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May 29, 2007

VIA E-FILING
Dr. Burl W. Haar
Executive Secretary
Minnesota Public Utilities Commission
121 7th Place East, Suite 350
St. Paul, MN 55101

Re: In the Matter of a Site Permit Application for a Large Wind Energy Conversion System for the Taconite Ridge I Wind Energy Center in St. Louis County
Docket No. E015/WS-07-676

Dear Dr. Haar:

Pursuant to Minn. Stat. § 216F.04 and Minn. Rules Chapter 4401, Minnesota Power hereby seeks from the Minnesota Public Utilities Commission ("Commission") a Site Permit authorizing Minnesota Power to construct the Taconite Ridge I Wind Energy Center ("Taconite Ridge I") in St. Louis County. Taconite Ridge I will be a 25 MW wind energy facility and therefore meets the definition of a Large Wind Energy Conversion System under Minn. Stat. § 216F.01, subd. 2 and Minn. Rules 4401.0200, subp. 9 and requires a Site Permit. As more fully described in the attached application, Taconite Ridge I will be constructed and owned by Minnesota Power.

The enclosed Site Permit Application that is being e-Filed and hand delivered, was prepared by Tetra Tech EC, Inc. – Minnesota Power's environmental consultant on this project. The signature of their authorized representative as preparer of the document is included below.

Note that a down-payment in the amount of $7,500.00 on the expected total $15,000.00 permit application fee has been forwarded under separate cover to the Department of Commerce Energy Facility Permitting staff, at their request.

Please direct any questions you may have with respect to this filing to Blake Francis at Minnesota Power at (218-722-5642 x 3584) or me at the above listed number.

Yours truly,

David R. Moeller

Signature of Preparer of Permit Application:

Rebecca Longly
Senior Environmental Consultant
Tetra Tech EC, Inc.

DRM:sr
Enc.
cc: Ms. Sharon Ferguson – Minnesota Department of Commerce (, 4 paper and 1 electronic copies)
Mr. Curtis Nelson – OAG-RUD (2 paper copies)

STATE OF MINNESOTA	)	AFFIDAVIT OF SERVICE VIA
	) ss	E-FILING AND
COUNTY OF ST. LOUIS	)	FIRST CLASS MAIL

Susan Romans, of the City of Duluth, County of St. Louis, State of Minnesota, says that on the 29th day of May, 2007, she e-filed Minnesota Power's Site Permit Application for a Large Wind Energy Conversion System for the Taconite Ride I Wind Energy Center in St. Louis County on Burl Haar and Sharon Ferguson and caused to be served paper copies of the same on Burl Haar and Sharon Ferguson via hand delivery on May 30, 2007.

Susan Romans

Subscribed and sworn to before
me this 29th day of May, 2007.

Kristie J. Lindstrom
Notary Public

KRISTIE J. LINDSTROM
NOTARY PUBLIC - MINNESOTA
My Commission Expires Jan. 31, 2010

Taconite Ridge I Wind Energy Center
Site Permit Application
Docket Number E-015/WS-07-676

May 2007

Site Permit Application for a Large Wind Energy Conversion System

Taconite Ridge I Wind Energy Center
St. Louis County, Minnesota

Minnesota Power

Docket Number E-015/WS-07-676

May 2007

Minnesota Power
30 West Superior Street
Duluth, Minnesota 55802

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1.0 PROJECT SUMMARY

1.1 Introduction

Minnesota Power (MP or Applicant) submits a Site Permit Application to construct a Large Wind Energy Conversion System (LWECS), the Taconite Ridge I Wind Energy Center (Project) as defined in the Wind Siting Act, Minn. Stat. § 216F.02, subd. 2. The 25-megawatt (MW) Project is proposed to be located in central St. Louis County on property owned by United States Steel Corporation (US Steel) at its Minntac Mine in Mountain Iron. This Project will be the first commercial wind energy facility in northeastern Minnesota.

The entire output of ten 2.5 MW turbines built by Clipper Windpower, Inc., a wholly owned subsidiary of Clipper Windpower PLC, will be used by MP to serve its customer energy needs. Existing infrastructure will allow MP to move the energy throughout its system without the need to build additional transmission lines.

1.2 Project Site

The Project Site (see Map 1) represents the leased property where the wind energy facility will be constructed. The Project Site is located approximately 58 miles northwest of Lake Superior and near the City of Mountain Iron. The Project is located on a ridge known as the Laurentian Divide within the Mesabi Iron Range which is a vast deposit of iron ore and other minerals. US Steel owns and operates the Minntac Mine, which includes the Project Site. The Minntac Mine is the largest taconite pellet mine in the United States. The Superior National Forest is located directly north of the Project Site and consists of vegetated areas of predominately native forest communities.

The Project Site is located in portions of Sections 23 through 27 in the unorganized portion of Township 59 North and Range 18 West in St. Louis County.

The Project Site is roughly 475 acres in an irregular shaped parcel of land that is bounded by undeveloped land owned by US Steel to the north and east, the Minntac Mine active operations to the northwest and south. The center of the Project Site is made up of an east to west ridge with elevations ranging 1,600 to 1,850 feet above mean sea level. Most of the Project Site is undeveloped deciduous forest with some cleared areas. There is a 22 kilovolt (kV) electrical distribution line that traverses from north to south through the western section of the Project Site. Just south of the Project Site, MP owns two 115 kV transmission lines which connect to its Minntac Substation just southwest of the Project Site. The project's preliminary layout is shown in Map 2.

1.3 Site Control

MP has a long term lease with US Steel, owner of the property. The long-term lease covers wind rights and wind turbine locations, access roads, underground or overhead collector lines, an operation and maintenance building, and a laydown area. The lease term supports the expected 35-year life of the project.

1.4 Wind Resource

MP contracted with FPL Energy for consulting services during June/July 2006 that included installing two temporary meteorological towers on leased areas; one of which is on the Project Site. Since mid-July site specific wind data has been collected from these towers. The Applicant hired WindLogics, Inc. starting in

the fall of 2005 to model four virtual meteorological towers within the greater Mountain Iron area .The objective of this study was to provide an analysis of the overall wind regime, including a long-term estimation of the wind resource and initial turbine layout. MP provided Clipper Windpower with Project Site information and wind data collected from mid-July 2006 through early May 2007. Clipper Windpower, the turbine supplier, has contracted with Global Energy Concepts, a recognized wind resource and site assessment firm, to complete a site suitability analysis by mid-May 2007 (see Appendix B.2). Tetra Tech reviewed meteorological data from the Duluth International Airport for the period of record from 1930 to 1996. The data indicated that the site represents favorable wind conditions for a LWECS. The average wind speed ranges from 16.8 to 17.4 mile per hour (7.52 to 7.84 meters per second) at a height of 262 feet (80 meters). Tetra Tech reviewed meteorological data and found that the prevailing wind direction is northwest to north northwest, with significant winds also coming from the south.

1.5 Projected Output

The Project will have a nameplate capacity of 25 MW. Assuming a net capacity factor of approximately 34 to 36 percent Projected annual output will be approximately 74,000 to 78,000 megawatt hours.

1.6 Siting Plan

The turbines will be sited on the top of the ridge to take advantage of prevailing strong north and south winds. MP will prepare the final layout to optimize wind resources and maximize areas on top of the ridge. The layout will also minimize impacts on potentially sensitive natural and cultural resources as described in Section 5.0 of the Site Permit Application.

MP will use the 2.5 MW Liberty wind turbines manufactured by Clipper. The Clipper turbine has a rotor diameter (RD) of 305 to 315 feet.

Previous LWECS Site Permit requirements identify minimum setbacks from residences of 500 feet and from public or developed roads of 250 feet. As Table 1-1 demonstrates, the turbines will have suitable setbacks from off-leased property. Additionally, in order to minimize turbine wake and to maximize wind resources, the Department of Commerce recommends siting turbines no closer than approximately 3 rotor diameters (RD). The turbines are located no closer than approximately 3 RD.

Table 1–1 Turbine Spacing Distances

Turbine Description	East-West Spacing	Perimeter Setback*
Clipper 2.5 MW C-96, C-93 turbines	An average of 950 feet - more than 3 RD (between turbines)	Range of 1 to 3 RD

* Existence of developed mining facitilities to the west and south of the Project Site along with a generally steep drop in elevation in those directions and to the north and east, preclude the need to maintain generally recommended setbacks to accommodate any future adjacent wind energy facilities.

1.7 Interconnection and Transmission

The applicant will interconnect into the existing Minntac 115/230 kV Substation at the Minntac Mine. A 34.5 kV generator outlet line will be constructed from the Taconite Ridge I Wind Energy Center to the Minntac 115/230 kV Substation. It will be connected to the low side of a new step up transformer inside the substation footprint. Depending on final engineering design, the 34.5 kV collector system would be installed almost entirely underground to its interconnection to the Minntac Substation, or a relatively short length (not to exceed 1000 feet) would be constructed as an overhead line spanning the Minntac Mine

haul road located between the Project Site and the Substation. If an overhead line is necessary, it would accommodate vertical clearances for US Steel haul trucks, as well as meeting requirements of the National Electric Safety Code (NESC). The interconnection will step up from the 34.5 kV collector voltage to the 115 kV transmission voltage within the existing footprint of the 115/230 kV substation. The interconnection will be with the Midwest Independent Transmission System Operator (MISO) to connect the Project's 25 MW to the grid. Firm transmission service will be used to deliver the Taconite Ridge wind output to serve the MP load.

1.8 Environmental Analysis

The Project Site is located next to a large industrial mine site. Areas further to the north are sparsely populated. The Project Site is undeveloped upland deciduous forest. MP has two 115 kV transmission lines that border the southern boundary of the Project Site and connect to the existing 115/230 kV Minntac Substation located southwest of the Project Site. Therefore, siting the wind energy project adjacent to energy infrastructure and an industrial site is compatible with the surrounding land uses.

The impacts of the construction and operation of the proposed wind facility are described in detail in Section 5.0.

1.9 Permits and Licenses

Minnesota Power and MP's contractors will obtain all permits and approvals. Permits and approvals are identified in Section 13.

1.10 Construction

MP, the turbine supplier, and Balance of Plant (BOP) contractor with local contractors will perform or manage all development and installation activities.

MP will perform the following:

- Site resource analysis
- Siting and layout of wind project
- Environmental review
- Obtain permits, licenses and approvals for Project
- Design the grounding and electrical collector system
- Provide Construction & Project Management for the project

The turbine supplier will perform the following:

- Assemble and test turbine components
- Provide service personnel to work with BOP contractor and local contractors during tower erection, nacelle field erection, and start-up and commissioning of wind facility

The BOP consultant will perform the following:

- Civil engineering design for access roads, tower and turbine foundations, and O&M Service Building.

MP or its consultant will provide or direct to the following design:

- MP distribution engineers will design the grounding and electrical collector system design.

The BOP contractor and local contractors will perform the following:

- Erection and installation of the wind turbines
- Test the wind turbines
- Construct foundations, transformers, and access roads
- Rough grade laydown areas
- Construct the electrical feeder and collection system
- Construct the Operations & Maintenance (O&M) Building and laydown area
- Install the communication system, data software and hardware and telephone or fiber-optic cable

A Quality Assurance/Quality Control and site safety program will be implemented and construction techniques are discussed further in Section 6.0.

1.11 Operation and Maintenance

The Project is scheduled to be operational by mid-2008. Clipper will be responsible for Operation and Maintenance during the initial 2-year warranty period. MP will be responsible for the operation and maintenance of the wind facility for the remaining useful life of the Project, or a minimum of twenty years. MP will contract with an operations and maintenance subcontractor for the initial startup of the Project. MP may self-operate the wind facility after the initial warranty period on the turbines has expired.

1.12 Decommissioning

The lease agreement with the property owner states that MP will remove the turbines, transformers, and Operations and Maintenance Building following the end of the Project's useful life. With US Steel's consent, MP has an option to repower the energy facility. Foundations will be removed to a depth of 3.5 to 4 feet unless an agreement has been arranged with the property owner to leave in place.

Because the proposed project is an important part of MP's renewable energy portfolio, the applicant does not anticipate decommissioning of the site. The applicant believes that it is more likely that the existing infrastructure will be replaced by newer technology before the end of the existing equipment's productive lifetime of approximately 35 years.

However, should the site be decommissioned, the salvage value of the generation equipment and material value of the towers and cabling can be recycled which will offset much of the anticipated expense if decommissioning of the project ever becomes necessary. There is an active salvage market for recycled wind turbines and materials used in the construction of wind energy facilities (e.g. electric generators, copper wires and cables) so the project's physical assets, if decommissioning were to occur, it would be dispersed through normal market forces. The most conservative estimated total decommissioning expense would be no more than a total of $300,000 (in 2007 dollars, including allowance for salvage value) If full decommissioning were ever necessary it would include removal of the wind turbines and appurtenant facilities including the substation interconnection, access roads, underground cables and any overhead lines, towers, buildings, transformers, etc.

Unless otherwise agreed to by the landowner (US Steel) of the Project Site, the turbine foundations would be abandoned "in place" and covered by a minimum of 2 feet of common borrow fill along with 6 inches of top soil and seeded. The access roads would also be graded and shaped back to the surrounding terrain

and covered with 6 inches of topsoil and re-seeded to prevent erosion. The project site area will be allowed to revert back to its natural vegetative state (forested, or shrub condition).

Decommissioning costs will be updated approximately every 5 years using current market and cost information. Funds for decommissioning will be available in a manner that is consistent with other electric generating assessed owned and operated by Minnesota Power.

1.13 Project Ownership

MP will own the Taconite Ridge I Wind Energy Center, including all equipment up to the connection at the Minntac Substation, which is owned by MP. MP is exploring the feasibility of the Mountain Iron Economic Development Authority owning a minority share of the project thereby meeting the requirements of a Community-Based Energy Development (C-BED) project under the Minn. Stat. §216B.1612. There are several options under this arrangement that are being considered.

2.0 APPLICANT

The Applicant is Minnesota Power (MP). MP is an investor-owned public utility that provides electricity in a 26,000-square-mile service territory in northeastern Minnesota. MP supplies retail electric service to 141,000 retail customers, wholesale electric service to 16 municipalities, and some of the largest industrial customers in the United States, including US Steel. MP is a member of MISO.

2.1 Contact Information

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2.2 Other LWECS in Minnesota

Taconite Ridge I Wind Energy Center is MP's first LWECS located in Minnesota and the first commercial wind facility in northeastern Minnesota. MP will also be the purchaser of 30 MW of wind energy from the proposed Bear Creek Wind Partners, LLC wind facility in Todd and Otter Tail counties, a C-BED project.

2.3 Compliance with Wind Siting Act and Minnesota Rules 4401

This Site Permit Application provides information necessary to demonstrate compliance with the Wind Siting Act in Minnesota Statutes Chapter 216F (and applicable portions of Chapter 216E) and Minnesota Rules Chapter 4401. The siting of the Project was made in an orderly manner compatible with environmental preservation, sustainable development, and the efficient use of resources under Minn. Stat. § 216F.03 and Minn. Rules 4401.0450, subp. 3.

The Wind Siting Rules (Minnesota Rules Chapter 4401) govern the contents and treatment of applications for LWECS site permits under the Wind Siting Act. To the extent available, MP has presented available information required by the Wind Siting Rules. Project design, use of wind resources, and technical information have been provided for a thorough evaluation of the reasonableness of the Project Site as a location for the Project.

2.4 State Policy

As required under Minn. Stat. § 216F.03 and Minn. Rules 4401.0450, subp. 3, MP will further the state policy by siting the Project in an orderly manner compatible with environmental preservation, sustainable development, and the efficient use of resources. MP is designing the Project to take full advantage of the highest prevailing winds in northeastern Minnesota by siting the turbines along the top of the Laurentian Divide and minimizing the environmental impact by locating the Project adjacent to existing transmission facilities and an active industrial mining site.

In addition, MP will be utilizing the output from the Project to meet its renewable energy requirements under Minn. Stat. § 216B.1691. As a renewable energy project, MP will be seeking current cost recovery of Project costs as allowed under Minn. Stat. § 216B.1645 and its Renewable Resources Rider. Finally, MP's use of existing transmission will efficiently utilize resources as required under Minn. Stat. § 216E.02, subd. 1 and Minn. Rules 4400.0300.

2.5 Certificate of Need (CON)

Under Minn. Stat. § 216B.243, a Certificate of Need is required to construct Large Energy Facilities, as defined in Minn. Stat. § 216.2421, subd. 2. Under Minn. Stat. § 216B.2421, subd. 2(1), the Project does not meet the definition of a Large Energy Facility because it is less than 50 MW. In addition, any transmission infrastructure either does not meet the definition of a Large Energy Facility under Minn. Stat. § 216B.2421, subd. 2(2) or (3) or meets the CON statutory exemption under Minn. Stat. § 216B.243, subd. 8(4). The subtransmission line will be a 34.5 kV line less than one mile in length.

3.0 PROPOSED SITE

3.1 Identification of Project Site

The Project Site was selected based on excellent wind resources, close proximity to existing transmission infrastructure, the ability to lease property, compatibility with land use, and other considerations necessary to allow wind power to be generated from the site. The site boundary encompasses an area of approximately 475 acres. The land permanently occupied by the facility is expected to be less than 10 percent of this area.

The Project Site (see Map 1) represents the leased property where the wind energy facility will be constructed. The Project Site is located approximately 58 miles northwest of Lake Superior and near the City of Mountain Iron. The Project is located on a ridge known as the Laurentian Divide within the Mesabi Iron Range which is a vast deposit of iron ore and other minerals. US Steel owns and operates the Minntac Mine, which includes the Project Site. The Minntac Mine is the largest taconite pellet mine in the United States. The Superior National Forest is located directly north of the Project Site and consists of vegetated areas of predominately native forest communities.

The Project Site is located in portions of Sections 23 through 27 in the unorganized portion of Township 59 North and Range 18 West in St. Louis County.

The Project Site is roughly 475 acres in an irregular shaped parcel of land that is bounded by undeveloped land owned by US Steel to the north and east, the Minntac Mine active operations to the northwest and south. The center of the Project Site is made up of an east to west ridge with elevations ranging 1,600 to 1,850 feet above mean sea level. Most of the Project Site is undeveloped deciduous forest with some cleared areas. There is a 22 kilovolt (kV) electrical distribution line that traverses from north to south through the western section of the Project Site. Just south of the Project Site, MP owns two 115 kV transmission lines which connect to its Minntac Substation just southwest of the Project Site. The project's preliminary layout is shown in Map 2.

3.2 Wind Rights

MP has worked with US Steel to obtain wind rights and a lease for approximately 475 acres to construct the 25 MW Taconite Ridge I Wind Energy Center. Land rights encompass the wind facility project and all associated facilities including wind and buffer easements, wind turbines, access roads, underground or overhead electrical collection system, laydown area and an operations and maintenance building. The lease term supports the expected 35-year life of the Project.

3.3 Wind Characteristics

The meteorology of this region is dominated by the location and strength of the jet stream and related tracks of synoptic-scale weather systems (i.e., low and high pressure systems). During the winter and transitional seasons, the site is influenced by transient and developing synoptic-scale weather systems associated with the cool/cold season jet stream position. These weather systems establish strong pressure gradients that drive the low-level winds. In the summer season, the jet stream weakens and moves north, resulting in generally weaker synoptic systems and weaker winds.

MP retained the services of WindLogics, Inc. to analyze the detailed wind characteristics for four virtual towers located northwest of Virginia, Minnesota in the Minntac Mine area. The objective of this study

was to provide an analysis of the overall wind regime at the Project Site, including a long-term estimation of the wind resource and initial turbine layout.

The WindLogics modeling system was used to gather statistics and information covering the entire site, with a comprehensive analysis reported for one virtual tower located within the bounds of the site. Using data from the WindLogics Weather Archive, WindLogics executed a detailed, twelve-month modeling process that was then normalized to reflect long-term values using forty years of additional WindLogics data. The study found that the annual average values at 262 feet above ground level (AGL) for all four of the tower locations were similar. The average wind speeds for the four virtual towers ranged from 14.8 to 19.0 mph (7.52 to 7.84 m/s).

3.3.1 Interannual Variation

Tetra Tech also reviewed National Weather Service climate data from Duluth International Airport. Based on data collected for the period of 1984 through 1991, the average annual wind speed ranged from 9.32 mph (4.16 m/s) to 11.08 mph (4.95 m/s), or a variation of approximately 16 percent.

3.3.2 Seasonal Variation

The expected wind speeds in the Project Site at 262 feet (80 meters) is shown in Table 3-1. The strongest wind speeds typically occur during the transition months of October at 19.08 mph (8.52 m/s), and November at 18.95 mph (8.46 m/s). The summer months of June and July have the lowest average wind speeds at 15.31 mph (6.84 m/s) and 14.81 mph (6.61 m/s), respectively.

Table 3–1 Normalized Wind Speed Averages

Month	Tower 1		Tower 2		Tower 3		Tower 4		Four Tower Average	
	(m/s)	(mph)	(m/s)	(mph)	(m/s)	(mph)	(m/s)	(mph)	(m/s)	(mph)
Jan	8.36	18.70	8.07	18.05	8.07	18.05	8.15	18.23	8.16	18.25
Feb	7.93	17.74	7.61	17.02	7.52	16.82	7.66	17.13	7.68	17.18
Mar	7.88	17.63	7.57	16.93	7.6	17.00	7.65	17.11	7.68	17.18
Apr	7.88	17.63	7.46	16.69	7.4	16.55	7.64	17.09	7.6	17.00
May	7.68	17.18	6.91	15.46	6.94	15.52	6.95	15.55	7.12	15.93
Jun	7.03	15.73	6.74	15.08	6.78	15.17	6.79	15.19	6.84	15.30
Jul	6.9	15.43	6.54	14.63	6.55	14.65	6.46	14.45	6.61	14.79
Aug	7.15	15.99	6.84	15.30	6.83	15.28	6.94	15.52	6.94	15.52
Sep	8.13	18.19	7.86	17.58	7.8	17.45	7.81	17.47	7.9	17.67
Oct	8.7	19.46	8.41	18.81	8.37	18.72	8.6	19.24	8.52	19.06
Nov	8.73	19.53	8.34	18.66	8.33	18.63	8.44	18.88	8.46	18.92
Dec	8.41	18.81	8.15	18.23	8.06	18.03	8.26	18.48	8.22	18.39
Annual	7.84	17.54	7.54	16.87	7.52	16.82	7.61	17.02	7.63	17.07

Note: Wind data from WindLogics' 11-22-05 Mt. Iron Wind Resource Analysis report for Minnesota Power

3.3.3 Diurnal Conditions

Table 3-2 presents the expected diurnal variations of the wind speeds. Figure 3-1 shows how these wind speeds are expected to vary over the course of a day. Wind speeds are generally greatest during the nighttime and early morning hours and decline at midday.

Table 3–2 Normalized Wind Speed Diurnal Variation (m/s)

	Tower 1		Tower 2		Tower 3		Tower 4		Four Tower Average	
	(m/s)	(mph)	(m/s)	(mph)	(m/s)	(mph)	(m/s)	(mph)	(m/s)	(mph)
Low	7.05	15.77	6.9	15.43	6.7	14.99	6.8	15.21	6.86	15.35
High	8.5	19.01	8.1	18.12	8.2	18.34	8.2	18.34	8.25	18.45

Note: Wind data from WindLogics' 11-22-05 Mt. Iron Wind Resource Analysis report for Minnesota Power

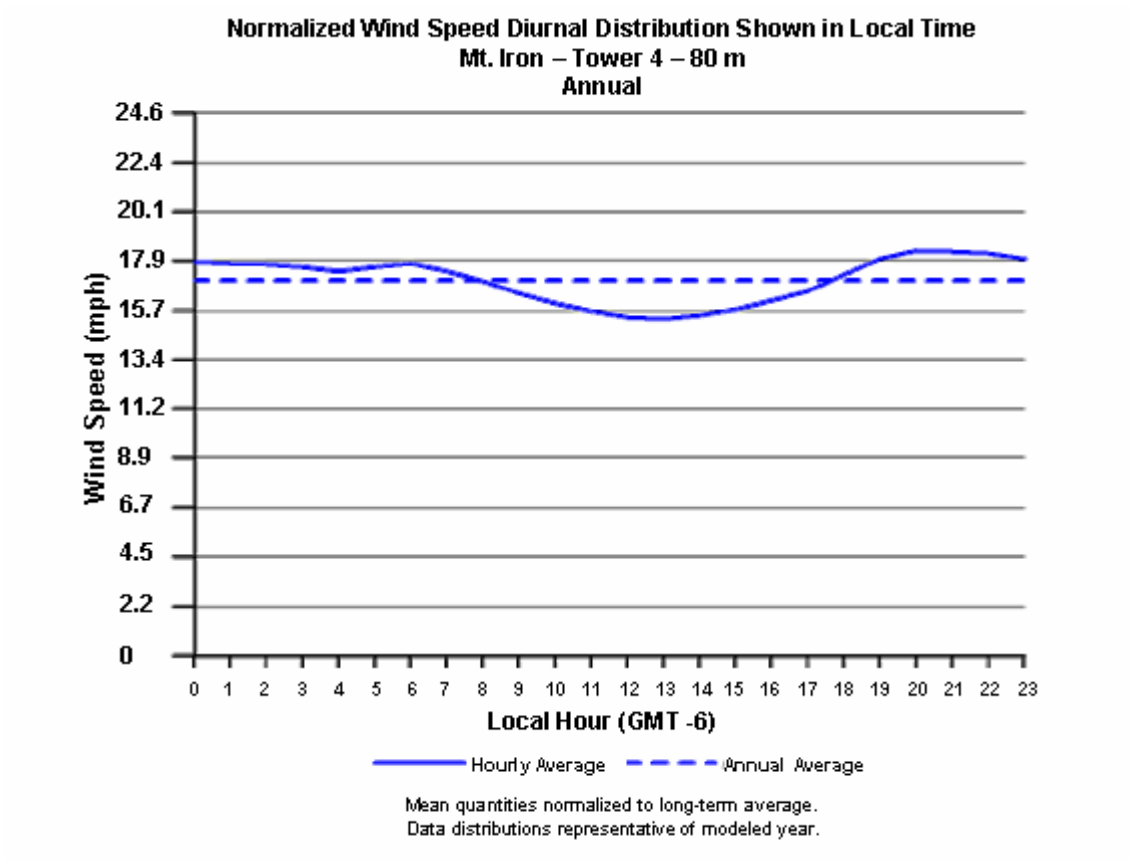

Figure 3–1 Normalized Wind Speed Diurnal Distribution Shown in Local Time (Source: WindLogics' 11-22-05 Mt. Iron Wind Resource Analysis report for Minnesota Power)

3.3.4 Atmospheric Stability

Atmospheric stability can be defined as the tendency of the atmosphere to resist or enhance vertical motions (or turbulence). The stability of the atmosphere is directly related to the changes of temperature with height. A common method of categorizing atmospheric stability was developed by Pasquill. This method uses 6 stability classes named A, B, C, D, E, and F, with Class A being the most unstable or most turbulent, and Class F being the most stable or least turbulent. As described in Table 3-3, the atmospheric stability at the Project site is primarily neutral.

