacts

The Proposed Project would be sited in a rural area with few obstructions such as trees or buildings. This type of location allows a minimum portion of the wind to be dissipated prior to reaching the wind turbines. In addition to the wind turbines themselves, a substation with transformers, a switching station and approximately ten miles of transmission lines would need to be constructed along with equipment buildings. Equipment buildings would be used for operation and maintenance activities necessary to run the Proposed Windpark and would be located on the same parcel as the substation. Vegetative screening would possibly be used at the substation and switching station. Access roads would need to be built as the site is likely to be fairly remote. The proposed site is mainly near rural gravel roads used for rural residential and agricultural traffic. Several county highways and a state highway are also located in the Proposed Project Area.

The Proposed Windpark would result in impacts to 62.5 acres of land to construct the 134 turbines needed to reach 200 MW of total generating capacity. Some additional land would be temporarily disturbed during construction but would not be permanently altered from its existing land use. The entire Proposed Project Area covers approximately 20,000 acres.

The Proposed Windpark would be located near the Buffalo River State Park. It may be possible to see some of the wind turbines from certain areas of the park. Portions of the Route 1 transmission line may also be visible from the State Park; along Route 2 the transmission line would not be visible from the State Park.

The wind turbines would likely be fitted with lights according to the most recent FAA requirements because the turbines would be taller than 200 feet. Lighting may consist of white, flashing lights during the day. The turbines could be fixed with constant red lights at night.

Mitigation
Mitigation of visibility impairment and shadow flicker is best accomplished by remotely locating the windpark and HVTL. The Applicant has proposed a 700 ft minimum setback from residences. This would reduce but not eliminate visual or shadow flicker impacts in the project area. The turbines would likely be designed with a uniform off-white color to help the turbines of the windpark blend in with the horizon. Vegetative screening would possibly be used at the substation and switching station parcel to mitigate visual impacts of the buildings and electrical infrastructure.

The Proposed Project Draft Site Permit outlines setbacks for wind turbine placement, which requires 5 RD on prevailing wind direction and 3 RD on non-prevailing wind directions from the perimeter of the lands where the Applicant does not hold the wind rights. The Applicant proposes a 5.1 RD setback from the perimeter along the north-south axis (downwind spacing) and a 3.2 RD setback from the perimeter on the east-west axis (crosswind spacing). Wind turbine towers shall not be placed less than 5 RD from the perimeter of the site on the north-south axis and 3 RD on the east-west axis, without the approval of the PUC. These setbacks would further reduce potential visual or shadow flicker impacts.

4.4 OZONE FORMATION

Ozone formation does not occur with wind turbines or HVTLs. However, other large electric power generating facilities, such as biomass facilities have the potential to produce reactive organic gas, which can lead to ground-level ozone formation. Minnesota Rules 7849.7060, subpart 2 requires that anticipated ozone formation expressed as reactive organic gases due to the project must be addressed in the ER. Reactive organic gases are chemicals that are precursors to formation of ground-level ozone.

4.4.1 No Build

If the Proposed Project were not built, the proposed site would remain as it exists today and no additional power would be generated. In this scenario there would be no reactive organic gases to form ozone.

Impacts
If the Proposed Project were not built, there would not be additional impact on the environment from ozone formation because the site would remain as it exists today.

Mitigation
If the Proposed Project were not built, mitigation would not be required because the site would remain as it exists today and there would not be reactive organic gases that cause the formation of ozone.

4.4.2 200 MW LWECS

A 200 MW LWECS constructed in another location would not result in the release of reactive organic gases because wind farms do not emit these gases. Without the release of reactive organic gases, a 200 MW LWECS would not result in the formation of ground-level ozone.

Impacts
A 200 MW LWECS would not cause the formation of ground-level ozone. LWECS do not emit reactive organic gases that lead to the formation of ozone.

Mitigation
A 200 MW LWECS would not result in the need for mitigation of ozone formation because LWECS do not emit the reactive organic gases that lead to the formation of ozone.

4.4.3 77 MW Biomass Facility

Biomass boiler facilities emit NO_x and VOC emissions, which are two of the reactive organic gases that lead to ground-level ozone formation.

Impacts
The NO_x emissions estimated for a 77 MW biomass facility in Table 1 are approximately 588 tons per year. The estimated VOC emissions for a 77 MW biomass facility in Table 2 are about 79 tons per year. The NGPP Minnesota Biomass LLC project area in southern Minnesota is designated as attainment for ozone by EPA for the current 8-hour standard. (The 1-hour ozone standard was revoked by EPA in June 2005.) If a 77 MW biomass facility were located at the NGPP Minnesota Biomass LLC site, the Noble Flat Hill Windpark site, or anywhere else in the state of Minnesota, the site would be in attainment for the 8-hour ozone standard. The entire state of Minnesota has been designated by EPA as attainment for the 8-hour ozone standard. A review of ozone monitoring data in the areas surrounding the NGPP Minnesota Biomass LLC project site and the Proposed Project Area confirm that 8-hour ozone standards are being met. Given these analyses, ground-level formation of ozone is unlikely to be an issue.

Mitigation
NGPP Minnesota Biomass LLC's EAW indicates that biomass boiler would be equipped with a Selective Non-Catalytic Reduction (SNCR) system to control NO_x. The EAW states that the SNCR system would have a control efficiency of 75 percent. Based on experience with SNCR systems at similar facilities, a level of at least 75 percent control appears to be a reasonable expectation for control of NO_x emissions at 38.5-77 MW biomass facilities. This reduction in NO_x emissions would directly lead to a reduction in ground-level ozone formation.

NGPP Minnesota Biomass LLC did not state that its biomass boiler would be equipped with any form of VOC emission control device. Based on experience with similar biomass-fired boilers, this is a reasonable expectation given the relatively small amounts of VOC emissions compared with the extensive cost of VOC control equipment. Therefore, a 77 MW biomass facility would not be expected to include VOC control equipment in its operation.

4.4.4 Noble Flat Hill Windpark Project and Associated 230 kV HVTL

The Proposed Project would not result in the release of reactive organic gases because a windpark would not emit these gases. Without the release of reactive organic gases the Proposed Project would not result in the formation of ground-level ozone.

Impacts
The Proposed Project would not cause the formation of ground-level ozone. The Proposed Project would not emit reactive organic gases that lead to the formation of ozone.

Mitigation
The Proposed Project would not result in the need for mitigation of ozone formation because the Proposed Project would not emit the reactive organic gases that lead to the formation of ozone.

4.5 FUEL AVAILABILITY AND DELIVERY

Large electric power generating facilities typically use some type of fuel to operate. Wind turbines do not require fuel. The alternatives to the Proposed Project were analyzed based on fuel need and availability. Minnesota Rules 7849.7060, subpart 2 requires that the availability of the fuel for the Proposed Project, as well as the amount of fuel required annually and the method of transportation to delivered the fuel to the plant, be addressed as part of the alternatives analysis.

4.5.1 No Build

If the Proposed Project were not built, the existing site would remain as it is today. A fuel source and method of delivery would not be required and no additional power would be generated.

Impacts
If the Proposed Project were not built, there would not be an additional impact on the environment as there would not be a need for a fuel source or a method of fuel delivery to the project area.

Mitigation
If the Proposed Project were not built, there would not be a need for mitigation as there would be no impacts from either fuel consumption or fuel delivery at the proposed site.

4.5.2 200 MW LWECS

The only fuel source that is required for a windpark to generate power is wind. Wind is not consumed by the windpark. Wind parks are located in areas that experience moderate to large amounts of wind on a consistent basis. Sustainable wind resources vary greatly across Minnesota. Wind resource maps have been developed for the DOC at several heights above ground surface, including 30 meters, 80 meters and 100 meters. Typical wind turbine hub heights that would likely be used for a 200 MW LWECS would be between 80 and 100 meters. Average wind speeds across Minnesota vary from approximately 11 to 20 miles per hour at 80 meters and from 12 to 21 miles per hour at 100 meters (Figure 4). A 200 MW LWECS would need to be located in an area with suitable wind speeds, which for Minnesota is generally the northwest, west central and southwest portions of the state.

In addition to wind speeds, the wind resource maps created for the DOC also estimate capacity factor. Capacity factors represent a ratio of the amount of energy that a wind turbine would generate in a given wind resource to the total potential energy that a turbine could generate (i.e. the name plate capacity of the turbine multiplied by total annual hours of 8760). For example the total amount of annual energy a 1.5 MW wind turbine could generate is 13,140 MW. In an area with a capacity factor of 35 percent the wind turbine would actually generate 4,599 MW. At a hub height of 80 meters, capacity factors of 35 to 45 percent are achievable in areas with wind resources economically sufficient for wind park development

Impacts
A proposed 200 MW LWECS would use wind to generate electricity. No other fuel would be required to operate the windpark. The 200 MW LWECS would not require fuel delivery and would not consume fuel. Therefore there would be no impacts to the environment related to fuel consumption or delivery from the 200 MW LWECS.

Mitigation
The 200 MW LWECS would not require fuel beyond wind for operation. Mitigation would not be required because no impacts to the environment related to fuel consumption or delivery would occur as a result of the 200 MW LWECS.

4.5.3 77 MW Biomass Facility

A combination of wood chips, logging waste, or agricultural biomass are the main fuel sources that would be required for a representative 77 MW steam turbine biomass plant. It is estimated that a biomass plant of this magnitude would consume approximately 80,000 tons of biomass per month to fuel the facility. It should be noted there are no biomass facilities of this magnitude currently operating in Minnesota. The fuel consumption estimate was derived by doubling the fuel requirements detailed in the EAW for the proposed NGPP Minnesota Biomass LLC's facility.

It is possible that rail may be an avenue for delivery of fuel to the facility depending on its location. However, the most likely method of delivery for wood or agricultural biomass fuel would be by semi-trucks. Semi-trailer trucks would likely deliver wood or agricultural biomass by loads of 20 tons or greater. It is estimated that fuel delivery would require an average of six to ten semi-trailer round trips per hour. The biomass facility would operate 24 hours a day, but fuel delivery would likely be mainly limited to between the hours of 6 AM and 6 PM. The total daily truck trips are estimated to be from 72 to 120. The origin of the fuel trucks and the total trip length required for delivery would depend on the location of the fuel source relative to the biomass facility.

A back-up fuel source would likely be required for the biomass plant, to assist with plant start-up or to sustain the plant temporarily when the biomass fuel supply had been exhausted. The most likely back-up fuel source would be natural gas. The construction of a natural gas pipeline would be required to deliver the natural gas, serving as back-up fuel, to the biomass facility.

Impacts
The EAW for the proposed NGPP Minnesota Biomass LLC's facility estimated that a 38.5 MW biomass facility would require 40,000 tons per month of biomass for operation. It was therefore assumed that a 77 MW biomass facility would require at least 80,000 tons per month of biomass for operation. A biomass supply of this magnitude would likely require a combination of woody biomass (including round wood, logging residue and wood chips) and agricultural biomass such as corn stalks, switch grass, or used live stock bedding. The main potential environmental impact related to biomass fuel generation for the 77 MW biomass facility would include wildlife habitat loss when forests were logged or when timber harvest residue was used.

Mitigation
One of the typically proposed major sources of woody biomass is harvest residue, sometimes referred to as underbrush, slash or logging waste. When harvest residue is removed after logging for consumption in a biomass facility wildlife habitat is impacted at the logging site. The logging residue provides temporary habitat for wildlife until shrub or forest re-growth begins. The Minnesota Forest Resource Council (MFRC) has developed woody biomass harvest guidelines to lessen impacts to wildlife habitat. The MFRC guidelines recommends leaving at least 1/3 of fine woody debris and logging slash on harvested sites. The MFRC additionally recommends the retention of snags and downed logs at harvested sites. These practices would ensure that some temporary wildlife habitat remains at harvest sites. In order to mitigate for potential wildlife habitat impacts from biomass harvest, the 77 MW biomass facility would need to require that its biomass suppliers follow MFRC harvest guidelines.

4.5.4 Noble Flat Hill Windpark Project and Associated 230 kV HVTL

Wind is the only fuel that would be required to operate the Proposed Windpark. The turbines from the Proposed Windpark would convert wind energy to electricity at the site. The generated electricity would be transmitted from the Proposed Windpark through an underground collection system to a Proposed HVTL that would then carry the electrical power to an Otter Tail Power 230 kV regional transmission line. The wind speed at 80 meters at the proposed project site ranges from 17.7 to 18.1 mile per hour (Figure 5) with capacity factors of 36 to 39 percent (Figure 6).

Impacts
The Proposed Windpark would use wind to generate electricity. No other fuel would be required to operate the windpark. The Proposed Windpark would not require fuel delivery and would not consume fuel. Therefore there would be no impacts to the environment related to fuel consumption or delivery from the Proposed Windpark.

Mitigation
The Proposed Windpark would not require fuel beyond wind for operation. Mitigation would not be required because no impacts to the environment related to fuel consumption or delivery would occur as a result of the Proposed Windpark.

4.6 ASSOCIATED TRANSMISSION FACILITIES

Wind parks produce electricity that needs to be transferred to the main power grid in order to be used by the consumer. This typically means that an HVTL needs to be present or constructed in order to connect a wind park to the main power grid. Minnesota Rules 7849.7060, subpart 2 requires the ER to address the facilities required to transmit electricity to customers and Minnesota Rules 7849.7060, subpart 3, requires the ER to address the impacts of high voltage transmission lines.

4.6.1 No Build

If the Proposed Project were not built the proposed site would remain as it exists today and no additional power would be generated. In this scenario there would be no transmission facilities required.

Impacts
If the Proposed Project were not built there would not be additional impact on the environment from new transmission facilities because the site would remain as it exists today.

Mitigation
If the Proposed Project were not built mitigation would not be required as no new transmission facilities would be constructed.

4.6.2 200 MW LWECS

A 200 MW LWECS constructed in a location other than the proposed site would require the construction of a substation as well as the installation of a transmission line. The transmission line is required to transport electricity to the main power grid. The length of the transmission line would depend on the location of the 200 MW LWECS in relation to a regional power line. If the 200 MW LWECS were constructed immediately adjacent to a regional power line only the substation would be required.

Impacts
A 200 MW LWECS would impact the surroundings in various ways. The construction of the substation and the installation of transmission lines have potential environmental effects; there are electrical and magnetic fields associated with a transmission line and there are also visual and noise impacts to consider.

Construction
In order to construct the substation, the construction site would need to be cleared of all vegetation. Approximately 10 acres of land would be required to build a substation including the control house and perimeter fence.

Construction of the transmission line would require the removal of vegetation taller than 25 feet and within 25 feet of either side of the transmission poles for right-of-way. Also, over the life of the transmission line, plants that interfere with proper operation and maintenance would be cleared using mechanical or hand methods or herbicides when permitted.

Post Construction
When voltage travels through a wire there is an electric field that extends from the conductors to nearby objects such as trees, cars, and the ground. The electric field decreases in magnitude with increasing distance from the transmission line. Besides an electric field, voltage carrying wires also generate a magnetic field. The magnetic field of a transmission line surrounds the conductor and decreases with increasing distance from the conductor. Generally the magnitude of the magnetic field associated with a transmission line is less than that produced by household appliances and thus does not result in significant impacts.

Visual impacts of a transmission line depend on what is surrounding the area of installation. High impact would occur when the transmission line is constructed near residential, recreational, and scenic areas.

Noise pollution is generated by transmission lines and the transformers (part of the substation). During wet weather, water can be atomized adjacent to the transmission line producing a crackling noise. The noise level is about 50 decibels which is similar to the sound produced by a humming refrigerator. In dry weather, the noise level of the transmission line is around the level of a whisper. The transformers also make noise when they are powered up. This noise is constant.

Mitigation
Construction
Mitigation for the construction of the substation required for the 200 MW LWECS would include minimizing the amount of vegetation cleared for construction, clearing all trash and unused materials, installing erosion control measures, and reseeding disturbed areas with native vegetation.

If the 200 MW LWECS were constructed immediately adjacent to a regional power line a transmission line would not be necessary and thus, would not require mitigation.

If the 200 MW LWECS were not constructed immediately adjacent to a regional power line a transmission line, mitigation would be necessary. In order to minimize the affects of the transmission line construction, transmission lines would be installed within existing right-of-way areas (i.e. roadways or utility corridors) or other previously disturbed areas whenever possible. The removal of vegetation would be minimized, as would erosion and runoff. After the completion of the project, measures may be utilized to minimize further runoff of surface soils into surface waters and repair damages to the construction site and removal of construction debris. To minimize the impact to waters that the transmission line crosses, the transmission line would be put in above the normal high water level.

Post Construction
The intensity of the electric field in the vicinity of a transmission line depends on the voltage that the line carries. The maximum electric field density allowed by the PUC permits is 8 kV/M. This standard was set up to prevent injury from serious shocks. A 230 kV transmission line would carry a maximum electric field of 4.66 kV/M, a density that is well below the Commission maximum. There are no known health effects associated with being in the close vicinity of an electric field. Health and safety concerns are minimal for low voltage transmission lines. The health effects associated with constant exposure to magnetic fields are uncertain. There has not been a maximum exposure limit established and the Minnesota Department of Health recommends a "prudent avoidance" to minimize exposure and unknown health effects.

Minimizing visual effects of a transmission line include constructing it in such a location that high impact areas are far away. Audio impacts are minimal because the noise levels are low and would not be conducted over long distances. If the transmission line were conducted within existing road right-of-ways, the noise created by the transmission line would blend in to the existing roadway noise.

4.6.3 77 MW Biomass Facility

Information for the 77 MW biomass facility was based on NGPP Minnesota Biomass LLC's EAW completed in 2003. The EAW states that the facility would be fueled by wood, wood waste, and agricultural biomass materials.

The 77 MW biomass facility would require the construction of a substation as well as the installation of a transmission line in order to transport electricity to the main power grid. If the 77 MW biomass facility were constructed immediately adjacent to a regional power line only construction of the substation would be necessary.

Impacts
The 77 MW biomass facility would result in an impact on the environment because of the need to construct a substation and install a transmission line. With the installation of a transmission line, electrical and magnetic field effects must be considered as well as visual impacts and noise pollution.

Construction
In order to construct the substation, the construction site would need to be cleared of all vegetation. Approximately 10 acres of land would be required to build a substation including the control house and perimeter fence.

Construction of the transmission line would require the removal of vegetation taller than 25 feet and within 25 feet of either side of the transmission poles for right-of-way. Also, over the life of the transmission line, plants that interfere with proper operation and maintenance would be cleared using mechanical or hand methods or herbicides when permitted.

Post Construction
When voltage travels through a wire there is an electric field that extends from the conductors to nearby objects such as trees, cars, and the ground. The electric field decreases in magnitude with increasing distance from the transmission line. Besides an electric field, voltage carrying wires also generate a magnetic field. The magnetic field of a transmission line surrounds the conductor and decreases with increasing distance from the conductor. Generally the magnitude of the magnetic field associated with a transmission line is less than that produced by household appliances and thus does not result in significant impacts.

Visual impacts of a transmission line depend on what is surrounding the area of installation. High impact would occur when the transmission line is constructed near residential, recreational, and scenic areas.

Noise pollution is generated by transmission lines and the transformers (part of the substation). During wet weather, water can be atomized adjacent to the transmission line producing a crackling noise. The noise level is about 50 decibels which is similar to the sound produced by a humming refrigerator. In dry weather, the noise level of the transmission line is around the level of a whisper. The transformers also make noise when they are powered up. This noise is constant.

Mitigation

Construction

Mitigation for the construction of the substation required for the 77 MW biomass facility would include minimizing the amount of vegetation cleared for construction, clearing all trash and unused materials, installing erosion control measures, and reseeding disturbed areas with native vegetation.

If the 77 MW biomass facility were constructed immediately adjacent to a regional power line, a transmission line would not be necessary and thus, would require no mitigation.

If the 77 MW biomass facility were not constructed immediately adjacent to a regional power line, the construction of a transmission line would be necessary. In order to minimize the affects of the transmission line construction, transmission lines would be installed within right-of-way areas or other previously disturbed areas whenever possible. The removal of vegetation would be minimized, as would erosion and runoff. After the completion of the project, measures may be utilized to minimize further runoff of surface soils into surface waters and repair damages to the construction site and removal of construction debris. To minimize the impact to waters that the transmission line crosses, the transmission line would be put in above the normal high water level.

Post Construction

The intensity of the electric field in the vicinity of a transmission line depends on the voltage that the line carries. The maximum electric field density allowed by PUC permits is 8 kV/M. This standard was set up to prevent injury from serious shocks. A 230 kV transmission line would carry a maximum electric field of 4.66 kV/M, a density that is well below the Commission maximum. There are no known health effects associated with being in the close vicinity of an electric field. Health and safety concerns are minimal at the low voltage of the transmission line. The health effects associated with constant exposure to magnetic fields are uncertain. There has not been a maximum exposure limit established and the Minnesota department of Health recommends a “prudent avoidance” to minimize exposure and unknown health effects.

Minimizing visual effects of a transmission line include constructing it in such a location that high impact areas are far away. Audio impacts are minimal because the noise levels are low and would not be conducted over long distances.

4.6.4 Noble Flat Hill Windpark Project and Associated 230 kV HVTL

The Proposed Project would require the construction of a substation and a transmission line that would run from the windpark to the main power grid. Both items are necessary in order to transport generated energy to consumers.

Impacts
The Proposed Project would result in an impact on the environment from construction of the substation and transmission line.

Construction
In order to construct the substation, the construction site would need to be cleared of all vegetation. Approximately 2.5 acres of a 10 acre plot would be required to build a substation including the control house and perimeter fence. The land desired for the construction of the substation is currently used for agriculture. The 230/34.5 kV substation would be able to accommodate the incoming 34.5 kV collection lines and the outgoing 230 kV line.

Two different routes are proposed for the path of the transmission line. Both lines begin at the Proposed Windpark substation near Glyndon, Minnesota and terminate at the existing Otter Tail Power 230 kV transmission line that is located to the southeast of Glyndon.

Route 1 (applicant's preference) would require 11.5 miles of transmission line to connect the substation and the existing OTP and would have a total width of 300 feet (150 feet from centerline). This route travels due east from the Noble Flat Hill Windpark substation parallel to 70th Avenue North for 2.35 miles until reaching State Highway 9 which it follows for right-of-way south for 9.05 miles until reaching the OTP on the north side of 50th Avenue South.

Route 2 would require 9.9 miles of transmission line to connect the substation and the existing OTP and would have a total width of 300 feet (150 feet from centerline). Route 2 follows the former Burlington North railroad right-of-way from the Noble Flat Hill Windpark I substation for 2.0 miles and then runs parallel to 110th Street North for 2.1 miles. After crossing the Buffalo River, Route 2 follows the former Burlington North railroad right-of-way through the town of Glyndon, Minnesota, until reaching the intersection of 7th Street SE and 110th Street North. The transmission line follows 110th Street South right-of-way for 1.6 miles until intersecting the former Burlington North railroad right-of-way which is followed for 2.2 miles to the OTP.

The transmission line is proposed to be constructed of single-circuit portions using mostly H-frame 230 kV structures embedded in 24-inch to 36-inch holes at a depth of 10 to 15 feet. The H-frame poles would be set 20 feet apart and 600-1000 feet apart in wetlands, waterways and to avoid structures. The approximate height of the pole structures would range from 80 to 100 feet for single-pole single-circuit structures with 300-600 feet between poles. Double-circuit single pole structures would have a height between 95 and 115 feet with 350-700 feet between poles. The use of single pole versus multiple pole structures is dependent on width of right-of-way as well as the actual path and necessary angles.

Construction of the transmission line would require the removal of vegetation taller than 25 feet and within 25 feet of either side of the transmission poles. Also, over the life of the transmission line, plants that interfere with the proper operation and maintenance of the transmission line would be cleared using mechanical or hand methods or herbicides when allowed.

Post Construction
The intensity of the electric field in the vicinity of a transmission line depends on the voltage that the line carries. The maximum electric field density allowed by PUC permits is 8 kV/M. This standard was set up to prevent injury from serious shocks. A 230 kV transmission line would carry a maximum electric field of 4.66 kV/M, a density that is well below the Commission maximum. There are no known health effects associated with being in the close vicinity of an electric field. Health and safety concerns are minimal with the low voltage of the transmission line. The health effects associated with constant exposure to

magnetic fields are uncertain. There has not been a maximum exposure limit established and the Minnesota department of Health recommends a "prudent avoidance" to minimize exposure and unknown health effects.

Minimizing visual effects of a transmission line include constructing it in such a location that high impact areas are far away. Audio impacts are minimal because the noise levels are low and would not be conducted over long distances.

Mitigation

Mitigation for the construction of the substation required for the Proposed Project would include minimizing the amount of vegetation cleared for construction, clearing all trash and unused materials, installing erosion control measures, and reseeding disturbed areas with native vegetation.

Construction

Mitigation for the construction of the substation required for the Proposed Project would include minimizing the amount of vegetation cleared for construction, clearing all trash and unused materials, installing erosion control measures, and reseeding disturbed areas with native vegetation.

In order to minimize the affects of the transmission line construction, transmission lines would be installed within right-of-way areas or other previously disturbed areas whenever possible. A narrow right-of-way (typical right-of-way for 230 kV line is 62.5 feet from center line) would decrease impacts. Increasing the spacing between poles to a safe maximum would also decrease impacts of transmission line construction.

The removal of vegetation would be minimized, as would erosion and runoff. After the completion of the project, measures may be utilized to minimize further runoff of surface soils into surface waters and repair damages to the construction site and removal of construction debris. To minimize the impact to waters that the transmission line crosses, the transmission line is put in above the normal high water level with maximum spacing between poles.

Post Construction

The intensity of the electric field in the vicinity of a transmission line depends on the voltage that the line carries. The maximum electric field density allowed by PUC permits is 8 kV/M. This standard was set up to prevent injury from serious shocks. A 230 kV transmission line would carry a maximum electric field of 4.66 kV/M, a density that is well below the Commission maximum. There are no known health effects associated with being in the close vicinity of an electric field. Health and safety concerns are minimal with the low voltage of the transmission line. The health effects associated with constant exposure to magnetic fields are uncertain. There has not been a maximum exposure limit established and the Minnesota department of Health recommends a "prudent avoidance" to minimize exposure and unknown health effects.

Minimizing visual effects of a transmission line include constructing it in such a location that high impact areas are far away. Audio impacts are minimal because the noise levels are low and would not be conducted over long distances.

4.7 WATER APPROPRIATIONS

Some types of large electric power generating facilities use a significant amount of water. Wind parks do not typically need as much water as a biomass facility for example. Minnesota Rules 7849.7060, subpart 2 requires the ER to address the anticipated amount of water that would be appropriated to operate the plant and the source of the water if known.

4.7.1 No Build

If the Proposed Project were not built, the proposed site would remain as it exists today and no additional power would be generated. In this scenario there would be no water appropriation required.

Impacts
If the Proposed Project were not built there would not be additional impact on the environment from water usage because the site would remain as it exists today.

Mitigation
If the Proposed Project were not built mitigation would not be required as no water would be used and the site would remain as it exists today.

4.7.2 200 MW LWECS

A 200 MW LWECS constructed in another location would require water appropriations to support the operations and maintenance facility with potable water sufficient for two employees. The source of the water would be either a single domestic-sized well or through a rural water supply system.

Impacts
In the event that a rural water supply system were used to supply water for the operation and maintenance facility, the only impact from the 200 MW LWECS would be the consumption of a small quantity of water. The domestic well would be located on the same parcel as the operations and maintenance facility and would not disturb additional land. A small amount of water, sufficient to run the operations and maintenance facility, would be removed from the local aquifer. This amount of water would be equivalent to a typical domestic residence or farmstead.

Mitigation
The amount of water required for a 200 MW LWECS would be equivalent to the amount consumed by a residence or farmstead in the area. This small consumption of water would not require mitigation.

4.7.3 77 MW Biomass Facility

The water appropriation estimates for a 77 MW biomass facility were based on NGPP Minnesota Biomass LLC's EAW completed in 2003. The EAW states that the facility would be fueled by wood, wood waste, and agricultural biomass materials.

Impacts
Water would be required for both the process and sanitation. Water necessary for the process could come from a well but depending on the water yield of the local a source of municipal water may be required. For some aspects of the process, such as in the cooling tower, effluent water from a wastewater treatment facility could be used. The source of water would depend on the availability of water sources at the facility location.

The required quantity of water would be dependant on the equipment used in the facility as well as water quality. Some aspects of the biomass facility that require water are: cooling, sanitation, washing, and separations. Average anticipated water flow would be 113 to 1184 gallons per minute (gpm) and a maximum water flow between 1134 and 1184 gpm. If a source of effluent water were available, the consumption of well or municipal water from would be at the lower end of the range. If the facility used only well or municipal water, the water usage would be at the upper end of the range previously described.

Mitigation

In the event that a local well was able to provide process water for the 77 MW biomass facility mitigation is not anticipated for water appropriation because the water used would not affect the water supplies to other locations. If a source of effluent water were identified to supply the majority of the water used in the biomass facility no mitigation is anticipated because this practice would minimize the change in water supply to other facilities. If only municipal water were used for the 77 MW biomass facility, modifications or an expansion of the water treatment plant be required may need to accommodate the increase in demand. The owner of the biomass facility would likely be required to pay a portion or all of the funds required to upgrade or expand the municipal water treatment plant. The owner of the biomass facility may also be required to assist the municipality with the permitting process required for the increased water appropriations.

4.7.4 Noble Flat Hill Windpark Project and Associated 230 kV HVTL

The Proposed Project would require some water appropriation to supply the operations and maintenance facility with potable water. The Applicant has stated that the water would be supplied through a local rural water supply system, Rural Water Services.

Impacts

The Proposed Project would use a local rural water system as the source water for the operation and maintenance facility. Significant modifications to the infrastructure of the local rural water system would not be required. The quantity of water that would be required is equivalent to that used in a residence or farmstead. No digging or abandonment of domestic wells is anticipated

Mitigation

The amount of water required for the Proposed Project would be equivalent to the amount consumed by a residence or farmstead in the area. This small consumption of water would not require mitigation. If wells on the parcel housing the operation and maintenance facility need to be abandoned, they would be capped according to Minnesota law.

4.8 WASTEWATER

Large electric power generating facilities may produce a significant amount of wastewater, depending on the processes utilized to generate power. Wind parks do not typically generate a significant quantity of wastewater. Minnesota Rules 7849.7060, subpart 2 requires the ER to address the potential wastewater streams and the types of discharges associated with such a project including potential impacts of a thermal discharge.

4.8.1 No Build

If the Proposed Project was not built, the proposed site would remain as it exists today and no additional power would be generated. In this scenario there would be no additional wastewater generated.

Impacts
If the Proposed Project was not built, there would not be additional impact on the environment from wastewater because the site would remain as it exists today.

Mitigation
If the Proposed Project was not built, mitigation would not be required as no wastewater would be generated and the site would remain as it exists today.

4.8.2 200 MW LWECS

A 200 MW LWECS constructed in another location would generate wastewater at the operations and maintenance facility. The wastewater generated in this facility would be from sanitation and equipment maintenance. Due to the likely rural location of a large windpark the small quantity of wastewater generated from the operations and maintenance facility would be discharge into a septic system. The septic system would be located on the same parcel as the operations and maintenance facility and would not require the disturbance of additional land. It may be possible to discharge wastewater from the 200 MW LWECS operation and maintenance facility into a municipal sanitary sewer system in the event that the proper infrastructure was located in close proximity facility.

Impacts
A 200 MW LWECS would not result in an impact on the environment because it would not result in the release of wastewater into the environment, but rather into a closed disposal system.

Mitigation
A 200 MW LWECS would not result in the need for mitigation of wastewater discharges because wastewater would be released into a system that is already monitored.

4.8.3 77 MW Biomass Facility

The wastewater effluent discharge estimates for a 77 MW biomass facility were based on NGPP Minnesota Biomass LLC's EAW completed in 2003. The EAW states that the facility would be fueled by wood, wood waste, and agricultural biomass materials.

Impacts
The wastewater generation for the 38.5 MW boiler firing biomass materials is dependant on the source of water used. If the plant used a mixture of effluent wastewater and/or city water the wastewater quantity was estimated by doubling the values for the 38.5 MW facility as a maximum 1168 GPM for the 77MW facility. If the facility only uses city water the discharge of wastewater is estimated by doubling the values for the 38.5 MW facility to be a maximum 616 GPM for a 77 MW facility. The wastewater could be disposed of into a city wastewater treatment facility with available capacity and would not require pretreatment. Table 3 summarizes wastewater generation for a 77 MW facility based on calculation using data from the 38.5 MW NGPP Minnesota Biomass Facility.

To approach zero discharge, the wastewater from cooling tower blowdown and boilers could be disposed of into a holding pond where it would evaporate or infiltrate.

Table 3: Wastewater Generation for a 77 MW Facility

Wastewater Source	Effluent & Well/City Water		Well/City Water Only	
	gpm	Million gpy	gpm	Million gpy
Cooling Tower Blowdown	822.0	432.0	272.0	143.0
Sanitary	2.0	1.0	2.0	1.0
Plant Wash & Misc.	26.0	13.6	26.0	13.6
Demineralization	7.0	3.6	7.0	3.6
Oil/Water Separation	4.0	2.2	4.0	2.2
Total Discharge	861.0	452.4	311.0	163.4

Source: NGPP Minnesota Biomass LLC's EAW for the original data, which were doubled to reflect a 77 MW facility

Mitigation
There is no mitigation anticipated of the wastewater discharge. The wastewater would be discharged into the city sewage system. The quantity of discharged wastewater depends on the water source. For a mixture of effluent and city water the maximum discharge would be 1168 GPM, and for city water use only the maximum discharge would be 616 GPM.

If the wastewater from the cooling tower blowdown and boilers were be disposed of into a holding pond it would contain minerals and sanitizer and would be at a temperature above ambient. In this disposal method the wastewater would be contained and not impact surface water sources. Sanitary wastewater would be discharged into the septic or sanitary sewer system.

4.8.4 Noble Flat Hill Windpark Project and Associated 230 kV HVTL

The Proposed Project would result in the release of wastewater from sanitation and equipment maintenance. The wastewater would be disposed of into an individual septic system.

Impacts
The individual septic system would have to be constructed in compliance with local codes and regulations. A system properly designed and installed to meet all local codes and regulations would not result in significant impacts as a result of wastewater discharges. Overall, the total quantity of wastewater treated at the site would be small, similar to the amount treated by a septic system treated by a domestic residence or farmstead.

Mitigation
The Proposed Project would not be required to mitigate for wastewater discharges because the amount of wastewater generated would be small and the wastewater would be treated by an individual septic system.

4.9 SOLID AND HAZARDOUS WASTES

The type of large electric power generating facility determines the amount of solid and hazardous wastes that are typically generated. Minnesota Rules 7849.7060, subpart 2 requires that the ER address the type and amounts of solid and hazardous wastes generated by the project, including the potential impacts of a thermal discharge.

4.9.1 No Build

If the Proposed Project was not built, the proposed site would remain as it exists today and additional power would not be generated. In this scenario there would be no solid or hazardous waste generated.

Impacts
If the Proposed Project was not built, there would not be an impact on the environment from solid or hazardous waste generation because the site would remain as it exists today.

Mitigation
If the Proposed Project was not built, there would not be solid or hazardous waste generated and therefore mitigation would not be required.

4.9.2 200 MW LWECS

Impacts
A 200 MW LWECS alternative would generate solid waste during construction of the facility as well as during operations. Wind turbines require petroleum-based fluids for proper operation that remain contained within the structure.

The 200 MW facility would generate small quantities of hazardous waste including: fluorescent lights, lubricating oil, ethylene glycol, degreasers, cleaning solvents, and batteries.

Mitigation
Solid waste would be disposed of off-site in an appropriate landfill facility. A leak or spill of petroleum-based fluids would be dealt with using appropriate clean up techniques to minimize environmental impact. Hazardous waste generation would fall below the quantity of a small quantities generator (220 pounds per month). Additional mitigation of hazardous waste would not be required.

4.9.3 77 MW Biomass Facility

A 77 MW Biomass facility would generate solid waste and also require some hazardous materials to be stored on-site. The solid and hazardous waste generation for a 77 MW biomass facility were based on NGPP Minnesota Biomass LLC's EAW.

Impacts
Solid waste generated during construction would likely include the following materials: scrap wood, plastics, wallboard, packing material, cardboard, scrap metals and electrical wires emissions. Solid waste generated during operation would include ash from burning biomass.

The generation of hazardous waste would not be anticipated in either construction or operation of the 77 MW Biomass Facility, except at a minimum amount during operation such that the facility is categorized as a "Very Small Quantity Generator".

The biomass facility would require the storage of some hazardous materials on site potentially including items such as diesel fuel, hydraulic oil or various solvents. The biomass facility would require fuel and SNCR NO_x reduction for operation.

Mitigation
Solid waste would be disposed of off-site at an appropriate landfill site. Ash generated during the combustion of fuel would be held on-site in an ash holding facility to be used as fertilizer for soil or it would be removed to off-site disposal facility.

The hazardous materials stored on site, such as diesel fuel or hydraulic oil, would be stored in tanks with the appropriate secondary containment to minimize spills. Refueling of vehicles and delivery of fuels to the site would be done in the containment area. Deliveries for the SNCR NO_x reduction tank would also occur within a secondary containment area. The tanks would be registered with the MPCA to ensure proper labeling, construction, inspections and above ground requirements are met.

4.9.4 Noble Flat Hill Windpark Project and Associated 230 kV HVTL

The Proposed Project is not expected to result in the direct release of HAPs or VOCs. There may be indirect emissions of HAPs or VOCs.

Impacts
The Proposed Project would generate solid waste during construction of the facility as well as during operations. Wind turbines require petroleum-based fluids for proper operation that remain contained within the structure. Additionally, the Proposed Project would generate small quantities of hazardous waste including: fluorescent lights, lubricating oil, ethylene glycol, degreasers, cleaning solvents, and batteries.

Mitigation
Solid waste generated during construction and operation would be disposed of in an appropriate off-site landfill facility. A leak or spill of petroleum-based fluids would be dealt with using appropriate clean up techniques to minimize environmental impact.

Hazardous waste generation would fall below the quantity of a small quantities generator (220 pounds per month. All waste or pollutants generated would be disposed of in accordance with Minnesota Rules 7045.

4.10 NOISE

Wind turbines generate varying levels of sound during operation depending on weather conditions. HVTLs can also produce audible sound from transmission line conductors and substation equipment. Depending on the receptor, these sounds can be perceived as varying levels of noise. Minnesota Rules 7849.7060, subpart 2 requires the anticipated noise impacts of a project, including the distance to the closest receptor where state noise standards can still be met to be addressed during the environmental review process. Noise is defined as unwanted sound. Sound travels in wave motion and produces a sound pressure level. This sound pressure level is commonly measured in decibels (dB(A)).

Current noise standards for the State of Minnesota are located in Minnesota Rules 7030.0040, subpart 2. The rules for permissible noise vary according to which "Noise Area Classification" is involved. In a residential setting, for example, the noise restrictions are more stringent than in an industrial setting. The rules also distinguish between nighttime and daytime noise; less noise is permitted at night. The standards list the sound levels not to be exceeded for 10 and 50 percent of the time in a one-hour survey (L_{10} and L_{50}) for each noise area classification, as shown in Table 4.

Table 4 : Applicable Minnesota Noise Standards

Noise Area Classification		Noise, Standard, dB(A)			
		Daytime (7 am to 10 pm)		Nighttime (10 pm to 7 am)	
		L_{50}	L_{10}	L_{50}	L_{10}
1	Residential	60	65	50	55
2	Commercial	65	70	65	70
3	Industrial	75	80	75	80

The standards are given in terms of the percent of time during a measurement period (typically one hour) during which a particular decibel dB(A) level may not be exceeded. A daytime L_{50} of 60 dB(A), for example, means that during the daytime, noise levels may not exceed 60 dB(A) more than 50 percent of the time (i.e., 30 minutes of an hour).

Rural residential homes are considered Noise Area Classification 1 (residential), while agricultural land and agricultural activities are classified as industrial (3).

4.10.1 No Build Alternative

Impacts
If the Proposed Project is not built, the Proposed Project Area would remain as it exists today as primarily rural residences separated by agricultural land. Under this scenario no additional power would be generated. Typical noise from agricultural activities and nearby roadways would continue to be a source of noise to nearby receptors.

Mitigation
The No Build Alternative would not change the existing noise levels in the Proposed Project Area, therefore no mitigation would be necessary.

4.10.2 200 MW LWECS

During operation, a 200 MW LWECS would create noise. The sound levels generated by individual turbines would vary depending on the speed of the turbine and the distance of the receptor from the turbine. The total number of turbines that would be used for a 200 MW LWECS would depend on the turbine size selected by the developer. Typical turbine sizes range from 1.0 to 2.5 MW, which would equate to a turbine array ranging from 80 to 200 turbines. An HVTL may be needed to connect the 200 MW LWECS to the power grid, depending on the location of the LWECS in relation to a regional transmission line.

Impacts
Noise calculations were made for the Wapsipinicon North Wind Project ER, which used a representative sound power level (L_p) of a GE 1.5 MW wind turbine for analysis. GE 1.5 MW turbines, such as those used in the Trimont Wind Farm in Martin and Jackson Counties, produce 104.5 dB(A) noise levels. The sound is generated from the wind turbine at points near the hub or nacelle, from the blade rotation, and form transformers near ground level. Based on the Wapsipinicon ER analysis, wind turbine placement would need to occur at a distance greater than 623 feet from a receptor in order to comply with the state Nighttime L_{50} noise standard of 50 dB(A).

Noise associated with HVTLs, which is weather dependent, includes sizzles, crackles, or hissing noises. These noises are audible at close distances to the HVTL during periods of high humidity due to ionization of electricity in moist air near the wires. This type of noise quickly dissipates with distance and becomes part of typical background noise, making it indistinctive from other noise.

Mitigation
LWECS Site Permit requirements include a minimum setback of at least 500 feet. Depending on size, model and sound profile of the turbine used for the project, mitigation for noise would potentially include increased setbacks from residences in the project area. Setback distances ranging from 750 to over 1000 feet could be required in order to meet the MPCA Nighttime L50 standard of 50 dB(A). There is also the potential for cumulative noise impacts to a single residence within the vicinity of multiple turbines. It is likely that setbacks of greater than 1000 feet would be required to meet the MPCA noise standards for residences near multiple turbines. Noise studies may be required to ensure that noise standards are met for the 200 MW LWECS. Mitigation measures would be determined during the permitting process and outlined as conditions in the site permit, which could also include setbacks to preserve wind rights as described for the Proposed Project in Section 4.10.4.2.

Noise impacts associated with HVTLs are not anticipated, therefore no mitigation is required.

4.10.3 77 MW Biomass Facility

A 77 MW Biomass facility would produce noise during operation from a variety of sources including the turbine/boiler building operations, conveyor/reclaiming system, hammer mill and bale choppers, front end loaders, and idling trucks. A HVTL may be needed to connect the biomass facility to the power grid, depending on the location of the biomass facility in relation to a regional transmission line.

Impacts
Environmental review completed for the proposed NGPP Minnesota Biomass project studied and estimated potential noise impacts from operation of a 38.5 MW biomass facility. These estimates indicated that residential receptors approximately 900 to 2,500 feet from operational activities would not exceed the Minnesota L50 daytime and nighttime standards or the L10 daytime noise standards during peak operations. The operational equipment required for a 77 MW biomass facility would be expected to produce similar noise levels to a 38.5 MW facility, but increase noise levels are possible. The stationary equipment for the biomass facility would be housed in buildings or enclosures designed to further attenuate noise.

As described previously for the LWECS, noise is associated with HVTLs during periods of high humidity. This type of noise is audible at close distances to the HVTL, but dissipates quickly with distance.

Mitigation
Noise studies would likely be required to ensure that noise standards are met for the 77 MW Biomass Facility. Additionally, locating the facility away from sensitive receptors would mitigate potential noise impacts. Enclosure of heavy equipment as practical would reduce noise impacts. Vegetation screening (to lessen visual impacts) planted around the perimeter of the project site would provide an additional layer of noise dissipation. Fuel windrows of wood debris would provide noise attenuation, further reducing operational noise impacts. Hours of operation for fuel delivery and heavy equipment operation would also reduce noise impacts.

Noise impacts associated with HVTLs are not anticipated, therefore no mitigation is required.

4.10.4 Noble Flat Hill Windpark Project and Associated 230 kV HVTL

The Proposed Windpark is a LWECS with a nameplate capacity up to 201 MW. The Applicant is proposing to use 134, GE 1.5 MW SLE wind turbines, along with a new single circuit 230 kV

transmission line to connect to the power grid. The hub height for the GE 1.5 MW SLE turbine is 80 meters (about 262 feet) and the rotor diameter (RD) for the turbine is 77 meters (253 feet). The Proposed Project would create noise during operation. Noise levels would vary depending on wind speed and distance to the nearest receptor.

Impacts

The sound from the Proposed Windpark would be generated from the wind turbine at points near the hub or nacelle, from the blade rotation, and form transformers near ground level. Based on the turbine manufacturer's information, turbines would need to be placed 650 to 700 feet from the nearest receptor in order to comply with the Minnesota L50 nighttime standard for residential receptors of 50 dB(A). Multiple turbines placed near a receptor would potentially create increased noise levels, compared to a single turbine.

As described previously for the LWECS, noise is associated with HVTLs during periods of high humidity. This type of noise is audible at close distances to the HVTL, but dissipates quickly with distance.

Mitigation

In accordance with previous LWECS Site Permit requirements, the Applicant has incorporated setbacks of at least 500 feet from residences and 250 feet from public roads. The Applicant would maintain an appropriate setback from inhabited residences to stay below the MPCA Nighttime Noise Limit of 50 dBA. To accommodate the anticipated GE 1.5 MW turbines, the setback from residences would be at least 700 feet. The Applicant would be required to comply with Minnesota noise standards for setbacks.

The Proposed Project Draft Site Permit outlines setbacks for wind turbine placement, which requires 5 RD on prevailing wind direction and 3 RD on non-prevailing wind directions from the perimeter of the lands where the Applicant does not hold the wind rights. The Applicant proposes a 5.1 RD setback from the perimeter along the north-south axis (downwind spacing) and a 3.2 RD setback from the perimeter on the east-west axis (crosswind spacing). Wind turbine towers shall not be placed less than 5 RD from the perimeter of the site on the north-south axis and 3 RD on the east-west axis, without the approval of the PUC.

Additionally, noise studies may be required to ensure that noise standards are met for the proposed project. Noise impacts associated with HVTLs are not anticipated, therefore no mitigation is required. Mitigation measures would be determined during the permitting process and outlined as conditions in the site permit.

5.0 Feasibility and Availability of Alternatives to the Project

Four alternatives were considered in the discussion of alternatives in Chapter 4, including the No Build alternative; a 200 MW LWECS constructed at an alternate location; a 77 MW Biomass Facility; and the Proposed Project. Minnesota Rules 7849.7060, subpart 1 requires that the environmental report address the feasibility and availability of each of the analyzed project alternatives. Discussion of the feasibility, availability and potential impacts summary for each of the alternatives evaluated in Chapter 4 is provided.

5.1 NO BUILD

The No Build alternative is an available option. However, not building the proposed facility would not generate additional power or help to meet the Minnesota REO and RES. If the No Build alternative were selected, there would be no impacts to lands in Minnesota at either the Proposed Project Site or an alternate location. As a result the No Build alternative would not require mitigation

5.2 200 MW LWECS

Throughout Minnesota there exist various wind facilities of different sizes that exploit wind conditions across the state to generate electricity. The only source of energy required for the operation of a wind park is wind. In addition to the existing LWECS facilities, the wind resources in Minnesota are sufficient to support another 200 MW LWECS facility. Wind resource maps have been developed by the Department of Commerce at various altitudes. Assuming that the 200 MW LWECS facility was built at an alternative site with adequate wind, the 200 MW LWECS facility is a feasible alternative.

Building the 200 MW LWECS facility would have few impacts. There would be no emission of the pollutants listed in Section 4.1, no direct release of HAPs or VOCs (although there may be indirect emissions of HAPs or VOCs), no release of reactive organic gases, and no formation of ground-level ozone. Due to the fact that none of these pollutants are generated or released, mitigation for the mentioned pollutants is not necessary. In addition, the 200 MW LWECS facility would not require fuel delivery or fuel consumption for operation. The LWECS would consume a very small quantity of water and generate only minimal quantities of wastewater and solid waste. The low impact and low necessity of mitigation for pollution emissions or various types makes the 200 MW LWECS facility a feasible alternative.

Construction of a wind park would decrease visibility and contribute to shadow flicker. Minimizing these effects must be balanced with maximizing turbine efficiency. Mitigation might include: using existing roads when possible, not building structures in biologically sensitive areas, and reseeding damaged areas.

Depending on the location of the 200 MW LWECS facility, the feasibility may be affected by the ability of the existing transmission system to transport the energy generated by the 200 MW LWECS facility. Many of the transmission systems in Minnesota are at capacity which would affect the availability of location options.

5.3 77 MW BIOMASS FACILITY

Based on NGPP Minnesota Biomass LLC's EAW completed in 2003, a 77MW biomass facility would be fueled by wood, wood waste, and agricultural biomass materials. The biomass would need to be delivered to the facility either by truck or train depending on the location of the biomass facility. Semi-trucks would be the likely delivery method and would need to deliver 72 to 120 truck loads per day for the facility to receive the necessary 80,000 tons per month of biomass necessary for operation. In addition to biomass, the 77MW biomass facility would need natural gas for a backup energy source. Access to natural gas would require pipeline construction as well as gas delivery.

An important note in regard to the 77 MW Biomass Facility Alternative is that currently there are no biomass facilities of 77 MW or larger in operation in Minnesota. An analysis of the availability of biomass and the economic feasibility of delivering the biomass would need to be conducted prior to undertaking a project of this magnitude.

The FibroMinn Biomass Facility located in Benson, Minnesota, is a 50 MW biomass facility and one of the largest known biomass facilities located in Minnesota. The FibroMinn facility has a consistent source of available biomass in the form of poultry litter from regional turkey and chicken farms. The FibroMinn facility burns approximately 75 percent poultry litter and only 25 percent of the biomass is wood or logging waste. Even with this consistent biomass source, FibroMinn can run into operational difficulties of transporting the required biomass to the site, especially in the face of variable and rising fuel costs. Transporting the large quantity of biomass required for a 77 MW facility, such as logging waste or wood chips, would be a massive effort. Furthermore, woody biomass availability can fluctuate based on the logging industry, which is often tied to the housing market. It is currently not known if a suitable location could be found to allow for the efficient and economical transport of the biomass required for a 77 MW Biomass Facility.

Continuous operation of a 77MW biomass facility would emit pollutants listed in Table 1. In addition to the pollutants listed, HAP and VOC emissions are generated by the combustion of wood, wood waste, and agricultural biomass materials in the biomass boilers. The 77MW biomass facility would also decrease visibility and emit NO_x and VOC, which are two of the reactive organic gases that lead to ground-level ozone formation.

The 77 MW biomass facility would also have environmental impacts related to the loss of wildlife habitat. During logging, waste wood is generated that is not desired by the logger. This waste, sometimes referred to as underbrush, is removed for use by biomass facilities. The underbrush, when left at the logging site, provides temporary shelter for wildlife during forest re-growth. In order to preserve wildlife habitat, the Minnesota Forest Resource Council (MRFC) recommends leaving at least one-third of the underbrush on site. In order to mitigate for potential wildlife habitat impacts from biomass harvest, the 77 MW biomass facility would need to require its biomass suppliers to follow MFRC harvest guidelines.

Burning biomass materials would require pollution control methods to decrease and control atmospheric emissions. The 77MW Biomass facility would also be required to conduct a Best Available Control Technology (BACT) which could limit the emissions of specific pollutants to amounts less than those presented in Table 1.

The facility would need to demonstrate that the new plant would be able to show compliance with the federal National Ambient Air Quality Standards (NAAQS), Minnesota Ambient Air Quality Standards (MAAQS), and the federal Class II increment standards. The biomass facility would generate wastewater flows, consume process water and generate solid waste (mainly in the form of ash) requiring proper disposal.

The 77 MW biomass facility is an available option although, the potential impacts and associated mitigation are greater for the biomass facility compared to the other alternatives.

5.4 NOBLE FLAT HILL WINDPARK AND ASSOCIATED 230 KV HVTL

Wind is the only fuel that would be required to operate the Proposed Windpark. The turbines from the windpark would convert wind energy to electricity at the site. The generated electricity would be transmitted from the windpark through an underground collection system to a proposed 230 kV transmission line that would then carry the electrical power to a regional transmission line. There are other wind parks in the region that are able to generate energy from the available wind resources. The regional OTP transmission line has the capacity to carry the additional electricity generated by the Proposed Windpark. Therefore, the Proposed Project is an available option.

The Proposed Project would not release pollutant emissions, little, if any, HAPs or VOCs, nor would it release reactive organic gases that result in the formation of ground-level ozone. The Proposed Windpark would not require fuel delivery and would not consume fuel. Therefore there would be no impacts to the environment related to fuel consumption or delivery from the Proposed Windpark.

The Proposed Project would not need mitigation for emissions of pollutants nor ozone generating gases. Mitigation for HAPs and VOCs would also not be required. Only a minimal quantity of water would be consumed by the Proposed Windpark and small quantities of wastewater and solid waste would be generated. These minor impacts would not require specific mitigation.

Construction of a wind park would decrease visibility and contribute to shadow flicker. The Proposed Project would also create noise. Minimizing these impacts must be balanced with maximizing turbine efficiency. Mitigation would include: providing adequate setbacks from residential properties, utilizing existing roads and road right-of-way corridors when possible, not building structures in biologically sensitive areas, and reseeding damaged areas.

The relatively minor impacts resulting from the construction and operation of the Proposed Project and the minimal associated mitigation make the Proposed Windpark a feasible option for energy generation.

6.0 Impacts of Windpark and HVTL Route Alternatives - Assessment of Impacts and Mitigation Measures

Construction of a wind park and HVTL includes both temporary and long-term impacts. Impacts are determined based on pre-construction (current) conditions of the proposed project site. Impacts could be a direct or indirect result of the Proposed Project action and may be positive or negative. Direct impacts are caused by the proposed action and occur at the same time and place. Indirect impacts are caused by the action and occur later in time or are farther removed in distance, but are still reasonably foreseeable.

This chapter provides specific, detailed environmental review level analysis required for an EIS. The potential impacts on social, economic, and natural resources and the possible mitigation measures intended to minimize impacts caused by the construction and future operation and maintenance of the Proposed Project are described.

