Environmental Report

Bitter Root Wind Farm Project

In the Matter of the Application of Buffalo Ridge Power Partners, LLC for a Certificate of Need for the 138 MW Bitter Root Wind Farm Project in Yellow Medicine and Lincoln County, Minnesota

PUC Docket No. IP-6684/CN-08-785

Energy Facilities Permitting
85 7th Place East, Suite 500
Saint Paul, MN 55101

March 2010

Responsible Governmental Unit	Project Proposer
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Abstract

On April 27, 2009, Buffalo Ridge Power Partners, LLC (applicant), filed a certificate of need application with the Minnesota Public Utilities Commission (Commission) for the Bitter Root Wind Farm Project (project). The applicant is proposing to construct a 138 megawatt (MW) large wind energy conversion system in Yellow Medicine and Lincoln County, Minnesota.

The proposed project is a large energy facility as defined by Minnesota Statute 216B.2421. Such a facility requires a certificate of need from the Commission (Minn. Stat. § 216B.243). Additionally, the Minnesota Department of Commerce must prepare an environmental report (ER) for the project (Minn. Rules 7849.1200).

Office of Energy Security, Energy Facility Permitting (OES EFP) staff is responsible for preparing the environmental report (ER). This ER has been prepared as per Minnesota Rules 7849.1100-2100. The ER is part of the record which the Commission will consider in making a decision on a certificate of need for the project.

Information about this project can be found on the Commission's energy facilities permitting website: http://energyfacilities.puc.state.mn.us/Docket.html?Id=25538, or obtained by contacting Suzanne Steinhauer, Office of Energy Security, 85 7th Place East, Suite 500, St. Paul, Minnesota 55101, phone: (651) 296-2888, email: suzanne.steinhauer@state.mn.us.

Information about the Commission's certificate of need process can be obtained by contacting Michael Kaluzniak, Minnesota Public Utilities Commission, 121 7th Place E., Suite 350, Saint Paul, MN 55101, phone: (651) 201-2257, email: mike.kaluzniak@state.mn.us.

The record for the certificate of need for this project can be found on the eDockets system at: https://www.eDockets.state.mn.us/EFiling/search.jsp; search on the year "**08**" and number "**785**".

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1.0 Introduction

On April 27, 2009, Buffalo Ridge Power Partners, LLC (applicant), filed a certificate of need application with the Minnesota Public Utilities Commission (Commission) for the Bitter Root Wind Farm Project (project). The applicant is proposing to construct a 138 megawatt (MW) large wind energy conversion system in Yellow Medicine and Lincoln County, Minnesota.

A final decision on turbine selection and design has not be made, but the project will consist of turbines with a rated output between 1.5 and 3.0 MW in such number and combination as to yield 138 MW. Facilities associated with the project include gravel access roads, an electrical collection system, an operation and maintenance building, meteorological towers, and a project substation.

The project would be located southwest of the city of Canby, Minnesota, within a project area of approximately 22,500 acres in Fortier and Florida Township in Yellow Medicine County and Hansonville Township in Lincoln County. Electricity from the project would be collected and transmitted to the project substation via 34.5 kilovolt electric lines. The project would connect to the electrical transmission grid via Otter Tail Power Company's 115 kV Toronto-Canby transmission line at the new project substation.

In addition to a certificate of need (CON), the project requires a site permit for the wind farm from the Commission. The site permit is being considered by the Commission in separate docket (WS-08-1448).

The proposed project is a large energy facility as defined by Minnesota Statute 216B.2421. As a result, it requires the Minnesota Department of Commerce to prepare an environmental report (ER) for the project (Minn. Rules 7849.1200). Office of Energy Security, Energy Facility Permitting (OES EFP) staff has prepared this ER to fulfill this requirement. The ER is part of the record which the Commission will consider in making a decision on a CON for the project.

The proposed project is intended to produce renewable energy in furtherance of Minnesota's renewable energy objectives. Accordingly, alternatives examined in this ER are limited to "eligible energy technologies" that support these objectives (Minn. Stat. § 216B.1691). These alternatives include: (1) a generic 138 MW wind generation project sited elsewhere in Minnesota, (2) a 53 MW biomass plant, and (3) a "no build" alternative.

Section 2 of the ER outlines the regulatory framework governing the project. Section 3 describes the proposed project. Section 4 describes alternatives to the project. Section 5 describes the potential impacts of the no build alternative. Section 6 discusses the potential human and environmental impacts of the project and alternatives, including possible mitigations. Section 7 discusses the availability and feasibility of alternatives. Section 8 describes the additional permits that may be required for this project.

Sources of Information

Information for this report is drawn from multiple sources, which are noted throughout. Primary sources include Buffalo Ridge Power Partners' applications to the Commission:

- Application for Certificate of Need, 138 MW Bitter Root Wind Farm Project, April 27, 2009[1]
- Application for Site Permit, 138 MW Bitter Root Wind Farm Project, October 13, 2009.[2]

Additional information has been incorporated from earlier, related Environmental Quality Board and Department of Commerce reports.

[1] Application for Certificate of Need, 138 MW Bitter Root Wind Farm Project, April 27, 2009 [hereafter CON Application], https://www.edockets.state.mn.us/EFiling/edockets/searchDocuments.do?method=viewDocument&documentId={6448DE91-3E6D-4919-BE92-CE9AC89718AE}&documentTitle=20094-36828-02&userType=public; https://www.edockets.state.mn.us/EFiling/edockets/searchDocuments.do?method=viewDocument&documentId={524973BC-63F5-43AE-BE5C-4CC65A09ABD3}&documentTitle=20094-36828-03&userType=public.

[2] Application for Site Permit, 138 MW Bitter Root Wind Farm Project, October 13, 2009 [hereafter Site Permit Application], http://energyfacilities.puc.state.mn.us/resource.html?Id=25620.

2.0 Regulatory Framework

Buffalo Ridge Power Partners, LLC (applicant), is proposing to construct the Bitter Root Wind Farm Project in Yellow Medicine and Lincoln County, Minnesota. The project is a large wind energy conversion system as defined in the Wind Siting Act (Minn. Stat. § 216F). The project is designed to produce 138 megawatts (MW) of power and thus is a large energy facility per Minnesota Statute 216B.2421.

In accordance with Minnesota Statute 216B.243, no large energy facility may be sited or constructed in Minnesota without issuance of a certificate of need (CON) by the Minnesota Public Utilities Commission (Commission). Accordingly, on April 27, 2009, the applicant submitted a certificate of need application to the Commission. On July 7, 2009, the Commission issued an order accepting the application as complete and authorizing an informal review process.[3]

The informal review process includes several steps designed to develop a record upon which a CON decision can be made, including: (1) a notice and comment period, (2) analysis by Department of Commerce, Office of Energy Security, Energy Regulation and Planning (OES ERP) staff, (3) analysis by Office of Energy Security, Energy Facility Permitting (OES EFP) staff, and (4) a public hearing conducted by an administrative law judge (ALJ). Based on the ALJ's hearing report and entire record, Commission staff will make a recommendation to the Commission on issuance of the certificate of need. The Commission is the final decision-making body.

2.1 Environmental Report

Per Minnesota Rule 7849.1200, the analysis provided by OES EFP staff takes the form of an environmental report (ER). The ER provides an analysis of potential human and environmental impacts of the project, as well as alternatives to the project. To develop the ER, OES EFP staff is required to conduct at least one public meeting in the proposed project area. The purpose of the meeting is to advise the public of the project and to solicit public input into the scope of the ER. A "scope" is a determination of what needs to be assessed in the ER in order to fully inform decision-makers and the public about the possible impacts of the project and potential alternatives.

OES EFP staff held a public information and scoping meeting on November 3, 2009, in Canby, Minnesota. Approximately 40 persons attended the meeting. A public comment period followed the meeting; the comment period closed on November 24, 2009. Two written comments were received during the comment period; a comment letter from the Minnesota Department of Natural Resources was received after the comment period. Concerns raised at the public meeting

[3] Order Finding Application Complete and Authorizing Informal Review Process, July 7, 2009, https://www.edockets.state.mn.us/EFiling/edockets/searchDocuments.do?method=showPoup&documentId={85E50FEF-16BC-4B29-9E8E-320D7E20EA69}&documentTitle=20097-39366-01.

and in written comments included potential impacts related to noise, aesthetics, livestock, wildlife, native vegetation, burial grounds, historical artifacts, topography, property values, and the terms of wind easements between landowners and the applicant.

Based on the scoping comments received and the rules governing the scope of an ER (Minn. Rules 7849.1500), the Director of OES issued a scoping decision on December 18, 2009 (Appendix A). This environmental report has been developed in accordance with the scoping decision.

As noted above (and in the scoping decision), a public hearing conducted by an ALJ will be held in the project area to further develop the record for a Commission decision. This ER will be introduced into the record by OES EFP staff.

2.2 Permits

Site Permit

In addition to a certificate of need, the proposed project requires a site permit for the wind farm (Minn. Stat. §216F.04). This permit is issued by the Commission and is being considered by the Commission in a separate docket[4] A site permit (authorizing the siting and constructing of the project) may not be issued before a certificate of need has been issued for the project (Minn. Stat. § 216B.243).

Additional Permits

In addition to approvals issued by the Commission, the project will require permits and approvals from federal agencies, additional state agencies, and local governments. These permits are discussed in Section 8.

Public Participation

The Commission relies on public participation in its certificate of need and permitting processes. Public participation enables the development of a thorough record. Citizens can ensure notice of these processes by placing their names on the appropriate OES project contact lists. Citizens can sign up for the Bitter Root Wind Farm project lists on line: http://energyfacilities.puc.state.mn.us/Docket.html?Id=25538.

Citizens may also have their names placed on these project lists by contacting OES project manger Suzanne Steinhauer, phone: (651) 296-2888, email: suzanne.steinhauer@state.mn.us.

[4] The Commission docket number for the site permit is: WS-08-1448; see http://energyfacilities.puc.state.mn.us/Docket.html?Id=25538.

3.0 Description of the Proposed Project

Buffalo Ridge Power Partners, LLC (applicant), is proposing to construct the Bitter Root Wind Farm Project (project), a 138 MW wind farm in Yellow Medicine and Lincoln County, Minnesota. Buffalo Ridge Power Partners, LLC, is a joint venture of ACCIONA Wind Energy USA, LLC and Global Wind Harvests, LLC. It is expected that upon construction and operation, the project will be owned and operated by ACCIONA Wind Energy. The project is intended to produce renewable energy in furtherance of Minnesota's renewable energy objectives (Minn. Stat. § 216B.1691).

3.1 Project Location

The project will be located in southwestern Minnesota near the city of Canby, Minnesota. It is proposed to be located within a project area of approximately 22,500 acres in Fortier and Florida Township in Yellow Medicine County and Hansonville Township in Lincoln County (Figure 1). The area is predominantly in agricultural use including the production of livestock; grasslands are prevalent in the northwestern section of the project area (Figure 2).

The general topography of the project area ranges from gently undulating to rolling and hilly. Elevations range from 408 to 531 feet above sea level. The area includes wetlands, lakes, intermittent drainages, and creeks (Figure 2, Figure 3). Relief is relatively greater in the valleys formed by Lazarus Creek and Canby Creek. At their steepest, valleys are up to 60 feet lower than the surrounding landscape.[5]

3.2 Project Description

The Bitter Root Wind Farm project will have a nameplate capacity of 138 MW. A final decision on turbine selection and design has not been made, but the project will consist of turbines with a rated output between 1.5 and 3.0 MW in such number and combination as to produce 138 MW.[6] Characteristics of turbines currently considered for use in the project are shown in Table 1. Turbines would be placed on towers 80 to 100 meters (262 ft. to 328 ft.) in height. Rotor diameters vary from 77 to 100 meters (253 to 328 ft.). The total height from the ground to the tip of a fully-extended rotor blade would be 389 to 492 feet.

Some site permit conditions for large wind energy conversion systems (LWECS) are based on criteria which are dependent on turbine size.[7] Turbines must be placed within the project boundary and meet all permit conditions. Accordingly, the final siting ("micro-siting") of wind turbines for the project will depend on, among other factors, the size of the turbines chosen for the project. A preliminary turbine layout using 1.5 MW turbines is shown in Figure 4. A preliminary layout using 3.0 MW turbines in shown in Figure 5.

[5] Site Permit Application, Section 8.11.
[6] Site Permit Application, Section 7.2.1.
[7] For example, turbine setbacks from the project boundary and all non-participating lands are expressed in rotor diameters (RD). Rotor diameters vary with turbine size.

Table 1. Wind Turbine Specifications[8]

Characteristic	Acciona 1.5 MW	Acciona 3.0 MW
Hub Height	80 m (262 ft)	100 m (328ft)
Rotor Diameter	77 m (253 ft)	100 m (328 ft)
Total Height	118.5 m (389 ft)	150 m (492 ft)
Cut-in Wind Speed	3.5 m/s (7.8 mph)	3.5 m/s (7.8 mph)
Rated Capacity Wind Speed	11.1 m/s (24.8 mph)	11.1 m/s (24.8 mph)
Cut-out Wind Speed	25 m/s (55.9 mph)	25 m/s (55.9 mph)
Rotor Speed	18.3 rpm	13.2 rpm
Distance to 50 dB(A) Noise Level	190 m (623 ft)	237 m (779 ft)
3 Rotor Diameters	231 m (759 ft)	300 m (984 ft)
5 Rotor Diameters	385 m (1,265 ft)	500 m (1,640 ft)

m = meters, ft = feet, m/s = meters per second, mph = miles per hour, rpm = revolutions per minute

Turbine towers will be secured by concrete foundations that vary in size and design depending on turbine size and soil and substrate conditions.[9] A control panel inside the base of each turbine tower houses communication and electronic circuitry. Each turbine will be connected to a supervisory control and data acquisition (SCADA) system. The SCADA system allows for real-time monitoring and control of turbine operation.

Facilities associated with the project include gravel access roads, a project substation, an operation and maintenance (O&M) building, meteorological towers, and an electrical collection system. The project will connect to the transmission grid through the project substation to the existing 115 kV Canby to Toronto transmission line operated by Otter Tail Power Company. The area of permanent, direct land use for the project will be approximately 120 acres.[10]

[8] Adapted from Site Permit Application, Table 7-1
[9] Site Permit Application, Section 7.2.4.
[10] Site Permit Application, Section 8.9.2.

Electricity generated by each turbine is stepped up by a pad-mounted transformer at the base of each turbine to a collection line voltage (34.5 kV). The collection lines and SCADA fiber optic cable will typically be buried; however, they may run overhead in some areas. The collection lines will carry power from the turbines to the project substation. The location of the substation has not been determined, but it will likely be sited in Fortier Township near the geographic center of the project.[11] Power entering the project substation will be transformed to a voltage of 115 kV and transmitted to the existing 115 kV Canby to Toronto transmission line.

Gravel roads will provide access to turbine sites for construction, maintenance, and eventual decommissioning. Turbine layout will attempt to minimize the length and extent of access roads. It is anticipated that 20-25 miles of access roads will be constructed for the project. Roads will be constructed of gravel over a graded dirt base and geotextile fabric (as needed). Roads will include appropriate drainage and will be maintained over the life of the project to keep them in good working condition.

The location of the operation and maintenance (O&M) building has not yet been determined, but the building is typically located adjacent to the project substation. The O&M building will be large enough to house equipment for maintaining turbines, administrative offices, meeting space, and employee support space. The O&M building will also house the SCADA system.