Table 3–3 Frequency of Stability Class*

Stability Class	Frequency
A	0.1%
B	2.4%
C	9.8%
D	64.5%
E	13.9%
F	9.3%

* Based on meteorological data collected at Duluth International Airport (surface data) and St. Cloud, Minnesota (upper air data) for the years 1984-1991.

3.3.5 Hub Height Turbulence

The Turbulence Intensity (TI) is defined as the measured standard deviation of wind speed over an hour, divided by the mean for the same period. Based on wind data measured over the period from July 2006 through February 2007, the mean TI at 33.55 mph (15 m/s) is 0.20 mph (0.09 m/s). The turbulence intensity for this part of Minnesota is anticipated to be of negligible concern.

3.3.6 Extreme Wind Conditions

According to National Weather Service climate data, the maximum hourly wind speed measured at Duluth International Airport was 56.8 mph (25.4 m/s), and the highest gust speed measured was 70.9 mph (31.7 m/s), for the period of record from 1930 to 1996. The measurement height for the Duluth data was 21 feet (6.4 m). For the project site, the highest measured wind speed was 47.0 mph (21 m/s). This value was measured at an elevation of 262.5 feet (80 m) over a short period of record from July 2006 through January 2007.

3.3.7 Wind Speed Frequency Distribution

Figure 3-2 presents a wind speed frequency distribution for the Project Area. Wind speeds of 11.2 mph (5 m/s) or greater occur approximately 79.2 percent of the time, and wind speeds of 15.7 mph (7 m/s) or greater occur approximately 58.4 percent of the time.

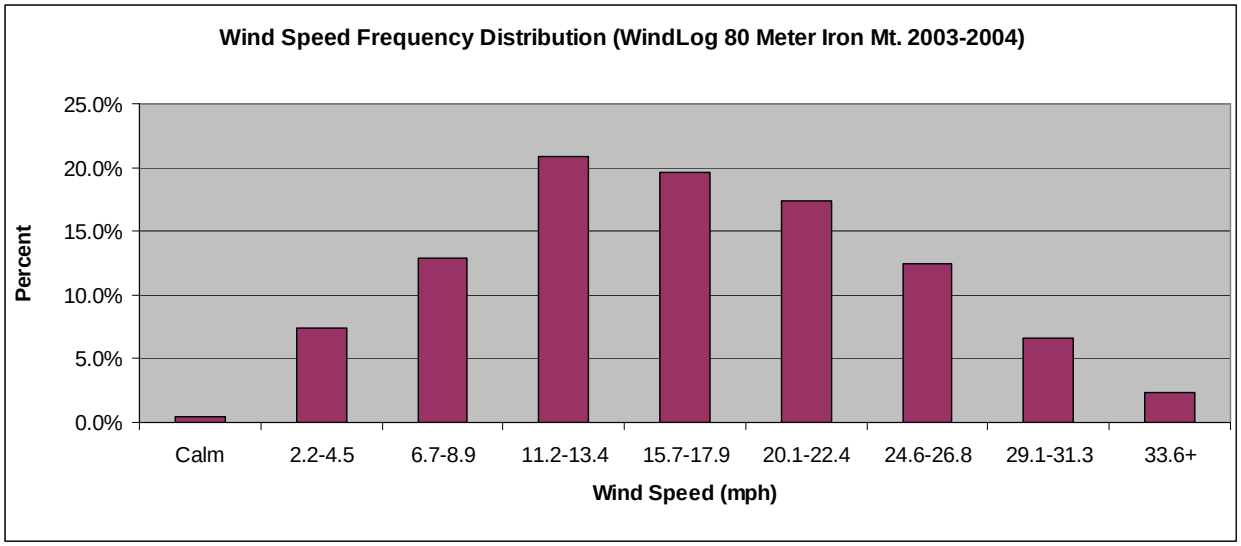

Figure 3–2 Wind Speed Frequency Distribution
Data Source: Clipper Site Suitability Data Requirements MtIron.xls.

3.3.8 Wind Variation with Height

Wind shear is the relative change in wind speed as a function of height. Wind shear is calculated using a power function based upon the distance from the ground.

The general equation used for calculating wind shear is $S/S0 = (H/H0)\alpha$, where S0 and H0 are the speed and height of the lower level and α is the power coefficient. The power coefficient can vary greatly due to the terrain roughness and atmospheric stability. The power coefficient will also change slightly with variation in height. The expected vertical variation with height or shear coefficient is 0.37. This value is based on the average 30 to 60 meter shear measured from July 2006 through February 2007.

3.3.9 Spatial Wind Variation

Figure 3-3 shows the spatial wind speed variation within the Project Area. This data was developed by Clipper Windpower for MP, Wind Park Site Suitability Conditions and Data (2003-2004). The study maps take into account wind data, topography, and surface roughness characteristics. The map shows that the well exposed terrain in the Project Area results in wind speed ranges up to approximately 17.9 mph (8 m/s). This is consistent with the average wind speeds predicted in WindLogics study as shown in Table 3.1. Little variation is expected across the Project Area, because of the relatively flat, open terrain.

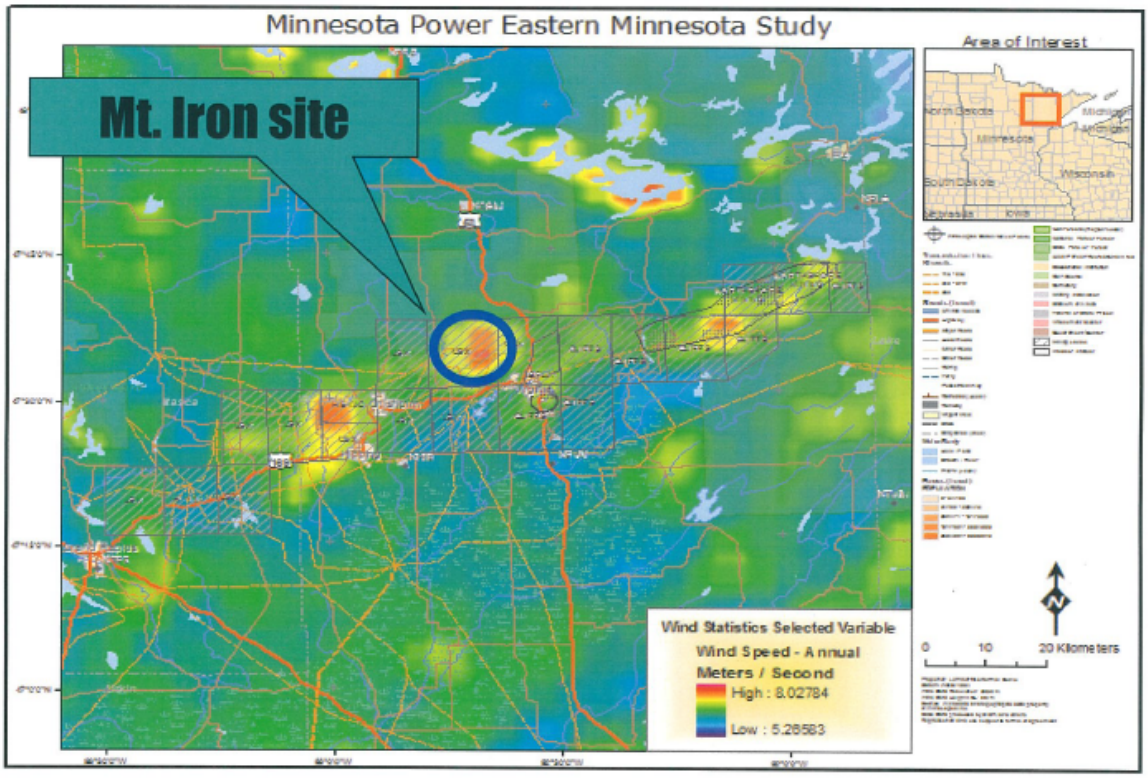

Figure 3–3 Wind Speed Spatial Variation

3.3.10 Wind Rose

A wind rose is a graphical presentation that shows the frequency of wind speed and directions observed relative to the compass points. Figure 3-4 shows the expected wind rose for the Project Area. The prevailing wind direction is northwest to north northwest, with significant winds also coming from the south.

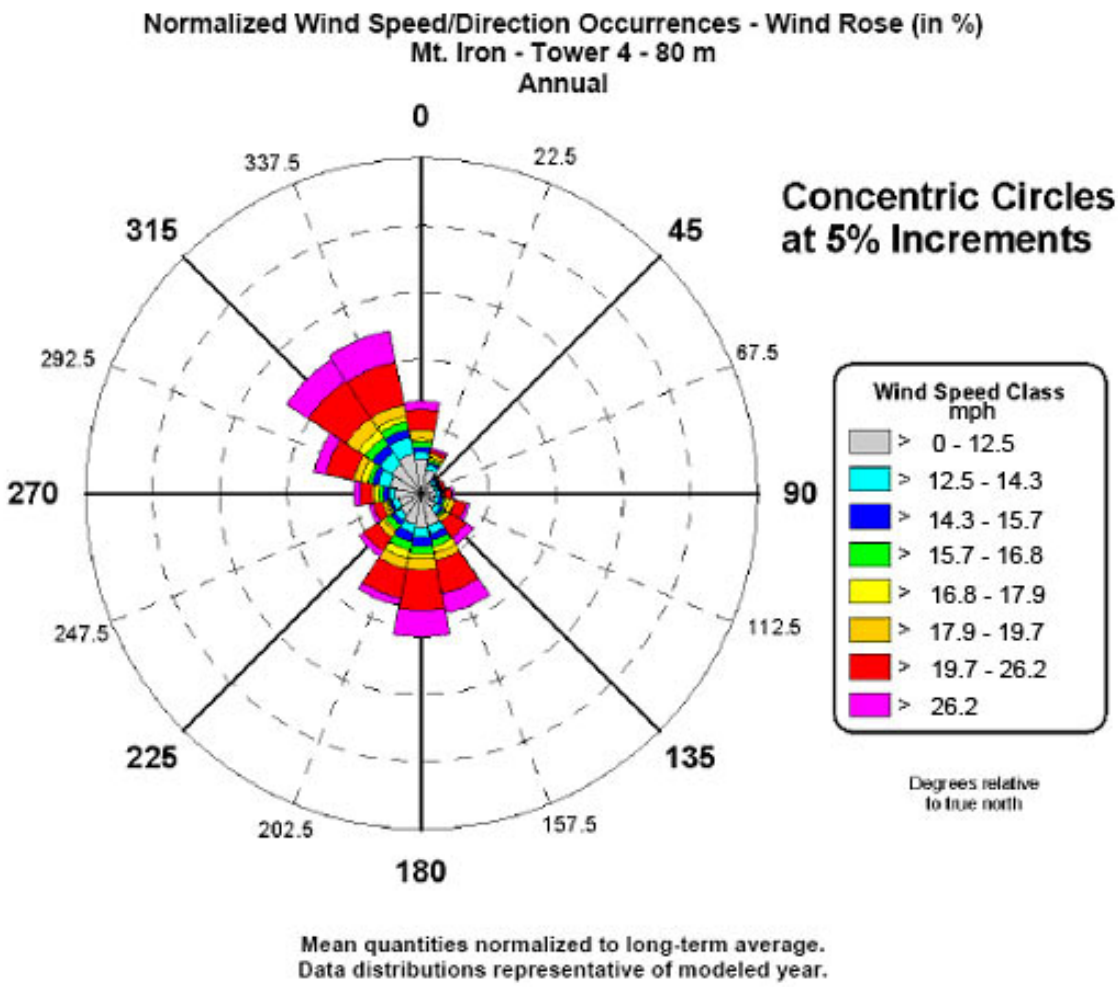

Figure 3–4 Normalized Wind Speed/Direction Occurrences – Wind Rose (in %)
(Source: *WindLogics' 11-22-05 Mt. Iron Wind Resource Analysis report for Minnesota Power*)

3.4 Other Meteorological Conditions

Average and Extreme Weather Conditions

Based on historical climate data for Duluth, Minnesota, mean annual temperature is approximately 39.1°F. The highest and lowest temperatures on record are 97°F and -39°F, respectively. Mean annual precipitation is 31 inches. Mean annual snowfall (including ice pellets and sleet) is 81.5 inches.

Icing

Clipper uses one or several automatic ice detectors to stop the machines in the event excessive ice build up on the blades in order to reduce the risk of ice falling and to prevent rotor unbalance due to uneven ice buildup.

The turbines will be equipped with one or several automatic ice detectors. Those detectors are located in the MET towers(s) or the turbines, depending on final design. The SCADA system communicates with the ice detector(s), and if ice is detected will send a signal to each turbine's controller to shut down.

In addition to the ice detector, there are two other systems that may be utilized to detect icing on the blades:

a The vibration switch inside the Nacelle.
b The built in accelerometer vibration sensor inside the turbine.

Those two devices can detect potential unbalance due to icing on the blades.

Expected annual losses due to weather (such as icing) is site specific, but are not expected to exceed 2 % at the Taconite Ridge I facility.

4.0 DESIGN OF PROJECT

4.1 Project Layout

The Project will consist of an array of wind turbines, transformers, and roads. The turbines will be interconnected by communication and electric power collection cable within the wind facility. In addition, associated facilities will include a 34.5 kV underground or overhead collector line, transformers at each turbine, 34.5 kV collector lines, a laydown area, an Operations and Maintenance (O&M) Building and a step up transformer at the 115/230 kV Minntac Substation. The laydown area may be maintained with a gravel surface to store operations and maintenance equipment and vehicles.

Land will be graded for the turbine pads. Drainage systems, access roads, storage areas, and O&M facilities will be installed as necessary to fully accommodate all aspects of Project construction, operation, and maintenance. The area of disturbances for each of the wind energy facility components are summarized in Table 4-1.

The electrical system design and interconnection details will be determined as a result of studies and agreements with MISO. The collector system will deliver power to the Minntac Substation. A step up transformer will be installed within the existing Minntac Substation footprint to step up the transmitted 34.5 kV power to 115 kV.

4.2 Wind Turbines

The Project will consist of 10 Clipper 2.5 MW Liberty Wind Turbines (IEC Class IIb) for an installed nameplate capacity of 25 MW. MP has entered into an agreement with Clipper to provide 10 turbines with a delivery currently targeted for November 2007. The turbines will be built with upgrades for cold weather climates. The turbine has a hub height of 265 feet and a rotor diameter of 305 to 315 feet. Turbine specifications are included in Appendix A.

4.2.1 Rotor

The rotor consists of three blades mounted to a rotor hub. The hub is attached to the nacelle, which houses the gearbox, generator, brake, cooling system and other electrical and mechanical systems. The preliminary 2.5 MW turbine design identifies a 305-foot to 315-foot rotor diameter (RD), with a swept area of 73,084 ft^2 for the 305 ft RD and 77,897 ft^2 for the 315 ft RD. The rotor tip speed will vary from 150 to 190 miles per hour (mph).

4.2.2 Tower

Each tower is composed of conical tubular steel with a hub height of 262 feet. The turbine tower, on which the nacelle is mounted, consists of four sections manufactured from certified steel plates. All welds are made in automatically controlled power welding machines and ultrasonically inspected during manufacturing per American National Standards Institute (ANSI) specifications. All surfaces are sandblasted and multi-layer coated for protection against corrosion. Access to the turbine is through a lockable steel door at the base of the tower. There is an internal ladder that runs to the nacelle. At the back of the nacelle there is a rolldown hatch which allows complete access to the nacelle. Also, there is an onboard crane that provides easy access to the brakes, generator, yaw drives and other components. The tower is equipped with interior lighting and a safety guide cable alongside the interior ladder.

4.2.3 Lightning Protection

Each turbine is equipped with a lightning protection system. The turbine is grounded and shielded to protect against lightning. The grounding system will be installed during foundation work, and must be designed for local soil conditions. The resistance to neutral earth will be in accordance with MP or local code requirements. Lightning receptors are placed in the three rotor blades and in the tower. The nacelle where the electrical components are housed is also fully shielded.

4.2.4 Foundation

The foundation design will be tailored to suit the soil and subsurface conditions. A geotechnical investigation will be performed at each tower location to analyze soils and rock conditions.

MP is considering using rock anchors as the turbines are located along a bedrock ridge. Geotechnical surveys, turbine tower load specifications and cost considerations will dictate final design parameters of the foundations. Foundations for similar sized turbines and transformer pads are generally octagonal, measuring 50 feet by 50 feet, 2500 square feet of concrete and extend 7 to 10 feet below grade. The construction area for the crane and foundation can be approximately 360 feet in diameter covered with a gravel material and reseeded, if necessary, to allow low growing plants to revegetate after construction completion. The wind turbine foundation design shall be prepared by a registered professional engineer licensed to practice in the State of Minnesota.

4.2.5 Turbine Safety Systems

All turbines are designed with built-in-safety equipment, and comply with the codes set forth by international standards as well as those of the Occupational Safety and Health Administration (OSHA) and the American National Standards Institute (ANSI).

4.3 Description of Electrical System

Each turbine will have a step-up transformer to raise the voltage to the distribution line, which is 34.5 kV. The electricity generated by the turbines will be run through an underground or part overhead collection system to the Minntac Substation a total length of cable for approximately three miles. In locations where two or more sets of underground lines converge, pad-mounted junction panels will be used to tie the lines together into one or more sets of larger feeder conductors. At the Minntac Substation, a step up transformer will convert the collector voltage electricity from 34.5 kV to 115 kV before it is delivered into the grid.

4.3.1 Transformers

Power from the turbines is directed through a breaker panel at the turbine base inside the tower and is connected to a pad-mounted step-up transformer that measures five feet by ten feet. The transformer steps up the voltage from 690 volts to 34.5 kV. The transformers are connected to underground cables to form an electrical collection system.

4.3.2 Electrical Collection System

The Project will use approximately three miles of underground 34.5 kV electrical power lines to collect the power from the turbines and transmit it to the Minntac Substation. The collector cables will be installed in a trench approximately 4 feet deep and 3 feet wide and located approximately five feet beyond the edge of the access roads. After the cables are installed, clean fill such as sand or fine gravel will cover

the cable followed by native soils and rock backfilled over the top. Depending on final engineering design, the 34.5 kV collector system would be installed almost entirely underground to its interconnection to the Minntac Substation, or a relatively short length (not to exceed 1000 feet) would be constructed as an overhead line spanning the Minntac Mine haul road located between the Project Site and the Substation. If an overhead line is necessary, it would accommodate vertical clearances for US Steel haul trucks, as well as meeting requirements of the National Electric Safety Code (NESC).

4.3.3 Step-up Transformer

A step-up transformer will be installed within the perimeter of the existing Minntac Substation which is owned and operated by MP. The step-up transformer will consist of an outdoor breaker, relaying equipment, high-voltage buswork, steel support structures and lightning suppression conductors. The transformer will be constructed on concrete foundations and will consist of a graveled footprint. The transformer will convert the 34.5 kV electricity to 115 kV at the Minntac Substation and be available for end users of the grid.

4.3.4 Interconnection

The interconnection study is complete as described in Section 1.7 Interconnection and Transmission.

4.3.5 Access Roads

The Project will take advantage of Minntac Mine roads where available, specifically to the south and west of the Project Site. These roads are approximately 35 feet in width. Additional graveled access roads will be constructed to provide access to the wind facility. The roads will be used throughout the life of the Project to allow access to and from the meteorological tower, wind turbines, transformers, collection cables and Operations and Maintenance Building. The roads will be constructed approximately 35 feet wide to support the crawler crane track. The roads will be designed to avoid or minimize any impacts to sensitive areas. The roads will be maintained during the life of the Project. The roads will be constructed by removing the vegetative subgrade or rock to an approximate depth of 8 to 12 inches below the surface. Gravel fill material will be placed, graded and compacted as required. The final road surface will be designed to provide adequate drainage and bearing capacity for the crawler crane track to access each of the wind turbine locations.

4.3.6 Meteorological Towers

A 198 foot meteorological tower was installed in June 2006 and may remain in place for the life of the Project. Another meteorological tower (265 foot) will be installed in 2007 and will remain in place for the life of the Project. Both towers will be guyed in place.The towers have a grounding system similar to that of the wind turbines. The towers will be connected to the central monitoring system as described in Section 4.3.8. MP may decide to dismantle the temporary meteorological tower after the permanent meteorological tower has been operational for at least one year.

4.3.7 Operations and Maintenance Building

An Operations & Maintenance Building of approximately 3000 square feet will be built within the Project Site due south of the string of turbines. The building will serve as a shop and storage area for spare parts and maintenance vehicles. The approximate 6.0 acre laydown area will be covered with gravel and will remain during the life of the Project as a storage area for equipment and vehicles used in the operation of the Project.

4.3.8 SCADA System

A Supervisory Control and Date Acquisition System (SCADA) will be installed to provide remote monitoring of individual turbines and the meteorological tower. Each turbine and the meteorological tower is connected to a remote sensing system through an underground fiber optic cable or copper signal wire. The information that is relayed to the SCADA system includes performance monitoring, energy reporting and faults or problems with operations. The cables or wire will be placed in the trenches with the collector lines. The fiber optic cables are then connected to a host computer that will be installed at the step-up transformer at the Minntac Substation and then connected to a remote computer terminal that will be maintained either at the MP Energy Control Center in Duluth, the MP Thompson Hydroelectric Facility, or the MP Generation Operations Center in Cohasset, MN. Additionally, the SCADA system can send signals to a fax, pager or cell phone to alert operations staff.

Table 4-1 Summary of Disturbances for Project

Component	Typical Construction Requirements (temporary)	Typical Maintenance/Operations Requirements (long-term)
Turbines	Approximately 360 foot diameter laydown area includes area for crane	Approximate 50 foot by 50 foot concrete surface including foundation and step up transformer pad at each turbine site, along with an approximate 60 foot by 100 foot gravel surfaced crane pad
Turbine Transformers	Within turbine construction area	Within 50 foot by 50 foot turbine area
Access Roads to Turbines	Approximately 3.0 miles Approximately 35 feet wide disturbance within an approximate 100 foot wide cleared construction area	Approximately 3.0 miles approximately 35 feet wide, including gravel surface and side slopes
Underground Lines (trenches)	Approximately 3.0 miles of underground line adjacent to access roads Disturbed area of no more than approximately 50 feet wide adjacent or near access road corridor	Trenches or berms filled, re-graded, and vegetated. No permanent surface disturbance
Operations & Maintenance Building	Approximately 0.07 acres total	Approximately 0.07 acres total
Laydown Area	Approximately 6.0 acres total	Approximately 6.0 acres of gravel surface if left permanently in place
Meteorological Towers	Approximately 300 feet by 300 feet laydown area	Approximately 30 feet by 30 feet disturbance for tower base
Step Up Transformer	Located all within the footprint of the Minntac Substation	Located all within the footprint of the Minntac Substation

5.0 ENVIRONMENTAL ANALYSIS

This section provides a description of the environmental conditions that exist within the Project Site. Consistent with Minnesota Public Utilities Commission (MPUC) procedures on siting LWECS and applicable portions of the Power Plant Siting Act, various exclusion and avoidance criteria were considered in the selection of the Project Site shown on Map 1, which shows the Project Site in relationship to the surrounding area. To support this siting process, maps of the Project Site were generated from existing data to show the following features:

- Parks and wildlife management areas available from Minnesota GIS sources;
- Monuments, historic sites, and trails shown on USGS 7.5 Minute Quadrangle Maps;
- Soil and geology;
- Roads and railways;
- Topography;
- Surface water hydrology including wetlands; and
- Land use and land cover.

Initial investigations also included agency queries consisting of a request for information relevant to assessment of impacts of Project development. These query letters were sent to the U.S. Fish and Wildlife Service (USFWS); Minnesota Department of Natural Resources (MNDNR); St. Louis County Administrator; Mountain Iron City Administrator, the City of Virginia Mayor, the 1854 Treaty Authority, the Bois Forte Tribal Council, and the Minnesota State Historical Preservation Office (MNSHPO). Query letters and responses are presented in Appendix C. This information, along with results of a Critical Issues Analysis of the Project Site, was used to prepare the following environmental analysis.