6.1 DESCRIPTION OF ENVIRONMENTAL SETTING

The Proposed Project is located in Clay County, Minnesota, approximately 10 miles northeast of the city of Moorhead, Minnesota, near the city of Glyndon (Figure 3). The Proposed Project boundary encompasses approximately 20,000 acres, located in Spring Prairie and Moland townships (Township 139N, Range 46W and Township 140N, Range 46W). As of the date of the Site Application, the Applicant had obtained lease and easement agreements with landowners for approximately 11,500 acres. An associated HVTL would be located along the eastern project boundary, generally following the State Highway 9 corridor. A new switching station would be located along the Otter Tail Power Sheyenne-Audubon 230 kV transmission line southeast of the city of Glyndon.

The Proposed Project Area is situated within the Red River Prairie Subsection, which covers 3,985,620 acres (6,173 square miles) in northwestern Minnesota, representing approximately 7 percent of Minnesota. The western boundary of this subsection is formed by the Red River. The eastern boundary follows the eastern limits of continuous tall grass prairie vegetation at the time of Euro-American settlement. Portions of a till plane are included. The southern boundary follows the southern end of the till plain and the Glacial Lake Agassiz basin.

The majority of the Red River Prairie Subsection is a glacial lake plain with silty, sandy, and clayey lacustrine deposits. It is level, uniform, and featureless, interspersed with wetlands, meandering waterways, and old beach ridges. Drainage is to the north via the Red River and its tributaries. The major landform is a large lake plain (Glacial Lake Agassiz). Minor landforms include till plain, beach ridges, sand dunes, and water-reworked till. The greatest depth of lake laid sediments is present along the Red River, which forms the western boundary. Lacustrine origin sediments thin to the east, where glacial till was leveled and reworked with little deposit of lacustrine sediments. Topography is flat to gently rolling with some steeper topography along drainages.

The majority of the land use in this area is agriculture. Due to the extensive agricultural use in the area, the lake plain has been intensively ditched. Some native flora persists in small fragments (in some

moderate size) east of the beach ridges and in the interbeach zone. Native flora consists of tallgrass prairie and wet prairie that is dominated by bluestems (*Andropogon scoparius* and *A. geradii*), Indian grass (*Sorghastrum nutans*), bluejoint grass (*Calamagrostis canadensis*), cordgrass (*Spartina pectinata*), cattails (*Typha spp.*), rushes (*Juncus spp.*), and sedges (*Carex spp.*). Narrow forested areas that consist of cottonwood (*Populus deltoids*), elm (*Ulmus spps*.) and willow (*Salix spp*.) are common along larger streams and rivers. Precipitation averages between 21 to 23 inches, with the lowest amounts at the southwestern edge of the subsection. About half of the precipitation arrives during the growing season. The growing season ranges from 111 to 136 days.

6.2 IMPACTS ON HUMAN SETTLEMENT

The Proposed Project has the potential to impact various aspects relating to human settlement. Construction and operation of the Proposed Project would disturb land, contribute to ambient noise and alter the viewshed of the landscape in the project area. Potential impacts to socioeconomics, displacement, noise, visual aesthetics and human health & site safety are addressed in this section.

6.2.1 Socioeconomic

During the public comment and EIS scoping period potential impacts to property values were identified as a concern by the public. The Final SDD indicated that the Draft EIS would attempt to gather information on property value impacts from constructed wind farms in Minnesota or from comparable wind farm projects in other states, realizing that the information available may only be anecdotal. The Final SDD states that potential impacts to socioeconomics from the Proposed Project will be analyzed in this Draft EIS.

Affected Environment

The Proposed Project Area is located in a rural area of Clay County in northwestern Minnesota. The closest community to the Proposed Project Area is the city of Glyndon, which has a population of 1,050. Based on U.S. Census Bureau information, in 2000, Clay County had a population of 51,229, and in 2006, the estimated population was 54,476, which equates to an approximate six percent increase. Statewide, Minnesota's population in 2006 was estimated at more than 5.1 million, up from approximately 4.9 million in 2000. This equates to roughly a four percent increase in state-wide population. Clay County encompasses 1,053 square miles, averaging 48.7 persons per square mile, while the statewide average population density is 61.8 persons per square mile (U.S. Census Bureau 2000).

Within Clay County, the percentage of people living below poverty levels (9.7 percent) is higher than the Minnesota State average of 8.1 percent. The Proposed Project occurs in areas that generally have similar to slightly lower percentages of minority and low-income populations than the county and state as a whole.

Detailed information on the socioeconomics of the Proposed Project Area can be found in Section 5.2 of the Windpark Site Application and in Section 5.1.2.6 of the Route Permit Application.

Impacts

The effects of the Proposed Project are difficult to quantify because of the multitude of factors that influence a property's market value, such as proximity to schools and parks, road accessibility, neighborhood perceptions, and topography for example. A direct influence on property value is often the status of the housing market, such as a buyer's market or a seller's market.

A comparable example of a LWECS is the Buffalo Ridge Windfarm located in southwestern Minnesota. The Buffalo Ridge Windfarm was developed in phases in the early to late-1990s. A large number of turbines are located near the city of Lake Benton in Lincoln County. According to the WRAP Report

(2002), there are a total of 281 turbines, producing a total of 210.75 MW of power. This example was used to gain information on how property values have been impacted in Lincoln County due to the construction of a LWECS.

According to the Lincoln County Assessor's Office, property values have increased approximately $500-1000/acre when land lease payments are transferred to the new land owner. In addition, properties without turbines that are adjacent to those with turbines have not experienced a change in value. Information regarding the influence of LWECS on property values was not available from other counties in the Buffalo Ridge windpark project area.

The Renewable Energy Policy Project (REPP), sponsored by the United States Government, conducted a statistical analysis to determine the extent to which property values are influenced in the vicinity of windparks. Ten areas around the United States were studied within a five mile radius of a turbine (any further away, the turbines are not noticeable enough to be of influence). Locations in California, Iowa, New York, Pennsylvania, Texas, Vermont, and Wisconsin were included in the REPP study.

The REPP study analyzed data from over 25,000 records of property sales within the areas influenced by wind turbines and from comparable communities that were not near windparks. For the majority of the properties that were part of the study, the property values rose more quickly near the turbines than the values of the comparable communities. The study indicated that values increased faster once the windparks were operational as compared to during construction.

Research completed by the Edison Electric Institute Siting and Environmental Planning Task Force reviewed numerous studies on property values related to transmission lines. These studies included appraiser studies, attitudinal studies, and statistical analyses. None of the studies reviewed during this research provided conclusive findings which could isolate the impacts of transmission lines on property values. The studies reviewed indicated that there is potential for transmission lines to reduce the sales prices of a residential or agricultural property by 0 to 10 percent. However, the studies indicated that a greater impact on property values is related to the other factors, such as the condition and size of the property, and neighborhood perceptions by potential buyers. The research also found that impacts would likely be greatest immediately following construction of a new line and would diminish over time.

Overall the Proposed Project is not anticipated to have significant temporary or long-term impacts on socioeconomics in the area. Economic development impacts, such as potential impacts to tax revenue, employment, and local businesses are described in Section 6.3.5.

Mitigation

Since socioeconomic impacts resulting from the Proposed Windpark are not expected to be significant, as a result specific mitigation has not been identified. As described in the Site Permit application and Route Permit application, individual landowners directly impacted by turbine siting and roadway construction would be compensated by the Applicant for their loss of agricultural production through easements. Property acquisition for the substation and switching station facilities and for transmission line right-of-way would include compensation for affected property owners.

As described in the Draft Site Permit, setbacks are used to mitigate for potential impacts caused by noise in order to comply with Minnesota Noise Standards, as described in Section 6.4.3. These setbacks could reduce potential negative impacts to property values caused by wind turbine siting and HVTL construction. There are additional setbacks in place to preserve wind rights of adjacent property owners that do not have an easement or lease agreement for Proposed Project.

The Proposed Project is not expected to create disproportionately high or adverse human health or environmental effects on low income populations, therefore, no mitigation was identified.

6.2.2 Displacement

Displacement occurs when a residence is located at a distance that would interfere with the safe operation of a windpark or transmission line. Large-scale projects, such as wind parks and HVTL projects, have the potential to result in displacement depending on project area conditions; and commercial and residential densities within a route alignment. The Final SDD states that potential displacement impacts from the Proposed Project will be analyzed in this Draft EIS.

Affected Environment

The Proposed Windpark is not anticipated to cause displacement of residential property owners. Since the transmission lines are greater than 200 kV, there may be instances where property is purchased per Minnesota Statutes 116C.63, subdivision 4 (sometimes referred to as "Buy the Farm"). This allows the property owner the option of having the property that the route crosses to be purchased at the fair market value of the land. This option is the landowner's choice and it is difficult to determine which, if any, would elect it.

Construction of the Proposed Windpark would take into account the location of existing residences. The Applicant has proposed a minimum setback of 700 ft from existing residences. The Applicant has conducted a desk-top analysis of residences located in the windpark project area. The proposed preliminary turbine array has attempted to place turbines and associated facilities in locations that would not displace current residential properties (Figure 7).

Transmission lines typically have a greater probability of causing displacement. Route 1 follows an existing road right-of-way while Route 2 follows a former BNSF railroad right-of-way where possible, but also runs through the city of Glyndon.

Impacts

Displacement as a result of the Proposed Windpark is not anticipated. The Applicant has proposed a minimum 700 ft setback from residences. The preliminary turbine array indicates that residential displacement would not occur as a result of turbine construction in the Proposed Windpark.

Route 1 would follow existing roadways, including 70th Avenue and State Highway 9. All of the homes located along the right-of-way are greater than 100 feet from the Proposed HVTL. Temporary indirect effects to residential properties along Route 1 may occur and would include construction-related noise, potential interruptions to traffic during construction, temporary impacts to properties, and possible changes to home or property values.

Residences and businesses near Route 2 were identified through review of high resolution aerial photographs and the Clay County Address Points database. Using GIS, the area within 150 feet on either side of the Route 2 centerline (for a total width of 300 feet) was evaluated to identify the number of residences and businesses present. Based on this analysis there are 19 residences and three businesses along Route 2.

Utilizing the same review of high resolution aerial photographs and the Clay County Address Points database, a total of one of these residences and two of the businesses were determined to be within 50 feet of the proposed Route 2 centerline (Figure 8). There is the potential that displacement would occur at these three properties if the Route 2 alignment was not altered

In order to try to avoid displacement, Route 2A was created as part of this Draft EIS analysis. Route 2A, as shown on Figure 1, bypasses the city of Glyndon with an alignment that follows road right-of-way west of the city. As described in detail in Chapter 1, Route 2A could avoid displacement of residences by

locating along the east side of County Highway 17. The Route 2A alignment then runs along the south side of the city limits of Glyndon where it connects to the former BNSF railroad grade, where it eventually connects into the proposed Route 2 alignment at County Highway 71.

Mitigation
As described in the Site Permit application and Route Permit application, landowners would be compensated for all easements and parcel acquisitions for the Proposed Project. Displacement impacts are not anticipated from the Proposed Windpark, therefore no mitigation is proposed.

Route 1
Based on a desk-top review of aerial photos, displacement of residences as a result of Route 1 is not anticipated. In the event that field verification indicates that residences fall within the proposed right-of-way for Route 1, the transmission alignment would be shifted in a manner such that no person would be displaced from their residence or business.

Easements of approximately ½-mile wide have already been acquired along approximately seven miles of the proposed route. These easements would allow for new right-of-way to be established on land adjacent to the existing road right-of-way to accommodate overhang from structures within the road right-of-way, or to allow structures to be placed on private land if construction within the road right-of-way is infeasible or not supported by the respective road authority. As part of the acquisition/coordination process, affected property owners would be notified of the construction schedule, site access requirements and vegetation clearing (and maintenance) requirements for construction and maintenance of the line.

The Applicant has coordinated with private landowners, township and county officials and representatives of Xcel Energy to minimize impacts of the right-of-way construction. No landowners would be displaced by the acquisition of the substation and switching station parcels.

Route 2
Displacement would not occur along the majority of Route 2, where it follows the former BNSF railroad right-of-way. In the event that field verification indicates that residences fall within the proposed right-of-way for Route 2, the transmission alignment could be shifted in a manner such that landowners would not be displaced from their residence.

However for the section of the Route 2 alignment that travels through the city of Glyndon there is the potential for displacement of up to three properties (one residence and two businesses). The Applicant would offer to purchase the properties at fair market value to provide compensation to the displaced property owners. In the event that the affected property owners choose not to accept displacement compensation, the Route 2 alignment would have to be altered, which would likely include a shift to avoid passing through the city of Glyndon.

The Applicant has coordinated with private landowners, township and county officials and representatives of Xcel Energy to minimize impacts of the right-of-way construction. No landowners would be displaced by the acquisition of the substation and switching station parcels.

Route 2A
Displacement can be avoided along the alternative Route 2A alignment. There are several homesteads located along the west side of County Highway 17, but could be avoided if the Proposed HVTL was located along the east side of the roadway. The Route 2A alignment connects into the Route 2 alignment before reaching the substation and switching station.

6.2.3 Noise

Wind turbines generate varying levels of sound during operation depending on weather conditions. HVTLs can also produce audible sound from transmission line conductors and substation equipment. Depending on the receptor, these sounds can be perceived as varying levels of noise. The Final SDD stated that the Draft EIS will include a description of the State noise standard requirements, and will describe potential noise impacts from the Proposed Project, along with possible mitigation measures.

Affected Environment

Noise is defined as unwanted sound. Sound travels in a wave motion and produces a sound pressure level. This sound pressure level is commonly measured in decibels (dB(A)), which was developed to approximate the human ear's sensitivity to certain frequencies by emphasizing the middle frequencies and de-emphasizing lower and higher frequencies. Decibels (dB(A)) represent the logarithmic increase in sound energy relative to a reference energy level. A sound increase of 3 dB(A) is barely perceptible to the human ear, a 5 dB(A) increase is clearly noticeable and a 10 dB(A) increase is heard twice as loud. Additionally, due to the logarithmic scale of dB(A), multiple sounds of the same level are not additive. For example a doubling of energy or a doubling of identical sources yields an increase of 3 dB(A) (i.e. 85 dB(A) + 85 dB(A) = 88 dB(A)) (Clafin, 2008). Typical noise levels of common sounds provided on the MPCA website including the following:

	dB(A)	Source
•	140	Jet Engine (at 25 meters)
•	120	Rock Concert
•	100	Jackhammer (at one meter)
•	80	Heavy Truck Traffic
•	60	Conversation Speech, Typical TV Volume
•	50	Library
•	40	Bedroom
•	20	Whisper

Current noise standards for the State of Minnesota are found in Minnesota Rules 7030.0040, subpart 2. The rules for permissible noise vary according to the Noise Area Classification (NAC) for the area. In a residential setting, for example, the noise restrictions are more stringent than in an industrial setting. The rules also distinguish between nighttime and daytime noise; less noise is permitted at night. The standards list the sound levels not to be exceeded for 10 and 50 percent of the time in a one-hour survey (L_{10} and L_{50}) for each NAC, as located in Table 5.

Table 5 : Applicable Minnesota Noise Standards

Noise Area Classification		Noise, Standard, dB(A)			
		Daytime (7 am to 10 pm)		Nighttime (10 pm to 7 am)	
		L_{50}	L_{10}	L_{50}	L_{10}
1	Residential	60	65	50	55
2	Commercial	65	70	65	70
3	Industrial	75	80	75	80

Source: Minnesota Rules 7030.0040

The standards are given in terms of the percent of time during a measurement period (typically one hour) during which a particular decibel dB(A) level may not be exceeded. A daytime L_{50} of 60 dB(A), for example, means that during the daytime, noise levels may not exceed 60 dB(A) more than 50 percent of the time (i.e., 30 minutes of an hour).

Some land uses are considered more sensitive to intrusive noise than others due to the type of activities typically involved at the sensitive human noise receptors, such as residences, schools, hospitals or daycare centers. The proposed project area comprises mainly rural residential and agricultural land uses. Rural residential homes are considered NAC 1 (residential), while agricultural land and agricultural activities are classified as industrial (3).

Ambient sound pressure levels in a particular region are composed of a variety of natural and manmade sources. Currently, noise in the Proposed Project Area is dominated by traffic on local roads and agricultural and equipment operations. Secondary noise in the area persists from general low-density, rural neighborhoods and farming-related activities. Ambient noise levels in the Proposed Project Area are typical of noise levels experienced within a predominantly rural area.

Impacts

The sources of audible noise from the Proposed Project would be from the operating wind turbines, transmission line conductors, and substation equipment. The impact of the Proposed Project facilities would be dependent on distance from the source of the noise to the receptor, ambient noise levels in the area, meteorological conditions, and natural attenuation of noise from vegetation and topography.

Windpark

Wind turbines create additional sources of noise in the environment. When in motion, wind turbines emit a perceptible sound. The sound is produced from mechanical equipment inside the nacelles of the turbines (mechanical noise) and from the interaction of turbine blades with wind (aerodynamic noise). Newer wind turbines generate minimal noise from mechanical equipment. The level of noise generated by the turbine blades varies with the speed of the turbine and the distance of the receptor from the turbine. On relatively windy days, turbines create more noise; however, the ambient natural wind noise levels tend to override turbine noise, especially as distance from the turbine increases.

Wind turbines would be audible at the closest residential areas in relation to the Proposed Project when residences are downwind, background levels are low, and wind speeds are high enough for turbine operation. Residents outside their houses and with a direct line of sight to an operating wind turbine may hear a “swooshing” sound characteristic of wind turbines. Sound generated within the Proposed Project Area would be consistent with sound generated at similar wind energy projects.

Noise levels provided by the turbine manufacturer (GE) included a 104.5 dB(A) sound power level at the turbine hub and a 2dB K-safety factor. The K factor describes GE’s uncertainty in the 104 dB(A) sound power level described in their noise specification. Using the above noise specifications it was determined that the setback for an isolated single 1.5 MW GE turbine is approximately 650 to 700 feet to ensure compliance with the MPCA 50 dB(A) noise standard limit.

<u>MDH Report</u>

A report completed by the Minnesota Department of Health (MDH) in May 2009 (See Appendix B) evaluates the possible health effects associated with low frequency (infrasound) vibrations and sound arising from LWECS. Infrasound is sub-audible, meaning that the frequency is not audible to the human ear, but can be sensed by some people as vibration. Sound from LWECS is an audible frequency sound.

The MDH report (2009) evaluates the possible health effects associated with low frequency (infrasound) vibrations and sound arising from LWECS. Two proposed wind power projects in Minnesota were used as examples for the MDH report: Bent Tree Wind Project (Freeborn County) and Noble Flat Hill Windpark (Clay, Becker, and Ottertail Counties). Infrasound is sub-audible, meaning that the frequency is not audible to the human ear, but can be sensed by some people as vibration. Sound from LWECS is an audible frequency sound.

The MDH report looked at mechanical noise, aerodynamic noise, modulation of aerodynamic noise, and wind farm noise. Mechanical noise from the turbine or gearbox is minimal and would only be heard above aerodynamic noise if the wind turbine was not functioning properly. Aerodynamic noise is caused by wind passing over the turbine blades, which interrupts the flow of air, creating turbulence and noise. It is not possible to eliminate turbulence and noise, but high aerodynamic noise can be corrected by adjusting the blade angle and rotor alignment to the wind.

Rhythmic modulation of noise is most noticeable to the receptor at close distances to the wind turbine blades. The distance-to-blade effect can cause a low frequency pulsing noise for receptors downwind of the turbine as the blade tip rotates. Modulation of noise can also be caused by wind shear (horizontal layers of different wind speeds) that the blade passes through as it rotates. This can cause a rhythmic noise pattern or pulsing sound. Additional literature reviewed for the MDH report suggests that aerodynamic modulation of wind turbines is typically underestimated when noise estimates are calculated. It goes on to suggest that detailed modeling or an aerodynamic noise assessment should be used to predict potential impacts of modulation at a proposed wind turbine site.

Wind farm noise associated with multiple turbines similarly distant from residences can cause noise noticeably louder than a single turbine. The MDH report indicated that during stable wind conditions, noise from wind farm turbines may be more noticeable and could cause an audible beat or dissonance.

Impacts of wind turbine noise are dependent on the receptor's sensitivity to sound. According to the MDH report, human sensitivity to sound, especially to low frequency sound, is variable. Individuals have different ranges of frequency sensitivity to audible sound; different sensitivity to vibrations; and different reactions/tolerance to those sensitivities. Reported health effects from low frequency stimulation are closely associated with annoyance from audible sound. Studies have not concluded, due to lack of reliable evidence, whether annoyance is a symptom or an accessory in the causation of health effects from low frequency noise. Common health complaints are sleeplessness and headaches, which have been correlated to annoyance complaints.

The MDH report concludes that wind turbines generate a broad spectrum of low-intensity noise. At typical setback distances, as those described for the Proposed Project, higher frequencies are attenuated. Walls and windows of homes attenuate high frequencies, but their effect on low frequencies is limited, which could cause potential impacts to some people especially at night. Businesses, public buildings, and people outside are not anticipated to be impacted by low frequency noise.

Additionally, the MDH report indicates that the potential impacts from low frequency noise generated from wind turbines is dependent on a number of factors, including receptor sensitivity, distance to receptor, weather and wind conditions, turbine design, operation and maintenance.

Transmission Line Routes

Corona (the small amount of electricity ionizing the moist air near the wires) on the transmission line conductors can generate electromagnetic noise. This audible noise would likely be heard near the transmission line conductors and the substation equipment. The level of noise generated by the conductors depends on conductor conditions, voltage level, and weather conditions. In foggy, rainy, and wet conditions, transmission conductors can create a crackling sound due to corona. All transmission lines can generate a small of amount of sound from corona, but it becomes more noticeable at higher voltages (i.e. 345 kV or higher).

If corona occurs from the Proposed Project, it is anticipated to be less than 50 dB(A), which is below the most restrictive permissible noise level for NAC 1 (see Table 5). During a heavy rain background noise would be generally greater than the anticipated noise from the proposed transmission line. During dry

weather, noise from the Proposed HVTL could be faintly audible or inaudible (less than 20 dBA, which is comparable to the level of a whisper).

The electromagnetic noise, caused by corona on the transmission line conductors, occurs at the frequencies at which radio and television signals are transmitted. This noise can cause interference (primarily with AM radio stations and the video portion of TV signals) with the reception of these signals depending on the frequency and strength of the radio and television signal. The Proposed Project is not anticipated to have significant impacts on radio or TV reception.

The main source of audible noise from a substation is due to the operation of the transformers. Transformers produce noise whenever they are energized, and the level of the noise depends on transformer size, voltage level, and weather conditions. Substation noise is generally minimal and nearly constant with slight variation because of operating conditions (i.e. cooling fans on or off). The substation parcel and switching station parcel are surrounded by rural land uses and are not anticipated to have significant noise impacts on nearby receptors. The nearest noise receptors to the substation and operations and maintenance building locations are more than 1,000 meters (3,280 ft) away. No transformers are planned at the switching station; therefore, noise produced from the operation of the switching station under normal conditions would be inaudible beyond the fence line.

The Proposed HVTL would be routed along existing road right-of-way and would also be routed to minimize impacts to residences along or near the route. The noise levels from the Proposed HVTL are comparable to the existing noise environment. The majority of Route 1 would be located adjacent to or within the State Highway 9 corridor. Noise from the Proposed HVTL would likely blend in with the existing ambient noise from the typical traffic patterns on State Highway 9. Along Route 2 the Proposed HVTL would be located in the former BNSF railroad right-of-way in an agricultural area and also pass through the city of Glyndon. Noise from the Proposed HVTL would likely blend in with existing noise levels from agricultural and urban activity along Route 2. Significant impacts related to noise from operation of the Proposed HVTL are not anticipated.

Mitigation

Potential impacts to nearby residents and other potentially affected parties in terms of noise would be taken into consideration as part of siting the turbines. The Applicant proposes minimum setbacks for turbines from occupied residences of 700 feet to avoid exceeding 50 dB(A) at occupied residences. The Applicant would ensure compliance with Minnesota Noise Standards.

The Draft Site Permit for the Proposed Project outlines setbacks for wind turbine placement, which requires 5 RD on prevailing wind direction and 3 RD on non-prevailing wind directions from the perimeter of the lands where the Applicant does not hold the wind rights. The Applicant proposes a 5.1 RD (1,300 feet) setback from the perimeter along the north-south axis (downwind spacing) and a 3.2 RD (800 feet) setback from the perimeter on the east-west axis (crosswind spacing). Wind turbine towers shall not be placed less than 5 RD from the perimeter of the site on the north-south axis and 3 RD on the east-west axis, without the approval of the PUC. These setbacks designed to protect wind rights would also provide noise mitigation for residential receptors adjacent to proposed turbine locations.

Two 10-acre parcels would be acquired to accommodate the 2.5-acre substation and the 6-acre switching station. The parcel size would allow for buffer land between electrical equipment and adjacent properties. Potential noise mitigation at the substation or switching station parcels may include berms or vegetative screening. The proposed substation and its transformers and the proposed switching station would be designed and constructed to comply with Minnesota Noise Standards.

The Proposed HVTL would be routed along existing corridors and would also be routed to minimize impacts to residences along or near the route. Corona can occur on all transmission lines. If this type of

interference occurs, the Applicant would investigate the problems and correct those caused by the Applicant's facilities.

The Applicant may be required to conduct noise studies to ensure that noise standards are met for the Proposed Project. Mitigation measures would be determined during the permitting process and outlined as conditions in the site permit.

6.2.4 Aesthetics

Wind park and HVTL projects involve tall, manmade structures that can typically be seen from a mile or more away depending on the surrounding landscape and topography of an area. The Final SDD stated that the Draft EIS will identify potential visual impacts from the Proposed Project on the surrounding landscape, including nearby residences and Buffalo River State Park. The Draft EIS will also discuss possible mitigation measures.

Affected Environment

Aesthetic resources are the various elements of the landscape that contribute to the visual character of a place. These elements can be either natural or human-made and include objects, vistas, and viewsheds. Examples of scenic resources could include outstanding natural features, dramatic vantage points, or pristine landscapes.

In general, the visual setting of the Proposed Project Area is predominantly rural and consists of an altered landscape with views ranging from scattered residences in an agricultural setting to roadways. Topography for most of the Proposed Project Area is primarily flat. Intermittent drainages enter the Proposed Project Area including some scattered wetlands. The colors of the landscape are seasonally variable and include green cropland during spring and summer, brownish-yellow fields during fall, and white during winter months. There are also some wooded areas present to the south of the Proposed Project Area, mainly adjacent to the Buffalo River. Land use/land cover within the Proposed Project Area is discussed in Section 6.4.5.

Windpark

Within the Proposed Windpark area, local vegetation is predominately agricultural crops and pasture. Crops include corn, soybeans, wheat, and sugar beets, which usually create a visually low uniform cover. A mix of deciduous and coniferous trees planted for windbreaks typically surround farmsteads. Generally, the forested areas are isolated groves or windrows established by the landowner/farmers.

Route 1

In general, Route 1 follows the MN State Highway 9 right-of-way. For 5.0 miles, Route 1 follows the existing Xcel Energy 23.5 kV transmission line. There is also a 0.15 mile segment that would be bored beneath the BNSF railway. Route 1 would pass through land that is used for both residential and agricultural purposes.

Route 2

The majority of visual setting for Route 2 includes rural residences and farm buildings dispersed along the transmission alignment. However, a portion of Route 2 would pass through the city of Glyndon with more urban characteristics, including residential housing, local business areas, and roadways. Route 2A would avoid the city of Glyndon by following County Highway 17 to the west of the city limits.

Impacts

Discussion of the aesthetics and potential visual impacts from the Proposed Project is difficult to quantify due to its subjective nature and varying human responses. Visual sensitivity (visual impact) is dependent on viewer attitudes, the types of activities in which people are engaged when viewing the site, and the

distance from which the site is seen. Overall, higher degrees of visual sensitivity are correlated with areas where people live, are engaged in recreational outdoor pursuits, or participate in scenic or pleasure driving. Conversely, visual sensitivity is considered low to moderate in industrial or commercial areas where the scenic quality of the environment does not affect the value of the activity. There are quantifiable aspects of the Proposed Project that can be discussed here but an individual's visual sensitivity and response to the Proposed Project is not quantifiable within this Draft EIS.

The Proposed Windpark would occur in an area primarily used for agricultural purposes, while Route 1 would use the majority of an existing transmission line alignment. Route 2 would utilize former BNSF railroad right-of-way and create new alignment through the city of Glyndon.

The installation of the Proposed Project would alter the land use and visual quality of the site. The topography in the vicinity of the Proposed Project is generally flat and the vegetation cover is uniformly low, making the landscape highly vulnerable to disruptions. Visual impacts would be greatest for those residences located nearest to project infrastructure such as wind turbines or HVTL and would be greatly reduced with significant distance from the Proposed Project. The Proposed Project would contrast with the open agricultural areas and would be visible to travelers along State Highway 9 and US Highway 10. Buffalo Ridge State Park and The Nature Conservancy land are within 6 miles of the Proposed Project Area. The Proposed Project would be visible from some vantage points in these areas. The proposed substation and switching station would be most visible to landowners immediately adjacent to the parcels of land that would be developed. The substation and switching station would also be visible to motorists driving along roads adjacent to the facilities.

Wind turbines, a transmission line, and houses currently exist near the Proposed Project Area, which are visible in the landscape. There are three 750 kW (1.98 MW total) turbines operating in rural Clay County on the western edge of Keene township, northeast of the Project area. The Proposed Project would cumulatively contribute to the visual character imposed by the existing infrastructure. The following paragraphs provide a discussion on potential visual impacts that are specific to the Proposed Windpark, Route 1, Route 2, and/or Route 2A.

Windpark

Installation of an 80 meter wind turbine would introduce a linear element to the landscape foreground. The presence of turbines within the viewshed of wildlife management areas (WMAs), waterfowl production areas (WPAs), Buffalo State Park, Scientific and Natural Areas (SNAs), and TNC's Bluestem prairie may diminish the natural quality of those areas and the experience of those persons utilizing the areas.

The FAA requires obstruction lighting or marking of structures over 200 feet above ground surface because they are considered obstructions to air navigation (U.S. Department of Transportation (DOT) FAA Advisory Circular 70/7460-IJ dated 11/29/95). The lighting on the turbines would be visible, especially at night.

Route 1

Route 1 would primarily follow roadway right-of-ways and an existing transmission line alignment. Two pole H-frame structures are typical for HVTL construction and would be used for the majority of the Proposed Project. Where conditions warrant, single-pole structures may be used. Single pole structures would typically be used in areas where the available right-of-way is limited, such as along roads in developed areas, or where landowner concerns preclude additional right-of-way. One segment of Route 1 is proposed to be bored under the BNSF railroad.

The single pole structures are between 95 and 115 feet high and are placed every 300 to 800 ft. The H-frame structures are 80 to 100 feet tall and are placed every 600 to 1,000 feet. The single pole

structures are taller, have closer spacing requirements and a narrower right-of-way compared to the H-frame structures. Visual impact to individual residences would vary depending on the distance each pole or structure is located from that residence, visual screening in place (i.e. established windbreaks), and viewer sensitivity.

Route 2
Most residences along the proposed Route 2 alignment are located within the city of Glyndon. Route 2 would contrast the open agricultural areas and would be visible to travelers along US Highway 10, and other county/township roads in the vicinity of the Route 2 alignment. Route 2 would require the construction of new right-of ways along approximately half of the proposed route. No segment of Route 2 is proposed to be below ground. Greatest visual impacts would likely occur to residences living along the proposed route in the city of Glyndon.

Route 2A
Route 2A is an alternative to a segment of the Route 2 alignment that would avoid passing through the city of Glyndon. This would minimize visual impacts to residences and businesses within the city limits. Route 2A would follow road right-of-way along County Highway 17, passing through rural agricultural areas, which includes several homesteads.

Mitigation

Windpark
There are several measures proposed by the Applicant to minimize visual impacts from the Proposed Windpark. These include:

- Ensure turbines are located outside of areas considered visually sensitive such as State Parks, WMAs, WPAs, or wetlands;
- illuminating turbines to meet the minimum requirements of the FAA regulations;
- using existing roads for construction and maintenance where possible; and
- locating access roads on gentle grades to minimize erosion and visible cuts and fills.

Siting of the wind turbines would be designed to minimize visual impacts to the surrounding area. The Applicant would also create a turbine design in which all turbines would be off-white and uniform in color to help minimize the visual obtrusiveness of the Proposed Windpark.

The FAA released guidance (DOT/FAA/AC 70/7460-1K Chg2 dated 02/07) on standards for obstruction lighting for wind turbine farms. The Applicant would use this guidance when applying to the FAA for approval of a lighting plan that would light the Proposed Windpark as one large obstruction versus every other structure over 200 feet in height. This would limit the number of lights required to be placed on turbines in the Proposed Project. In addition, the FAA now requires synchronized red strobe lights to further minimize the nighttime disturbance.

Additionally, as stated in Section 6.2.3.2 - Noise Mitigation, the Applicant would be required to meet certain setbacks for the wind turbines as described in the Draft Site Permit. The Applicant proposes minimum turbine setbacks of 700 feet from residences with wind lease agreements and additional setback distances from properties without easements. These setbacks would create a larger buffer between residences and the proposed wind turbines.

Wind power technology requires as much exposure to wind resources as possible to attain maximum efficiency. Therefore, mitigation measures that would result in shorter towers have not been considered because they would result in less efficiency per unit.

Route 1
The Applicant proposes to work with landowners and homeowners to identify aesthetic concerns. Care would be given to preserving the natural landscape and construction and operation would be conducted to prevent unnecessary destruction of the surrounding landscape.

Route 1 follows right-of-ways that already exist to help minimize the visual impacts and decrease the amount of terrain that would be altered. A segment of Route 1 would be bored under the BNSF railroad, which would also aid in decreasing visual impacts.

Transmission line pole types would be considered for the Proposed HVTL. Single pole structures would typically be used in areas where the available right-of-way is limited, such as along roads in developed areas, or where landowner concerns preclude additional right-of-way. The existing 23.5 kV distribution line would be co-located onto the transmission line, which would consolidate electrical utilities within one alignment. Two pole H-frame structures would typically be used along the alignment.

The total route width requested by the Applicant is 300 feet. The route width granted by the permit would likely be 125 feet. A single pole structure, which is the tallest of the two types of poles under consideration, is a maximum of 115 feet tall.

Route 2
Route 2 follows former BNSF right-of-way, which primarily avoids close proximity to residences. Visual impacts to residences in the city of Glyndon would be the primary concern for proposed Route 2. The Applicant would consider transmission line pole types to minimize visual impacts. This would include determining the feasibility of using single pole structures compared to the typical, two pole H-frame structures through the City to reduce impacts.

Route 2A
Mitigation measures for potential impacts from the Route 2A alignment would be similar to those described for Route 1.

The substation and switching station would have limited local visibility because they would be sited away from high traffic areas. Additionally, if concerns are raised in regard to the aesthetic impacts of the substation, screening with plants or berms may be employed to minimize visual impacts.

6.2.5 Human Health and Safety

The potential for human health and safety impacts from wind turbines and HVTLs have been conducted for other projects both in the United States and internationally for a number of years. During the public scoping process, concerns were raised regarding potential for human health and safety impacts from the Proposed Project. The Final SDD states that the Draft EIS will summarize available research and studies previously conducted on potential human health risks from wind turbines due to low-frequency noise and sound levels. The Draft EIS will also provide information from existing publications on human health risks concerning HVTL and electromagnetic fields (EMFs).

Affected Environment
Public services generally refer to services provided by government entities or to benefit public health and safety, such as education, emergency services (fire, ambulances, and police), potable water, waste management, and utilities. Many of the public services available to residents in Clay County are associated with the city of Moorhead, located approximately 12 miles southwest of the Proposed Project Area. Public services located or headquartered in the city of Moorhead, include medical care, waste management, and the Clay County Sheriff's office. Residents in the city of Glyndon pay a fee for city

sewer and water services. Xcel Energy provides gas and electric service to residents in the city of Glyndon. The Dilworth-Glyndon-Felton School is located in the city of Glyndon.

In the rural areas outside the City, landowners are typically serviced with privately-owned septic systems and wells. There is an established transportation and utility network that provides access and necessary services to industry, homesteads, and farms in the Proposed Project Area. Electrical utilities are present within the Proposed Project Area, with numerous aboveground distribution lines running along roadways. Xcel Energy has a 23.5 kV electrical distribution line running north-south along State Highway 9.

In general, the existing roadway infrastructure in and around the Proposed Project Area is characterized by two-lane paved and gravel roads, which would provide access to the Proposed Project. These roads include US Highway 10, State Highway 9, and several county and township roads. Private single-lane farm roads and driveways are also used by landowners to access their property. The Clay County area includes a major east-west railroad facility, with minor routes branching out of its cities in a number of directions. Additional information on transportation and traffic is discussed in Section 6.3.3.

Impacts

The Proposed Project is not anticipated to significantly impact health and human safety as it relates to delivery and use of public services. Temporary impacts to public services may occur during construction of the Proposed Project. The Proposed Project would provide an upgraded and additional source of electrical generation and infrastructure to the area.

Potential impacts related to health and human safety may occur during operation of the Proposed Project. These potential impacts include low frequency noise and sound levels associated with the Proposed Windpark, and electromagnetic fields associated with the Proposed HVTL. The following, as outlined by the Final SDD, provides a discussion on the potential human health risks from the Proposed Project.

Public Services and Infrastructure

The Proposed Project is expected to have minimal impact on the existing infrastructure. New infrastructure (HVTL and associated facilities) is proposed, which would be necessary to deliver the electricity generated by the Proposed Windpark. The following provides a brief description of the impacts that may occur during the construction and operation of the Proposed Project.

Electrical Service

The Proposed Project would include construction of 134 wind turbines, a pad-mounted transformer at the base of each turbine, and an underground and above ground electrical collection system. The power would be transmitted via an overhead Proposed HVTL to a point of interconnection at the existing OTP power line where it would enter the grid.

Roads

Construction and operation of the Proposed Project would require installation of new access roadways. The access roads would connect the wind turbine sites to existing roadways. The access roads would be constructed across primarily agricultural land. Impacts to prime farmlands are discussed in Section 6.3.2.

Construction traffic would use the existing county and state roadway system to access the Proposed Project Area to deliver construction materials and personnel. Significant impacts from traffic are not anticipated. Further discussion of transportation and traffic is provided in Section 6.3.3.

Water Supply

Construction and operation of the Proposed Project would not affect the area's water supply. Installation or abandonment of wells is not anticipated for the Proposed Project. The Applicant would avoid impacts to any water pipelines running through the Proposed Project Area.

Temporary dewatering may be required during construction for specific turbine foundations and/or electrical trenches. The Proposed Project would not require the appropriation of surface water or permanent dewatering. Water supply would be necessary for the operations and maintenance facility with water usage estimated to be similar to household use (60-70 gallons per person per day). The preferred source is rural water services, which may be available in the area.

Telephone

Construction and operation of the Proposed Project is not anticipated to impact telephone service in the Proposed Project Area. The Applicant would be required to locate all existing utilities prior to construction, including telephone lines, and would avoid existing utilities.

Federal Communications Commission (FCC) Registered Towers

The Applicant would conduct a microwave beam path analysis of the Proposed Project Area prior to construction, which would indicate potential impacts. The Applicant would not operate the Proposed Windpark so as to cause microwave, radio, telephone, or navigation interference, in compliance with FCC regulations.

Noise

The Final SDD stated that the EIS would summarize available information related to potential human health risks from wind turbines due to low frequency noise and sound levels. Noise was previously discussed in Section 6.2.3 as it relates to the potential generation of noise from the Proposed Project and provides a more detailed discussion than the summary that follows.

The most recent source of information available was completed in May 2009 by the MDH (Appendix B), which evaluated human sensitivity to variable frequencies of sound and the potential human health risks associated with wind turbines. The MDH report concludes that wind turbines generate a broad spectrum of low-intensity noise. This report found that human sensitivity to sound, especially to low frequency sound, is variable. Reported health effects from low frequency stimulation are closely associated with annoyance from audible sound. Studies have not concluded, due to lack of reliable evidence, whether annoyance is a symptom or an accessory in the causation of health effects from low frequency noise. Common health complaints are sleeplessness and headaches, which have been correlated to annoyance complaints.

Additionally, the MDH report indicates that the potential impacts from low frequency noise generated from wind turbines is dependent on a number of factors, including receptor sensitivity, distance to receptor, weather and wind conditions, and turbine design, operation and maintenance. Due to the many variables, conclusive evidence on the potential impact from noise generated by wind turbines is not available.

Electromagnetic Fields

No significant impacts on human health and safety from EMFs are anticipated from the Proposed Project. The following provides a discussion on research and information available regarding EMFs.

Any conductor carrying voltage (electric charge) is surrounded by an electric field. A HVTL is surrounded by an electric field that extends from the conductors to other nearby objects including the ground, cars and houses. The electric field associated with a HVTL gets weaker with increasing distance from the transmission line, and surrounding objects also help dissipate the strength of the electric field. The strength of the electric field is measured in kilovolts per meter (kV/m). The strength of the electric field depends on the amount of voltage that is carried in the wire.

Large objects in close proximity to a transmission line can pass an electric shock to a person who touches that object. To prevent or minimize the potential for electric shock, the Minnesota PUC has imposed a

permit condition on previous proceedings on HVTL route permits limiting electric field exposure to 8 kV/m at 1 meter above ground. This permit condition was designed to prevent serious hazard from shocks when touching large objects, such as semi trailers or large farm equipment under extra high voltage transmission lines of 500 kV or greater. The Proposed HVTL would have a maximum electric field density of 4.66 kV/m. The maximum electric field would be located under the conductors one meter above ground. Table 6 shows electric field strength and magnetic field strength at various distances.

In addition to electric fields, transmission lines are also surrounded by magnetic fields. A magnetic field is generated around an object when current passes through a conductive material. Magnetic fields are quantified in gauss (G) which is an expression of magnetic flux density. Magnetic fields also decrease intensity with increasing distance from the conductive material.

Table 6: EMF Strength for Maximum Operating Conditions

Distance from Centerline (feet)	Magnetic Field Strength (mG)	Electric Field Strength[1] (kV/m)
1,500	0.11	0
1,250	0.15	0
1,000	0.24	0
750	0.43	0.001
500	0.96	0.002
450	1.23	0.004
400	1.50	0.004
350	2.08	0.0089
300	2.66	0.009
250	3.84	0.015
200	6.01	0.029
175	7.89	0.043
150	10.73	0.068
125	15.60	0.15
100	24.43	0.23
90	30.29	0.32
80	38.54	0.45
70	50.69	0.68
60	69.55	1.06
50	100.76	1.78
45	128.23	2.46
40	155.69	3.13
35	202.65	4.18
30	249.61	5.23
25	300.23	5.59
20	350.85	5.95
15	359.30	4.93
10	367.74	3.92
5	351.59	4.29
0	335.44	4.66

1. Electric field strength is not affected by current load.
Source: Noble Flat Hill Route Permit, 2008

Under the conductors of the transmission line, the magnetic field is the strongest, at 335 mG, which is less than the magnetic field associated with a household appliance. Table 7 shows the magnitude of the magnetic field emitted by various appliances.

Table 7: Typical Magnetic Field Strength of Household Appliances at Various Distances

Electric appliance	3 cm distance (mG)	30 cm distance (mG)	1 m distance (mG)
Hair dryer	**60 – 20,000**	0.1 - 70	0.1 – 0.3
Electric shaver	**150 – 15,000**	0.8 - 90	0.1 – 0.3
Vacuum cleaner	2,000 – 8,000	**20 - 200**	1.3 - 20
Fluorescent light	400 – 4,000	**5 - 20**	0.2 – 2.5
Microwave oven	730 – 2,000	**40 - 80**	2.5 – 60
Portable radio	160 - 560	**10**	<0.1
Electric oven	10 - 500	**1.5 - 5**	0.1 – 0.4
Washing machine	8 - 500	**1.5 - 30**	0.1 – 1.5
Iron	80 - 300	**1.2 – 3.0**	0.1 – 0.3
Dishwasher	35 - 200	**6 - 30**	0.7 - 3
Computer	5 - 300	**<0.1**	
Refrigerator	5 - 17	**0.1 – 2.5**	<0.1
Color TV	25 - 500	0.4 - 20	**0.1 – 1.5**
With most household appliances the magnetic field strength at a distance of 30 cm is well below the guideline limit for the general public of 1000 mG.			

Source: Federal Office for Radiation Safety, Germany 1999
Normal operating distance is given in bold. From the World Health Org.

The effects of EMF on human health have been studied since the late-1970s. It has been theorized that there is a connection between childhood leukemia and exposure to EMF. According to the National Cancer Institute, studies conducted over the last three decades have failed to produce conclusive results in regard to the effects of EMF on human health, and no definitive cause/effect relationship has been established. Some have found associations between childhood leukemia and brain tumors in children living near power lines, while other studies have found no such or inconclusive associations. Therefore, researchers currently, "conclude that there is limited evidence that magnetic fields from power line cause childhood leukemia and that there is inadequate evidence that magnetic fields cause other cancers in children. There is no consistent relationship between magnetic fields from power lines or appliances and childhood brain tumors" (National Cancer Institute Fact Sheet on Magnetic Field Exposure and Cancer: Questions and Answers).

The National Institute of Environmental Health Sciences (NIEHS) *Report of Health Effects from Exposure to Power-Line Frequency Electric and Magnetic Fields* concluded that there is no evidence that is strong enough to make the conclusion that extremely low frequency electric and magnetic fields (ELF-EMF) exposure is a "known human carcinogen." It was also concluded that there is not enough evidence to label these exposures as "probable human carcinogen." It was concluded that it is still possible that ELF-EMF exposure could be a human carcinogen based on evidence of increased risk for developing childhood leukemia in children living in the close proximity of ELF-EMF and an increased occurrence of chronic lymphocytic leukemia in individuals with occupational exposure (NIEHS, 1999). Strong conclusions about health risks associated with ELF-EMF exposure have not been made by NIEHS or other agencies, because there is a lack of strong evidence to support such correlations and conclusions.

There is at present insufficient evidence to demonstrate a cause and effect relationship between EMF exposure and any adverse health effects. The PUC has not established limits on magnetic field exposure and there are no Federal or Minnesota health-based exposure standards for magnetic fields. There is uncertainty, however, concerning long-term health impacts, and the Minnesota Department of Health and the PUC all recommend a "prudent avoidance" policy in which exposure is minimized.

Wind Turbine Design and Maintenance

The wind energy industry has several occupational hazards, which include turbine height, high winds, and rotating machinery. Since wind energy gained popularity in the 1970s, accidents have occurred that resulted in human injury or death. Most of the accidents occurred during construction and maintenance of the turbines, but there have been other accidents that were a result of fire and turbine blade detachment. The level of safety risk involved with construction and operation of the wind turbine depends primarily on turbine design and maintenance.

Design

Wind turbines are designed to turn and face oncoming wind in order to maximize efficiency and prevent damage during high winds. In order to prevent damage, sensors in the turbine turn the turbine head parallel to the direction of the oncoming wind and when needed engage brakes to stop the blades. Problems occur when the brakes fail because they are used not only for stopping the turbine blades, but also to control the speed with which they turn. For example, brakes can fail due to a loss of power to the generator. When the brakes fail, the rotor continues to accelerate, and the blades can turn uncontrollably due to lack of resistance from the brakes. The rapid rotation of the propeller blades increases the forces acting on the blades beyond what the blade was designed to withstand.

Rapid rotation and no resistance on the blades, creates centripetal forces, which can break the blades, causing them to fly off the turbine tower. The turbine tower is in jeopardy of collapsing if the blades are allowed to rotate rapidly and potentially break away from the tower.

Maintenance

The main occupational hazard involved with wind turbines is the risk of falling from the tower or turbine while conducting maintenance. Most of the required maintenance takes place within the nacelle that would be located approximately 250 feet above the ground for the proposed turbines. The wind energy industry has safety precautions, referred to as fall protection technology, to prevent maintenance and other personnel from falling.

Equipment to prevent falls includes body support, a lanyard, and anchorage. The lanyard connects the body support to an attachment on the nacelle. Additionally, a fall arrest system uses a metal sleeve that slides along a metal cable that extends the length of the tower. In the event that a person slips, the sleeve grips the cable stopping their fall.

One of the greatest threats in any industry is workers not using safety equipment or not using it correctly. Besides documented cases of workers falling off of wind turbines, there are also accidents that have occurred during turbine construction and assembly (Gipe, 2004).

The Caithness Windfarms Information Forum (Forum website: www.caithnesswindfarms.co.uk) provides data on incidences of wind turbine failure resulting from a variety of reasons. This data was collected worldwide from available sources of documented incidences. The Forum website does not include every incident but provides the most comprehensive information available at the time of this EIS publication for the three most common causes of accidents: blade failure (includes incidences where a piece of the blade (independent of size) was thrown from the turbine), fire, and structural failure (failure of a major component of the turbine under conditions the component was designed to withstand, mainly referring to storm damage and tower collapse).

The data does not distinguish between different turbine models or from which country the data was obtained. The data provides general information, but does not provide enough information to make conclusions about the frequency of incidents, trends in the number of incidents, or which countries have the most incidents. Based on the data, however, it appears that blade failure, fire, and/or structural failure at a wind turbine or the Proposed Project is not likely.

Hazardous Materials

Several potentially hazardous materials would be used during construction and operation of the Proposed Project. These materials are common to wind park and HVTL projects and include diesel fuel, hydraulic fluid, and other fluids and solvents associated with typical construction projects. A small amount of turbine hydraulic fluids and lubricants would be contained within the nacelle of the individual wind turbines. A small amount of hydraulic fluid, lubricating oil, grease and solvents would be stored within the operations center. When fluids or oils are replaced, the waste substances would be disposed of at an appropriate hazardous materials management disposal facility or landfill.

Mitigation

As described in the Draft Site Permit, the Applicant would ensure that proper safeguards would be implemented for construction and operation of the Proposed Project. Construction and operation of the Proposed Project would be in accordance with federal and state permits and laws, as well as industry construction and operation standards. Public services are not anticipated to be significantly impacted by the Proposed Project.

Minor impacts are expected on the existing infrastructure during Proposed Project construction for temporary periods of time. The Applicant would work closely with the landowners to locate access roads to minimize land-use disruptions. Water supply wells are not anticipated to be impacted, but in the event wells are abandoned, they would be capped as required by Minnesota law. As required by the Draft Site Permit, Gopher One Call would be contacted prior to construction to locate and avoid all underground facilities. To the extent the Proposed Project facilities cross or otherwise affect existing telephone lines or equipment, the Applicant would enter into agreements with service providers to avoid interference with their facilities. If telephone line or other utilities are damaged during construction of the Proposed Project, the Applicant would work with the affected utility service to repair the damage in a timely and appropriate manner. The Applicant would operate the Proposed Project in compliance with FCC regulations. In the event the Proposed Project or its operation causes microwave or other interference, the Applicant would take the steps necessary to correct the problem.

As required, the Proposed HVTL would conform to all applicable local, state, and North American Electric Reliability Corporation (NERC) standards regarding clearance to the ground, clearance to crossing utilities, clearance to buildings, strength of materials, and right-of-way widths. The proposed HVTL would be designed to comply with local and state codes and NERC standards. Appropriate

standards would be met for construction and installation, and all applicable safety procedures would be followed during and after installation. This would include clear signage during all construction activities.

As required, the Proposed HVTL would be equipped with protective devices to safeguard the public if an accident was to occur and a structure or conductor on the transmission line was to fall to the ground. The protective devices are breakers and relays located where the line connects to the substation. This equipment would de-energize the transmission line should an event such as this occur.

Additionally, as stated in Section 6.2.3.2 - Noise Mitigation, the Applicant would be required to meet certain setbacks for the wind turbines. This would reduce the possibility of turbine equipment creating a human safety hazard. The Applicant proposes minimum setbacks for turbines from occupied residences of 700 feet, and additional setbacks from properties without easements in order to preserve wind resource rights.

The total route width requested by the Applicant is 300 feet. A single pole structure, which is the tallest of the two types of poles under consideration, is a maximum of 100 feet tall. A typical right-of-way for a 230 kV transmission line would be 62.5 feet on either side of the project centerline, minimizing the possibility of HVTL poles and associated equipment from being a human safety hazard outside of the right-of-way.

6.3 IMPACTS ON LAND-BASED ECONOMICS

The Proposed Project has the potential to impact various aspects relating to land-based economics. Construction and operation of the Proposed Project would disturb land, generate revenue, and create jobs in the project area. Potential impacts to recreation, prime farmland, transportation, mining, forestry, economic development, and archeological and historic resources are addressed in this section.

6.3.1 Recreation

Large-scale wind park and HVTL projects have the potential to impact recreational resources and recreational experiences within a project vicinity. The potential for impact from these types of projects is dependant upon location and placement of the project; and the number of recreational resources available and utilized in a given area. The Final SDD stated that sensitive resources, lands and parks within the Proposed Project vicinity would be analyzed in the EIS. This Draft EIS reviewed existing recreational opportunities, including Buffalo River State Park, within the vicinity of the Proposed Project and whether the Proposed Project would have a potential impact on those resources.

Affected Environment

Clay County provides a variety of recreational opportunities for residents and visitors. About three percent (19,756 acres) of the land in the County is available for recreational uses, such as camping, fishing, hunting, bird watching, swimming, biking, hiking, and nature observation. These recreational areas include golf courses, public hunting areas, shooting preserves, trails, rivers, and state-owned lands. The MDNR owns and manages wildlife management areas (WMAs), Buffalo River State Park, WPA parks, scientific and natural areas (SNAs), and the Bluestem Prairie SNA in partnership with The Nature Conservancy (TNC). The Buffalo River State Park and the Bluestem Prairie SNA provide opportunities for viewing wildlife, Greater prairie chicken breeding habitat, and intact native prairie ecosystems. Public lands within the Proposed Project Area are shown on Figure 9.

Buffalo State Park and the Bluestem Prairie nature preserve are located approximately six miles southeast of the Proposed Windpark, and along the southeast end of the proposed Route 1 alignment. There are no WMAs within the Proposed Project Area.

USFWS Waterfowl Protection Areas (WPAs) provide habitat for migratory waterfowl and wading birds to use for breeding, forage, and shelter. WPAs provide recreational opportunities for viewing wildlife in their natural habitats. There are no WPAs within the Proposed Project Area. The closest WPAs to the Project area are Hatchet Lake WPA and Jarvis WPA which are located approximately 4.5 miles east of the Proposed Project Area.