There are currently four meteorological towers installed on the project site. After construction, some of these towers may be removed; alternately, additional towers may be erected. Meteorological towers provide real-time data to the SCADA system and allow for remote monitoring of weather conditions.

3.3 Project Cost and Schedule

The cost of developing and constructing the Bitter Root Wind Farm project is estimated to be $276 - $331 million dollars.[12] Operating costs are estimated to be $40,000 - $60,000 dollars per turbine per year. The applicant anticipates beginning construction of the project in 2011 (pending receipt of approvals), with commercial operation beginning approximately 12-18 months after commencement of construction. The date of commercial operation depends on interconnection, permitting, and other project development activities.

[11] Site Permit Application, Section 7.4.1.
[12] Site Permit Application, Section 11.0. The applicant estimates the capital cost for the project to be between $2,000 and $2,400 dollars per installed kilowatt of nameplate capacity. Thus, 138 MW x (1,000 kW/MW) x ($2,000/kW) = $276 million dollars.

4.0 Description of Project Alternatives

This section describes alternatives to the Bitter Root Wind Farm project. Typically, alternatives to the project would include generation facilities of all types, including plants that use coal, natural gas, fuel oil, or similar non-renewable fuels. Alternatives would also include constructing transmission facilities (to import energy) in lieu of generation. However, the proposed project is intended to produce renewable energy in furtherance of Minnesota's renewable energy objectives. Accordingly, alternatives considered here are technologies eligible to be counted toward these objectives.[13]

Alternatives to the Bitter Root Wind Farm project examined in this ER include: (1) a generic 138 MW wind generation plant (LWECS) sited elsewhere in Minnesota, (2) a 53 MW biomass plant, and (3) a "no build" alternative.

4.1 138 MW LWECS

An alternative to the proposed project, which would utilize an eligible renewable energy (wind), is a large wind energy conversion system (LWECS) sited elsewhere in Minnesota. Such a project could, theoretically, be a 138 MW project or a combination of smaller dispersed project. The analysis in this ER will attempt to describe differences in the impacts associated with a generic 138 MW wind project sited in Minnesota and the Bitter Root Wind Farm project, sited in Yellow Medicine and Lincoln County.

4.2 53 MW Biomass Plant

A biomass alternative to the proposed project would be an eligible renewable energy alternative. There are various possible sources of biomass fuel that could be used. St. Paul District Energy, a combined heat and power facility in downtown St. Paul, is fueled primarily by waste wood and has an electric generation capacity of 25 MW. The 55 MW Fibrominn plant in Benson burns turkey litter. The Laurentian Energy Authority operates facilities in Hibbing and Virginia with a combined capacity of 35 MW that convert wood, wood wastes, and agricultural biomass into electricity.

The biomass alternative analyzed in this ER is one that would burn a combination of hybrid willows, poplars, and corn stover, with natural gas as a backup fuel. This alternative is considered because such a plant, the NGPP Minnesota Biomass, LLC, electric generation facility, has already undergone environmental review in Minnesota, and data regarding potential environmental impacts associated with such a plant are available. Additionally, given the potential available feedstock in the project area, such a biomass plant is feasible.

[13] Minn. Stat. § 216B.1691, Subd. 1. Eligible energy technologies include technologies that generate electricity from solar, wind, hydroelectric, hydrogen, or biomass.

The NGPP project was reviewed by the Environmental Quality Board (Board) in 2003 when it prepared an environmental assessment worksheet (EAW) on the proposed facility.[14] At the time that it was reviewed by the Board, the NGPP project was a 38.5 MW project. The analysis that was conducted on that facility by the Board is valid for use as an alternative analysis in this ER. The Bitter Root Wind Farm project will have a capacity of 138 MW, with an estimated capacity factor of 38 percent. The 53 MW biomass alternative examined in this ER is an appropriately-sized generation alternative.[15]

4.3 No Build Alternative

The no build alternative means that no wind project is constructed. The analysis for this alternative will consider the potential benefits and drawbacks of not constructing the proposed project.

[14] EQB Docket No. 03-67-EAW-NGP Biomass [hereafter Minnesota Biomass EAW] ; see http://energyfacilities.puc.state.mn.us/Docket.html?Id=4452

[15] 138 MW x 0.38 = 52.4 MW. The biomass alternative, because it has natural gas backup, is assumed for analysis purposes to have a capacity factor of 1.0. Scheduled and unscheduled maintenance would make the effective capacity factor slightly less than 1.0.

5.0 The No Build Alternative

Analysis of the no build alternative involves a discussion of the environmental impacts of continuing the status quo. For example, with a proposed highway project, the no build alternative would take into account the impacts associated with continuing to have traffic increase along existing roads and highways and for development to occur along these existing arteries. Potential impacts and benefits of the no build alternative for the Bitter Root Wind Farm project are discussed here

5.1 Impacts

At least three categories of impacts can be identified if the Bitter Root Wind Farm project is not built – (1) a hampering of the state's ability to meet its renewable energy objective, (2) the loss of economic benefits in the project area, and (3) the likely negative impact of providing replacement electricity from a non-renewable energy source.

Renewable Energy Objectives

Minnesota has committed to a renewable energy objective of generating 25 percent of its electricity from eligible renewable sources by the year 2025.[16] Minnesota utilities forecast the need for 4,700 to 6,500 MW of additional renewable generation by the year 2025 to meet this objective.[17] If the Bitter Root Wind Farm project is not built, it could hinder the ability of the state to meet its renewable energy objective. There are wind resources in other parts of the state and wind farms could be placed in these areas (Figure 6). However, the wind resources of the state are finite. The wind resource in the project area is very good, and, if untapped, could hinder the state's ability to meet its renewable energy objective.

Loss of Economic Benefits

If the Bitter Root Wind Farm project is not built, there will be a loss of economic benefits in the project area. Landowners would lose wind easement payments over the life of the project. Local governments would lose wind energy production tax revenues estimated at $508,000 - $580,000 dollars annually.[18] The Bitter Root Wind Farm project is expected to generate approximately 200 - 250 temporary construction jobs for local contractors and 15 -20 permanent jobs.[19] These employment opportunities and their associated income would be lost if the project is not built.

[16] Minn. Stat. § 216B.1691
[17] CON Application, Section 4.1
[18] CON Application, Section 3.1.3.
[19] Site Permit Application, Section 8.1.2

Replacement with a Non-Renewable Resource

If the Bitter Root Wind Farm project is not built, the electrical power it would have produced would need to be replaced, likely with a non-renewable energy resource.[20] Though the impacts associated with non-renewable sources vary, it is possible to estimate, as an example, the impact of replacing the Bitter Root Wind Farm project with coal energy. The Bitter Root Wind Farm project will produce approximately 460 gigawatt-hours annually (GWh/yr).[21] If this energy were produced by Xcel Energy's Sherco plant (a coal-fired plant), the plant would emit pollutants[22], including approximately:

- 690 tons/yr of nitrous oxides (NO_x)
- 690 tons/yr of sulfur dioxide (SO_2)
- 549,700 tons/yr of carbon dioxide (CO_2)

Nitrous oxides (NO_x) are greenhouse gases that cause ozone and related respiratory illnesses.[23] Sulfur oxides (SO_x) can cause acid rain and human respiratory illness.[24] Carbon dioxide (CO_2) is the most important greenhouse gas and is responsible for global warming and associated impacts including significant changes to world weather systems and ecosystems.[25]

5.2 Benefits

Benefits of not building the Bitter Root Wind Farm project would include avoidance of potential human and environmental impacts associated with the project. These impacts are discussed in Section 6 of this ER.

[20] In 2008, non-renewable energy sources accounted for approximately 92 percent of Minnesota's electrical energy supply. Energy Policy and Conservation Report ("Quad Report"), 2008, http://www.state.mn.us/mn/externalDocs/Commerce/Quadrennial_Report__2008_091509012935_2008-QuadReport.pdf.

[21] 138 MW x (1 GW/1000 MW) x (0.38) x (24 hours/day) x (365 days/yr.) = 460 GWh/yr.

[22] Minnesota Energy Planning Report, 2001, http://www.state.mn.us/mn/externalDocs/Commerce/Energy_Planning_Report_121602022402_2002PlanningRpt.pdf. Emission rates per unit of electricity estimated at 0.003 lbs/kWh (NO_x, SO_2) and 2.39 lbs/kWh (CO_2).

[23] Health and Environmental Impacts of NO_x, http://www.epa.gov/air/nitrogenoxides/.

[24] Health and Environmental Impacts of SO_2, http://www.epa.gov/air/urbanair/so2/.

[25] Climate Change 2007: Synthesis Report, Summary for Policymakers, An Assessment of the Intergovernmental Panel on Climate Change (IPCC), http://www.ipcc.ch/.

6.0 Human and Environmental Impacts

This section discusses the potential human and environmental impacts of the Bitter Root Wind Farm project and project alternatives. The alternatives include: (1) a generic 138 MW wind energy conversion system (LWECS) sited elsewhere in Minnesota, and (2) a 53 MW biomass plant. The potential impacts of the no build alternative are discussed in Section 5. Additionally, this section discusses mitigation strategies for potential impacts.

6.1 Air Emissions – Criteria Pollutants

Electric generation facilities have the potential to emit air pollutants during construction and operation. Minnesota Rule 7849.1500 requires this ER to examine emissions of the following pollutants: sulfur dioxide (SO_2), nitrogen oxides (NO_x), carbon dioxide (CO_2), mercury (Hg), and particulate matter (PM). These common pollutants (other than mercury) are known as criteria pollutants.[26]

Bitter Root Wind Farm Project

The Bitter Root Wind Farm project will emit no criteria pollutants during operation. A minimal amount of these pollutants will be produced during construction, e.g., due to the operation of heavy machinery. Transmission lines, under certain conditions, produce limited amounts of ozone and nitrogen oxide emissions. Emissions of these pollutants will be minimal.

Generic 138 MW LWECS

A generic 138 MW LWECS would emit no criteria pollutants during operation, and would have ancillary emissions (construction, transmission line) similar to those from the Bitter Root Wind Farm project.

53 MW Biomass Plant

A 53 MW biomass plant would emit criteria pollutants (Table 2). These pollutants are based on a plant similar to the NGPP Minnesota Biomass plant (see Section 4.2). Each of these pollutants has potential to cause to human and environmental health impacts. Sulfur oxides (SO_x) cause acid rain and human respiratory illness.[27] Nitrous oxides (NO_x) are greenhouse gases that cause ozone and related respiratory illnesses.[28] Carbon dioxide (CO_2) is a greenhouse gas that is, in part, responsible for global warming and associated impacts including significant changes to world ecosystems.[29] Mercury can cause impaired neurological development in children.[30] Inhalation of particulate matter causes human respiratory illness.[31]

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[26] What Are the Six Common Air Pollutants?, http://www.epa.gov/air/urbanair/.
[27] Health and Environmental Impacts of SO_2, http://www.epa.gov/air/urbanair/so2/.
[28] Health and Environmental Impacts of NO_x, http://www.epa.gov/air/nitrogenoxides/.
[29] Climate Change 2007: Synthesis Report, Summary for Policymakers, An Assessment of the Intergovernmental Panel on Climate Change (IPCC), http://www.ipcc.ch/.
[30] Health Effects, http://www.epa.gov/mercury/effects.htm.
[31] Health and Environment, http://www.epa.gov/air/particlepollution/health.html.

Table 2. Biomass Plant Emissions, Criteria Pollutants[32]

Pollutant	lbs/kWh	tons/year
Sulfur Dioxide (SO_2)	1.73 E-04	80.3
Nitrogen Oxides (NO_x)	9.9 E-04	459.8
Carbon Dioxide (CO_2)	1.34[33]	6.2 E05[34]
Mercury (Hg)	2.4 E-08	0.011
Particulate Matter (PM)	3.56 E-04	166.5

lbs/kWh = pounds per kilowatt-hour

Because these pollutants are diffused into a global atmosphere, regional impacts are difficult to quantify. However, impacts due to particulate matter and ground-level ozone can be localized. Particulate matter and ozone are the pollutants of most concern in Minnesota, and they are tracked regionally by the Minnesota Pollution Control Agency.[35] Because the plant is fired primarily with biomass, net impacts from carbon dioxide will be minimal. Carbon dioxide released by the plant will be incorporated into plant matter which, in time, will serve as fuel for the plant. The plant will operate, to a great extent, as a closed carbon dioxide loop.[36]

Mercury exists throughout the environment; however, the primary source of mercury in air emission is coal, i.e., the burning of coal in a coal-fired power plant. The biomass plant considered here would use biomass as a primary fuel and natural gas as a backup fuel. Thus, emissions of mercury, and related impacts, are anticipated to be minimal.

Mitigation

Emissions of some criteria air pollutants can be mitigated through control technologies. Nitrous oxides emissions could be reduced by approximately 75 percent through use of a selective non-

[32] Adapted from Minnesota Biomass EAW, http://energyfacilities.puc.state.mn.us/Docket.html?Id=4452. Boiler heat input capacity = (53/38.5) x 527.5 MMBtu/hr = 726 MMBtu/hr.
[33] AP-42, Fifth Edition, Volume 1, Chapter 1 External Combustion Sources, Section 1.6 Wood Residue Combustion in Boilers, http://www.epa.gov/ttn/chief/ap42/ch01/final/c01s06.pdf.
[34] Because the plant is fired with biomass (excepting natural gas backup) net carbon dioxide emissions from the plant would be minimal. Carbon dioxide released from the plant would be integrated into new biomass materials which, in time, would be harvested and used to fire the plant. There would be carbon dioxide emissions related to transport of biomass and plant operations.
[35] Air Quality Index for Minnesota, http://aqi.pca.state.mn.us/.
[36] Fuels used to collect and transport biomass would likely not be carbon neutral and would create carbon dioxide emissions.

catalytic reduction (SNCR) system on the biomass boiler.[37] Particulate matter emissions could be reduced by 90 percent with add-on devices such as a multi-cyclone and dust collector.[38]

In addition to the use of control equipment to mitigate pollutant impacts, a 53 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). A BACT analysis and implementation could limit emissions from the plant to less than those presented in Table 2.

6.2 Air Emissions – Hazardous Air Pollutants and Volatile Organic Compounds

Electric generation facilities have to potential to emit air pollutants during construction and operation. Minnesota Rule 7849.1500 requires this ER to examine emissions of hazardous air pollutants (HAP) and volatile organic compounds (VOC). These classes of pollutants are known or suspected of causing cancer and other serious health effects.[39]

Bitter Root Wind Farm Project

The Bitter Root Wind Farm project will not emit HAPs or VOCs during operation. There are petroleum-based fluids used in the operation of wind turbines. These fluids include: gear box oil, hydraulic fluid, and gear grease. These fluids have a low vapor pressure and thus release of VOCs will be minimal. A minimal amount of HAPs and VOCs will be produced during construction, due to the use of diesel fuel in heavy machinery.

Generic 138 MW LWECS

A generic 138 MW LWECS would have HAP and VOC emissions similar to the Bitter Root Wind Farm project.

53 MW Biomass Plant

A 53 MW biomass plant would emit HAPs and VOCs (Table 3). These pollutants are based on a plant similar to the NGPP Minnesota Biomass plant (see Section 4.2). Because these pollutants are diffused into a global atmosphere, regional impacts are difficult to quantify. The only area in Minnesota with a cancer risk due to HAPs greater than 100 in a million is the Minneapolis - Saint Paul metro area.[40] The emissions from the biomass plant are, compared with other sources, relatively small.