5.1 Description of Environmental Setting

The Project Site is located approximately 58 miles northwest of Lake Superior near the City of Mountain Iron, Minnesota. The Project is located on a ridge known as the Laurentian Divide with elevations ranging from 1,600 to 1,850 feet above mean sea level (msl). The Project is located within the Mesabi Iron Range which is a vast deposit of iron ore and other minerals within a region collectively known as the Iron Range of Minnesota. U.S. Steel owns and operates Minntac Mine coterminous with the Project Site. Minntac Mine is the largest taconite pellet mine in the U.S. and covers in excess of 30 sections of land, including the Project Site. Superior National Forest is located directly north of the Project Site and consists of vegetated areas of predominately native forest communities. Superior National Forest provides a number of resources for recreation and tourism.

The Project Site is primarily located in the Northern Lakes and Forests ecoregion described below:

> *"The Northern Lakes and Forests is a region of nutrient poor glacial soils, coniferous and northern hardwood forests, undulating till plains, morainal hills, broad lacustrine basins, and extensive sandy outwash plains. Soils in this ecoregion are thicker than in those to the north and generally lack the arability of soils in adjacent ecoregions to the south. The numerous lakes that dot the landscape are clearer and less productive than those in ecoregions to the south (USEPA 2002)."*

5.2 Socioeconomics

5.2.1 Description of Resources

St. Louis County, a semi-rural area in northeastern Minnesota, is the study area for this Project. Baseline data for the county include population and demographic data, as well as current business and economic statistics information. Information in this section was obtained from the U.S. Census Bureau based on the 2000 census data, as reviewed, updated, and reported each year, and on the 2002 Economic Census.

St. Louis County comprised 6,225 square miles with 32.2 people per square mile and a total population of 200,528 people in 2000, down 9.8 percent from a population of 222,229 in 1980. St. Louis County decreased by 1.7 percent between 2000 and 2005. The population of minority and low-income populations in the county and state are shown in Table 5-1.

Table 5–1 Minority Populations and Low-Income Populations, St. Louis County, 2000

Location	Total Population	Percent Minority*	Percent Individuals below Poverty Level (2003)**
St. Louis County	200,528	3.8	10.5
State of Minnesota	4,919,479	11.8	8.0

Source: U. S. Census Bureau 2000
* Minority populations are persons of Hispanic or Latino origin of any race, Blacks or African Americans, American Indians or Alaska Natives, Asians, and Native Hawaiian and other Pacific Islanders.
** Low-income populations are persons living below the poverty level. In 2000, the poverty weighted average threshold for a family of four in the United States was $17,603 and $8,794 for an unrelated individual.

Duluth is the largest city and county seat of St. Louis County. Cities in and bordering the Project Site include Mountain Iron and Virginia to the southeast. There are also several small semi-rural communities near the Project Site including Parkville to the south. According to a report produced by St. Louis County Planning Department, the Mountain Iron-Buhl and Virginia school districts provide educational services to K-12 pupils in the areas of Mountain Iron and Virginia, respectively (St. Louis County, 2007).

The 2000 U.S. Census reports that there were 82,619 occupied housing units in St. Louis County. There were 2.32 persons per household. St. Louis County had a home ownership rate of 74.7 percent in 2000. The median value of owner-occupied housing units was $75,000, significantly less than the state average of $122,400. Median household income was $39,379 in 2003, just 75 percent of the state median household income of $50,157.

According to the Minnesota State Demographic Center it is estimated that the population of St. Louis County will decrease by 3.2 percent by 2010, resulting in an estimated census population of approximately 194,170 people.

The economic base of St. Louis County consists primarily of management, professional, and related occupations (30.5 percent); sales and office occupations (26.2 percent); and educational, health, and social services (25.7 percent). Additionally, 5.6 percent of the employed civilian population of St. Louis County works in the mining industry. In comparison, the economic base of Minnesota consists primarily of management, professional, and related occupations (35.8 percent); sales and office occupations (26.5 percent); and educational, health, and social services (20.9 percent). A summary of the non-farm jobs and payroll for St. Louis County is shown in Table 5-2.

Table 5–2 Non-Farm Private Employment by Industry, 2002, St. Louis County

Industry	Paid Employees	Annual Payroll ($1,000)
Mining	5,300	D
Manufacturing	5,644	201,549
Wholesale Trade	2,375	84,768
Retail Trade	12,772	225,176
Information	2,221	64,094
Professional, Scientific and Technical Services	3,637	107,596
Administrative & Support and Waste Management & Remediation Service	3,020	56,614
Educational Services	250-499	D
Health Care and Social Assistance	17,951	523,580
Arts, Entertainment and Recreation	748	10,202
Accommodation and Food Services	9,494	97,954
Other Services (except public administration)	2,966	51,958

Source: U.S. Census Bureau 2002
D: Withheld to avoid disclosing data of individual companies.

Agriculture is an important activity in the county,but not in the vicinity of the Project Site.

Unemployment in St. Louis County has consistently remained slightly lower than that of the entire state of Minnesota, with an unemployment rate of 4.3 percent in 2002, whereas 4.6 percent of the state work force was unemployed in 2002 (US Census Bureau, 2002).

5.2.2 Impacts

Economic impacts are described as the amount of money and/or employment that the Project may deliver in terms of:

- Employment
- Income
- Government costs and tax revenues.

Construction of the Project is anticipated to cost $50 million and be complete within four to six months following commencement of construction. During construction and operation, the Project will function as a “basic industry” in St. Louis County and the northeastern region of the State of Minnesota. Basic industries are those business and government activities which bring outside income into an area economy. Income from sources outside the area that is received as paychecks and subsequently spent generates additional income and employment in the area, which is called the multiplier effect. Construction employment accounts for less than four percent of the St. Louis County workforce, according to the St. Louis County Planning Department. If local contractors are employed for portions of the construction, total wages and salaries paid to contractors and workers in St. Louis County and adjacent counties will contribute to the total personal income of the region. Additional personal income will be generated in the local, regional, and state economies due to the multiplier effect of each dollar paid in salaries and wages. Multipliers used for basic industries are estimated to be between one and three times the original salary and wages. This multiplier effect occurs as wage earners buy goods and services locally with the money earned and contribute to local, state and national taxes. Purchase of goods such as energy, fuel, operating supplies, and equipment also generate sales tax revenues.

Long-term impacts to the St. Louis County tax base, as a result of the construction and operation of the Project, will contribute to the local economy in northeastern Minnesota. Development of wind energy projects in this region is important in diversifying and strengthening the economic base and encouraging economic growth of the region and the local counties where wind energy projects are located. In addition to new jobs and increased personal income, wind energy projects pay a Wind Energy Production Tax to applicable taxing districts totaling $0.0012 per kWh of electricity produced in St. Louis County according to the Minnesota Department of Commerce. County government expenses are not expected to increase because of the Project. Leading industries in St. Louis County are not expected to be impacted during construction or operation of the Project. MP will coordinate with U.S. Steel during construction of the Project so that construction and operation of the Project will not affect Minntac Mine's operations.

There is no environmental justice population (minority, including Native Americans, or low income) in the Project Site, turbines will not be placed in an area occupied primarily by any minority group.

5.2.3 Mitigative Measures

Socioeconomic impacts associated with the Project will be positive. These impacts result from the influx of wages and purchases made at local businesses during Project construction, as well as the increase in the county's tax bases resulting from the construction and operation of the wind turbines. Since impacts resulting from the Project are expected to be beneficial to the local community rather than detrimental, specific mitigation is not required.

5.3 Noise

5.3.1 Description of Resources

The Project Site is located in a rural and industrial area. Sources of background noise audible to local residents and visitors to the area include wind, mining activity, recreation (primarily hunting), and vehicles. General noise level data from the USEPA and National Transit Institute were used to provide a typical sound level range for rural residential and mining uses. Typical baseline average day-night sound levels measured in A-weighted decibels [dB(A)] in the Project Site likely range from approximately 38 dB(A) to 48 dB(A) (USEPA 1978). The day-night standard includes a 10 dBA penalty applied to sound levels at night to account for the greater sensitivity of people to noise at night. Without this penalty, the average levels would be 6.4 dBA lower with a range of 31.6 to 41.6 dBA. These are relatively low background levels and are generally representative of the site. Higher levels exist near roads and other areas of human activity. The windy conditions in this region may elevate ambient noise levels relative to rural areas with less wind. Typical levels of sounds in various settings and from various sources are presented in Table 5-3. Minnesota noise standards are presented in Table 5-4.

Table 5–3 Noise Levels from Common Sources Expressed in A-weighted decibels [dB(A)]

db(A)	Typical Source
163	Rifle
120	Chainsaw; Hammer on Nail
90	Tractor
85 to 88*	Construction of Project
70	Freeway Traffic
50	Refrigerator
45 to 50*	Operation of Project
40	Quiet Residential Area
30	Quiet Bedroom at Night
10	Threshold of hearing
0	No sound

Source: League for the Hard of Hearing 2007; Tipler 1991
*Estimated dB(A) based on a distance of 50 feet

Table 5-4 State of Minnesota Noise Standards [db(A)]*

Noise Area Classification (as Identified in Minn. Rule 7030.0050)	Daytime	Daytime	Nighttime	Nighttime
	L50	L10	L50	L10
1	60	65	50	55
2	65	70	65	70
3	75	80	75	80

* A-weighted decibels
Source: Minnesota Rule 7030.0040

5.3.2 Impacts

Noise is defined as any unwanted sound. Noise can have such subjective effects as annoyance, nuisance, and dissatisfaction, and can also interfere with activities such as speech, sleep, and learning. Physiological effects such as anxiety, tinnitus, or hearing loss can also occur as a result of noise exposure. Contribution to hearing loss can begin at levels as low as 70 dB(A)

The National Safety Council (NSC) recommends no more than 85 dB(A) for eight hours of exposure as the safe limit for farm operations. Industrial standards of the Occupational Safety and Health Administration (OSHA) regulations would apply during construction, operation and maintenance of the facility. Short-term noise issues would be related to construction of the Project and long-term issues would be related to operation of the facility. Noise generated by construction activities would occur intermittently over the construction period during daytime hours and would be generated by an increase in traffic on local roads, as well as heavy equipment operation. Available estimates from other wind facilities construction projects indicate that the maximum noise levels from heavy equipment would be 85 to 88 dB(A) at a distance of 50 feet (Western 2003). These levels would be attenuated to below the daytime ambient level at any residence and would not constitute a noise impact.

Noise will be produced by the wind turbines during normal operation at a relatively low level. This will consist of mechanical noise from the equipment in the nacelle at the top of the tower and aerodynamic noise as the blades pass through the air. The level of noise generated by turbines will vary with the wind speed, speed of the turbine, and distance of the listener from the turbine. Noise levels produced by operation of the turbines were modeled to determine at what distance turbine noise would not exceed Minnesota Pollution Control Agency (MPCA) noise standards. Noise levels were modeled using the CadnaA noise model produced by Datakustik in Germany. The attenuation algorithms used in the model are based on those in the ISO Standard 9613-2 for attenuation of sound out doors. The most significant attenuation is from hemispherical spreading of the sound from the point sources defined by the following equation:

$$Lp = Lw - 10 \times \log_{10}(2 \times pi \times r^2) - A_{atm}$$

Where:

Lp = sound pressure level at the distance of interest
Lw = turbine sound power level
r = distance of interest

Other less significant attenuating mechanisms include atmospheric absorption, ground absorption, scattering of sound waves, and shielding by terrain and trees. In order to produce a worst-case impact analysis, atmospheric absorption was the only other factor included in the modeling.

The sound power level for the Clipper 2.5 MW turbines is 106 dBA as reported by Clipper. The results of this model are shown in the Noise Contour Map (Figure 5-1**)** which also shows the locations of the turbines and the nearest residence. As evident from this figure, the model considers the cumulative contribution of all the turbines at all points on the map. Based on these worst-case findings, it can be seen that the 50 dBA noise contour barely extends beyond the lease area at a maximum distance of about one-quarter mile. This is the maximum distance where an exceedence of a state noise standard would no longer occur for the Nighttime L_{50} standard of 50 dB(A) (Minn. Rule 7030.0040). The conservatively modeled level at the nearest residence, at a distance of about 8,400 feet, is 30.2 dBA during the maximum turbine operating noise level. This is below the lowest ambient level of 31.6 dBA anticipated to exist in the area under calm wind conditions. During windy conditions that would allow the turbine to produce this maximum noise level the ambient level would be closer to the upper end of the stated range at 41.6 dBA. It is unlikely that the turbines would ever be audible at any residence and no exceedance of any state noise standard would occur under any circumstance.

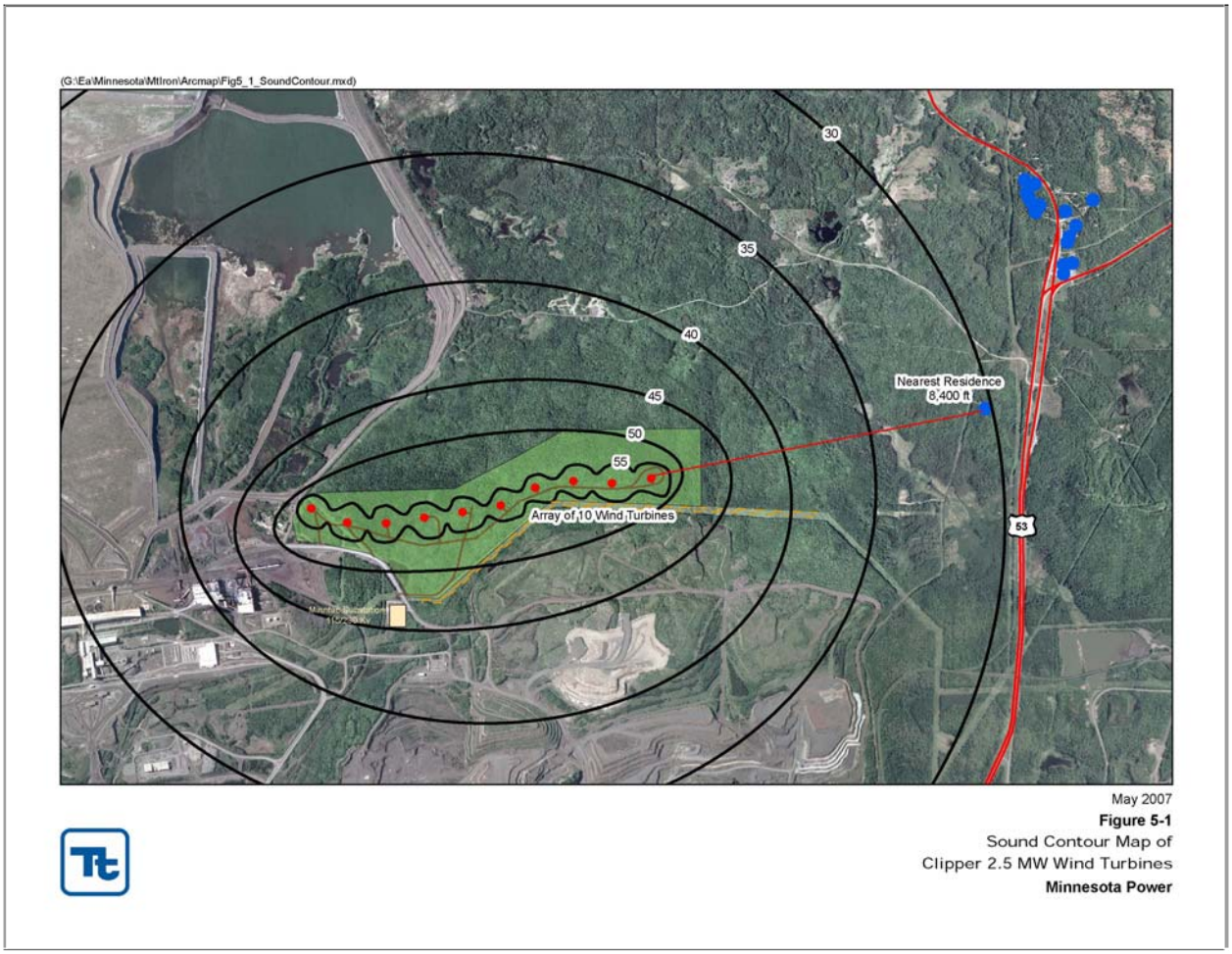

Figure 5–1 Sound Contour Map of Clipper 2.5 MW Wind Turbines

5.3.3 Mitigative Measures

Noise impacts to nearby residents and other potentially affected parties have been taken into consideration as part of the actual siting of the turbines. Turbines will be sited more than 8,400 feet from occupied residences, therefore no mitigation is required.

5.4 Visual Impacts

5.4.1 Description of Resources

Scenic quality is determined by evaluating the overall character and diversity of landform, vegetation, color, water, and cultural or manmade features in a landscape. Typically, more complex or diverse landscapes have higher scenic quality than those landscapes with less complex or diverse landscape features.

The Project Site lies in a semi-rural location with extensive mining operations and National Forest property dominating land use. The topography varies from rolling terrain in the southern portion of the Project to steeper, hilly terrain in the northern portion of the Project. Intermittent drainages and scattered wetlands are present in the Project Site.

Structure and color features within the Project Site include those associated with forest land to the north. Colors are seasonally variable and include green forest land during spring and summer, varied yellow, orange, red and brown associated with late fall and white during the winter periods. A different landscape dominated by cleared land, large industrial buildings and cleared roads persists south, west and northwest of the Project Site associated with the Minntac Mine. This area is characterized by a uniform gray and brown color throughout most of the year. There are very few settlements in the area and include scattered residences and associated buildings (inhabited and uninhabited). Forest land comprises much of the Project Site and areas to the north with mining facilities adjacent to the south, west and northwest.

Key observation points (KOPs) are viewing locations that represent the location of the anticipated concentration of sensitive viewers (or the highest incidence of sensitive viewers) near the Project (Map 7). KOPs for the Project include roadways and occupied residences within the vicinity of the Project Site and could include receptors in the nearby area of homes knows as Britt and Parkville, and the nearby cities of Mountain Iron and Virginia. As the property is owned by US Steel there are no farmsteads within the Project Site and the nearest residence is approximately 8,400 feet (1.60 miles) northeast of the nearest proposed turbine location. The Superior National Forest is located north of the Project Site and is an area used for seasonal recreation and tourism. There are no designated trails in this protion of the Superior National Forest. The cities of Virginia, Mountain Iron, residences along Highway 53 and the Superior National Forest are considered potential KOPs.

5.4.2 Impacts

The placement of turbines will have an effect on the visual quality within the vicinity of the Project. Discussion of the aesthetic effect of the wind facility is based on subjective human response. The Project will have a combination of perceived effects on the visual quality/semi-rural character of the area. From one measure of standards, the Project could be perceived as a visual intrusion. On the other hand, wind facilities have their own aesthetic quality, distinguishing them from other land uses.

The 10 turbines will be sited on a prominent ridge spaced approximately 1,000 feet apart. The uppermost portion of the turbine blades will reach up to 380 feet above ground surface and will be visible from Virginia and Mountain Iron. Visitors to the Superior National Forest will be able to see the turbines, as well. Views from the north looking south will change the visual character of the area from rangeland and forest land to quasi-industrial. Views from the south will add to the already industrial nature of the area. However, the turbines will become another feature on the horizon. These structures will be visible from all of the identified KOPs. In addition, some of the turbines will require strobe lights for aircraft safety, potentially further altering the view from KOPs. Visual effects will decrease as the distance from these facilities increases.

Impacts on visual resources within the Project Site were determined by considering the post-construction views from the KOPs, as discussed above. The Project is located south of Superior National Forest, which is considered a potentially unique viewshed during seasons of recreational use and tourism. However, due to the fact that the wind facility is concentrated south of the Forest with mining operations adjoining the Project to the south and west and portions of the Forest to the west and northwest, the density of recreation and tourism in this area is likely to be low; therefore, the impacts to sensitive viewers are likely to be low. No other highly distinctive or important landscape features, registered cultural resources, or unique viewsheds are located within the Project Site.

5.4.3 Mitigative Measures

The following are proposed measures to mitigate visual impacts:

- Collector lines will be buried, to the extent practical, to minimize aboveground structures within the turbine array;
- Turbines will not be located in biologically sensitive areas, and to the extent possible, will not be located in wetlands;
- Turbines will be illuminated to meet FAA regulations;
- Existing roads associated with Minntac Mine will be used for construction and maintenance where possible, minimizing the need for new roads;
- Access roads created for the Project will be constructed to minimize changes to the landscape texture;
- Temporarily disturbed areas will be revegetated to blend in with existing vegetation; and
- Turbines will be sited with minimum setbacks of 750 feet, or more from public roads and more than 8,400 feet from occupied residences.

To attain maximum efficiency, wind power technology requires as much exposure to the wind as possible. Mitigation measures that would result in shorter towers or placement of the turbines at alternate locations off the ridgelines have not been considered as they would result in less efficiency per unit.

5.5 Public Services and Infrastructure

5.5.1 Description of Resources

The Project is located in a semi-rural area in northeastern Minnesota. There is an established transportation and utility network that provides access and necessary services to the mining industry, nearby towns and cities, homesteads, and farms near the Project Area.

Electrical Service. There are two primary utility providers within St. Louis County (Minnesota Power and Lake Country Power). Two existing 115 kV transmission lines run east to west and are located south of the Project Site. Also, an existing 115/230 kV substation, the Minntac Substation is located southwest of the Project Site.

Roads. The existing roadway infrastructure near the Project Site is characterized primarily by county roads or non-public mining haul roads. For purposes of comparison, the functional capacity, or Average Daily Traffic (ADT), of a two-lane paved rural highway is in excess of 5,000 vehicles per day. The 2003 MNDOT average traffic count on Highway 169/53 east of the Project Site and running north to south is 9,400 vehicles per day.

Water Supply. There is not an established water supply infrastructure within the Project Site. No wells are located within the Project Site.

Telephone and Fiber Optic. Telephone and fiber optic infrastructure are not located within the Project Site.

Radar. Radar operations have not been identified within the Project Site.

5.5.2 Impacts

The Project is expected to have a minimal effect on the existing infrastructure. The following is a brief description of the impacts that may occur during the construction and operation of the Project:

- Electrical Service**.** Construction of the Project will add 10 wind turbine generators and transformers, an underground or part underground and overhead (not expected to exceed 1,000 feet of overhead).. The electrical collection system will tie into the existing Minntac Substation.
- Roads**.** Constructing the Project will require the addition of approximately three miles of gravel access roads. In addition, during operation of the Project, the access roads will be used by operation and maintenance crews while inspecting and servicing the wind turbines. The access roads will be between towers and offset as necessary to allow for adequate crane access. The roads will be approximately 35 feet wide and low profile to allow cross-travel by mining equipment. The Applicant will work closely with the US Steel to locate these access roads to minimize land use disruptions to the extent possible. A map depicting the proposed layout of the access roads is shown on Map 2.
- Water Supply**.** Construction and operation of the Project will not impact the water supply as established infrastructure is not present within the Project Site. The abandonment of any wells is not required for the Project. In the event wells are encountered and must be abandoned, they will be capped as required by Minnesota law. The Project will not require appropriation of surface water or dewatering of underground aquifers. It is likely that the Project will require a single domestic-sized well for the operations and maintenance facility.
- Telephone and Fiber Optic**.** Construction and operation of the Project will not impact telephone and/or fiber optic service as these infrastructure are not present within the Project Site. Unknown existing utilities will be located prior to construction and service providers will be contacted to avoid underground facilities. To the extent project facilities cross or otherwise affect existing telephone and/or fiber optic lines or equipment, the Applicant will enter into agreements with service providers so as to avoid interference with their facilities.
- Radar. Wind turbines are required to be constructed at a certain minimum distance from a radar facility, determined by the height of the wind turbine and tower, so that construction and operation of the Project does not affect radar operation. Specific information on latitude, longitude, and elevation of the turbines will be submitted to the FAA to ensure compliance with these requirements.

Potential impacts of proposed construction and operation of the Project on existing telecommunications infrastructure within St. Louis County were assessed. Included in the assessment were potential impacts to non-Federal Government microwave paths, off-air TV station infrastructure, and Federal Government National Telecommunications and Information Administration (NTIA) telecommunications systems. To date, the Project is not anticipated to have an impact on existing non-Federal Government microwave transmissions within the Project Area of St. Louis County. There is, however, potential for some interference with off-air television reception in surrounding communities.

The following is a brief description of the telecommunications studies and/or findings for the Project:

Federal Government Systems. The Project is currently coordinating with the NTIA to determine if the proposed Project will impact Federal Government Communication links. Results of the NTIA inquiry will be provided in a supplemental filing to this Site Permit Application.

Off Air TV Stations. Cable television is available in most of the areas close to the proposed wind energy facility with populations greater than 100 people.

The primary TV transmitters are from General Rapids, Minnesota along Route 169 to Virginia, Minnesota. The other transmitters that are in the area are either low power and/or in excess of 50 miles away. With most of the communities in this area, issues will not arise with degradation to Off-Air TV

reception as the population areas are to the south and east. Taconite Ridge is being built to the north of most of the population centers.

Off-Air antennas are installed on approximately ten percent of the structures inside the areas of interest and approximately ten percent outside the area of interest. Satellite antenna systems appear on approximately ten percent outside the area of interest. Satellite antenna systems appear on approximately ten percent of the structures. An observation noted about the Off-Air antennas: most of the Off-Air

antennas, in use, align to an azimuth towards Grand Rapids, Minnesota. The Off-Air antennas in use appear to be mounted below tree level and in need of repair. The only networks represented in this area are ABC, NBC and FOX. The measurement sites, on average received five analog stations and one digital station.