Impacts

Proposed Windpark-related facilities would be constructed on the west side of State Highway 9, which would avoid WMAs, SNAs, Buffalo State Park, and Bluestem Prairie SNA and TNC lands. In general, recreational impacts would be visual in nature affecting individuals using public land near the Proposed Project Area. Visual impacts would be most noticeable to recreationists within one to four miles of the Proposed Windpark site.

The Proposed HVTL would likely be visible to individuals using recreation resources with 1.5 to 2 miles of the line. The Proposed HVTL would not cross SNA or State Park lands, therefore no direct impacts are anticipated to those areas. The Proposed HVTL would cross the Buffalo River regardless of which route alternative is selected. The Proposed HVTL would likely be visible, depending on the amount of tree canopy at the proposed crossing area, by people canoeing or fishing on the Buffalo River. Tree cover within the SNA and State Park would help minimize visual impacts. The Proposed Project is not anticipated to impact land heavily used for recreation in this area.

Additional discussion on potential visual and aesthetic impacts is provided in Section 6.2.4 of this Draft EIS.

Mitigation

As described in the Draft Site Permit, the Proposed Project facilities would not be located within public parks, WMAs, SNAs, USFWS lands, TNC lands, or other public recreational areas. The Applicant would work with MDNR, USFWS, and TNC to avoid and minimize impacts to waterfowl and other natural resources. Specific mitigation for recreational lands or recreation opportunities is not recommended for the Proposed Project Area. Additional visual and aesthetic impact mitigation measures are described in Section 6.2.4 of this Draft EIS.

6.3.2 Prime Farmland

Wind parks in the Midwest are typically located in open areas with high quality wind resources. Many of these same areas are used for agricultural production or grassland. The Proposed Project Area is primarily farmland and grassland. The Final SDD states that potential impacts to prime farmland would be analyzed in the EIS and mitigation measures identified as necessary.

Affected Environment

The majority of the Proposed Project Area is farmland and grassland. According to the 1997 Census of Agriculture, the number of farms has decreased over the past ten years in Clay County. However, the average size of farms has increased from 579 acres in 1987 to 655 acres in 1997. According to the 2002 Agricultural Census, approximately 90 percent of farmland is used for crop production.

The primary crops grown in Clay County include wheat, soybeans, and sugar beets. Sales from these crops in 2002 were $112,696,000. Livestock sales accounted for $22,228,000 of the total sales in 2002. The most common livestock raised in Clay County includes turkeys, hogs, and cattle.

Converting cropland to the Conservation Reserve Program (CRP) is another source of farm income. CRP lands are grassland and legume croplands that are planted to protect and improve the soil and cannot be harvested or pastured. These areas are enrolled in the CRP for 10-year periods.

Most of the soil within the Proposed Project Area is considered prime farmland (Figure 10). Soil types in the Proposed Project Area include primarily Mollisols or Aquolls. Table 8 summarizes the acres of prime farmland soils located within the Proposed Project areas and is also illustrated on Figure 10. Discussion of soils in the Project area and potential project related impacts to soils is provided in Section 6.4.2 of the Draft EIS.

Table 8: Acres of Prime Farmland Soils within the Proposed Project Area

Project Areas	Soils Class	Acres
Windpark	Prime Farmland (all areas)	1,545
	Farmland of statewide importance	21
	Prime farmland if drained	17,136
Total Acres		**18,702**
Route 1	Prime Farmland (all areas)	1
	Farmland of statewide importance	--
	Prime farmland if drained	347
Total Acres		**348**
Route 2	Prime Farmland (all areas)	45
	Farmland of statewide importance	--
	Prime farmland if drained	311
Total Acres		**356**
Route 2A	Prime Farmland (all areas)	88
	Farmland of statewide importance	--
	Prime farmland if drained	289
Total Acres		**377**

Source: 2007 NASS Land Cover Dataset and GIS Analysis

Impacts

Wind turbine and road placement had not been finalized at the time of this Draft EIS publication. Specific impacts to agricultural lands from the final turbine and road placement design would be assessed prior to construction.

In general, the Proposed Project would temporarily inhibit agricultural production at various locations within the Proposed Project Area during the different phases of construction. Agricultural production would be permanently lost in structure locations, access road locations and on portions of the substation and switching station parcels. Each turbine foundation would be a concrete octagon shape between 40 and 60 feet in diameter. During construction, an area up to 150 feet by 50 feet would be temporarily disturbed for structure assembly and raising onto the foundation. Approximately 465 acres of land would be temporarily affected for contractor staging and lay down areas. During operation, farming would be allowed up to the turbine foundations and along access roads.

The Proposed Project would require acquisition of parcels for the proposed substation and the proposed switching station, both of which are currently used for agricultural purposes. Approximately 2.5 acres of the substation parcel and six acres of the switching station parcel would be removed from agricultural production to accommodate the substation and switching station equipment and other necessary facilities, which includes a 400 foot buffer area around the switching station and substation. The remainder of the two ten-acre parcels could continue to be used for agricultural production.

Based on a 16 foot width, the proposed 27 miles of access roads would permanently remove approximately 52 acres of agricultural land from production. During construction of the proposed access roads, the workspace would be between 24 and 30 feet wide.

Based on the general information described above, the Proposed Project, including wind turbines, switching station, substation, and access roads would permanently remove a total of approximately 65 acres of prime farmland (approximately 0.3 percent of the total Proposed Project Area acreage) from agricultural production.

The Proposed HVTL would be located within the existing roadway right-of-way, which would minimize impacts to agricultural production. Most impacts to farmland would be limited to possible pole placement within the field production areas. During construction, temporary impacts such as soil compaction and crop damage within the right-of-way would likely occur along the route.

For Route 1, no farm fields would be bisected by the Proposed HVTL alignment. For Route 2, however, some farm fields would be bisected, where railroad right-of-way has been sold back to landowners in the area. Some permanent impacts would result where the new right-of-way bisects agricultural fields. New right-of-way would be created for approximately 4.8 miles of the 9.9 mile Route 2 alignment. Route 2A would bisect one quarter section of farmland in order to connect to former BNSF railroad right-of-way.

Additionally, consultation with landowners by the Applicant identified six quarter sections as known to be tiled within the Proposed Project Area. Impacts to drain tile due to Proposed Project construction and operation would be avoided where possible; however, some damage may be unavoidable when constructing access roads or installing the underground collection system within the Proposed Windpark.

Mitigation

The Applicant proposes to locate the wind turbines and access roads so that most of the productive farmland would be avoided as much as possible. Only land for the turbine, substation/switching station, O&M building, and access roads would be taken out of crop production. As described in the Draft Site Permit, all land surrounding the turbines and access roads would be restored as needed and may still be farmed. The Applicant proposes to allow agricultural production to continue on the substation and O & M building parcels within a 400 foot buffer from those facilities.

The Applicant proposes that wherever possible, poles would be placed so they fall within existing right-of-way, minimizing permanent impacts to agricultural land. Impacts to farmland are anticipated to be minimal and/or temporary impacts associated with construction. The Draft Site Permit requires that measures to minimize soil compaction are taken during all phases of the Proposed Project. Work in agricultural areas could be performed during winter months and when soils are not saturated to minimize the potential for soil compaction. The Applicant would compensate landowners for unavoidable crop damage and soil compaction that occurs during project construction. Additionally, the Proposed Project would require easements on private land along the Proposed HVTL right-of-way as described under mitigation in Section 6.2.2.

The Draft Site Permit requires mitigation measures for drainage tile. All turbine and facility siting would include discussions with property owners to identify features on their property, including drain tile, which should be avoided. If there is damage to drain tile as a result of construction activities or operation of the windpark, the Applicant would work with affected property owners to repair the damaged drain tile in accordance with an agreement between the Applicant and the owner of the damaged tile. If the facilities are proposed to be located on CRP land, the Applicant would work with the landowner to pay the required fees for loss of acreage in the program or possibly remove the impacted parcel from the CRP program if necessary

6.3.3 Transportation

Transportation infrastructure and traffic patterns can be impacted from construction and operation of wind park and HVTL projects. During the public scoping process, concerns were raised regarding road impacts and construction traffic. The Final SDD states that the Draft EIS would gather information regarding the

anticipated amount of construction traffic associated with the Proposed Project and identify potential impact and mitigation for construction-related road damage.

Affected Environment

The Proposed Project is located in a sparsely populated, rural area in west-central Minnesota. There is an established transportation and utility network that provides access and necessary services to the industry, homesteads, and farms in the Proposed Project Area. In general, the existing roadway infrastructure in and around the Proposed Project Area is primarily county and township roads. Access to the Proposed Project Area also includes two-lane paved and gravel roads. Furthermore, many landowners use private single-lane farm roads and driveways on their property.

Highway access to the Proposed Project Area is provided by State Highway 9 (running north-south along eastern edge of the Proposed Project Area) and US Highway 10 (running east-west just south of the Proposed Project Area). State Highway 9 intersects Interstate Highway 94 approximately 15 miles south of Glyndon, near the city of Barnesville, Minnesota.

There are also two County State Aid Highways (CSAHs) within the Proposed Project Area. CSAH 26 runs east-west along the northern boundary of the area, and CSAH 19 runs north-south through the middle of the area. There are also five County Roads (CRs) within the Proposed Project Area (CR 68, 93, 91, 88, and 92). The existing roadways in the Proposed Project Area are displayed in Figure 1.

The existing traffic volumes on the area's county highways, as shown in Table 9, were obtained from Minnesota Department of Transportation (MDOT) 2005 Traffic Volume maps. The highest existing Annual Average Daily Traffic (AADT) near the Proposed Project Area is 15,100 vehicles per day along US Highway 10. The highest existing AADT within the area is 1,750 along State Highway 9. Along the CSAHs within the Proposed Project Area, the AADTs are below 2,000 vehicles per day. Along the CRs within the area, the AADTs are below 300 vehicles per day indicating very low traffic volumes.

Table 9: Existing Daily Traffic Levels within the Proposed Project Area

Roadway Description	2005 Existing Average Annual Daily Traffic (AADT)
State Highway 9	1750
CSAH 19	75
CSAH 26	1600/1100
County Road 68	45
County Road 88	15
County Road 91	90
County Road 92	25
County Road 93	245
U.S. Highway 10	15,100
Interstate Highway 94	18,500

Source: MDOT 2005 Traffic Volumes map

Clay County has one major east-west railroad facility, with minor routes branching out of its cities in a number of directions. A major intermodal terminal facility is located in Dilworth (approximately nine miles from the Proposed Project Area). The Burlington Northern Santa Fe Railroad owns the majority of the tracks. The Amtrak trains provide daily passenger rail service to the area and also express service for packages and mail.

Located approximately seven miles southwest of the Proposed Project Area, the nearest airport is the Moorhead Municipal Airport. This airport was constructed in 1996. Currently, it has one runway that is 4,000 feet long and 75 feet wide and a helicopter landing pad. Nighttime landings are possible with pilot

activated lights on the runway. The airport provides 28 conventional hangers and one maintenance hanger. The airport also has a chemical loading facility for crop-dusting aircraft. Crop dusting is typically carried out during the day by highly maneuverable airplanes or helicopters.

Impacts

Construction and operation of the Proposed Project would require the installation of new access roadways within the windpark. The access roads would connect the towers to the existing roadway system. After construction the access roads would be used infrequently by the occasional maintenance worker accessing the towers. The constructed turbine access roads would not impact the existing roads in the project.

The construction period is expected to be between 6 to 12 months. Construction traffic would use the existing county and state roadway system to access the Proposed Project Area and deliver construction materials and personnel. Truck access to the Proposed Project Area is generally served by State Highway 9 and US Highway 10. Specific additional truck routes would be dictated by the location required for delivery.

Several types of light, medium, and heavy-duty construction vehicles would travel to and from the site, as well as private vehicles used by the construction personnel. The Applicant estimates that there would be 75 large truck trips per day and up to 200 small-vehicle (pickups and automobiles) trips per day during peak construction periods. Maximum traffic volumes are anticipated during turbine foundation and tower assembly. Construction and operation of the Proposed Project would require the installation of new access roadways within the Proposed Windpark. The access roads would connect the turbine sites to the existing roadway system.

Construction traffic related to the Proposed Project would be perceptible and would temporarily add to local traffic, similar to seasonal variations due to the autumn harvest. At the completion of each construction phase, equipment would be removed from the site or reduced in number. Proposed Project construction is not anticipated to result in adverse traffic impacts.

Proposed Project operation would require a multi-person maintenance crew driving through the area to monitor and maintain the wind turbines. The maintenance crew would monitor the wind turbines as needed. There would be a slight increase in roadway traffic for occasional turbine and substation repair. This is not anticipated to cause significant impacts to existing roadway traffic.

Traffic disruption associated with the construction of the Proposed HVTL would be localized for short, temporary periods during construction. Significant impacts are not anticipated for roadway traffic from construction of the Proposed HVTL.

The Proposed Project would include the installation of wind turbine towers in croplands and installation of a HVTL transmission line, which could create the potential for collisions with crop-dusting aircraft. The Proposed HVTL lines are expected to be similar to existing transmission lines in the region, such as the existing 39 kV line along State Highway 9 and the OTP regional 230 kV line. The collection system within the Proposed Windpark would be located underground and would not pose a hazard to aircraft. Turbines would be visible from a distance and lighted according to the 2007 revised FAA guidelines.

The Proposed Project would not affect the operation of the railroads or railroad service in the area. As discussed in Section 6.2.5, significant impacts to public services and infrastructure are not anticipated.

Mitigation

As stated in section 5.5.3 of the Noble Flat Hill Windpark permit application, construction and operation of the Proposed Project would be in accordance with all associated federal and state permits and laws, as well as industry construction and operation standards. Transportation disruptions are anticipated to be

localized, temporary and intermittent for the 6-12 month period required to construct the Proposed Project.

The Project Proposer would work closely with the landowners to locate wind park access roads to minimize land-use disruptions and disruptions of the existing rural agricultural roads in the Proposed Project Area. Long term impacts to the transportation network from the Proposed Project beyond the construction period are not anticipated.

Prior to construction, the Applicant would coordinate with local jurisdictions (county and township) to obtain the necessary road access and overwidth/overweight permits as needed for trucks and cranes, as required in section 5.8.2.4 of the Noble Flat Hill Windpark permit application. The timing and logistics for transporting heavy components for the Proposed Project would be dictated by seasonal roadway restrictions for the area. Mitigation for road impacts would include an agreement between the Applicant and the community for any damage committed to roadways, associated with large truck, increased small vehicle traffic, overwidth/overweight vehicles and general construction activities.

As described in Section 6.3.2, the Applicant would work closely with the landowners to locate windpark access roads to minimize land use disruptions. Landowners would be compensated for loss or damage of property based on agreements made prior to construction.

Section 5.8.3.1 of the Noble Flat Hill Windpark permit application requires the Applicant to mark and light the turbines to comply with current FAA requirements. The permit further requires the applicant to paint meteorological towers red to improve visibility and reduce risk to crop dusters. Permanent meteorological towers would be required to be constructed as free-standing with no support wires. In the event that support wires are necessary, the wires would be required to be marked with safety shields (colored balls) for increased visibility. The Applicant would be required to notify local airports of the constructed towers location and height.

6.3.4 Mining and Forestry

Aggregate resources are typically used during construction of wind park and HVTL projects. The size and location of the project can have an impact on local aggregate resources. HVTL projects may cross forest lands requiring clearing of trees. This could impact forest production areas within a project vicinity. The Final SDD states that these two resources are analyzed in the EIS for potential impacts from the Proposed Project.

Affected Environment

Forestry
The Proposed Project occurs in what was historically the Red River prairie region in Minnesota. The primary tree cover in the Proposed Project Area is associated with waterways and homesteads. None of these areas are economically significant forest production areas.

Mining
Large deposits of glacially derived sediments are present throughout the eastern portion of the Proposed Project Area. As a result, aggregate mining operations are present in the vicinity of the Proposed Project. According to MDOT county pit maps for Clay County, there are no active or inactive aggregate pits or rock quarries within a mile of the Proposed Project facilities. Although there are aggregate mines in the region, there are no mined areas or identified potential mineral resources in the immediate area of the Proposed Project.

Impacts

Forestry

The Proposed Windpark would be located primarily on cultivated, agricultural land that does not have forest resources, and therefore would not impact forest production. The Proposed HVTL would be located primarily in public road right-of-way, which is also not a forest production area. Therefore, no impacts are anticipated to forest resources from the Proposed Project.

Mining

Sand and gravel operations in the area are located to the east of the Proposed Project Area. There are no actively mined sand or gravel operations in the Proposed Project Area. The Proposed HVTL and substation would be built largely within or adjacent to existing public road right-of-way areas which are already unavailable for mining activities. Therefore, the Proposed Project is not anticipated to impact mineral resources or mining operations.

Construction of access roads would require gravel and aggregate. A new aggregate mine larger than 40 acres would require a mandatory EAW and permitting process. The permitting and EAW process for a new gravel mine would likely not be completed in a timeframe to meet the Applicants proposed 2010 construction schedule for the project. As a result, existing local aggregate mines would be used to supply the aggregate resources necessary to construct the Proposed Project.

Based on the dimensions of the proposed access roads (16 ft x 6 in x 27 miles), approximately 45,000 cubic yards of gravel would be required for project completion. Currently there are 35 active aggregate mines located within a reasonable distance of the Proposed Project Area that could supply the necessary aggregate resources. A cursory review of aggregate resources sold by local mines indicated several million yards of aggregate are sold per year in the region. This indicates that the estimated amount of aggregate necessary for completion of the Proposed Project is a small percentage of the annual production of mines in the region. Based on this information, the Proposed Project would not significantly impact aggregate resources at existing, permanent mines, and would likely have resources available for construction of the Proposed Project.

Mitigation

Impacts from the Proposed Project to forest resources are not anticipated, therefore no mitigation is proposed. Proposed Project facilities would not be located near sand and gravel mining operations. Additionally, existing aggregate production from mines in the region can easily provide the aggregate supplies needed to construct the Proposed Project. As a result no mitigation is proposed.

6.3.5 Economic Development

Large-scale wind park and HVTL projects have the potential to impact the economic development of an area in a number of ways, including job creation, temporary community service use during construction, and generation of tax revenue. During the public scoping process for the Proposed Project, public comments were received related to economic benefits and tax revenue from the Proposed Project. The Final SDD states that the Draft EIS would gather and summarize information regarding tax revenue generation, estimates of job creation, and potential revenue generated by the Proposed Project for the local community.

Affected Environment

According to the Bureau of Economic Analysis, the per capita personal income (PCPI) for Clay County was $28,312 in 2006. This represents 73 percent of the state average PCPI of $38,859 in 2006. Clay County has a minority population, consisting mostly of Hispanic or Latino origin, totaling 6.8 percent, which is lower than the state's minority population total of 12.6 percent (US Census Bureau 2007a).

The economic base of Clay County consists primarily of management, professional, and related occupations (31.9 percent); sales and office occupations (27.9 percent); and educational, health, and social services (27.4 percent). The economic base of the Proposed Project area is primarily rural agricultural production.

Majority of the land in the Proposed Project Area is used for agriculture. Within the city of Glyndon (population 1,050), there is some light industry, retail, construction, and public and private services, which contribute to the local economy. Much of the tourism in the region is associated with either the city of Moorhead or the Red River Valley. Buffalo River State Park and the adjacent Bluestem Prairie SNA (one of the largest tracts of native prairie in the state) are located southeast of the Proposed Project Area along the Proposed HVTL.

The Clay County Comprehensive Plan (Plan) was adopted in 1980 and updated in 2001. The Plan contains Clay County's long-range plan for growth and development over the next 20 years as well as goals, policies, and the general framework to protect land use, growth areas, and transportation corridors. The County Vision identified in the Plan includes several themes: strong agricultural base; planned, sustainable growth; strong economy; responsive, cooperative government; preservation of natural resources, open spaces, and recreational opportunities; and high quality of life. The Plan outlines a number of goals and policies for implementing those goals. As it relates to the Proposed Project, the first goal for economic development is: Cooperatively utilize existing and new resources for economic growth in the County. Policy #7 under that goal in the Plan states: Ensure that Clay County continues to have access to state-of-the-art telecommunications and essential utility infrastructure.

Clay County currently utilizes wind energy with wind turbines in the city of Moorhead and three 750 kW turbines operating in rural Clay County on the western edge of Keene Township (Clay County 2001, p.2-50). The Plan identifies commercial development of wind energy as an opportunity for Clay County, and sites a survey of farmers conducted by the Minnesota Project in 1995 that showed nearly unanimous support for wind development, both for environmental benefits and rural economic development (Clay County 2001, p.2-51).

Impacts

Temporary jobs would become available during construction for turbine assembly, access road construction, and HVTL-related project facilities. Short-term, local economic impacts include potential increased revenue for local businesses due to increased spending from the influx of project construction workers purchasing local goods and services. As a result, short-term impacts to local businesses from the Proposed Project are anticipated to be generally positive.

The future of renewable energy resources and the economy is not known. Presently, the State of Minnesota has set goals for using renewable energy sources that are helping drive the demand for facilities, such as the Proposed Project. As a result of the Proposed Project, long-term impacts may result from new infrastructure and additional power generation. The Applicant does not currently have a Power Purchase Agreement (PPA) for the power generated by the Proposed Windpark. It is not known if the power generated from the Proposed Project would be available to or have an impact on local businesses and residents. In the event that a PPA is secured with a local or regional utility, the additional power generated in the area may have a positive effect on local businesses and the quality of services provided to the public. If the Proposed HVTL is not constructed the Proposed Windpark would not have the infrastructure available to outlet the power generated.

The local property taxes generated from the Proposed Project through the state production tax are estimated to be over $800,000 per year. The establishment of this area of Minnesota as a producer of alternative energy may also encourage the development of wind-related businesses in the area, and thus contribute to economic growth in the region.

Based on the Clay County Comprehensive Plan, the Proposed Project appears to fit with identified goals for economic development in the County. The Plan does not specifically identify locations for placement of wind energy facilities.

As previously indicated, the primary land use in the Proposed Project Area is agricultural production, which would be impacted during construction and operation of the Proposed Project through the loss of productive agricultural land. Impacts to prime farmland are further described in Section 6.3.2.2.

Mitigation
The economic development impacts associated with the Proposed Project appear to be primarily positive. There would likely be a short-term influx of local spending during construction. Long-term, the new infrastructure and additional power may prompt further economic development in the area with wind-related or other businesses. These potential impacts seem to coincide with the goals and policies outlined in the 2001 Clay County Comprehensive Plan. Additionally, there would be an increase in the County's tax base from the construction and operation of the Proposed Project. Therefore, no mitigation for economic development impacts has been identified.

6.3.6 Archaeological and Historic Resources

The construction of wind park and HVTL projects disturbs land and can alter landscapes, which could impact archeological and historic resources within a project vicinity. This Draft EIS reviewed available cultural resources information for the Proposed Project Area to determine if there would be potential impacts from the Proposed Project and identify appropriate mitigation measures, if needed.

Affected Environment

Cultural History
Minnesota's prehistory has been divided into three broad cultural periods: Pre-Contact (9,500 B.C. to A.D. 1650), Contact (A.D. 1650 to 1837), and Post-Contact (1837 to 1945). The settlement of the Clay County area follows the overall settlement patterns of the state.

During the Pre-Contact period, ancestors of present day Native Americans are believed to have arrived in the Clay County area approximately 7,000 years ago. Evidence has been found indicating that Native Americans were living along major rivers 3000-4000 years ago, hunting bison and other game in the area.

By A.D. 1650, the first French explorers had reached Minnesota, ending Minnesota's prehistory and initiating the Contact Period, which included settlement by other Euro-American groups.

At that time, the Native American tribes present in the state included the Chiwere Siouan language groups, Eastern Dakota, Western Dakota, and Ojibwe Indians, all of which were in constant interaction with Euro-Americans in search of animal furs. The Contact Period lasted until around 1837 when Native Americans were forcibly divided into communities and put onto reservations, and Euro-American settlement expanded and new ways of life (i.e., lumbering and intensive agriculture) overtook the region.

When Euro-American settlers arrived around 1800, Dakota (Sioux) and some Ojibwe (Chippewa) Indians were living in the area. In 1825, a treaty negotiated by the U.S. government established a boundary between the settlers and the tribes at the Buffalo River. In 1851, the Sioux ceded their lands to the U.S. government and moved to reservations outside Clay County; in 1855, the Ojibwe also ceded their lands and moved.

The Post-Contact Period began with the intensive settlement of Minnesota by Euro-Americans and the resettlement of Native Americans to reservations. The waterways in the state initially served as the

primary means for commerce, travel, and sustenance for the first Euro-Americans to permanently settle the state and played a major role in the development of the state by providing a means to transport raw materials from Minnesota. By the 1850's, trading of fur and other goods grew between merchants in Hudson's Bay and merchants in St. Paul. The Hudson's Bay Company built a steamboat landing and warehouse near the confluence of the Buffalo and Red Rivers, which became the Euro-American settlement in Clay County. By the late 1860's, permanent settlers began moving into the county. In 1870, several Norwegian families settled along the Buffalo River northwest of Glyndon. Real settlement, however, did not begin until the railroads arrived.

In 1871, the Northern Pacific Railway completed its line from Duluth to the Red River and the city of Moorhead was established. During the next twenty years the Northern Pacific and Great Northern Railways built branch lines throughout the county. Immigrants were mainly farmers, who grew wheat at first, then diversified out of single crop farming to potatoes, alfalfa, and corn, as well as raising livestock.

By the twentieth century, improved roads and the automobile made travel to town much easier, shifting community focus to small towns. The rural to urban shift continued through the Great Depression and World Wars I and II as the number of small family farms decreased due to improved technology requiring fewer farmers to farm more land. This trend has continued into the twenty-first century in Clay County and other parts of Minnesota.

The cultural history of this area represents some of the state's most interesting and complex cultural resources. Original Public Land Surveyor Maps from 1870 and 1872 indicated that the Proposed Project area was mostly prairie with some wet prairie at the time of initial development. The only timber in the area was located along the Buffalo River.

Documented Cultural Resources

A record search and review of existing records contained at the Minnesota State Historic Preservation Office (SHPO) in the Minnesota Archaeology Inventory database and the Standing Structures Inventory database was conducted for the Proposed Project Area. The records search was conducted to determine if significant archeological, architectural history, or tribal resources have been documented or any surveys gave been conducted within the Proposed Project Area or within one mile of the Proposed Project Area.

Windpark

No cultural resources surveys have been conducted within one mile of the Proposed Project Area. However, the record search at SHPO found the information, as follows, for archaeological sites, historic properties, and National Register eligible properties.

Archaeological Sites

Three archaeological sites have previously been documented within the Proposed Project Area and two archaeological sites are within the 1-mile buffer. Sites within the Proposed Project Area include a structural ruin and associated artifact scatter (21CY0011), an Archaic period lithic scatter (21CY0027), and a Woodland period artifact scatter (21CY0028). None of the sites within the Proposed Project Area have been evaluated for NRHP eligibility. Previously identified archaeological sites within 1-mile of the Proposed Project Area include a Woodland period artifact scatter (21CY0029) and a Pre-Contact lithic scatter (21CY0052). Neither of these sites has been evaluated for National Register of Historic Places (NRHP) eligibility.

Historical Properties

Two architectural history properties have been identified within the Proposed Project Area, and three properties have been identified within the 1-mile buffer. Properties within the Proposed Project Area include the Thordtvedt Homestead (CY-MOL-001) and a church (CY-MOL-002). These properties have not been evaluated for NRHP eligibility.

Architectural history properties within 1-mile of the Proposed Project Area include the Concordia Lutheran Church (CY-MOL003), Moland Town Hall (CY-MOL-004), and the Spring Prairie Township Hall (2Y-SPR-001). None of these properties have been evaluated for listing on the NRHP.

National Register Eligible Properties
According to SHPO file search of archaeological sites and architectural history properties performed on August 18, 2008, no properties evaluated for the National Register have been identified within the Project area.

Transmission Line Routes
There have been at least four cultural resources surveys conducted within the search area for the Proposed HVTL. All of these surveys involved background or historical research and field surveying. Two of these surveys were conducted in the late 1970s for improvements along State Highway 9 (along Route 1) and US Highway 10 which transects Route 1, Route 2, and Route 2A. Additional surveys performed included a bridge replacement on US Highway 10 over the Buffalo River near Route 1. These surveys provide significant survey information for Route 1 and Route 2 cultural resources. The Route 2A alignment was identified during this Draft EIS process and analysis, therefore a survey was not completed for it.

Route 1

Archaeological Sites
No archaeological sites have been documented within 1 mile of Route 1**.**

Historical Properties
One architectural history property has been identified within 1 mile of Route 1. This property, the Spring Prairie Township Hall, has not been evaluated for listing on the NRHP; however, the proposed location of Route 1 would likely pass in close proximity to the property.

National Register Eligible Properties
According to SHPO file search of archaeological sites and architectural history properties performed on August 18, 2008, no properties evaluated for the National Register have been identified within Route 1 of the Proposed Project Area.

Route 2

Archaeological Sites
One archaeological site has been documented within 1 mile of Route 2. This site is located 0.2 miles from Route 2 and consists of a Pre-contact Late Woodland artifact scatter. This site has not been evaluated for listing on the NRHP.

Historical Properties
A total of 13 architectural history properties have been identified within 1 mile of Route 2, primarily in the Town of Glyndon. None of the 13 properties have been evaluated for listing on the NRHP; however, the proposed location of Route 2 would likely pass in close proximity to some of these properties.

National Register Eligible Properties
According to SHPO file search of archaeological sites and architectural history properties performed on August 18, 2008, no properties evaluated for the National Register have been identified within Route 2 of the Proposed Project Area.

Impacts
Cultural resources could be affected directly during the construction of the Proposed Project. Construction within the turbine footprint, cable trenching, access roads, and borrow areas could impact cultural resources. In addition, construction of turbines may impact viewshed integrity from existing structures and residences. Based on the initial SHPO records search results, the need for a Phase IA Cultural Resources Survey was described in the site permit application and route permit applications.

Phase IA Survey
In May 2009, as required by the Draft Site Permit, Phase IA Cultural Resource Surveys (Phase IA Survey) were conducted for the Proposed Project Areas. The preliminary findings of the Phase IA Survey are described in a cultural resources technical memorandum provided by Applicant (Appendix C – Tetra Tech, 2009x). Information from the draft version of the Phase IA Surveys was used for this Draft EIS, and the final version of the Phase IA Surveys will be provided to the SHPO for their review.

The Phase IA Surveys identified an Area of Potential Effect (APE) for direct effects. This APE includes areas both permanently and temporarily impacted by Proposed Project construction. An APE for visual effects (indirect effects) was also identified as two miles surrounding the APE for the windpark and one mile surrounding the APE for direct effects of the proposed HVTL.

Background research at the SHPO was completed for the Phase IA Surveys in November 2007 and October 2008. This research included gathering information on previously identified archaeological sites, architectural structures, and cultural resource surveys within the APE for direct effects; archaeological sites and cultural resource surveys within one mile of the APE for direct effects; and architectural properties within two miles of the proposed turbine layout and within one mile of the proposed route alignment (or within the APE for visual effects).

The background research was a more detailed review of previously documented cultural resources as previously described in Section 6.3.6.1 - Affected Environment for archaeological sites and architectural history properties. The SHPO file search conducted in October 2008 indicated that no properties evaluated for the National Register have been identified within the Proposed Project Area.

Archaeological fieldwork was conducted within the Proposed Project APE for direct effects, which included a pedestrian survey, site documentation and evaluation. The Phase IA Cultural Resources Survey for the Proposed Project provides greater detail on field methodology.

Findings and Potential Impacts
The following information provides a brief summary of the results of the Phase IA Surveys (See Appendix C). The Phase IA Cultural Resources Surveys for the Proposed Project provides further discussion and detail.

Windpark
Five new, pre-contact archaeological sites were documented during the pedestrian survey of the APE for direct effects. Four of the five sites are represented by isolated projectile points, while one site had a flake made of chert. All sites have been cultivated for numerous years, indicating that the findings are likely isolated.

Six historic scatters (new, post-contact archaeological sites) were documented during the pedestrian survey of the APE for direct effects. All but one scatter can be lined to the late nineteenth/early twentieth century farmsteads. It is likely, however, that the remaining scatter is indirectly linked to a farmstead of similar age as the rest of the historic scatters found. All scatter sites have since been demolished and/or razed, and all but one have been heavily disturbed by agricultural practices.

With the exception of a standing barn at one of the historic scatter sites, only one other architectural property was documented within the APE for direct effects. This is an abandoned railroad grade of the former BNSF (formerly known as the Great Northern Railroad), which would be transected at several locations by proposed access roads and collection lines within Sections 12 and 13, T140N, R47W. The former BNSF railroad grade is partially vegetated and has been altered in portions of it by local landowners.

Route 1
One new archaeological site was documented during the pedestrian survey with the finding of a portion of a projectile point. No additional materials were found in the currently and historically cultivated field, therefore the site is considered isolated.

No other new archaeological or architectural features were found within the Route 1 APE for direct effects.

Route 2
To date, only a file review of Route 2 has been conducted. The Phase IA Survey indicates a low potential for intact archaeological resources due to the presence of the railroad grade. Therefore, a pedestrian survey was not conducted.

Route 2A
Route 2A was not surveyed and did not have a file review completed for it. The majority of Route 2A follows existing road right-of-way. A small segment of Route 2A (one quarter section) crosses an agricultural production area before it connects with former BNSF railroad right-of-way. Given the present and former land uses along the Route 2A alignment, there is a low potential for intact archaeological resources along the majority of the route.

Mitigation
As outlined in the Draft Site Permit, the Applicant has initiated consultation with the Minnesota SHPO regarding adverse direct effects the Proposed Project may have to properties within the Proposed Project Area or adverse visual effects the Proposed Project may have to architectural properties in the vicinity of the Proposed Project Area. Information regarding the Proposed Project will be provided to SHPO in order to address potential adverse visual effects to historic properties.

The Draft Site Permit requires avoidance of archaeological sites and architectural history properties as the preferred mitigation method; however, if sites cannot be avoided, then further investigations may be needed to evaluate significance and recover data as described in the Phase IA Survey Report.

The Phase IA Survey Report provided recommendations for treatment of cultural resources identified and not yet identified within the vicinity of the Proposed Project Area that may be impacted by the Proposed Project. These recommendations were based on the results of the records research, pedestrian survey, and informal consultation with the SHPO regarding archaeological resources. The recommendations are provided below.

Additional archaeological investigations are recommended along the wooded area immediately north (terrace and floodplain) of the Buffalo River if the Proposed Project includes disturbing areas outside the existing road right-of-way. This would include the completion of shovel testing within areas directly impacted by the Proposed Project.

As previously described, the pedestrian survey identified an abandoned farmstead as a newly documented archaeological site. The Phase IA Survey Report recommended that the Proposed Project avoid directly impacting this archaeological site and the architectural component (barn) or if avoidance is not possible,

then it is recommended that the archaeological and architectural components of this farmstead be evaluated for its eligibility for the listing in the National Register.

The former BNSF railroad grade was identified as an architectural property that would be directly impacted by the Proposed Project. The Phase IA Survey Report recommended an architectural investigation to assess the effects of the Proposed Project on the railroad grade and to identify mitigation measures if the property is considered historic and would result in an adverse effect. Based on the results of this investigation, further recommendations would be made as necessary for avoidance or mitigation.

Additionally, the Phase IA Survey Report also recommended that an Unanticipated Discoveries Plan be available for the engineering and construction crews in the case of the discovery of cultural materials. This plan would outline the steps that should be taken if cultural materials are found during project construction.

6.4 IMPACTS ON NATURAL ENVIRONMENT

The Proposed Project includes activities that have the potential to impact various aspects of the natural environment. Topics relating to the natural environment discussed in this chapter include: Air Quality, Soils, Geology, Water Quality, Groundwater, Wetlands, Floodplains, Fisheries, Wildlife and Land cover. Where applicable the Proposed Project includes the combined Noble Flat Hill 201 MW Windpark and the 230 kV HVTL as a whole. Specific details pertaining to the individual areas, such as the Proposed Windpark versus the Proposed HVTL route alignments, are discussed separately when needed.

6.4.1 Air Quality

The primary air quality concerns associated with wind park and HVTL projects are the generation of fugitive dust emissions from construction related traffic and activities, and the generation of ozone and nitrogen oxide emissions surrounding the transmission line conductors. This section evaluates the potential impacts of these pollutants on the Proposed Project Area.

Affected Environment

The Proposed Project Area is currently in compliance with all federal ambient air quality standards for all regulated pollutants, and therefore, is considered in attainment for air permitting purposes. The land use in the area is primarily agricultural with limited homestead sites located along the transmission line alignment and near the individual wind turbines. Fugitive dust emissions in the area occur regularly due to agricultural activities, travel on the local gravel roads, and wind erosion across local roads and fields. These conditions are most present in the hot and dry summer months but can also become a problem in the winter months where significant snow cover is lacking.

Ozone emissions associated with electrical conductors is also present in the area due to the electrical transmission system that already exists in the Proposed Project Area. The levels of ozone present are imperceptible to local residents.

Impacts

Fugitive dust emissions would occur as a result of various construction activities related to the Proposed Project. The Applicant estimates that they would construct approximately 27 miles of additional gravel roads in the area as a result of the project. The individual roads would be short in distance as they are simply access roads to the construction site for each individual wind turbine.

Construction related activities would occur on a daily basis until project completion. The estimated completion time for the Proposed Project is approximately 60 days for access road construction and 160 days to wind turbine construction. The total construction period is estimate to span a minimum of six

months (180 days) as the Proposed Project would also include construction of the turbine foundations which will require three weeks time to cure prior to wind turbine construction. Dust emissions that are a result of the Proposed Project would be temporary in nature as they would only occur during project construction periods and only during travel times. Emissions from these roads would be similar to that of existing agricultural equipment traveling on the local gravel roads.

Temporary and localized impacts to air quality are likely to occur during construction activities due to emissions from construction vehicles and fugitive dust from clearing activities. The magnitude of construction emissions would vary according to weather and phase of construction. Weather has a significant impact on the severity of fugitive dust during construction activities, as it does during routine agricultural travel. Wet conditions would greatly reduce the levels and associated impacts due to fugitive dust.

Wind erosion across the newly constructed roads is also a source of fugitive dust. Heavy wind conditions can cause fugitive dust to become airborne and fly around. Natural moisture conditions, as well as natural wind breaks, help to reduce the amount of wind induced fugitive dust. Other specific control measures are identified in the mitigation section below.

The primary air quality concerns related to transmission lines are ozone and nitrogen oxide emissions surrounding the conductor due to "corona discharge." "Corona discharge" is when a thin layer of air molecules around the conductors becomes electrically charged, and during wet conditions, conducts electricity. This phenomenon produces a small amount of ozone, however, the amount of ozone produced is likely in the same range of that produced by a lightning storm. Furthermore, moisture (the same factor that increases corona discharge from the transmission lines) inhibits the production of the ozone.

The Environmental Protection Agency (EPA) has regulations regarding permissible concentrations of ozone and oxides of nitrogen (62 Federal Register 38856). The national standard is 0.08 parts per million (ppm) on an eight-hour averaging period (40 CRF Part 50). The Minnesota state standard is 0.08 ppm based on the fourth highest 8-hour daily maximum average in one year (Minnesota Rules 7009.0080). Incremental concentrations of ozone due to corona would be expected to be in the order of one-tenth of the standard near the transmission line (0-8 parts per billion), and insignificant at ground level.

Mitigation

Construction of the Proposed Project would generate dust in the Proposed Project Area. However, project construction would take place mainly on agricultural lands. The amount of dust generated during construction would be similar to dust levels generated from existing agricultural activities such as plowing, planting, and harvesting.

During the construction phases of the Proposed Project, the Applicant would utilize several methods to mitigate the impacts from fugitive dust. These methods include water and/or chemical applications to travel roads during non-freezing conditions. This would be applied on an as-needed basis; which depends greatly on the natural moisture and weather conditions during a certain timeframe.

Wet conditions would greatly reduce the impact of fugitive dust as it prevents it from freely becoming airborne due to vehicle travel, construction activities, and wind erosion. During dry conditions, the Applicant would apply water and/or chemical applications to reduce potential fugitive dust impacts.

The Applicant would control fugitive dust both as part of the permitted process and for safety reasons. During heavy equipment operation, fugitive dust can create dangerous site conditions when it is not controlled. Fugitive dust can deteriorate working conditions for employees and create dangerous visual conditions during operation of heavy equipment.

During winter conditions, water applications are not feasible due to freezing temperatures. However, snow application and naturally occurring snowfall reduces the impact of fugitive dust due to it impeding the dust from becoming airborne. Similarly, dust gets bound into the freezing material and is not free to become airborne.

Project requirements dictated that wind turbine sites remain a consistent distance from local residences in order to comply with MPCA noise standards. As stated in the Applicant's Noble Flat Hill Windpark Site Permit Application, dated October 17, 2008, there is a minimum setback restriction of 700 feet from any residence. This setback was developed to provide noise mitigation for wind turbines and would also provide mitigation for potential construction-related, air quality impacts to local residences.

The ozone produced from the 'corona discharge' that is associated with the transmission lines is a naturally occurring, somewhat weather dependent phenomena. As discussed above, wet conditions increase corona discharge activity. However, those same wet conditions inhibit the production of ozone. Therefore, the weather conditions that are needed for one part of the process inhibit the associated discharge of that process.

As discussed above, ozone concentrations produced by corona for the Proposed Project are expected to be minimal when compared to federal air quality standards. Therefore, no significant mitigation measures are required to control ozone. These findings are consistent with other transmission line projects.

6.4.2 Water Quality, Soils and Geology

Construction of wind park and HVTL projects require the excavation of soils and the placement of pole and foundations. This construction has the potential to permanently impact soils, bedrock, and water quality depending on individual site conditions. This Draft EIS analyzed data regarding soils, geology, and water quality to determine potential impacts from the Proposed Project. Possible mitigation measures were also identified.

Affected Environment

Geology

Data on the geology of the Red River Valley were obtained from the Department of North Dakota State University. The Proposed Project Area is located within the Red River Valley subsection of Northwestern Minnesota. The Red River Valley is the youngest major land surface in the contiguous United States, with Glacial Lake Agassiz draining only about 9,200 years ago. The geology of Clay County is a direct result of the glaciers once covering the area. The western portion of the County is made up of glacial drift (ground moraine) and the eastern part of the County is made up of terminal moraine.

Underlying the Red River Valley are soils that support agricultural activity. These soils consist of developed clays derived from the late-glacial erosion and reworking of Cretaceous shales dispersed as fine grained sediments into Lake Agassiz. Pre-glacial topography is still present in this area, but is buried underneath several hundred feet of this glacial drift and glacial lake sediments. Bedrock in the Proposed Project Area is PreCambrian granitic and gneissic basement rock (greater than 2.5 billion years in age) exists at a depth of approximately 200-300 feet. Overlying this rock at about 100-200 feet is glacial sediment (predominantly till with some localized zones of outwash sands and gravels).Over this layer at approximately 85 feet are slickensided fat clays and silty clays.

Soils

Soils within the Proposed Project Area are poorly, somewhat poorly, and moderately well-drained lacustrine clays, silts, and sands. Soil types within the Proposed Project Area are displayed in Figure 11. They are primarily Mollisols or Aquolls. Borolls (cold, dry Mollisols). Other soils in the Proposed Project

Area include saline soils which are present in localized areas and dry, sandy and gravelly soils which are characteristic of the beach ridges to the east of the Proposed Project Area (Clay County 2002).

Water Quality

The Buffalo River is the major water resource within the vicinity of the Proposed Project Area. The Buffalo River was added to the MPCA 303(d) in 1996, listed as impaired for aquatic life due to excessive turbidity. The water quality standard for turbidity is 25 NTU (nephelometric turbidity units), with a waterbody listed as impaired if at least three independent readings and ten percent of the total readings out of a minimum of 20 readings fall below 25 NTU standard (MPCA, 2007). Water quality data from MPCA Electronic Data Access (EDA) website for the Buffalo River indicates that turbidity ranged from 6 to 99 NTUs with an average of 36 NTUs in 2006 at monitoring station (S003-693) near the city of Glyndon. The suspected sources that have created the impairment in the river include runoff and erosion from urban and agricultural land uses as well as in-stream channel erosion and instability. There are no lakes within the Proposed Project Area. Based on analysis of the NWI wetlands database, as described in Section 6.4.3, there are approximately 38.5 acres of wetlands within the Proposed Project Area. The majority of the wetlands in the Proposed Project Area are seasonally flooded basins but small areas of shallow marshes and shrub swamps are also present. There are some county ditches located within the Proposed Project Area.

Impacts

Geology

The Proposed Project would not require substantive excavation, and minimal grading is anticipated to construct the facilities such as wind turbine foundations and access. Surficial soil deposits are more than 200 feet deep, while construction activities for the Proposed Project are projected to be approximately 10 to 15 feet below the surface. The bedrock in the project area is well below the depth of proposed construction activities and therefore direct project impacts to bedrock are not anticipated. The Proposed Project would not impact the geology of the Proposed Project Area.

Soils

Soils were reviewed within the Proposed Project Area. Potential impacts to these areas are described in the following paragraphs.

Windpark

Surface soils would be disturbed by site clearing, grading, and excavation activities at structure and access road locations, as well as during transport of construction materials and machinery. This disturbance is minimal and is similar to typical agricultural practices such as plowing and tilling. In temporary workspace areas adjacent to the access roads or turbine foundations, the Applicant would work with the affected land owner to conduct activities to reduce the impacts of soil compaction due to construction, such as deep soil ripping. No permanent impacts to soil are anticipated during the construction of the turbines and associated facilities.

Transmission Line Routes

The installation of the transmission line poles would minimally disturb soils during construction. Temporary work spaces for individual transmission line pole installation would be approximately 250 square feet in size (50 ft by 50 ft area). Vegetation clearing is required in an area within 25 feet of the centerline of the transmission line poles (50 feet wide). Within temporary workspace areas and the HVTL alignment surface soils would be disturbed by vegetations clearing and excavation activities and during transport of construction materials and machinery and transmission pole installation. This disturbance is minimal and is similar to typical agricultural practices such as plowing and tilling. The Applicant would conduct activities to reduce the impacts of construction related soil compaction, such as deep soil ripping.

No permanent impacts to soil are anticipated during the construction of the transmission line or the switching station.

Water Quality

Water quality within the Proposed Project Area was analyzed for this Draft EIS. The following paragraphs describe potential impacts in the Proposed Windpark area and within the Proposed HVTL route alignments.

Windpark

There are no lakes and very few wetland areas within the Proposed Project Area. Based on the preliminary turbine array the majority of construction activities in the Proposed Windpark would not be in close proximity to wetlands, ditches or the Buffalo River. However, depending on the final turbine array and access road alignment some construction may take place adjacent to wetlands or ditches. Sediment could reach surface waters during construction of the Proposed Project while the ground is disturbed by excavation, grading, and construction traffic. The Applicant would be required to secure and NPDES construction permit for the Proposed Project and develop a Storm Water Pollution Prevention Plan (SWPPP). Within the SWPPP specific BMPs would be identified to reduce erosion, sediment runoff and impacts to water quality. Construction BMPs would include items such as silt fences, bio-roles, staked bales or silt curtains. Once construction is complete the disturbed areas would be restored to their previous conditions of crops or grasses. At which time sediment runoff would be similar to conditions prior to construction. The implementation of the construction BMPs in the SWPPP would ensure minimal impacts to water quality of adjacent wetlands or ditches.

Transmission Line Routes

There are no wetlands located within the Proposed HVTL alignment for Route 1. Just over one-half of an acre of wetlands are located within the Route 2 alignment, and about one acre of wetlands is located in the Route 2A alignment. As a result, an impact to the water quality of wetlands is not anticipated from construction of the Proposed HVTL for any of the route alternatives.

Route 1, Route 2, and Route 2A would cross the Buffalo River. A public water utility crossing permit would be required from the MDNR for the Proposed HVTL to cross the river. The Buffalo River channel is relatively narrow at approximately 45 feet wide, and due to the narrow channel width it is unlikely that the MDNR permit would allow transmission line poles to be placed within the Buffalo River channel. Depending on pole spacing, it is possible that transmission line poles would be placed in the riparian area of the Buffalo River. The Applicant would be required to identify specific BMPs in the SWPPP for the Proposed Project to minimize water quality and sediment impacts to the Buffalo River because the river is an impaired water body. The temporary workspace to install transmission line poles is relatively small, and construction BMPs, such as silt fences, bio roles, silt curtains and the use of wood mats for construction vehicles, would be able to effectively control sediment and runoff associated with construction. The installation of the transmission line poles is not anticipated to impact the water quality of the Buffalo River for construction for any of the alternative route alignments.

Mitigation

Geology

The Proposed Project would not require substantive excavation, and minimal grading is anticipated to construct the facilities. Proposed construction depths are shallow and would not encounter bedrock. No impacts to bedrock or geology are anticipated and therefore no mitigation is recommended.

Soils

The Applicant intends to implement construction BMPs to protect topsoil and adjacent resources and to minimize soil erosion. Section 5.13.3 of the Noble Flat Hill Windpark Site Permit Application requires

the Applicant to treat and restore construction-related soil compaction through tillage (i.e. deep soil ripping) operations. Sections 5.18.3 and 5.19.3 of the same permit application further stipulate the use of construction BMPs and suggest possible means of protecting topsoil and minimizing erosion, such as by protecting exposed soil, seeding, mulching, etc.

Section 5.1.5.9 of the Noble Flat Hill Route Permit similarly requires the Applicant to use construction BMPs to minimize impacts to soils. In keeping with this requirement, where disturbance and excavation cannot be avoided, the Applicant intends to implement BMPs to minimize soil impacts.

Construction would generally occur on agricultural lands and the proposed construction related activities are similar to impacts from typical agricultural practices such as tilling, planting or harvesting. Minimal impacts to soils are anticipated from the Proposed Project and therefore no mitigation beyond employing construction BMPs is recommended.

Water Quality

The potential for impacts to water quality as a result of the Proposed Project is low; the majority of construction would not occur adjacent to lakes, wetlands or ditches. Nevertheless, mitigation measures to protect water quality are specified in sections 5.16.3 and 5.17.3 of the Noble Flat Hill Site Permit Application and section 5.1.5.9 of the Route Permit Application. Consistent with these permit requirements, the Applicant intends to obtain an NPDES construction permit and prepare a SWPP as part of the permit. Specific construction BMPs to protect water quality would be included in the SWPPP.

Both of the Proposed HVTL routes would cross the Buffalo River, and as stated in section 4.7.2 in the Route Permit Application, the Applicant intends to obtain the required public waters utility crossing permit from the MDNR. Conditions of the permit would likely not allow placement of transmission line poles within the river channel. The SWPPP and utility permit would be required to identify specific construction BMPs to protect the water quality of the Buffalo River. Recommended mitigation to avoid impacts to the Buffalo River include: avoiding placing transmission line poles adjacent to or in the riparian zone of the river; minimizing the size of temporary work space in the riparian zone of the river; use wood mats or other practices to limit potential impacts to soils in the riparian zone and reduce the potential for sediment impacts to the river channel; assemble items such as transmission line poles outside of temporary work space adjacent to the river; employ construction BMPs, such as silt curtains and silt fences, to contain sediment runoff and limit the potential for down stream impacts to the river.

6.4.3 Groundwater, Wetlands and Floodplains

The location of a wind park or HVTL primarily determines the potential impacts it may have on groundwater resources, wetlands, and floodplains. Wind park turbine placement and route alignment can be designed to avoid wetlands and floodplain areas as much as practical. Groundwater impacts are related to depth to groundwater and location of aquifers within a project area. The Final SDD states that the EIS would provide a description of potential impacts to the floodplain or groundwater where applicable. It also states that potential changes in floodplain storage and potential for groundwater contamination would be described. Permit and mitigation requirements related to construction within the floodplain or areas affecting groundwater resources are also provided.

Affected Environment

Groundwater

There are three primary aquifers in Clay County, the Buffalo, Moorhead, and Kragnes aquifers. The Buffalo aquifer is the primary source of groundwater in Clay County. It is thirty-two miles long, ranges from one to eight miles wide and lies five miles east of Moorhead. Glacial sediments overlay more than half the aquifer at a depth from 20 to 120 feet. The thickness of the aquifer ranges from 0 feet at the edges

to around 200 feet at the center with the flow generally northward toward adjacent streams. A direct link between the Buffalo River and the aquifer has been identified, indicating a potential for pollution of the aquifer from inputs to the Buffalo River. County well log records indicate that groundwater in the vicinity of the Proposed Project Area ranges between 16 feet and 30 feet below ground surface.

Wetlands

Numerous federal, state, county, and local regulations affect construction and other activities in wetlands. The principal laws in Minnesota affecting wetlands and streams are Sections 404 and 401 of the Federal Clean Water Act (CWA), the public waters laws administered by the MDNR, and the Minnesota Wetlands Conservation Act (WCA). Section 404 (regulation of discharge of dredge/fill materials into wetlands) is implemented by USACE. The public waters laws regulate work in public waters, including wetlands listed on the MDNR inventory of protected waters and wetlands. The local government unit (LGU) has the primary responsibility for administration of the WCA and for making key determinations to wetlands. The Clay County Soil and Water Conservation District is the identified LGU for the Proposed Project Area.

The National Wetland Inventory (NWI) database indicates the general location of wetlands based on changes in vegetation patterns as observed from aerial photography. NWI maps were reviewed to determine the presence of wetland habitat within the Proposed Project Area.

During several site visits by the Applicant, the Proposed Project Area was observed to be primarily agricultural land with scattered, isolated wetlands. The delineation of wetlands in the Proposed Project Area is scheduled to be conducted during the growing season of 2009 to define wetland boundaries and minimize wetland impacts by the Proposed Project.

Windpark

Three types of wetlands where identified from the NWI database within the Proposed Windpark (Types 1, 3 and 6). These identified wetlands include Routes 1, 2, and 2A where they exist within the Proposed Windpark (Figure 12). A summary of these wetlands are found in Table 10. Type 1 wetlands are seasonally flooded basins or flats, which include wet meadows, bottomland hardwoods and shallow-freshwater swamps. Type 3 wetlands are defined as a shallow marsh. Type 6 wetlands are defined as shrub swamps.