Mitigation

It is possible to mitigate HAP and VOC emissions with control technologies. However, given the relatively small amounts of HAP and VOC emissions compared with the costs of control equipment, it is likely that control technologies will not be employed.

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[37] Minnesota Biomass EAW.
[38] Id.
[39] About Air Toxics, http://www.epa.gov/ttn/atw/allabout.html;
[40] Summary of Results for the 2002 National-Scale Assessment, http://www.epa.gov/ttn/atw/nata2002/risksum.html.

Table 3. Biomass Plant Emissions, Hazardous Air Pollutants and Volatile Organic Compounds[41]

Pollutant	lbs/kWh	tons/year
Hazardous Air Pollutants (HAPs)	2.78 E-04	128.9
Volatile Organic Compounds (VOCs)	9.0 E-05	41.9

lbs/kWh = pounds per kilowatt-hour

6.3 Visibility Impairment

Wind turbines are tall towers with large, rotating blades. Consequently, they can impair visibility or otherwise impact the visible environment. This section discusses potential impacts related to visibility including shadow flicker, impacts on the viewshed, and the lighting of turbines.

Bitter Root Wind Farm Project

The Bitter Root Wind Farm project would, to some degree, impair visibility and cause shadow flicker. The project would introduce industrial wind turbines to an otherwise rural countryside. The potential impact of such an introduction depends somewhat on the aesthetic values of the observer. For some, wind turbines are an intrusion on a rural landscape. For others, wind turbines have a grace that is harmonious with a rural landscape. Yellow Medicine and Lincoln County are predominantly rural with an agricultural base. Wind turbines, as gatherers of a renewable wind harvest, are in some sense compatible with a rural, agricultural heritage.

Development of an objective measure of visibility or aesthetic impairment is a difficult task. Current methods used to assess visual impacts include viewshed mapping, photographic simulations, and video animation.[42] All of these methods depend, to some extent, on assessing the current aesthetic resources of the project area, i.e., the aesthetics of the area before construction of a wind farm. Such an assessment can be subjective; however, state and federal agencies perform assessments regularly in the development of parks that have valuable aesthetic resources. The project area for the Bitter Root Wind Farm project does not contain state or federal parks or other aesthetic resources designated as visually valuable, e.g., state scenic highway.[43] This does not mean the area is not aesthetically valuable on a local level. The area includes several state wildlife management areas and is known for its birding. Residents and

[41] Adapted from Minnesota Biomass EAW, http://energyfacilities.puc.state.mn.us/Docket.html?Id=4452. Boiler heat input capacity = (53/38.5) x 527.5 MMBtu/hr = 726 MMBtu/hr.
[42] Visual Considerations: Public Perceptions, Regulatory Environment and Assessment Methods in the Eastern U.S., http://www.nationalwind.org/assets/blog/Allen-NWCC_2009.pdf.
[43] Minnesota State Highway 75, which parallels the project area to the east, is a state scenic byway: King of Trails, http://www.exploreminnesota.com/byway/21869/king-of-trails. The byway highlights American Indian heritage, prairie lands, birding and the scenic enjoyment of wind turbines along the Buffalo Ridge. For a listing of aesthetic resources in the project area, see Table 5.1, Site Permit Applications, Section 5.0.

visitors enjoying these wildlife areas and associated fauna would experience an aesthetic impact due to the proposed Bitter Root Wind Farm project.

Wind turbines, per Federal Aviation Administration (FAA) requirements and because of their height, would be lighted.[44] In general, turbines have flashing white lights during the day and red lights during the evening.

Shadow flicker is the intermittent change in light intensity due to rotating wind turbine blades casting shadows on the ground. Shadow intensity, or how "light" or "dark" a shadow appears at a specific receptor, will vary with the distance from the turbine. Closer to a turbine, the turbine blades will block out a larger portion of the sun's rays and shadows will be wider and darker. Receptors located farther away from a turbine will experience thinner and less distinct shadows since the blades will not block out as much sunlight. Shadow flicker is reduced or eliminated when buildings, trees, blinds, or curtains are located between the turbine and receptor.

Mitigation

Mitigation of visibility impairments and shadow flicker is best accomplished by proper siting of the project and individual wind turbines. In general, siting wind projects in rural areas minimizes human impacts. Visibility impacts can be mitigated by siting wind projects outside of areas deemed visually valuable by the state, e.g., state parks.

Setbacks from individual turbines, as embodied by Minnesota's general permit standards, mitigate visibility impacts.[45] Wind turbines must be set back from non-participating properties a distance of 5 rotor diameters (RD) on the prevailing wind direction and 3 RD on the non-prevailing wind direction. The potential setback distances for the Bitter Root Wind Farm project are shown in Table 1. The applicant has committed to maintaining 1,000 foot setbacks from residences; additional setbacks may be required to meet Minnesota noise standards.[46] These setbacks minimize the general visibility of the wind turbines and also shadow flicker. Finally, turbines are designed to be a uniform off-white color to blend in with the horizon and reduce visibility impacts.

Lighting required by the FAA is similar to that for other tall structures in rural areas, and mitigation is not expected to be necessary.

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[44] FAA Advisory Circular AC 70/7460-2K, HTTP://RGL.FAA.GOV/REGULATORY_AND_GUIDANCE_LIBRARY/RGADVISORYCIRCULAR.NSF/0/22990146DB0931F186256C2A00721867/$FILE/AC70-7460-2K.PDF.

[45] Commission Order Establishing General Permit Standards, http://energyfacilities.puc.state.mn.us/documents/19302/PUC%20Order%20Standards%20and%20Setbacks.pdf.

[46] Minnesota Rules Chapter 7030 at all residential receivers (homes). Residential noise standard NAC-1, L50 50 dBA during overnight hours.

Generic 138 MW LWECS

A generic 138 MW LWECS located elsewhere in Minnesota would have visual impacts and mitigation strategies similar to that of the Bitter Root Wind Farm project. Impacts could be mitigated by possibly locating in a more rural area of Minnesota; however, such a location would need to also have wind resources similar to those in Yellow Medicine and Lincoln County.[47] Impacts could also be mitigated by utilizing wind turbines capable of generating more energy. For example, a 138 MW project consisting of 1.5 MW turbines requires 92 turbines; a similar project consisting of 3.0 MW turbines requires 46 turbines. The larger turbines would create a larger individual "eyeprint," but the smaller number of turbines would likely create a relatively smaller visual impact for the project.

53 MW Biomass Plant

A 53 MW biomass plant would impair visibility in the immediate area of plant, and to the extent a stack plume is visible, in the greater area. A biomass plant would not cause shadow flicker due to the lack of exterior moving parts that could cast alternating shadows.

A biomass plant would be industrial in nature with many buildings, conveyors, biomass piles, and a boiler stack. The building that houses the boiler is likely to be at least 100 feet tall. The conveyors and biomass piles could range from 30 to 50 feet in height. The plant buildings, conveyors, and 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 estimated height for the boiler stack is approximately 150 feet. Particulate matter control devices would capture most of the particulates from the boiler exhaust gas stream. Thus, 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. If taller than 200 feet, the boiler stack may require FAA lighting, similar to wind turbines.

Mitigation

Mitigation of visibility impairment is best accomplished through selective location of the biomass plant. The site for the biomass plant does not need to be a rural, agricultural setting. The plant could be located in an industrial location allowing it to blend in with other industry. Thus, the plant could be located away from aesthetically valuable resources. However, the biomass plant would need to be located in an area where biomass is readily available in large quantities. Vegetative screening (trees, shrubs) could be used to partially block views of the industrial buildings, silos, conveyors, and boiler stack.

6.4 Ozone Formation

Large electric power generating facilities, such as biomass facilities, have the potential to produce reactive organic gases, which can lead to ground-level ozone formation. Wind turbines

[47] Yellow Medicine and Lincoln County are rural areas. There are 17 counties in Minnesota with lower population densities, http://www.demography.state.mn.us/resource.html?Id=5238.

do not produce ozone or ozone precursors. Minnesota Rules 7849.1500, subpart 2 requires that this ER address anticipated ozone formation.

Ozone can cause human health risks, and can also damage crops, trees, and other vegetation.[48]

Bitter Root Wind Farm Project

The Bitter Root Wind Farm project would not produce ozone or ozone precursors. Thus, there would no human or environmental impacts due to ozone formation.

Generic 138 MW LWECS

A generic 138 MW LWECS would have ozone formation similar to the Bitter Root Wind Farm project.

53 MW Biomass Plant

A 53 MW biomass plant would produce ozone precursors (e.g., NO_x, VOC) that would lead to ozone formation. Impacts from ozone can be localized. However, the state of Minnesota is designated as in attainment for ozone by the Environmental Protection Agency (EPA). Given this status, ground level ozone formation and associated impacts are anticipated to be minimal.

Mitigation

Ozone formation could be mitigated by mitigating ozone precursors. See discussion in Sections 6.1 and 6.2 regarding nitrous oxides (NO_X) and volatile organic compounds (VOC) respectively.

6.5 Fuel Availability

Large electric power generating facilities require some type of fuel. This section discusses the availability of fuel for the proposed project and alternatives.

Bitter Root Wind Farm Project

The Bitter Root Wind Farm project relies on wind to generate electricity. Winds are generated by earth and solar processes; accordingly, the fuel for the project is a very long-term renewable resource. Wind is not consumed by wind turbines. Wind that passes through a wind turbine does release energy to the turbine and turbulence is created in the wake of the turbine. Thus, to operative effectively, turbines must be setback a distance from other turbines.[49]

The actual availability of wind varies considerably across Minnesota, and has been analyzed by the Minnesota Department of Commerce.[50] Wind resources in Yellow Medicine and Lincoln County are relatively good (Figure 6). Estimated wind speeds at a height of 79 meters for the

[48] Ozone, http://www.epa.gov/Ozone/. Air Quality – Ozone, http://www.health.state.mn.us/divs/eh/air/ozone.htm.
[49] The distance between turbines necessary for effective operation is approximately 6 rotor diameters (RD) on the non-prevailing wind axis and 10 RD on the prevailing wind axis. Accordingly, Minnesota requires setbacks of 3 x 5 RD for each turbine. See, PUC Order Establishing General Permit Standards, http://energyfacilities.puc.state.mn.us/documents/19302/PUC%20Order%20Standards%20and%20Setbacks.pdf.
[50] Wind Resource Analysis Program 2002, http://www.state.mn.us/mn/externalDocs/Commerce/WRAP_Report_110702040352_WRAP2002.pdf.

Bitter Root Wind Farm project are 16.1 to 20.4 miles per hour (7.2 to 9.1 meters per second).[51] Power generation by the project depends not only on how quickly the wind blows (how much energy it contains), but also how frequently it blows. Wind turbines generate power only when the wind is blowing.[52] This frequency is expressed as capacity factor, i.e., how much power the turbine is generating compared to how much it could generate if it was operating all the time. Capacity factors of 35 to 40 percent are typically achievable in Minnesota for large wind farms. The Bitter Root Wind Farm project is estimated to have a capacity factor in this range.[53]

Generic 138 MW LWECS

A generic 138 MW LWECS would utilize the same fuel as the Bitter Root Wind Farm project – wind. To be economically feasible, a 138 MW LWECS sited elsewhere in Minnesota would need to be placed in a good wind resource. The availability of good, undeveloped wind resources in Minnesota remains high. Impacts on the fuel (wind) resources would be similar to those for the Bitter Root Wind Farm project.

53 MW Biomass Plant

A combination of wood chips and agricultural biomass would be the main fuel sources for a 53 MW biomass plant. Natural gas would be used as a fuel backup. Such a plant would consume approximately 55,000 tons of biomass per month. There are currently no biomass plants of this size operating in Minnesota.[54]

It is possible that rail could be used for delivery of fuel to the plant, depending on its location. However, the most likely method of delivery for wood and agricultural biomass fuel would be by semi-trailer trucks. Trucks would likely deliver wood and agricultural biomass by loads of 20 tons or greater. 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 number of daily truck trips is estimated to be approximately 90. The origin of the biomass trucks and the total trip length required for delivery would depend on the location of the biomass source relative to the biomass plant.

A back-up fuel source would be required for the biomass plant, to assist with plant start-up and to sustain the plant temporarily when the biomass fuel supplies are low. Natural gas would be used as a backup fuel. The construction of a natural gas pipeline would be required to deliver the natural gas to the biomass plant.

Potential impacts to the environment related to fuel for a biomass plant include possible degradation of the environment due to biomass removal (e.g., increased soil erosion due to

[51] Site Permit Application, Section 5.4.
[52] See Table 1 which list includes "Cut-in Wind Speeds", i.e., the minimum wind speed necessary for the turbine to operate.
[53] Site Permit Application, Section 13.0.
[54] Xcel Energy's Bay Front power plant in Ashland, Wisconsin generates approximately 76 MW, and is moving toward becoming a 100% biomass plant, http://www.xcelenergy.com/Company/Environment/Renewable%20Energy/Pages/Biomass.aspx.

removal of agricultural biomass; loss of wildlife habitat), air pollution due to biomass transport, and the impacts associated with building a natural gas pipeline.

Mitigation

Impacts related to fuel for a biomass plant could be mitigated by using guidelines for biomass harvest that minimize impacts and by siting the plant to minimize impacts related to biomass transportation. As an example, the Minnesota Forest Resource Council (MFRC) has developed woody biomass harvest guidelines to lessen impacts to wildlife habitat.[55] In order for mitigation to work, the biomass plant would need to require that its biomass suppliers follow biomass harvest guidelines.

6.6 Associated Transmission Facilities

Electrical generation facilities typically require construction of transmission facilities such as transmission lines and substations to connect to the transmission grid. This section discusses these associated transmission facilities and their potential impacts.

Transmission lines over 100 kilovolts and longer than 1,500 feet are defined as "high voltage transmission lines" and are subject to regulation by the Commission[56]. Wind generation facilities require construction of lower voltage electric infrastructure (typically, 34.5 kV), referred to as feeder or collector lines, to collect the power generated by the wind turbines and get it to the project substation before connecting to the transmission grid.

Bitter Root Wind Farm Project

The Bitter Root Wind Farm Project would construct a project substation near the center of the project area. The project substation would convert the lower voltage collector lines to 115 kV. Power from the project substation will interconnect with the existing 115 kV Canby to Toronto transmission line.

The Bitter Root Wind Farm project would collect the electrical power generated by turbines through a 34.5 kV collection system. Strings of collector lines would be buried underground between turbines; collector lines may either continue underground or be constructed above ground when they reach public roads or the edge of farm fields. The collection lines will carry power to the project substation

Impacts from the project's associated transmission facilities would include impacts due to construction and impacts due to operation. Construction impacts would include impacts related to land clearing and materials transport. Operation impacts would include impacts related to electromagnetic fields (EMF), noise, and visibility. Power moving through a transmission line creates EMF. These fields decrease with distance from the transmission line. The primary potential impact is possible generation of stray voltage in nearby, ungrounded structures.

[55] Forest Biomass and Biofuels Harvest, http://www.frc.state.mn.us/initiatives_policy_biofuels.html.
[56] Minn. Statute 216E.01, subdivision 4. Under Minn. Statute 216E.05, high voltage transmission lines between 100 and 200 kV may be permitted by local governments.

During wet weather, water can be ionized adjacent to transmission lines creating a crackling noise. Visual impacts of a transmission line depend on context. High visual impacts likely occur when a line is located near areas with relatively higher population densities, e.g., residential, recreational, and scenic areas.