Most of the housing in the area is below hill level and propagation issues encountered now and after turbine installation, will remain the same. Outside of the areas of interest, no issues will arise, as the communities are geographically far enough away that the turbines will be out of line-of-sight.

5.5.3 Mitigative Measures

Construction and operation of the Project will be in accordance with all associated federal and state laws, as well as industry construction and operation standards. Due to the minor impacts expected on existing infrastructure during Project construction and operation, mitigation measures are not anticipated.

Damage to public roads will be repaired in accordance with applicable laws and obtained permits and damage to private roads will be promptly repaired unless otherwise negotiated with the affected landowner.

Minnesota Power is committed to constructing and operating the Project in a manner that minimizes these impacts. In the event residents experience such disruption or interference after the turbines are in operation, these measurements will provide data that can be used to determine whether the Project is the cause of disruption or interference of television reception.

Minnesota Power will not operate the Project in a manner that will cause communication interference contrary to FCC regulations or other laws. However, in the event of a material problem after construction, Minnesota Power will take the measures necessary to correct the problem. In the event of a material problem with television reception after construction, Minnesota Power will work with affected residents to determine the cause of interference and where necessary reestablish acceptable reception quality in a timely fashion.

Prior to commencement of construction, the results of consultation with the NTIA will be submitted to MPUC. A response from the NTIA will only be received if any issues are discovered. It is not anticipated that any issues will arise with the Project.

After construction of the wind turbines, if there are areas experiencing degraded Off-Air TV receptions, investigations are necessary. If the investigation shows that it is, a number of mitigation strategies implemented will restore the homes in the area to at least the same television coverage that existed prior to the installation of the wind turbine facility. The mitigation methods may involve any of the following, either singly or in combination.

- Installation of high-gain TV antenna with preamplifier to boost the received signal level at individual homes.
- Where cable television exists, provide cable hookups to homes affected.
- Installation of a cable system to provide hookups to homes affected.
- Installation of a wireless TV distribution system, to provide TV channels to the cluster of homes affected.
- Provide satellite TV reception service to homes affected.
- Provide a satellite head end reception point with a cable distribution system to a cluster of homes near the head end.

5.6 Cultural and Archaeological Impacts

5.6.1 Description of Resources

The heritage of the Project Site is reflected in its cultural resources. Cultural resources are those aspects of the physical environment that relate to human culture, society, and cultural institutions that hold communities together and link them to their surroundings. Cultural resources include prehistoric and historic sites, buildings, structures, objects, districts, natural features, and biota that are considered important to a culture or community for scientific, traditional, religious, or other reasons.

Tetra Tech contracted with McFarlane Consulting, LLC (McFarlane) to conduct a records search and review of existing records contained at the Minnesota State Historic Preservation Office (SHPO) and the GIS database (I-sites) housed at the Minnesota Office of the State Archaeologist (OSA). The records search was conducted to determine if significant archaeological or historic resources have been documented within the Project Area and vicinity and, if present, identify the likelihood of impacts to these resources from development of the Project.

Minnesota's prehistory has been divided into four distinct cultural periods: Paleo-Indian (9,500-7,500 B.C.), Archaic (7,500-5,500 B.C.), Woodland (5,500 B.C-A.D. 1000), and Late Prehistoric (A.D. 1000-1650). European American settlers entered the area after 1650 at which time European diseases and competition for resources and land caused a dramatic decline in native tribal populations. The archaeological region in the vicinity of the Project Site is known as the Central Lakes Coniferous East Archaeological Region. The area has not been intensively studied by archaeologists and there is limited literature available relevant to the Project Site. No cultural resources surveys or inventories have been conducted within the Project Site.

In 1882 the Project Site was mapped by U.S. Geological Survey (USGS) land surveyors and described as "original pine lands and swamp" (Trygg 1969). Most of the area was logged off during the late 19th and early 20th centuries. The Project Site is currently forested with new growth pine stands, other conifers, aspen, and birch.

The records search did not find any listed historic structures, historic sites, National Register properties or archaeological sites within the Project Site. However, the OSA lists one historic archaeological site on U.S. Forest Service (USFS) land within one mile of the Project Site and two historic archaeological sites on USFS land within three miles of the Project Site Information about the USFS sites is limited and only general site locations were provided. These locations are presented in Table 5-5. Also, a copy of the Cultural Resources Report is presented in Appendix B.3.

Table 5–5 Historic/Archaeological Sites Near the Project Area

Historic Site Number	Location	Distance to Project Area
St. Louis 667	T59N R19W Sec. 27	One mile
St. Louis 164	T59N R19W Sec. 32	Three miles
St. Louis 585	T59N R17W Sec. 17	Three miles

5.6.2 Impacts

The Project Site has been defined as having moderate potential for unidentified archaeological sites and historic structures (McFarlane 2006). Undisturbed lands within the Project Area located in the higher elevations have the highest archaeological potential. In these locations bedrock exposures and lag deposits of Banded Iron Formation (BIF) chert are likely to exist. These exposures are often associated with prehistoric quarries and toolstone procurement centers.

The Project vicinity has been subject to extensive mining operations. It is possible that 19th and 20th century historic sites and structures associated with mining operations exist in the Project Site Considering the heavy impacts caused by mining activities, previously disturbed areas may be precluded from needing intensive archaeological investigations.

5.6.3 Mitigative Measures

Section 106 of the Historic Preservation Act must be addressed if the project requires any US ACOE approval under Section 404 or 401. This would be the case if there were any impacts to waters or wetlands of the US. Accordingly, a Phase I Archaeological Survey (pedestrian survey, shovel testing, and soil probes) may be conducted within the areas that will be permanently or temporarily impacted during construction or operation of the Project. The footprint of the wind turbine towers, the access road, and utility corridor plus a reasonable buffer will receive a Phase I investigation, if required. The remaining area between towers would be subjected to a less intensive Phase I investigation.

Phase I investigations typically begin with the high probability areas. Investigators then develop a context for additional finds through review of local topography as early in the research as possible. Because prehistoric archaeological sites, especially sites represented only by lithic debris, tend to be small and diffuse in this area, a pedestrian survey will be conducted at a spacing of 16 feet in the footprint and buffer areas, and 33 feet in the areas between towers. The Phase I survey would include observation of eroded ravines, streambeds and exposures for signs of lithic activity.

Pedestrian survey, with proper surface visibility and conducted by experienced personnel, is preferable to shovel testing for an area this large, especially because there is only moderate anticipation of intact buried soils, and because the area may contain small, diffuse lithic sites. Adequate soil probes must be taken throughout any area investigated by pedestrian survey to detect any possible buried soil horizons. Shovel testing, if necessary, would be conducted on a 33-foot grid in the footprint and buffer areas, and 49 feet in the areas between towers.

If a survey, is performed the, results will be provided to the Minnesota SHPO and the OSA to determine whether cultural resources are present. Any unrecorded resources that are found shall be evaluated for integrity and potential listing on the National Register of Historic Places (NRHP). Previously undocumented resources that are eligible for listing on the NRHP will be avoided.

Prior to construction, workers will be trained about the need to avoid cultural properties, about how to identify cultural properties, and about the procedures to follow if undocumented cultural properties, including gravesites, are found during construction. If any archaeological sites are found during construction, work will be stopped immediately and the MPUC and SHPO will be notified.

5.7 Recreational Resources

5.7.1 Description of Resources

Recreation resources were obtained online from the St. Louis County Land Department, Minnesota Department of Natural Resources (MNDNR), and United States Department of Agriculture (USDA) Forest Service. Based on a review of these online resources, recreational opportunities in St. Louis County include hunting, boating, fishing, camping, wildlife viewing, skiing, snowmobiling, and hiking. Many of these activities are provided within the boundaries of Wildlife Management Areas (WMAs), Scientific and Natural Areas (SNAs), and State and National Forests.

WMAs improve wildlife production and provide public hunting and trapping opportunities. WMAs are closed to all-terrain vehicles and horses because of potential detrimental effects on wildlife habitat. Conversely, SNAs protect rare and endangered species habitat, unique plant communities, and geologic features that possess exceptional scientific or educational values. SNAs are open for observation, education, and research, but are closed to most other recreational activities unless otherwise noted. While there are WMAs and SNAs in the vicinity of the Project Site, the closest WMA, Great Scott WMA, is located 12 miles southwest of the Project Site and Lost Lake Peatland SNA is located approximately 19 miles northeast of the Project Site.

Recreational resources proximal to the Project Site include activities within the boundary of Superior National Forest, which is north of the Project. There are no designated trails in the Superior National Forest near the Project Site. Among numerous other activities, hunting in Superior National Forest is varied and ranges from big game animals such as white-tailed deer, moose, and black bear to small game such as grouse and snowshoe hare. In the fall, hunters take to the many lakes, streams, and wetlands located throughout the forest to hunt a variety of waterfowl. Both puddle ducks (mallards and wood ducks) and diving ducks (scaup, ringbills, goldeneye, and buffleheads) can be found in fair numbers during parts of the hunting season. Canada and snow geese are occasional visitors to the Forest as well. Lakes and rivers that have beds of wild rice are particularly attractive to waterfowl.

5.7.2 Impacts

Due to the Project's proximity to existing mining operations, it is unlikely that recreational activities would be significantly impacted by the Project. Game populations within the Project vicinity would not decline as a result of the Project; however, further study may be required to determine potential impacts to avian species within the Project vicinity. The Project would not reduce camping or hiking opportunities. Due to the distance of the identified WMAs and SNAs within the vicinity, the Project does not pose a great visual impact to people who use the WMAs and SNAs for recreation.

5.7.3 Mitigative Measures

Wind turbines will not be located in WMAs, SNAs, State or National Forests, or other areas with exceptional value for recreation.

5.8 Public Health and Safety

5.8.1 Description of Resources

5.8.1.1 Air Traffic

The nearest airports include Eveleth-Virginia Municipal Airport, approximately 10 miles south of the Project Site; Cook Municipal Airport, approximately 20 miles north of the Project Site; and Chisholm-Hibbing Airport, approximately 25 miles southwest of the Project Site. Overhead subtransmission lines are expected to be similar (shorter height) to the 115 kV transmission lines already present just south of the Project Site and the turbines and meteorological towers themselves would be visible from a distance. The turbines will be visible from a distance and lighted according to FAA guidelines.

5.8.1.2 Electric and Magnetic Fields (EMF)

EMF currently exists in the Project Site where electric conductors exist with an electrical current flow. Electric and magnetic fields are invisible lines of force that surround any electrical appliance or wire that is conducting electricity. The electric power we use daily is a 60-Hertz (Hz) alternating current, meaning that electric charges move back and forth 60 times a second.

Electric fields are created by voltage – the higher the voltage, the stronger the electric field. Anytime an electrical appliance is plugged in, even if it is not on, an electric field is created. But electric fields are easily blocked by walls, trees, and even your clothes and skin, and the farther away you move from the source of the electric field, the weaker it becomes. Moving even a few feet away from an appliance makes a big difference in the strength of the electric field that you're exposed to.

Magnetic fields, measured in milliGauss (mG), only exist when an electric appliance is turned on – the higher the current, the greater the magnetic field. As with electric fields, the strength of a magnetic field dissipates dramatically as you move away from its source. However, unlike electric fields that are easily blocked, magnetic fields can pass through walls and clothes and other barriers.

Because they are more difficult to block, studies on EMF and possible health effects focus on magnetic fields. Examples of conductors to be used in the Project Site include 34.5 kV sub transmission lines, 34.5 kV underground collector lines, substation transformers, control building wiring, and electrical appliances.

Human health concerns have been identified with regards to the EMF surrounding transmission lines. Since 1979, there has been considerable attention focused on understanding the effects of electric and magnetic fields (EMF) on humans. The question of whether exposure to power-frequency (60 Hz) magnetic fields can cause biological responses or even health effects has been the subject of considerable research for the past three decades. There is presently no Minnesota statute or rule that pertains to magnetic field exposure. The most recent and exhaustive reviews of the health effects from power-frequency fields conclude that the evidence of health risk is minimal. The National Institute of Environmental Health Sciences (NIEHS) issued its final report, "NIEHS Report on Health Effects from Exposure to Power-Line Frequency Electric and Magnetic Fields" on June 15, 1999, following six years of intensive research. NIEHS concluded that there is little scientific evidence correlating ELF-EMF exposures with health risk.

The Minnesota State Interagency Working Group on EMF Issues, consisting of members from the Minnesota Department of Health, Department of Commerce, Public Utilities Commission, Pollution Control Agency, and Environmental Quality Board conducted research related to EMF, which resulted in

similar findings to the NIEHS report. The group issued "A White Paper on EMF Policy and Mitigation Options" in September of 2002 wherein it concluded:

- Research on the health effects of EMF has been carried out since the 1970s. Epidemiological studies have mixed results – some have shown no statistically significant association between exposure to EMF and health effects, and some have shown a weak association. More recently, laboratory studies have failed to show such an association, or to establish a biological mechanism for how magnetic fields may cause cancer.
- The Minnesota Department of Health (MDH) concludes that the current body of evidence is insufficient to establish a cause and effect relationship between EMF and adverse health effects. However, as with many other environmental health issues, the possibility of health risk from EMF cannot be dismissed.

The conclusions of the Minnesota State Interagency Working Group are also consistent with those reached by the MDH in 2000 and the 1999 Final Report issued by the NIEHS.

5.8.1.3 Security and Safety

The Project Site is located in a semi-rural area with relatively low population. Construction and operation of the Project would have minimal impacts on the security and safety of the local populace. In addition, access to the wind facility is controlled by the landowner, US Steel.

5.8.1.4 Traffic

The existing ADT levels are discussed in Section 5.5.

5.8.2 Impacts

5.8.2.1 Air Traffic

The Project will have no significant impacts on air traffic in the region because there are no airports in the Project Site (the nearest airport is 10 miles south of the Project Site) and the wind and meteoroloigcal towers will have lighting to comply with FAA requirements.

5.8.2.2 Electric and Magnetic Fields

While the general consensus is that electric fields pose no risk to humans, the question of whether exposure to magnetic fields potentially can cause biological responses or even health effects continues to be the subject of research and debate. Based on the most current research on EMF, facilities such as those comprising the Project are not expected to have significant impacts to public health and safety. The addition of infrastructure associated with the Project is not expected to add significantly to the presence of EMF exposure in the vicinity. Additionally, the 34.5 kV collector lines will be buried in a trench and therefore, EMF would be confined to a very narrow area around the trench all within the access road right-of-way.

5.8.2.3 Security and Safety

Project construction and operation will have no significant impact on the security and safety of the local community. Some additional risk for worker or public injury will exist during the construction phase, as it would for any large construction project. Work plans and specifications would be prepared to address

worker safety during Project construction and all work completed on the Project will comply with Occupational Safety and Health Administration (OSHA) requirements.

5.8.2.4 Traffic

Motor vehicle traffic near the Project Site would temporarily increase during the construction phase as contractors working in the area establish the new power generation system. The maximum construction workforce is expected to generate approximately 150 additional vehicle trips per day. Using any combination of county highways and roads throughout the Project Site, the impacts are considered negligible. Since many of the area roadways have minimal average daily traffic (ADT), the addition of 150 vehicle trips may be perceptible, but would still be less than seasonal variations such as seasonal tourism and existing traffic resulting from mining operations. Traffic management and control of the local roadways would be considered in the forward planning and implementation of the Project. With these measures, the potential for a traffic fatality is low; consequently, an increase in risk to local residents or increase in injuries and fatalities related to traffic is not anticipated. The Balance of Plant (BOP) contractor's crews will not exceed 75 employees during peak construction across the project site with and average workforce of 25.

5.8.3 Mitigative Measures

5.8.3.1 Air Traffic

The Applicant will light the turbines and meteorological towers to comply with FAA requirements.

5.8.3.2 Electric and Magnetic Fields

No impacts due to EMF are anticipated and therefore no mitigation is necessary.

5.8.3.3 Security

The following security measures will be taken to reduce the chance of physical and property damage, as well as personal injury, at the site:

- In most cases, the towers will be placed at least 750 feet from non public, mine roads and feet from occupied homesteads. These distances are considered to be safe based on developer experience, and are consistent with St. Louis County Planning and Zoning regulations. They also serve to minimize the danger of any ice shedding and reduce noise and shadow flicker.
- Appropriate security measures will be taken during the construction and operation of the Project, including, temporary (safety) and, if necessary, permanent fencing, warning signs, and locks on equipment and wind power facilities.
- Turbines will sit on solid steel enclosed tapered tubular towers in which all electrical equipment will be located (except for the pad-mounted transformer in certain turbine models). Access to the tower is through a solid steel door that will be locked when not in use.
- The Contractor will develop a Health and Safety Plan that will be kept on site during construction.

5.8.3.4 Traffic

The traffic projections for construction will not significantly impact public health and safety because the local roads are designed to carry more than 150 additional trips per day. Therefore, no mitigation is necessary.

5.9 Hazardous Materials

5.9.1 Description of Resources

A thorough regulatory database search for hazardous waste sites as part of the Phase I Environmental Site Assessment (ESA) was conducted to identify any hazardous waste sites, including hazardous substances and petroleum products, within the Project Site. Potential hazardous materials within the Project Site would be associated with logging activities and mining operations, and include petroleum products such as fuel and lubricants.

Based on the results of the ESA, no hazardous substances or petroleum products were observed within the Property Site during the Property reconnaissance. The Applicant does not anticipate encountering any hazardous substances or petroleum products during construction of the Project.

5.9.2 Impacts

Potentially hazardous materials associated with the Project include fluids found in association with turbines and substation/transformer equipment. There will be three types of fluids used in the operation of the wind turbines that are petroleum products. These fluids are necessary for the operation of each turbine and include gear box oil, hydraulic fluid, and gear grease. The transformers contain mineral oil.

5.9.3 Mitigative Measures

Because there are no proposed impacts to hazardous waste sites, including hazardous substances and petroleum products, no mitigative measures are necessary. If any wastes, fluids or pollutants are generated during any phase of the construction or operation of the Project, they will be handled, processed, treated, stored and disposed of in accordance with Minnesota Rules Chapter 7045.

5.10 Effects on Land-Based Economies

5.10.1 Description of Resources

Proximal to the Project Site, forestry and mining are the most important land-based industries. U.S. Steel's Minnesota Ore Operations, located as part of and south of the Project Site, includes the Minntac Mine in Mountain Iron and the Keewatin Taconite Plant, 25 miles to the west. At these facilities, iron-bearing taconite rock is mined and processed into taconite pellets for use in the steelmaking process. In 2003, Minnesota Ore Operations produced 18.7 million tons of taconite pellets. Within the Project Site, land cover consists of forest land owned by U.S. Steel that has not been clear-cut for mining operations. An illustration of the land uses and land cover is shown on Map 4.

5.10.2 Impacts

Due to the Project's location in privately-owned forest land, there will not be a loss of agricultural land as a result of the construction of the wind facility. Additionally, only a very small percent of the total acreage leased for the wind facility is directly impacted by the turbines, foundations, roads, and other infrastructure. The estimated acreage of permanent facilities for the Project is shown in Table 5-6. Turbine micro-siting will include discussions with U.S. Steel to identify features on its property which should be avoided.

Table 5–6 Summary of Total Permanent Surface Disturbance

Facility	Approximate Acres
Turbines	21.5
New Permanent Access Roads	13.5
Operations and Maintenance Building	0.07
Laydown Area (if not reclaimed)	6.0
Collector (feeder) Lines (overhead cleared right-of-way, if any)	2.0
Permanent met Towers	0.8
Total Acres	**43.87**
Percent of Project Area	**9.2**

5.10.3 Mitigative Measures

No impacts to land-based economics are anticipated and therefore, no mitigation is necessary.

5.11 Tourism and Community Benefits

5.11.1 Description of Resources

Tourism is significant within St. Louis County due to the unique combination of natural and industrial resources. Superior National Forest provides vast opportunities for recreation and wildlife viewing. There are also several WMAs and SNAs located in the northern portion of St. Louis County. The Project Site is adjacent to the southern border of Superior National Forest, which generates a great deal of seasonal tourism; however, while the Project Site is near many areas dependent upon seasonal tourism and recreational activities, the majority of forest land and lakes used for recreation are located further north.

The Project Site is located in an area generally known as the Iron Range that includes the cities of Mountain Iron and Virginia. Within the Project vicinity are several resources for visitors to delve into the history of the Iron Range. These resources include the Iron Range Research Center, Iron World and various mine tours and historic points of interest.

5.11.2 Impacts

The Project Site is located in an area directly south of Superior National Forest with the majority of the recreational areas located further north. Additionally, the Project is within U.S. Steel Minntac Mine and while it is not an area used for recreation, many visitors tour the mine. No negative impacts are anticipated to tourism resources. Positive impacts to the community may arise due to the presence of the Project if it becomes a tourist attraction. Communities in southwestern Minnesota have benefited not only from the financial benefits of wind facilities, but have also used them to educate local communities about alternative energy resources and to promote tourism to the area.

5.11.3 Mitigative Measures

No impacts on tourism are anticipated, and as such, no mitigation is necessary.

5.12 Topography

5.12.1 Description of Resources

As a result of periodic glaciations, the topography of the site has relatively moderate, to somewhat steep relief with moderate to good drainage as shown on Map 5. Rolling hills with side slopes ending in drainage ways characterize the Project Site. The Project Site includes relatively high elevations for Minnesota, being located along the Laurentian divide.

5.12.2 Impacts

Wind turbines and access roads will not require significant excavation or fill.

5.12.3 Mitigative Measures

No impacts are anticipated, and as such, no mitigative measures are necessary.

5.13 Soils

5.13.1 Description of Resources

Soils in the Project Site are generally derived from glacial till mantle over bedrock controlled ridges. The primary series identified in the project site include the Eveleth, Conic, Biwabik and Eaglenest Series. These series are generally moderately deep to very deep well drained soils formed in a mantle overlying dense glacial till. None of these soils are considered prime farmland. Surface soil textures are gravelly to very stony sandy loams to loams. The A horizons are generally very thin with moderate organic mater content with weakly developed B horizons to depths of 12 to 24 inches below surface. Depth to Bedrock is often less than 24 inches. Soils are acidic to very strongly acidic and well drained. Soils series are shown on Map 6.

5.13.2 Impacts

Construction activities including road construction and turbine pad excavations will result in surface disturbances throughout the Project Site. Topsoil could become contaminated or lost if protective measures are not taken as an initial step in project construction. Excavations can leave soil exposed and susceptible to wind and water erosion if mitigation measures are not implemented. Increased surface traffic can lead to compaction if soils are moist and mitigation measures are not implemented. Trenching depths may vary due to bedrock conditions.

5.13.3 Mitigative Measures

Initial Project development will include vegetation and top soil removal from areas of permanent disturbance including new access roads and turbine pads. The topsoil will be bladed to the side and placed on top of adjacent soils in a manner that will make it available for future reclamation should these facilities ever be removed.

A National Pollutant Discharge Elimination System (NPDES) permit to discharge storm water from construction activities will be acquired prior to construction from the Minnesota Pollution Control Agency (MPCA). As part of this application, a storm water pollution protection plan (SWPPP) will be developed to minimize soil erosion. This plan will identify best management practices (BMPs) to be employed during construction and operation of the Project to protect topsoil and adjacent resources and to

minimize soil erosion. Practices may include containing excavated material, protecting exposed soil, and stabilizing restored material.

Compaction will be minimized by salvaging topsoil prior to construction and, if necessary, tilling soil as part of the final reclamation treatment measures.

Through implementation of these environmental protection measures, soil erosion, compaction, and other related disturbance will be short-term. With the proper implementation of environmental protection measures intended to prevent, minimize, and/or reclaim soil erosion, compaction, and spill effects, no unmitigated loss of highly productive soil will result from the Project.

5.14 Geologic and Groundwater Resources

5.14.1 Description of Resources

The Project Site is located on a topographic ridge comprising a portion of the Laurentian Divide. This divide represents bedrock exposures or bedrock covered by a thin veneer of glacial sediments. The bedrock ridge is surrounded by glacial till of Wisconsin (Pleistocene) age (Jennings and Reynolds, 2005).

The rocks which comprise the bedrock ridge are part of the Minntac sequence (Jirsa, et al, 2005). These rocks are primarily metamorphic schists of volcanic and intrusive igneous origin of Archean age (>2.5 billion years old). They are generally medium-grained, of amphibolite (intermediate) metamorphic grade, with a strong, planar fabric resulting from the micaceous minerals of which they are largely composed. The attitude and orientation of these planar fabrics should be investigated to ensure that stable foundations are designed for the wind towers.

Mineral deposits in the region are comprised of iron ore deposits hosted in the Biwabik Iron Formation of Proterozoic age (Jirsa, et al, 2005). Because the Biwabik occurs south of the Minntac outcrop belt, mineral development is not expected in the Project Site.

5.14.2 Impacts

Impacts for geologic and groundwater resources are not anticipated. It is probable that Project operations and maintenance requirements will be limited and easily satisfied with a single domestic-size water well. Local groundwater supplies are adequate for the Project.

5.14.3 Mitigation Measures

Wind turbine locations are not expected to impact existing domestic water wells. Also, the turbine tower footings are generally not deeper than 35 feet below ground surface, which in these glacial till sediments is far above the local water table.

5.15 Surface Water and Floodplain Resources

5.15.1 Description of Resources

Surface water and floodplain resources for the Project Site were identified by reviewing U.S. Geological Survey topographic maps and Flood Insurance Rate Maps produced by the Federal Emergency Management Agency (FEMA). An illustration of the hydrologic resources in the vicinity of the Project Site is shown on Map 7. While mapped floodplains were identified within St. Louis County, the Project Site does not appear to intersect major floodplains.