Table 10: Wetland Areas within the Windpark Area

NWI Circular 39	Square Feet	Acres
Type 1	1,270,115.3	29.2
Type 3	308,054.8	7.1
Type 6	87,472.9	2.0
Total	1,665,643	38.3

Transmission Line Routes

The wetlands identified for each of the routes includes the portions of the routes within the Proposed Windpark area, as shown on Figure 12. This means that some of the wetlands identified for the Proposed Windpark in Table 10 may overlap with wetlands identified in Table 11 and 12.

There were no wetlands identified within a 300 foot buffer of Route 1. Three types of wetlands where identified from the NWI database within a 300 foot buffer of Route 2 (Types 1, 5 and 6).
A summary of these wetlands are found in Table 11. Type 1 wetlands are seasonally flooded basins or flats, which include wet meadows, bottomland hardwoods and shallow-freshwater swamps. Type 5 wetlands are defined as open fresh water. Type 6 wetlands are defined as shrub swamps.

Table 11: Wetland Areas within 300 Feet of Route 2

NWI Circular 39	Acres
Type 1	0.44
Type 5	0.01
Type 6	0.18
Total	0.63

There were three types of wetlands identified within 300 feet of Route 2A (Types 1, 3, 5 and 6).

Table 12: Wetland Areas within 300 Feet of Route 2A

NWI Circular 39	Acres
Type 1	0.44
Type 3	0.37
Type 6	0.18
Total	0.99

The NWI database does not indicate any wetlands or riparian areas along the southern ends of Route 1, Route 2, or Route 2A near the Buffalo River. It is possible during construction additional wetlands or riparian areas may be encountered, which have not been identified in the NWI database.
Definitions of wetland types: (Cowardin, et. al., 1979)

Floodplains

Federal Emergency Management Agency (FEMA) collected data and has mapped flood plains nationwide. FEMA maps were reviewed to determine the presence of floodplains within the Proposed Project Area. This search indicated that several floodplains areas are located within the site. The Buffalo River travels along the Proposed Project Area's southern and western boarders. The Buffalo River has floodplain zones which are classified as 100-year and 500-year flood elevations within the Proposed Project Area (Figure 13). Floodplain areas found in the Proposed Project Area are summarized in Table 13 and 14. FEMA defines a 100-year flood zone as the following: "A 100-year flood is the flood elevation that has a one percent chance of being equaled or exceeded each year. The 100-year flood is that standard used by most Federal and state agencies and is used by the NEIP as the standard for floodplain management and determination of flood insurance" (FEMA FAQ documents). Following a similar classification or definition, a 500-year flood is the flood elevation that has 0.2 percent chance of being equaled or exceeded each year.

Table 13: Floodplains within the Windpark area

Floodplain	Acres
100-Year	431.2
500-Year	--

Table 14: Floodplains within 300 Feet of Route 1, Route 2, Route 2A

Route	Floodplain	Acres
Route 1	100-Year	34.4
Route 1	500-Year	7.6
Route 2	100-Year	9.1
Route 2	500-Year	30.6
Route 2A	100-year	10.3
Route 2A	500-year	20.4

Note: Route areas include the floodplain areas within a 300' buffer.

Impacts

Groundwater Resources

The Proposed Project is located on the west side of State Highway 9 and therefore would avoid the beach ridges to the east of the Proposed Project Area where the Buffalo Aquifer has the potential to be contaminated. No impacts to the aquifer are expected due to construction. The transmission structures design provided in the Route Permit Application submitted by the Applicant specifies the transmission poles would be placed in 24–36 inch diameter holes to depths 10–15 feet below grade, then backfilled with native soils or granular material. The wind turbine foundation design provided in the Site Permit Application for a LWECS submitted by the Applicant specifies the base portion of the foundation for a 1.5 MW turbine bearing is approximately seven feet below grade.

Groundwater elevations recorded in County well logs show groundwater ranges from 16–30 feet below ground surface; therefore the transmission poles and wind turbine foundations are not anticipated to penetrate the groundwater. Significant impacts to the Buffalo River are not anticipated that would result in permanent degradation of the aquifer. Municipal or private water sources would not be impacted in the Proposed Project Area.

Wetlands

Potential impacts to wetlands from turbine placement, access roads, and Proposed HVTL route alternatives were analyzed for this Draft EIS.

Windpark

Impacts to wetlands area anticipated to be minimal. The total number of wetland acres within the Proposed Project Area is very small, comprising less than 0.5 percent of the total lands for potential construction. Based on the preliminary wind turbine array, the wind turbines, substation, the operations and maintenance center, and access roads would not impact wetlands within the Proposed Project Area. The Draft Site Permit does allow for temporary impacts to wetland areas for the installation of the under ground collection system, if approved by the agency with jurisdiction over the wetland. If temporary impacts occur from the construction of the under ground collection system, the Applicant would restore the impacted wetland to pre-construction conditions, replacing disturbed soils and vegetation as necessary. In the event that wetlands are discovered during final design of the Proposed Windpark, the Applicant would conduct delineations of the wetland areas, develop measures to avoid impacts and of necessary consult with the appropriate agency to determine acceptable mitigation strategies to offset wetland impacts.

Transmission Line Routes

The Route 1, 2, and 2A alignments would span wetlands and drainage systems to the maximum extent practicable. Based on the defined alignments for the three route alternatives, wetland impacts are anticipated to be minimal for construction of the Proposed HVTL. Wetlands comprise less than 0.5 percent of the area within Route 2 and Route 2A. No wetlands were identified within Route 1. It is possible that wetland areas not identified by the NWI dataset would be encountered in the riparian area of the Buffalo River. If wetland areas are identified within the riparian zone of the Buffalo River during construction the Applicant would conduct delineations of the wetland areas, develop measures to avoid impacts and of necessary consult with the appropriate agency to determine acceptable mitigation strategies to offset wetland impacts. When it is not possible to span the wetland, the Applicant would draw on several options during construction to minimize impacts:

- When possible, construction would be scheduled during frozen ground conditions;
- Crews would attempt to access the wetland with the least amount of physical impact to the wetland (i.e. shortest route);

- The structures would be assembled on upland areas before they are brought to the site for installation;
- When construction during winter is not possible, wooden mats would be used where wetlands would be impacted.

Floodplains
Impacts to floodplain areas are anticipated to be minimal. Based on the preliminary wind turbine array, turbine locations, substation, operations and maintenance center, and access roads would not impact the floodplain. Pending the final location of individual transmission poles, there is potential that a transmission line poles may be placed within the Buffalo River floodplain along a route alignment.

Mitigation

Groundwater
Based on review of County well logs, the construction of the turbine foundations proposed by the Applicant would not intercept the groundwater aquifer in Proposed Project Area. Construction of the concrete turbine foundations would not have the potential for contamination of the groundwater aquifer as hazardous materials are not used in the construction process. A small amount of hydraulic fluid, lubricating oil, grease and cleaning solvent would be stored at the operation and maintenance building but these materials would be stored and handled according to MPCA requirements for hazardous substances and do not pose a significant threat to the ground water aquifer in the project area. The Proposed Project activities are not anticipated to impact groundwater resources within the vicinity of the Proposed Project Area and therefore no mitigation is recommended.

Wetlands
Wetlands have been avoided to the greatest extent possible during the preliminary design phase of the Proposed Project. As required by the Draft Site Permit, the Applicant will conduct a biological survey of the project area that will include a search for wetland areas. If wetland areas are located during the biological survey they will be avoided to the maximum extent possible. During the final design and construction phase of the Project it may be determined that access roads or the underground collection system have the potential to impact wetlands. If wetland impacts cannot be avoided a preconstruction notification to the federal, state, and local jurisdictions would be submitted by the Applicant.

The Section 404 and Minnesota Wetland Conservation Act permit applications would be submitted to the U.S. Army Corps of Engineers and the LGU prior to construction. The Applicant would be required to complete field wetland delineations to define the areas of wetland impacts. The Applicant would develop a mitigation strategy that is acceptable to the regulatory agencies with jurisdiction over the wetlands. Mitigation may include construction of new wetlands, expansion or enhancement of existing wetlands or the purchase of mitigation credits from an approved wetland mitigation bank.

Floodplains
Construction of the Proposed Project in floodplain areas was reviewed for this Draft EIS. The following paragraphs describe the potential impacts within floodplain areas in the Proposed Windpark area and for the Proposed HVTL route alternatives.

Windpark
Based on the preliminary turbine array there would not be construction of wind turbines, access roads, substation or the under ground collection system within the floodplain. The Site Permit Application states that the Applicant would avoid constructing facilities required by the Windpark within the Buffalo River Floodplain. The construction and operation of the Proposed Windpark would not impact the floodplain and therefore no mitigation is recommended.

Transmission Line Routes
Both routes pass though floodplain areas associated with the Buffalo River. The installation of the individual poles would not create a measureable loss of floodplain storage or alter the flood elevations within the floodplain. Mitigation for impacts to the floodplain from the Proposed HVTL construction is not recommended. The Applicant would be required to obtain a permit from the MDNR for the Proposed HVTL to cross the Buffalo River and would be required to adhere to all conditions of the MDNR permit for a utility to cross a MDNR Protected Water.

6.4.4 Fisheries and Wildlife Resources

The Proposed Project Area covers approximately 20,000 acres in central Clay County. The construction of wind turbines, access roads and associated facilities would permanently alter approximately 65 acres of land. An estimated 465 acres of land would be temporarily disturbed during project construction. The Proposed HVTL route alignment is 300 feet wide (150 feet to either side of the HVTL centerline), but only a few acres of the land within the alignment would be directly impacted through the construction of the Proposed HVTL and installation of transmission line poles. The construction and operation of the Proposed Project has the potential to alter wildlife habitat or impact fisheries and wildlife populations. A discussion of the existing fisheries and wildlife resources within the Proposed Project Area and the potential for project related impacts is provided.

Affected Environment

Fisheries
A limited amount of fisheries resources exist within the Proposed Project Area. There are no lakes or ponds capable of supporting a significant fish community within the Proposed Project Area. The Buffalo River is the only water body with a significant fish community. The Buffalo River is an 88-mile long river that begins at Tamarack Lake and flows north and west through Becker and Clay Counties, where it ultimately discharges into the Red River. The watershed area of the Buffalo River is over 1,000 square miles. Based on the MDNR public access points GIS data layer, there are no designated public access points along the Buffalo River. However, the river can be accessed at numerous road crossings and can also be accessed within the Buffalo River State Park, located just to the southeast of the Proposed Project Area. Recreational uses along the Buffalo River include fishing, canoeing and hiking along trails.

The MPCA conducted fish community monitoring at several reaches on the Buffalo River in 1994, 2005 and 2006. Across all surveys a total of 38 fish species were collected from the different reaches. The most abundant fish species collected include fathead minnows, common shiner, Johnny darter, white sucker and redhorses (golden, shorthead and silver). The Buffalo River contains a variety of game fish species including bluegill, channel catfish, largemouth bass, northern pike, rockbass, smallmouth bass, walleye and yellow perch. The MPCA calculated Index of Biotic Integrity (IBI) scores from the fish community data collected during some of the site visits. The IBI was developed as a way to use various aspects of a biological community (typically fish or macroinvertebrates) as an indicator of the overall health of a water body. The IBI scores typically range from 0 to 100, with high scores indicative of a healthy aquatic system and low scores indicative of disturbance and degradation. IBI scores were calculated by the MPCA for two reaches of the Buffalo River, returning scores of 58 (fair) and 67 (good) for the fish community. Based on these IBI scores plus the additional fish community data collected by the MPCA, the Buffalo River has a healthy fish community that has adapted to the landscape alterations (conversion of native prairies and wetlands to agricultural uses) within the watershed.

Wildlife
There is a limited amount of wildlife habitat available within the Proposed Project Area. Over 87 percent of the land cover within the Proposed Project Area is in agricultural uses including a variety of cultivated crop lands and pastures (See Figure 14). An additional 8.3 percent of the land in the Proposed Project

Area is developed use (residential, developed open space, etc.). The remaining four percent of the land cover is in some form of vegetative cover. There are small amounts of forests, non-agricultural grass lands and wetlands within the Proposed Project Area. The majority of available wildlife habitat in the Proposed Project Area is associated with the Buffalo River corridor. Adjacent to the Proposed Project Area wildlife habitat (i.e. forests, prairies, wetlands) exists on public lands such as within the Buffalo River State Park or WMAs. Even with the limited amount of native vegetation, a variety of wildlife species exist within the Project Area, especially those species that have adapted to living in an agricultural setting. There are a variety of mammals (including bats), birds, reptiles, amphibians and insects that occur in the area. Detailed information relating to wildlife species in the Proposed Project Area can be found in Section 5.19 of the Site Permit Application and Sections 5.1.5.8 and 5.2.5.8 in the Route Permit Application.

One of the items of concern related to wildlife impacts from windparks is mortality to birds and bats. Collisions between wind turbines and birds or bats can include the stationary towers as well as the spinning turbine blades. Studies have been conducted to assess the impacts on bird and bat mortality from wind turbine collisions at existing windparks in the United States. The Proposed Project Area lies within the Mississippi Flyway, which includes large spring and fall migrations of various species of birds. A discussion of the potential for bird and bat mortality from the Proposed Project is included

Impacts

Fisheries

The only fisheries resource in the Proposed Project Area is the Buffalo River. Based on MPCA surveys, a healthy, diverse fish community exists in the river. The Buffalo River flows through the southwest corner of the Proposed Windpark and also crosses the route alignments. Based on the preliminary turbine array, there would be no wind turbines, access roads or other facilities constructed in close proximity to the Buffalo River. All of the Proposed HVTL alignments would cross the Buffalo River. The Applicant would be required to obtain a public utility crossing from the MDNR for the HVTL. It is likely that permit would prohibit construction activities or the placement of transmission line poles within the channel of the Buffalo River. The aquatic habitat within the channel of the Buffalo River would not be impacted by the construction of the Proposed Windpark or HVTL. Depending on final spacing of the transmission line poles, there may be HVTL construction related activities within the Buffalo River riparian zone. The Buffalo River is listed as impaired for turbidity by the MPCA. As a result the Applicant would be required to identify specific construction BMPs within their NPDES construction permit designed to protect the water quality and aquatic health. Project related impacts to the fish community or angling activity of the Buffalo River are not anticipated.

Wildlife

There is minimal potential for wildlife impacts related to habitat loss from the Proposed Project. The windpark, associated facilities and HVTL would generally be constructed on agricultural lands. There is a limited amount of natural wildlife habitat within the Proposed Project Area and based on the preliminary turbine array, natural habitats would not be impacted by the construction of wind turbines, access roads, associated facilities or the HVTL.

The majority of non-agricultural vegetation in the Proposed Project Area is associated with the Buffalo River corridor. Wind turbines would not be constructed within the Buffalo River riparian habitat. The Proposed HVTL would cross the Buffalo River regardless of which route alternative is selected. The crossing would require a public waters utility crossing permit from the MDNR. Some vegetation within the Proposed HVTL alignment would be removed from the riparian area of the Buffalo River at the site of the crossing. Compared to the length of the Buffalo River riparian corridor, the amount of riparian habitat lost due to vegetation clearing at the Buffalo River crossing would be small for all routes, totaling approximately three acres of riparian forest vegetation cleared in the Route 1 alignment and

approximately six acres of riparian forest vegetation cleared in the Route 2 and 2A alignments. The 2007 NASS land cover dataset classifies some of the Buffalo River riparian habitat within the Route 1, Route 2, and Route 2A alignments as woody wetlands, while these areas are not classified as wetlands by the NWI dataset. Overall there is minimal potential for the displacement of wildlife and loss of habitat from construction of the Proposed Project.

The Applicant has proposed to conduct a biological survey of the Proposed Project Area during the summer of 2009 (Appendix D). The biological survey will include an assessment of the presence of significant biological resources and also identify of wetland areas. The potential for general wildlife habitat impacts or species specific impacts from the Proposed Project will be evaluated. If areas within the Buffalo River riparian area are determined to be wetlands, the Applicant would be required to conduct wetland delineations and also determine impact areas. The Applicant would also be required to develop an acceptable mitigation plan for impacts to riparian wetland vegetation from the HVTL crossing.

Birds

Wind parks have the potential to cause bird mortality due to collisions. The potential for bird mortality related to a wind park is dependant on a variety of factors including the amount of bird usage in the project area, the amount and proximity of potential habitat in the project area, turbine design and other local factors such as visibility. The Applicant conducted Spring and Fall bird counts in the Proposed Project Area in 2008 to estimate bird usage and the potential for Project related impacts (Tetra Tech, 2009x and Tetra Tech 2009 x). Point counts estimating bird usage were conducted at eight locations within the Proposed Windpark project area, five locations within one mile of the Proposed Windpark area and four locations along the Route 1 alignment, for a total of 17 survey locations. Detailed information regarding study design, survey methods, results and interpretations can be found in the "Spring 2008 Avian Survey – Noble Flat Hill Windpark, Clay County Minnesota" report (Tetra Tech, 2009x) and "Fall 2008 Avian Survey – Noble Flat Hill Windpark, Clay County Minnesota" report (Tetra Tech, 2009x). A discussion of the report findings is provided.

The survey results indicated that the Proposed Project Area receive a moderate amount of bird usage. A total of 77 species were observed during the Spring surveys and 68 species were observed during the Fall surveys. Species most commonly observed during the Spring and Fall counts are listed in Table 15. Based on the survey results, total bird usage and species richness were lower within the Proposed Windpark area as compared to the points located outside the Proposed Windpark area during both the Spring and Fall surveys. The higher bird usage and species richness outside of the Proposed Windpark area is likely due to the relatively low amount of native vegetation and habitat within the Proposed Windpark area and the presence of habitat features such as the Buffalo River State Park and native prairie tracts to the east and southeast of the Proposed Windpark (See Figure 15 for display of rare, sensitive and native habitats).

Risk factors were calculated for the species commonly observed during the Spring and Fall surveys. The risk factors are a calculation of the number of birds flying within the wind turbine rotor swept area (RSA) during the 20 minute survey. The RSA is an appropriate risk zone as the springing turbine rotors are an aspect of the wind turbines likely to cause mortality, and birds observed flying within the RSA are at risk of collision. Species that typically fly above (such as migration waterfowl) or below (such as various song birds) the RSA have less risk of mortality. Based on the spring surveys Canada goose, common grackle, mallard and barn swallow exhibit relatively high risk factors within the Proposed Project Area. For the Fall surveys Brewer's blackbird, red-winged blackbird, rusty blackbird, Canada goose, barn swallow and unidentified blackbirds exhibited relatively high risk. Based on the results of the Spring and Fall point count surveys conducted by the Applicant for the Proposed Project Area, some bird mortality would likely occur due to collisions with the wind turbines. Table 15 shows the type of species observed at least once per 20 minute point survey for Spring and Fall Surveys at 17 survey sites within and adjacent to the Proposed Project Area.

Table 15: Species for Spring and Fall Surveys

Species Common Name	Spring Survey	Fall Survey
Brewer's Blackbird		X
Red-winged Blackbird	X	X
Common Grackle	X	
Barn Swallow	X	X
Canada Goose	X	X
Mallard	X	
Bobolink	X	
Rusty Blackbird		X
American Goldfinch		X
American Crow		X
Unidentified Blackbird		X

Source: Spring 2008 and Fall 2008 Avian Surveys – Noble Flat Hill Windpark, Clay County, Minnesota.

Several studies have been conducted at wind parks across the Midwest that have attempted to quantify bird mortality from wind turbine collisions. A survey of the bird mortality at the Top of Iowa Windfarm located in Worth County, Iowa was conducted in 2003 and 2004 (Jain, 2005; Kofford, et al, 2004). The surveys resulted in calculations of bird mortality rates of approximately 0.3 and 0.8 birds/turbine/year. The study concluded that their estimate of bird mortality at the Top of Iowa Windfarm was similar to estimates of mortality for other wind parks in the western and mid-western states ranging from less than 1 bird/tower/year to 2.83 birds/tower/year. (Osborn et al., 2000; Erickson et al., 2002, 2004; Johnson et al., 2002; Young et al., 2003).

A four-year monitoring study estimating bird usage and mortality was conducted at the Buffalo Ridge Windfarm in Southwest Minnesota (Johnson et. al, 2000). The Buffalo Ridge Windfarm is a large project consisting of over 350 turbines that have been constructed in several phases using a variety of wind turbine designs and sizes. The study found that bird use near the wind park was significantly higher in wooded, wetland and grassland habitats as compared to cropland and CRP. The study concluded that some habitat avoidance by birds occurs within 100 meters of a wind turbine but that overall reduced bird usage within a wind park is relatively minor and not likely to have population consequences on a regional level. The Buffalo Ridge Study also pointed out that a benefit of habitat avoidance immediately adjacent to a wind turbine would be a reduction in the potential for wind turbine collision mortality to birds. Estimates of bird mortality from the four year Buffalo Ridge Windfarm study showed approximately 0.98 bird/turbine/year to 4.5 birds/turbine/year, across the three phases of the overall wind park. The survey also estimated bird mortality at reference sites outside of the windpark to be 1.1 birds/year, indicating that bird mortality at reference sites was actually higher than some areas of the windpark. The conclusion of the study was that overall bird mortality from the Buffalo Ridge Windfarm was minor and likely inconsequential from a population standpoint.

The land cover within the Proposed Project Area is mainly agricultural crops and with only small amounts of vegetated forest, wetland or grassland habitats present. The general habitat conditions near the Proposed Project are similar to those for both the Top of Iowa and Buffalo Ridge Windfarms. The Proposed Project is within the Mississippi Flyway but is not immediately adjacent to large wetland habitats or wildlife refuges that would be heavily used as staging and migration areas near the Proposed Windpark. Bird mortality for the Proposed Project is expected to be within the range of mortality observed at the Top of Iowa Windfarm and Buffalo Ridge Windfarm, which was determined to be minor for both projects. The total amount of bird mortality that may occur as result of the Proposed Project is not known but is anticipated to be low, resulting in local but not population level impacts.

Raptors

Raptors were observed within the Proposed Project Area during the Spring and Fall counts, with the most common species including northern harrier, American kestrel, red-tailed hawk, merlin, and turkey vulture. Bald Eagles were also observed during the surveys, with two individuals observed during the Spring surveys and five individuals observed during the Fall surveys. The overall raptor use of the areas within and adjacent to the Project Area was low, which equated to low calculated risk factors for all raptor species. There is the potential for collision mortality to raptors as a result of the Proposed Project. However, for all species observed during the surveys, total mortality is expected to be low, resulting in local but not population level impacts to raptors. Fatalities due to electrocution can also occur when birds with large wingspans, such as raptors, either come in contact with two conductors or a conductor and a grounding device. The transmission lines for 230 kV HVTL for the Proposed Project would provide adequate spacing to eliminate the risk of electrocution to raptors and other birds with large wing spans.

Bats

Bats typically utilize farm buildings and dead and dying trees with cavities and loose bark as roosting and maternity habitat. Bats typically use forests, riparian corridors and wetlands as feeding habitats due to higher nocturnal insect densities in these areas. There is minimal native vegetation that would serve as wildlife habitat within the Proposed Project Area. However, little is known about bat usage in the Proposed Project Area. The Applicant has initiated an acoustic survey to gather information on bat passage rates in the various habitats of the Proposed Project Area. As discussed under potential impacts to birds above, the landscape and available habitat within the Proposed Project Area is similar to the Top of Iowa and Buffalo Ridge Windfarm projects. Studies at the Top of Iowa Windfarm estimated bat mortality over a two year study to range from 6 to 9 bats/turbine/year (Jain, 2005), which was higher than other comparative studies. Bat mortality estimates at the Buffalo Ridge Windfarm were estimated to range from 0.25 to 2.0 bats/turbine/year (Johnson et. al, 2000). There are bats in the Proposed Project Area and some wind turbine collision bat mortality is likely to occur as a result of the Proposed Project. However, compared to birds less is known about bat populations and habitat preferences on a local, regional or national level. The estimated bat mortality from the Proposed Project would be expected to be similar to the estimates from other wind park sites such as the Buffalo Ridge Windfarm.

Mitigation

Fisheries

Based on the preliminary turbine array, construction of the wind turbines, access roads or associated facilities would not be in close proximity to the Buffalo River. Construction of the Proposed HVTL would cross the Buffalo River, but transmission line poles would not be placed within the river and required construction BMPs would limit impacts to water quality or aquatic habitat required by the fish community. The Proposed Project would not result in impacts to aquatic habitat, fish community or angling activity of the Buffalo River and as a result no mitigation is recommended.

Wildlife

The Proposed Project would result in a minimal loss of native vegetation that provides significant wildlife habitat. The majority of construction activities and land alterations for the wind turbines, access roads, associated facilities and HVTL would occur on agricultural lands. Based on the preliminary turbine array and Proposed HVTL routes, the Proposed Project would not impact the wildlife habitat within natural areas such as the Buffalo River State Park, WMAs, Scientific and Natural Areas or native prairie tracts. The Applicant was originally considering a larger overall project area that extended several miles to the east of State Highway 9. This area contains a greater amount of native prairie and wetland habitat as well as WMAs, and as a result would have more wildlife species utilizing the area (Figure 15). Based on consultations with agencies such as the MDNR, the Applicant shifted the project area to the current 20,000 acre alignment and no turbine would be located east of State Highway 9 (Figure 1).

A concern with the past construction of some windparks was the absence of consideration of potential wildlife impacts during siting and design. By coordinating with MDNR on potential habitat and wildlife impacts and shifting the overall project area to avoid sensitive habitats, the Applicant has taken measures during the planning stages of the project to minimize potential wildlife impacts. As required by the Draft Site Permit, the Applicant will conduct a pre-construction inventory of existing biological resources, native prairie, and wetlands in the Proposed Project Area (Appendix D). The Applicant will use the results of the pre-construction biological survey to minimize and avoid impacts to wildlife and sensitive native habitats during final project engineering and design of wind turbines, access roads and transmission line pole placement. If it is determined that impacts would occur the Applicant will coordinate with the MDNR or other appropriate agencies to develop an acceptable mitigation strategy as required by the Draft Site Permit.

Birds

Some previously constructed windparks have failed to take wildlife habitat and bird usage into account during the engineering, design and site location process of a project. Additionally, surveys of existing habitats or bird usage within a selected project area was not determined prior to construction, which made it difficult to determine project related impacts after the windpark was operational compared to pre-project conditions.

The Applicant has worked closely with the agencies in Minnesota, such as the MDNR, to avoid areas with significant native habitats for the location of the Proposed Project. The final Proposed Project Area has been shifted by the Applicant to avoid native prairie tracts and WMAs east of State Highway 9. The final project area has a limited amount of native habitat and consists mostly of actively farmed agricultural uses, which would result in minimal impacts to wildlife habitat. The Applicant has also conducted pre-construction bird usage surveys and plans to conduct post construction monitoring as well. The post-construction monitoring surveys will include estimates of mortality. As required, the Applicant will also conduct a pre-construction inventory of existing biological resources, native prairie, and wetlands in the Proposed Project Area (Appendix D). As discussed in Section 6.4.4.2, bird mortality related to wind turbines is expected to be minor for the Proposed Project, similar to the mortality estimates for other wind parks, which have not resulted in significant population level impacts to birds.

By conducting pre and post monitoring bird usage surveys and mortality estimates, the Applicant has provided the MDNR with valuable information that can be utilized by the MDNR for further direction of windpark siting, permitting and regulation. If significant bird morality for wind turbine collision is documented after construction, it is recommended that the Applicant consult the MDNR or other appropriate agency to determine if modifications to the Proposed Windpark can be made to reduce bird mortality or if an alternate acceptable mitigation strategy can be developed.

Bats

As described above under wildlife mitigation, the Applicant has worked closely with the agencies in Minnesota, such as the MDNR, to avoid areas with significant native habitats for the location of the Proposed Project and shifted the final Proposed Project Area to avoid native prairie tracts and WMAs east of State Highway 9. By shifting the project site away from natural habitats, the Applicant has attempted to minimize impacts to bats. However, because bat use is unknown, and potentially suitable habitat for bats is present in shrubby areas and near draws, lakes and wetlands, the Applicant has initiated an acoustic survey to gather information on bat passage rates in the various habitats of the Proposed Project Area. The Applicant will analyze the results of the acoustic bat monitoring surveys during final design and engineering to minimize impacts to bats. If it is determine that significant impacts to bats may occur, the Applicant will coordinate with the MDNR or other appropriate agency to develop an acceptable mitigation strategy to offset project related impacts to bats.

6.4.5 Land Cover

Affected Environment

The map of the natural vegetation of Minnesota (Coffin and Pfannmuller, 1988) identifies the area of Clay County for which the Proposed Project is located in, as historically upland prairie and prairie wetland. Upland prairie vegetation includes bluestems, Indian grass, needle grass, grama grasses, composites, and other forbs. Prairie wetland vegetation includes blue-joint grass, cord grass, cattails, rushes, and sedges. Tallgrass prairie is a climax vegetation community that was adapted to thrive amidst harsh natural disturbances such as periodic fires, drought, and extreme temperature (Thompson, 1992). As a result of settlement in the mid-1800s, the rich prairie soils of the Red River Valley were converted into farmland. During this process, the wetland areas were frequently ditched and drained. Only a small fraction of the original prairie and wetlands remain as relic habitats. With the settlement of the area natural disturbances such as fires were suppressed, which allowed trees to begin to colonize the area. This was especially true for areas that were not plowed or cultivated, such as along stream and river corridors. Additionally, trees were planted by landowners for shelter belts (windrows and homestead groves).

According to the MDNR Natural Heritage Database (MDNR 2007) numerous prairie types have been identified in Clay County east of the Proposed Project Area. Prairie habitat types include; Dry Sand – Gravel Prairies, Mesic Prairies, Wet Bush Prairies, Wet Prairies, Wet Saline Prairies, Wet Seepage Prairies, and several undetermined native plant communities. The majority of these prairie habitats are Wildlife Management Areas (WMAs) managed by the U.S. Fish and Wildlife Service (USFWS). Additional prairie habitats are located in portions of the Buffalo River State Park and within Scenic and Natural Areas (SNAs) that are managed by the MDNR. There are also remnant prairie and wetland areas that are owned and managed by The Nature Conservancy, southeast of the Proposed Project Area. According to the Clay County Comprehensive Plan the prairie resources in the county vary in quality from low, modest, medium, and high significance. The prairie designated as medium or high significance represents the least disturbed and best example of native prairie remaining in the State.

Land cover information was acquired from the United States Department of Agriculture (USDA), National Agricultural Statistics Service (NASS), Research and Development Division (RDD), Geospatial Information Branch (GIB), Spatial Analysis Research Section (SARS).

The USDA, NASS 2007 Minnesota Cropland Data Layer (CDL) is a raster, geo-referenced, crop-specific land cover data layer. The CDL is produced using satellite imagery from the Indian Remote Sensing RESOURCESAT-1 (IRS-P6) Advanced Wide Field Sensor (AWiFS) collected during the current growing season. The purpose of the CDL is to use satellite imagery to provide acreage estimates to the Agricultural Statistics Board for the state's major commodities and produce digital, crop-specific, categorized geo-referenced output products. The strength and emphasis of the CDL is agricultural land cover. A large amount of Clay County is agricultural so therefore this dataset is more relevant than general land cover databases and is updated more frequently than nationwide land cover databases. Land cover within the Windpark area is summarized in Table 16. Land cover along the Routes is summarized in Table 17.

According to the 2007 NASS dataset land cover types in the Proposed Project Area is composed primarily of cultivate lands, rural residential and farmstead properties (Figure 14). Major crops include corn, soybeans, spring wheat and sugar beets. Other crops in the area include alfalfa, barley, canola, dry beans, and sunflowers. Range and pasture lands are used to graze cattle, sheep, and horses. There are over 240 acres of grasslands and grass/pasture non-agricultural cover in the windpark. Some of the grassland or grass/pasture non-agricultural cover types within the Proposed Project Area are likely enrolled in the Conservation Reserve Program (CRP). CRP land is typically covered by brome grasses, orchard grass, and alfalfa. The CPR lands are typically enrolled in the program for 10-year cycles.

Non-farmed cover types within the Proposed Windpark include approximately 24 acres of deciduous forest, 434 acres is woody wetlands, 55 acres of herbaceous wetlands, 1,365 acres of developed open space and 49 acres of low/medium intensity developed lands. Natural habitats constitute a small portion of the total area with deciduous forest accounting for less than one percent and woody wetland accounting for less than two percent of the area within the windpark. Generally, the forest and woody wetland areas are isolated groves or windrows established by the landowner/ farmers to prevent wind erosion and shelter dwellings or areas within the riparian zone of the Buffalo River.

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Table 16: Land Cover within the Windpark Area Based on 2007 NASS Dataset.

Cover Type	Acres
Corn	2,936.7
Deciduous Forest	24.2
Developed Low/Medium Intensity	49.1
Developed Open Space	1,365.3
Grass/Pasture Non-Agricultural	237.6
Grassland	5.1
Open Water	27.7
Soybeans	5,729.4
Spring Wheat	5,567.7
Sugar Beets	2,860.3
Other Crops(1)	559.6
Herbaceous Wetlands(2)	54.9
Woody Wetlands(2)	433.9
Total Acres	**19,851.5**

(1) : Other crops include alfalfa, barely, canola, dry beans, and sunflowers.

(2) : NWI wetland dataset identified 38.5 acres of wetland in Proposed Project Area. The majority of woody wetlands in the NASS Land Cover dataset are associated with riparian areas of the Buffalo River. The NWI did not identify the riparian areas of the Buffalo River as wetlands. Wetland delineations will be conducted for identified wetlands that have the potential to be impacted by the Proposed Project.

Table 17 summarizes the 2007 NASS land cover for the entire length of each, including those segments located within the Proposed Windpark area. Therefore some of the land cover acreages may overlap with the acreages presented in Table 16.

Table 17: Land Cover within the Route 1, Route 2, and Route 2A HVTL Alignments[1] based on the 2007 NASS Dataset.

	Cover Type	Acres
Route 1	Corn	10.7
Route 1	Deciduous Forest	1.3
Route 1	Developed Low/Medium Intensity	27.1
Route 1	Developed Open Space	244.8
Route 1	Grass/Pasture Non-Agricultural	10.5
Route 1	Grassland	--
Route 1	Open Water	0.7
Route 1	Soybeans	61.4
Route 1	Spring Wheat	33.1
Route 1	Sugar Beets	12.4
Route 1	Other Crops[2]	3.5
Route 1	Herbaceous Wetlands	3.3
Route 1	Woody Wetlands	4.7
Total Acres		**413.5**
Route 2	Corn	45.6
Route 2	Deciduous Forest	1.3
Route 2	Developed Low/Medium/High Intensity	16.7
Route 2	Developed Open Space	108.2
Route 2	Grass/Pasture Non-Agricultural	2.6
Route 2	Grassland	--
Route 2	Open Water	0.1
Route 2	Soybeans	71.9
Route 2	Spring Wheat	60.2
Route 2	Sugar Beets	41.3
Route 2	Other Crops[2]	2.7
Route 2	Herbaceous Wetlands	3.4
Route 2	Woody Wetlands	8.1
Total Acres		**362.1**
Route 2A	Corn	37.6
Route 2A	Deciduous Forest	0.1
Route 2A	Developed Low/Medium Intensity	8.0
Route 2A	Developed Open Space	113.7
Route 2A	Grass/Pasture Non-Agricultural	1.4
Route 2A	Grassland	--
Route 2A	Open Water	--
Route 2A	Soybeans	89.5
Route 2A	Spring Wheat	85.3
Route 2A	Sugar Beets	40.7
Route 2A	Other Crops[2]	--
Route 2A	Herbaceous Wetlands	--
Route 2A	Woody Wetlands	6.3
Total Acres		**382.6**

(1): Route 1 and 2 areas include 300' alignment but exclude alignment area within Windpark.
(2): Other crops include alfalfa, barely, canola, dry beans, and sunflowers

Within the Route 1 HVTL alignment the most prevalent land cover types include developed open space, soybeans and developed low/medium intensity lands. These three land cover types account for approximately 90 percent of the lands within the Route 1 alignment. Other land cover types present in lesser amounts include corn, sugar beets, woody and herbaceous wetlands and deciduous forests.

Within the Route 2 HVTL alignment the most prevalent land cover types include developed open space, soybean, sugar beets and spring wheat. These four land cover types account for approximately 82 percent of the lands within the Route 2 alignment. Other land cover types present in lesser amounts include developed low/medium/high intensity lands, corn, woody and herbaceous wetlands, other crops and deciduous forests.

Within the Route 2A HVTL alignment the most prevalent land cover types include developed open space, soybeans, and spring wheat. These three land cover types account for approximately 75 percent of the land within the Route 2A alignment. Other land cover types present in the Route 2A alignment include sugar beets, corn, developed low/medium intensity land, and woody wetlands.

Impacts

Windpark

The amount of land cover that would be impacted as a result of the Proposed Project would be calculated once a final site layout is determined. Based on the preliminary wind turbine array and estimated length of access roads, approximately 65 acres of the Proposed Project Area would be permanently impacted by the Project facilities. The existing land cover would be permanently removed and replaced by wind turbines, access roads, and transformers. The Proposed Project would also involve building a new substation and an operations and maintenance facility, which would involve temporarily disturbing approximately eight acres of land and permanently disturbing approximately two acres of land. Additional areas may also be disturbed for underground collector lines during construction. However, these impacts would be temporary and the disturbed lands would be restored to their original land cover type after installation of the underground collection system. Approximately 465 acres of land would be temporarily affected for contractor staging and lay down areas. Temporarily disturbed agricultural areas would be reseeded, by the Applicant, with a stabilizing crop such as wheat or rye. Non-crop lands would be seeded and stabilized after construction is complete and would be allowed to naturally re-vegetate to allow new vegetation to blend in with existing vegetation. Only two percent of the entire Proposed Property Area is covered by deciduous forest and the preliminary placement of the turbines is not within a forested area.

Transmission Line Routes

The Route 1 and Route 2 would mainly occur along roads and agricultural lands that have been previously disturbed. Impacts to native vegetated habitat types are expected to be minor. The Applicant will conduct a comprehensive onsite biological assessment of the determined transmission line route, substation parcel, and switching station parcel prior to construction activities. Efforts will be required to assure that any identified prairie remnants and threatened and endangered species would be avoided near the route. The Applicant would be required to adhere to water and soil conservation practices during construction of the Proposed Project to protect adjacent water resources and minimize soil erosion, thus protecting essential habitat.

Mitigation
Some amount of land cover would be disturbed temporarily due to construction, while additional lands would be permanently altered to construct the wind turbines, access roads, transformers, a substation, an operations and maintenance facility and HTVL poles. Based on the preliminary turbine array the majority of construction activities and land cover alterations would take place on agricultural lands. Significant impacts to vegetated land cover habitats as a result of the Proposed Project are not anticipated. As required in the Draft Site Permit, the Proposed Project has been designed to minimize impacts to vegetated land cover habitats by the following measures:

- Conduct a pre-construction inventory of the Proposed Project Area for existing wildlife management areas, scientific and natural areas, recreation areas, wetlands, native prairie, and forests;
- Exclude established wildlife management, recreation and scientific and natural areas from consideration for wind turbine, access road, or electrical line placement;
- Avoid disturbance to wetlands during construction and operation of the Project. If jurisdictional wetland impacts are proposed, then the Applicant would apply for the appropriate wetland permits and develop an acceptable mitigation strategy;
- Minimize the need to clear existing trees and shrubs;
- Avoid disturbance to native prairie. If native prairie impacts are necessary, the Applicant would be required to prepare, with the advice of the MDNR and any others selected by the Applicant, a prairie protection and management plan. The plan will be submitted to the PUC and MDNR after issuance of the site permit and prior to construction. Project facilities including wind turbines, foundations, access roads, underground collector lines, and transformers, shall not be placed in native prairie unless addressed in the prairie management plan. Measures to be taken to mitigate unavoidable impacts to native prairie would be agreed to by the Applicant and the MDNR; and
- The Applicant would be required to use BMPs to protect topsoil and adjacent resources and to minimize soil erosion. Practices may include containing excavated material, protecting exposed soil and stabilizing restored material, re-vegetating non-cropland and range areas with wildlife conservation species and, wherever feasible, planting native tall grass prairie species in cooperation with landowners.

6.5 IMPACTS ON RARE AND UNIQUE NATURAL RESOURCES

The native landscape in Minnesota has been altered as a result of human activities such logging, agriculture and mining. The Proposed Project would be located in Clay County which consisted mainly of prairie vegetation prior to European settlement. The widespread conversion of the native prairie landscape to agriculture uses resulted in a reduction or loss of many native plants, animals or ecological communities within Clay County. The Proposed Project would result in further disturbance of the landscape. An examination of potential impacts to rare or unique plant species, animal species and native communities and habitats in Clay County resulting from the Proposed Project is provided.

Affected Environment
The MDNR and the USFWS maintain a list of threatened and endangered plant and animal species. The Natural Heritage Information System (NHIS) contains known records of threatened, endangered and special concern species as well as rare or unique natural communities. NHIS data for Clay County was obtained from the MDNR for use in this Draft EIS. The MDNR also provided information regarding high quality habitats in Clay County, which was gathered during the Minnesota County Biological Survey (MCBS) program. The MCBS identifies significant natural communities that are important to plant and animal species within Minnesota, with examples of these communities including sedge meadow, bulrush marsh or red pine-white pine forests.

A review of the NHIS records revealed that there are no federally threatened or endangered plant species within one mile of the Proposed Project Area, including the Windpark and HVTL Routes 1, 2 and 2A. Additionally the NHIS records revealed that there are no federally threatened or endangered animal species within one mile of the Proposed Project Area. The search of the NHIS records revealed that there are three plant species listed as special concern species by the MDNR within one mile of the Proposed Project Area including the species northern gentian, small white lady slipper and felwort. The NHIS records also included two native prairie grass species, Alkali cord-grass and alkali-grass, that are monitored by the MDNR even though they do not have a listing status. The NHIS records indicate that there are no animal species listed as endangered in Minnesota within one mile of the Proposed Project Area. There is one animal species listed as threatened and three species listed as special concern in Minnesota within one mile of the Project Area. Wilson's phalarope is a bird listed as threatened in Minnesota, marbled godwit and greater prairie chicken are bird species listed as special concern species in Minnesota and the black sand shell is a freshwater mussel species listed as special concern in Minnesota.

Information related to the life history and habitat requirements of the above plant and animal species was obtained from the MDNR rare species guide website (www.dnr.state.mn.us/rsg/index.html). A brief description for each identified plant and animal species is provided.

Plants

As indicated by its name, the small white lady's-slipper is a short plant with white flowers that typically reaches a height of eight inches or less. The MDNR has not completed a species profile for the small white lady's-slipper, but information on the species has been gathered by the Michigan State University Extension (http://web4.msue.msu.edu/mnfi/abstracts/botany/Cypripedium_candidum.pdf). Plants are typically found in dense clumps and the non-flowering specimens can be difficult to identify. The habitat where the small white lady's-slipper is typically found includes prairie wetlands and fens, including wetlands with alkaline conductions or groundwater seepage. The small white lady's-slipper has been documented in 50 counties in Minnesota, mainly along the western and southern borders of the state. The main threat to small white lady's-slipper is the loss of prairie wetland habitats or the lack of fire in prairie habitats which allow the invasion of woody shrubs and the displacement of the species.

Felwort is a fairly short, erect plant with blue to purple flowers that ranges from 1 to 2.5 feet in height. It is mainly found in wet meadows or bogs. Felwort has been documented in only five counties in northwest Minnesota; however it is found throughout the western half of the United States as well as all of Canada, north to Alaska. The loss of the preferred wetland habitats likely poses the greatest threat to the species in Minnesota.

The northern gentian is known in only eight counties in northwest Minnesota; however it is found throughout the western half of the United States as well as the western Canadian provinces. It is found mainly in wet meadows or along stream banks.

Nuttall alkaligrass is a short bunch-grass that grows one to two feet in height, forming erect spreading clumps (Johnson and Larson, 2007). This species is native to grasslands, and is typically found in seasonally wet soils that are alkaline or saline. It is often found with alkaline cordgrass or prairie cordgrass. It can be found across South Dakota, Minnesota and Wisconsin.

Alkali cordgrass is similar to prairie cordgrass but is much shorter, at only two to three feet in height compared to up to eight feet in height for the more widespread prairie cordgrass (Johnson and Larson, 2007). Alkali cordgrass is generally limited to wet alkali or saline meadow habitats. It is found in these habitats in South Dakota but its range is Minnesota appears to be fairly limited, confined to areas of the Red River Valley.

Animals

The Wilson's phalarope is a long-legged shorebird that is most commonly found in wetland habitats such as wet prairies, fens or other grass or sedge dominated wetlands in Minnesota. An important microhabitat feature preferred by the Wilson's phalarope is abundant short vegetation in or adjacent to shallow open water. As a result, human altered habitats such as shallow pastures provide suitable conditions for the species. In Minnesota the Wilson's phalarope is considered a priority species under the MNDNR Nongame Wildlife Program 10 year strategic plan. The Wilson's phalarope has been documented in 32 counties in Minnesota, but it is most common in the western and northern most counties.

The marbled godwit is a large shorebird that can be up to 20 inches in height as is often distinguished from other shorebirds by its very long slender bill that can be up to five inches. The marbled godwit prefers native grasslands with fairly sparse cover that are adjacent to wetlands. In Minnesota, marbled godwits utilize moderately grazed pasture or wet prairies interspersed with wetlands such as sedge fens. These areas provide the invertebrate food source required by the godwits. The loss of semi-permanent and permanent wetlands, along with the conversion of grasslands to row crops results in a loss of the habitats required by the marbled godwit and presents the biggest threat to the species. The marbled godwit has been documented in 22 counties in Minnesota, with nesting verifies in 11 of those counties.

The greater prairie chicken is brown bird that has a short, round appearance. Habitats required by greater prairie chickens includes dense undisturbed grasses, 12-15 inches high for nesting and open areas with very short cover are utilized for courtship activities. The greater prairie chicken in typically associated with native prairies and grasslands in Minnesota, often adjacent to crop lands as a food source. Currently, the greater prairie chicken is found in 20 counties in Minnesota. The greatest threat to greater prairie chickens is the loss of required habitats, including large open treeless landscapes. As grassland areas are converted to croplands, the habitat and range of the species within Minnesota is reduced.

The black sandshell is an elongate mussel that is approximately eight inches long. It is typically found in riffle or run areas, with hard sand or gravel substrates. The black sandshell is normally found in medium to large rivers where is spends most of its life cycle buried in the substrate, gathering food as a filter feeder. The mussel can be very long lived, surviving for many decades. Long term threats to the black sandshell include manipulation of the habitat for navigation in large rivers, such as the Mississippi, non-point source pollution and degradation of riffle habitats from sediment pollution.

Impacts

There are no known occurrences of federally threatened or endangered plant or animal species within one mile of the Proposed Project Area. A review of the NHIS records obtained from the MDNR revealed that there are five state listed plant species and four state listed animal species located within one mile of the Proposed Project Area. Table 18 summarizes the NHIS records for species identified within one mile of the Proposed Project Area, state and federal listing status of each species and number of known occurrences within one mile. The locations of the state listed plant and animals species within one mile of the Proposed Project Area are displayed in Figure 15. In accordance with MDNR rules for NHIS data the locations can be displayed and the locations can be identified as threatened or endangered plants or animals. However, the specific locations of the each individual identified species can not be displayed. If actual locations of individual rare, sensitive, threatened or endangered species were revealed there is the danger that the species could be inadvertently harmed by people who go to observe the species or by poachers seeking to collect, capture, kill or sell the species for gain or profit.

Table 18: Summary of NHIS records of threatened, endangered or special concern plant and animal species within one mile of the Proposed Project.

Common Name	Scientific Name	Occurrences within 1 Mile	Federal Status	MN Status	State Rank(1)
Plants					
Northern Gentian	Gentiana affinis	1	None	Special Concern	S3
Small White Lady's-slipper	Cypripedium candidum	1	None	Special Concern	S3
Felwort	Gentianella amarella ssp. Acuta	1	None	Special Concern	S3
Alkali Cord-grass	Spartina gracilis	3	None	None	S4
Nuttall Alkaligrass	Puccinellia nuttalliana	2	None	None	SNR
Animals					
Wilson's Phalarope	Phalaropus tricolor	1	None	Threatened	S2B
Marbled Godwit	Limosa fedoa	5	None	Special Concern	S3
Greater Prairie-chicken	Tympanuchus cupido	8	None	Special Concern	S3B
Black Sandshell		2	None	Special Concern	S3

Notes:

(1) S1: Critically imperiled in Minnesota because of extreme rarity or because of some factor(s) making it especially vulnerable to extirpation from the state.
S2: Imperiled in Minnesota because of rarity or because of some factor(s) making it very vulnerable to extirpation from the state.
S3: Vulnerable in Minnesota either because rare or uncommon, or found in a restricted range, or because of other factors making it vulnerable to extirpation.
B: Breeding: Basic rank refers to the breeding population of the element in Minnesota.

A summary of the number of occurrences of special concern plant species and special concern and threatened animal species within the Proposed Project Area is provided in Table 19. The specific plant and animal species are not identified as this would be in violation of the rules governing use of NHIS data provided by the MDNR. The summary table indicates that of the eight known occurrences of special concern plant species from the NHIS database, two occur within the Proposed Windpark, one occurs within the Route 1 alignment and there are no occurrences of listed plant species within the Route 2 or Route 2A alignments (Figure 15). The remaining four known occurrences of listed plant species occur to the east of the Proposed Project Area. There are 16 known occurrences of state listed special concern or threatened animal species within one mile of the Proposed Project Area from the NHIS database. Of the 16 known occurrences, seven are located within the Proposed Windpark, one is located within Route 1, one is located within Route 2 and none are located within Route 2A (Figure 15). An additional seven of the 16 identified occurrences of state listed animal species from the NHIS records are located to the east of the Proposed Project Area (Figure 15).

Table 19: Comparison of state listed special concern and threatened plant and animal species within Proposed Windpark and HVTL Routes.

Common Name	Know Occurrences of Threatened and Endangered Species					
	Total	Windpark	Route 1	Route 2	Route 2A	Additional Within 1 Mile
Plants	8	2	1	0	0	4
Animals	16	7	1	1	0	7

An analysis of the land cover and vegetation within the Proposed Project Area is provided in Section 6.4.5. The vast majority of land within the Proposed Project Area is row crop agricultural land uses. The five identified plant species from the NHIS dataset within one mile of the Proposed Project are found in native prairie or native wetland habitats. These habitat types are not prevalent within the Proposed Project Area. All of the known occurrences of native prairie or wetland habitats that could support the five identified special concern plant species are located east of the Proposed Project Area (Figure 15). As required by the Draft Site Permit, wind turbines, access roads, transmission line poles or other associated project facilities can not be located within native prairie or within identified wildlife management areas.

As a result the Proposed Project is not anticipated to result in significant impacts to the five plant species identified from the NHIS dataset within one mile to the Proposed Project Area.

There is one state-listed threatened animal species and three special concern species from the NHIS dataset within one mile of the Proposed Project Area. The threatened species Wilson's phalarope utilizes native wetland habitats for feeding and nesting. The required habitats for Wilson's phalarope are not prevalent within the Proposed Project Area but some potential habitat likely exists to the east of the Project Area. Due to the distance of the wind turbines from the potential habitat, the Proposed Windpark would not likely result in habitat avoidance behavior for the species. Spring and fall bird surveys were completed in 2008 by the Applicant for the Proposed Project, during which a Wilson's phalarope was observed. Wind parks are known to create direct mortality to birds and there is the potential the Proposed Windpark may cause mortality to Wilson's phalarope. Impacts would be to local individuals and not create adverse population level impacts for the species.

The special concern bird species identified within one mile of the Proposed Project Area include the marbled godwit and the greater prairie chicken. The preferred habitat for these species includes native prairie and wetland habitats, with short vegetative cover for feeding, nesting and breeding. The required habitats are not prevalent within the Proposed Project Area. As required by the Draft Site Permit, project facilities would not be constructed within native habitats such as prairies or wetlands identified in the Proposed Project Area. Spring and fall bird surveys were completed in 2008 by the Applicant for the Proposed Project, during which greater prairie chicken and marbled godwit were observed. Wind parks are known to cause mortality to birds and there is the potential that the Proposed Windpark may cause mortality to marbled godwit or greater prairie chicken, however these impacts would likely be to local individuals and not create population level impacts for either species.

The black sandshell is a mussel species that requires hard substrates in medium to large sized rivers. The Proposed Project is adjacent to the Buffalo River in Clay County. The facilities associated with the Proposed Windpark with not impact the Buffalo River directly or indirectly. All of the three identified HVTL route alternatives would be required to cross the Buffalo River. The Applicant would be required to obtain a permit for a utility to cross a public water from the MDNR. The conditions of the permit would not likely allow the placement of HVTL poles with the channel of the Buffalo River and as a result direct impacts to the black sandshell or their preferred habitat would not result from the construction of the Proposed HVTL, regardless of the route alternative selected. Depending of the final pole spacing for the Proposed HVTL, some poles may be placed within the riparian area of the Buffalo River. The Applicant will be required to protect the water quality of the river from sediment or erosion impacts through the NPDES construction permit for the Proposed Project. Significant impacts to the habitat of the black sandshell from the construction of the Proposed HVTL are not anticipated.

Known locations of native vegetated communities and sites of biodiversity significance are provided in the MCBS dataset for Clay County and within the NHIS dataset. The native vegetated communities within one mile of the Proposed Project Area are displayed in Figure 15. There are no known records of native vegetated communities or sites of biodiversity significance within the Proposed Project Area. All of the known areas of native vegetated habitats and sites of biodiversity significance are located east of the Proposed Project Area (Figure 15)

Mitigation

The NHIS records revealed there are five state listed plant species and four state listed animal species within one mile of the Proposed Project Area. In the Site Permit Application and Route Permit Application the Applicant proposed the following measures to minimize or avoid project related impacts to federal and state listed species and rare or sensitive habitat:

- Conduct a pre-construction inventory of existing biological resources, native prairie, and wetlands in the Proposed Project Area;

- Avoid or minimize disturbance of individual wetlands or drainage systems during construction of the Proposed Project;
- Conduct Fall and Spring Avian Point County Survey for the Proposed Project Area;
- Conduct Acoustical Bat Survey for the Proposed Project Area;
- Avoid or minimize placement of turbines in high quality native prairie.
- Implement erosion and sediment control practices for work conducted near the river or stream areas.