Mitigation

The project substation will be placed adjacent to the existing 115 kV Canby to Toronto transmission line, thus minimizing the transmission corridor needed for interconnection.[57] Construction impacts could be mitigated by minimizing the amount of land clearing required. Collection lines for the project will be routed along existing corridors (roadways, utility corridors).[58] Operation impacts could be mitigated by placing transmission lines away from population densities. Visual impacts could also be mitigated by placing collector lines underground, while aesthetic impacts from overhead collector and transmission lines can be mitigated through design and pole placement.

Generic 138 MW LWECS

A generic 138 MW LWECS would have transmission facilities similar to the Bitter Root Wind Farm project. Accordingly, potential impacts and mitigation strategies are also similar. The primary driver of potential impacts is the length and voltage of the transmission line required to interconnect the wind project with the transmission grid. A relatively longer line or higher voltage would create greater construction and operation impacts.

53 MW Biomass Plant

A 53 MW biomass plant would have transmission facilities similar to the Bitter Root Wind Farm project; however an electrical collection system and project substation would not be required. The plant would include a transformer at the plant to transform the voltage to transmission levels and a transmission line between the plant and a substation where the power would enter the grid.

Potential impacts and mitigation strategies would be similar to those for the Bitter Root Wind Farm project. Again, the primary driver of potential impacts is the length and voltage of the transmission line required to connect the biomass plant to the transmission grid. A relatively longer line or higher voltage would create greater construction and operation impacts.

6.7 Water Appropriations

Large electric power generating facilities may require water for operations. This section discusses potential water appropriation impacts from such facilities.

[57] Site Permit Application, Section 7.4.
[58] Site Permit Application, Section 7.3.

Bitter Root Wind Farm Project

The Bitter Root Wind Farm project would require water appropriations for potable and sanitary water for the operations and maintenance facility. Water would be supplied through either rural water or a single domestic-sized well. This amount of water used would be roughly equivalent to the amount consumed by a residence or farmstead in the area, and would likely not require mitigation.

Generic 138 MW LWECS

A generic 138 MW LWECS would have water appropriations similar to the Bitter Root Wind Farm project.

53 MW Biomass Plant

A 53 MW biomass plant would require water appropriations for energy production (process water) and sanitation. Process water could come from a well; however, a municipal water source may also be required. For some aspects of the process, such as in the cooling tower, effluent water from a wastewater treatment facility could be used. Thus, the sources of water would depend on the type and availability of water sources near the facility location.

The required quantity of water would be dependent on plant design and water quality. Functions within the plant that require water include cooling, sanitation, washing, and separations. The average anticipated water use would be approximately 850 gallons per minute. If a source of effluent wastewater were available, the appropriation of well or municipal water would be relatively lower. If the plant used only well or municipal water, the water appropriation would be relatively higher. Based on anticipated water use, the plant would require a water appropriations permit from the Minnesota Department of Natural Resources (DNR).[59]

Mitigation

Mitigation of well water and municipal water use by the plant could be achieved through plant equipment choices and through the use of effluent water (water that has already been appropriated). If municipal water were used for the plant, modifications or an expansion of the municipal water treatment plant be required to accommodate the increase in demand.

6.8 Wastewater

Large electric generation facilities have the potential to generate significant amounts of wastewater. This section discusses potential impacts from wastewater generation.

Bitter Root Wind Farm Project

The Bitter Root Wind Farm project does not create wastewater during the generation of electricity. However, wastewater would be created by the operation and maintenance (O&M) building. This wastewater would likely be discharged into a septic system associated with the building. The potential impacts of this wastewater and septic system are anticipated to be

[59] Water Use Permits, http://www.dnr.state.mn.us/waters/watermgmt_section/appropriations/permits.html.

minimal. Thus, mitigation of the impacts, beyond a properly functioning septic system, is not required.

Generic 138 MW LWECS

A generic 138 MW LWECS would have wastewater impacts similar to the Bitter Root Wind Farm project.

53 MW Biomass Plant

A 53 MW biomass plant would have process and sanitary wastewater discharges. The amount of wastewater discharge would depend on the water sources used for the plant (see Section 6.7). If well and municipal water are used, anticipated average wastewater discharge would be approximately 110 million gallons per year. If effluent water is also utilized, wastewater discharge would increase to approximately 310 million gallons per year.

Mitigation

Wastewater impacts could be mitigated by proper processing. The most likely scenario is transference of the wastewater to a municipal sewage system for treatment and release. Wastewater could be held or pre-treated at the biomass plant. Holding could reduce discharges through evaporation. However, holding introduces risks related to storing wastewater away from surface and ground waters.

6.9 Solid and Hazardous Wastes

Large electric generation facilities have the potential to generate solid and hazardous wastes. This section discusses potential impacts from such wastes.

Bitter Root Wind Farm Project

The Bitter Root Wind Farm project would create solid and hazardous wastes. Solid wastes would be generated during construction, e.g., scrap wood, plastics, cardboard, wire. Small amounts of solid and hazardous wastes would be generated during operation, e.g., oils, grease, hydraulic fluids, solvents. Lubricants and fluids would be stored at the operation and maintenance building.

Solid and hazardous wastes, if not properly handled, can contaminate surface and ground waters. This contamination can cause human health impacts, e.g., cancer.[60]

Mitigation

Solid wastes would be disposed of according to solid waste plans in Yellow Medicine and Lincoln County. Hazardous wastes would be handled appropriately. Leaks or spills would be mitigated using appropriate clean up techniques. A listing of all potentially hazardous materials related to the project will be maintained for the project. It is not anticipated that the project will

[60] Volatile Organic Compounds (VOCs) in Minnesota's Ground Water, http://www.pca.state.mn.us/water/groundwater/gwmap/voc-fs.pdf.

require a hazardous waste license. Hazardous waste generation would likely fall below the quantity required for a very small quantity generator license (220 pounds per month).[61]

Generic 138 MW LWECS

A generic 138 MW LWECS would have solid and hazardous waste impacts similar to the Bitter Root Wind Farm project.

53 MW Biomass Plant

A 53 MW biomass plant would create solid and hazardous wastes. Solid wastes would be generated during construction, e.g., scrap wood, plastics, cardboard, wire. Solid waste generated from operations would consist primarily of ash from the biomass boiler. Small amounts of hazardous wastes would be generated during operation, e.g., oils, grease, hydraulic fluids, solvents. Hazardous materials would likely be stored on site, e.g., diesel fuel.

Mitigation

Mitigation of wastes would be similar to the Bitter Root Wind Farm project. Ash generated by the plant would be held on-site in an ash holding facility or removed to an off-site disposal facility. Storage tanks would be registered and maintained in accordance with Minnesota Pollution Control Agency (MPCA) guidelines.

6.10 Noise

Large electric generation facilities have the potential to generate noise. This section discusses potential impacts from such noise.

Noise can be defined as unwanted or inappropriate sound. Sound has multiple characteristics which determine whether a sound is too loud or otherwise inappropriate. Sound travels in a wave motion and produces a sound pressure level. This sound pressure level is commonly measured in decibels (dB). Sounds also consists of frequencies, e.g., the high frequency (or pitch) of a whistle. Most sounds are not a single frequency but a mixture of frequencies. Finally, sounds can be constant or intermittent. The perceived loudness of a sound depends on all of these characteristics.

Typically a sound meter is used to measure loudness. The meter sums up the sound pressure levels for all frequencies of a sound and calculates a single loudness reading. This loudness reading is reported in decibels, with a suffix indicating the type of calculation used. For example, “dB(A)” indicates a loudness reading using an A-weighted calculation (or “scale”).

The State of Minnesota has promulgated noise standards designed to ensure public health and minimize citizen exposure to inappropriate sounds (Table 4). The rules for permissible noise vary according to land use, i.e., according to their noise area classification (NAC). In a residential setting, for example, noise restrictions are more stringent than in an industrial setting.

[61] Very Small Quantity Generator Hazardous Waste Collection Program, http://www.pca.state.mn.us/publications/w-hw2-50.pdf.

Rural residential homes are considered NAC 1 (residential), while agricultural land and agricultural activities are classified as NAC 3 (industrial). The rules also distinguish between nighttime and daytime noise; less noise is permitted at night. The rules list the sound levels not to be exceeded for 10 percent and 50 percent of the time in a one-hour survey (L_{10} and L_{50}) for each noise area classification.

Potential human impacts due to noise include hearing loss, stress, annoyance, and sleep disturbance.[62]

Table 4. Minnesota Noise Standards[63]

Noise Area Classification[64]	Daytime		Nighttime	
	L_{50}[65]	L_{10}	L_{50}	L_{10}
1	60	65	50	55
2	65	70	65	70
3	75	80	75	80

Bitter Root Wind Farm Project

The operation of wind turbines in the Bitter Root Wind Farm project would produce noise. Turbines produce mechanical noise (noise due to the gearbox and generator in the nacelle) and aerodynamic noise (noise due to wind passing over the turbine blades).[66] Perceived sound characteristics would depend on the type/size of turbine, the speed of the turbine (if turning), and the distance of the listener from the turbine.

Wind turbines produce audible, low frequency sound and sub-audible sound (infrasound). These sounds can have a rhythmic modulation due to the spinning of the turbine blades.[67] Impacts due to these sound characteristics are subjective, i.e., human sensitivity, especially to low frequency

[62] Occupational and Community Noise, World Health Organization, http://www.who.int/mediacentre/factsheets/fs258/en/.
[63] Minnesota Rules 7030.0040, https://www.revisor.leg.state.mn.us/rules/?id=7030.0040. Standards expressed in dB (A).
[64] Minnesota Rules 7030.0050, https://www.revisor.leg.state.mn.us/rules/?id=7030.0050. The noise area classification is based on the land use activity at the location of the receiver (listener).
[65] Minnesota Rules 7030.0020, https://www.revisor.leg.state.mn.us/rules/?id=7030.0020. "L_{50}" means the sound level, expressed in dB(A), which is exceeded 50 percent of the time for a one hour survey. "L_{10}" means the sound level, expressed in dB(A), which is exceeded ten percent of the time for a one hour survey.
[66] Public Health Impacts of Wind Turbines, Minnesota Department of Health, May 22, 2009, http://www.health.state.mn.us/divs/eh/hazardous/topics/windturbines.pdf.
[67] Id.

sound, is variable. However, in general, low frequency sounds can cause annoyance and sleep disturbance.[68]

Mitigation

The primary means of mitigating sound (noise) produced by wind turbines is proper siting. Turbines must be sited to comply with noise standards in Minnesota Rules 7030.[69] For rural residential areas in Yellow Medicine and Lincoln County, this means that sound levels must meet an L_{50} standard of 50 dB(A) (Table 4). The distance that turbines are setback from residences would depend on the type and size of turbine. Setback distances to the 50 dB(A) level for turbines under consideration for this project are shown in Table 1. The setback distance for a 1.5 MW turbine is 623 feet; the distance for a 3.0 MW turbine is 779 feet. The applicant has stated that no turbines will be placed within 1,000 feet of any home; this setback is reflected in preliminary turbine layouts shown in Figures 4 and 5.

Cumulative noise impacts must also be considered. That is, if there are multiple turbines in the vicinity of a residence, the standards set by Minnesota Rules 7030 must still be met. This may require additional setbacks. Setback requirements are enforced by site permits issued by the Commission for wind farms. The Commission is currently reviewing public health setbacks related to wind farms to determine if they remain appropriate and reasonable.[70]

Generic 138 MW LWECS

A generic 138 MW LWECS would have noise impacts similar to the Bitter Root Wind Farm project.

53 MW Biomass Plant

A 53MW biomass plant would create noise during operation from a variety of sources including the turbine/boiler building, conveyor system, hammer mill and bale choppers, front end loaders, and idling trucks. Based on noise studies, the plant would need to be located approximately 2,100 feet from a residence to the meet the daytime L_{50} standard of 60 dB(A), and approximately 6,200 feet from a residence to meet the nighttime L_{50} standard of 50 dB(A). These are conservative estimates – they are based on maximum equipment operation and have not been adjusted for possible noise shielding.

Mitigation

Sound (noise) from the biomass plant could be mitigated by proper siting. A study would likely be required to ensure that noise standards are met for all local residents. Enclosure of heavy equipment would reduce noise impacts. Vegetative screening, planted to lessen visual impacts, would provide noise mitigation. Fuel windrows could provide noise attenuation. Hours of operation, e.g., for fuel delivery or heavy equipment operation, could be managed to reduce noise impacts and meet daytime and nighttime standards.

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[68] Id.
[69] Minn. Rules 7030.0040, Noise Standards, https://www.revisor.leg.state.mn.us/rules/?id=7030.0040
[70] Commission Investigation into Large Wind Energy Conversion Systems Permit Conditions on Setbacks and the Minnesota Department of Health Environmental Health Division's White Paper on Public Health Impacts of Wind Turbines, CI-09-845, http://www.puc.state.mn.us/puc/energyfacilities/012254#windhealth.

6.11 Property Values

Large electric generation facilities have the potential to impact property values. This section discusses potential property value impacts from the operation of a generation facility in the project area.

Bitter Root Wind Farm Project

The Bitter Root Wind Farm project would be located in Yellow Medicine and Lincoln County in southeastern Minnesota. Yellow Medicine County has a population of 9,958 persons.[71] The home ownership rate is approximately 79.5%.[72] Lincoln County has a population of 5,837 persons.[73] The home ownership rate is approximately 80.3%.[74]

The impact on property values due to the project are difficult to quantify because of the multitude of factors that influence a property's market value, including acreage, schools, parks, neighborhood characteristics, and improvements. A direct influence on property value is often the status of the housing/land market at the time of sale, i.e., a buyer's market or a seller's market.

The Renewable Energy Policy Project (REPP) conducted a statistical analysis to determine the extent to which property values are influenced in the vicinity of wind projects.[75] Ten communities in the United States were studied within a five mile radius of a wind project. The study indicated that property values were not negatively impacted within the viewshed of a wind project. Lawrence Berkeley National Laboratory recently completed a nationwide study on the potential impacts of wind projects on property values.[76] Results indicate that property values near wind projects are not negatively impacted. The study indicates that home buyers and sellers consider a property's scenic vista when determining an appropriate sales price; however, sales prices are not significantly affected by views of wind turbines.

Mitigation

Negative impacts to property value due to the Bitter Root Wind Farm project are not anticipated; thus, mitigation is not necessary. This inference does not preclude the possibility that in specific instances, property values may be negatively impacted. Such impacts can be mitigated by siting turbines away from residences and viewsheds.

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[71] U.S. Census Bureau, http://quickfacts.census.gov/qfd/states/27/27173.html.
[72] Id.
[73] U.S. Census Bureau, http://quickfacts.census.gov/qfd/states/27/27081.html.
[74] Id.
[75] The Effect of Wind Development on Local Property Values, May 2003, http://www.repp.org/articles/static/1/binaries/wind_online_final.pdf.
[76] The Impact of Wind Power Projects on Residential Property Values in the United States: A Multi-Site Hedonic Analysis, December 2009, http://www1.eere.energy.gov/windandhydro/pdfs/wind_power_projects_residential_property_values.pdf.

Generic 138 MW LWECS

A generic 138 MW LWECS would have property value impacts similar to the Bitter Root Wind Farm project.

53 MW Biomass Plant

A 53 MW biomass plant would have the potential to negatively impact property values near the plant site and possibly along roads used to transport biomass. However, as with the Bitter Root Wind Farm project, impacts on property values due to a plant are difficult to quantify because of the multitude of factors that influence a property's market value. For example, if biomass for the plant were supplied by neighboring land parcels, these parcels might experience an increase in property value.