There are approximately 28 lakes greater than 160 acres in size in the vicinity of the Project Site and many rivers have their headwaters in the vicinity. They include the St. Louis River, Cloquet River, and Whiteface River. Water flows southwest, channeled by the drumlins.

5.15.2 Impacts

The Project Site is situated on top of the Laurentian Divide, which does not appear to affect drainages in the area. However, given the small amount of wetlands within the Project Site, floodplains may require further evaluation from a regulatory perspective. During periods of intense rainfall and during spring runoff, many of the upland drainage bottoms may exhibit temporary flooding. On-site or off-site flooding would not likely result from the construction and grading of roads and other facilities related to the Project. Implementation of environmental protection measures such as installation of adequately-sized and appropriately placed culverts, and avoidance of channels and other areas of concentrated flow, would ensure that such on-site or off-site flooding does not occur. The wind turbines will be built on uplands, and this will avoid streams located in topographically lower positions in the landscape.

Risk for contamination of surface waters will be reviewed after determining all final facility locations. Where discharge of hazardous waste or sediment is a risk, mitigation measures will be employed.

5.15.3 Mitigative Measures

If it is determined that the Project will impact Waters of the U.S. or Minnesota Public Waters, the Applicant will apply for the necessary permits prior to construction. Access roads constructed adjacent to streams and drainage ways will be designed in such a manner that runoff from the upper portions of the watershed can flow unrestricted to the lower portions. A NPDES permit application and SWPPP will be prepared by the Applicant and submitted to the MPCA prior to the construction of the Project. Compliance with this permit and the associated SWPPP will ensure that surface water is not adversely affected by runoff from disturbances and construction areas. If required, a Spill Prevention, Control, and Countermeasure (SPCC) plan will be developed and implemented.

5.16 Wetlands

5.16.1 Description of Resources

A site reconnaissance was conducted September 27, 2006 with the objective of characterizing habitats, wildlife, and identifying wetlands and other aquatic sites which could potentially be impacted development of the Project. At the time of this application, a wetlands delineation is in process. Ongoing consultation and the results of these delineations will determine if state or federal wetland development permits will be required. Literature review, queries of state and federal natural resource-related databases, and interviews of state and federal management personnel were the primary sources used for the background investigation.

A search of the National Wetlands Inventory (NWI) database indicated that no large palustrine, or marshy wetlands, are located along the ridge within the Project Site where turbines will be placed. One wetland and two to three drainage features are located in the southwestern corner of the Project Site. However, there are several emergent, forested/shrub and lacustrine wetlands located to the north of the Project Site. These wetlands do not appear to be impacted by the current turbine layout; however, ancillary facilities such as roads and collection lines should be sited to avoid these areas as to the extent practicable NWI wetland resources within the Project Site are depicted on Map 7**.**

5.16.2 Impacts

Temporary impacts to wetlands or waters may occur where access for construction requires installation of temporary crossing structures at channels, wetlands, or other wet areas. If required at these sites, one of the following types of temporary crossings would be constructed:

1) At-grade crossings without dredge or fill of wetlands, possibly including wetland crossings using wooden matting;

2) Culverted crossings using geotextile, coarse rock fill and culverts.

Equipment crossings in wetland areas which do not have defined channels would be restricted to crossing on wooden mats to prevent compression and or disturbance of wetland soils. Areas with water in defined channels would be crossed at temporary, at-grade crossings or culverted crossings to prevent permanent impacts to these areas. Crossing of areas which have a combination of a defined channel and adjacent wetland areas may require the use of wooden mats and installation of a temporary at-grade or culverted crossings. Permanent impacts to wetlands would occur where new access roads or underground collector lines are installed within a wetland or across a channel.

5.16.3 Mitigation Measures

Wetlands will be avoided to the extent practicable during the construction phase of the Project. If wetland impacts cannot be avoided, the Applicant will submit Section 404 and Minnesota Wetland Conservation Act permit applications to the U.S. Army Corps of Engineers (USACE) and the State prior to construction. Wetlands in Minnesota are regulated under a variety of local, state, and federal programs. Many times two or more of these programs have jurisdiction over a particular wetland or waterway. In some cases, various portions of the same wetland will be regulated by different programs.

Where crossings are required, construction activities would include implementation of Best Management Practices (BMPs) to control erosion and otherwise minimize impacts to wetland properties. Fill material placed below the high water mark would be free of topsoil, decomposable materials, and toxic concentrations of persistent synthetic organic compounds. Temporary crossings would be inspected as needed in accordance with applicable BMPs.

Temporary crossings would be removed immediately when they are no longer needed. All construction materials (e.g., rock, geotextile fabric, culvert, etc.) would be removed and the site would be restored to its original grade. The disturbed area would be smoothed and appropriately stabilized with silt fence or erosion control blankets as necessary to control erosion. The site would be seeded with local native species adapted to site conditions as necessary to promote prompt revegetation. Due to the temporary nature of impacts, it is likely that onsite propagules (e.g., living plants and seeds) would regenerate vegetative cover similar to that found prior to the disturbance without additional seeding. Silt fences would remain in place to continue capturing sediment until the crossing site is fully stabilized and revegetated as determined in consultation with USACE. Soils at risk of erosion would be identified prior to disturbance and the need for placement of additional silt fence or erosion control matting would be evaluated and implemented as needed.

If required by agencies governing wetland resources, off-site mitigation of wetland losses will be employed to reduce the overall effect of the Project. The Applicant will work with local, state, and federal agencies to minimize or avoid disturbances which would require mitigation through creation of new wetlands.

5.17 Vegetation

5.17.1 Description of Resources

The Project is located in an area primarily comprised of native deciduous forest, where aspen (*Populus* sp.), paper birch (*Betula papyrifera*), maple (*Acer* sp.), and balsam poplar (*Populus balsamifera*) characterize the community known as an Upland Deciduous Forest, and is distinguished by the mix of deciduous species. Covering a smaller extent of the Project Site is an Upland Shrub/Tree vegetation community which is characterized by low-growing deciduous woody plants and trees which include maple (*Acer* sp.) and basswood (*Tilia* sp.). Agricultural land is virtually non-existent within the Project Area. A summary of the various land uses and cover types in the Project Site is provided in Table 5-7.

5.17.2 Impacts

Some of the wind turbine sites are located in areas of shrubby vegetation on the plateau. Access roads and supporting infrastructure will be designed to minimize impacts to plant communities to the extent practicable.

5.17.3 Mitigation Measures

The Applicant will mitigate its impacts by revegetating areas of temporary disturbance as quickly as practicable. Approval with the property owner will be negotiated prior to any removal of trees during construction. The property owner may engage in ongoing forest management activities throughout the lease area.

5.18 Wildlife

Due to the migratory and transient behavior of many of the wildlife species within the region, the information presented includes a discussion of wildlife resources within the Project Site, as well as at a regional level. The status and distribution of wildlife species was determined based on the completion of a background investigation and a site reconnaissance. A site reconnaissance was conducted September 6, 2006 with the objective of characterizing habitat and species observed during the visit are listed in Table 5-8. Wetlands, aquatic sites, and other areas of valued wildlife habitat which could potentially be impacted by the proposed development were identified. Literature review, queries of state and federal natural resource related databases, and interviews of state and federal management personnel were the primary sources used for the background investigation related to species potentially found in the Project Site. Query letter responses are included in Appendix C. The following section does not include a discussion on wildlife species listed as threatened, endangered or of special concern by state or federal management agencies. Refer to Section 5.19, Rare and Unique Natural Resources, for information on these resources.

Wildlife use of the Project Site is largely affected by the types of habitat found there. The dominant land cover is deciduous forest land and some areas of shrub range land. Agricultural land is virtually non-existent within the Project Site. Woody cover-types provide food, hiding and thermal cover, and nesting habitats for a variety of species, especially migratory birds. Resident and migratory birds, mammals, reptiles and amphibians, and insects occupy the region both continually and intermittently throughout the year.

Table 5–7 Wildlife Species Observed within the Project Site (September 6, 2006)

Common Name	Scientific Name
Birds	
Northern Flicker	*Colaptes auratus*
Mallard	*Anas platyrhynchos*
Ruffed Grouse	*Bonasa umbellus*
Double Crested Cormorant	*Phalacrocorax auritus*
Common Raven	*Corvus corax*
America Robin	*Turdus migratorius*
Canada Goose	*Branta canadensis*
Northern Harrier	*Circus cyaneus*
Gull	*Larus sp.*
Song Sparrow	*Amphispiza belli*
Common Loon	*Gavia immer*
Slate-Colored Junco	*Junco hyemalis*
Mammals	
White-Tailed Deer	*Odocoileus virginianus*

5.18.1 Description of Resources

5.18.1.1 Resident and Migratory Birds

The Project Site lies within the Mississippi Flyway, which is the longest flyway, stretching more than 3000 miles from the arctic coast of Alaska to the Gulf of Mexico. The Flyway is heavily utilized by numerous species of birds during the spring and fall migrations. These include many species of waterfowl (i.e., ducks, geese and swans), shorebirds, songbirds, and raptors. Waterfowl, raptors, shorebirds, and grassland bird species are likely to migrate through the area in the vicinity of the Project on a seasonal basis. Also, based on the number and types of wetlands present in the vicinity of the Project Site, these habitats are likely to provide nesting and migration stopover habitat for large numbers of breeding waterfowl or shorebirds. However, there appear to be no nesting or migration stopover habitat within the Project Site.

A variety of raptor species are both common spring and fall migrants and residents during the breeding season. Raptor species likely or known to occur within the Project Site are the red-tailed hawk (*Buteo jamaicensis*), northern harrier (*Circus cyaneus*), Cooper's hawk (*Accipiter cooperii*), rough-legged hawk (*Buteo lagopus*), broad-winged hawk (*Buteo platypterus*), red-shouldered hawk (*Buteo lineatus*), bald eagle (*Haliaeetus leucocephalus*), merlin (*Falco columbarius*), osprey (*Pandion haliaetus*), and American kestrel (*Falco sparverius*). The turkey vulture (*Cathartes aura*), northern hawk owl (*Surnia ulula*), snowy owl (*Nyctea scandiaca*), barred owl (*Strix vari*), and great horned owl (*Bubo virginianus*) may also occur in the vicinity of the Project Site. Also, the large lakes in the area, including a complex of lakes and reservoirs to the south including Two Rivers and Twin Rivers Reservoirs likely contain abundant tree roosting and nesting habitat for bald eagles and provide foraging sites. Marsh areas may also be attractive to rodent prey species utilizing associated seed as food resource.

5.18.1.2 Mammals

The wood lands and wetland areas provide habitat for a variety of large and small mammals that inhabit the Project Site. Native flora provides year round food sources and thermal/hiding cover for species.

Smaller mammals occupying the grassland and woody vegetation areas provide a food source for larger carnivorous and omnivorous mammals and birds.

White-tailed deer, the dominant big game species in the area, favor the wooded areas in the region for cover. A review of the MNDNR Deer Population Model for spring pre-fawning (2006) indicates that deer density within St. Louis County range from as few as one deer to as many as 15 deer per square mile. A list presented in Appendix D identifies mammals that can be expected to occupy the Project Site throughout the year.

5.18.1.3 Reptiles and Amphibians

Several reptile and amphibian species may use the wetland and deciduous forested areas within the region. However, the majority of these species would be concentrated in wetland or aquatic habitats and these habitats are limited within the Project Site.

5.18.2 Impacts

General Wildlife Impacts

Construction activities that remove vegetation and disturb soil may cause direct impacts to individuals of less mobile species (e.g., small mammals, amphibians, reptiles) through direct mortality or displacement and exposure to predators). Permanent habitat loss from construction of access roads and tower foundations would be minimal and restricted to localized areas, while other construction disturbances would be temporary. Revegetation of areas disturbed by the Project would mitigate these short-term effects. More mobile species (medium to large mammals and birds) would be expected to disperse from the area of disturbance and re-enter the area following the completion of construction.

Disturbance to wildlife due to noise, vehicles, and human presence would be localized and of short duration. Vehicles traveling on access roads could kill small mammals, reptiles, or birds, though more mobile species would be able to avoid impacts from vehicles. Nests of ground-nesting birds could be impacted by vehicle traffic if construction activities occur during spring and early summer months when birds are nesting. However, these losses are not expected to cause a significant decline in overall wildlife populations. Therefore, no significant impacts are expected to occur.

Avian/Bat Impacts

Summary of National Wind Turbine/ Avian and Bat Mortality Data
Nationwide, the potential for avian mortality has been addressed by selecting project locations outside of known concentrations of birds and by adjusting turbine sites within the project location to avoid sensitive avian habitats. Despite these efforts, mortality to birds resulting from collision with wind turbines has been documented (Nelson and Curry 1995; Osborn et al. 2000). Studies conducted prior to 2004 indicate an average of 2.3 avian fatalities per turbine per year in the U.S. outside of California and 2.7 per turbine per year in the Upper Midwest for all species combined. These studies have shown that raptor fatalities average 0.03 per turbine per year across the U.S. outside of California (NWCC 2004). Avian collisions with turbines may be influenced by such factors as annual migration and local movement patterns, turbine size, and weather.

Expected Impacts to Avian and Bat Species at the Project
Bird/Turbine interactions are determined by a number of factors including visibility and weather, with increased bird and turbine interactions occurring at night and in inclement weather. Inclement weather and low cloud ceilings force migrating birds to fly at reduced altitudes, thereby putting them at greater

risk for adverse interactions with turbines, turbine towers and support infrastructure (National Wind Coordinating Committee [NWCC] 2004). Most migrating waterfowl fly several thousand feet above ground level (e.g., 2,000 feet for Canada geese), which is well above the rotor swept area of the turbines. The greatest risk would be for those birds that stop over in the vicinity of the Project Site, since they would be flying at lower altitudes while ascending and descending. However, there is no literature that indicates that waterfowl are particularly vulnerable to collisions with tall, manmade structures.

Reports describing avian mortality at wind energy facilities were reviewed during the analysis of the Project. The Buffalo Ridge Study (WEST 2000) and Top of Iowa Study (TOI; Koford et al. 1985) were the primary avian mortality studies reviewed. Summaries of these studies and their findings are presented in Appendix D. These studies identified several site-specific factors that warrant consideration in the context of the Project. The following section presents details of both studies and the implications of those findings regarding the potential effects of the proposed project on birds and bats.

Buffalo Ridge Study

Buffalo Ridge is currently one of the largest wind energy center outside of California with a total of 354 wind turbines in operation. Buffalo Ridge is a segment of the 62-mile-long Bemis Moraine, which is located in Lincoln and Pipestone Counties in southwest Minnesota and Brookings County, South Dakota. Buffalo Ridge is located in the Coteau des Prairies, a major physiographic landform consisting of terminal moraines and stream-dissected lands. Habitats in the study area were characterized as being primarily agricultural crops including corn, soybeans, small grains, hay and pasture, and CRP set-asides planted to a mixture of smooth brome and alfalfa or to monocultures of switchgrass. During the four-year study period, much of the land previously enrolled in the CRP program was put back into crop production. Relatively minor vegetation types in the study area include deciduous woodlots associated with farmsteads, wooded ravines, and wetlands.

- Buffalo Ridge is not located in a major waterfowl staging area or along significant waterfowl migration routes.
- Bird detections during point-count surveys at the Buffalo Ridge sites were lower than eight other sites monitored during 1996.
- Data indicated that the Buffalo Ridge site received comparably less use by nocturnal migrants than other areas sampled in west-central and southwestern Minnesota.
- The intensive agriculture within Buffalo Ridge provides habitat different than habitat present at the Project Site. The Buffalo Ridge site is located in an area where intensive modifications have been made to the natural environment to facilitate agricultural production.
- During the four-year Buffalo Ridge study, thirty-one avian fatalities of 15 species were found on reference plots and fifty-five windfarm-related avian fatalities comprised of at least 31 species were found (Johnson, et.al., 2002).
- Avian fatalities associated with wind turbines were found to be 76.4 percent passerines, 9.1 percent waterfowl, 5.5 percent waterbirds, 5.5 percent upland gamebirds, 1.8 percent raptors and 1.8 percent shorebirds.
- A total of 184 bat fatalities were found in 1998 and 1999 within the three wind development areas. Bat mortalities were all found associated with turbines and appeared turbine-related. Hoary bats were the most common fatality.

Top of Iowa Study

The Top of Iowa (TOI) Wind Farm is located near Joice in Worth County, Iowa and was completed in December 2001. The facility is composed of 89 turbines mounted on 235-foot high tubular towers. Each turbine is equipped with three 85-foot blades. Blade speed at the tips is approximately 130 mph.

The TOI site is centrally located near three large, state-owned WMAs which provided a wide variety of habitat under state management (wetland, grassland and forest habitat). The proximity of these WMAs provides attractive habitat for migrating birds in an otherwise intensively farmed region of northern Iowa. In addition, the complex of the three WMAs provides important avian breeding habitat, particularly for wetland and grassland bird species. The Project Area has exhibited historically high bird use with migrant and resident shorebirds, rails, raptors, sparrows and icterids historically moving between the WMAs. These movements routinely take them through the area that is now occupied by the windfarm. The quality of the habitat, coupled with the location of a portion of the windfarm in an area that has been closed to Canada goose hunting for 30 years, results in high Canada goose usage at the TOI site.

Important site-specific factors at the TOI site include:

- The habitat present around the TOI is vastly superior in both quality and quantity to both the Buffalo Ridge and the Project Site.
- The proximity of the TOI site to three Iowa WMAs has been demonstrated to increase avian and bat usage within and near the Project Site.
- The TOI study demonstrated that the location of a wind energy facility near and within habitat that experiences high avian usage does not seem to adversely affect avian use at turbine sites.
- High avian use of the TOI site is an important consideration when making comparisons and extrapolating potential avian and bat interactions to the Project Site.
- Windfarm-related mortality during 2003 and 2004 was a total of seven birds. In 2003, two bird deaths, a yellow-throated vireo and a tree swallow, were attributed to interactions with windfarm infrastructure. In 2004, five bird deaths (yellow-headed blackbird, red-tailed hawk, golden-crowned kinglet and two carcasses of unidentifiable bird species) were attributed to interactions with windfarm infrastructure.
- Windfarm-related bat mortality during 2003 and 2004 was 74 bats. In 2003, 30 bat deaths (hoary, red, little brown, big brown and silver-haired bats) were attributed to interactions with windfarm infrastructure. In 2004, 44 bat deaths (hoary, red, little brown, big brown, silver-haired and eastern pipistrelle bats) were attributed to interactions with windfarm infrastructure.
- Avian interactions and mortality were low, given the high avian use of the Project Site. However, investigators found that bat mortality numbers at the TOI site may be cause for concern.

Overall Impacts to Wildlife

Development of the Project, including the construction and operation of the Project, is expected to result in minimal impacts to wildlife and would not reduce the viability of wildlife populations. Some small-scale displacement of wildlife is expected during construction; however, wildlife would likely reoccupy impacted areas shortly after completion of construction activities. Available habitat in the Project Area would be reduced slightly, but the reduction would be a small percentage of the entire area. Operation and maintenance will not significantly change the existing land use or have an effect on species within the Project Site. While it is likely that there would be impacts to individual birds because of collisions with wind turbines and/or transmission lines of the proposed Project, there is no evidence available that indicates that the proposed location or Project facilities present a high risk for impacts to wildlife populations at the site. Fewer larger towers are expected to result in fewer bird and bat strikes.

5.18.3 Mitigation Measures

During consultations with the USFWS, the primary environmental concerns expressed were potential for impacts to wetlands, streams, and forested areas. In addition to minimizing disturbances to these resources, the USFWS recommended implementing the Interim Guidelines to Avoid and Minimize Impacts to Wildlife from Wind Turbines (USFWS 2003). Several of the recommendations made in these guidelines are proposed as part of the Project design. Such proposed mitigation measures include:

1. The Project Site has been selected, in part, due to the low use of the area by migratory birds and relatively low value of the area for wildlife habitat relative to sites in other portions of the state.
2. Facilities have been sited in locations where impacts to locally important habitats (e.g., wetlands and grasslands) are minimized.
3. Surface disturbances and above-ground facilities have been minimized to the extent practicable.

Based on implementation of these, no significant impacts to wildlife would be expected to occur due to the construction and operation of the proposed Project.

5.19 Rare and Unique Natural Resources

5.19.1 Description of Resources

For the purpose of this discussion, Rare and Unique Natural Resources are considered to be those species identified as threatened, endangered, candidate or sensitive by state and federal management agencies, or other natural resource features identified by state or federal management agencies to be unique within the region of the Project Site.

The Endangered Species Act of 1973, as amended, requires protection of those species federally listed as threatened or endangered, as well as protection of habitat designated as critical to the recovery of those listed species. Projects that could potentially have an adverse effect on listed species or critical habitat require consultation with the USFWS.

The MNDNR maintains a Natural Heritage Database (NHD) through their Natural Heritage Program and Non-Game Wildlife Program, which is the most complete source of data on Minnesota's rare, endangered, or otherwise significant plant and animal species, plant communities, and other natural features. The results of a NHD query letter for the Project Site and a one mile buffer search radius found that there are no documented sightings of federally threatened or endangered species within the Project Site or search radius (MNDNR 2005). The following section summarizes species that are federally listed and/or state threatened.

5.19.1.1 Bald Eagle (Federal Threatened, State Threatened)

Currently 680 pairs of bald eagles (*Haliaeetus leucocephalus*) nest in Minnesota. Bald eagles typically build nests in large trees and snags in view of large bodies of water that support fish populations. In Minnesota, bald eagles are found primarily in the north central part of the state and along the Mississippi River. Resident bald eagles live near large bodies of open water such as lakes, marshes, seacoasts and rivers, where there are plenty of fish to eat and tall trees for nesting and roosting. During winter, eagles will migrate to southern states and will congregate near waters which are free of ice and roost in communal groups at night. Large bodies of water near the Project Site include several tailings ponds to the northeast and a complex of lakes and reservoirs to the south, including Two River and Twin River Reservoirs. Active bald eagle nests are known to occur within the vicinity of the Project Site

(MDNR 2006). Bald eagles may occur as seasonal or as permanent residents, foraging and/ or nesting in the vicinity of the Project Site. During the site visit, suitable bald eagle nesting and foraging habitat was observed within the Project Site. Anecdotal information acquired from mine employees indicates that bald eagles have been observed in the vicinity of the Project.

5.19.1.2 Canada Lynx (Federal Threatened)

The lynx (*Lynx Canadensis*) was once hunted and trapped in Minnesota, but due to declining numbers, the lynx has been protected in Minnesota since 1984. In 2000, USFWS classified the lynx as a "federally threatened species." Lynx live in dense forests across northern Canada, in the northern extremes of Minnesota and Maine, and in mountainous regions of the northwestern U.S. Snowshoe hares are the main prey, but birds and small mammals are also eaten. The lynx typically will not occur when snowshoe hares are absent. There have been a total of 102 lynx sitings in St. Louis County, many occurring in the Superior National Forest just north of the Project Site (MDNR 2006). Canada lynx may potentially occur within the Project Site.

5.19.1.3 Gray Wolf

There are about 2,500 gray wolves (*Canis lupis*) in Minnesota, a federally protected animal since 1972. Wolves eat a variety of large and small animals, but white-tailed deer make up approximately 80 percent of their diet. Beaver are often taken in the spring and summer, while deer, and a few moose, are taken more frequently in winter. In areas of mixed farms and forest, domestic livestock are sometimes preyed upon. However, wolves prefer the large, extensive forest areas of northern Minnesota. Gray wolves may potentially occur within the Project Site. During the site visit, candid scat consistent with gray wolf was observed within the Project Site. Anecdotal information acquired from locals who frequent the area indicates gray wolf have been observed in the vicinity of the Project Site. In March 2007, the gray wolf was delisted in Minnesota.

5.19.2 Unique Natural Resources

Lands that are managed or preserved for their unique qualities include SNAs, WMAs and State and National parks. The objectives of these areas include: preservation of the ecological diversity of Minnesota's natural heritage, including landforms, fossil remains, plant and animal communities, and rare and endangered species; or other biotic features and geological formations for scientific study and public edification as components of a healthy environment. The Project Site is privately owned and does not contain these management areas. However, several of these state properties are within the region of the Project Site.

The SNA Program's goal is to ensure that no single rare feature is lost from any region of the state. This requires protection and management of each feature in sufficient quantity and distribution across the landscape. There are no SNAs within the Project vicinity, with the closest being Lost Lake Peatland SNA located 19 miles to the northeast as previously noted in this document.

Great Scott WMA is located 12 miles southwest of the Project Site. WMAs are areas managed to provide recreation and wildlife habitat for a variety of game and non-game species. These areas are predominantly used for hunting; however, they are increasingly being used for wildlife viewing. For more information on these areas, see the Recreational Resources section of this document.

The Superior National Forest is located within the Project vicinity approximately one mile north of the Project Site.

5.19.3 Impacts

The Project would not impact any federal- or state-listed threatened or endangered species. As previously discussed, the site reconnaissance, consultation with the USFWS (USFWS 2005), and the query of the NHD indicate that there are no federal threatened or endangered species documented to occur within the Project Site. Likewise, these sources indicate that the state-listed or rare species that could potentially occur within the Project Site are species associated with and dependent on wetlands and aquatic areas. Impacts to these areas will be minimal and avoided where practicable. In addition, a variety of mitigation measures will be implemented to avoid and minimize impacts to all wildlife species. For more discussion on mitigation measures, see the Wildlife section of this document.