During the Site Permit Application and Route Permit Application process the Applicant conducted consultations with the MDNR, USFWS and NRCS related to avoiding potential project related impacts to threatened and endangered plant and animal species, as well as sensitive habitats and biological communities. As requested by the MDNR an USFWS, the Applicant has shifted the location of the Proposed Project Area to the west to avoid the identified native vegetated habitats, sites of biodiversity significance and greater prairie chicken booming ground located to the east of State Highway 9. As displayed in Figure 15, all of the native vegetated communities, sites of biodiversity significance and greater prairie chicken booming grounds are located to the east of State Highway 9, outside of the current Proposed Project Area.

Significant impacts to threatened, endangered or special concern listed plant and animal species are not anticipated as a result of the Proposed Project. Due to the limited amount of preferred habitat required by the identified listed plant and animals species within the Proposed Project, potential impacts are anticipated to be small. However, wind parks are known to cause mortality for bird species. Pre-construction surveys observed the species such as Wilson's phalarope, marbled godwit and greater prairie chicken were observed in vicinity of the Proposed Project. There is the potential for the Proposed Windpark to cause mortality to sensitive bird species but these impacts are anticipated to be small, occurring to local individuals and not resulting in population level impacts. As requested by the MDNR, the Applicant would conduct post construction monitoring for birds and bats in the Project Area. In the event that significant impacts to state listed bird or other wildlife species are determined during post-construction monitoring, the Applicant would work with DNR or other appropriate agencies to determine acceptable mitigation strategies and complete the MDNR endangered species takings permit process if requested.

As required by the Draft Site Permit the Applicant will conduct a biological survey of the Proposed Project Area prior to construction (see Appendix D). The biological survey will search for native prairies, forests, wetlands or biologically sensitive areas within the Proposed Project Area. The results of the survey will be submitted to the MDNR and PUC for review and consultation. The conditions of Draft Site Permit prohibit the placing of wind turbines, access roads, transmission line poles or other associated facilities within identified native prairie habitats or sensitive areas. In the event that native communities or sensitive habitats are identified during the biological survey of the Proposed Project Area, the Applicant will work with the MDNR and PUC to develop the proper avoidance and mitigation measures to minimize the potential for impacts to the identified habitats from the Proposed Project. The Draft Site Permit also requires the Applicant to prepare and submit a prairie protection and restoration plan to the PUC and MDNR in the event that native prairie habitats are observed during the biological survey of the Proposed Project Area. The prairie protection and restoration plan would include measures to avoid project related impacts to native prairie habitats. As described in the Draft Site Permit, the Applicant will be required to mitigate unavoidable impacts to native prairie habitats through restoration or management of other native prairie areas in degraded conditions, through conservation easements or by other acceptable means agreed to by the PUC and MDNR prior to construction.

7.0 Other Considerations

The Proposed Project has the potential to create environmental impacts and consume resources within Clay County. The specific detailed analysis of potential environmental impacts from the Proposed Project is provided in Chapter 6. An EIS for a proposed action includes a summation of the significant environmental impacts and resource consumption determined during the environmental review analysis. This chapter provides a summary of the significant and unavoidable adverse impacts, irreversible or irretrievable commitment of resources, and comparison of route alternatives analyzed for the Proposed Project.

7.1 SIGNIFICANT UNAVOIDABLE ADVERSE IMPACTS

Typically, unavoidable adverse impacts from wind park and HVTL projects result from physical impacts to the land associated with construction of project facilities and from visual impacts on the surrounding landscape. The Proposed Project would have both temporary and long-term significant impacts on agricultural land use and aesthetic factors. Mitigation measures for the impacts identified and described in Chapter 6 of this Draft EIS would be implemented to minimize these unavoidable adverse environmental impacts.

Prime Farmland
Temporary impacts are caused by construction activities, while permanent impacts result from the placement of structures and access roads. The Applicant has estimated that approximately 465 acres of prime farmland would be temporarily impacted by construction of the Proposed Windpark. It is estimated that 65 acres of farmland would be permanently taken out of agricultural production by the Proposed Windpark and associated facilities. Mitigation for these impacts includes avoiding productive farmland to the extent possible for the siting to wind turbines and access roads.

Temporary impacts caused by the construction, staging, and stringing operations for the Proposed HVTL route alternatives would occur. The Applicant is proposing to locate the majority of the routes within existing right-of-way (i.e. road, railroad, utility), which would avoid significant permanent impacts to prime farmland.

The Draft Site Permit requires that measures to minimize soil compaction are taken during all phases of the Proposed Project. Transmission line poles would be placed as much as possible within the existing right-of-way, which would minimize permanent impacts to agricultural land. Efforts would be made to stage construction within the right-of-way areas and in previously-disturbed areas, to the extent possible. If additional areas are needed temporarily for construction, temporary easements would be obtained from affected landowners. Work in agricultural areas could be performed during winter months and when soils are not saturated to minimize the potential for soil compaction. The Applicant would compensate landowners for unavoidable crop damage and soil compaction that occurs during project construction.

Aesthetics
Wind park and HVTL projects involve tall, manmade structures that can typically be seen from a mile or more away depending on the surrounding landscape and topography of an area. The presence of a windpark and/or HVTL can detract from the visual landscape and character of an area.

Windpark
The construction of the Proposed Windpark would be visible for several miles from the project site depending upon topography, land cover, and an individual's vantage point. The Proposed Windpark would likely be visible from Buffalo River State Park, some public lands, and nearby residences.

The Applicant has proposed to minimize visual impacts by making all of the wind turbines an uniform, off-white color, illuminating the towers based on minimum FAA standards, and locating turbine sites outside of visually sensitive areas, such as Buffalo River State Park. The Draft Site Permit requires certain setbacks for turbine siting that the Applicant will comply with, which should also help minimize visual impacts.

Route 1
The Proposed HVTL alignment for Route 1 would be taller, and therefore, more visible than the existing transmission line along State Highway 9. The Proposed Project as a whole would likely be visible from Buffalo State Park and from nearby residences. Route 1 would primarily follow road right-of-way and an existing transmission line alignment. Single pole and H-frame structures would be used depending upon site conditions and needs. Pole spacing would also impact the visual effects of the Proposed HVTL, with wider spacing resulting in the construction of less poles.

Route 2
The Proposed HVTL alignment for Route 2 would utilize former BNSF railroad right-of-way, bisect farmland, and pass through the city of Glyndon. The greatest impacts would occur to residents within the city of Glyndon, where displacement of one residence and two businesses may occur from the Proposed HVTL. Single pole and H-frame structures would be used depending upon site conditions and needs. Pole spacing would also impact the visual effects of the Proposed HVTL.

Route 2A
Route 2A is an alternative segment of Route 2, which would bypass the city of Glyndon. Route 2A would follow road right-of-way past the city of Glyndon, then bisect a farm field before connect with former BNSF railroad right-of-way. This route was analyzed in this Draft EIS as an option to minimize potential visual and displacement impacts from Route 2. Single pole and H-frame structures would be used depending upon site conditions and needs. Pole spacing would also impact the visual effects of the Proposed HVTL.

7.2 IRREVERSIBLE/IRRETRIEVABLE COMMITMENT OF RESOURCES

There are commitments of resources associated with this project that are irreversible and irretrievable, but those that do exist are primarily related to construction. Irreversible and irretrievable resource commitments are related to the use of nonrenewable resources and the effects that the use of these resources have on future generations. Irreversible effects primarily result from the use or destruction of a specific resource that cannot be replaced within a reasonable time frame. Irretrievable resource commitments involve the loss in value of an affected resource that cannot be restored as a result of the proposed action. Construction resources that would be used include aggregate resources, concrete, steel, and hydrocarbon fuel. These resources would be used to construct the Proposed Project. During construction, vehicles would be traveling to and from the site utilizing hydrocarbon fuels.

7.3 COMPARISON OF ROUTE ALTERNATIVES

As previously described in this Draft EIS, three alternative route alignments were analyzed for potential impacts from the Proposed Project. Table 20 compares the potential impacts to homes, soils, crop lands,

wetlands, ecologically sensitive areas and project cost between the three Noble Flat Hill 230 kV HVTL route alternatives identified in this Draft EIS.

Table 20: Comparison of Potential Impacts from the HVTL Route Alternatives

	Analysis Category	Route 1	Route 2	Route 2A
Alignment Size	Length (mi)	11.5	9.9	10.5
	Acres	413.4	362.3	382.5
	Alignment ROW Sharing	11.5	5.1	7.3
	Percent of ROW Sharing	100%	52%	69%
Homes	Number of Homes in Route	40	29	11
	Number of Homes per Mile	3.5	3	1.1
Soils	Prime Farmland (acres)	348	356	377
	Percent of Area Prime Farmland	84%	98%	99%
Crop Land and Grassland	Crop Land (acres)	121.1	221.7	253.1
	Percent of Area Crop Land	29%	61%	66%
	Grassland (acres)	10.5	2.6	1.4
	Percent of Area Grassland	2.5%	0.7%	0.4%
Wetlands	Total Wetland Acres	0	0.63	0.99
	Percent Wetland Area	0%	0.2%	0.3%
Ecological Sensitive Areas	Number of PWI crossed	1	1	2
	Number of MCBS Biodiversity Sites	0	0	0
	Area of MCBS Biodiversity Sites (acres)	0	0	0
Project Cost*	Total Cost	$16,800,000	$14,300,000	$14,300,000
	Cost Per Mile	$1,460,869	$1,444,444	$1,361,904

NA = Data not available

* Project Cost is based on information provided in the Route Permit Application. It is unknown if these costs reflect estimated easement and property acquisitions.

8.0 Permits and Approvals

Various permits are required for the completion of wind projects. This section summarizes the permits that may be required for the Proposed Project.

Table 21: Potentially Required Permits and Approvals

Agency	Type of Approval
FEDERAL	
Federal Aviation Administration	• Notice of Proposed Construction or Alteration within six miles of Public Aviation Facility and structures over 200 feet to complete a 7460 Proposed Construction or Alteration Form • Determination of No Hazard
Federal Energy Regulation Commission	• Exempt wholesale generator status and market based rate authorization
Natural Resource Conservation Service/ U.S. Department of Agriculture	• Farmland Protection Policy Act/ Farmland Conversion Impact Rating
U.S. Army Corps of Engineers	• Section 404 Permit
Minnesota Department of Transportation	• Permit to Cross Federal Aid Highway (US Highway 10)
STATE OF MINNESOTA	
Minnesota State Historic Preservation Office	• Culture and Historic Resources Review
Minnesota Department of Transportation	• Utility Permit • Highway Access Permit • Oversize/Overweight Permit
Minnesota Board of Water and Soil Resources	• Wetland Conservation Act Approval
Minnesota Department of Natural Resources	• Pubic Water Works • License to Cross Public Lands and Waters (Division of Lands and Minerals) • Endangered Species Consultation
Minnesota Pollution Control Agency	• NPDES Storm Water Permit • NPDES Construction Permit • License for Very Small-Quantity Generator of Hazardous Waste • Section 401 Water Quality Certification • Aboveground storage tank (AST) notification Form
Minnesota Department of Health	• Water Well Permit
Minnesota Public Utilities Commission	• Certificate of Need • Site Permit • Route Permit

Agency	Type of Approval
LOCAL PERMITS	
County, Township	• Road right-of-way Use Permit • Driveway Access Permit • Overwidth/Overweight Loads Permit • Individual Septic Tank Permit • Utility Permit • Moving Permit
Clay County Soil and Water Conservation District	• Wetland Conservation Act Approval
Buffalo Red River Watershed District	• Wetland

8.1 FEDERAL

Federal Aviation Administration (Windpark)

7460 Proposed Construction or Alteration Form
The 7460 Proposed Construction or Alteration Form is required by the Federal Aviation Administration for construction projects proposed within six miles of Public Aviation Facility as well as for structures that are over 200 feet tall.

Determination of No Hazard
Clearance from the FAA stating that the proposed construction or alteration does not pose a hazard to air travel.

Federal Energy Regulatory Commission (Windpark)

The FERC is the U.S. agency that has jurisdiction over the sale of interstate electricity.

Exempt Wholesale Generator Status and Market Based Rate Authorization
While applying for exempt wholesale generator status is not required of a windpark, it is common. Once the status is granted, the Wholesale Generator is exempt from certain aspects of the Public Utility Holding Company Act of 2005. Benefits include exemption from Commission access to books and records, as well as, waivers of accounting, record-retention and reporting requirements.

Application approval by FERC is required to obtain market based rate authorization. This authorization is required of any facility that will sell power onto the wholesale grid. Upon issuance of the order, the seller is placed on a list of companies that have been granted market based rate authority. Triennial filings are required to maintain authority.

Natural Resource Conservation Service/ U.S. Department of Agriculture (Transmission Line)

Farmland Protection Policy Act/ Farmland Conversion Impact Rating
The intention of the Farmland Protection Act is to minimize the loss of agricultural land uses. The Project Proposed works with the lead government agency to comply with the requirements of this program.

U.S. Army Corps of Engineers (Transmission Line and Windpark)

Section 404 Permit
A Section 404 permit is required by the USACE in order to discharge dredged or fill material into U.S. waters under the Clean Water Act. This permit is applied for after the route of the transmission line is determined.

Minnesota Department of Transportation

Permit to Cross Federal Aid Highway (Transmission Line)
Any transmission that crosses a federal highway (U.S. Highway 10) requires a use and occupancy agreement according to 23 CFR 645.213. The Project Proposer coordinates with the MDOT to obtain approvals.

8.2 STATE

Minnesota State Historic Preservation Office (Transmission Line and Windpark)

Culture and Historic Resources Review
A meeting with the Culture and Historic Resources Review would help the Project Proposer identify possible impacts to cultural and historical resources.

Minnesota Department of Transportation

Utility Permit (Transmission Line)
The Utility Permit is necessary for construction, placement, or maintenance of utility lines that are located adjacent or across the highway right-of-way. These permits are acquired after completion of line designs.

Highway Access Permit (Transmission Line and Windpark)
Permits of this nature are required in an effort to maintain the effective flow of traffic while accommodating access needs of land development projects.

Oversize/Overweight Permit (Transmission Line and Windpark)
These permits may be required to move over sized and heavy loads on State roads. There are restrictions on times of travel as to not impede travel at high traffic times.

Board of Water and Soil Resources (Transmission Line and Windpark)

Wetland Conservation Act
The Wetland Conservation Act is a way to preserve the wetlands in Minnesota and the benefits that they provide. The act is implemented locally by cities, counties, watershed management organizations, soil and water conservation districts, and townships. For the Proposed Project, the Clay County Soil and Water Conservation District implements the Wetland Conservation Act and the DNR enforces it.

Under the Wetland Conservation Act, anyone proposing a project must first try to avoid disturbing the wetlands, then to minimize impact to wetland, and finally, replace wetland lost as a result of the project. The legislation's goal is no-net-loss of wetland.

Minnesota Department of Natural Resources

Pubic Water Works (Transmission Line)
The DNR Public Water Works Permits apply to all public waters identified in the Public Water Inventory. If a proposed project might affect the course, current, or cross-section of a listed water body, a Public Water Work Permit may be required by the DNR.
According to Minnesota Statutes 103G.245, subdivision 1 (except as provided in subdivisions 2, 11, and 12), any state, political subdivision of the state, public or private corporation or person must have a Public Water Works Permit to:

1. Construct, reconstruct, remove, abandon, transfer ownership of, or make any change in a reservoir, dam, or waterway obstruction on public waters; or
2. Change or diminish the course, current, or cross section of public waters that is entirely or partially within the state, changes including filling, excavating, or placing of materials in or on the beds of public waters.

License to Cross Public Lands and Waters – Division of Lands and Minerals (Transmission Line)
A license from the MDNR is required to install a utility over, under or across any state land or public water, under Minnesota Statue 84.415. A utility includes telephone, fiber optic, electrical or other lines, cables or conduits, as well as, pipelines or mains for gases, liquids, or solids in suspension. In the license application, the land alignment and water crossing sites must be identified including where the utility will be installed. The utility crossing rules require that the route design avoid impacts to natural features to the maximum extent possible, including items such as vegetation, steep slopes, riparian areas or sensitive lands (i.e. designated scenic and natural areas). The utility crossing rules state that existing road or bridge crossing over public waters should be utilized for new utility crossing locations whenever possible

Endangered Species Consultation
The Minnesota Endangered Species Program is enforced by the MDNR, which uses Minnesota Rules 6134 to protect and regulate endangered and threatened species, as well as species of concern in the State. The rules prohibit taking an endangered or threatened species without a permit. Taking permits may be issued for reasons such as education, enhancing propagation of the species, and preventing injury to people and property. Species of concern are not specifically protected by Minnesota Rules but are monitored and managed by the MDNR.

Minnesota Pollution Control Agency

NPDES Storm Water Permit (Transmission Line)
The regulation of storm water is part of the National Pollutant Discharge Elimination System (NPDES) permit program. Permitting authority was given to the MPCA for Minnesota's NPDES program by the EPA.

Storm water permits require the control of polluted discharges. Prevention plans must be developed by the regulated party to address storm water discharge in a manner according to the applicable pollution prevention practices to minimize the pollution leaving a site.

The MPCA requires the acquisition of a NPDES Storm Water Permit for construction projects that disturb more than one acre of surface land. Under this program, the Proposed Project Qualifies for a General Permit. The application submissions include SWPPP incorporating BMPs to minimize pollution discharged during construction.

NPDES Permit: Construction (Windpark)
The NPDES Construction Permit is enforced to decrease the amount of sediment released into water be construction. Construction projects are the most significant source of sediment affecting the waterways of

Minnesota. The Proposed Project qualifies as a large construction activity (disturbing five or more acres of land) and thus, are under Phase I of the NPDES Permit and require general permit coverage.

License for Very Small-Quantity Generator of Hazardous Waste (Windpark)
In order for a business to qualify for a License for Very Small-Quantity Generator of Waste License, that business must generate 100 kilograms (220 pounds or about 22 gallons liquid) or less of hazardous waste per month. Under the guidelines, the waste must accumulate so slowly that accumulating enough waste to ship takes months or years and hiring a waste disposal company to collect smaller amounts is not economically feasible. A Very Small-Quantity Generator of Waste may deliver waste to collection sites that will combine their waste from other facilities to ship for disposal.

Section 401 Water Quality Certification
In accordance with the federal Clean Water Act a state Section 401 water quality certification must be obtained in order to receive federal permits for activities that may result in discharge of water into navigable waters of the U.S. The Section 401 permit must be acquired to ensure that the project will comply with state water quality standards.

Aboveground Storage Tank (AST) Notification Form
All regulated above ground storage tanks that store substances that are liquids at ambient temperature and pressure with a capacity greater than 1,100 gallons, must be registered with the MPCA. The MPCA must be notified within 30 days of tank installation or if the status of the tank changes.

Minnesota Department of Health

Water Well Permit (Windpark)
The MDH must be notified before the construction of a well begins. The form must be submitted by the well contractor or property owner.

Minnesota Department of Labor and Industry

The Minnesota Department of Labor and Industry operates to ensure that Minnesota's working conditions are equitable, healthy and safe.

Plumbing Plan Review (Windpark)
The Department of Labor and Industry (DLI) reviews proposed plumbing projects before construction to be sure that they comply with the Minnesota Plumbing Code (Minnesota Rules 4715). All interior plumbing as well as the connections for sewer, water service and storm water drainage is reviewed. The plumbing plans are checked for pipe size, proper connections, materials, fixture specifications and backflow prevention. Approval must be given before installation of any portion of the plumbing system.

Minnesota Public Utilities Commission

The Minnesota Public Utilities Commission regulates the construction of transmission lines in Minnesota. The PUC is responsible for determining if there is a need for a new transmission line by requiring the Project Proposer to apply for a Certificate of Need. Along with determining need, the PUC also determines the route of the line and conditions regarding construction, operation, and maintenance of the transmission line through the route permitting process.

Certificate of Need (Transmission Line and Windpark)
A Certificate of Need must be submitted to and reviewed by the Commissioner before the issuance of a Route Permit. The Noble Flat Hill Windpark I, LLC and associated transmission line filed a petition with the MPUC stating that a separate Certificate of Need is not required for the windpark and the transmission

line. The Certificate of Need is not required for the transmission line because the line is directly associated with the plant and necessary to connect the plant to the transmission system. The Certificate of Need for the windpark was also petitioned for exemptions on the basis that Noble is proposing a renewable energy facility and lacks much of the information required for the certificate and that similar exemptions have been granted for other proposed wind parks.

Site Permit (Windpark)
Minnesota Statutes 216F.04 states that no entity may construct a LWECS without a Site Permit from the commission and the large electric power generating plant may only be constructed on the approved site. The Site Permit is required for any combination of WECS with a combined capacity of 5,000 kW or more. The Proposed Project would have a 201 MW capacity and as such, requires a Permit.

Route Permit (Transmission Line)
According to Minnesota Statutes 216E.03, subdivision 2, a Route Permit from the commission is required to construct a high voltage transmission line and may only be constructed along the route approved by the commission. A high voltage transmission line is defined as having the capability of transmitting 100 kV or more. The Proposed Project is a 230 kV line thus, a Route Permit is required.

Within 60 days of completing the permit application, a public hearing will be held to obtain public opinion on alternative transmission routes and the appropriate scope for the EIS. A contested case hearing can also be held for interested persons to submit evidence for or against the Proposed Project. After contestation is complete a report and recommendations are submitted to the PUC regarding the application.

HVTLs cannot be constructed until a Route Permit is approved by the PUC.

8.3 LOCAL

County, Township

Road Right-of-Way Permit (Transmission Line)
These permits may be required to cross or occupy the right-of-way of a road belonging to the county, township, or city.

Driveway Access Permit (Transmission Line and Windpark)
These permits may be required in order to construct access roads off of county, township, or city roads.

Overwidth/Overweight Load Permit (Transmission Line and Windpark)
These permits may be required in order to move loads that are wide or heavy on the county, township, or city roads.

Individual Septic Tank Permit (Windpark)
Clay County Environmental Health inspects septic systems and issues permits and certifications. New septic systems require a design, permit and inspection before backfilling.

Utility Permit (Transmission Line and Windpark)
A Utility Permit from Clay County is required to install, replace and maintain utilities on County right-of-way. After being granted the Utility Permit, the permit holder must follow all requirements established by the County Highway Engineer. The Utility Permit application must be complete, submitted and approved before initiation of construction.

Moving Permit (Windpark)
Due to the size of the materials and equipment required to construct the turbines, a permit may be required to transport materials to the Windpark. Permits may be required at the local, County or State level.

Clay County Soil and Water Conservation District

Wetland Conservation Act Approval (Transmission Line and Windpark)
See Board of Soil and Water Resources.

Buffalo Red River Watershed District

Wetland (Transmission Line)
The Buffalo Red River Watershed District enforces rules regarding many aspects of the Buffalo River Watershed District including the construction of an artificial drainageways across a subwatershed into another watershed, alterations of any legal drainage system, drainage of any wetland among others. Permits are required in order to construct, alter or remove wetlands. The permit must be approved before initiating construction and construction must be completed within one year unless otherwise stated.

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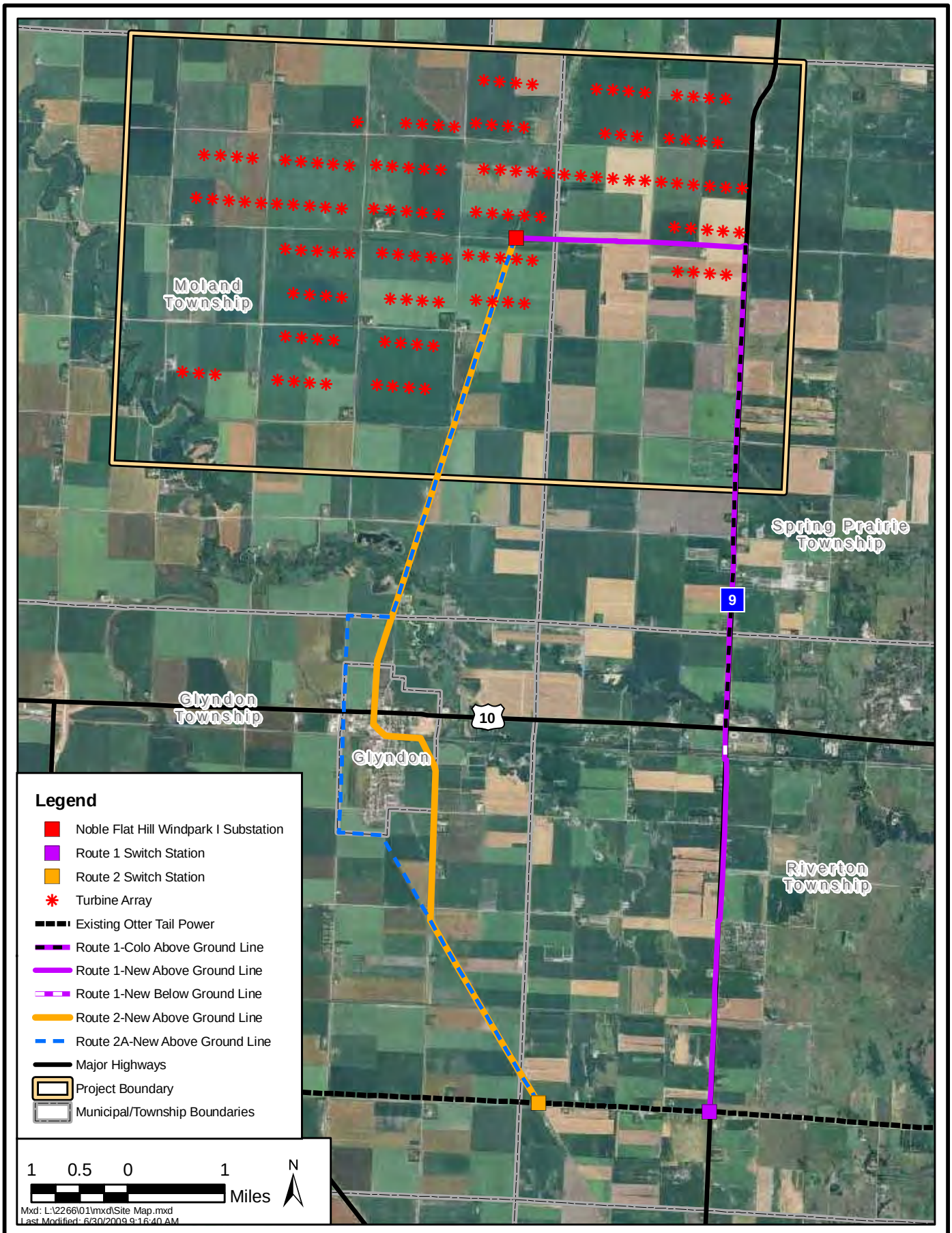

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Site Map and Route Alternatives

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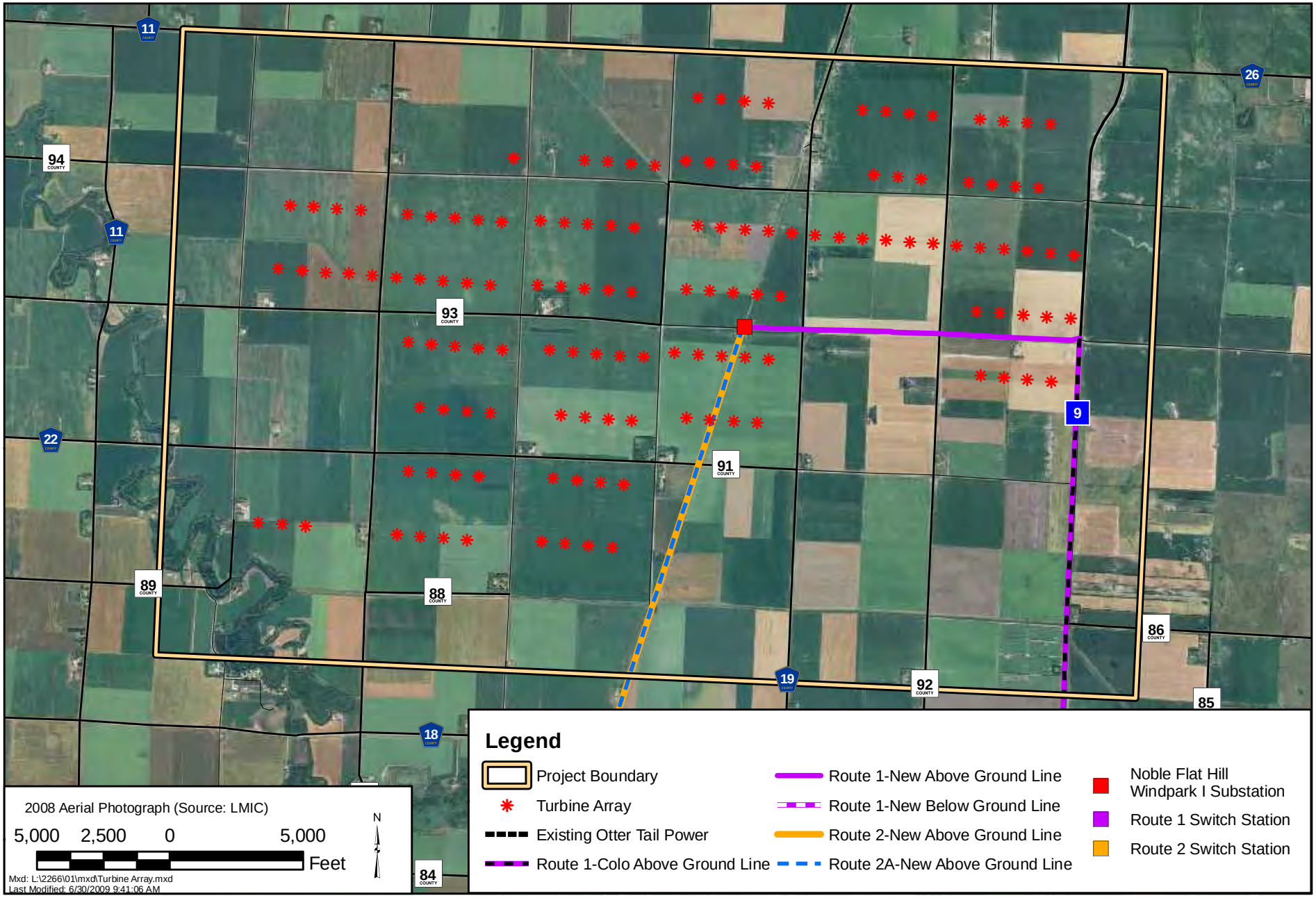
Figure 1



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Preliminary Turbine Array

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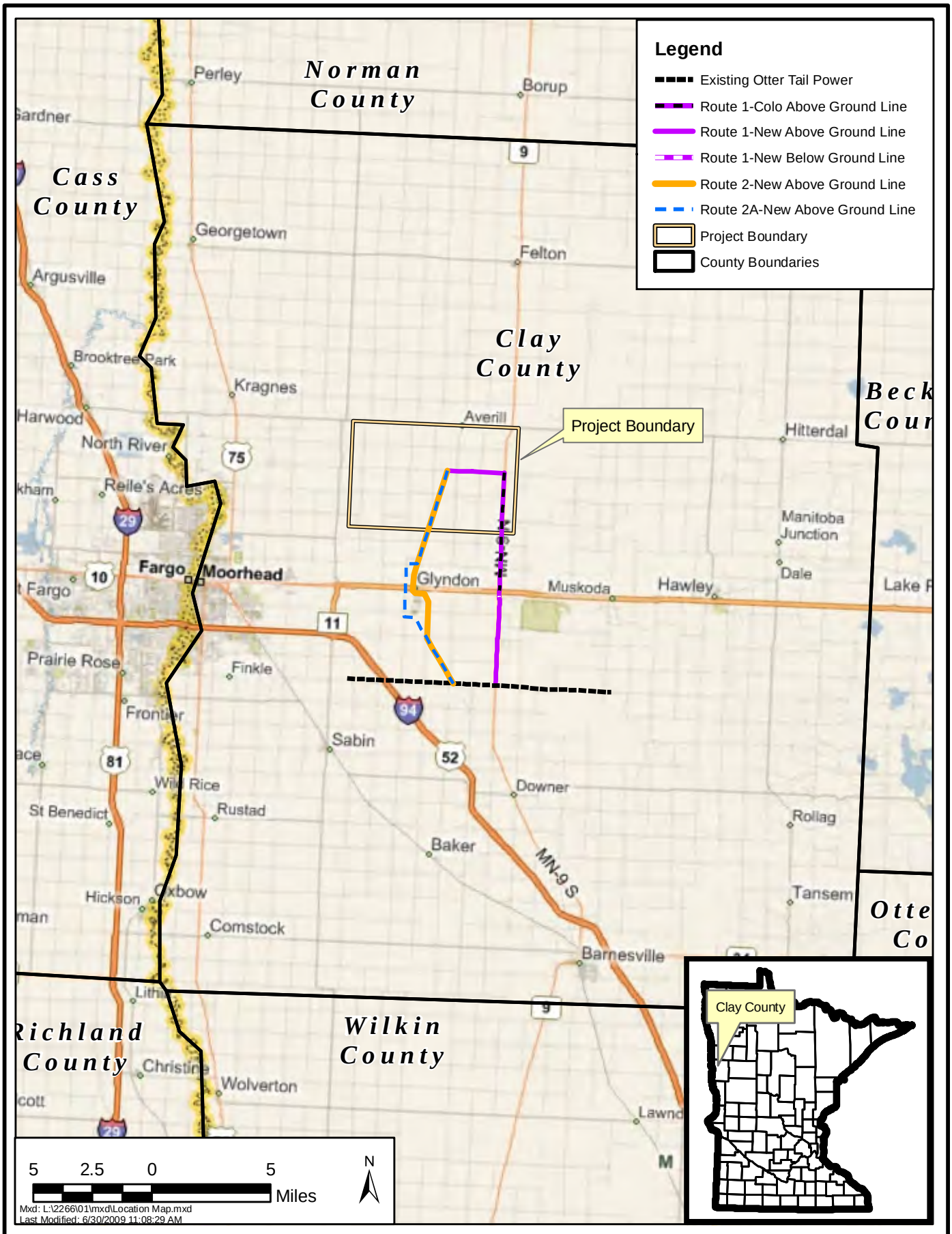
Figure 2



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Site Location Map
(Project Area in Clay County)

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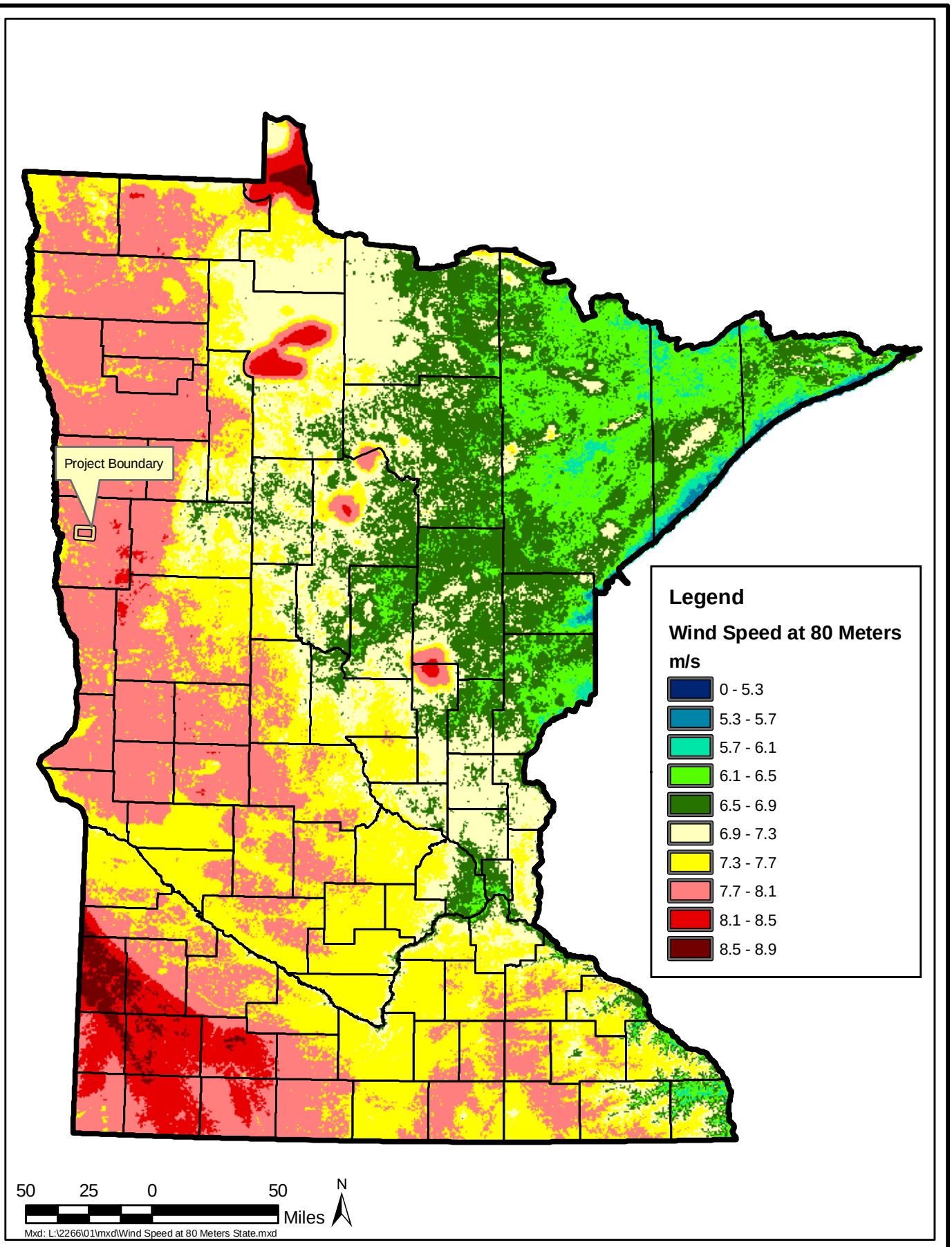
Figure 3



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Wind Speeds in Minnesota at 80 Meters

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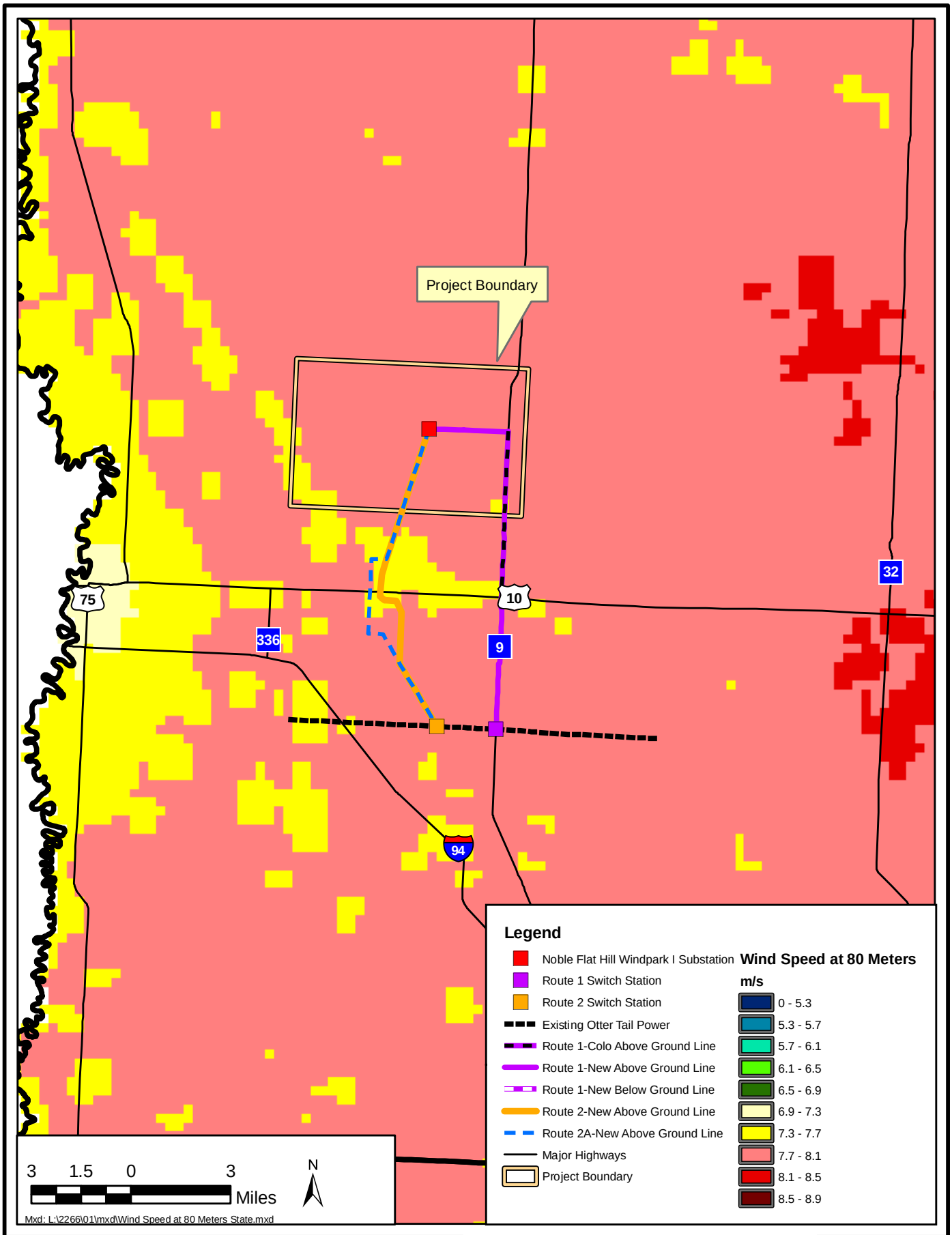
Figure 4



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Wind Speeds in Project Area at 80 Meters

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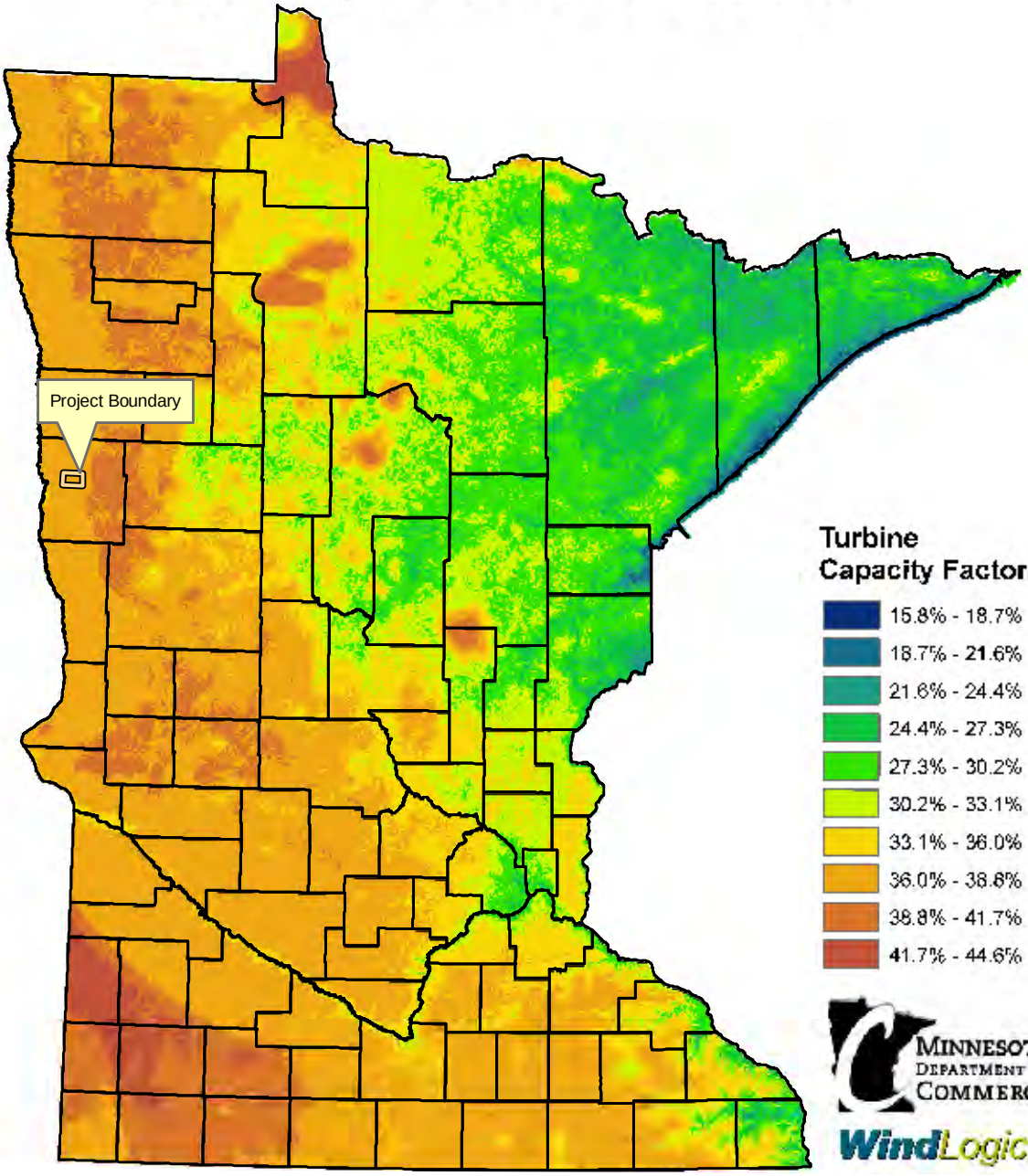
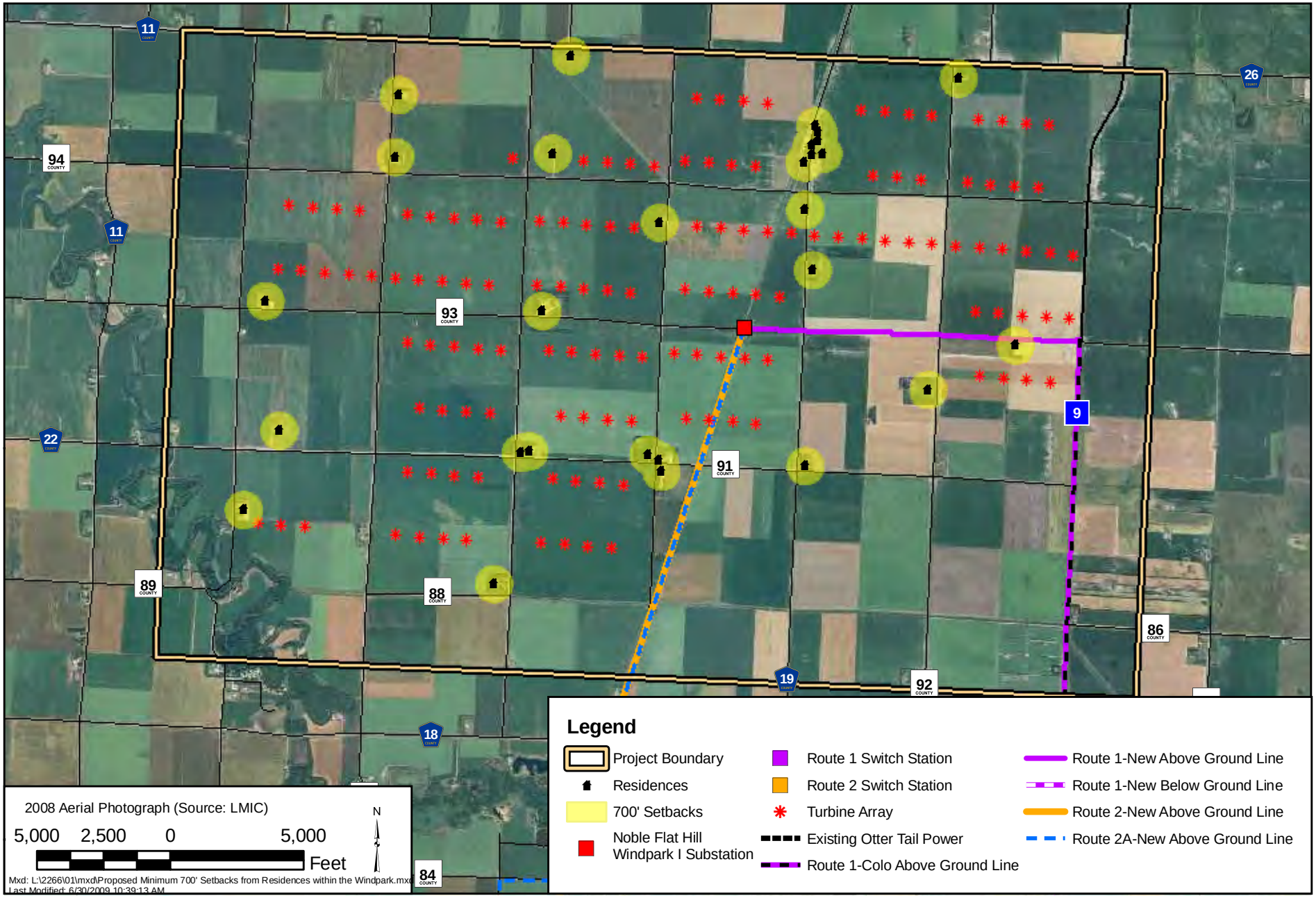
Figure 5

Minnesota's Wind Resource by Capacity Factor at 80 Meters



DEPARTMENT OF COMMERCE Capacity Factors for Minnesota at 80 Meters	office of energy security Minnesota Department of Commerce	JUL 2009 Figure 6



DEPARTMENT OF COMMERCE

Proposed Minimum 700-ft Set-backs from Residences within the Windpark

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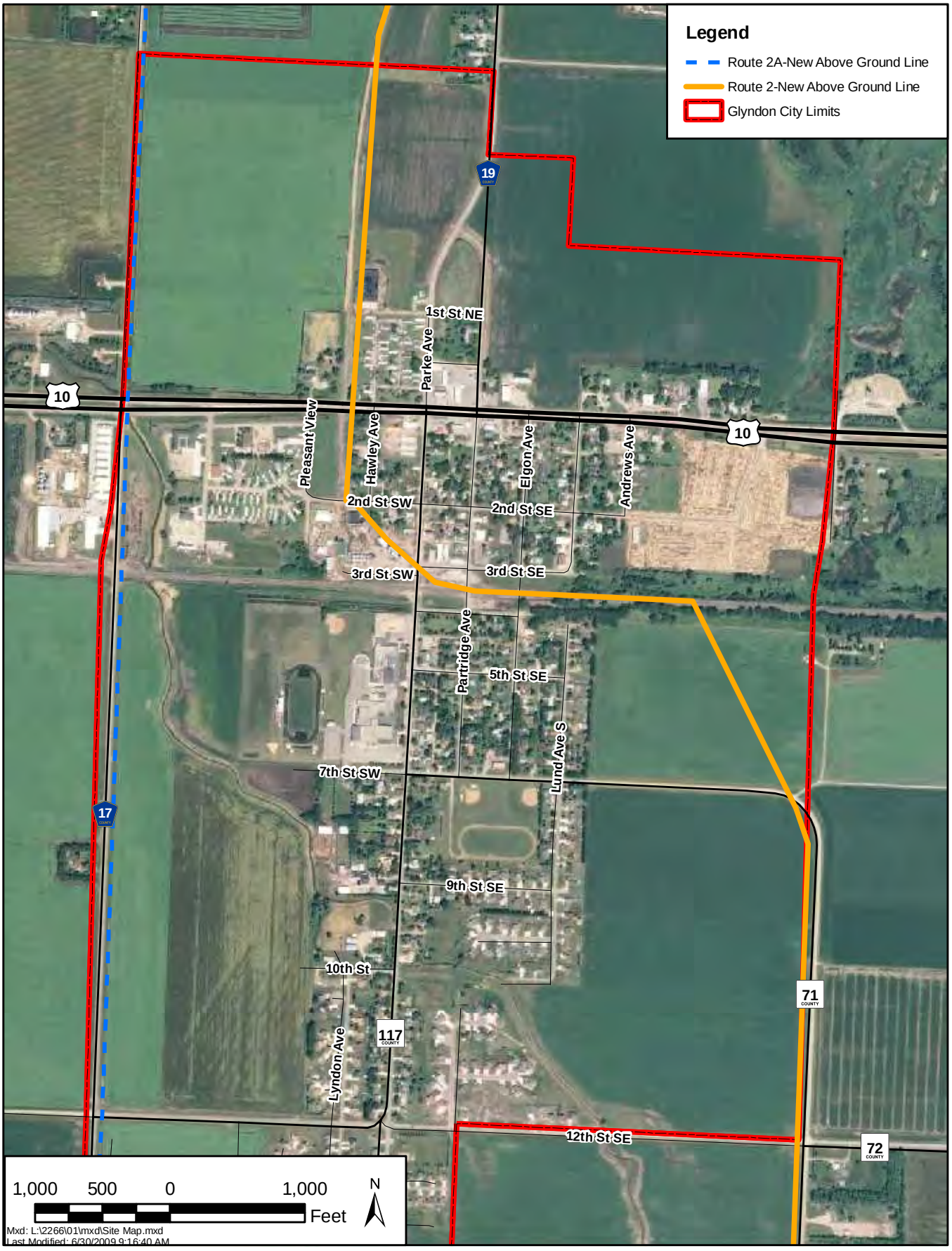
Figure 7



DEPARTMENT OF COMMERCE

Proposed Route 2 Alignment through City of Glyndon

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Minnesota Department of Commerce

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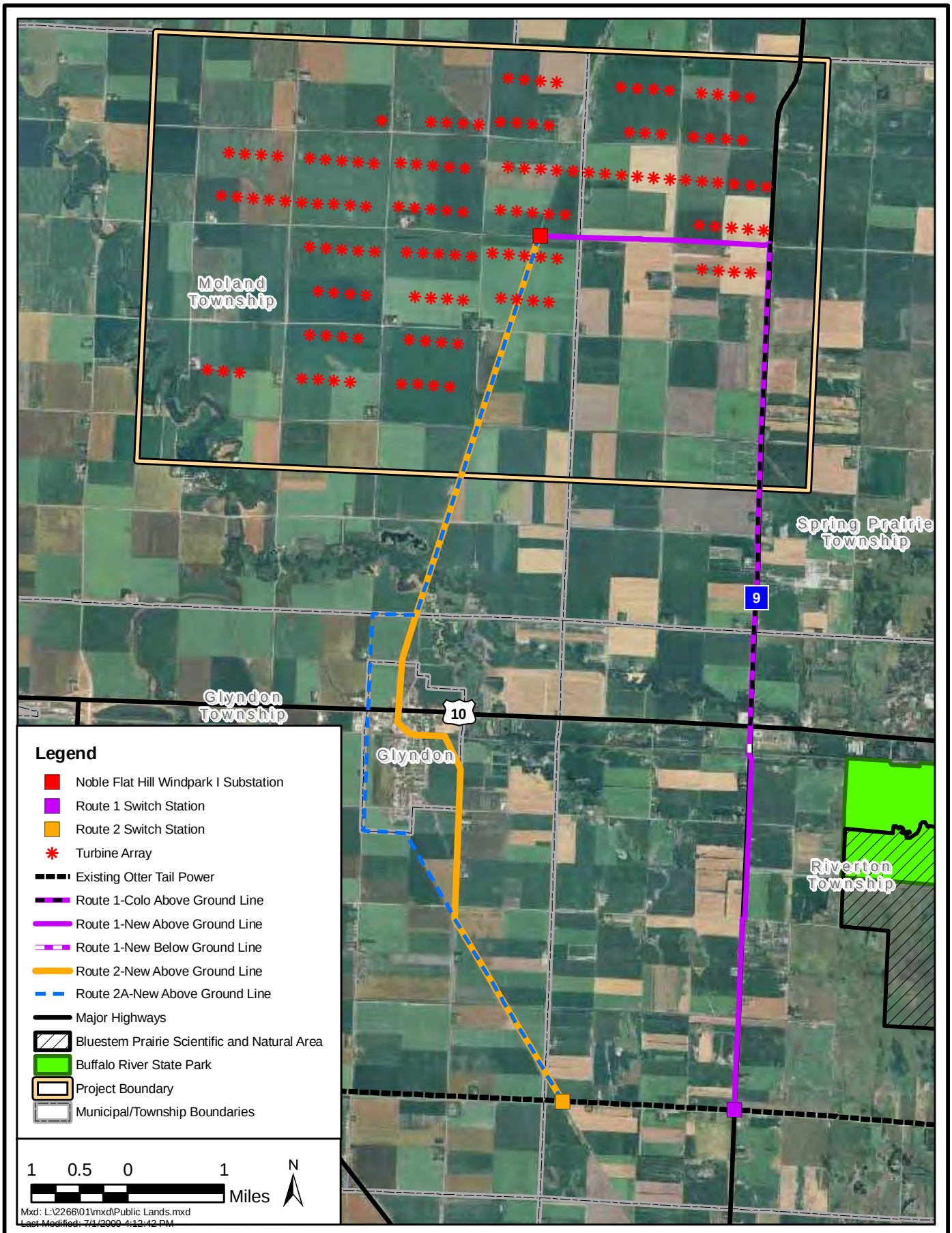
Figure 8



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Public Lands in Project Area
(Parks, Trails, WMA's, etc.)