Mitigation

Because the plant is sited in one location (as compared to multiple turbine locations), property value impacts could be mitigated by proper siting.

6.12 Historic and Archaeological Resources

Large electric generation facilities have the potential to impact historic and archaeological resources, particularly during construction. This section discusses potential impacts to historic and archaeological resources from the operation of a generation facility in the project area.

Bitter Root Wind Farm Project

The Bitter Root Wind Farm project would be located in the Prairie Lake Region, an archaeological region in the Northeastern Plains.[77] The region transitions from woodlands to shortgrass and midgrass prairies. Water is plentiful, but the region is susceptible to drought as water flows out of the region, rather than through it. Habitation sites are commonly located near lakes and river valleys.

A review of Minnesota state historical records indicates that there are six historic properties and eight archaeological sites within one mile of the proposed project area.[78] The historic properties include a school, rock wall, state line marker, bridge, museum, and homestead. Archaeological sites are scattered throughout the area, but include two sites along Lazarus Creek.

Construction of the Bitter Root Wind Farm project would likely not impact historic properties, but could impact archaeological sites. Construction will include digging, trenching, and movement of soil. These activities could uncover or otherwise impact archaeological sites.

Mitigation

The Minnesota State Historic Preservation Office (SHPO) has recommended that a Phase I archaeology survey be conducted for all project construction activities. The applicant has indicated that it will perform such a survey. If archaeological sites are found during the survey

[77] Site Permit Application, Section 8.5.
[78] Id.

or construction, mitigative measures will be developed in consultation with SHPO, the State Archaeologist and American Indian communities.[79]

Generic 138 MW LWECS

A generic 138 MW LWECS located elsewhere in Minnesota would have impacts to historic and archaeological resources similar to the Bitter Root Wind Farm project. Mitigation measures would also be similar. Historic and archaeological resources are distributed throughout the state.[80] Archaeological sites are more typically found near regional water resources, e.g. Mississippi River, Minnesota River, Lake Superior. Because of the dispersed nature of LWECS, turbines, roads, and collector lines are usually able to be located to avoid historic and archaeological resources.

53 MW Biomass Plant

A 53 MW biomass plant would have impacts to historic and archaeological resources similar to the Bitter Root Wind Farm project. Mitigation measures would also be similar. A biomass plant requires water for operations. Locating a plant near surface waters increases the likelihood of encountering archaeological sites during construction.

6.13 Livestock

Large electric generation facilities have the potential to impact the health of fauna, directly and through impacts to the ecosystem. This section discusses potential impacts to livestock (a subset of local fauna) due to the operation of a generation facility in the project area. Potential impacts to wildlife are discussed in Section 6.14.

There are few aspects of livestock health that can be considered outside of ecosystem health. That is, livestock health depends on ecosystem health (clean water, fresh air, healthy soils and crops). Generation facilities that impair ecosystem functioning can negatively impact livestock health, e.g., emissions of hazardous air pollutants. Potential ecosystem impacts due to generation facilities are discussed elsewhere in this report (e.g., Sections 6.1 and 6.2 discussing air pollutants).

There are potential impacts to livestock health that are independent of ecosystem health, i.e., impacts to health due to annoyance or stress. This stress could result from a variety of impacts related to generation facility operations, e.g., lights, noises, electrical shock. Shadow flicker is discussed in Section 6.3; noise is discussed in section 6.10.

Electrical shock could be caused by stray voltage or induced voltage.[81] Stray voltage occurs with electrical distribution lines to residences and transmission lines that parallel them. Stray voltage flows through the ground. Induced voltage occurs with ungrounded metal objects (e.g.,

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[79] Id.
[80] Distribution of Recorded Archaeological Site in Minnesota, http://www.osa.admin.state.mn.us/mnarch/map.html.
[81] See, for example, the discussion of stray voltage and induced voltage in the draft environmental impact statement for the Brookings County to Hampton 345 kV transmission line project, Section 6.2; http://energyfacilities.puc.state.mn.us/resource.html?Id=25589.

fences) that parallel transmission lines. Induced voltage flows through the metal objects. As discussed in Section 6.6, for purposes of this discussion transmission lines are electrical lines with voltages of 100 kV or greater. Distribution lines, or in this case collector lines, are electrical lines with voltages less than 100 kV.

Bitter Root Wind Farm Project

Livestock in the area of the Bitter Root Wind Farm project would be exposed to noise and shadow flicker created by wind turbines. Exposure would depend on animal husbandry practices (e.g., grazing, housing) and on the distance between livestock and the turbines. Health impacts from turbine noise and shadow flicker are uncertain. Information about impacts to livestock is anecdotal and indicates that livestock are not impacted by turbine operations. Grazing animals appear to graze near, under, and up to turbine towers (Figure 7). Studies designed to assess turbine impacts on avian wildlife have found that wildlife use areas near wind turbines (e.g., nesting, feeding), but avoid the area surrounding turbine towers.[82] It's unclear whether these species are avoiding stress due to noise or flicker, or if they are avoiding potential impact with turbine blades. Studies designed to assess direct turbine impacts to non-avian wildlife (e.g., mice, squirrels, deer) are scarce, presumably because impacts to these species are anticipated to be minimal.

The Bitter Root Wind Farm project does not include distribution lines to residences or transmission lines. The collection lines for the project do not connect to residences and operate at a distribution-level voltage (34.5 kV). No health impacts to livestock from stray or induced voltage are anticipated.

Generic 138 MW LWECS

A generic 138 MW LWECS located elsewhere in Minnesota would have livestock impacts similar to the Bitter Root Wind Farm project.

53 MW Biomass Plant

A 53 MW biomass plant would have livestock impacts less than those of the Bitter Root Wind Farm project. Biomass plant operations would create noise and lighting that could impact livestock health. Additionally, the plant could have an associated transmission line that produced stray or induced voltage. However, the plant could be sited away from livestock operations to minimize health impacts. In this sense, the biomass plant represents a concentrated impact that can be moved away from livestock. Wind turbines represent a diffuse impact that exists within landscapes utilized by livestock.

[82] Site Permit Application, Section 8.17. For example, studies of grassland nesting passerines (songbirds) show that use of grasslands areas was reduced within 50 meters (164 ft.) of turbines, but that areas further away did not have reduced use.

6.14 Natural Environment – Flora and Fauna

Large electric generation facilities have the potential to impact wildlife, directly and through impacts on habitat. This section discusses potential wildlife impacts from the operation of a generation facility in the project area.

The Bitter Root Wind Farm project area consists primarily of croplands (44%) and grasslands (36%).[83] Scattered patches of wetlands, prairies, forest, and shrublands comprise the remaining wildlife habitat. The project area includes wildlife management areas (WMAs), waterfowl production areas, (WPAs) and a national wildlife refuge (Figure 8). The area also includes regions of high and outstanding biological diversity as identified by the Minnesota County Biological Survey (MCBS) (Figure 9). Additionally, MCBS has identified a large area of prairies and interconnecting grasslands, the Yellow Medicine Coteau Macrosite, in the northern portion of the project area.[84]

A number of animal species are adapted to the habitat of the project area – a mixed agricultural landscape with interspersed uncultivated patches. In such areas, crops provide seasonal cover and food, while uncultivated areas provide long-term cover, food, and water. A variety of mammals are typical in this landscape including mice, squirrel, rabbits, deer, fox, and skunk.[85] Reptiles and amphibians in this landscape are associated with wetlands, waterways, and forested areas. Typical reptiles and amphibians include snakes, turtles, and frogs. Birds and bats are found in this landscape, including grassland birds, migratory birds, raptors, and waterfowl.[86] Several rare and sensitive bird species utilize the habitat of the project area, including upland sandpipers and loggerhead shrikes.[87]

Bitter Root Wind Farm Project

The Bitter Root Wind Farm project would negatively impact select wildlife in the project area. Impacts related to construction are likely minimal, but could be significant. The physical footprint of a wind turbine is relatively small. Direct land use for the project is anticipated to be approximately 120 acres (turbines, access roads, operation and maintenance building). This is less than 0.01% of the estimated project acreage (22,500 acres). If the land used for project construction is agricultural land, wildlife impacts would likely be minimal; such land is relatively poorer habitat for wildlife. However, if the land used for project construction is biologically significant habitat then impacts to wildlife could be significant – in the number of species impacted and their sensitivity.

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[83] Site Permit Application, Section 8.16.
[84] Minnesota Department of Natural Resources Letter to Office of Energy Security, December 1, 2009, https://www.edockets.state.mn.us/EFiling/edockets/searchDocuments.do?method=showPoup&documentId={BA9405DD-CB43-45E3-BED1-A0E709A398ED}&documentTitle=200912-44871-01.
[85] Site Permit Application, Section 8.17.
[86] Id.
[87] Site Permit Application, Appendix F, Table 5; noting sensitive species in the project area. Eighteen sensitive species were documented in the project area during study in 2008. Sensitive species are state-listed species of special concern or species of greatest conservation need. See, Minnesota's Comprehensive Wildlife Conservation Strategy, www.dnr.state.mn.us/cwcs.

Impacts on ground species due to operation of the project would be minimal. However there would be negative impacts to avian species, i.e., birds and bats. Birds can collide with spinning turbine blades. Bats can avoid turbines blades, but appear to suffer injury to their respiratory systems when they fly through low pressure wakes near turbine blades.[88]

Birds

Studies have been conducted throughout the Midwest in an attempt to quantify bird and bat mortality due to wind turbines. A study of bird mortality rates at a wind farm in Iowa resulted in estimated mortality rates between 0.3 and 0.8 birds per turbine per year.[89] This estimate is similar to results from studies in other states where mortality rates ranged between < 1 to 2.83 birds per turbine per year.[90] Studies conducted in the Buffalo Ridge region of southwestern Minnesota resulted in estimated bird mortality rates between 1.0 and 4.5 birds per turbine per year.[91] Nocturnal migrants suffered relatively more mortalities; local grassland species suffered relatively less. The studies noted that birds tend to avoid turbine towers, but utilized the surrounding habitat.

A study of wildlife in the Bitter Root Wind Project area was conducted in 2008.[92] Avian use is greatest in the northern third of the project area, roughly corresponding with the area's grassland and MCBS wildlife habitat.[93] Highest overall use of the project area is in the spring, driven by waterfowl migration. Passerines, an order of perching birds often referred to as songbirds, are the most abundant bird type in the summer and fall.[94] The study projects that impacts to raptors and waterfowl due to turbine operations will be minimal – raptors because raptor use of the area is relatively low; waterfowl because they appear less vulnerable to turbine collisions.[95] Impacts to passerines would be relatively higher – passerines are prevalent in the area and, in general, make up more than 80% of bird fatalities at wind farms.[96] Passerine mortalities will likely be greater than 4.5 birds per turbine per year.[97] Avoiding regions of the project area with passerine habitat could reduce these impacts.

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[88] Extreme Pressure Changes near Blades Injures Bat Lungs, http://www.ucalgary.ca/news/aug2008/batdeaths.
[89] Bird and Bat Behavior and Mortality at a Northern Iowa Windfarm, Jain, 2005 http://www.batsandwind.org/pdf/Jain_2005.pdf.
[90] Id.
[91] Avian Monitoring Studies at the Buffalo Ridge, Minnesota Wind Resource Area: Results of a 4-Year Study, http://energyfacilities.puc.state.mn.us/documents/AvianMonitoringBuffaloRidge.pdf [hereafter Buffalo Ridge Studies].
[92] Wildlife Studies for the Bitter Root Wind Resource Area, Yellow Medicine and Lincoln Counties, Minnesota, April 2009; Site Permit Application, Appendix F [hereafter Bitter Root Wildlife Study].
[93] Bitter Root Wildlife Study, Executive Summary. For all bird species combined, the highest use occurred at survey points #2 and #3. Waterfowl use was greatest at point #2; passerine use was greatest at point #3. Survey points #2 and #3 are in the northern third of the project area, see Figure 1.
[94] Id.
[95] Id., p.12-15.
[96] Id, p. 14
[97] The high end of the range from the Buffalo Ridge Studies is 4.5 birds/turbines/year. The Bitter Root Wind Farm project area is on the north end of the Buffalo Ridge and contains, in parts, excellent passerine habitat. The Bitter Root Wildlife Study confirms strong passerine use of the project area. Thus, mortalities will likely be equal to or greater than the high end of the Buffalo Ridge Studies.

In sum, studies of bird mortalities near wind farms indicate that mortalities will occur and that they will vary with bird type (e.g., raptor, passerine) and bird use (habitat). Whether the number of mortalities is significant from a population standpoint is uncertain.

Bats

Bats typically utilize forests, riparian corridors, and wetlands as feeding habitat due to higher nocturnal insect densities in these areas. The Iowa wind farm study estimated bat mortality rates between 6 and 9 bats per turbine per year.[98] A Buffalo Ridge study estimated bat mortality rates at 2.2 bats per turbine per year.[99]

Bat activity within the Bitter Root Wind Farm project area is relatively high.[100] Activity is greatest in late July through mid-August. Based on this activity, bat mortality rates are estimated to be between 10 and 38 bats per turbine per year.[101] Whether this number of mortalities is significant from a population standpoint is uncertain.

Mitigation

Impacts to ground animals are expected to be minimal and mitigation is not required. Impacts to birds and bats could be mitigated by siting. Siting away from bird habitat (grasslands, riparian areas) and bat feeding areas (forest, riparian areas) would reduce bird and bat mortalities. Birds and bats fly relatively less in windy conditions. Wind turbines operate in windy conditions and require a minimum wind speed ("cut-in" speed, Table 1). Thus, impacts to birds and bats could be mitigated by employing turbines with a relatively higher cut-in speed or by using SCADA system controls to implement a higher cut-in speed.[102]

Generic 138 MW LWECS

A generic 138 MW LWECS located elsewhere in Minnesota would have wildlife impacts similar to and possibly less than the Bitter Root Wind Farm project. Information about local bird and bat populations within Minnesota is incomplete. The Bitter Root Wind Farm project area has good habitat for birds, with superior habitat for passerines that utilize grasslands. The project area has relatively high bat activity. Thus, bird and bat mortalities for a wind farm sited elsewhere in Minnesota would likely be less than that for the Bitter Root Wind Farm project.

53 MW Biomass Plant

A 53 MW biomass plant would have wildlife impacts similar to the Bitter Root Wind Farm project, excepting impacts to birds and bats. The plant would be constructed on an approximately 60 acre site. This acreage would be removed from use as wildlife habitat.

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[98] Bird and Bat Behavior and Mortality at a Northern Iowa Windfarm, Jain, 2005 http://www.batsandwind.org/pdf/Jain_2005.pdf.

[99] Bat Interactions with Wind Turbines at the Buffalo Ridge, Minnesota Wind Resource Area, November 2003, http://my.epri.com/portal/server.pt?space=CommunityPage&cached=true&parentname=ObjMgr&parentid=2&control=SetCommunity&CommunityID=404&RaiseDocID=000000000001009178&RaiseDocType=Abstract_id.

[100] Bitter Root Wildlife Study, p 17. Bat activity within the project area averaged 38 bat passes/detector-night. This measurement is among the highest recorded nationally, see Table 11.

[101] Id.

[102] Effectiveness of Changing Wind Turbine Cut-In Speeds to Reduce Bat Fatalities at Wind Facilities, April 2009, http://www.batsandwind.org/pdf/curtailment_2008_final_report.pdf.