Unique resources, such as state management areas and recreation areas, will not be directly impacted by the Project. However, some of the areas may experience indirect impacts, most notably, visual impacts to recreation areas.

5.19.4 Mitigative Measures

There is a variety of mitigation measures associated with various resource areas that will assist in minimizing impacts to rare and unique natural resources. The mitigation measures associated with the Wildlife section, Recreation Resources and Visual Resources are all measures that will protect Rare and Unique Natural Resources. Some specific proposed mitigative measures are:

- Turbines will not be located in biologically sensitive areas such as, relict prairies, or in close proximity to WMAs, and impacts to important habitats will be avoided where practicable.
- Existing roads will be used for construction and maintenance where possible, and the extent of new road construction will be minimized;
- Access roads created for the Project will be located, to the extent practical, on gentle grades to minimize visible cuts and fills; and
- Temporarily disturbed areas will be reseeded, if necessary, to blend in with existing cover and land uses.

5.20 Summary of Impacts

The majority of potential impacts will be mitigated through implementation of BMPs and compliance with applicable permits. However, some impacts are unavoidable and are discussed further below.

5.20.1 Visual Impacts

The wind turbine arrays will be prominent features in the landscape. By design, these structures are placed in open areas of higher elevations. Some mitigative measures can be implemented to somewhat limit visual impacts. However, there is no way to make these structures unnoticeable. The degree to which the visual impacts are considered adverse is subjective, and can be expected to vary depending on the viewer's perspective.

5.20.2 Commitment of Land and Associated Resources

The Project Site includes a total of 475 acres of land. Of the 475 acres, only approximately 44.acres (9.2 percent) of this area will be permanently occupied by the project facilities including turbines, foundations, roads, and other infrastructure. Areas not included in this total could continue to be used in their current manner.

5.20.3 Noise

When in motion, the wind turbines emit a perceptible sound. The level of this noise varies with the speed of the turbine and the distance of the listener from the turbine. On relatively windy days, the turbines create more noise. However, the ambient or natural noise level simply from the wind tends to override the turbine noise as distance from the turbines increases. Noise at residences and the most probable locations of receptors (e.g., public roads) will be less than the MPCA standards.

5.20.4 Impacts to Wildlife

Birds and bats have been documented to occasionally collide with wind turbines at other sites and there is potential for such collisions to occur at this proposed Project. Given that the species commonly found in the Project Site are not of limited distribution or population, mortality associated with these collisions is not likely to result in impacts on a population scale. While wildlife habitat in the Project Site is of low quality, to the extent habitat is lost from construction of Project facilities, some impacts to wildlife will occur. Overall, the impact of the Project on wildlife is expected to be minimal.

6.0 CONSTRUCTION

Several activities must be completed prior to the proposed commercial operation date. The majority of the activities relate to equipment ordering lead-time, as well as design and construction of the facility. Below is a preliminary schedule of activities necessary to develop the Project. Pre-construction, construction, and post-construction activities for the Project include:

- Ordering all necessary components including towers, nacelles, blades, foundations, and transformers;
- Final turbine micrositing;
- Complete survey to microsite locations of structures and roadways;
- Conduct geotechnical soil/bedrock borings, testing and analysis to support foundation and road design, electrical parameters and chemical compatibility;
- Complete design of foundations, collection system, and roads;
- Complete construction of access roads;
- Complete construction of Operations & Maintenance Building
- Construct underground electric feeder lines and install underground communication cables;
- Construct, if necessary, any overhead portion of the electric feeder lines (not expected to exceed 1000 feet in total)
- Design and install the Step-up Transformer at the Minntac Substation;
- Install tower foundations and grounding;
- Erect wind turbine towers;
- Conduct and accept facility testing; and
- Begin commercial operation.

Access roads will be built adjacent to the towers, allowing access to the turbines during and after construction. These roads will be approximately 35 feet wide during construction activities and have an aggregate surface as cover and be able to support a track mounted crane. The specific turbine placement will determine the amount of private roadway that will be constructed for the Project.

During the construction phase, several types of light, medium and heavy-duty construction vehicles will travel to and from the site, as well as private vehicles used by the construction personnel. MP estimates that there will be approximately 150 trips per day (based on five crews generating 30 trips per day) in the area during peak construction periods. That volume will occur during the peak time when the majority of the road, foundation and tower assembly are taking place. At the completion of each construction phase this equipment will be removed from the site or reduced in number.

6.1 Construction Management

MP will be primarily responsible for the construction management of the Project. MP will use the services of local contractors, where possible, to assist in Project management as follows:

- Arrange wind turbine shipping;
- Inspect all shipped components and parts;
- Secure building, electrical, grading, road, and utility permits;
- Perform detailed civil, structural and electrical engineering;
- Schedule execution of construction activities;
- Complete surveying and geotechnical investigations; and
- Forecast Project labor requirements and budgeting.

MP will serve as the key contact and interface for subcontractor coordination. MP will coordinate materials receiving, inventory and distribution. They will also oversee the installation of roads, concrete foundations, communication and power collection lines, as well as erect the wind turbines, the 690 V/34.5 kV step-up transformers and the 34.5/115 kV step-up transformer at the Minntac Substation and build the maintenance building. The Project will be constructed under the direct supervision of an on-site construction manager with the assistance of BOP with local contractors.

The construction team will be on site to handle materials purchasing, construction, quality control, testing and start-up. MP will manage the BOP to complete all aspects of construction.

Throughout the construction phase, ongoing coordination occurs between the construction manager and the BOP construction teams. The MP construction manager will also to coordinate all communication between local officials, citizens groups, and US Steel.

Before the Project becomes fully operational, an Operations and Maintenance (O&M) staff will be hired and become familiar with the project site and operations. The construction manager and the O&M staff manager will work together to ensure a smooth transition from construction through wind facility commissioning and operation.

6.2 Wind Facility Construction

The completion of the Project will require various types of civil work and physical improvements to the land. The construction consists of the following tasks:

- Site development (staking wind facility layout);
- Construct access roads;
- Construct tower and turbine foundations;
- Install electrical and communications systems;
- Construct step-up transformer and Operations & Maintenance Building
- Tower assembly and erection;
- Plant Commissioning; and
- Site Clean-Up.

6.2.1 Geotechnical Investigations

The Balance of Plant (BOP) contractor will conduct a detailed geotechnical investigation to identify subsurface conditions which will dictate the design of the turbine foundations, underground trenching, and electrical grounding systems. Based on a literature review, the Laurentian Divide ridge is hard bedrock and should provide excellent foundation support. A track-mounted drill will bore to a nominal depth of 10 to 40 feet deep depending on rock depth. Testing will be done to measure the bedrock's physical, chemical and electrical properties. The geotechnical investigations will be used to determine the best foundation design (either typical spread mat footing, rock anchor design, or a rock socket design); to ensure a proper grounding system design and cable ampacities for the soil thermal and electrical characteristics and to determine the bedrock corrosivity to electrical and concrete components.

6.2.2 Access Roads

The BOP contractor with local contractors will be responsible for clearing the Project Site in the vicinity of the turbines, collector lines and access roads. Prior to construction, ongoing forest management activities conducted by the landowner may clear trees from much of the Project Site. As necessary,

remaining trees and shrubs will be removed to facilitate Project construction activities. These trees will be utilized or disposed of in accordance with landowner requirements. A surveyor will stake all turbine locations, laydown area, clearing limits of the access roads, and the Operations & Maintenance Building.

The BOP contractor will hire a local contractor to construct access roads. Road construction will be performed in multiple phases beginning with rough grading and leveling. The vegetative subgrade will be removed to approximately 8 inches below the surface. A geotextile fabric may be installed and then a clean gravel layer will be placed, graded and compacted. Stormwater controls such as hay bales, silt fences, diversion ditches, and culverts will be be installed in accordance with local, state and federal regulations. The roads will be approximately 35 feet wide and will be designed to accommodate a track-mounted crane to assist in the assembly and erection of the wind towers.

6.2.3 Foundations and Transformer Pads

Upon completion of the access roads, turbine foundation construction will begin. First, a laydown area measuring 360 feet in diameter will be cleared for each turbine. A tackhoe or dozer will be used to excavate the foundation or remove the overburden off the ledge rock. Blasting may be required to level the foundation area or remove fractured ledge rock.

The foundation will also serve as the base for the step-up transformer which steps the voltage from 690 volts to 34.5 kV. The bus cabinet and control panels will be installed in the step-up transformer. Mat type foundations for similar sized turbines are approximately 50 by 50 feet across at the base, and extend 7 to 10 feet below grade. The footprint of rock anchor foundations will be less depending on the results of the structural analysis. For each turbine location, a 60 foot by 100 foot gravel surfaced crane pad will be built. The results of the geotechnical analysis, turbine tower load specifications, and cost analysis will determine the type of foundation design. The wind turbine foundation design will be prepared by a registered professional engineer licensed to practice in the State of Minnesota.

6.2.4 Collection System

Upon completion of the roads, turbine foundations and transformer pads, either a trench approximately three feet wide and four feet deep or a raised berm will be constructed to allow for direct burial (plowing) of the 34.5 kV collector cable. The exact detail will be determined based on depth of bedrock at the site, which will be determined during the geotechnical investigation. The trench or berm will be staked in the field and generally located ten feet from the edge of the access road. Cables rated at 34.5 kV will be installed into the trench along with a fiber optic cable. The fiber optic cable is designed to convey operations information from the turbines to the SCADA system. The cables will be connected to the step-up transformers at each turbine. The cable will be connected to the 34.5/115 kV transformer at the Minntac Substation to step the voltage from 34.5 kV to 115 kV. After the electrical system is inspected and tested, a clean fill such as sand will be used to cover and protect the cables. Excess material will be rough-graded onsite. Depending on final engineering design, the 34.5 kV collector system would be installed almost entirely underground to its interconnection to the Minntac Substation, or the length (not to exceed 1000 feet) would be constructed as an overhead line spanning the Minntac Mine haul road located between the Project Site and the Substation. If an overhead line is necessary, it would accommodate vertical clearances for US Steel haul trucks, as well as meeting requirements of the National Electric Safety Code (NESC).

6.2.5 Step-Up Transformer at the Minntac Substation and Maintenance Building

Separate subcontractors will be hired to install the 115 kV/34.5 kV transformer and the Operations & Maintenance Building. The step up transformer components will be delivered to the site on a flat-bed

transport truck. The work will start with the construction of several foundations for the transformers, steel buss work, and electrical connections for the terminations. Once the construction is complete, an inspection and commissioning test plan will be conducted in support of energizing the Project.

Similarly the maintenance building will begin construction at the same time. The initial work will entail clearing and grubbing the site, grading the area, and then constructing the building. Both structures will require the use of track-hoe, front-end loaders, bull dozers, small cranes and boom-trucks, concrete trucks, cable spool trucks, bucket trucks, and winch trucks.

6.2.6 Wind Turbine Assembly and Erection

The wind turbines consist of three main components: 1) the tower 2) nacelle, and 3) rotor blades. All turbine components will be delivered to the Project site on flatbead transport trucks and off-loaded at each individual turbine site. The nacelle will be constructed with the assembly of the rotor, connection and internal cables. Also, the rotor blades (3) will be attached to the nacelle. The tower comes in four sections and will be assembled in place one section at a time. Each tower section will be lifted into place with the track mounted crawler crane. Once the tower and pedestal are in place, the base section of the tower will be bolted to the pedestal. Each successive tower section will be bolted to the previous one until all four sections are in place. The crane will lift the nacelle followed by the rotor. These will be secured in place and all electrical controls will be checked for continuity.

6.2.7 Site Restoration

Site restoration will begin after all of the heavy construction work has been completed and weather is suitable. Disturbed areas beyond gravel areas will be seeded/mulched, as necessary, to control erosion by water and wind. Other restoration activities will include finishing the maintenance building, washing turbine towers, painting scratches on towers and exposed bolts.

7.0 COMMISSIONING

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

8.0 PROJECT OPERATION AND MAINTENANCE

The Project includes a computer-controlled communications system (SCADA) that permits automatic, independent operation and remote supervision, thus allowing the simultaneous control of many wind turbines. Each wind turbine in the Project will communicate directly with the SCADA system for the purposes of performance monitoring, energy reporting and trouble-shooting. Under normal conditions each wind turbine operates autonomously, making its own control decisions. The SCADA system offers access to wind turbine generation or production data, availability, meteorological, and communications data, as well as alarms and communication error information. Performance data and parameters for each machine (generator speed, wind speed, power output, etc.) can also be viewed, and machine status can be changed. There is also a "snapshot" facility that collects frames of operating data to aid in diagnostics and troubleshooting of problems.

The Project will be operated and maintained by Clipper during the two year base warranty period. Following that time, MP will operate and maintain the project. However, MP will be responsible for Project operation and maintenance for the remaining life of the Project. MP will contract with the most appropriate supplier of operations and maintenance services at the time of operation to assure timely and efficient operations. MP will maintain a computer program and database for tracking each wind turbine's operational history. At some stage of operation the management and ownership may be transferred to the Mountain Iron Economic Development Authority under the CBED Statute.

8.1 Maintenance Schedule

MP & Clipper will remotely monitor the Project on a daily basis. Several daily checks will be made in the first three months of commercial operation to see that the Project is operating within expected parameters.

Once installed, the Project service and maintenance is carefully planned and divided into the following intervals:

- First service inspection (Clipper / MP)
- Semi-annual service inspection (Clipper / MP)
- Annual service inspection (Clipper /MP)
- Two years service inspection (Clipper / MP)
- Five years service inspection (MP)

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

Semi-Annual Service Inspection. Regular service inspections commence six months after the first inspection. The semi-annual inspection consists of lubrication and a safety test of the turbine.

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

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

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

8.2 General Maintenance Duties

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

- Maintenance on the wind turbines and on the mechanical, electrical power, and communications system;
- Performance of all routine inspections;
- Maintenance of all oil levels and changing oil filters;
- Maintenance of the control systems, all Project structures, access roads, drainage systems and other facilities necessary for the operation;
- Maintenance of all field maintenance manuals, service bulletins, revisions, and documentation for the Project;
- Maintenance of all parts, price lists, and computer software;
- Maintenance and operation of the Step-up Transformer;
- Provide all labor, services, consumables, and parts required to perform scheduled and unscheduled maintenance on the wind facility, including repairs and replacement of parts and removal of failed parts;
- Manage lubricants, solvents, and other hazardous materials as required by Local and/or State regulations;
- Maintain appropriate levels of spare parts in order to maintain equipment. Order and maintain spare parts inventory;
- Possess ability to rent or secure all necessary equipment including industrial cranes for removal and reinstallation of turbines;
- Hire, train, and supervise a work force necessary to meet the general maintenance requirements; and
- Implement appropriate security methods.

8.3 Operations & Maintenance Building

The preliminary location and layout of the Operations & Maintenance Building will be located approximately 1,000 feet south of Turbine 5. Typically buildings used for this purpose are approximately 3,000 to 4,000 square feet in size, which house all the necessary equipment to maintain the Project. A septic system and a well may be installed near the building if allowed by the US Steel. The septic system or any other facility will be maintained by a liscensed local contractor on a regular basis.

9.0 COST ANALYSIS

MP has estimated the costs using typical wind design, construction and operation data to be approximately $50,000,000. A service life of 25 years has been assumed to estimate annualized capital costs. MP will submit a separate filing with the Commission seeking current cost recovery of these costs as allowed under Minn. Stat. § 216B.1645 and its Renewable Resources Rider.

10.0 PROJECT SCHEDULE

The tentative project schedule is listed below. However, a later delivery of Clipper turbine components or a delay in receiving the site permit may result in delaying the Project completion. In addition, if adverse weather conditions arise (high wind or cold temperatures) during construction or turbine erection this too may adversely impact the schedule resulting in delays. The Clipper turbine components must arrive on site prior to March 1, 2008 otherwise road weight restrictions may delay the delivery by up to 3 months. The most aggressive schedule is listed in Table 10-1; however, a delayed schedule could result in wind facility Commercial Operation as late as August 2008.

Table 10–1 Anticipated Project Schedule

Task	Anticipated Date
Receive Site Permit	September 2007
Collector Construction	October 2007 – February 2008
Substation Construction	October 2007 – January 2008
Access Road Construction	September 2007 – November 2007
Foundations for Turbines and Step Up Transformers	October 2007 – November 2007
Receive and Store Wind Turbines at Minntac Mine	November 2007 – January 2008
Large Crane Arrives on Site	January 2008
Wind Turbine Erection	January 2008 – March 2008
Commissioning / Start-Up	March 2008 – April 2008
Wind Facility Commercial Operation	April 2008

11.0 ENERGY PROJECTIONS

Annual energy production is estimated to be approximately 74,000 to 78,000 megawatt hours recognizing that the wind variations will occur which would increase or decrease this output projection**.**

12.0 DECOMMISSIONING AND RESTORATION

MP has a contractual obligation to US Steel to remove the wind facilities, including foundations to a depth of four feet, when the wind easement expires. MP also reserves the right to explore alternatives regarding Project decommissioning at the end of the permit term. Retrofitting the turbines and power system with upgrades based on new technology may allow the wind facility to produce efficiently and successfully for many more years. Based on estimated costs of decommissioning and the salvage value of decommissioned equipment, the salvage value of the wind facility will exceed the cost of decommissioning.

Because the proposed project is an important part of MP's renewable energy portfolio, the applicant does not anticipate decommissioning of the site. The applicant believes that it is more likely that the existing infrastructure will be replaced by newer technology before the end of the existing equipment's productive lifetime of approximately 35 years.

However, should the site be decommissioned, the salvage value of the generation equipment and material value of the towers and cabling can be recycled which will offset much of the anticipated expense if decommissioning of the project ever becomes necessary. There is an active salvage market for recycled wind turbines and materials used in the construction of wind energy facilities (e.g. electric generators, copper wires and cables) so the project's physical assets, if decommissioning were to occur, it would be dispersed through normal market forces. The most conservative estimated total decommissioning expense would be no more than a total of $300,000 (in 2007 dollars, including allowance for salvage value) If full decommissioning were ever necessary it would include removal of the wind turbines and appurtenant facilities including the substation interconnection, access roads, underground cables and any overhead lines, towers, buildings, transformers, etc.

Unless otherwise agreed to by the landowner (US Steel) of the Project Site, the turbine foundations would be abandoned "in place" and covered by a minimum of 2 feet of common borrow fill along with 6 inches of top soil and seeded. The access roads would also be graded and shaped back to the surrounding terrain and covered with 6 inches of topsoil and re-seeded to prevent erosion. The project site area will be allowed to revert back to its natural vegetative state (forested, or shrub condition).

Decommissioning costs will be updated approximately every 5 years using current market and cost information. Funds for decommissioning will be available in a manner that is consistent with other electric generating assessed owned and operated by Minnesota Power.

12.1 Decommissioning Economics and Financial Surety

Information to follow.

13.0 IDENTIFICATION OF REQUIRED PERMITS AND APPROVALS

The federal and state permits or approvals that have been identified as being required for the construction and operation of the Project are shown in Table 13-1.

Table 13–1 Required Permits and Approvals

Permit	Permitting Agency	Trigger	Permit Required
Notice of Proposed Construction or Alteration	Federal Aviation Administration	Facility safety lighting	Yes
Determination of No Hazard	Federal Aviation Administration	Turbines and facility safety lighting	Yes
Clean Water Act Section 404 Permit	U.S. Army Corps of Engineers' St. Paul District Office	Discharges of dredged or fill material into waters of the United States, including their adjacent wetlands	TBD
Exempt Wholesale Generator Status	Federal Energy Regulatory Commission	Seeking status as an exempt wholesale generator must file with the Commission	Yes
Market-based Rate Authorization (Petitions for Rate Approval pursuant to Section 284.123(b)(2) 18 C.F.R. Section 381.403)	Federal Energy Regulatory Commission	Commissioning of the wind facility	TBD
STATE OF MINNESOTA			
Site Permit	Minnesota Public Utilities Commission (MPUC)	Construction of a Large Wind Energy Conversion System (LWECS)	Yes
General NPDES Permit for Stormwater Discharges Associated with Construction Activities	Minnesota Pollution Control Agency (MPCA)	Disturbance of greater than 1 acre of ground	Yes
Section 401 Water Quality Certification	MPCA	Impacts to waters of the US (Corps Section 404 permit)	TBD
Small Quantity Hazardous Waste Generator License	MPCA	Generation more than 100 pounds of hazardous waste each year	TBD
Above-ground Storage tank (AST) Notification Form	MPCA	Any above-ground petroleum storage tank 500 gallons or greater	TBD
License for Crossing Public Lands and Waters	Minnesota DNR	Any wind facilities that require crossing of or location on State administered Public Lands or Waters	TBD
Public Waters Work Permit	Minnesota DNR	Any construction activities that impact waterways, including wetlands Applies to public waters that are identified on DNR public waters inventory maps	TBD
Wetland Conservation Act Compliance	St. Louis County Soil & Water Conservation District – MN Board of Soil and Water Resources (rules)	Construction activities that impact non-state wetlands	TBD

Permit	Permitting Agency	Trigger	Permit Required
Well Construction Notification	Minnesota Dept. of Health (MDH)	Installation of private well(s) for O&M building	TBD
Plumbing Plan Review	Minnesota Dept. of Labor and Industry	Plumbing system for O&M building	TBD
Highway Access Permit	Minnesota Dept. of Transportation	Access to State roads from wind facilities.	Yes if off Highway 56 or 16
Utility Access Permit	Minnesota Dept. of Transportation	Utility construction impacts to state roads	Yes
Oversize & Overweight Permit	Minnesota Dept. of Transportation	Use of oversize and overweight vehicles	Yes
ST LOUIS COUNTY			
Highway Access Permit (County and Local Roads)	St. Louis County Engineer and Township Chairs	Access to county and local roads from wind facilities.	Yes
Zoning Permit	St. Louis County Office of Planning and Environmental Services	No County zoning permit required for wind projects greater than 5 MW	No
Individual Sewage Treatment System Permit (ISTS)	St. Louis County Office of Planning and Environmental Assistance	Connection to existing or approval of on-site sewage and water (O&M building).	TBD

TBD: To Be Determined

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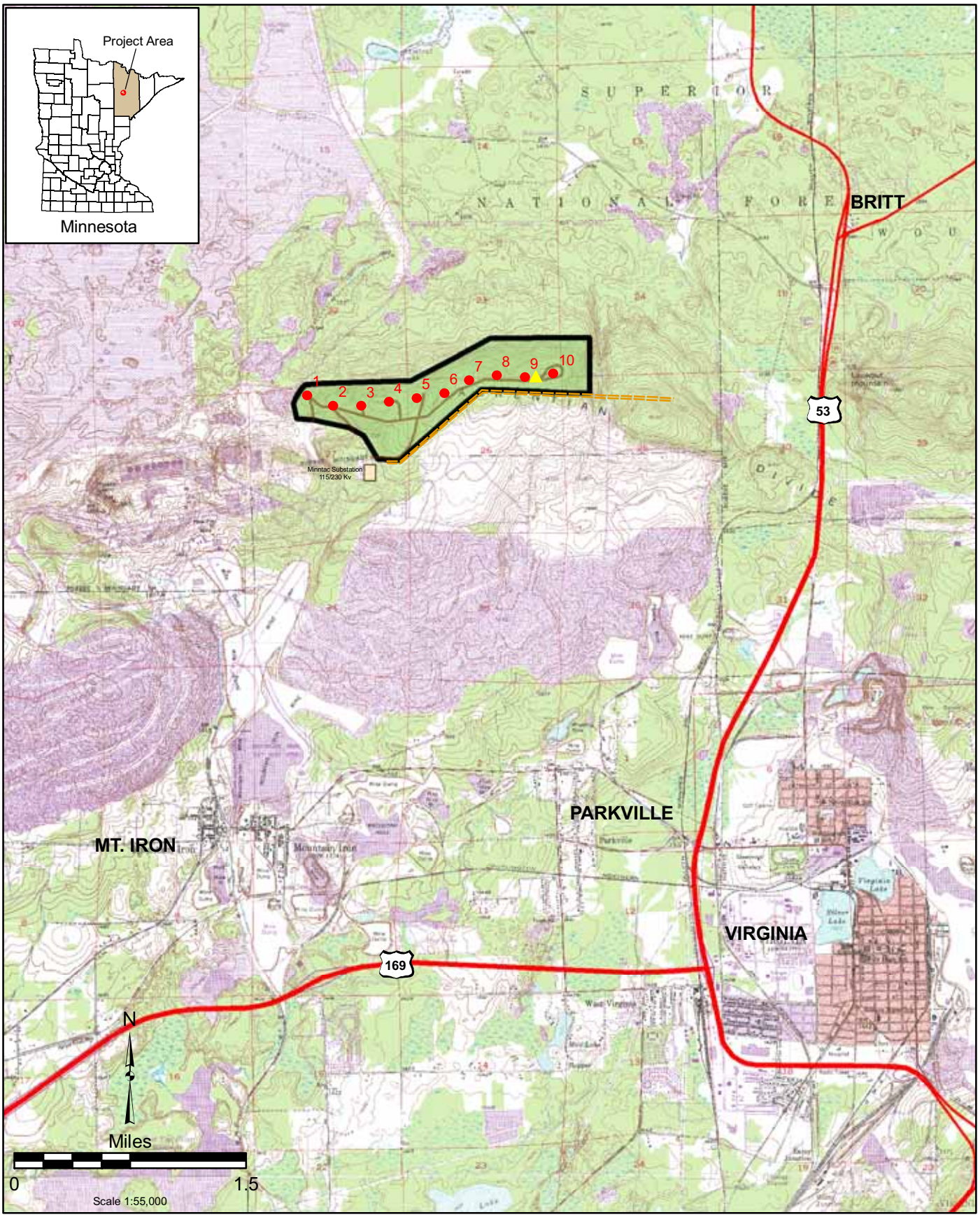