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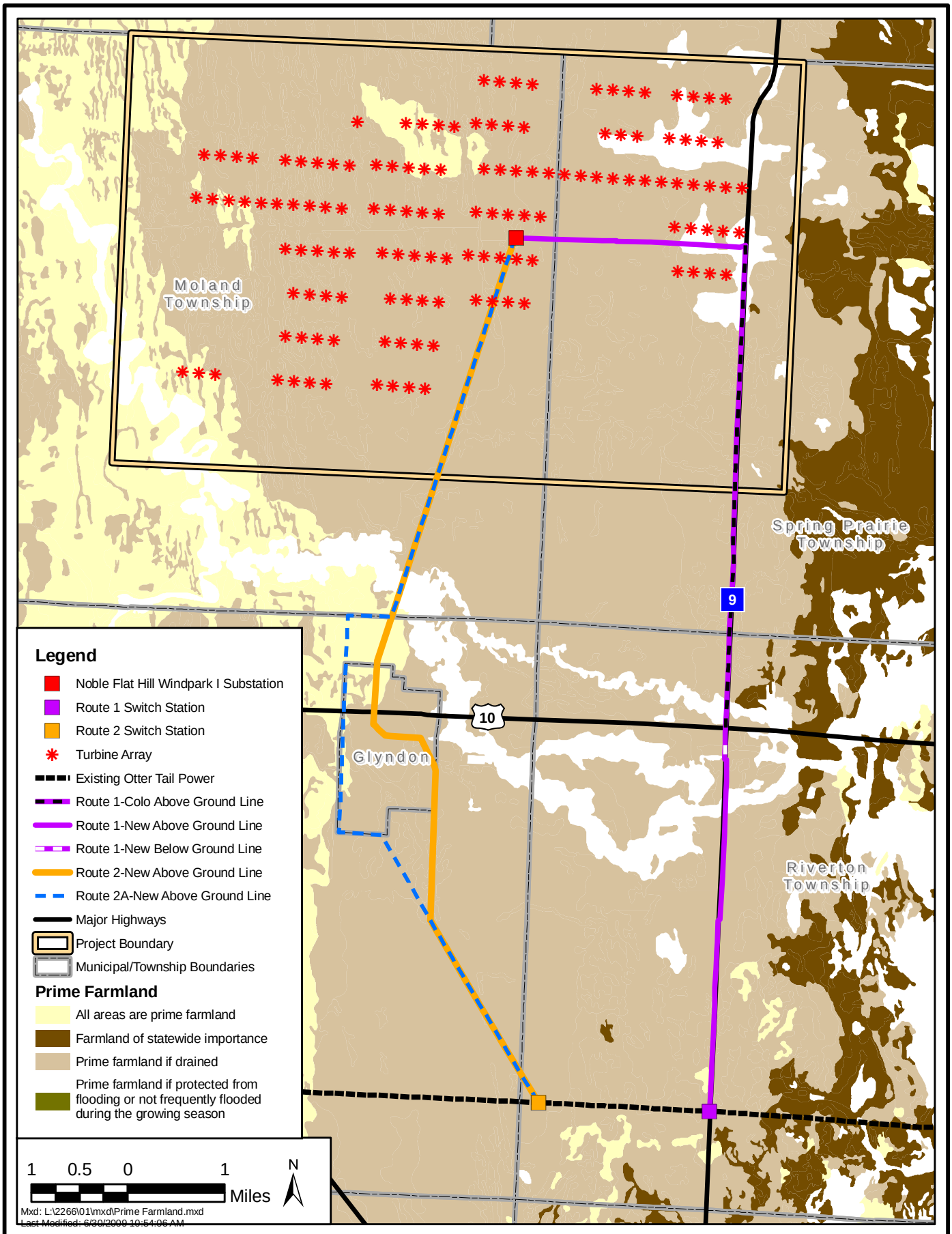
JUL 2009

Figure 9



DEPARTMENT OF COMMERCE

Prime Farmland

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Minnesota Department of Commerce

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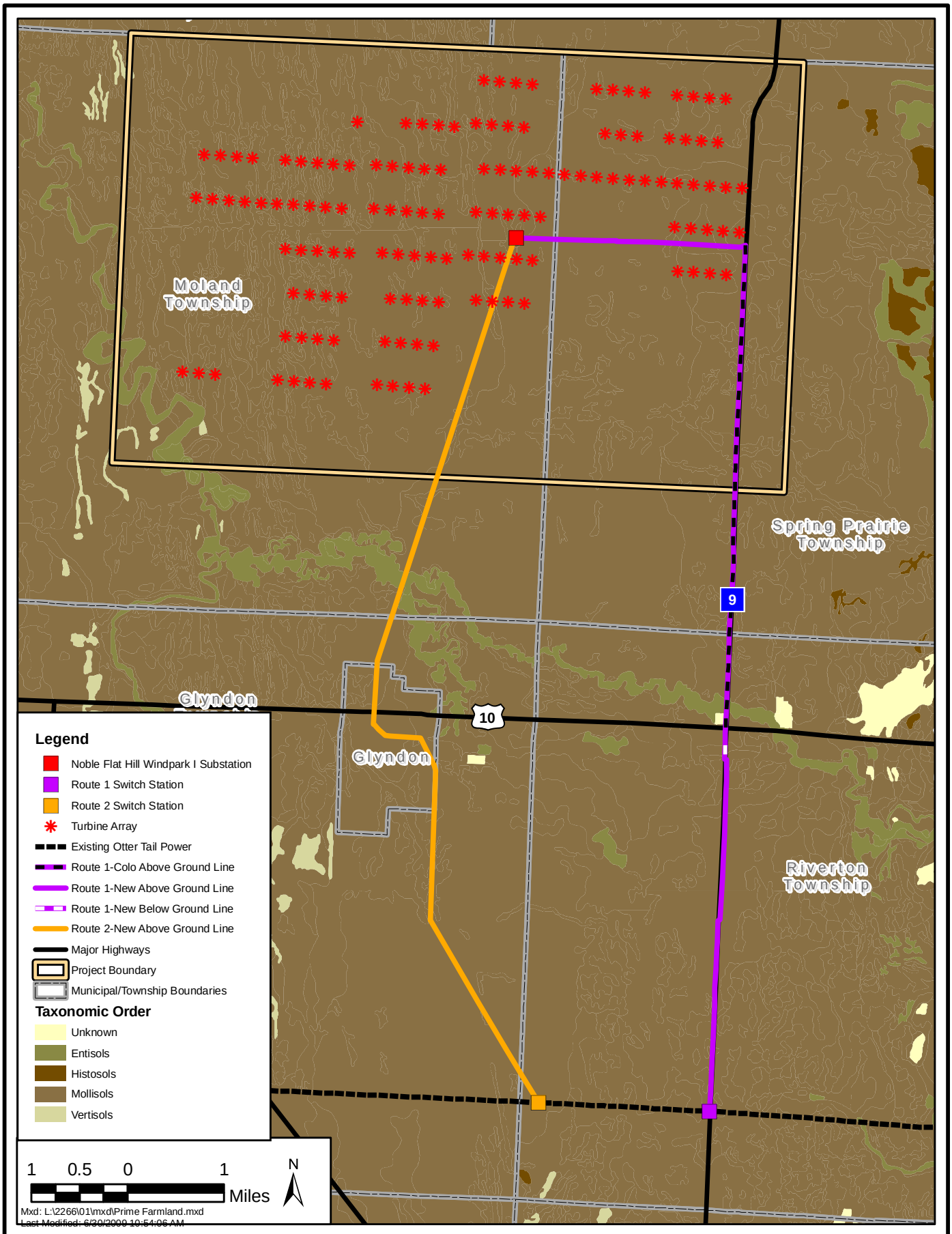
Figure 10



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Clay County Soil Survey

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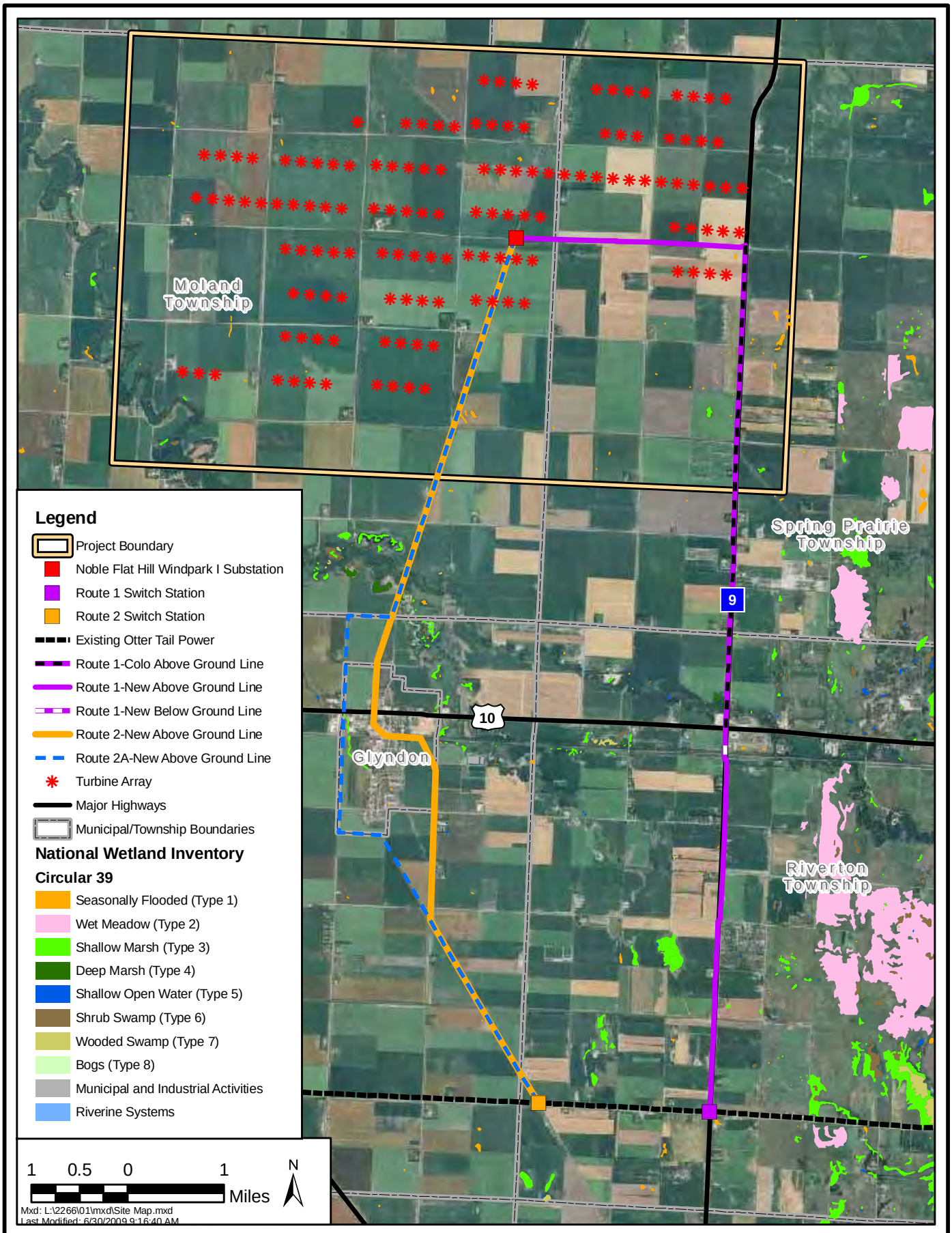
JUL 2009

Figure 11



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NWI Wetlands

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Minnesota Department of Commerce

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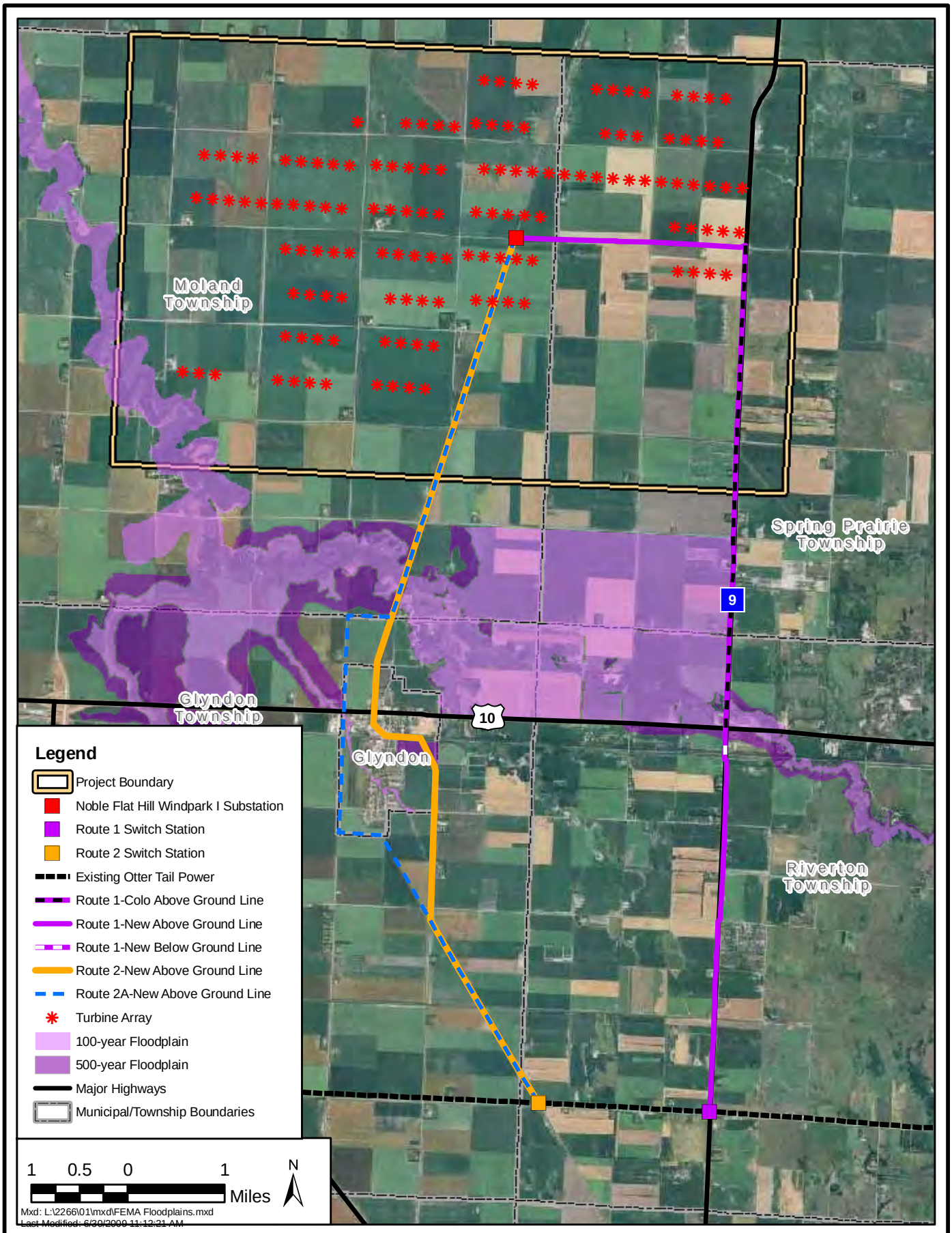
Figure 12



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FEMA 100yr and 500yr Floodplains

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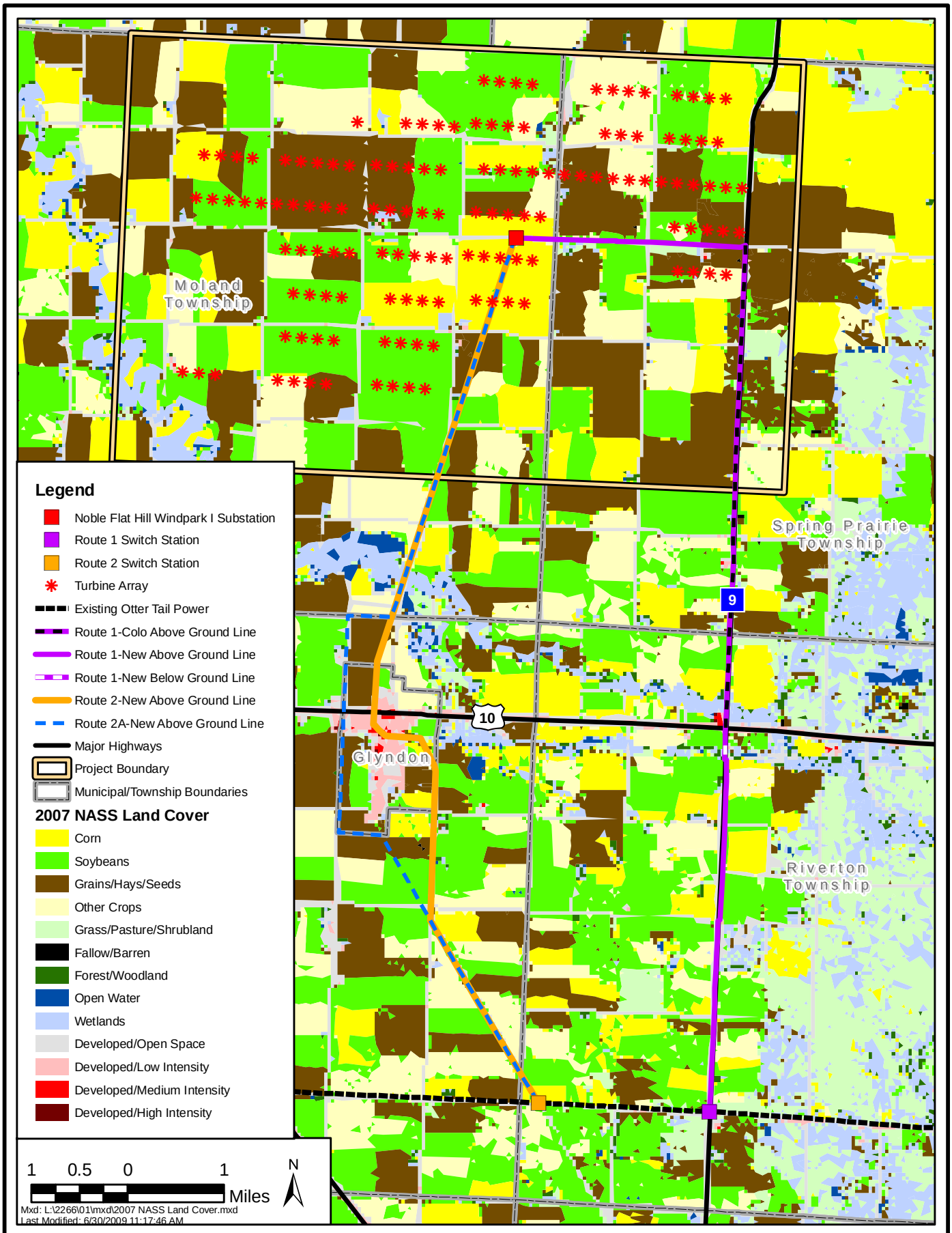
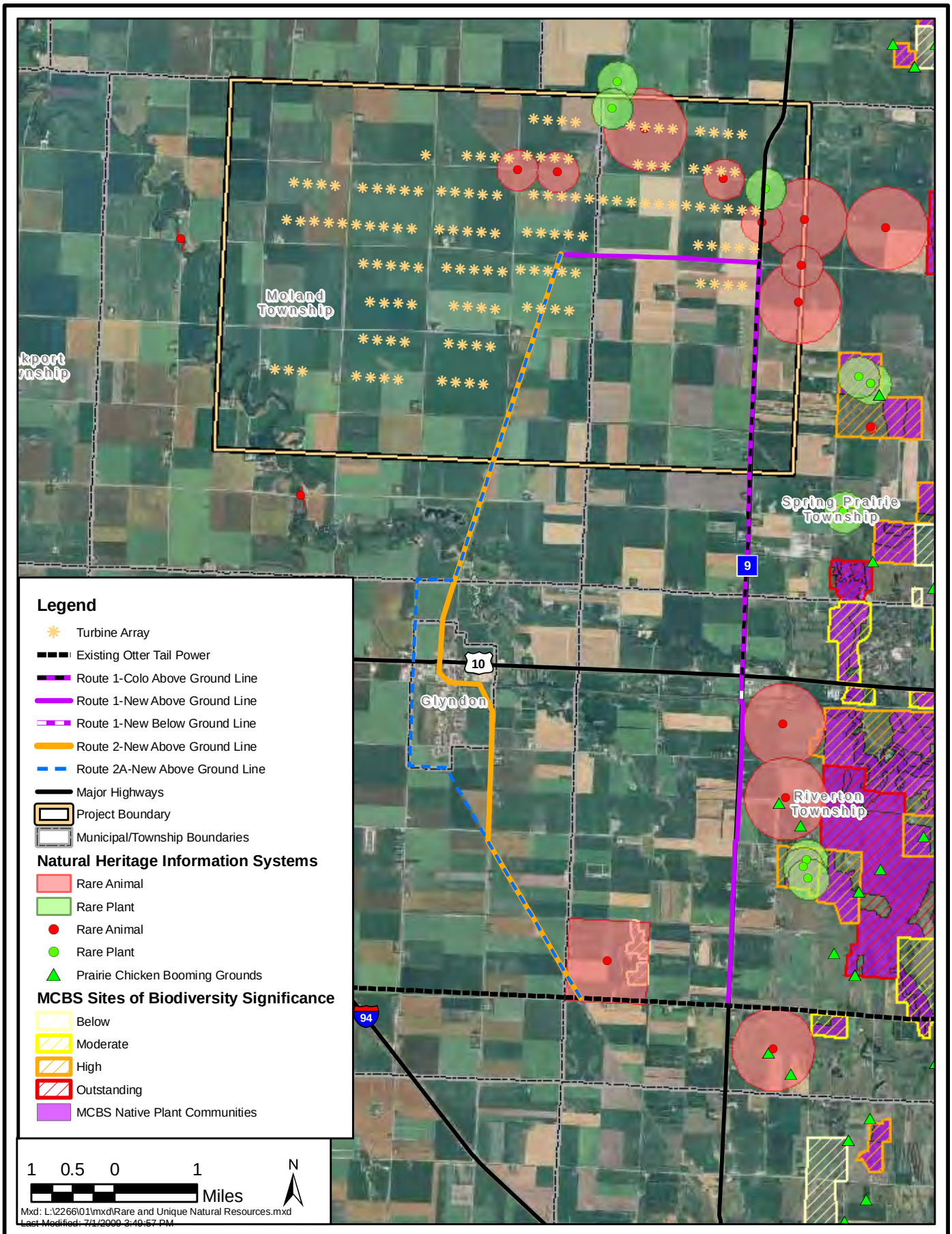
Figure 13



DEPARTMENT OF COMMERCE		JUL 2009
2007 NASS Land Cover	office of energy security	Figure 14



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Rare and Unique Natural Resources

office of energy security
Minnesota Department of Commerce

JUL 2009

Figure 15

Appendix A

Final Scoping Decision Document – Issued by the Office of Energy Security Director

In the Matter of the Noble Flat Hill Windpark I, LLC Applications for a 201 Megawatt Large Wind Energy Conversion System Site Permit, a 230 Kilovolt High Voltage Transmission Line Route Permit and a Certificate of Need for the Noble Flat Hill Windpark I Project in Clay County.

ENVIRONMENTAL IMPACT STATEMENT SCOPING DECISION

PUC Docket Nos. IP6687/WS-08-1134
TL-08-988
CN-08-951

The above matter has come before the Director of the Office of Energy Security for a decision on the scope of the Environmental Impact Statement (EIS) to be prepared on the proposed Noble Flat Hill Windpark I Project (Project). Noble Flat Hill Windpark I, LLC (Applicant), a subsidiary of Noble Environmental Power, an independent power producer and renewable energy company based in Essex, Connecticut, is proposing the project.

The Project is a Large Wind Energy Conversion System (LWECS), as defined by the Wind Siting Act, Minnesota Statute 216F.01. The Project is located in Clay County and would be up to 201 megawatts (MW) in size, consisting of up to 134, 1.5 MW General Electric wind turbine generators. Associated facilities include access roads, a substation, an Operations and Maintenance building, a wind electrical collection system, and a new 230 kilovolt (kV) high voltage transmission line (HVTL) of approximately 11.5 miles.

The Project requires a Certificate of Need (CN), a Site Permit for the LWECS and a Route Permit for HVTL. The Applicant filed an application for a CN with the Public Utilities Commission (Commission) on October 17, 2008, that was accepted as complete on January 14, 2009; an application for a Site Permit on October 17, 2008, that was accepted on December 23, 2008, with the Commission issuing a draft permit on that date; and an application on August 29, 2008, for a Route Permit, that was accepted as complete on September 26, 2008.

The Director of the Office of Energy Security (OES), in consultation with the Applicant and the Commission, has decided to join the environmental review requirements of the various permits into one document, as per Minn. Rule 7849.7100, subp 2. OES will issue an EIS in lieu of the Environmental Report normally required in a CN proceeding, including in the EIS the analysis of alternatives required by Minn. Rule 7849.7060.

OES Energy Facility Permitting (EFP) staff held a public information and scoping meeting for the Project in Glyndon on Wednesday, February 4, 2009. There were approximately 120 residents in attendance at the meeting. Public comments relating to both the proposed LWECS and HVTL were presented by attendees at the public meeting. The public comment period on the project was open until Wednesday, February 25, 2009. Residents submitted 14 written comments to the OES. The Minnesota DNR was the only government agency to submit written comments during the scoping process.

Response to Public Comments

The following are the questions and comments received from the public during the comment period. The EIS will address these issues as follows:

Human Health Risks. The EIS will summarize available research and studies previously conducted on potential human health risks from wind turbines due to low-frequency noise and sound levels. Potential human health risks concerning the HVTL and electromagnetic fields (EMF) will be addressed in the same manner.

Aesthetics–Noise. The EIS will include a description of the State noise standard requirements, and will describe potential noise mitigation measures. The EIS will not conduct field studies, but will research available information on noise-related impacts from existing wind parks or HVTL and provide a qualitative estimate of potential noise related project impacts.

Aesthetics–Visual. The EIS will identify potential visual impacts from the wind park and HVTL on the surrounding landscape, including analysis for nearby residences and Buffalo River State Park. Possible mitigation measures for visual impacts will also be identified.

Wildlife. The EIS will include an analysis of potential wildlife and habitat impacts from both the wind park and the HVTL. General information will be provided on issues such as wildlife displacement or alteration of migration routes. Specific impacts to wildlife will be estimated through habitat loss when possible. Information will be gathered on the habitat and biological requirements of rare and sensitive species in the area to determine potential project impacts.

Road Impacts and Construction Traffic. The EIS will gather information relating to the anticipated amount of construction traffic associated with the proposed project and to the extent possible, determine the potential for construction-related road damage. The EIS will also provide a description of mitigation required by the Applicant for project-related road damage.

Flooding and Groundwater. The EIS will include a description of the soils and underlying geology in the project area to assess potential impacts to the floodplain or groundwater where applicable. The EIS will also provide a description of potential changes in floodplain storage as related to existing defined floodplain elevations, but detailed hydrological modeling of floodplain changes will not be conducted. The EIS will also describe the potential for groundwater impacts (i.e. contamination or alteration of drinking water supplies) as a result of the proposed project. The EIS will also describe the permit and mitigation requirements associated with construction within the floodplain or areas affecting groundwater reserves.

Site Safety and Hazards. A description of the safety factors of the constructed towers will be included in the EIS and will be based on the safety records of previously constructed towers. The EIS will use information provided by the Applicant to describe the hazardous substances that are within the turbines and assess the potential for impacts from the project. The EIS will also provide a description of hazardous materials that may be present on site during project construction (i.e. diesel fuel; hydraulic fluid) and the preventative measures that will be employed to prevent impacts from hazardous chemicals. The EIS will also describe project or

site specific plans or preventative measures that will be employed for the project such as the Spill Prevention, Control and Countermeasure Plan.

Public Notice and Participation Process. The EIS will describe the required process detailed under PUC rules for public participation, review and comment during the CN, Site and Route Permit Applications and EIS review and approval periods.

Economic Benefits and Tax Revenue. The EIS will gather and summarize information regarding how the proposed project will be taxed and how the generated tax revenue will be distributed. The EIS will also summarize the Applicant's estimates of jobs generated by the project and potential revenue created for the local economy during project construction and operation.

Sensitive Resources, Lands and Parks. The EIS will provide a description of the sensitive resources and lands in proximity to the proposed project, including the Buffalo River State Park. The EIS will describe the habitats and resources present on these lands, including park amenities and recreational opportunities. The EIS will provide an estimate of the potential for project related impacts to these sensitive resources.

Property Values. The EIS will attempt to gather information on property value impacts from constructed wind farm projects in Minnesota or from comparable projects in other states and provide an estimate of the potential impacts from the proposed project. However, project related property values impacts are very difficult to estimate and there may only be anecdotal information available to include in the EIS discussion of potential property value impacts.

Compatibility with County Rules and Regulations. The EIS will describe the different State, county and local regulatory requirements for the proposed project. Compatibility with existing zoning and regulatory requirements will be described as well as the potential need for variances from existing regulations that may be required of the proposed project.

Permit Requirements. The EIS will include a summary of permits and approvals required for the Wind Park and the HVTL. In addition, permit requirements may be discussed in specific sections where applicable.

The EIS will not address the following issues:

Project Location and Site Selection. The EIS will not evaluate the Applicant's rationale for selecting Clay County for the project nor describe the procedures used to determine potential turbine locations, but rather will address the impacts of the project as proposed.

Target Sales Market for Generated Power. The EIS will not provide information regarding where the electrical power generated by the proposed project will be sold and consumed or whether or not the Applicant will have a sales agreement in place with a specific power supplier. The comments have been forwarded to OES Energy Regulation and Planning for input into their analysis and testimony in the Certificate of Need hearing.

Alternatives under Review

Project Alternatives. Because the environmental review requirements for both the Certificate of Need and the Route Permit will be addressed in a single EIS, the analysis will review feasibility, general impacts and mitigation measures for those alternatives that would otherwise be required in an Environmental Report for the Certificate of Need.

The first section of the EIS will consider alternatives that have an impact on the proposed project. OES will evaluate alternatives that deliver an equal amount of energy and capacity as proposed by the Applicant. Such alternatives may attempt to reduce, mitigate or eliminate the need for the proposed Project, while delivering the proposed "needed" energy. Any analysis of the alleged need will be conducted through the Certificate of Need testimony and public hearing(s) generally and not specifically in this EIS. The EIS will focus on the environmental, social, economic and cultural impacts of the proposed project and alternatives.

The energy from the project that would be produced by Noble Flat Hill Windpark I, LLC, would, according to the Applicant, contribute to Minnesota utilities' Renewable Energy Standard (RES) compliance. Under this scenario, it is not logical to conduct an analysis of an alternative that would not contribute to the RES. The generally equivalent alternatives that will be discussed in this section will be a generic 200 MW wind generation facility; a 77 MW biomass plant, considered an "eligible energy technology" that can produce an equivalent amount of energy as the wind facility; and the "no-build" option.

Route Alternatives. Further analysis of the Applicant's proposed and alternative transmission routes was requested by a few residents, along with suggestions to keep the HVTL away from residences by possibly moving Route 1, the alternative, further west to minimize impacts. Another comment was provided in relation to the Applicant's alternative route, suggesting that running through Glyndon is not properly analyzed as the best alternative to the preferred route.

The second section of this EIS will include an analysis of the potential environmental and socio-economical impacts of both HVTL routes presented by the Applicant in the Route Permit Application. The EIS will also review the possibility of adapting the alternate route to run west of Glyndon.

Having reviewed the matter, consulted with the EFP staff, and in accordance with Minnesota Rule 7849.5300, I hereby make the following Scoping Decision:

MATTERS TO BE ADDRESSED

INTRODUCTION

1.0 SUMMARY OF THE NOBLE FLAT HILL WINDPARK I PROJECT

Project Description
Project Location
Project Purpose
Project Alternatives
Sources of Information

2.0 REGULATORY FRAMEWORK

Commission Certificate of Need
Commission Site Permit
Commission Route Permit
Scoping of Environmental Impacts and Alternative Routes
Environmental Impact Statement Requirement

ALTERNATIVES TO THE PROJECT

3.0 POTENTIAL HUMAN AND ENVIRONMENTAL IMPACTS

Alternatives for Review

No-build alternative
200 MW wind project
77 MW biomass plant
Noble Flat Hill Wind Project and Associated 230 kV HVTL

Review for each Alternative [Minn. Rule 7849.7060, subp. 2, A-J]

Emissions
Hazardous air pollutants and VOCs
Visibility impairment & shadow flicker
Ozone formation
Fuel availability and delivery
Associated transmission facilities
Water appropriations
Wastewater
Solid and hazardous wastes
Noise

4.0 POTENTIAL MITIGATION MEASURES

No-build alternative
200 MW wind project
77 MW biomass plant
Noble Flat Hill Wind Project and Associated 230 kV HVTL

5.0 FEASIBILITY AND AVAILABILITY OF ALTERNATIVES

No-build alternative
200 MW wind project
77 MW biomass plant
Noble Flat Hill Wind Project and Associated 230 kV HVTL

IMPACTS OF WIND PARK AND HVTL ROUTE ALTERNATIVES

6.0 ASSESSMENT OF IMPACTS AND MITIGATION MEASURES

Description of Environmental Setting

Impacts on Human Settlement
- *Socioeconomic*
- *Displacement*
- *Noise*
- *Aesthetics*
- *Human Health and Safety*

Impacts on Land-based Economics
- *Recreation*
- *Prime Farmland*
- *Transportation*
- *Mining and Forestry*
- *Economic Development*
- *Archeological and Historic Resources*

Impacts on Natural Environment
- *Air Quality*
- *Water Quality, Soils and Geology*
- *Groundwater and Wetlands*
- *Fish and Wildlife Resources*
- *Vegetation*

Rare and Unique Natural Resources

7.0 OTHER CONSIDERATIONS

Significant Unavoidable Adverse Impacts
Irreversible/Irretrievable Commitment of Resources

8.0 PERMITS AND APPROVALS REQUIRED

Federal
State
Local

ISSUES OUTSIDE THE SCOPE OF THE EA

The Environmental Impact Statement will not consider the following matters:

1. The manner in which land owners are paid for transmission right-of-way easements, as that is outside the PUC jurisdiction.
2. Any alternatives not described specifically in this Scoping Decision.

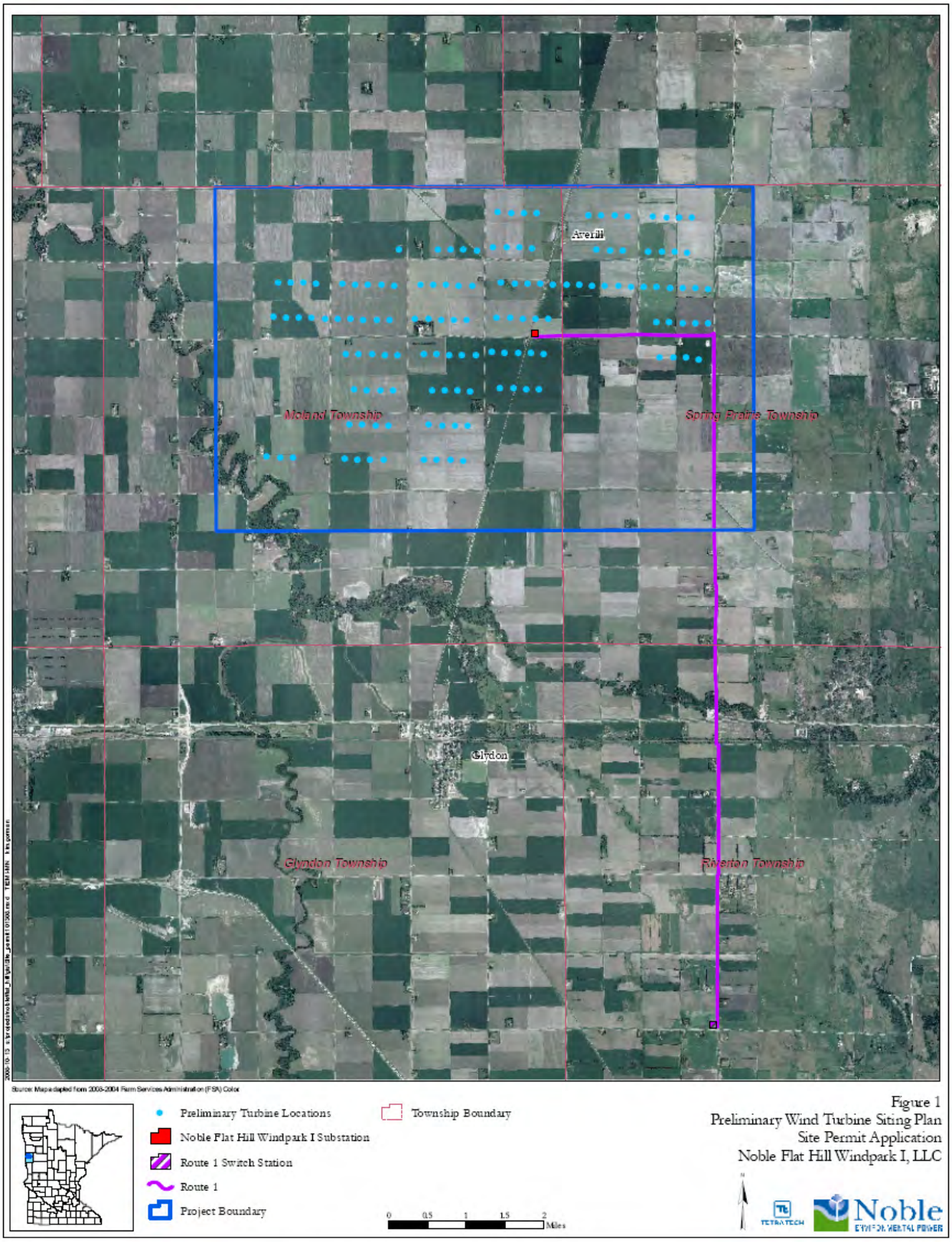
SCHEDULE

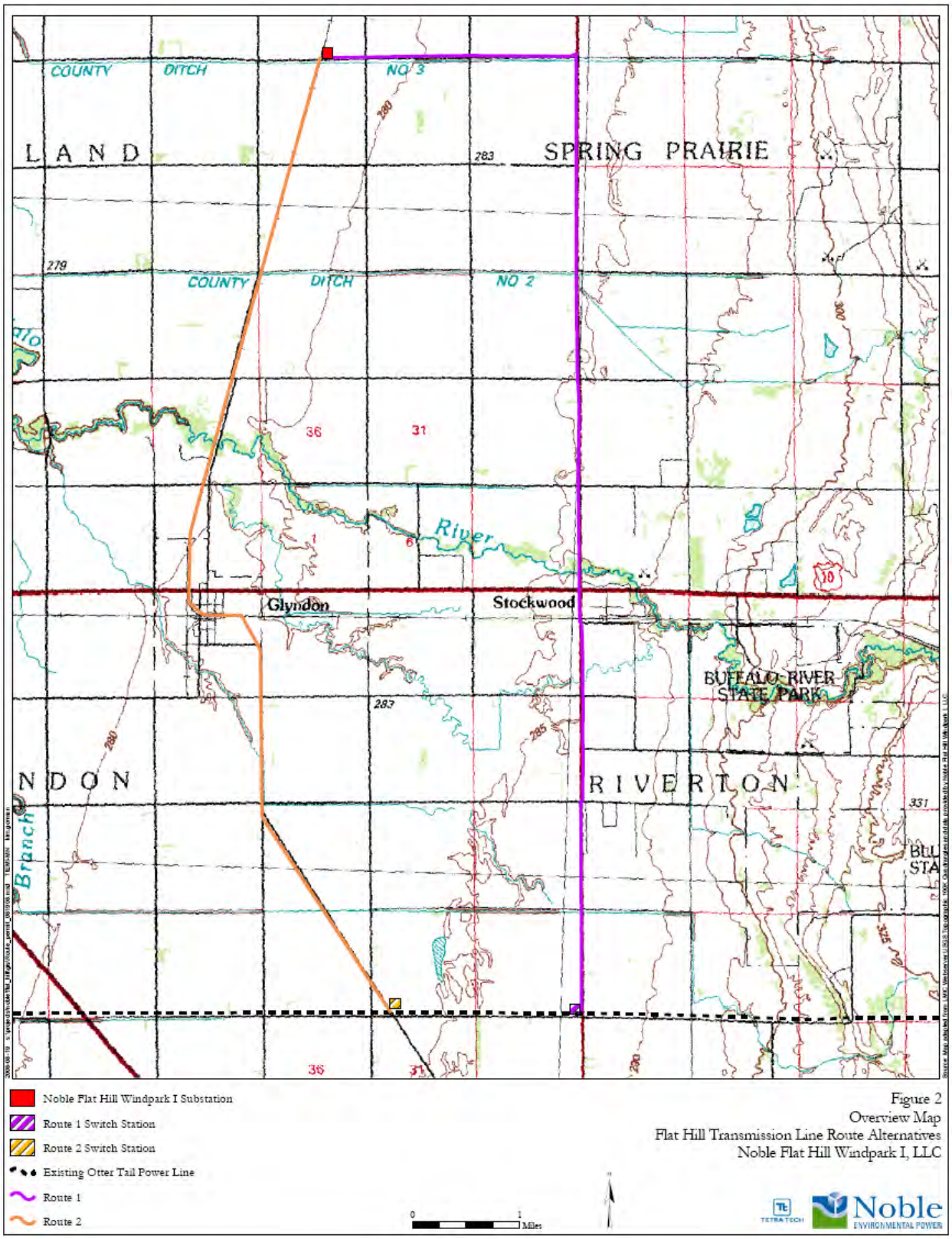
The Draft EIS shall be completed and available by July 2009. A public hearing will be held in Clay County before an Administrative Law Judge after the Draft EIS has been issued and notice served. The exact date and location of the public hearing has not been set.

Signed this 27th day of April, 2009

STATE OF MINNESOTA
DEPARTMENT OF COMMERCE
OFFICE OF ENERGY SECURITY

William Glahn, Director


Averill
Molanol Township
Spring Prairie Township
Glydon
Glydon Township
Riverton Township
Source: Maps adapted from 2003-2004 Farm Services Administration (FSA) Color
Preliminary Turbine Locations
Noble Flat Hill Windpark I Substation
Route 1 Switch Station
Route 1
Project Boundary
Township Boundary
0 0.5 1 1.5 2
Miles
Figure 1
Preliminary Wind Turbine Siting Plan
Site Permit Application
Noble Flat Hill Windpark I, LLC
TETRA TECH
Noble


COUNTY
DITCH
NO 3
LAND
SPRING PRAIRIE
COUNTY
DITCH
NO 2
River
Glyndon
Stockwood
BUFFALO RIVER
STATE PARK
RIVERTON
Noble Flat Hill Windpark I Substation
Route 1 Switch Station
Route 2 Switch Station
Existing Otter Tail Power Line
Route 1
Route 2
0
1
Miles
Figure 2
Overview Map
Flat Hill Transmission Line Route Alternatives
Noble Flat Hill Windpark I, LLC
TETRA TECH
Noble
ENVIRONMENTAL POWER

Appendix B

Public Health Impacts of Wind Turbines, 2009 – Prepared by the Minnesota Department of Health

Public Health Impacts
of
Wind Turbines

Prepared by:
Minnesota Department of Health
Environmental Health Division

In response to a request from:
Minnesota Department of Commerce
Office of Energy Security

May 22, 2009

Table of Contents

Tables

Figures

I. Introduction

In late February 2009 the Minnesota Department of Health (MDH) received a request from the Office of Energy Security (OES) in the Minnesota Department of Commerce, for a "white paper" evaluating possible health effects associated with low frequency vibrations and sound arising from large wind energy conversion systems (LWECS). The OES noted that there was a request for a Contested Case Hearing before the Minnesota Public Utilities Commission (PUC) on the proposed Bent Tree Wind Project in Freeborn County Minnesota; further, the OES had received a long comment letter from a citizen regarding a second project proposal, the Lakeswind Wind Power Plant in Clay, Becker and Ottertail Counties, Minnesota. This same commenter also wrote to the Commissioner of MDH to ask for an evaluation of health issues related to exposure to low frequency sound energy generated by wind turbines. The OES informed MDH that a white paper would have more general application and usefulness in guiding decision-making for future wind projects than a Contested Case Hearing on a particular project. (Note: A Contested Case Hearing is an evidentiary hearing before an Administrative Law Judge, and may be ordered by regulatory authorities, in this case the PUC, in order to make a determination on disputed issues of material fact. The OES advises the PUC on need and permitting issues related to large energy facilities.)

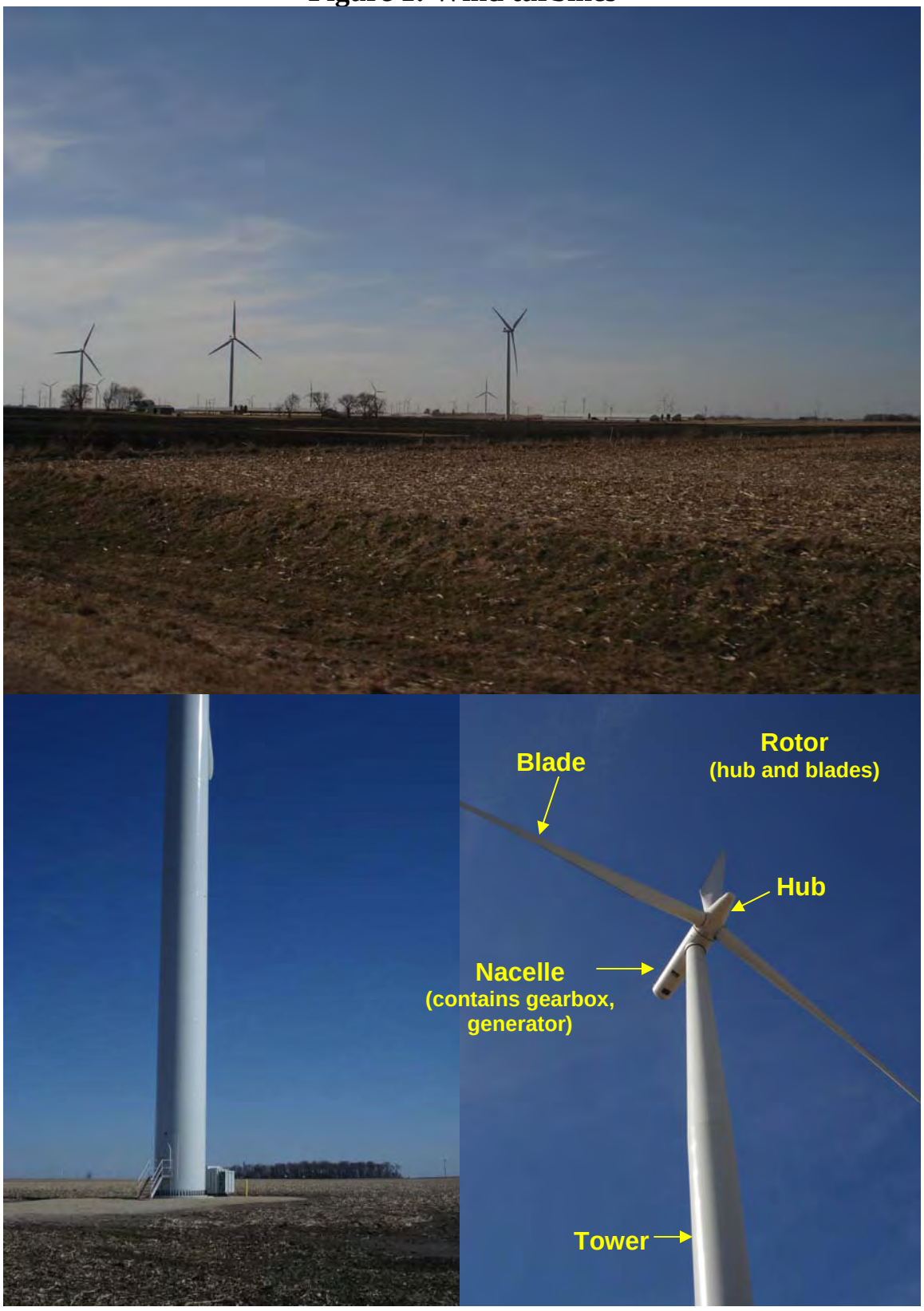
In early March 2009, MDH agreed to evaluate health impacts from wind turbine noise and low frequency vibrations. In discussion with OES, MDH also proposed to examine experiences and policies of other states and countries. MDH staff appeared at a hearing before the PUC on March 19, 2009, and explained the purpose and use of the health evaluation. The Commissioner replied to the citizen letter, affirming that MDH would perform the requested review.

A brief description of the two proposed wind power projects, and a brief discussion of health issues to be addressed in this report appear below.

A. Site Proposals

Wind turbines are huge and expensive machines requiring large capitol investment. Figure 1 shows some existing wind turbines in Minnesota. Large projects require control of extensive land area in order to optimize spacing of turbines to minimize turbulence at downwind turbines. Towers range up to 80 to 100 meters (260 to 325 feet), and blades can be up to 50 meters long (160 feet) (see Tetra Tech, 2008; WPL, 2008). Turbines are expected to be in place for 25-30 years.

Figure 1: Wind turbines



1. Bent Tree Wind Project in Freeborn County

This is a proposal by the Wisconsin Power and Light Company (WPL) for a 400 megawatt (MW) project in two phases of 200 MW each (requiring between 80 and 130 wind turbines). The cost of the first phase is estimated at $497 million. The project site area would occupy approximately 40 square miles located 4 miles north and west of the city of Albert Lea, approximately 95 miles south of Minneapolis (Figure 2) (WPL, 2008). The Project is a LWECS and a Certificate of Need (CON) from the PUC is required (*Minnesota Statutes 216B.243)*. The PUC uses the CON process to determine the basic type of facility (if any) to be constructed, the size of the facility, and when the project will be in service. The CON process involves a public hearing and preparation of an Environmental Report by the OES. The CON process generally takes a year, and is required before a facility can be permitted.

WPL is required to develop a site layout that optimizes wind resources. Accordingly, project developers are required to control areas at least 5 rotor diameters in the prevailing (north-south) wind directions (between about 1300 and 1700 feet for the 1.5 to 2.5 MW turbines under consideration for the project) and 3 rotor diameters in the crosswind (east-west) directions (between about 800 and 1000 feet). Thus, these are minimum setback distances from properties in the area for which easements have not been obtained. Further, noise rules promulgated by the Minnesota Pollution Control Agency (MPCA; *Minnesota Rules* Section 7030), specify a maximum nighttime noise in residential areas of 50 A-weighted decibels (dB(A). WPL has proposed a minimum setback of 1,000 feet from occupied structures in order to comply with the noise rule.

2. Noble Flat Hill Wind Park in Clay, Becker and Ottertail Counties

This is a LWECS proposed by Noble Flat Hill Windpark I (Noble), a subsidiary of Noble Environmental Power, based in Connecticut. The proposal is for a 201 MW project located 12 miles east of the City of Moorhead, about 230 miles northwest of Minneapolis (Figure 3) (Tetra Tech, 2008). The cost of the project is estimated to be between $382 million and $442 million. One hundred thirty-four GE 1.5 MW wind turbines are planned for an area of 11,000 acres (about 17 square miles); the site boundary encompasses approximately 20,000 acres. Setback distances of a minimum of 700 feet are planned to comply with the 50 dB(A) noise limit. However, rotor diameters will be 77 meters (250 feet). Therefore, setback distances in the prevailing wind direction of 1,300 feet are planned for properties where owners have not granted easements. Setbacks of 800 feet are planned in the crosswind direction.