However, the land used for the project would likely be agricultural land; such land is relatively poorer habitat for wildlife. Impacts from operation of the plant are anticipated to be minimal. Emissions from the plant (e.g., hazardous air pollutants) could, through impacts to the environment, impact wildlife. The extent of this impact is uncertain.

7.0 Feasibility and Availability of Alternatives

This section describes the feasibility and availability of alternatives to the Bitter Root Wind Farm project.

Bitter Root Wind Farm Project

The Bitter Root Wind Farm project is feasible and available.

Generic 138 MW LWECS

A generic 138 MW LWECS is feasible and likely available. Wind farms are in development across the state and Minnesota's wind resources are sufficient to facilitate a 138 MW project. Feasibility and availably are dependent on the ease of interconnection to the electrical transmission grid. In some parts of the state, the transmission grid is very near capacity and the connection of additional generating capacity is not easily achieved.

53 MW Biomass Plant

A 53 MW biomass plant is feasible and likely available. There is not currently a biomass plant of this size in Minnesota.[103] Thus, there may be equipment, financing, logistical, or other impediments that limit the ready availability of a 53 MW plant.

No Build Alternative

The no build alternative is feasible and available, but would not further Minnesota's renewable energy objectives.

[103] The Fibrominn plant has an output of 55 MW, but uses turkey litter as fuel source, http://www.fibrowattusa.com/projects/fibrominn/

8.0 Required Permits

The Bitter Root Wind Farm project will require permits and approvals from entities other than the Minnesota Public Utilities Commission. Federal, state, and local permits or approvals that have been identified for construction and operation of the project are listed in Table 5.

Table 5. Permits and Approvals[104]

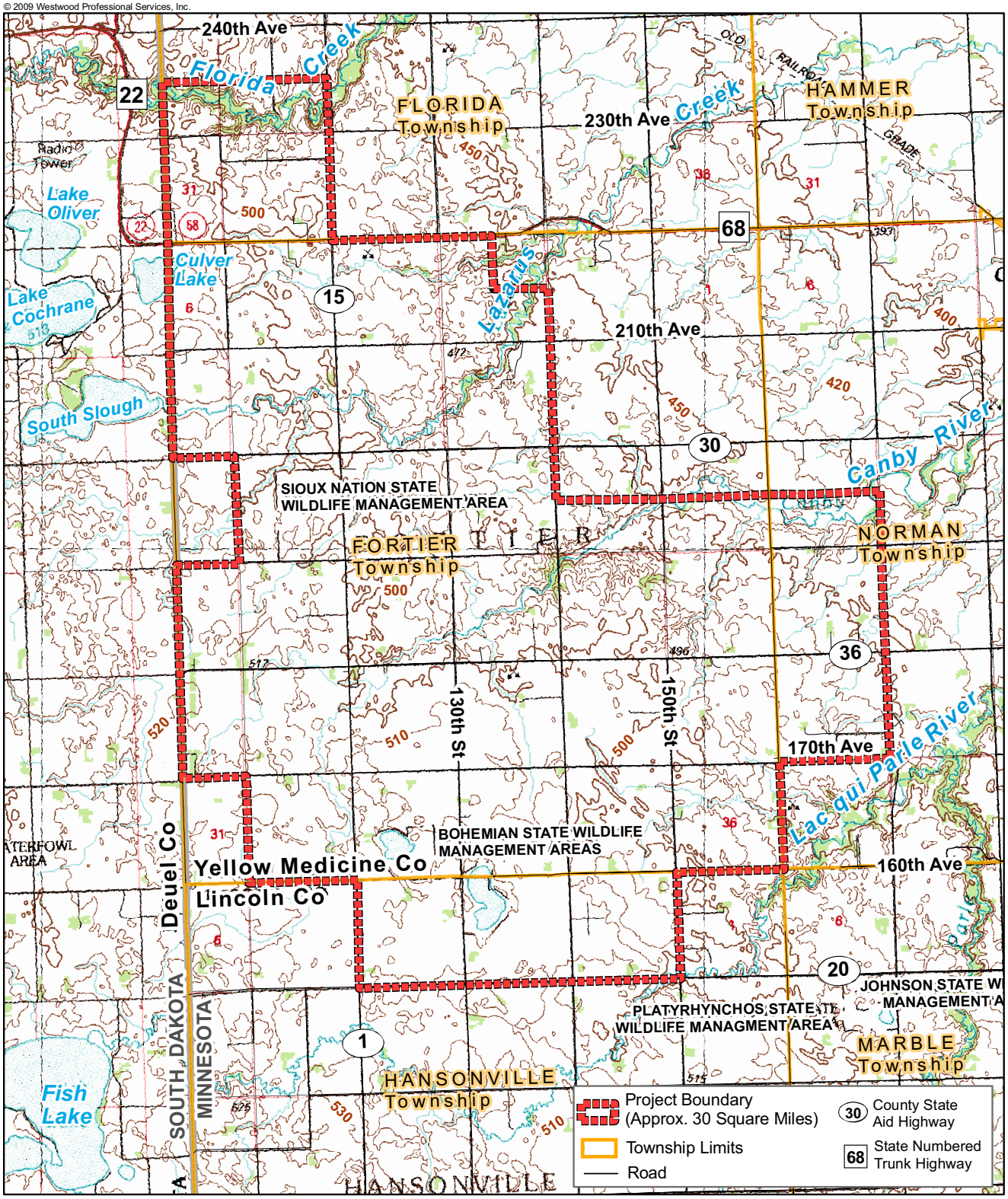
Agency	Type of Approval
Federal	
Federal Aviation Administration	Notice of Proposed Construction or Alteration; Determination of No Hazard
U.S. Army Corps of Engineers	Wetland (Section 404) Permit
Natural Resources Conservation Service	Prime Farmland Permit
State of Minnesota	
Minnesota Public Utilities Commission	Certificate of Need; LWECS Site Permit
Minnesota State Historical Preservation Office	Cultural and Historic Resources Review
Minnesota Board of Water and Soil Resources	Wetland Conservation Act Approval
Minnesota Department of Natural Resources	Pubic Water Works Permit
	License to Cross Public Lands and Waters
	Water Appropriations Permit
Minnesota Pollution Control Agency	NDPES Stormwater Permit for Construction
	License for Small Quantity Generator of Hazardous Waste
	Aboveground Storage Tank (AST) Notification Form
	State Water Quality (Section 401) Certification

[104] Potentially required permits and approvals for the Bitter Root Wind Farm Project. Adapted from Site Permit Application, Section 15.0.

Agency	Type of Approval
Minnesota Department of Health	Water Well Permit; Well Construction Notification
	Plumbing Plan Review
Minnesota Department of Transportation	Utility Access Permit, Highway Access Permit
	Oversize and Overweight Permit
	Aviation Clearance; Tall Towers Permit
Local Permits	
Yellow Medicine County	Building Permits
	Conditional Use Permits (meteorological towers)
	Individual Septic Tank Systems Permit
	Driveway Permit; Utility Permit
	Overwidth/Overweight Permits; Moving Permit
Lincoln County	Building Permits
	Individual Septic Tank Systems Permit
	Driveway Permit; Utility Permit
	Overwidth/Overweight Permits
Yellow Medicine County Soil and Water Conservation District; Lincoln County Soil and Water Conservation District	Wetland Conservation Act Approval
Townships	Road Access Permits

Figures

Figure 1. Project Boundary Map



Data Source(s): USGS MnDNR DRG (100K Clear Lake Quad, date unknown); Minor Civil Divisions, Minnesota, 2003; Minnesota Road Basemap (2008); Minnesota Altas and Gazatter (2003); US Census Road lines (2007); ESRI Major Roads (2006).

Bitter Root Wind Project

Yellow Medicine and Lincoln counties, Minnesota

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Project Location Map

Exhibit 2

Map Document: (P:\20081107\gis\PUC\090922\20081107oc02A_Exhibit2.mxd)
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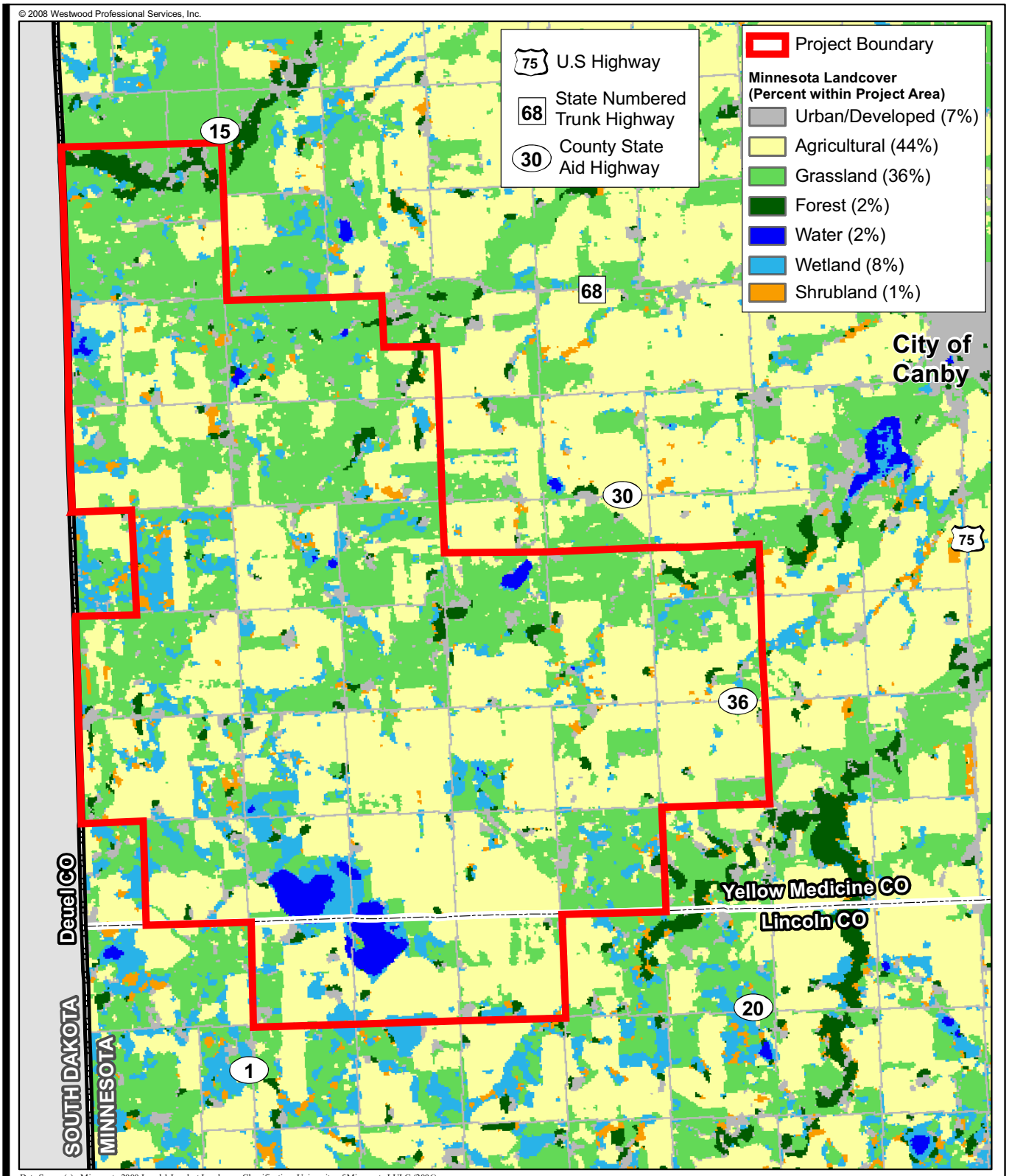
Figure 2. Land Cover Map



Data Source(s): Minnesota 2000 Level 1 Landsat Landcover Classification; University of Minnesota LULC (2006).

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Land Cover Map

Exhibit 10

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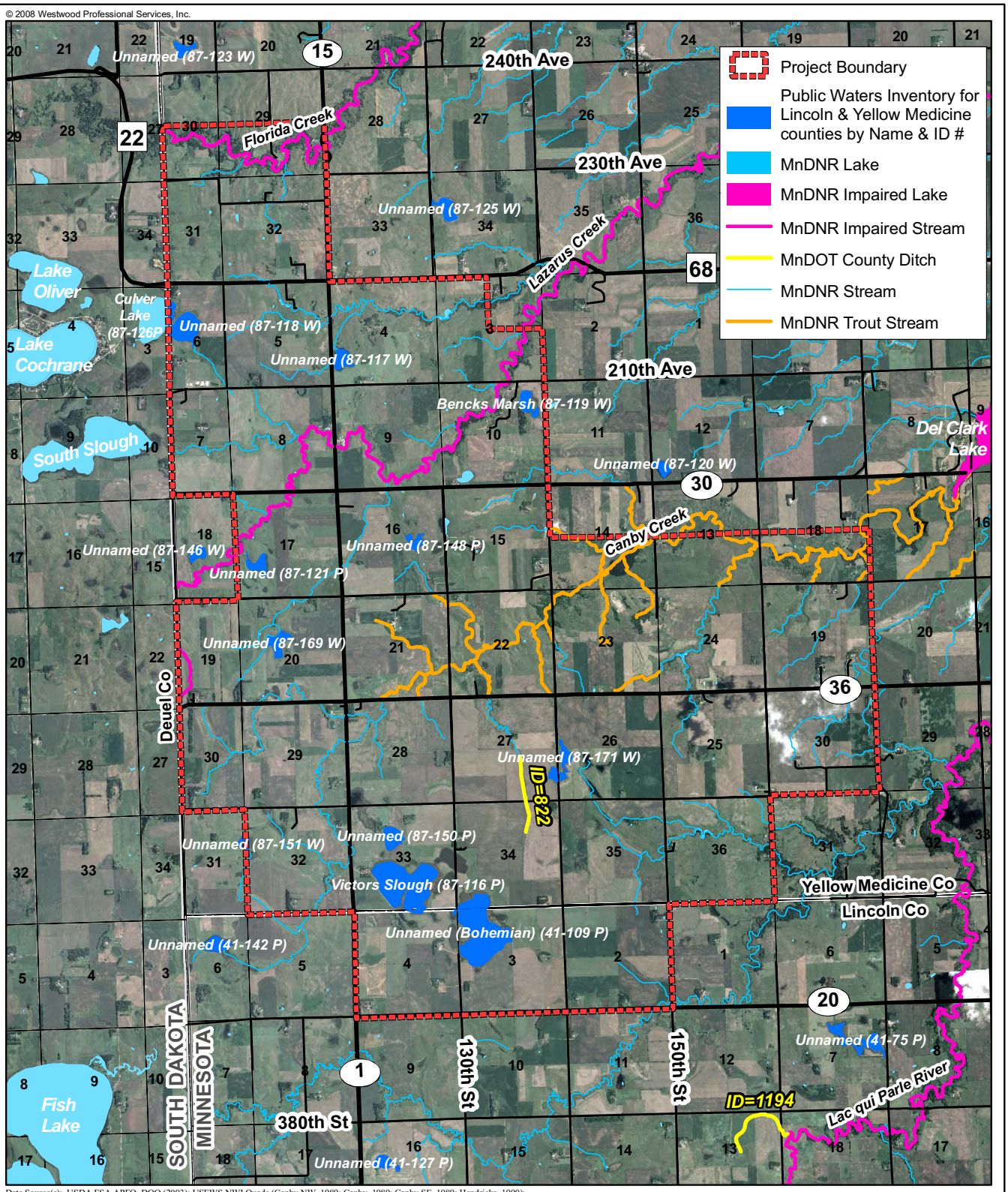
Figure 3. Surface Water Map



Data Source(s): USDA FSA APFO, DOQ (2003); USFWS NWI Quads (Canby NW, 1989; Canby, 1989; Canby SE, 1989; Hendricks, 1990); SD PLS (unknown date); MNDNR PLS (2004); ESRI Major Roads (2006); South Dakota DOT Roads (2008); MnDOT Basemap (2008); Minnesota Altas and Gazatteer (2003); DNR 24K Streams (2001); DNR 24K Lakes (1990); Minnesota Impaired Streams and Lakes (2006); Trout Lake Designations (2004); MnDNR Trout Streams (2002); MnDOT Basemap- Ditches (2003); Minnesota DNR-Division of Waters Public Waters Inventory (PWI) Basin Delineations (2003).