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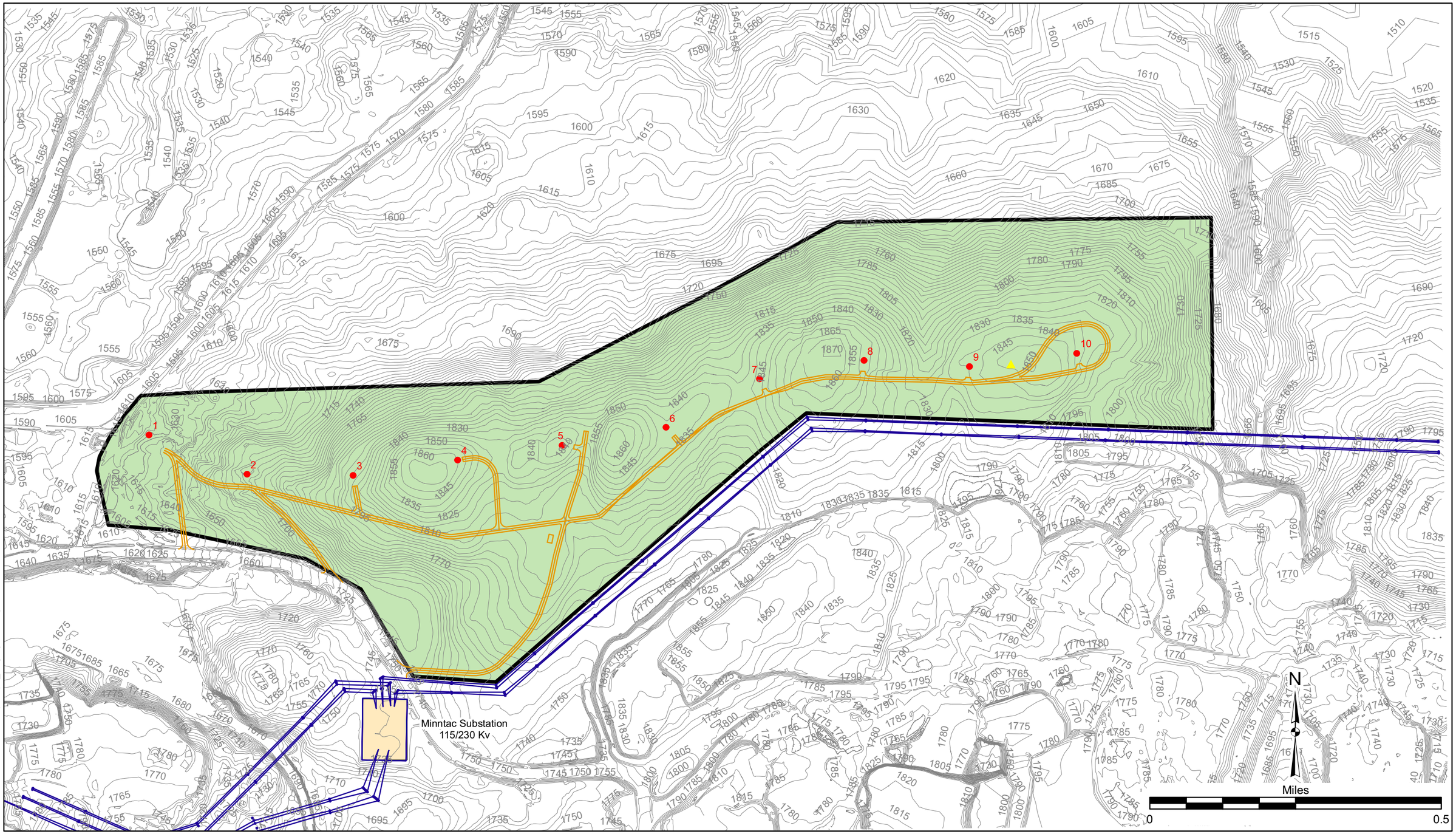
May 2007

Turbine Location
Meteorological Tower
Access Road
Major Road
Transmission Line
Project Area
Substation

Map 1. Project Vicinity
Taconite Ridge Wind Farm
St. Louis County, Minnesota
Minnesota Power



April 2007

Map 2. Project Layout

Taconite Ridge I Wind Energy Center

St. Louis County, Minnesota

Minnesota Power

Turbine Location

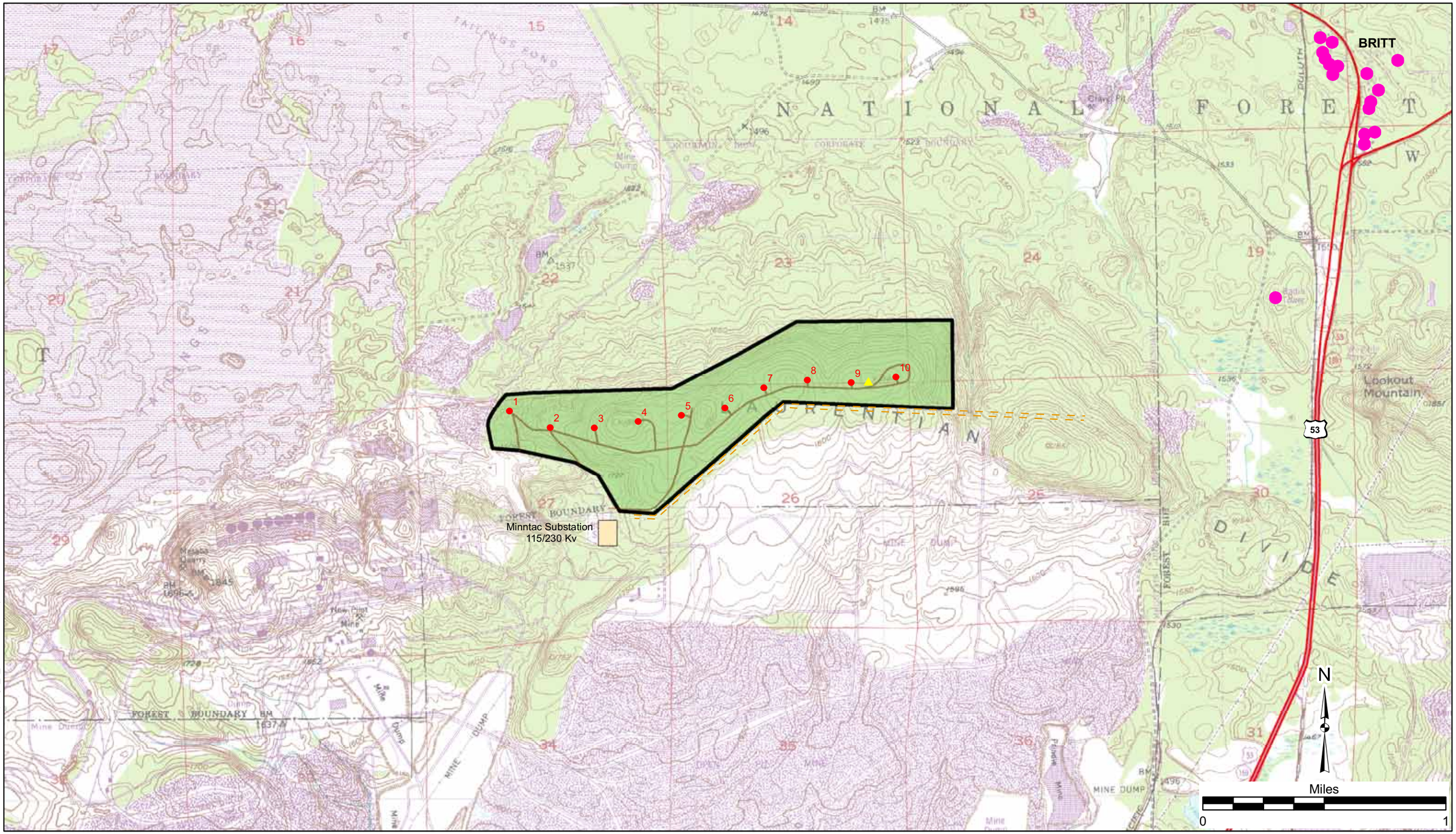
Meteorological Tower

Access Road

Transmission Line

Project Area

Substation



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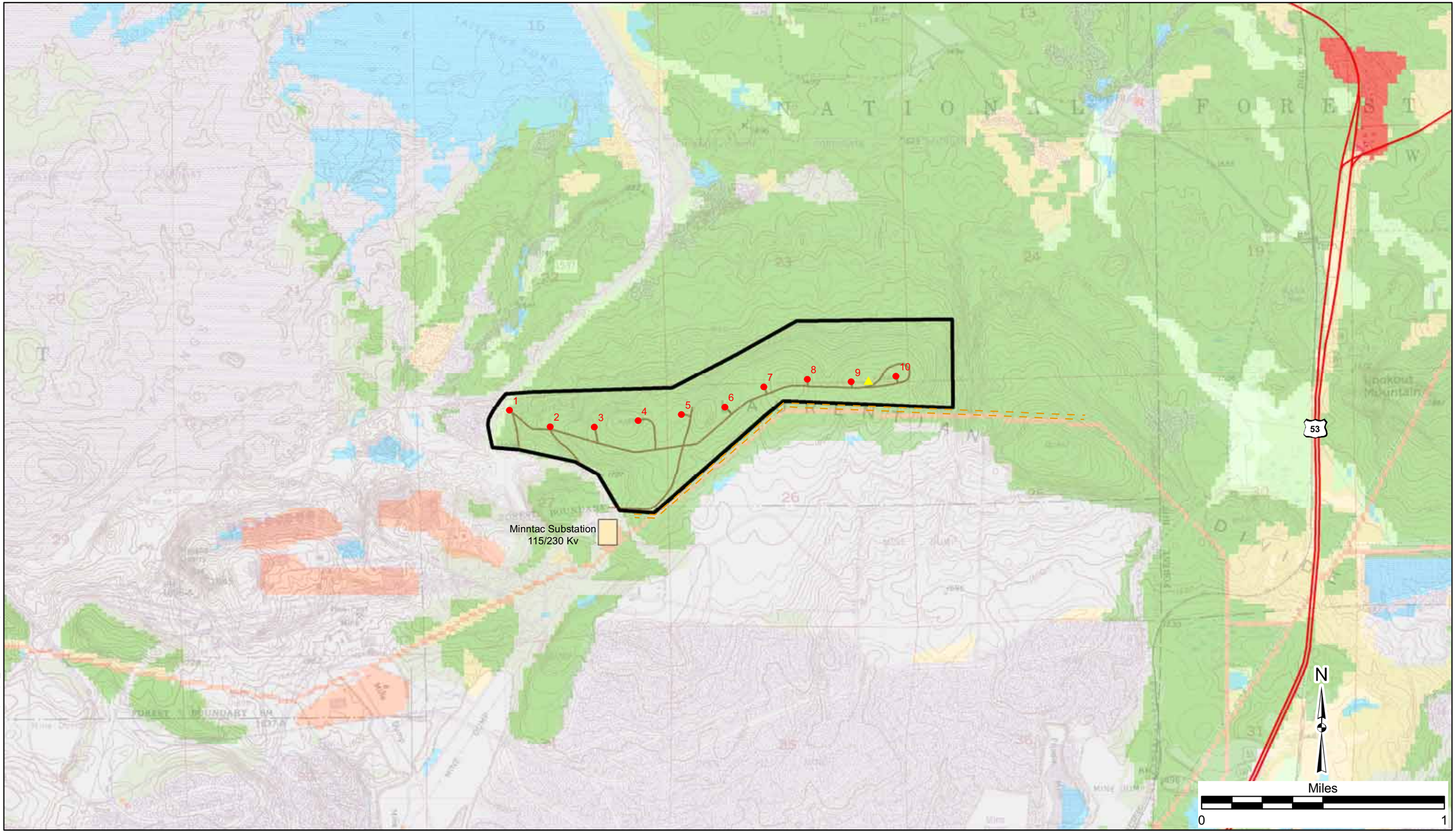
Residences
Turbine Location
Meteorological Tower
Major Road
Access Road
Transmission Line
Project Area
Substation

April 2007

Map 3. Residences
Taconite Ridge I Wind Energy Center
St. Louis County, Minnesota
Minnesota Power



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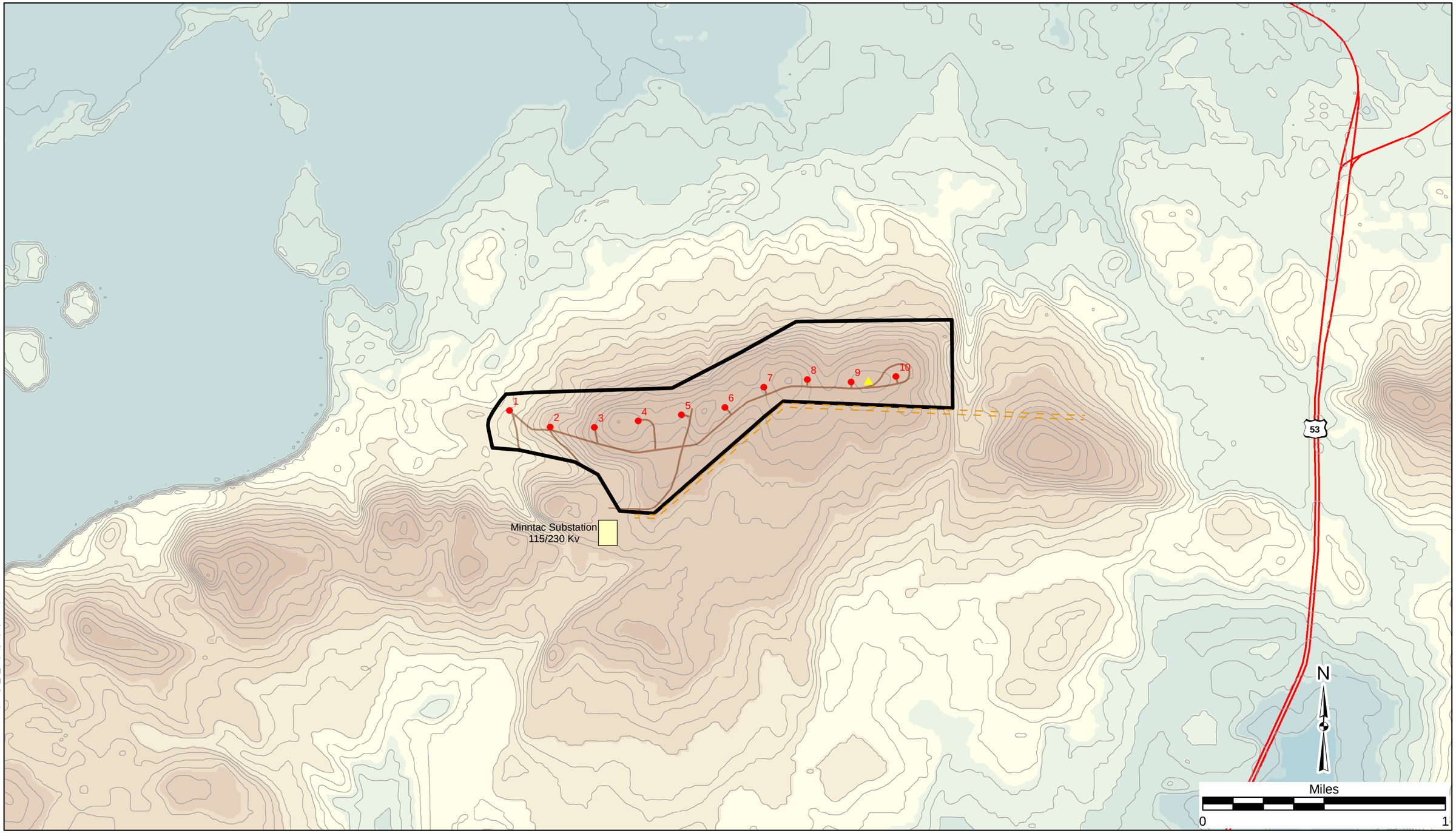
April 2007

Map 4. Land Use and Land Cover
Taconite Ridge I Wind Energy Center
St. Louis County, Minnesota
Minnesota Power

- Turbine Location
- Meteorological Tower
- Major Road
- Access Road
- Transmission Line
- Project Area
- Substation
- Forest
- Grassland
- Gravel pits and open mines
- Open water
- Other rural developments
- Urban/Industrial
- Wetlands - bog, marsh and fen



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Turbine Location
Meteorological Tower
Contour Interval (5 m)
Major Road
Transmission Line
Access Road
Project Area
Substation

Elevation (meters)

444 - 454
454 - 465
465 - 477
477 - 490
490 - 504
504 - 522
522 - 541
541 - 571

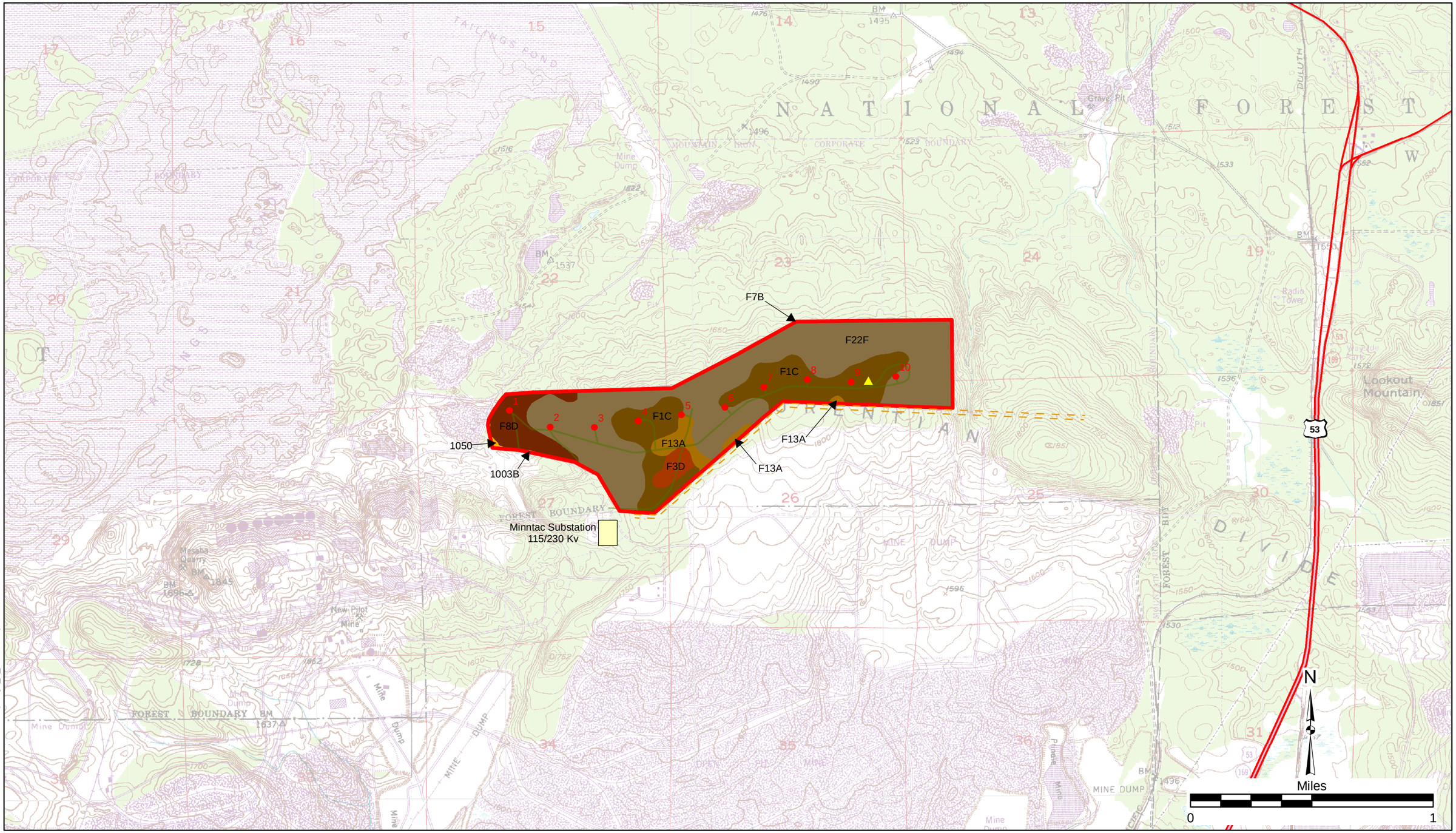
April 2007

Map 5. Topography

Taconite Ridge I Wind Energy Center

St. Louis County, Minnesota

Minnesota Power



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April 2007

Map 6. Soils

Taconite Ridge I Wind Energy Center

St. Louis County, Minnesota

Minnesota Power

Turbine Location

Meteorological Tower

Transmission Line

Major Road

Access Road

Project Area

Substation

Soil Map Units

1003B - Udorthents, loamy

1050 - Tailings basin

F13A - Babbitt, bouldery-Aquepts

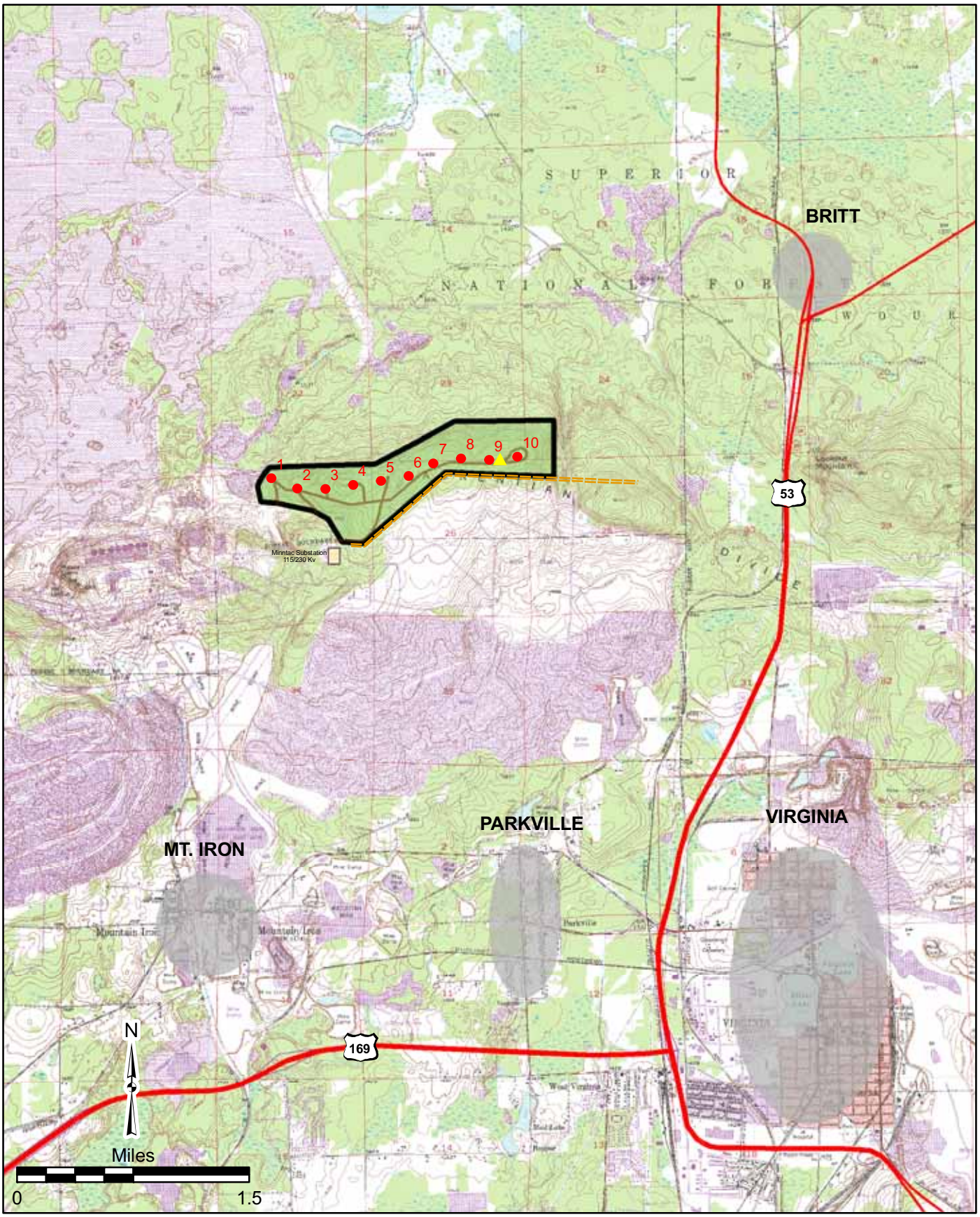
F1C - Eaglesnest stony loam

F22F - Eveleth-Conic complex

F3D - Eveleth-Eaglesnest-Conic complex

F7B - Biwabik-Graycalm complex

F8D - Biwabik-Graycalm-Friendship complex



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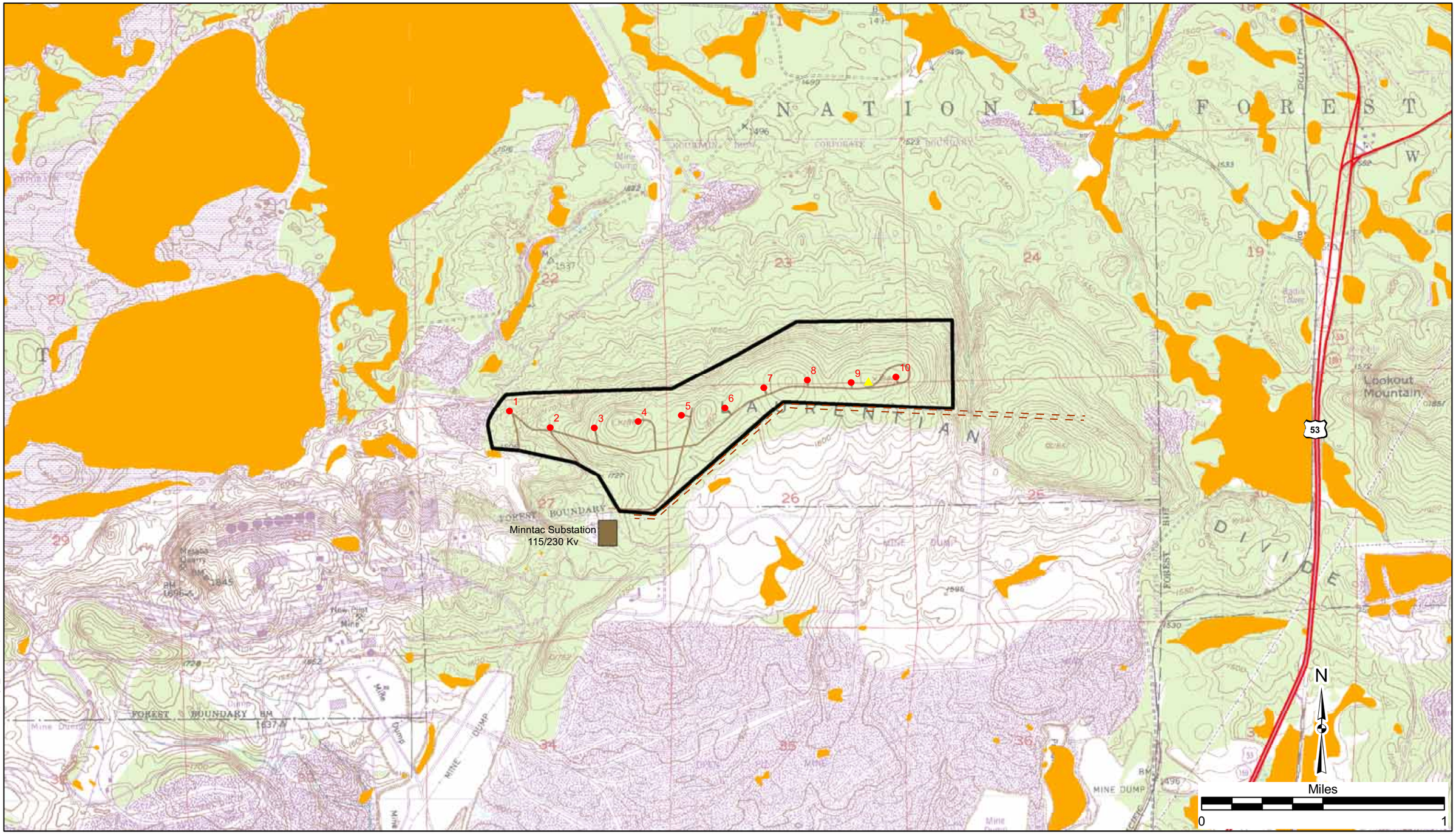
May 2007