Figure 2: Bent Tree Wind Project, Freeborn County

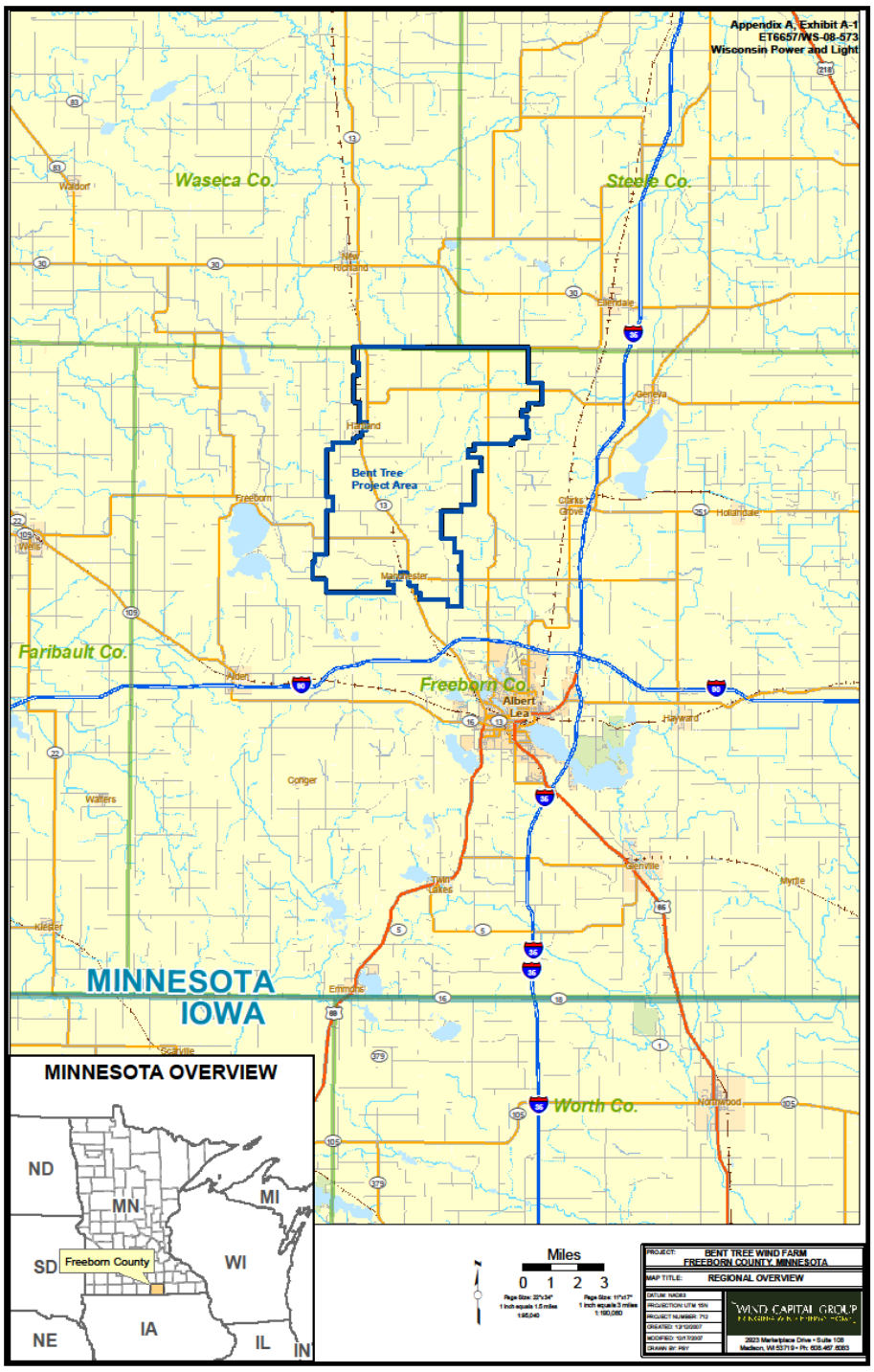
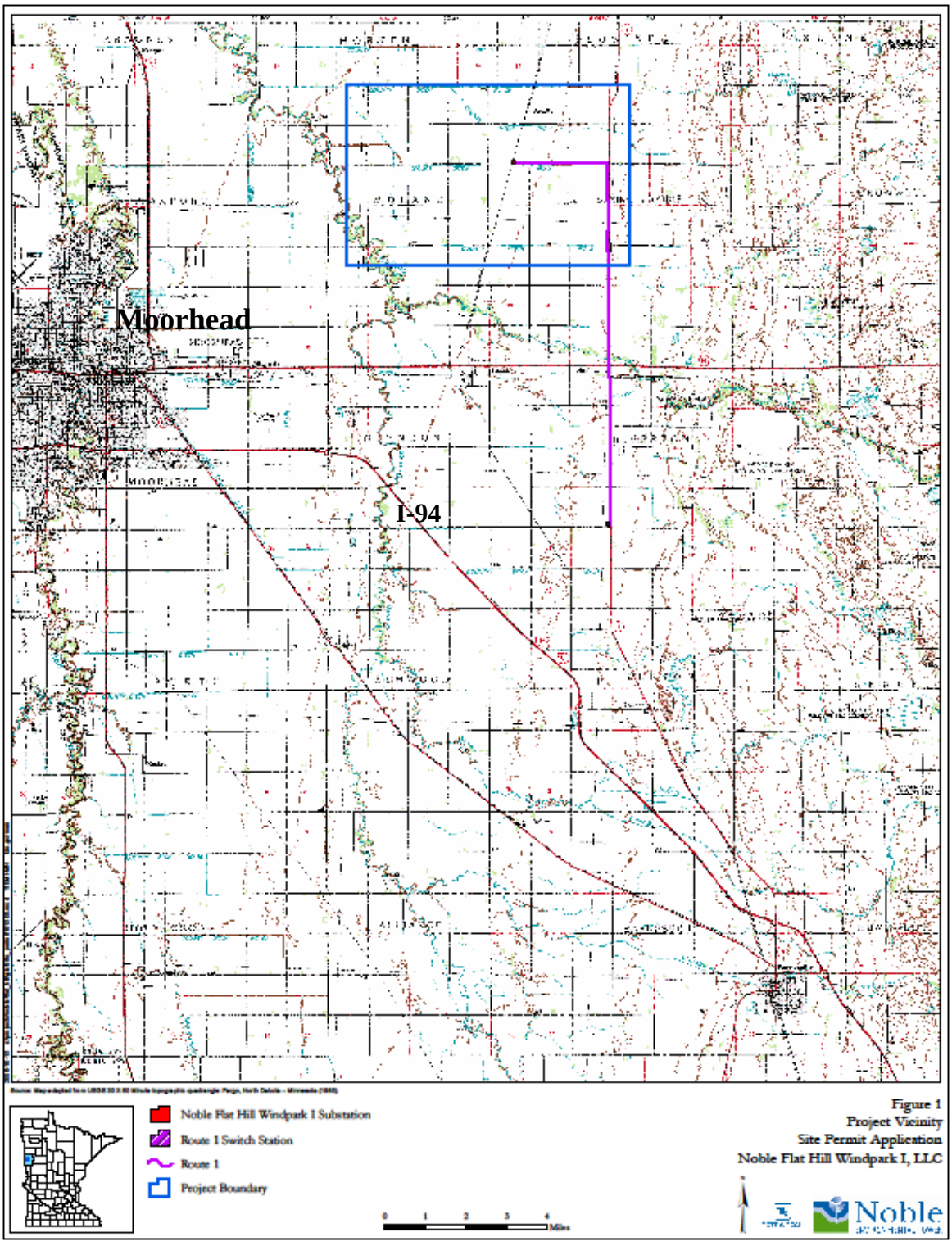


Figure 3: Noble Flat Hill Wind Park, Clay, Becker, Ottertail Counties



B. Health Issues

The National Research Council of the National Academies (NRC, 2007) has reviewed impacts of wind energy projects on human health and well-being. The NRC begins by observing that wind projects, just as other projects, create benefits and burdens, and that concern about impacts is natural when the source is near one's home. Further, the NRC notes that different people have different values and levels of sensitivity. Impacts noted by the NRC that may have the most effect on health include noise and low frequency vibration, and shadow flicker. While noise and vibration are the main focus of this paper, shadow flicker (casting of moving shadows on the ground as wind turbine blades rotate) will also be briefly discussed.

Noise originates from mechanical equipment inside the nacelles of the turbines (gears, generators, etc.) and from interaction of turbine blades with wind. Newer wind turbines generate minimal noise from mechanical equipment. The most problematic wind turbine noise is a broadband "whooshing" sound produced by interaction of turbine blades with the wind. Newer turbines have upwind rotor blades, minimizing low frequency "infrasound" (i.e., air pressure changes at frequencies below 20-100 Hz that are inaudible). However, the NRC notes that during quiet conditions at night, low frequency modulation of higher frequency sounds, such as are produced by turbine blades, is possible. The NRC also notes that effects of low frequency (infrasound) vibration (less than 20 Hz) on humans are not well understood, but have been asserted to disturb some people.

Finally, the NRC concludes that noise produced by wind turbines is generally not a major concern beyond a half mile. Issues raised by the NRC report and factors that may affect distances within which wind turbine noise may be problematic are discussed more extensively below.

II. Elementary Characteristics of Sensory Systems and Sound

A. Sensory Systems

1. Hearing

Sensory systems respond to a huge dynamic range of physical stimuli within a relatively narrow dynamic range of mechanical, chemical and/or neuronal (electrophysiological) output. Compression of the dynamic range is accomplished by systems that respond to logarithmic increases in intensity of physical stimuli with arithmetically increasing sensory responses. This general property is true for hearing, and has been recognized since at least the mid-19th century (see e.g., Woodworth and Schlosberg, 1964). "Loudness" is the sensory/perceptual correlate of the physical intensity of air pressure changes to which the electro-mechanical transducers in the ear and associated neuronal pathways are sensitive. Loudness increases as the logarithm of air pressure, and it is convenient to relate loudness to a reference air pressure (in dyne/cm^2 or pascals) in tenths of logarithmic units (decibels; dB). Further, the ear is sensitive to only a relatively narrow frequency range of air pressure changes: those between approximately 20 and 20,000 cycles per second or Herz (Hz). In fact, sensitivity varies within this range, so that the sound pressure level relative to a reference value that is audible in the middle of the range

(near 1,000 Hz) is about 4 orders of magnitude smaller than it is at 20 Hz and about 2 orders of magnitude smaller than at 20,000 Hz (Fig. 3). Accordingly, measurements of loudness in dB generally employ filters to equalize the loudness of sounds at different frequencies or "pitch." To approximate the sensitivity of the ear, A-weighted filters weigh sound pressure changes at frequencies in the mid-range more than those at higher or lower frequencies. When an A-weighted filter is used, loudness is measured in dB(A). This is explained in greater detail in Section B below.

The ear accomplishes transduction of sound through a series of complex mechanisms (Guyton, 1991). Briefly, sound waves move the eardrum (tympanic membrane), which is in turn connected to 2 small bones (ossicles) in the middle ear (the malleus and incus). A muscle connected to the malleus keeps the tympanic membrane tensed, allowing efficient transmission to the malleus of vibrations on the membrane. Ossicle muscles can also relax tension and attenuate transmission. Relaxation of muscle tension on the tympanic membrane protects the ear from very loud sounds and also masks low frequency sounds, or much background noise. The malleus and incus move a third bone (stapes). The stapes in turn applies pressure to the fluid of the cochlea, a snail-shaped structure imbedded in temporal bone. The cochlea is a complex structure, but for present purposes it is sufficient to note that pressure changes or waves of different frequencies in cochlear fluid result in bending of specialized hair cells in regions of the cochlea most sensitive to different frequencies or pitch. Hair cells are directly connected to nerve fibers in the vestibulocochlear nerve (VIII cranial nerve).

Transmission of sound can also occur directly through bone to the cochlea. This is a very inefficient means of sound transmission, unless a device (e.g. a tuning fork or hearing aid) is directly applied to bone (Guyton, 1991).

2. Vestibular System

The vestibular system reacts to changes in head and body orientation in space, and is necessary for maintenance of equilibrium and postural reflexes, for performance of rapid and intricate body movements, and for stabilizing visual images (via the vestibulo-ocular reflex) as the direction of movement changes (Guyton, 1991).

The vestibular apparatus, like the cochlea, is imbedded in temporal bone, and also like the cochlea, hair cells, bathed in vestibular gels, react to pressure changes and transmit signals to nerve fibers in the vestibulocochlear nerve. Two organs, the utricle and saccule, called otolith organs, integrate information about the orientation of the head with respect to gravity. Otoliths are tiny stone-like crystals, embedded in the gels of the utricle and saccule, that float as the head changes position within the gravitational field. This movement is translated to hair cells. Three semi-circular canals, oriented at right angles to each other, detect head rotation. Stimulation of the vestibular apparatus is not directly detected, but results in activation of motor reflexes as noted above (Guyton, 1991).

Like the cochlea, the vestibular apparatus reacts to pressure changes at a range of frequencies; optimal frequencies are lower than for hearing. These pressure changes can be caused by body movements, or by direct bone conduction (as for hearing, above) when vibration is applied directly to the temporal bone (Todd et al., 2008). These investigators

found maximal sensitivity at 100 Hz, with some sensitivity down to 12.5 Hz. The saccule, located in temporal bone just under the footplate of the stapes, is the most sound-sensitive of the vestibular organs (Halmagyi et al., 2004). It is known that brief loud clicks (90-95 dB) are detected by the vestibular system, even in deaf people. However, we do not know what the sensitivity of this system is through the entire range of sound stimuli.

While vestibular system activation is not directly felt, activation may give rise to a variety of sensations: vertigo, as the eye muscles make compensatory adjustments to rapid angular motion, and a variety of unpleasant sensations related to internal organs. In fact, the vestibular system interacts extensively with the "autonomic" nervous system, which regulates internal body organs (Balaban and Yates, 2004). Sensations and effects correlated with intense vestibular activation include nausea and vomiting and cardiac arrhythmia, blood pressure changes and breathing changes.

While these effects are induced by relatively intense stimulation, it is also true that A-weighted sound measurements attuned to auditory sensitivity, will underweight low frequencies for which the vestibular system is much more sensitive (Todd et al., 2008). Nevertheless, activation of the vestibular system *per se* obviously need not give rise to unpleasant sensations. It is not known what stimulus intensities are generally required for for autonomic activation at relatively low frequencies, and it is likely that there is considerable human variability and capacity to adapt to vestibular challenges.

B. Sound

1. Introduction

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

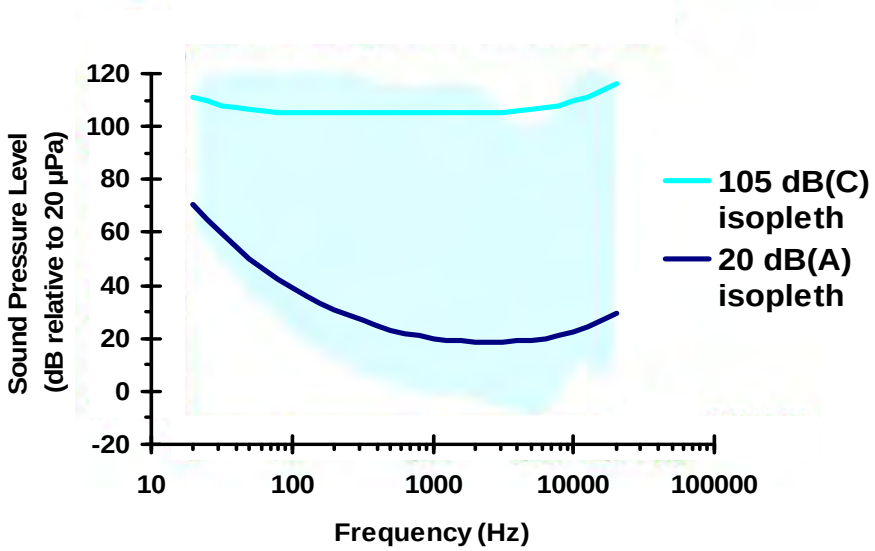
Audible Frequency Sound

Besides frequency sensitivity (between 20 and 20,000 Hz), humans are also sensitive to changes in the amplitude of the signal (compression waves) within this audible range of frequencies. Increasing amplitude, or increasing sound pressure, is perceived as increasing volume or loudness. The sound pressure level in air (SPL) is measured in micro Pascals (μPa). SPLs are typically converted in measuring instruments and reported as decibels (dB) which is a log scale, relative unit (see above). When used as the unit for sound, dBs are reported relative to a SPL of 20 μPa. Twenty μPa is used because it is the approximate threshold of human hearing sensitivity at about 1000 Hz. Decibels relative to 20 μPa are calculated from the following equation:

$$\text{Loudness (dB)} = \text{Log}\left(\left(\text{SPL} / 20\ \mu\text{Pa}\right)^2\right) * 10$$

Figure 4 shows the audible range of normal human hearing. Note that while the threshold sensitivity varies over the frequency range, at high SPLs sensitivity is relatively consistent over audible frequencies.

Figure 4: Audible Range of Human Hearing



Equivalence curves for different frequencies, when sound meter readings in dB are taken with A or C-weighting filters. (Adapted from EPD Hong Kong SAR, 2009)

Sub-Audible Frequency Sound

Sub-audible frequency sound is often called infrasound. It may be sensed by people, similar to audible sound, in the cochlear apparatus in the ear; it may be sensed by the vestibular system which is responsible for balance and physical equilibrium; or it may be sensed as vibration.

Resonance and modulation

Sound can be attenuated as it passes through a physical structure. However, because the wavelength of low frequency sound is very long (the wavelength of 40 Hz in air at sea level and room temperature is 8.6 meters or 28 ft), low frequencies are not effectively attenuated by walls and windows of most homes or vehicles. (For example, one can typically hear the bass, low frequency music from a neighboring car at a stoplight, but not the higher frequencies.) In fact, it is possible that there are rooms within buildings exposed to low frequency sound or noise where some frequencies may be amplified by resonance (e.g. ½ wavelength, ¼ wavelength) within the structure. In addition, low frequency sound can cause vibrations within a building at higher, more audible frequencies as well as throbbing or rumbling.

Sounds that we hear generally are a mixture of different frequencies. In most instances these frequencies are added together. However, if the source of the sound is not constant, but changes over time, the effect can be re-occurring pulses of sound or low frequency modulation of sound. This is the type of sound that occurs from a steam engine, a jack hammer, music and motor vehicle traffic. Rhythmic, low frequency pulsing of higher frequency noise (like the sound of an amplified heart beat) is one type of sound that can be caused by wind turbine blades under some conditions.

2. Human Response to Low Frequency Stimulation

There is no consensus whether sensitivity below 20 Hz is by a similar or different mechanism than sensitivity and hearing above 20 Hz (Reviewed by Møller and Pedersen, 2004). Possible mechanisms of sensation caused by low frequencies include bone conduction at the applied frequencies, as well as amplification of the base frequency and/or harmonics by the auditory apparatus (eardrum and ossicles) in the ear. Sensory thresholds are relatively continuous, suggesting (but not proving) a similar mechanism above and below 20 Hz. However, it is clear that cochlear sensitivity to infrasound (< 20 Hz) is considerably less than cochlear sensitivity to audible frequencies.

Møller and Pedersen (2004) reviewed human sensitivity at low and infrasonic frequencies. The following findings are of interest:

- When whole-body pressure-field sensitivity is compared with ear-only (earphone) sensitivity, the results are very similar. These data suggest that the threshold sensitivity for low frequency is through the ear and not vestibular.
- Some individuals have extraordinary sensitivity at low frequencies, up to 25 dB more sensitive than the presumed thresholds at some low frequencies.
- While population average sensitivity over the low frequency range is smooth, sound pressure thresholds of response for individuals do not vary smoothly but are inconsistent, with peaks and valleys or "microstructures". Therefore the sensitivity response of individuals to different low frequency stimulation may be difficult to predict.
- Studies of equal-loudness-levels demonstrate that as stimulus frequency decreases through the low frequencies, equal-loudness lines compress in the dB scale. (See Figure 4 as an example of the relatively small difference in auditory SPL range between soft and loud sound at low frequencies).
- The hearing threshold for pure tones is different than the hearing threshold for white noise at the same total sound pressure.

3. Sound Measurements

Sound measurements are taken by instruments that record sound pressure or the pressure of the compression wave in the air. Because the loudness of a sound to people is usually the primary interest in measuring sound, normalization schemes or filters have been applied to absolute measurements. dB(A) scaling of sound pressure measurements was intended to normalize readings to equal loudness over the audible range of frequencies at low loudness. For example, a 5,000 Hz (5 kHz) and 20 dB(A) tone is expected to have the same intensity or loudness as a 100 Hz, 20 dB(A) tone. However, note that the absolute sound pressures would be about 20,000 μPa and 40,000 μPa, respectively, or about a difference of 20 dB (relative to 20 μPa), or as it is sometimes written 20 dB(linear).

Most sound is not a single tone, but is a mixture of frequencies within the audible range. A sound meter can add the total SPLs for all frequencies; in other words, the dB readings over the entire spectrum of audible sound can be added to give a single loudness metric. If sound is reported as A-weighted, or dB(A), it is a summation of the dB(A) scaled sound pressure from 20 Hz to 20 kHz.

In conjunction with the dB(A) scale, the dB(B) scale was developed to approximate equal loudness to people across audible frequencies at medium loudness, and dB(C) was developed to approximate equal-loudness for loud environments. Figure 4 shows isopleths for 20 dB(A) and 105 dB(C). While dB(A), dB(B), dB(C) were developed from empirical data at the middle frequencies, at the ends of the curves these scales were extrapolated, or sketched in, and are not based on experimental or observational data (Berglund et al., 1996). As a result, data in the low frequency range (and probably the highest audible frequencies as well) cannot be reliably interpreted using these scales. The World Health Organization (WHO, 1999) suggests that A-weighting noise that has a large low frequency component is not reliable assessment of loudness.

The source of the noise, or the noise signature, may be important in developing equal-loudness schemes at low frequencies. C-weighting has been recommended for artillery noise, but a linear, unweighted scale may be even better at predicting a reaction (Berglund et al., 1996). A linear or equal energy rating also appears to be the most effective predictor of reaction to low frequency noise in other situations, including blast noise from mining. The implication of the analysis presented by Berglund et al. (1996) is that annoyance from non-tonal noise should not be estimated from a dB(A) scale, but may be better evaluated using dB(C), or a linear non-transformed scale.

However, as will be discussed below, a number of schemes use a modified dB(A) scale to evaluate low frequency noise. These schemes differ from a typical use of the dB(A) scale by addressing a limited frequency range below 250 Hz, where auditory sensitivity is rapidly changing as a function of frequency (see Figure 4).

III. Exposures of Interest

A. Noise From Wind Turbines

1. Mechanical noise

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

2. Aerodynamic noise

Aerodynamic noise is caused by wind passing over the blade of the wind turbine. The tip of a 40-50 meter blade travels at speeds of over 140 miles per hour under normal operating conditions. As the wind passes over the moving blade, the blade interrupts the laminar flow of air, causing turbulence and noise. Current blade designs minimize the amount of turbulence and noise caused by wind, but it is not possible to eliminate turbulence or noise.

Aerodynamic noise from a wind turbine may be underestimated during planning. One source of error is that most meteorological wind speed measurements noted in wind farm literature are taken at 10 meters above the ground. Wind speed above this elevation, in

the area of the wind turbine rotor, is then calculated using established modeling relationships. In one study (van den Berg, 2004) it was determined that the wind speeds at the hub at night were up to 2.6 times higher than modeled. Subsequently, it was found that noise levels were 15 dB higher than anticipated.

Unexpectedly high aerodynamic noise can also be caused by improper blade angle or improper alignment of the rotor to the wind. These are correctable and are usually adjusted during the turbine break-in period.

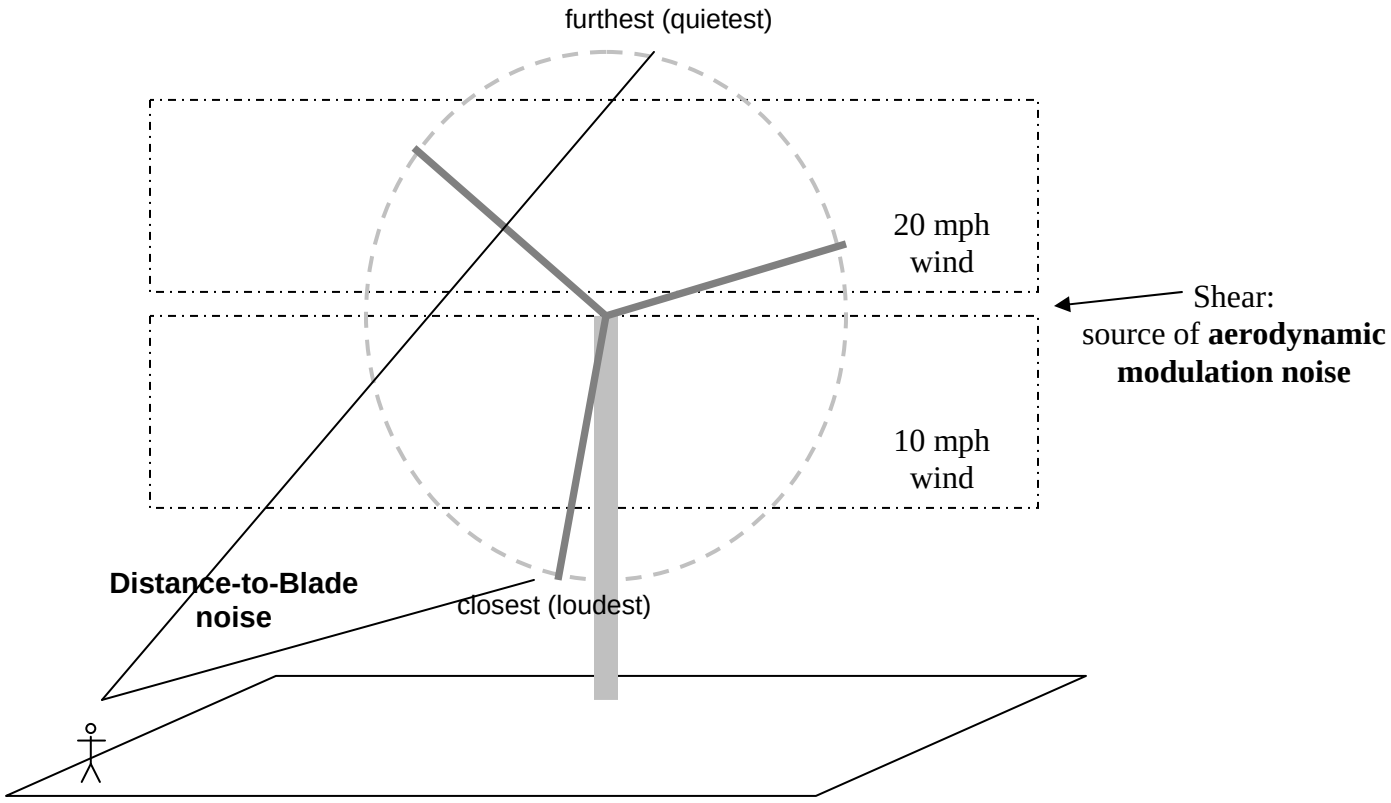
3. Modulation of aerodynamic noise

Rhythmic modulation of noise, especially low frequency noise, has been found to be more annoying than steady noise (Bradley, 1994; Holmberg et al., 1997). One form of rhythmic modulation of aerodynamic noise that can be noticeable very near to a wind turbine is a distance-to-blade effect. To a receptor on the ground in front of the wind turbine, the detected blade noise is loudest as the blade passes, and quietest when the blade is at the top of its rotation. For a modern 3-blade turbine, this distance-to-blade effect can cause a pulsing of the blade noise at about once per second (1 Hz). On the ground, about 500 feet directly downwind from the turbine, the distance-to-blade can cause a difference in sound pressure of about 2 dB between the *tip* of the blade at its farthest point and the *tip* of the blade at its nearest point (48 meter blades, 70 meter tower). Figure 5 demonstrates why the loudness of blade noise (aerodynamic noise) pulses as the distance-to-blade varies for individuals close to a turbine.

If the receptor is 500 feet from the turbine base, in line with the blade rotation or up to 60° off line, the difference in sound pressure from the *tip* of the blade at its farthest and nearest point can be about 4-5 dB, an audible difference. The tip travels faster than the rest of the blade and is closer to (and then farther away from) the receptor than other parts of the blade. As a result, noise from other parts of the blade will be modulated less than noise from the tip. Further, blade design can also affect the noise signature of a blade. The distance-to-blade effect diminishes as receptor distance increases because the relative difference in distance from the receptor to the top or to the bottom of the blade becomes smaller. Thus, moving away from the tower, distance-to-blade noise gradually appears to be more steady.

Another source of rhythmic modulation may occur if the wind through the rotor is not uniform. Blade angle, or pitch, is adjusted for different wind speeds to maximize power and to minimize noise. A blade angle that is not properly tuned to the wind speed (or wind direction) will make more noise than a properly tuned blade. Horizontal layers with different wind speeds or directions can form in the atmosphere. This wind condition is called shear. If the winds at the top and bottom of the blade rotation are different, blade noise will vary between the top and bottom of blade rotation, causing modulation of aerodynamic noise. This noise, associated with the blades passing through areas of different air-wind speeds, has been called aerodynamic modulation and is demonstrated in Figure 5.

Figure 5: Sources of noise modulation or pulsing



In some terrains and under some atmospheric conditions wind aloft, near the top of the wind turbine, can be moving faster than wind near the ground. Wind turbulence or even wakes from adjacent turbines can create non-uniform wind conditions as well. As a result of aerodynamic modulation a rhythmic noise pattern or pulsing will occur as each blade passes through areas with different wind speed. Furthermore, additional noise, or thumping, may occur as each blade passes through the transition between different wind speed (or wind direction) areas.

Wind shear caused by terrain or structures on the ground (e.g. trees, buildings) can be modeled relatively easily. Wind shear in areas of flat terrain is not as easily understood. During the daytime wind in the lower atmosphere is strongly affected by thermal convection which causes mixing of layers. Distinct layers do not easily form. However, in the nighttime the atmosphere can stabilize (vertically), and layers form. A paper by G.P. van den Berg (2008) included data from a study on wind shear at Cabauw, The Netherlands (flat terrain). Annual average wind speeds at different elevations above ground was reported. The annual average wind speed at noon was about 5.75 meters per second (m/s; approximately 12.9 miles per hour(mph)) at 20 m above ground, and about 7.6 m/s (17 mph) at 140 m. At midnight, the annual averages were about 4.3 m/s (9.6 mph) and 8.8 m/s (19.7 mph) for 20m and 140 m, respectively, above ground. The data show that while the average windspeed (between 20m and 140m) is very similar at noon and midnight at Cabauw, the windspeed difference between elevations during the day is

much less than the difference at night (1.85 m/s (4.1 mph) and 4.5 m/s (10 mph), respectively). As a result one would expect that the blade angle can be better tuned to the wind speed during the daytime. Consequently, blade noise would be greater at night.

A number of reports have included discussion of aerodynamic modulation (van den Berg, 2005; UK Department of Transport and Industry, 2006; UK Department for Business Enterprise and Regulatory Reform, 2007; van den Berg, 2008). They suggest that aerodynamic modulation is typically underestimated when noise estimates are calculated. In addition, they suggest that detailed modeling of wind, terrain, land use and structures may be used to predict whether modulation of aerodynamic noise will be a problem at a proposed wind turbine site.

4. Wind farm noise

The noise from multiple turbines similarly distant from a residence can be noticeably louder than a lone turbine simply through the addition of multiple noise sources. Under steady wind conditions noise from a wind turbine farm may be greater than noise from the nearest turbine due to synchrony between noise from more than one turbine (van den Berg, 2005). Furthermore, if the dominant frequencies (including aerodynamic modulation) of different turbines vary by small amounts, an audible beat or dissonance may be heard when wind conditions are stable.

B. Shadow Flicker

Rhythmic light flicker from the blades of a wind turbine casting intermittent shadows has been reported to be annoying in many locations (NRC, 2007; Large Wind Turbine Citizens Committee, 2008). (Note: Flashing light at frequencies around 1 Hz is too slow to trigger an epileptic response.)

Modeling conducted by the Minnesota Department of Health suggests that a receptor 300 meters perpendicular to, and in the shadow of the blades of a wind turbine, can be in the flicker shadow of the rotating blade for almost 1½ hour a day. At this distance a blade may completely obscure the sun each time it passes between the receptor and the sun. With current wind turbine designs, flicker should not be an issue at distances over 10 rotational diameters (~1000 meters or 1 km (0.6 mi) for most current wind turbines). This distance has been recommended by the Wind Energy Handbook (Burton et al., 2001) as a minimum setback distance in directions that flicker may occur, and has been noted in the Bent Tree Permit Application (WPL, 2008).

Shadow flicker is a potential issue in the mornings and evenings, when turbine noise may be masked by ambient sounds. While low frequency noise is typically an issue indoors, shadow flicker can be an issue both indoors and outdoors when the sun is low in the sky. Therefore, shadow flicker may be an issue in locations other than the home.

Ireland recommends wind turbines setbacks of at least 300 meters from a road to decrease driver distraction (Michigan State University, 2004). The NRC (2007) recommends that shadow flicker is addressed during the preliminary planning stages of a wind turbine project.

IV. Impacts of Wind Turbine Noise

A. Potential Adverse Reaction to Sound

Human sensitivity to sound, especially to low frequency sound, is variable. Individuals have different ranges of frequency sensitivity to audible sound; different thresholds for each frequency of audible sound; different vestibular sensitivities and reactions to vestibular activation; and different sensitivity to vibration.

Further, sounds, such as repetitive but low intensity noise, can evoke different responses from individuals. People will exhibit variable levels of annoyance and tolerance for different frequencies. Some people can dismiss and ignore the signal, while for others, the signal will grow and become more apparent and unpleasant over time (Moreira and Bryan, 1972; Bryan and Tempest, 1973). These reactions may have little relationship to will or intent, and more to do with previous exposure history and personality.

Stress and annoyance from noise often do not correlate with loudness. This may suggest, in some circumstances, other factors impact an individual's reaction to noise. A number of reports, cited in Staples (1997), suggest that individuals with an interest in a project and individuals who have some control over an environmental noise are less likely to find a noise annoying or stressful.

Berglund et al. (1996) reviewed reported health effects from low frequency noise. Loud noise from any source can interfere with verbal communication and possibly with the development of language skills. Noise may also impact mental health. However, there are no studies that have looked specifically at the impact of low frequency noise on communication, development of language skills and mental health. Cardiovascular and endocrine effects have been demonstrated in studies that have looked at exposures to airplane and highway noise. In addition, possible effects of noise on performance and cognition have also been investigated, but these health studies have not generally looked at impacts specifically from low frequency noise. Noise has also been shown to impact sleep and sleep patterns, and one study demonstrated impacts from low frequency noise in the range of 72 to 85 dB(A) on chronic insomnia (Nagai et al., 1989 as reported in Berglund et al., 1996).

Case studies have suggested that health can be impacted by relatively low levels of low frequency noise. But it is difficult to draw general conclusions from case studies. Feldmann and Pitten (2004)) describe a family exposed during the winter to low frequency noise from a nearby heating plant. Reported health impacts were: "indisposition, decrease in performance, sleep disturbance, headache, ear pressure, crawl parästhesy [crawling, tingling or numbness sensation on the skin] or shortness of breath."

Annoyance, unpleasant sounds, and complaints

Reported health effects from low frequency stimulation are closely associated with annoyance from audible noise. "There is no reliable evidence that infrasounds below the hearing threshold produce physiological or psychological effects" (WHO, 1999). It has not been shown whether annoyance is a symptom or an accessory in the causation of

health impacts from low frequency noise. Studies have been conducted on some aspects of low frequency noise that can cause annoyance.

Noise complaints are usually a reasonable measure of annoyance with low frequency environmental noise. Leventhall (2004) has reviewed noise complaints and offers the following conclusions:

> " The problems arose in quiet rural or suburban environments
> The noise was often close to inaudibility and heard by a minority of people
> The noise was typically audible indoors and not outdoors
> The noise was more audible at night than day
> The noise had a throb or rumble characteristic
> The main complaints came from the 55-70 years age group
> The complainants had normal hearing.
> Medical examination excluded tinnitus.
>
> " These are now recognised as classic descriptors of low frequency noise problems."

These observations are consistent with what we know about the propagation of low intensity, low frequency noise. Some people are more sensitive to low frequency noise. The difference, in dB, between soft (acceptable) and loud (annoying) noise is much less at low frequency (see Figure 4 audible range compression). Furthermore, during the daytime, and especially outdoors, annoying low frequency noise can be masked by high frequency noise.

The observation that "the noise was typically audible indoors and not outdoors" is not particularly intuitive. However, as noted in a previous section, low frequencies are not well attenuated when they pass through walls and windows. Higher frequencies (especially above 1000 Hz) can be efficiently attenuated by walls and windows. In addition, low frequency sounds may be amplified by resonance within rooms and halls of a building. Resonance is often characterized by a throbbing or a rumbling, which has also been associated with many low frequency noise complaints.

Low frequency noise, unlike higher frequency noise, can also be accompanied by shaking, vibration and rattling. In addition, throbbing and rumbling may be apparent in some low frequency noise. While these noise features may not be easily characterized, numerous studies have shown that their presence dramatically lowers tolerance for low frequency noise (Berglund et al., 1996).

As reviewed in Leventhall (2003), a study of industrial exposure to low frequency noise found that fluctuations in total noise averaged over 0.5, 1.0 and 2.0 seconds correlated with annoyance (Holmberg et al., 1997). This association was noted elsewhere and led (Broner and Leventhall, 1983) to propose a 3dB "penalty" be added to evaluations of annoyance in cases where low frequency noise fluctuated.

In another laboratory study with test subjects controlling loudness, 0.5 – 4 Hz modulation of low frequency noise was found to be more annoying than non-modulated low

frequency noise. On average test subjects found modulated noise to be similarly annoying as a constant tone 12.9 dB louder (Bradley, 1994).

B. Studies of Wind Turbine Noise Impacts on People

1. Swedish Studies

Two studies in Sweden collected information by questionnaires from 341 and 754 individuals (representing response rates of 68% and 58%, respectively), and correlated responses to calculated exposure to noise from wind farms (Pedersen and Waye, 2004; Pedersen, 2007; Pedersen and Persson, 2007). Both studies showed that the number of respondents perceiving the noise from the wind turbines increased as the calculated noise levels at their homes increased from less than 32.5 dB(A) to greater than 40 dB(A). Annoyance appeared to correlate or trend with calculated noise levels. Combining the data from the two studies, when noise measurements were greater than 40 dB(A), about 50% of the people surveyed (22 of 45 people) reported annoyance. When noise measurements were between 35 and 40 dB(A) about 24% reported annoyance (67 of 276 people). Noise annoyance was more likely in areas that were rated as quiet and in areas where turbines were visible. In one of the studies, 64% respondents who reported noise annoyance also reported sleep disturbance; 15% of respondents reported sleep disturbance without annoyance.

2. United Kingdom Study

Moorhouse et al. (UK Department for Business Enterprise and Regulatory Reform, 2007) evaluated complaints about wind farms. They found that 27 of 133 operating wind farms in the UK received formal complaints between 1991 and 2007. There were a total of 53 complainants for 16 of the sites for which good records were available. The authors of the report considered that many complaints in the early years were for generator and gearbox noise. However, subjective analyses of reports about noise ("like a train that never gets there", "distant helicopter", "thumping", "thudding", "pulsating", "thumping", "rhythmical beating", and "beating") suggested that aerodynamic modulation was the likely cause of complaints at 4 wind farms. The complaints from 8 other wind farms may have had "marginal" association with aerodynamic modulation noise.

Four wind farms that generated complaints possibly associated with aerodynamic modulation were evaluated further. These wind farms were commissioned between 1999 and 2002. Wind direction, speed and times of complaints were associated for 2 of the sites and suggested that aerodynamic modulation noise may be a problem between 7% and 25% of the time. Complaints at 2 of the farms have stopped and at one farm steps to mitigate aerodynamic modulation (operational shutdown under certain meteorological conditions) have been instituted.

3. Netherlands Study

F. van den Berg et al. (2008) conducted a postal survey of a group selected from all residents in the Netherlands within 2.5 kilometers (km) of a wind turbine. In all, 725 residents responded (37%). Respondents were exposed to sound between 24 and 54 dB(A). The percentage of respondents annoyed by sound increased from 2% at levels of 30 dB(A) or less, up to 25% at between 40 and 45 dB. Annoyance decreased above 45 dB. Most residents exposed above 45 dB(A) reported economic benefits from the

turbines. However, at greater than 45 dB(A) more respondents reported sleep interruption. Respondents tended to report more annoyance when they also noted a negative effect on landscape, and ability to see the turbines was strongly related to the probability of annoyance.

4. Case Reports

A number of un-reviewed reports have catalogued complaints of annoyance and some more severe health impacts associated with wind farms. These reports do not contain measurements of noise levels, and do not represent random samples of people living near wind turbines, so they cannot assess prevalence of complaints. They do generally show that in the people surveyed, complaints are more likely the closer people are to the turbines. The most common complaint is decreased quality of life, followed by sleep loss and headache. Complaints seem to be either from individuals with homes quite close to turbines, or individuals who live in areas subject to aerodynamic modulation and, possibly, enhanced sound propagation which can occur in hilly or mountainous terrain. In some of the cases described, people with noise complaints also mention aesthetic issues, concern for ecological effects, and shadow flicker concerns. Not all complaints are primarily about health.

Harry (2007) describes a meeting with a couple in Cornwall, U.K. who live 400 meters from a wind turbine, and complained of poor sleep, headaches, stress and anxiety. Harry subsequently investigated 42 people in various locations in the U.K. living between 300 meters and 2 kilometers (1000 feet to 1.2 miles) from the nearest wind turbine. The most frequent complaint (39 of 42 people) was that their quality of life was affected. Headaches were reported by 27 people and sleep disturbance by 28 people. Some people complained of palpitations, migraines, tinnitus, anxiety and depression. She also mentions correspondence and complaints from people in New Zealand, Australia, France, Germany, Netherlands and the U.S.

Phipps (2007) discusses a survey of 619 households living up to 10 kilometers (km; 6 miles) from wind farms in mountainous areas of New Zealand. Most respondents lived between 2 and 2.5 km from the turbines (over 350 households). Most respondents (519) said they could see the turbines from their homes, and 80% of these considered the turbines intrusive, and 73% considered them unattractive. Nine percent said they were affected by flicker. Over 50% of households located between 2 and 2.5 km and between 5 and 9.5 km reported being able to hear the turbines. In contrast, fewer people living between 3 and 4.5 km away could hear the turbines. Ninety-two households said that their quality of life was affected by turbine noise. Sixty-eight households reported sleep disturbances: 42 of the households reported occasional sleep disturbances, 21 reported frequent sleep disturbances and 5 reported sleep disturbances most of the time.

The Large Wind Turbine Citizens Committee for the Town of Union (2008) documents complaints from people living near wind turbines in Wisconsin communities and other places in the U.S. and U.K. Contained in this report is an older report prepared by the Wisconsin Public Service Corporation in 2001 in response to complaints in Lincoln County, Wisconsin. The report found essentially no exceedances of the 50 dB(A) requirement in the conditional use permit. The report did measure spectral data

accumulated over very short intervals (1 minute) in 1/3 octave bands at several sites while the wind turbines were functioning, and it is of interest that at these sites the sound pressure level at the lower frequencies (below 125 Hz) were at or near 50 dB(A).

Pierpont (2009) postulates wind turbine syndrome, consisting of a constellation of symptoms including headache, tinnitus, ear pressure, vertigo, nausea, visual blurring, tachycardia, irritability, cognitive problems and panic episodes associated with sensations of internal pulsation. She studied 38 people in 10 families living between 1000 feet and slightly under 1 mile from newer wind turbines. She proposes that the mechanism for these effects is disturbance of balance due to "discordant" stimulation of the vestibular system, along with visceral sensations, sensations of vibration in the chest and other locations in the body, and stimulation of the visual system by moving shadows. Pierpont does report that her study subjects maintain that their problems are caused by noise and vibration, and the most common symptoms reported are sleep disturbances and headache. However, 16 of the people she studied report symptoms consistent with (but not necessarily caused by) disturbance of equilibrium.

V. Noise Assessment and Regulation

1. Minnesota noise regulation

The Minnesota Noise Pollution Control Rule is accessible online at: https://www.revisor.leg.state.mn.us/rules/?id=7030 . A summary of the Minnesota Pollution Control Agency (MPCA) noise guidance can be found online at: http://www.pca.state.mn.us/programs/noise.html . The MPCA standards require A-weighting measurements of noise; background noise must be at least 10 dB lower than the noise source being measured. Different standards are specified for day and night, as well as standards that may not be exceeded for more than 10 percent of the time during any hour (L10) and 50 percent of the time during any hour (L50). Household units, including farm houses, are Classification 1 land use. The following are the Class 1 noise limits:

Table 1: Minnesota Class 1 Land Use Noise Limits

Daytime		Nighttime	
L50	L10	L50	L10
60 dB(A)	65 dB(A)	50 dB(A)	55 dB(A)

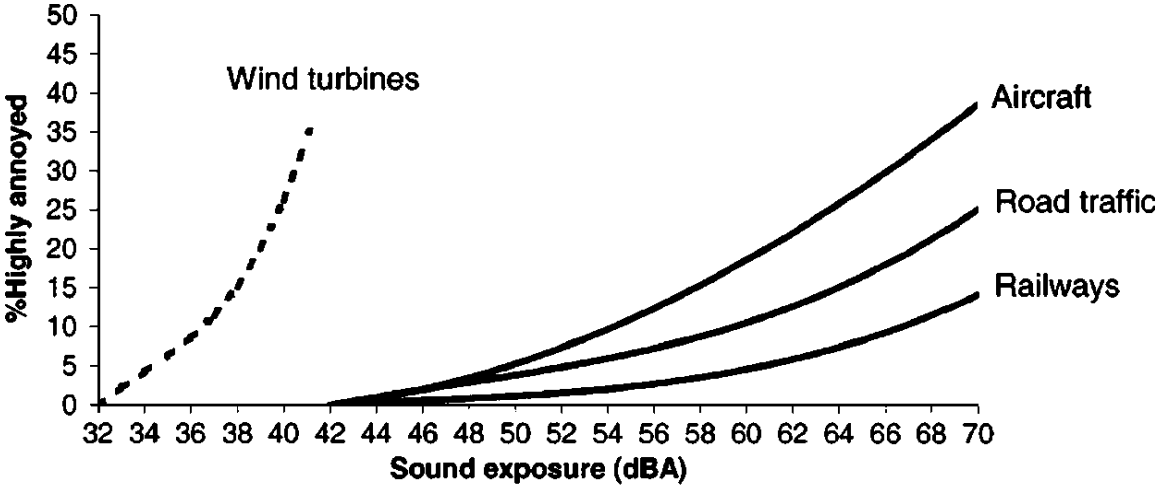
These noise limits are single number limits that rely on the measuring instrument to apply an A-weighting filter over the entire presumed audible spectrum of frequencies (20 Hz to 20 KHz) and then integrating that signal. The result is a single number that characterizes the audible spectrum noise intensity.

2. Low frequency noise assessment and regulation

Pedersen and Waye (2004) looked at the relationship between total dB(A) sound pressure and the annoyance of those who are environmentally exposed to noise from different sources. Figure 6 demonstrates the difficulty in using total dB(A) to evaluate annoyance. Note how lower noise levels (dB(A)) from wind turbines engenders annoyance similar to

much higher levels of noise exposure from aircraft, road traffic and railroads. Sound impulsiveness, low frequency noise and persistence of the noise, as well as demographic characteristics may explain some of the difference.

Figure 6: Annoyance associated with exposure to different environmental noises



Reprinted with permission from Pedersen, E. and K.P. Waye (2004). Perception and annoyance due to wind turbine noise–a dose–response relationship. The Journal of the Acoustical Society of America 116: 3460. Copyright 2004, Acoustical Society of America.

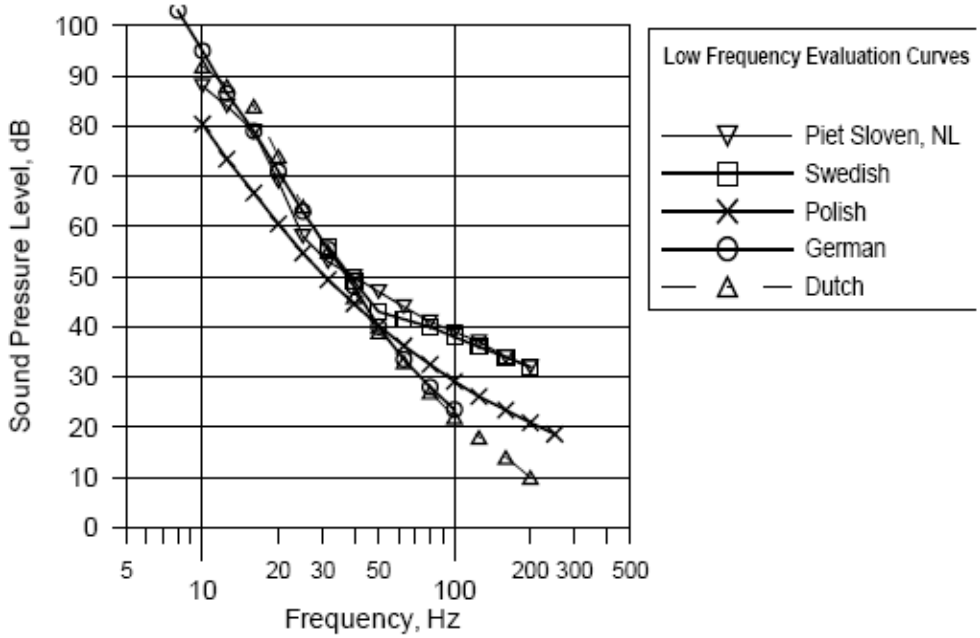
Kjellberg et al. (1997) looked at the ability of different full spectrum weighting schemes to predict annoyance caused by low frequency audio noise. They found that dB(A) is the worst predictor of annoyance of available scales. However, if 6 dB ("penalty") is added to dB(A) when dB(C) – dB(A) is greater than 15 dB, about 71% of the predictions of annoyance are correct. It is important to remember that integrated, transformed measurements of SPL (e.g. dB(A), dB(C)) do not measure frequencies below 20 Hz. While people detect stimuli below 20 Hz, as discussed in above sections, these frequencies are not measured using an A-weighted or C-weighted meter.

The World Health Organization (WHO) recommends that if dB(C) is greater than 10 dB more than dB(A), the low frequency components of the noise may be important and should be evaluated separately. In addition, WHO says "[i]t should be noted that a large proportion of low-frequency components in noise may increase considerably the adverse effects on health." (WHO, 1999)

Many governments that regulate low frequency noise look at noise within bands of frequencies instead of summing the entire spectrum. A study by Poulsen and Mortensen (Danish Environmental Protection Agency, 2002) included a summary of low frequency noise guidelines. German, Swedish, Polish, and Dutch low frequency evaluation curves were compared (see Figure 7). While there are distinctions in how the evaluation curves are described, generally, these curves are sound pressure criterion levels for 1/3 octaves from about 8 Hz to 250 Hz. Exceedance in any 1/3 octave measurement suggests that the noise may be annoying. However, note that regulations associated with low frequency

noise can be quite complex and the regulatory evaluations associated with individual curves can be somewhat different.

Figure 7: 1/3 Octave Sound Pressure Level Low frequency Noise Evaluation Curves



(Danish Environmental Protection Agency, 2002)

The Danish low frequency evaluation requires measuring noise indoors with windows closed; SPL measurements are obtained in 1/3 octave bands and transformed using the A-weighting algorithm for all frequencies between 10 and 160 Hz. These values are then summed into a single metric called $L_{pA,LF}$. A 5 dB "penalty" is added to any noise that is "impulsive". Danish regulations require that 20 dB $L_{pA,LF}$ is not exceeded during the evening and night, and that 25 dB $L_{pA,LF}$ is not exceeded during the day.

Swedish guidance recommends analyzing 1/3 octave bands between 31.5 and 200 Hz inside a home, and comparing the values to a Swedish assessment curve. The Swedish curve is equal to the United Kingdom (UK) Department of Environment, Food and Rural Affairs (DEFRA) low frequency noise criterion curve for overlapping frequencies (31.5 – 160 Hz).

The German "A-level" method sums the A-weighted equivalent levels of 1/3 octave bands that exceed the hearing threshold from 10 – 80 Hz. If the noise is not tonal, the measurements are added. The total cannot exceed 25 dB at night and 35 dB during the day. A frequency-dependent adjustment is applied if the noise is tonal.

In the Poulsen and Mortensen, Danish EPA study (2002), 18 individuals reported annoyance levels when they were exposed through earphones in a controlled environment to a wide range of low frequency environmental noises, all attenuated down to 35 dB, as depicted in Table 2. Noise was simulated as if being heard indoors, filtering out noise at

higher frequencies and effectively eliminating all frequencies above 1600 Hz. Noise levels in 1/3 octave SPLs from 8 Hz to 1600 Hz were measured and low frequencies (below 250 Hz) were used to predict annoyance using 7 different methods (Danish, German A-level, German tonal, Swedish, Polish, Sloven, and C-level). Predictions of annoyance were compared with the subjective annoyance evaluations. Correlation coefficients for these analyses ranged from 0.64 to 0.94, with the best correlation in comparison with the Danish low frequency noise evaluation methods.

As would be expected, at 35 dB nominal (full spectrum) loudness, every low frequency noise source tested exceeded all of the regulatory standards noted in the Danish EPA report. Table 2 shows the Danish and Swedish regulatory exceedances of the different 35 dB nominal (full spectrum) noise.