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Surface Water Map

Exhibit 14

Map Document: (P:\20081107\gis\PUC\20081107pw01A_Exhibit14.mxd)
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Figure 4. Preliminary Turbine Layout, 1.5 MW Turbines

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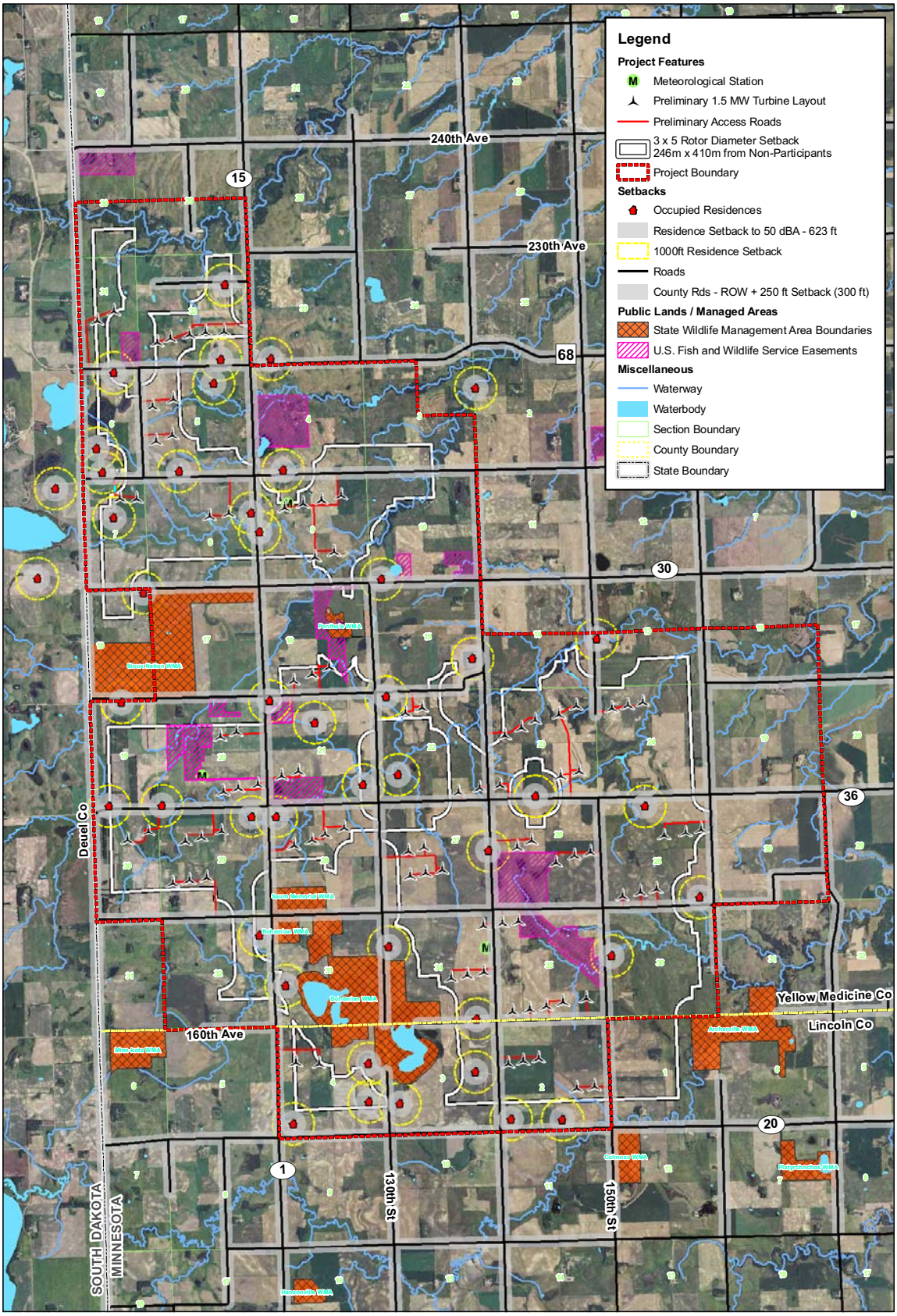

Data Source(s): USFWS (2009), USGS (2009), MNDNR (2007), ESRI (2006), MN LMIC (2010), Acciona (2010), Westwood (2010).

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Bitter Root Wind Project

Yellow Medicine and Lincoln Counties, MN

Public Lands and Constraint Map
with Preliminary 1.5 MW Turbine Layout

EXHIBIT 1

Figure 5. Preliminary Turbine Layout, 3.0 MW Turbines

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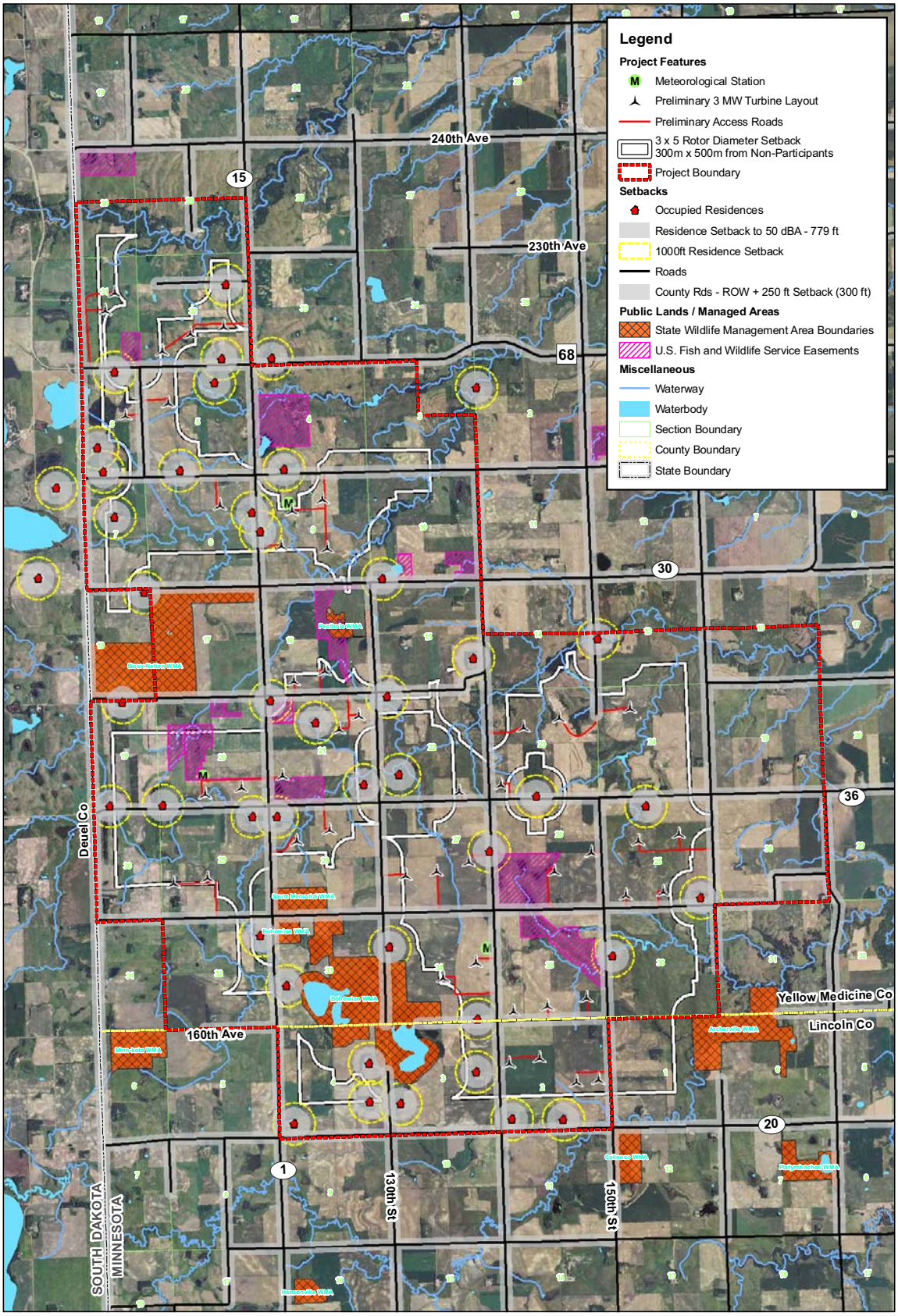

Data Source(s): USFWS (2009), USGS (2009), MNDNR (2007), ESRI (2006), MN LMIC (2010), Acciona (2010), Westwood (2010).

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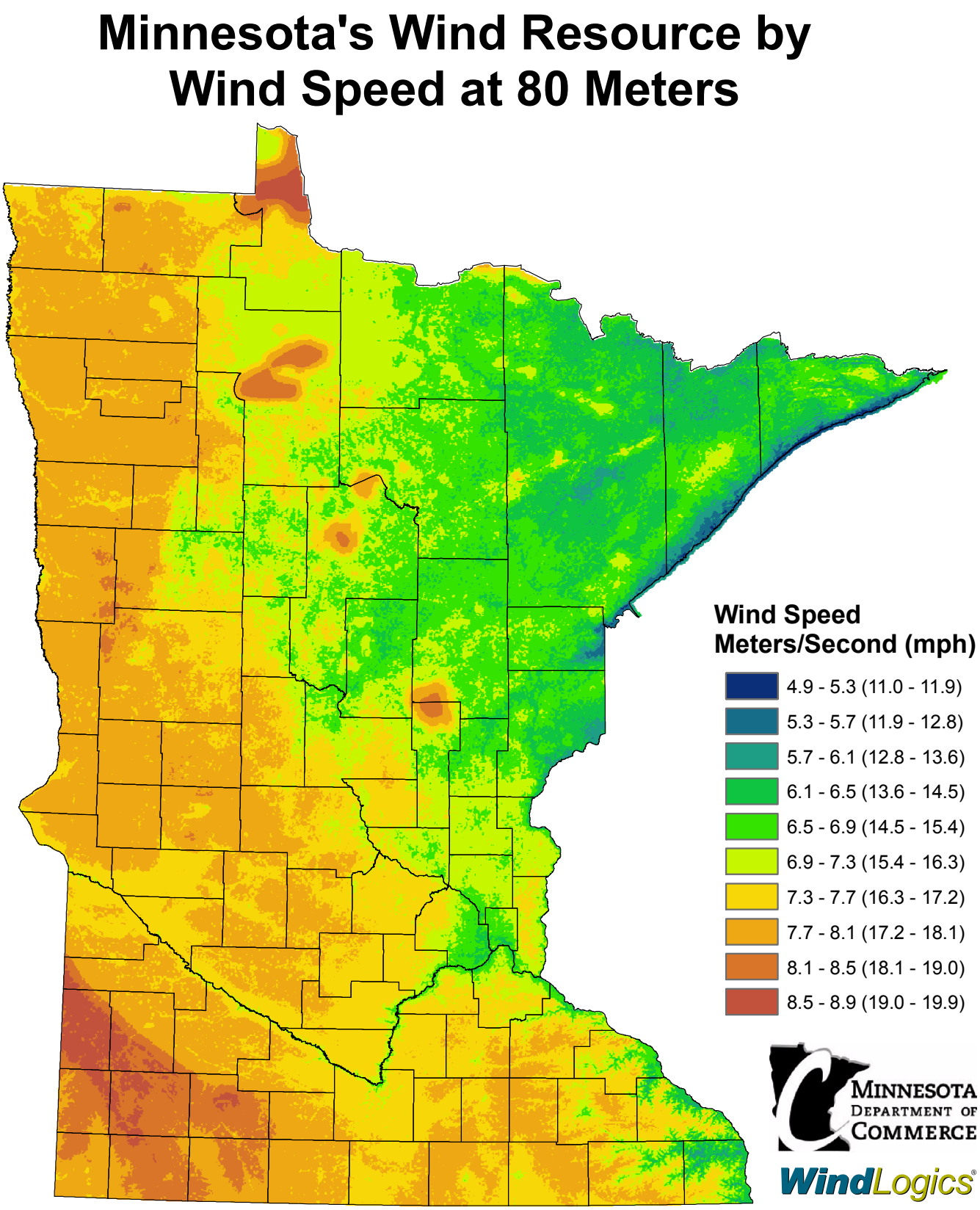
Bitter Root Wind Project

Yellow Medicine and Lincoln Counties, MN

Public Lands and Constraint Map
with Preliminary 3 MW Turbine Layout

EXHIBIT 2

Figure 6. Wind Resource Map



This map has been prepared under contract by WindLogics for the Department of Commerce using the best available weather data sources and the latest physics-based weather modeling technology and statistical techniques. The data that were used to develop the map have been statistically adjusted to accurately represent long-term (40 year) wind speeds over the state, thereby incorporating important decadal weather trends and cycles. Data has been averaged over a cell area 500 meters square, and within any one cell there could be features that increase or decrease the values shown on this map. This map shows the general variation of Minnesota's wind resource and should not be used to determine the performance of specific projects.

January 2006

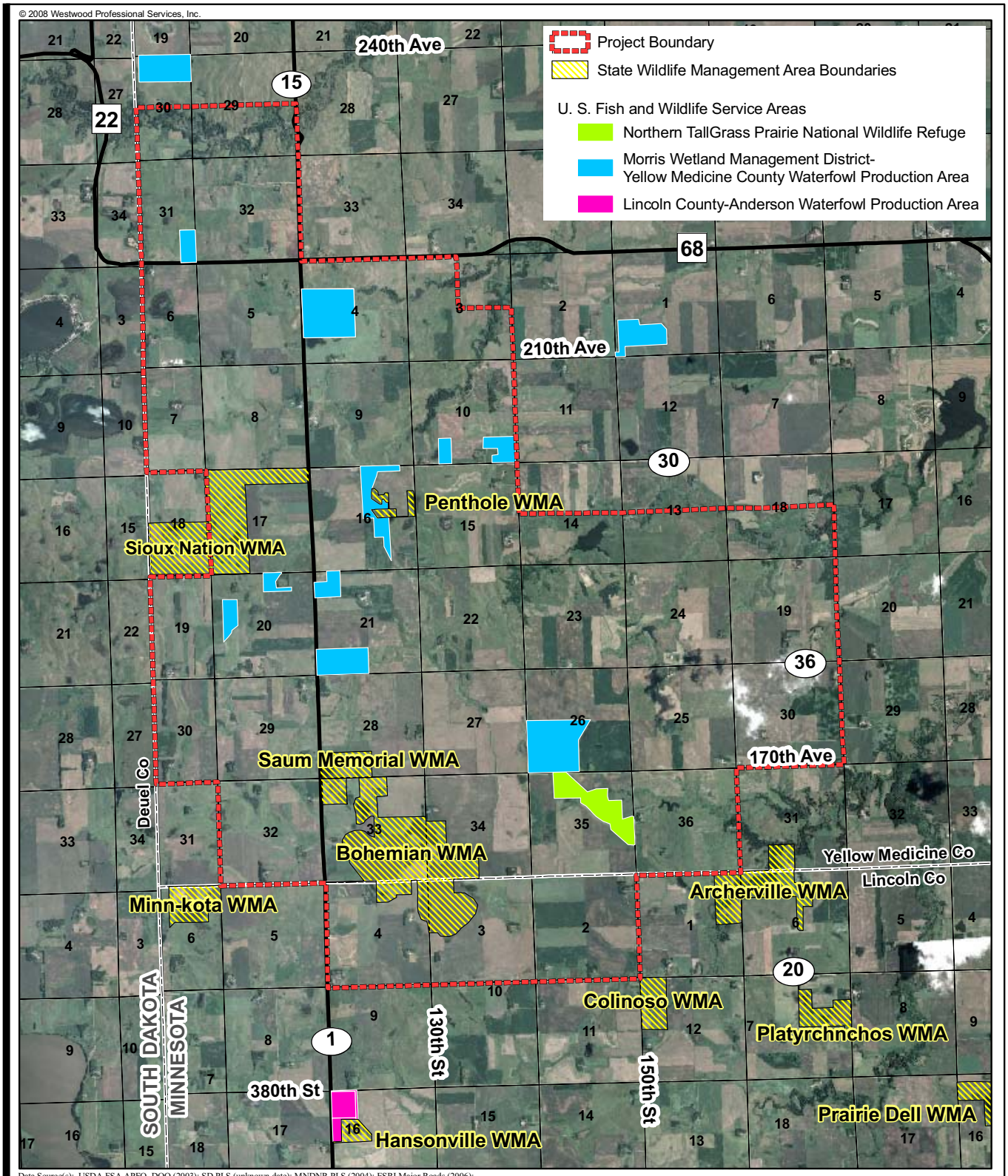
Figure 7. Photographs of Livestock near Wind Turbines

www.waubrawindfarm.com.au/faqs/WaubraFAQs.htm

www.answers.com/topic/wind-farm

www.mywindpowersystem.com/

Figure 8. Wildlife Areas Map



Data Source(s): USDA FSA APFO, DOQ (2003); SD PLS (unknown date); MNDNR PLS (2004); ESRI Major Roads (2006); South Dakota DOT Roads (2008); MnDOT Basemap (2008); Minnesota Altas and Gazatteer (2003). Global Winds "FWSinterest" shapefile received from Wayne Hederson at the Morris Wetland Management District/USFWS (April 10, 2008); MnDNR-GAP Stewardship 2008 - Federal Lands (2008); MnDNR-Wetland Management Areas (2006).

Bitter Root Wind Project

Yellow Medicine and Lincoln counties, Minnesota

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Westwood

N

0 1.25 Miles

Recreation, Wildlife and USFWS Areas Map

(No recreation areas, county or state parks are located within Project Area)

Exhibit 8

Map Document: (P:\20081107\gis\PUC\090604\20081107land01A_NewEx8.mxd)
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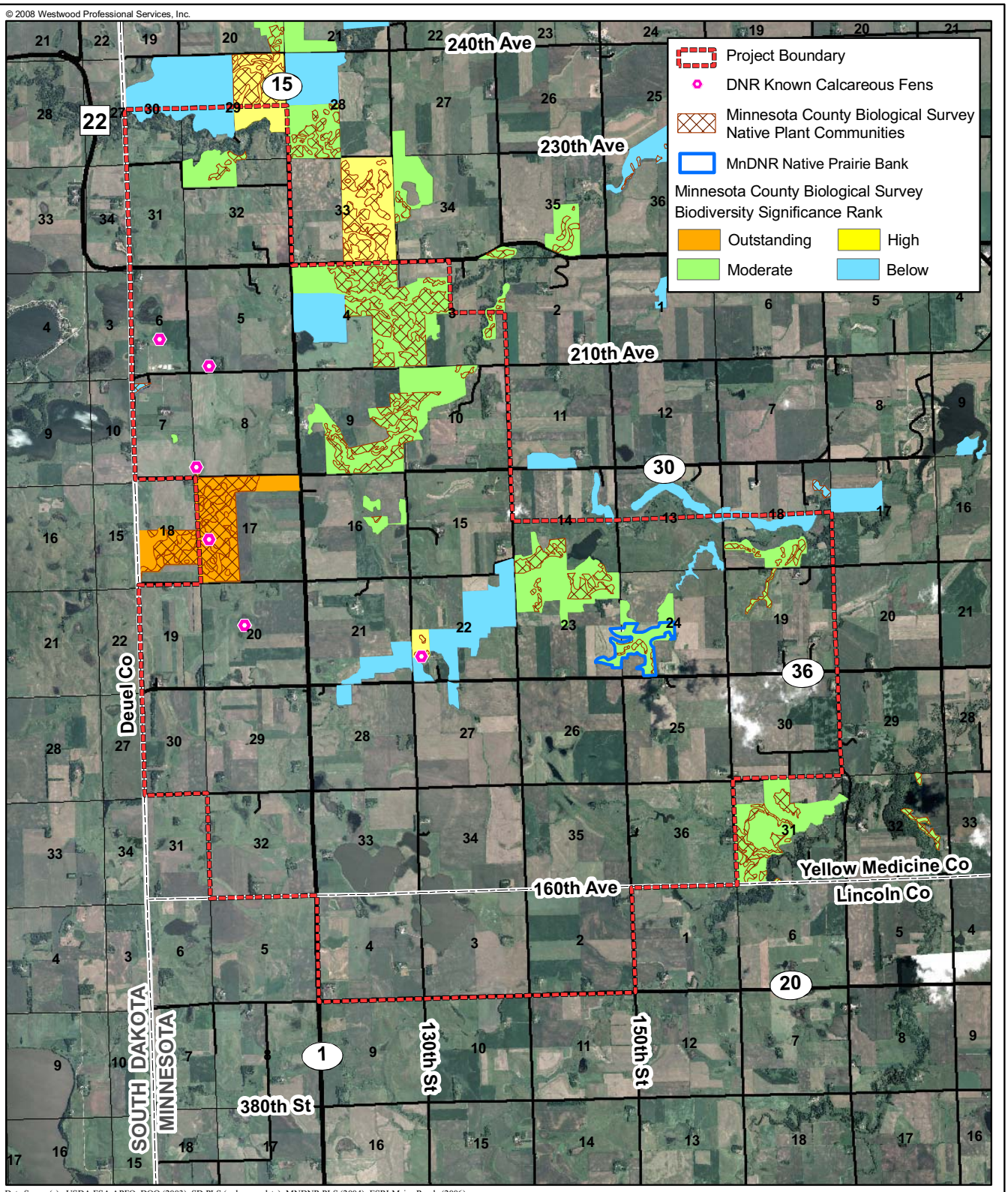
Figure 9. Minnesota County Biological Survey Map



Data Source(s): USDA FSA APFO, DOQ (2003); SD PLS (unknown date); MNDNR PLS (2004); ESRI Major Roads (2006); South Dakota DOT Roads (2008); MnDOT Basemap (2008); Minnesota Altas and Gazatteer (2003). Minnesota DNR-Calcareous Fens (2008); MCBS Native Plant Communities (2007); MCBS Sites of Biodiversity Significance (2006); MnDNR Native Prairie Bank (2008).

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0 Miles 1.25

Rare Natural Features Map

Exhibit 16

Map Document: (P:\20081107\gis\PUC\20081107rte01A_Exhibit16.mxd)
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Appendices

Appendix A

Environmental Report Scoping Decision

office of energy security

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In the Matter of the Application of Buffalo Ridge Power Partners, LLC for a Certificate of Need for the 138 Megawatt Bitter Root Wind Farm Project in Yellow Medicine and Lincoln Counties, Minnesota

ENVIRONMENTAL REPORT SCOPING DECISION
PUC Docket No. IP-6684/CN-08-785

The above matter has come before the Director of the Office of Energy Security (OES) for a decision on the content of the Environmental Report (ER) to be prepared in consideration of the Buffalo Ridge Power Partners, LLC, Application for a Certificate of Need for the proposed 138 Megawatt (MW) Bitter Root Wind Farm Project (Project) in Yellow Medicine and Lincoln counties.

A final decision on turbine selection and design has not be made, but the Project will consist of turbines with a rated output of 1.5 or 3.0 MW in such number and combination as to yield 138 MW. Facilities associated with the Project include gravel access roads, an electric collection system, an operation and maintenance building, one meteorological tower, and a project substation.

The Project is located southwest of the city of Canby, Minnesota, within a project area of approximately 22,500 acres in Fortier and Florida townships of Yellow Medicine County and Hansonville Township in Lincoln County. Electricity from the Project would be transmitted to the project substation via 34.5 kilovolt electric lines. The Project would connect to the electric grid along Otter Tail Power Company's 115 kV Toronto-Canby transmission line at the new Project substation.

The project requires a certificate of need (CON) and a site permit for the wind farm from the Minnesota Public Utilities Commission (Commission). The CON (CN-08-785) and site permit (WS-08-1448) are being considered by the Commission in separate dockets.

On April 27th, 2009, Buffalo Ridge Power Partners, LLC, filed a certificate of need application with the Commission for the Bitter Root Wind Farm Project. On July 17, 2009, the Commission issued an order accepting the application as complete and authorizing an informal review process. The proposed project is a large energy facility (Minn. Stat. § 216B.2421). As such, it requires the Minnesota Department of Commerce to prepare an environmental report for the project (Minn. Rules 7849.1200).

A public meeting was held on November 3, 2009, in Canby, Minnesota, to receive comments on the scope of the environmental report. Approximately 40 persons attended the meeting.

A public comment period followed the meeting; the comment period closed on November 24, 2009. Two written comments were received during the comment period. Concerns raised at the public meeting and in written comments included potential impacts to real estate values, noise,

aesthetics, livestock, wildlife, native vegetation, burial grounds, historical artifacts, topography, and the ability for landowners within the Project Area to participate in other wind projects. A number of comments concerned the terms of the wind easements and leases between landowners and the Applicant.

The proposed project is intended to produce renewable energy in furtherance of Minnesota's renewable energy objectives. Accordingly, alternatives examined in the ER will be limited to "eligible energy technologies" that support these objectives (Minn. Stat. § 216B.1691). These alternatives include: (1) a generic 138 MW wind generation project sited elsewhere in Minnesota, (2) a 53 MW biomass plant, and (3) a "no-build" option. An ER provides a high level environmental analysis of the proposed Project and system alternatives, and reviews environmental impacts associated with named and alternative projects. It is only one part of a larger Office of Energy Security investigation of the Certificate of Need Application. The OES in its overall review will address in detail all the issues and alternatives required by rule.

The ER will address the comments received which include impacts of Large Wind Energy Conversion Systems on real estate values, noise, aesthetics, livestock, native vegetation, Historical and archaeological resources (including burial grounds and historical artifacts), historical artifacts, and the natural environment (including topography, flora, and fauna).

Having reviewed the matter, consulted with the OES Energy Facility Permitting staff, and in accordance with Minnesota Rules 7849.1400 and 7849.1500, I hereby make the following scoping decision:

MATTERS TO BE ADDRESSED

1.0 Bitter Root Wind Farm Project Description [Minn. Rule 7849.1500, subp. 1, A]

2.0 Alternatives to be Evaluated [Minn. Rule 7849.1500, subp. 1, B]

2.1 No-build Alternative
2.2 A Generic 138 MW Wind Project
2.3 A 53 MW Biomass Plant

3.0 Human and Environmental Impacts [Minn. Rule 7849.1500, subp. 1, C, D]

3.1 Emissions [Minn. Rule 7849.1500, subp. 2, A]
- No-build alternative
- 138 MW wind project
- 53 MW biomass plant
- Bitter Root Wind Farm Project

3.2 Hazardous air pollutants and VOCs [Minn. Rule 7849.1500, subp. 2, B]
- No-build alternative
- 138 MW wind project
- 53 MW biomass plant

- Bitter Root Wind Farm Project

3.3 Aesthetic Impact and visibility impairment [Minn. Rule 7849.1500, subp. 2, C]
- No-build alternative
- 138 MW wind project
- 53 MW biomass plant
- Bitter Root Wind Farm Project

3.4 Ozone formation [Minn. Rule 7849.1500, subp. 2, D]
- No-build alternative
- 138 MW wind project
- 53 MW biomass plant
- Bitter Root Wind Farm Project

3.5 Fuel availability and delivery [Minn. Rule 7849.1500, subp. 2, E]
- No-build alternative
- 138 MW wind project
- 53 MW biomass plant
- Bitter Root Wind Farm Project

3.6 Associated transmission facilities [Minn. Rule 7849.1500, subp. 2, F]
- No-build alternative
- 138 MW wind project
- 53 MW biomass plant
- Bitter Root Wind Farm Project m

3.7 Water appropriations [Minn. Rule 7849.1500, subp. 2, G]
- No-build alternative
- 138 MW wind project
- 53 MW biomass plant
- Bitter Root Wind Farm Project

3.8 Wastewater [Minn. Rule 7849.7060, subp. 2, H]
- No-build alternative
- 138 MW wind project
- 53 MW biomass plant
- Bitter Root Wind Farm Project

3.9 Solid and hazardous wastes [Minn. Rule 7849.1500, subp. 2, I]
- No-build alternative
- 138 MW wind project
- 53 MW biomass plant

- Bitter Root Wind Farm Project

3.10 Noise [Minn. Rule 7849.1500, subp. 2, J]
- No-build alternative
- 138 MW wind project
- 53 MW biomass plant
- Bitter Root Wind Farm Project

3.11 Real Estate Values
- No-build alternative
- 138 MW wind project
- 53 MW biomass plant
- Bitter Root Wind Farm Project

3.12 Historic and Archaeological resources
- No-build alternative
- 138 MW wind project
- 53 MW biomass plant
- Bitter Root Wind Farm Project

3.13 Livestock
- No-build alternative
- 138 MW wind project
- 53 MW biomass plant
- Bitter Root Wind Farm Project

3.14 Natural Environment (topography, flora, and fauna)
- No-build alternative
- 138 MW wind project
- 53 MW biomass plant
- Bitter Root Wind Farm Project

4.0 Mitigation measures [Minn. Rule 7849.1500, subp. 1, E]

4.1 No-build alternative
4.2 138 MW wind project
4.3 53 MW biomass plant
4.4 Bitter Root Wind Farm Project

5.0 Feasibility and availability of alternatives [Minn. Rule 7849.1500, subp. 1, F]

5.1 No-build alternative
5.2 138 MW wind project
5.3 53 MW biomass plant
5.4 Bitter Root Wind Farm Project

6.0 Required permits [Minn. Rule 7849.1500, subp. 1, G]

ISSUES OUTSIDE OF THE ENVIRONMENTAL REPORT

The environmental report will not consider the following matters:

1. Impacts or mitigative measures associated with specific sites, including specific tower or road locations for the proposed project and alternatives.
2. The negotiation and content of easement agreements by which land owners are paid for property rights, including wind rights.
3. Any alternatives not specifically described in this scoping decision.

SCHEDULE

The environmental report will be completed in February, 2010. A public hearing will be held in the project area before an Administrative Law Judge after the environmental report has been issued and notice served.

Signed this 18th day of December, 2009

STATE OF MINNESOTA
DEPARTMENT OF COMMERCE
OFFICE OF ENERGY SECURITY

William Glahn, Director