Table 2: 35 dB(A) (nominal, 8 Hz-20KHz) Indoor Noise from Various Outdoor Environmental Sources

	Traffic Noise	Drop Forge	Gas Turbine	Fast Ferry	Steel Factory	Generator	Cooling Compressor	Discotheque
Noise	67.6 dB(lin)	71.1 dB(lin)	78.4 dB(lin)	64.5 dB(lin)	72.7 dB(lin)	60.2 dB(lin)	60.3 dB(lin)	67.0 dB(lin)
Noise ≥ 20 Hz	35.2 dB(A)	36.6 dB(A)	35.0 dB(A)	35.1 dB(A)	33.6 dB(A)	36.2 dB(A)	36.6 dB(A)	33.6 dB(A)
	62.9 dB(C)	67.3 dB(C)	73.7 dB(C)	61.7 dB(C)	66.0 dB(C)	58.6 dB(C)	59.0 dB(C)	57.8 dB(C)
Danish Environmental Protection Agency	14.5 dB	21.5 dB *	14.8 dB	15.0 dB	13.1 dB	16.1 dB	14.0 dB	18.0 dB *
Swedish National Board of Health and Welfare	14.1 dB	19.7 dB	15.9 dB	16.8 dB	15.5 dB	18.3 dB	16.0 dB	10.0 dB
* includes 5 dB "penalty"								

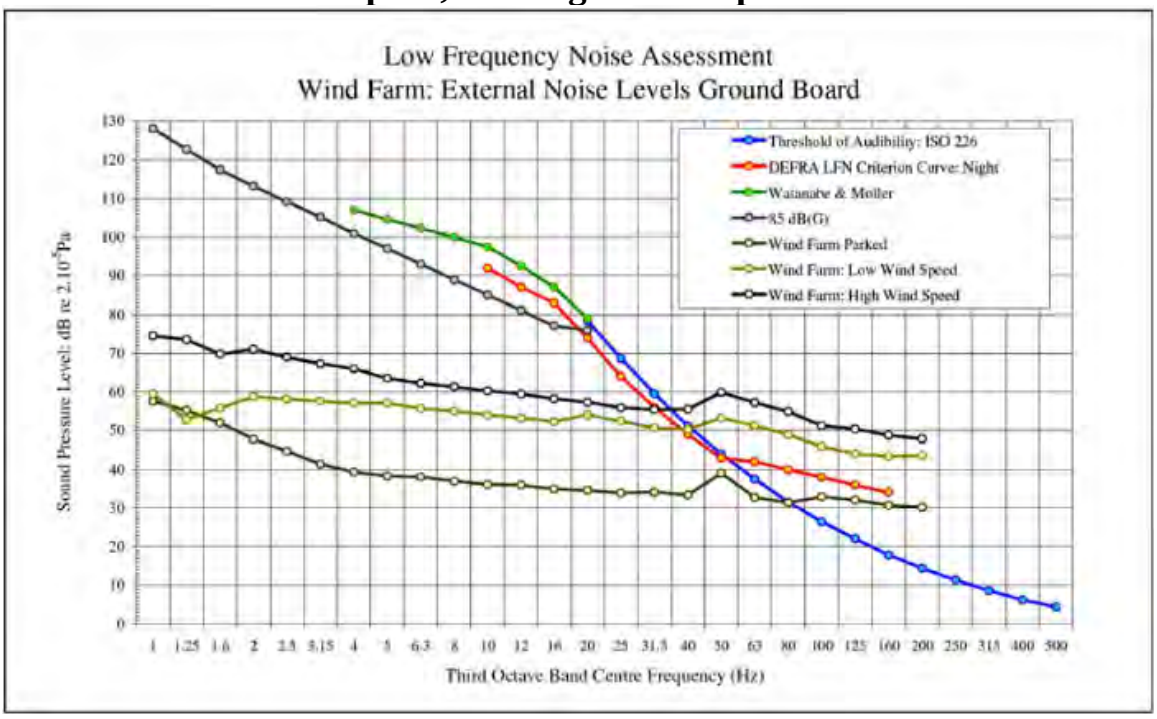
Noise adjusted to dB(lin), dB(A), dB(C) scales. Calculated exceedances of Danish and Swedish indoor criteria. (data from Danish Environmental Protection Agency, 2002)

In their noise guidance, the WHO (1999) recommends 30 dB(A) as a limit for “a good night’s sleep”. However, they also suggest that guidance for noise with predominating low frequencies be less than 30 dB(A).

3. Wind turbine sound measurements

Figure 8 shows examples of the SPLs at different frequencies from a representative wind turbine in the United Kingdom. Sound pressure level measurements are reported for a Nordex N-80 turbine at 200 meters (UK Department of Transport and Industry, 2006) when parked, at low wind speeds, and at high wind speeds. Figure 8 also includes, for reference, 3 sound threshold curves (ISO 226, Watanabe & Moller, 85 dB(G)) and the DEFRA Low Frequency Noise Criterion Curve (nighttime).

Figure 8: Low Frequency Noise from Wind Farm: Parked, Low Wind Speed, and High Wind Speed

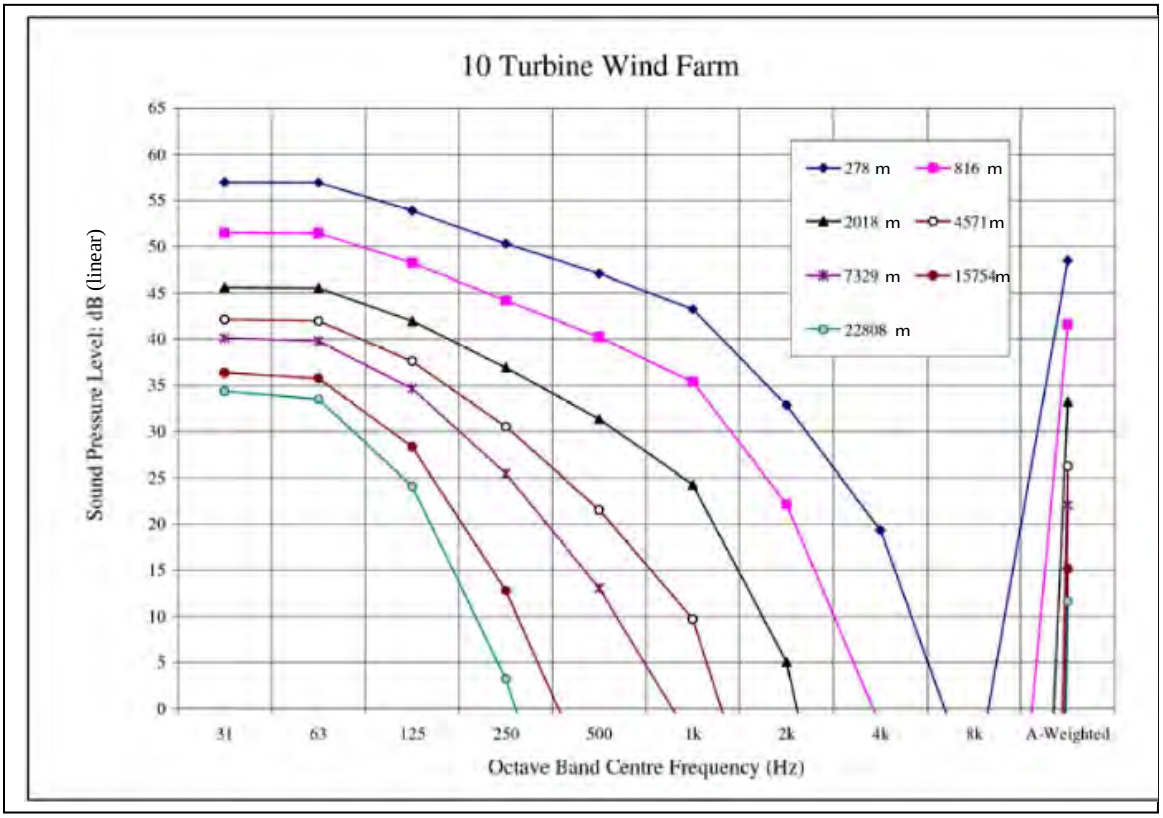


(UK Department of Transport and Industry, 2006)

In general, sound tends to propagate as if by spherical dispersion. This creates amplitude decay at a rate of about -6 dB per doubling of distance. However, low frequency noise from a wind turbine has been shown to follow more of a cylindrical decay at long distances, about -3 dB per doubling of distance in the downwind direction (Shepherd and Hubbard, 1991). This is thought to be the result of the lack of attenuation of low frequency sound waves by air and the atmospheric refraction of the low frequency sound waves over medium to long distances (Hawkins, 1987).

Figure 9 shows the calculated change in spectrum for a wind farm from 278 meters to 22,808 meters distant. As one moves away from the noise source, loudness at higher frequencies decreases more rapidly (and extinguishes faster) than at lower frequencies. Measurement of A-weighted decibels, shown at the right of the figure, obscures this finding.

Figure 9: Change in Noise Spectrum as Distance from Wind Farm Changes



(UK Department of Transport and Industry, 2006)

Thus, although noise from an upwind blade wind turbine is generally broad spectrum, without a tonal quality, high frequencies are efficiently attenuated by both the atmosphere, and by walls and windows of structures, as noted above. As a result, as one moves away from a wind turbine, the low frequency component of the noise becomes more pronounced.

Kamperman and James (2008) modeled indoor noise from outdoor wind turbine noise measurements, assuming a typical vinyl siding covered 2X4 wood frame construction. The wind turbine noise inside was calculated to be 5 dB less than the noise outside. Model data suggested that the sound of a single 2.5 MW wind turbine at 1000 feet will likely be heard in a house with the windows sealed. They note that models used for siting turbines often incorporate structure attenuation of 15dB. In addition, Kamperman and James demonstrate that sound from 10 2.5 MW turbines (acoustically) centered 2 km (1¼ mile) away and with the nearest turbine 1 mile away will only be 6.3 dB below the sound of a single turbine at 1000 feet (0.19 mile).

4. Wind turbine regulatory noise limits

Ramakrishnan (2007) has reported different noise criteria developed for wind farm planning. These criteria include common practices (if available) within each jurisdiction for estimating background SPLs, turbine SPLs, minimum setbacks and methods used to

assess impacts. Reported US wind turbine noise criteria range from: ambient + 10 dB(A) where ambient is assumed to be 26 dB(A) (Oregon); to 55 dB(A) or "background" + 5 dB(A) (Michigan). European criteria range from 35 dB(A) to 45 dB(A), at the property. US setbacks range from 1.1 times the full height of the turbine (consenting) and 5 times the hub height (non-consenting; Pennsylvania); to 350 m (consenting) and 1000 m (non-consenting; Oregon). European minimum setbacks are not noted.

VI. Conclusions

Wind turbines generate a broad spectrum of low-intensity noise. At typical setback distances higher frequencies are attenuated. In addition, walls and windows of homes attenuate high frequencies, but their effect on low frequencies is limited. Low frequency noise is primarily a problem that may affect some people in their homes, especially at night. It is not generally a problem for businesses, public buildings, or for people outdoors.

The most common complaint in various studies of wind turbine effects on people is annoyance or an impact on quality of life. Sleeplessness and headache are the most common health complaints and are highly correlated (but not perfectly correlated) with annoyance complaints. Complaints are more likely when turbines are visible or when shadow flicker occurs. Most available evidence suggests that reported health effects are related to audible low frequency noise. Complaints appear to rise with increasing outside noise levels above 35 dB(A). It has been hypothesized that direct activation of the vestibular and autonomic nervous system may be responsible for less common complaints, but evidence is scant.

The Minnesota nighttime standard of 50 dB(A) not to be exceeded more than 50% of the time in a given hour, appears to underweight penetration of low frequency noise into dwellings. Different schemes for evaluating low frequency noise, and/or lower noise standards, have been developed in a number of countries.

For some projects, wind velocity for a wind turbine project is measured at 10 m and then modeled to the height of the rotor. These models may under-predict wind speed that will be encountered when the turbine is erected. Higher wind speed will result in noise exceeding model predictions.

Low frequency noise from a wind turbine is generally not easily perceived beyond ½ mile. However, if a turbine is subject to aerodynamic modulation because of shear caused by terrain (mountains, trees, buildings) or different wind conditions through the rotor plane, turbine noise may be heard at greater distances.

Unlike low frequency noise, shadow flicker can affect individuals outdoors as well as indoors, and may be noticeable inside any building. Flicker can be eliminated by placement of wind turbines outside of the path of the sun as viewed from areas of concern, or by appropriate setbacks.

Prediction of complaint likelihood during project planning depends on: 1) good noise modeling including characterization of potential sources of aerodynamic modulation noise and characterization of nighttime wind conditions and noise; 2) shadow flicker modeling; 3) visibility of the wind turbines; and 4) interests of nearby residents and community.

VII. Recommendations

To assure informed decisions:

- Wind turbine noise estimates should include cumulative impacts (40-50 dB(A) isopleths) of all wind turbines.
- Isopleths for dB(C) - dB(A) greater than 10 dB should also be determined to evaluate the low frequency noise component.
- Potential impacts from shadow flicker and turbine visibility should be evaluated.

Any noise criteria beyond current state standards used for placement of wind turbines should reflect priorities and attitudes of the community.

VIII. Preparers of the Report:

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Appendix C

Cultural Resources Summary Tech Memo
Prepared by Tetra Tech

Memo

To: Mike Beckner, Director of Development, Noble Environmental Power, LLC

From: Sean Flannery, Project Manager, Tetra Tech

Copy: Patrick McCarthy, Environmental Project Manager, Noble Environmental Power, LLC

Date: June 12, 2009

Re: Noble Flat Hill Windpark I cultural resources summary information

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Cultural and Archaeological Resources

This memo is a summary of the results of the record search that was documented in the site and route permit applications and the Phase IA Cultural Resource Surveys for the Noble Flat Hill Windpark I and the proposed transmission line (preferred route). These reports are in the draft stage and the final reports will be provided to the SHPO for their review.

1.0 Noble Flat Hill Windpark I

1.1 APE FOR DIRECT EFFECTS

For the purposes of the Phase IA survey, the Area of Potential Effect (APE) for direct effects includes areas permanently impacted by project construction including the wind turbine generator locations, access roads, trenching for the underground electrical collection system, and the O & M Building, and areas temporarily impacted by project construction including installation of crane pads at each turbine site, temporary access roads for the cranes, temporary laydown areas around each turbine, and storage/stockpile areas.

1.2 APE FOR VISUAL EFFECTS

A request for guidance concerning the size of the APE for visual effects was declined by the SHPO; thusly, Tetra Tech suggests that a 2.0-mile APE for visual effects would be appropriate for the Project.

1.3 BACKGROUND RESEARCH

In November 2007 and in October 2008, Tetra Tech conducted background research at the SHPO for information on previously identified archaeological sites, architectural structures, and cultural resource surveys within the APE for direct effects, archaeological sites and cultural resource surveys within 1 mile

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(1.6 kilometer [km]) of the APE for direct effects, and architectural properties within 2 miles (3.2 km) of the proposed turbine layout or within the APE for visual effects. The records search included but was not limited to: archaeological site forms, architectural property inventory tables, Original Public Land Surveyor Maps, available plat maps and aerial photographs, and previous survey reports.

1.4 RESULTS OF BACKGROUND RESEARCH

1.4.1 Previous Archaeological Studies

A review of SHPO records indicated that no archaeological surveys have been conducted within the APE for direct effects or within 1-mile of the APE. This is not unexpected due to lack of public lands in the APE and the absence of state and federal projects in the area. The lack of archaeological surveys in the vicinity of the APE for direct effects does limit the quantity and quality of known cultural resources known from this area.

1.4.2 Previous Architectural Studies

A review of SHPO records indicated that no architectural history surveys have been conducted within the APE for direct or visual effects. This is not unexpected due to lack of public lands in the APE and the absence of state and federal projects in the area. The lack of architectural history surveys in the vicinity of the APE for direct and visual effects does limit the quantity and quality of known structures known from this area.

1.4.3 Archaeological Sites

No archaeological sites have been recorded (field checked) or reported (not field checked) within the APE for direct effects. Three sites have been recorded within 1-mile (1.6 km) of the APE for direct effects. These sites include a structural ruin and associated artifact scatter (21CY0011), an Archaic period lithic scatter (21CY0027), and a Woodland period artifact scatter (21CY0028). None of the sites within the proposed Project area have been evaluated for NRHP eligibility.

1.4.4 Architectural Properties

No architectural properties have been previously inventoried within the APE for direct effects; however, a total of four properties have been documented within the 2-mile APE for visual effects. All four properties are unevaluated for listing on the NRHP.

Two architectural history properties (Thordtvedt Homestead [CY-MOL-001] and a church [CY-MOL-002]) have been documented within 1-mile of the proposed turbine layout. Property CY-MOL-002 is a church that has not been evaluated for NRHP eligibility; no further information is provided on the inventory form (Historical Properties Inventory Form, CY-MOL-002, on file at the SHPO). Property CY-

MOL-001, the Thordtvedt Homestead, is documented as a house, log cabin, and unspecified outbuildings. According to the inventory form, the Thordtvedt family was one of the first Euro-American settlers to homestead the flat land of Clay County, arriving in 1870 (Historical Properties Inventory Form, CY-MOL-001, on file at the SHPO). The Thordtvedt family built two log cabins and two houses from 1870 to 1904. The inventory form indicated the first cabin was constructed 1870, and was later moved and then burned. A second log cabin was constructed 1879 and was moved to its current location in 1945. The first house was constructed in 1874 or 1875, which later burned in 1909. A second house was constructed in 1904. These structures have not been evaluated for NRHP eligibility.

Architectural history properties within 1 to 2 miles of the turbine layout include the Concordia Lutheran Church (CY-MOL-003) and Moland Town Hall (CY-MOL-004). Neither property has been evaluated for NRHP eligibility; no further information is provided on the inventory form (Historical Properties Inventory Forms, CY-MOL-003 and CY-MOL-004), on file at the SHPO.

1.4.5 National Register Eligible or Listed Properties

According to the SHPO file search of archaeological sites and architectural history properties performed in October 2008, no properties evaluated for the National Register have been identified within the Project area.

1.5 FIELD METHODS

All archaeological fieldwork within the Project APE for direct effects was conducted in accordance with the SHPO Guidelines for Archaeological Projects in Minnesota (Anfinson 2005) and The Secretary of the Interior's Standards and Guidelines for Archeology and Historic Preservation [48 Federal Register 44716-44740] (National Park Service [NPS] 1983).

1.5.1 Pedestrian Survey

A systematic pedestrian surface survey at 15-meter (m) (49-feet [ft]) interval transects was conducted in the APE for direct effects. The pedestrian survey was employed to ascertain whether artifacts or features were present on the surface within the APE for direct effects. Land-use, ground cover, and surface visibility were also documented during the pedestrian survey. These observations were particularly important in ascertaining whether additional fieldwork was necessary in areas with poor or no surface visibility.

1.5.2 Site Delineation

If isolated finds, artifact scatters, or features were identified during the pedestrian survey, an intensive surface survey of the area was conducted at 10-m (33-ft) or 5-m (16-ft) intervals to delineate the site's boundaries. During this intensive pedestrian survey, the boundaries were flagged and recorded with a

Trimble GeoXT global positioning system (GPS) unit and sketched on a site map. Temporally or culturally diagnostic artifacts and features were also recorded with the Trimble GeoXT unit and sketched on a site map.

1.5.3 Site Documentation

A Trimble GeoXT 2005 operating ESRI ArcPad® and GPS Analyst® was used to navigate the survey corridor and document all isolated finds, scatters, and features. Within the ArcPad program, the site was recorded as a point or polygon and given an identification number. Site characteristics were recorded on standardized forms and included information such as types, quantities, and locations of archaeological materials observed, field conditions, and whether or not archaeological materials were collected. Photographic documentation of the site included photos of the site from the cardinal directions and photos of features of temporally or culturally diagnostic materials in situ.

Collection strategies varied depending upon site size and complexity. Smaller artifact scatters were piece-plotted and collected. Only temporally or culturally diagnostic materials were collected from larger scatters. All collected artifacts were labeled with a unique field number, project name, date, collector, locational coordinates, and a general description of the material collected.

1.5.4 Site Evaluation

Since this level of investigation is limited to a pedestrian survey, site evaluation is limited to recommendations for no further work, additional work, and avoidance. Recommendations for no further work will generally be limited to isolated finds, scatters, features, or structural ruins that are within a clearly disturbed context, not over 50 years old, and/or that can be described through historic documentation. Examples of where no further work may be recommended could be a chipped stone isolated find within a cultivated field or a historic scatter which through historic documentation can be linked to a farmstead extant from 1910 to 1980.

Recommendations for additional work could include isolated finds, scatters, features, or structural ruins that have the potential to contain intact surface or subsurface cultural deposits or features, are over 50 years old, may not be clearly described through historic documentation, or are associated with significant historic events. Examples of where additional work may be recommended could be chipped stone scatter exposed on the surface within a native prairie or a historic scatter containing artifacts associated with the Contact Period events in western Minnesota.

Recommendations for avoidance could include larger scatters containing features or structural ruins that have the potential to contain intact surface or subsurface cultural deposits or features and/or are potentially eligible, considered eligible, or are listed on the NRHP. Examples of where avoidance may be

recommended could be stone circles on the surface within a native prairie or a large multi-component Precontact/Contact site that has already been considered eligible for listing on the NRHP.

2.0 Archaeological Survey Results-Windpark

2.1 INTRODUCTION

The Phase IA archaeological field survey for the Project was conducted from May 6 to 14, 2009. Adam C. Holven, M.A. served as Principal Investigator for archaeology, Erika L. Eigenberger, B.A., served as Field Director, and the field crew included archaeologists Pamela Hale, Nicole Lohman, and Daniel Schauder.

2.1.1 APE for Direct Effects

For the purposes of the Phase IA survey, the APE for direct effects includes areas that will be permanently impacted by project construction including the wind turbine generator locations, transmission line structure locations, access roads, and the O & M Building, and areas that will be temporarily impacted by project construction including installation of crane pads at each turbine site, temporary access roads for the cranes, temporary laydown areas around each turbine, trenching for the underground electrical collection system, and storage/stockpile area.

2.2 SURVEY RESULTS

During the Phase IA for the Project, Tetra Tech documented 11 new archaeological sites including 5 Precontact isolated finds and 6 Post-contact historic scatters.

2.2.1 Newly Documented Precontact Archaeological Sites

Four sites and one site lead were documented during the pedestrian survey of the APE for direct effects. All sites are represented by isolated projectile points, with the exception of site lead 121.9, which is represented by a flake. Site descriptions and interpretations of these sites within a cultural context are provided below.

2.2.1.1 Site 121.5

Site 121.5 is a complete Avonlea projectile point manufactured from Knife River Flint (KRF). The isolated find was located within a cultivated sugar beet field within the Lake Agassiz Plain approximately 2.2 miles northeast of the Buffalo River. Surface conditions at the time of the discovery were excellent with 75 to 100 percent surface visibility. Additional transects at 5-m intervals extending to a radius of 30 m in the vicinity of the point failed to document any additional materials. It is assumed that numerous

years of cultivation would have exposed additional materials if present. Due to an absence of additional materials, site 121.5 is considered an isolated find at this time.

2.2.1.2 Site 121.8

Site 121.8 is a complete Besant projectile point manufactured from a raw material similar in description to Swan River Chert (Bakken 1995). The isolated find was located within a cultivated sugar beet field within the Lake Agassiz Plain approximately 3.4 miles north-northeast of the Buffalo River. Surface conditions at the time of the discovery were excellent with 75 to 100 percent surface visibility. Additional transects at 5-m intervals extending to a radius of 30 m in the vicinity of the point failed to document any additional materials. It is assumed that numerous years of cultivation would have exposed additional materials if present. Due to an absence of additional materials, site 121.8 is considered an isolated find at this time.

2.2.1.3 Site 121.9

Site 121.9 consists of an isolated flake manufactured from chert similar in description to Swan River Chert (Bakken 1995). The flake appears to be the proximal portion of a secondary flake. The isolated find was located within a cultivated bean field within the Lake Agassiz Plain approximately 2.1 miles east-northeast of the Buffalo River. Surface conditions at the time of the discovery were excellent with 75 to 100 percent surface visibility. Additional transects at 5-m intervals extending to a radius of 30 m in the vicinity of the point failed to document any additional materials. It is assumed that numerous years of cultivation would have exposed additional materials if present. Due to an absence of additional materials, site 121.9 is considered an isolated find at this time.

2.2.1.4 Site 121.11

Site 121.11 is a complete Besant projectile point manufactured from a raw material similar in description to Red River Chert (Bakken 1995). The isolated find was located within a cultivated bean field within the Lake Agassiz Plain approximately 1.5 miles north of the Buffalo River. Surface conditions at the time of the discovery were excellent with 75 to 100 percent surface visibility. Additional transects at 5-m intervals extending to a radius of 30 m in the vicinity of the point failed to document any additional materials. It is assumed that numerous years of cultivation would have exposed additional materials if present. Due to an absence of additional materials, site 121.11 is considered an isolated find at this time.

2.2.1.5 Site 121.12

Site 121.12 is a complete, although slightly damaged, Besant projectile point manufactured from a raw material similar in description to Red River Chert (Bakken 1995). The isolated find was located within a cultivated sugar beet field within the Lake Agassiz Plain approximately 3.3 miles north-northeast of the Buffalo River. Surface conditions at the time of the discovery were excellent with 75 to 100 percent

surface visibility. Additional transects at 5-m intervals extending to a radius of 30 m in the vicinity of the point failed to document any additional materials. It is assumed that numerous years of cultivation would have exposed additional materials if present. Due to an absence of additional materials, site 121.12 is considered an isolated find at this time.

2.2.2 Newly Documented Post-contact Archaeological Sites

Six historic scatters were documented during the pedestrian survey of the APE for direct effects. All but one scatter can be linked to late nineteenth/early twentieth century farmsteads. It is likely that the one scatter not directly associated with a farmstead is indirectly linked to a farmstead and of similar age to the other historic scatters. Site descriptions and interpretation of these sites within a cultural context is provided below.

2.2.2.1 Site 121.1

Site 121.1 consists of a medium density historic artifact scatter associated with a razed farmstead within a cultivated sugar beet field within the SW ¼ of the NW ¼ of Section 17, T140N, R46W. Artifacts observed on the surface included animal bone (2nd phalange from a bovid), brick and concrete fragments, coal, window and container glass (colors in amber, aqua, clear, cobalt blue, milk, and violet colored from UV exposure), whiteware, stoneware (glaze colors included blue/gray, brown, white, and yellow), and porcelain, nails and unidentified metal fragments and other materials including a graphite battery rod and a rubber ball. Temporally diagnostic materials observed at the site including blown and machined manufactured bottle necks, and canning jar lid fragment embossed with “BOYD’S GENUNINE”. The oldest of these materials is the blown bottle fragment which likely dates from the 1890s to 1910. The Boyd’s Genuine canning jar lid was also produced during this time but was also produced into the 1950s (Toulouse 1971).

An examination of historical documents reveals a structure at this location in 1909 (Alden Publishing Company 1909). At that time, the land was platted to N.F. Tabaka and by 1916, the land was platted to A.J. Katzur (Hixson 1916). This farmstead appears in aerial photographs from 1938 and 1948, but does not appear in more recent photographs (1954 and after).

The artifacts in conjunction with historic documentation suggest this historic scatter represents a farmstead that was present from the early 1900s to at least 1948. By 1954, the farmstead was not present. The presence of melted glass at the site may indicate the buildings were razed after 1948. A review of the 1954 aerial photograph revealed no structures or trees which may indicate that site was used for pasture or cropland. Based on field observations, Site 121.1 is heavily disturbed due to the demolition of the farmstead and subsequent agricultural practices.

2.2.2.2 Site 121.2

Site 121.2 consists of a medium density historic artifact scatter associated with a demolished farmstead within a cultivated sugar beet field within the SE ¼ of the NW ¼ of Section 6, T140N, R46W. Artifacts observed on the surface included brick fragments (yellow and red), coal, concrete fragments, window and container glass (colors in clear and green), large mammal bone, metal (both decorative and unidentifiable pieces), porcelain, stoneware (white glaze), and whiteware (glazed blue on white). Temporally diagnostic materials observed at the site include a 1960s 7-Up bottle fragment.

An examination of historical documents reveals a structure at this location in 1909 (Alden Publishing Company 1909). At that time, the land was platted to John Gunnerius and by 1916, the land was still platted to John Gunnerius (Hixson 1916). This farmstead appears in aerial photographs from 1938 and 1954, but does not appear in more recent photographs (1958 and after).

The artifacts in conjunction with historic documentation suggest this historic scatter represents a farmstead that was present from the early 1900s to at least 1954. By 1958, the farmstead was not present. A review of the 1958 aerial photograph revealed no structures or trees which may indicate that site was used for pasture or cropland. Based on field observations, Site 121.2 is heavily disturbed due to the demolition of the farmstead and subsequent agricultural practices.

2.2.2.3 Site 121.3

Site 121.3 consisted of a medium density historic artifact scatter associated with a demolished farmstead within a cultivated field within the SW ¼ of the SE ¼ of Section 6, T140N, R46W. Artifacts observed on the surface included a brass shotgun casing for a paper cartridge (too corroded to identify makers mark), bovid tooth and astragulus, brick and concrete fragments, window and container glass (colors in clear, brown, and green), metal fragments, plastic dinning ware, porcelain, stoneware (glaze colors included white and black), and whiteware (including plain and painted decorations). Temporally diagnostic materials observed at the site include a brass primer from a paper shotgun shell which came into use in the 1880s and were replaced with plastic hulls during the 1960s (Hawks 2008). One circular depression approximately 1.5 m by 1 m in size and 20 cm deep was observed. This feature contained depression rings indicating that sediment is still settling in this feature. Given this feature's context within an abandoned farmstead, it likely represents the presence of a well or an outhouse.

An examination of historical documents reveals a structure at this location in 1909 (Alden Publishing Company 1909). At that time, the land was platted to Rasmus Eide and by 1916, the land was still platted to Rasmus Eide (Hixson 1916). This farmstead appears in aerial photographs from 1938 to 1972, but does not appear in more recent photographs (1977 and after).

The artifacts in conjunction with historic documentation suggest this historic scatter represents a farmstead that was present from the early 1900s to at least 1972. By 1977, the farmstead was not present. A review of the 1977 aerial photograph revealed no structures or trees and presence of cropland. Based on field observations, Site 121.3 is heavily disturbed due to the demolition of the farmstead and subsequent agricultural practices.

2.2.2.4 Site 121.4

Site 121.4 consisted of a sparse historic artifact scatter associated with a demolished farmstead within a cultivated field within the SE ¼ of the SE ¼ of Section 2, T140N, R47W. Artifacts observed on the surface included brick fragments (yellow), window and container glass (colors in amethyst, aqua, and clear), stoneware, and whiteware. Temporally diagnostic materials observed at the site include the base to a rectangular medicine bottle, likely from the 1890s or early 1900s, and sun-colored amethyst (SCA), which is most commonly found in bottle and containers from the 1890s to the 1920s (Bureau of Land Management/Society for Historical Archaeology 2009).

An examination of historical documents reveals a structure approximately 500 feet north of Site 121.4 in 1909 (Alden Publishing Company 1909). At that time, the land was platted to JJ Kane and by 1916, the land was platted to C.A. Carlson (Hixson 1916). This farmstead does not appear in aerial photographs (1938 and after), but a large discoloration in the soil can be seen approximately 400 feet north of the site. This discoloration was likely the location of the farmstead observed on the 1909 plat map (Alden Publishing Company 1909).

The artifacts in conjunction with historic documentation suggest this historic scatter is likely indirectly associated to activities on the farmstead present on the 1909 plat map. Due to the distance between the scatter and purported location of the farmstead and the sparse nature of the scatter, it is likely that this scatter may represent dumping activities that occurred south of the farmstead or the spread of materials after the demolition of the structure sometime before 1938. Based on field observations, Site 121.4 is heavily disturbed due to the demolition of the farmstead and subsequent agricultural practices.

2.2.2.5 Site 121.6

Site 121.6 consisted of a sparse historic artifact scatter not associated with any historically documented farmsteads or structures within a cultivated field within the SE ¼ of the NE ¼ of Section 15, T140N, R47W. Artifacts observed on the surface included window and container glass (colors in clear and green), metal (U-shaped iron bracket, an iron spring, and miscellaneous metal fragments) stoneware (tan glaze), and whiteware. No temporally diagnostic materials were observed at the site.

A review of available historic documentation failed to identify an adjacent or nearby farmstead or structure that may have been associated with the site. The thin scatter of historic materials may represent a dumping episode that occurred prior to the introduction of modern synthetic materials that was later

spread out by agricultural practices. Based on field observations, Site 121.6 is likely heavily disturbed due to agricultural practices. Although it was not possible to correlate the scatter with a historically documented farmstead or structure, the site lacks integrity and artifacts present do not represent the types of materials that would be expected at a site that is older than the historical documentation for the area.

2.2.2.6 Site 121.7

Site 121.7 consists of an abandoned farmstead containing historic artifact scatters, features, and a standing structure (barn). The site is located within the SE ¼ of the NW ¼ of Section 12, T140N, R47W. The site is largely overgrown with grasses, scrubs, and trees, and has not been disturbed through agricultural practices. Due to the vegetation, only artifact scatters and features visible on the surface were noted. These included a square cement slab foundation (23 feet by 30 feet), a small rectangular concrete foundation (40 feet by 20 feet) containing modern beer bottles, a large trash pile containing metal cans, fuel tanks and drums, farm machinery, and miscellaneous metal, four truck frames from the 1920s through the 1950s, horse or tractor drawn farming equipment and machinery, and a windmill. One standing, but non-operational barn was also observed at the site roughly 60 feet by 30 feet in size. The original extent of the farmstead encompassed approximately 7.5 acres. The project APE transects the northwestern corner of the original farmstead and the remainder of the farmstead is located to the south and east of the Project Area. Features observed outside the APE for direct effects include the foundation for demolished farmhouse and the foundations to other outbuildings.

An examination of historical documents reveals a structure at this location in 1909 (Alden Publishing Company 1909). At that time, the land was platted to Amundo O. Slensrud and by 1916, the land was platted to R. Stensrud (Hixson 1916). Plat maps from 1951 (Pioneer Atlas Company), 1980 (Rockford Map Publishers), and 1993 (Midland Atlas Company) indicate that the structures are present and the associated land is platted to Alton J. Larson. A review of the Clay County Assessor's Office records lists Mr. Larson as the owner of the property through 2008.

This farmstead appears in aerial photographs from 1938; however, it is not until 1948 when several structures (the house, barn, and three outbuildings) become easily recognizable from the aerial photograph. The structures are difficult to identify on the 1954, 1958, 1972, 1977, and 1981 aerials due to poor resolution; however, the footprint of the farmstead is visible. On 1984 aerial photograph, the house, barn, and three associated outbuildings are visible and easily discernible. The 1991 aerial photograph reveals that the farmhouse was still extant in 1991, but it is not clear from the aerials if the three outbuildings were still extant at this time. By 2003, the farmhouse was no longer extant.

Based on field observations, portions of Site 121.7 within the APE for direct effects have been lightly disturbed due to the partial demolition of structures within the farmstead. It is likely that intact archaeological deposits and features greater than 50 years old exist at this site, but it is also likely modern deposits less than 50 years also exist and are mixed with the older deposits/materials.

2.2.3 Newly Documented Architectural Property-Site 121.14

With the exception of the standing barn at Site 121.7, only one other architectural property was documented within the APE for direct effects during the pedestrian survey. Site 121.14, an abandoned railroad grade of the Great Northern Railroad, is transected at several locations by proposed access roads and collection lines within Sections 12 and 13, T140N, R47W.

Site 121.14 first appears in historic documentation in 1874 (Andreas 1874), and was know as the St. Vincent Ex. St. Paul Pacific Railroad. The railroad trended north-northeast from the town of Glyndon through Moland and Spring Prairie Townships and headed north toward Crookston. By 1909, the railroad was renamed Great Northern Railroad, a name which it kept until 1970, when the Great Northern Railroad, Northern Pacific Railway, Chicago, Burlington & Quincy Railroad, and Spokane, Portland & Seattle Railway were all consolidated in the Burlington Northern Railroad. Site 121.14 appeared as the Burlington Northern Railroad on the Moland 1993 plat map (Midland Atlas Company 1993). Between 1993 and the present, this portion of the Burlington Northern Railroad was closed, the tracks and ties were removed from the grade, and the railroad right of way was sold back to local landowners.

The current condition of Site 121.14 in the vicinity of the APE for direct effects includes a railroad grade that is partially vegetated. All bridges over drainage ditches have been removed and portions of the grade that transect agricultural fields have been altered by local landowners. Although some physical characteristics of the railroad are no longer present, railroads in this region have played a significant role in the development of the Clay County and the Red River Valley.

3.0 Noble Flat Hill Windpark I Transmission Line-Route 1

Route 1 is the preferred route for the proposed transmission line. A file review and a field survey were conducted along this route.

3.1 APE FOR DIRECT EFFECTS

For the purposes of the Phase IA survey, the APE for direct effects includes areas permanently impacted by project construction including areas directly affected by project construction such as the transmission line corridor, substation, and the switching station. The APE for direct effects included the route as describe in the Noble Flat Hill Windpark I Route Permit Application

3.2 APE FOR VISUAL EFFECTS

A request for guidance concerning the size of the APE for visual effects was declined by the SHPO; thusly, Tetra Tech suggests that a 1.0 mile APE for visual effects would be appropriate for the proposed transmission line.

3.3 BACKGROUND RESEARCH

In November 2007 and in October 2008, Tetra Tech conducted background research at the SHPO for information on previously identified archaeological sites, architectural structures, and cultural resource surveys within APE for direct effects, and archaeological sites, architectural properties, and cultural resource surveys within 1 mile (1.6 kilometer [km]) of the APE for direct effects. The records search included but was not limited to: archaeological site forms, architectural property inventory tables, Original Public Land Surveyor Maps, available plat maps and aerial photographs, and previous survey reports.

3.4 RESULTS OF BACKGROUND RESEARCH

3.4.1 Previous Archaeological Studies

A review of SHPO records indicated that one archaeological survey has been conducted within the APE for direct effects or within 1 mile of the APE. The survey was conducted in the late 1970s and included improvements along Trunk Highway 10, which transects the project APE in Section 5, T139N, R46W of Riverton Township (Peterson 1977). No cultural materials were noted within the portion of the project transecting the proposed transmission line project APE.

3.4.2 Previous Architectural Studies

A review of SHPO records indicated that no architectural history surveys have been conducted within the APE for direct or visual effects. This is not unexpected due to lack of public lands in the APE and the absence of state and federal projects in the area. The lack of architectural history surveys in the vicinity of the APE for direct and visual effects does limit the quantity and quality of known structures from this area.

3.4.3 Archaeological Sites

No sites have been recorded (confirmed) or reported (not field checked) within the APE for direct effects or within 1 mile of the APE for direct effects.

3.4.4 Architectural Properties

No properties have been previously inventoried within the APE for direct effects; however, one property has been documented within the 1-mile APE for visual effects. The property is the Spring Prairie Township Hall (2Y-SPR-001) and is located in the NE ¼ of Section 32, Township 140N, Range 46W. This property has not been evaluated for listing on the NRHP.

3.4.5 National Register Eligible or Listed Properties

According to SHPO file search of archaeological sites and architectural history properties performed in October 2008, no properties evaluated for the National Register have been identified within the Project area.

3.5 FIELD METHODS

All archaeological fieldwork within the proposed transmission line project APE for direct effects was conducted in accordance with the SHPO Guidelines for Archaeological Projects in Minnesota (Anfinson 2005) and The Secretary of the Interior's Standards and Guidelines for Archeology and Historic Preservation [48 Federal Register 44716-44740] (National Park Service [NPS] 1983).

3.5.1 Pedestrian Survey

A systematic pedestrian surface survey at 15-m (49-ft) interval transects was conducted in the APE for direct effects. The pedestrian survey was employed to ascertain whether artifacts or features were present on the surface within the APE for direct effects. Land-use, ground cover, and surface visibility were also documented during the pedestrian survey. These observations were particularly important in ascertaining whether additional fieldwork was necessary in areas with poor or no surface visibility.

3.5.2 Site Delineation

If isolated finds, artifact scatters, or features were identified during pedestrian survey, an intensive surface survey of the area was conducted at 10-m (33-ft) or 5-m (16-ft) intervals to delineate the site's boundaries. During this intensive pedestrian survey, the boundaries were flagged and recorded with the Trimble GeoXT GPS unit and sketched on a site map. Temporally or culturally diagnostic artifacts and features were also recorded with the Trimble GeoXT unit and sketched on a site map.

3.5.3 Site Documentation

A Trimble GeoXT 2005 operating ESRI ArcPad® and GPS Analyst® was used to navigate the survey corridor and document all isolated finds, scatters, and features. Within the ArcPad program, the site was recorded as a point or polygon and given an identification number. Site characteristics were recorded on standardized forms and included information such as types, quantities, and locations of archaeological materials observed, field conditions, and whether or not archaeological materials were collected. Photographic documentation of the site included photos of the site from the cardinal directions and photos of features of temporally or culturally diagnostic materials in situ.

Collection strategies varied depending upon site size and complexity. Smaller artifact scatters were piece-plotted and collected. Only temporally or culturally diagnostic materials were collected from larger scatters. All collected artifacts were labeled with a unique field number, project name, date, collector, locational coordinates, and a general description of the material collected.

3.5.4 Site Evaluation

Since this level of investigation is limited to a pedestrian survey, site evaluation is limited to recommendations for no further work, additional work, and avoidance. Recommendations for no further work will generally be limited to isolated finds, scatters, features, or structural ruins that are within a clearly disturbed context, not over 50 years old, and/or that can be described through historic documentation. Examples of where no further work may be recommended could be a chipped stone isolated find within a cultivated field or a historic scatter which through historic documentation can be linked to a farmstead extant from 1910 to 1980.

Recommendations for additional work could include isolated finds, scatters, features, or structural ruins that have the potential to contain intact surface or subsurface cultural deposits or features, are over 50 years old, may not be clearly described through historic documentation, or are associated with significant historic events. Examples of where additional work may be recommended could be chipped stone scatter exposed on the surface within a native prairie or a historic scatter containing artifacts associated with the Contact Period events in western Minnesota.

Recommendations for avoidance could include larger scatters containing features or structural ruins that have the potential to contain intact surface or subsurface cultural deposits or features and/or are potentially eligible, considered eligible, or are listed on the NRHP. Examples of where avoidance may be recommended could be stone circles on the surface within a native prairie or a large multi-component Precontact/Contact site that has already been considered eligible for listing on the NRHP.

4.0 Archaeological Survey Results – Transmission Line-Route 1

4.1 INTRODUCTION

The Phase IA archaeological field survey for the Project transmission line was conducted from May 6 to 14, 2009. Adam C. Holven, M.A. served as Principal Investigator for archaeology, Erika L. Eigenberger, B.A., served as Field Director, and the field crew included archaeologists Pamela Hale, Nicole Lohman, and Daniel Schauder.

4.1.1 APE for Direct Effects

For the purposes of the Phase IA survey, the APE for direct effects includes areas permanently impacted by project construction including areas directly affected by project construction such as the transmission line corridor, substation, and the switching station.

4.2 SURVEY RESULTS

During the Phase IA for the proposed transmission line, Tetra Tech documented 1 new archaeological site.

4.2.1 Site 121.13

Site 121.13 consists of the basal portion of a side-notched projectile point manufactured from Swan River Chert. The limited size of the fragment makes identification difficult, but based on the depth and location of the notch and deeply concave base, the point most closely resembles Middle to Late Archaic forms from the Northern Plains. The isolated find was located within a cultivated sugar beet field within the Lake Agassiz Plain approximately 1.2 miles north of the Buffalo River. Surface conditions at the time of the discovery were excellent with 75 to 100 percent surface visibility. Additional transects at 5-m intervals extending to a radius of 30 m in the vicinity of the point failed to document any additional materials. It is assumed that numerous years of cultivation would have exposed additional materials if present. Due to an absence of additional materials, site 121.13 is considered an isolated find at this time.

5.0 Flat Hills I Transmission Line-Route 2

To date, only a file review has been conducted for Route 2. Based on the presence of a railroad grade along Route 2, there is a low potential for intact archaeological resources to be present. Therefore, a pedestrian survey along this route has not been deemed necessary at this time. If it becomes necessary for the development of the Project, a pedestrian survey of Route 2 will be conducted and the results will be provided for review. The APE for direct effects included the route as describe in the Noble Flat Hill Windpark I Route Permit Application and the APE for visual effects extended 1 mile beyond the APE for direct effects.

5.1.1 Previous Archaeological Studies

A review of SHPO records indicated that no previous surveys have been conducted within the APE for direct effects or within 1 mile of the APE.

5.1.2 Previous Architectural Studies

A review of SHPO records indicated that no architectural history surveys have been conducted within the APE for direct or visual effects. This is not unexpected due to lack of public lands in the APE and the absence of state and federal projects in the area. The lack of architectural history surveys in the vicinity of the APE for direct and visual effects does limit the quantity and quality of known structures known from this area.

5.1.3 Archaeological Sites

One archaeological site has been documented within 1 mile of Route 2. Site 21CY0029 is located 0.2 miles from Route 2 and consists of a Pre-contact Late Woodland artifact scatter. This site has not been evaluated for listing on the National Register of Historic Places (NRHP).

5.1.4 Architectural Properties

No properties have been previously inventoried within the APE for direct effects; however, 13 architectural history properties have been identified within 1 mile of Route 2, primarily in the Town of Glyndon. None of the 13 properties have been evaluated for listing on the NRHP; however, the proposed location of Route 2 would likely pass in close proximity to some of these properties.

5.1.5 National Register Eligible or Listed Properties

According to SHPO file search of archaeological sites and architectural history properties performed in October 2008, no properties evaluated for the National Register have been identified within the Project area.

6.0 Recommendations

The following recommendations were based on the results of the records search, pedestrian survey, and informal consultation with the SHPO regarding archaeological resources. Recommendations for architectural resources were based on Tetra Tech's experience with architectural resources and knowledge of SHPO concerns. To date, the SHPO declined to comment on viewshed or architectural assessment activities for the Project.

6.1 AREAS WITH NO OR POOR SURFACE VISIBILITY

Additional archaeological investigations are recommended along the wooded area immediately north (terrace and floodplain) of the Buffalo River if the project plans include disturbing areas outside the existing road right of way. Based on the geomorphology of the Buffalo River, there is a moderate potential for buried Precontact archaeological sites in this area. Additionally, a review of previous surveys has identified an abundance of significant archaeological sites along the Buffalo River

approximately 3 miles east of the preferred transmission line corridor. Additional archaeological testing would include the completion of shovel testing within areas directly impacted by project plans.

Additional archaeological investigations are not recommended along developed areas immediately south of the Buffalo River (Clay County Recycling Center) at this time due to previous disturbances in this area.

With the exception of the Buffalo River crossing, Tetra Tech does not recommend additional subsurface testing in portions of the APE for direct effects with poor surface visibility. These areas consisted of approximately 15 percent of the APE for direct effects and were predominately cultivated agricultural fields, road right of ways, drainage ditches, and residential yards. Based on Tetra Tech's pedestrian survey results, all documented Precontact archaeological sites in this area were isolated finds. Standard shovel testing procedures at 15-m (49-ft) intervals would be inadequate to locate isolate finds that appear randomly distributed across the survey area. Tetra Tech has also extensively reviewed historical documents including plat maps and aerials photographs and has found that six of the seven historic scatters can be correlated with historically documented farmsteads. Using these resources, Tetra Tech has observed no other historical structures or features within the APE for direct effects. It is Tetra Tech's opinion that there is a low probability that historically undocumented structures or features exist within the APE for direct effects, and there is also a low probability that historical scatters not associated with any farmstead exist within the APE. Given our current understanding of Precontact and Post-contact sites within the area, Tetra Tech recommends that an Unanticipated Discoveries Plan be available for the engineering and construction crews in the case of the discovery of cultural materials.

6.2 NEWLY DOCUMENTED ARCHAEOLOGICAL SITES

No further archaeological work is recommended for the six Precontact isolated finds. It is assumed that modern cultivation practices would have exposed any additional artifacts if present in the area surrounding these isolated finds. Since no additional materials were located, it is assumed that these isolated finds are not associated with any unknown larger sites.

No further work is recommended for the five historic scatters. Four of the five historic scatters can be linked to known farmsteads which have been demolished and converted into agricultural cropland. Although it was not possible to correlate Site 121.6 with a historically documented farmstead or structure, the site lacks integrity and the artifacts present do not represent the types of materials that would be expected at a site that is older than the historical documentation for the area; thusly, no further work is recommended at this site.

Site 121.7 is an abandoned farmstead that consists of historic foundations, artifact scatters, and a historical architectural component (barn), and it is recommended that project plans avoid directly impacting this archaeological site and the architectural component (barn) or if avoidance is not possible,

then it is recommended that the archaeological and architectural components of this farmstead be evaluated for its eligibility for listing in the National Register.

6.3 NEWLY DOCUMENTED ARCHITECTURAL PROPERTIES

One architectural property, a railroad grade associated with the St. Vincent Ex. St. Paul Pacific Railroad and later with Great Northern Railroad (Site 121.14), will be directly impacted by project plans. An architectural investigation is recommended to assess the effects of the proposed project on the line, and to suggest mitigation measures if the property is considered historic and would result in an adverse effect. Based on the results of this investigation, recommendations for avoidance or mitigation will be made if necessary.

Appendix D

Biological Survey Methods Tech Memo
Prepared by Tetra Tech

Memo

To: Mike Beckner, Director of Development, Noble Environmental Power, LLC

From: Sean Flannery, Project Manager, Tetra Tech

Copy: Patrick McCarthy, Environmental Project Manager, Noble Environmental Power, LLC

Date: June 22, 2009

Re: Noble Flat Hill Windpark I Biological Survey Methods

This memo is a description of the survey methods that will be utilized during the biological preservation survey in support of the Site Permit process for the Noble Flat Hill Windpark I.

Biological Survey Methods

The biological survey for the Noble Flat Hill Windpark I (the "Project") includes an inventory of existing Wildlife Management Areas (WMA), Scientific and Natural Areas (SNA), recreational areas, native prairies and forests, wetlands, biologically sensitive areas including rare and endangered species information, and wildlife impacts.

A desktop analysis of the Project area was conducted using the following data sources:

- National Wetlands Inventory
- Department of Natural Resources Public Waters Inventory (PWI) Map
- United States Geological National Hydrography Dataset (NHD)
- Natural Resource Conservation Service Soil Survey Geographic Database (SSURGO)
- Parks mapping
- Public Recreation Information Map
- Natural Heritage Database Information (NHIS)
- Minnesota County Biological Survey (MCBS) Data
- Existing land cover
- Potential Avian and Bat Mortality Review

A biological field reconnaissance will be conducted during June 2009 to assess for the presence of significant biological resources and habitat within the Project area. Biologists will use the NHIS and MCBS information obtained from the Minnesota DNR (MDNR) and existing land cover information to determine the presence of threatened and endangered species and sensitive habitat within the proposed areas of impact and the larger Project area as a whole. Information from NHIS and MCBS will provide biologists with a list of locations where rare species and

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habitats have occurred within the Project area. Biologists will visit each location to document and confirm presence of rare species and habitats. Biologists will also record incidental observations of federal or state-listed species in the Project area.

Additionally, the field reconnaissance will include an evaluation of the presence of wetlands and waterways. The reconnaissance is intended to identify the presence of wetlands and waters within the areas of impact (including turbine areas, access roads, collection lines, and the T-line) that may be subject to the jurisdiction of the United States Army Corps of Engineers (USACE), Minnesota Wetland Conservation Act (WCA), and/or Minnesota Department of Natural Resources (MN DNR).

For the field evaluations, Tetra Tech will download GPS coordinates for the areas of impact into Trimble GeoXT handheld GPS units, which have an accuracy of one meter or less. The base map information, including shapefiles for the turbine locations, roads, collection lines and T-Line, will be downloaded onto GPS units and viewed using ArcGIS 9.2 ArcMAP software. Using the ArcMap software, points, lines, and polygons will be captured for specific field conditions. In general, the handheld Trimble units will be used to locate and document conditions within the previously identified areas of impact, as well as additional native prairies, forests, wetlands, biologically sensitive areas that are identified within the Project area. If a significant feature is identified, the GPS unit will be used to capture the feature as a polygon. The results of the Biological Survey will be provided once completed.

Avian and Bat Survey Methods

Tetra Tech conducted Spring and Fall Avian Surveys in 2008 to estimate the use of the Project area by raptors and other birds during migration. Point counts (variable circular plots) were conducted within the survey area using standardized Tetra Tech protocol. Tetra Tech distributed 9 survey locations within the Project area boundaries (including one point which overlapped the Project area boundary) and 8 survey locations outside of, but within close proximity to, the Project area boundaries. Experienced field ornithologists collected data for all birds observed within an 800-meter radius circular plot centered on each observation point. Surveys at each point lasted for 20 minutes, during which time biologists continuously scanned for birds and recorded any visual or auditory observations. Weather information such as temperature, wind speed, wind direction, and cloud cover was recorded for each survey. The date, start and end time of the observation period, species or best possible identification of species, number of individuals, distance from observer, flight height, flight direction, behavior, and habitat type were recorded. Behaviors recorded included: perching, flying, walking, soaring, circle soaring, and other. Statistical analysis was used to calculate avian use, flight behavior, and a relative collision exposure index. The Spring and Fall Avian Survey reports will be included as attachments to the Biological Survey report.

Tetra Tech conducted a Grassland Bird Survey at the Project area to quantify resident grassland bird use and identify potential impacts associated with the construction and/or operation of the

proposed Project. Experienced field biologists conducted grassland bird transect surveys at four locations within the Project area and at two locations outside (east) of the Project area to evaluate avian use, behavior, and species composition during the breeding season. Locations of transects were dispersed throughout the Project area to cover the majority of habitat types available. Surveys were conducted once per week for eight weeks between July 16, 2008 and September 4, 2008. Experienced field ornithologists walked one-kilometer (km) transects and continuously scanned for birds and recorded both visual and auditory observations. Weather information such as temperature, wind speed, wind direction, and cloud cover was recorded for each survey. The date, start and end time of the observation period, species or best possible identification of species, number of individuals, distance from observer, flight height, flight direction, behavior, and habitat type were recorded. Behaviors recorded included: perching, flying, walking, soaring, circle soaring, and other. The Grassland Bird Survey report will be included as attachments to the Biological Survey report.

Tetra Tech conducted a Bat Acoustic Survey to document and determine the presence of bats in the Project area, including the rate of occurrence, relative activity levels, and species diversity (when possible) during the late summer and fall migration period. To document bat activity and habitat use patterns, Tetra Tech conducted passive acoustic monitoring surveys with Anabat SD-1 (Northtronics) detectors. The surveys were designed to document bat activity near the ground, at an intermediate height, and near the rotor swept area (RSA) of the proposed turbines. These data were correlated with on-site weather conditions to characterize potential temperature and wind-speed affects on bat activity. The Bat Acoustic Survey report will be included as attachments to the Biological Survey report.