Turbine Location
Meteorological Tower
Access Road
Major Road
Transmission Line
Project Area
Substation
Key Observation

Map 7. Key Observations
Taconite Ridge Wind Farm
St. Louis County, Minnesota
Minnesota Power



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April 2007

Turbine Location
Meteorological Tower
Major Road
Access Road
Transmission Line
Project Area
Substation
Wetlands

Map 8. National Wetlands Inventory Land
Taconite Ridge I Wind Energy Center
St. Louis County, Minnesota
Minnesota Power

APPENDIX A

CLIPPER WIND
LIBERTY 2.5 MW TURBINE SPECIFICATIONS

2.5 MW Liberty Wind Turbine - Technical Specifications

2.5 MW Liberty Wind Turbine for IEC class I, II & III wind conditions

CERTIFICATIONS:

- Germanischer Lloyd WindEnergie GmbH: Statement of compliance for design assessment of the wind turbine: WT-00-009A-2006 (C-93) / WT-00-008A-2006 (C-96) / WT-00-012A-2006 (C-89)

- USDOE's NREL Accredited Lab 12/04-3/05 : Drivetrain dynamometer test

General

Type	Horizontal axis, 3 blades, upwind
Power	2500 KW system power output
Components	Purpose designed by Clipper
Primary brake	Blade pitch (aerodynamic)
Operation	Variable speed 9.6 to 15.5 rpm
Yaw	Electromechanical
Hub height	80m standard / other options available

Rotor

Wind Class	Class Ia*	Class IIa	Class IIb	Class IIIb
Diameter	89m	93m	96m	99m
Swept area	6221m^2	6793m^2	7238^2	7698m^2
Blades	43.2m	45.2m	46.7m	48.2m
Tilt	5.5			
Tip speed @ rated output	75 m/s			
Rotor lock	Integrated into base, hydraulic			
Rotor turning Gear	Manual, high torque			
	*Class Ia - all parameters same as IEC Class Ia except 50-year return gust value is 64.5 m/s instead of 70 m/s			

Pitch system

Type	Individual blade pitch
Drive	DC electric servo-drive

Failsafe braking	Battery banks
Blade bearings	Internal gear, dual row ball-bearing

Hub	
Type	Spherical
Material	Ductile cast iron

Power train	
Mainshaft	Forged steel, integrated with gear housing
Lubrication	Forced, mechanical pump
Filtration	Multi-element; inline coarse/fine and offline filter system
Cooling	Radiator; external to nacelle
Gearbox mounting	Stable, non-floating

Controller	
Voltage	3 phase 480 VAC
Computer	Embedded Motorola power PC
Operator interface	Palm Top or Laptop PC
SCADA	Fiber optic connections, serial interface

Generators	
Type	Synchronous Permanent Magnet
Number of units	4
Rated power (each)	660 kW at 1133 rpm
Voltage	1320 VDC at rated power
Enclosure	1P54
Cooling	TEWAC (IP54) options available
Windings	Form-wound, insulation class H
Operation	Continued operation with one generator outage

Power Converter

Advanced generator control technology enables wide range variable rotor speed, improving turbine aerodynamic efficiency by adjusting to ever-changing wind velocities, briefly storing and releasing energy from wind gusts while also reducing torque spikes. Net benefit : More production and extended life.

Type	4X, voltage sourced, IGBT based 6 pulse, inverters
Voltage	690 VAC
Frequency	50Hz or 60Hz ± 3Hz

The D-GenQ with 4 high efficiency Mega-Flux generators provides continued operation even with a generator outage, in contrast to today's turbines with single generator drivetrain.

Grid Compatibility		
Frequency-continuous	50Hz or 60Hz ± 3Hz	
Line voltage 690 VAC	Continuous	5 sec
	±10%	±20%
Line fault ride-thru	-90% of nominal line for 3 sec.	
Line phase imbalance	rated power	cut-in
	±5%	±10%

Machine Base	
Material	Ductile cast iron, single piece, no welds

Yaw system	
Drives	4 Electrico-mechanical motors with planetary drives
Brake	Disc, 4 Active hydraulic brake calipers
Yaw bearing	Internal gear, ball bearing

Parking brake	
Type	Dual disc with active hydraulic brake calipers
Location	Intermediate stage of gearbox

Service hoist	
Type	On-board, 2 metric-ton jib hoist

Maintenance interval	
Post commissioning	Once at 700 hours, every 6 months thereafter

Condition-based monitoring
Blade strain measurement
Real time gearbox oil analysis

The Liberty Turbine's onboard crane provides easy access to the brakes, generators, yaw drives,

Bearing temperatures

Vibration monitoring

Hydraulic system pressures

and D-GenQ components quickly, and with minimum interruption of production. Nacelle access through the power rolldown hatch at the rear affords unsurpassed servicing convenience.

Access
Nacelle top-hatch, nacelle aft roll-down door, hub entry from nacelle interior, spinner hatches

Lightning protection	
Blade	Tip + 2 receptors, internal ground conductor
Nacelle	Air termination, full shielded, (Faraday cage)
Electrical	IEC 61400-24 level III

Tower	
80m hub height, optional to height available	
Type	Tubular
Material	Steel plate
Sections	4 (80m hub height)

Lifting requirements	
80m hub height	Same crane size as most 1.5 MW turbines.

The Liberty Turbine costs less to transport and install because it weighs less and is more compact than turbines currently available in the same size class. The Liberty Turbine is installed with the same crane capacity as most 1.5 MW turbines, resulting in significant savings!

APPENDIX B

PHASE IA CULTURAL RESOURCES REPORT

McFarlane Consulting, LLC
318 Goodhue Street, Suite # 1
St. Paul, Minnesota
55102
651-283-6781
joemcfarlane@comcast.net

Laura Roberts 3 November
Tetra Tech EC, INC 2006

Letter Report
Mt. Iron
Phase 1 a Literature Search

Project Description

The Mt. Iron Wind Farm will be dispersed throughout twelve (12) sections of land, including buffer areas, near Mt. Iron, Minnesota (Figure 1). Specific locations are listed in Table 1.

TABLE 1		
Township	Range	Section
58 N	19 W	3
59 N	19 W	25, 34, 35, 36
59 N	18 W	23, 24, 25, 26, 27, 30, 31

Project Setting

Geologically, the project area is capped with Pleistocene and Late Wisconsinian age deposits associated with the Rainey Lobe (Hobbs 1982). Ground and end moraines of the Nashwauk Moraine Association cover the project area. Typical soils in the area are poorly developed loamy sands that have formed in glacial till, outwash and lacustrine materials. Iron mining drastically changed the local landscape throughout the 20th century but portions of the project area appear to be relatively intact.

In 1882, the project area was described by U.S. Land Surveyors' as 'original pine lands' and swamp (Trygg 1965). Most of the original pine was logged off during the late 19th and early 20th centuries. The area is presently forested with new growth pine stands, conifers, aspen and birch. Drainage flows through the St. Louis River watershed.

Archaeologically, the project falls within the Central Lakes Coniferous East Archaeological Region of Minnesota. The area has only been intermittently studied by archaeologists and there is a limited body of literature relevant to the project area.

Records Search Results

A records search of prehistoric and historic archaeological sites, historic structures and National Register Properties was conducted at the State Historic Preservation Office in St. Paul, Minnesota and the Office of the State Archaeologist in Fort Snelling, Minnesota. The U.S. Forest Service maintains a large inventory of archaeological properties throughout northern Minnesota but because the project area does not involve U.S. Forest Service Land, the Forest Service was not contacted directly. The Office of the State Archaeologist maintains a limited data base of Forest Service records which was used for this study. The results of the records search are as follows:

1. Sites within the project area

The records search did not find any listed Historic Structures, Historic Sites, National Register Properties or Archaeological Sites within the proposed project boundaries as illustrated in Figure 2.

2. Sites near the project area

The Office of the State Archaeologist lists 1 historic/archaeological site on U.S. Forest Service land within one mile of the project boundaries and 2 historic/archaeological sites within 3 miles. Information about U.S. Forest Service sites is limited and only general site locations are provided. They are:

Sites within 1 mile:

St. Louis 667: T59N, R19W, Sec 27.

Sites within 3 miles:

St. Louis 164: T59N, R19W, Sec 32.
St. Louis 585: T59N, R17W, Sec 17.

4. Archaeological Probability:

The entire project area lies in an area of moderate archaeological potential. Undisturbed portions of the project area within the Laurentian Divide highlands have the highest archaeological potential. Numerous bedrock exposures and lag deposits of Banded Iron Formation (BIF) chert are likely to exit in the area and should be considered likely prehistoric quarry locations. The possibility that 19th century historic sites and structures related to 20th century mining are also of concern.

5. Proposed Archaeological Survey:

The total project area encompasses approximately 12 square miles but the proposed undertaking will likely impact a substantially smaller area. The area has been subject to extensive mining operations for decades. Recent activity may not be recorded on current maps so an on-site visit is strongly recommended. Precise project locations have not been determined so the following survey recommendations, though general, should be considered. Numerous structures are depicted in Trygg's map rendition of the 1882 U.S. Geological Survey (Figure 3). Though

historic mining activity has likely destroyed most, if not all, of these structures, there remains the possibility that remnants of the 1882 structures still exist.

Recommended Survey method:

1) Visual inspection of all WTGs, electric line corridors, access roads, substation areas, etc.
2) Subsurface testing in all areas where ground disturbing activities are likely to occur. Subsurface tests can include standard shovel test techniques and soil probes. Shovel testing is recommended in areas with limited surface visibility to assess landform integrity, identify buried soil horizons, and to determine the presence or absence of archaeological materials. Soil probes are recommended to assess subsurface conditions in areas with good surface visibility and to confirm the extent of disturbed areas identified through shovel testing.

Buried Features Warning: These standard archaeological survey techniques cannot always detect buried features (e.g. pits, graves). An Inadvertent Discovery Protocol should be developed and distributed to construction crews. Inadvertent discoveries (especially burials) can still be encountered in areas determined by the archaeologists to have been disturbed. A brief (20 to 30 minute) training for field crews by a professional archaeologist is recommended.

If Archaeological materials are found:

1) Additional shovel tests in the immediate vicinity may be necessary to locate site boundaries and/or find alternate pole locations.

2) If human remains are encountered, all ground disturbing investigations in proximity must stop, and interested parties should be notified. These include: a) Client, b) St. Louis County Sheriff's office, c) Office of the State Archaeologist, and d) the Minnesota Indian Affairs Council.

Respectfully yours,

Joseph L. McFarlane

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APPENDIX C

AGENCY LETTERS

TETRA TECH EC, INC.

August 24, 2006

Mrs. Laurie Fairchild
U.S. Fish and Wildlife Service
Twin Cities Minnesota Field Office
4101 E. 80th Street
Bloomington, MN 55425-1665

Re: Potential Wind Development Project Consultation

Dear Mrs. Fairchild:

I would like to request a search for USFWS listed threatened or endangered species within the vicinity of a potential wind energy development project. The site is located in St Louis County. The proposed project may involve activities in the areas listed in Table 1.

Table 1. Township, range, section data for proposed wind energy development project.

Township		Range		Section	Township		Range		Section
58	N	19	W	3	59	N	18	W	30
59	N	18	W	23	59	N	18	W	31
59	N	18	W	24	59	N	19	W	25
59	N	18	W	25	59	N	19	W	34
59	N	18	W	26	59	N	19	W	35
59	N	18	W	27	59	N	19	W	36

It is our goal to perform a thorough analysis of the proposed project area, hence an adequate review of the USFWS's resource information will greatly aid in determining potential project impacts and or feasibility. Please feel free to contact me if you have any questions.

Sincerely,

Laura Roberts
Biologist
Tetra Tech EC, Inc.
503-727-8076 (office)
503-227-1287 (Fax)
laura.roberts@tteci.com

TETRA TECH EC, INC.

August 24, 2006

Mrs. Sarah Hoffmann
NHIS Data Distribution Coordinator
Minnesota Department of Natural Resources
Division of Ecological Services
Box 25, 500 Lafayette Road
St. Paul, MN 55155-4025

Re: Potential Wind Development Project Consultation

Dear Mrs. Hoffmann:

I would like to request a search for threatened or endangered species within the vicinity of a potential wind development project. The site is located in St Louis County, Minnesota. The proposed project may involve activities in the areas listed in Table 1, and shown in the attached vicinity map.

Table 1. Township, range, section data for proposed wind energy development project.

Township		Range		Section	Township		Range		Section
58	N	19	W	3	59	N	18	W	30
59	N	18	W	23	59	N	18	W	31
59	N	18	W	24	59	N	19	W	25
59	N	18	W	25	59	N	19	W	34
59	N	18	W	26	59	N	19	W	35
59	N	18	W	27	59	N	19	W	36

It is our goal to perform a thorough analysis of the proposed project area, hence an adequate review of the MDNR's resource information will greatly aid in determining potential project impacts and or feasibility. Please feel free to contact me if you have any questions.

Sincerely,

Laura Roberts
Biologist
Tetra Tech EC, Inc.
503-727-8076 (office)
503-227-1287 (Fax)
laura.roberts@tteci.com

Tetra Tech EC Inc.
1750 SW Harbor Way
Ste 400
Portland, OR 97201

Minnesota Department of Natural Resources

Natural Heritage and Nongame Research Program, Box 25
500 Lafayette Road
St. Paul, Minnesota 55155-40
Phone: (651) 259-5107 Fax: (651) 296-1811 E-mail: sarah.hoffmann@dnr.state.mn.us

September 18, 2006

Ms. Laura Roberts
Tetra Tech EC, Inc.
1750 SW Harbor Way, Suite 400
Portland, OR 97201

Re: Request for Natural Heritage information for vicinity of proposed St. Louis County Wind Development, T59N R18W Sections 22-27, St. Louis County
NHNRP Contact #: ERDB 20070236

Dear Ms. Roberts,

The Minnesota Natural Heritage database has been reviewed to determine if any rare plant or animal species or other significant natural features are known to occur within an approximate one-mile radius of the area indicated on the map enclosed with your information request. Based on this review, there are no known occurrences of rare species or native plant communities in the area searched.

The Natural Heritage database is maintained by the Natural Heritage and Nongame Research Program, a unit within the Division of Ecological Services, Department of Natural Resources. It is continually updated as new information becomes available, and is the most complete source of data on Minnesota's rare or otherwise significant species, native plant communities, and other natural features. Its purpose is to foster better understanding and protection of these features.

Because our information is not based on a comprehensive inventory, there may be rare or otherwise significant natural features in the state that are not represented in the database. A county-by-county survey of rare natural features is now underway, and is in progress for St. Louis County. Our information about native plant communities is, therefore, good for that county. However, because survey work for rare plants and animals is less exhaustive, and because there has not been an on-site survey of all areas of the county, ecologically significant features for which we have no records may exist on the project area.

Please be aware that review by the Natural Heritage and Nongame Research Program focuses only on *rare natural features*. It does not constitute review or approval by the Department of Natural Resources as a whole. If you require further information on the environmental review process for other natural resource-related issues, you may contact your Regional Environmental Assessment Ecologist, Dave Holmbeck, at (218) 327-4317.

An invoice in the amount of $70.75 will be mailed to you under separate cover within several weeks of the date of this letter. You are being billed for map and database search and staff scientist review. Thank you for consulting us on this matter, and for your interest in preserving Minnesota's rare natural resources.

Sincerely,

Sarah Hoffmann

Sarah D. Hoffmann
Endangered Species Environmental Review Coordinator

Dear Ms. Roberts:
We have reviewed the information provided with your transmittal, and we concur with your determination that the proposed action will have no effect on federally-listed threatened or endangered species.
Thank you.

Paul J. Burke
Biologist
US Fish and Wildlife service
Twin Cities, MN

Laura.Roberts@tteci.com

09/27/2006 03:20 PM

To paul_burke@fws.gov

cc

Subject USFW Wind Development Consultation Letter

Hello Mr. Burke,
I am emailing you with regards to the letter of consultation sent to your office on August 24, 2006, requesting a search of threatened and endangered species in an area north of Mt. Iron in St. Louis County, Minnesota. We are investigating the area as a measure of due diligence for the preliminary siting of a proposed wind energy facility.

We have made the determination that the proposed action will have no effect on bald eagle, gray wolf, or Canada lynx and we request your concurrence on the matter.

Please feel free to contact me with any questions or concerns you may have, or if you require any additional information,

Thank you,
Laura
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TETRA TECH

April 2, 2007

Ms. Barbara Hayden, Planning Director
St. Louis County Planning Department
227 West 1 Street
Duluth, Minnesota 55802

RE: Proposed Minntac Wind Farm, St. Louis County, Minnesota
Tetra Tech Project No. 7551197.100

Dear Ms. Hayden:

Tetra Tech, EC Inc. (Tetra Tech) is conducting an investigation of property in the City of Mountain Iron, St. Louis County as a potential location for a wind-powered energy facility. We are requesting assistance in identifying information related to planning and coordination and wetlands under the Wetland Conservation Act.

While the project is still in the planning and development stage, it is estimated that the facility will consist of no more than 20, 2.5 Megawatt (MW) wind turbines, an operations and maintenance building, and a 34.5 kV subtransmission line less than 700 feet long connecting to the existing 230 kV Minnesota Power Substation southwest of the proposed project. The wind facility will be owned and operated by Minnesota Power on property owned by U.S. Steel.

While many details, including the exact location of wind turbines and associated facilities have yet to be determined, the area shown in the attached figure and outlined in the following table is the primary focus of our investigation.

Township	Range	Section
59N	18W	23-27

The information I am requesting will be used to help guide project development in a manner that avoids impacts to sensitive resources where practicable. Inquiry letters have been sent to other agencies including U.S. Fish and Wildlife Service and the Minnesota Department of Natural Resources. If you require further information or have questions regarding this matter, please call me at (406) 248-9161.

Tetra Tech
P.O. Box 30615, Billings, MT 59107
618 South 25th Street, Billings, MT 59101
Tel 406.248.9161 Fax 406.248.9282 www.tetratech.com

Thank you for your assistance.

Respectfully submitted,

Tetra Tech

Jeffrey R. Rice
Project Manager, Natural Resources

HMW(JRR)rr

cc: Rebecca Longley (TtEC, Boston)

Enclosure

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TETRA TECH

April 2, 2007

Mr. Craig J. Waino, City Administrator
City of Mountain Iron
8586 Enterprise Drive South
Mountain Iron, Minnesota 55768

RE: Proposed Minntac Wind Farm, St. Louis County, Minnesota
Tetra Tech Project No. 7551197.100

Dear Mr. Waino:

Tetra Tech, EC Inc. (Tetra Tech) is conducting an investigation of property in the City of Mountain Iron, St. Louis County as a potential location for a wind-powered energy facility. We are requesting assistance in identifying information related to planning and coordination and wetlands under the Wetland Conservation Act.

While the project is still in the planning and development stage, it is estimated that the facility will consist of no more than 20, 2.5 Megawatt (MW) wind turbines, an operations and maintenance building, and a 34.5 kV subtransmission line less than 700 feet long connecting to the existing 230 kV Minnesota Power Substation southwest of the proposed project. The wind facility will be owned and operated by Minnesota Power on property owned by U.S. Steel.

While many details, including the exact location of wind turbines and associated facilities have yet to be determined, the area shown in the attached figure and outlined in the following table is the primary focus of our investigation.

Township	Range	Section
59N	18W	23-27

The information I am requesting will be used to help guide project development in a manner that avoids impacts to sensitive resources where practicable. Inquiry letters have been sent to other agencies including U.S. Fish and Wildlife Service and the Minnesota Department of Natural Resources. If you require further information or have questions regarding this matter, please call me at (406) 248-9161.

Tetra Tech
P.O. Box 30615, Billings, MT 59107
618 South 25th Street, Billings, MT 59101
Tel 406.248.9161 Fax 406.248.9282 www.tetratech.com

Thank you for your assistance.

Respectfully submitted,

Tetra Tech

Jeffrey R. Rice
Project Manager, Natural Resources

HMW(JRR)rr

cc: Rebecca Longley (TtEC, Boston)

Enclosure

n:\typing\7551197\Query Letters\Mt. Iron (HW3-30)

TETRA TECH

April 11, 2007

Mr. Jim Sanders
Forest Supervisor
Superior National Forest
8901 Grand Ave. Pl.
Duluth, Minnesota 55808

RE: Proposed Minntac Wind Farm, St. Louis County, Minnesota
Tetra Tech Project No. 7551197.100

Dear Mr. Sanders:

Tetra Tech, EC Inc. (Tetra Tech) is conducting an investigation of property in the City of Mountain Iron, St. Louis County as a potential location for a wind-powered energy facility. We are requesting assistance in identifying any cultural sites or natural resource features of significance within the proposed project boundary, described in the table below.

While the project is still in the planning and development stage, it is estimated that the facility will consist of no more than 20, 2.5 Megawatt (MW) wind turbines, an operations and maintenance building, and a 34.5 kV subtransmission line less than 700 feet long connecting to the existing 230 kV Minnesota Power Substation southwest of the proposed project. The wind facility will be owned and operated by Minnesota Power on property owned by U.S. Steel.

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Thank you for your assistance.

Respectfully submitted,

Tetra Tech

Jeffrey R. Rice
Project Manager, Natural Resources

HMW(JRR)rr

cc: Rebecca Longley (TtEC, Boston)

Enclosure

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TETRA TECH

April 11, 2007

Ms. Rosemary Berens
Tribal Historic Preservation Officer
Bois Forte Tribal Council
5344 Lakeshore Drive
Box 16
Nett Lake, MN 55772

RE: Proposed Minntac Wind Farm, St. Louis County, Minnesota
Tetra Tech Project No. 7551197.100

Dear Ms. Berens:

Tetra Tech, EC Inc. (Tetra Tech) is conducting an investigation of property in the City of Mountain Iron, St. Louis County as a potential location for a wind-powered energy facility. We are requesting assistance in identifying any cultural sites of significance within the proposed project boundary, described in the table below.

While the project is still in the planning and development stage, it is estimated that the facility will consist of no more than 20, 2.5 Megawatt (MW) wind turbines, an operations and maintenance building, and a 34.5 kV subtransmission line less than 700 feet long connecting to the existing 230 kV Minnesota Power Substation southwest of the proposed project. The wind facility will be owned and operated by Minnesota Power on property owned by U.S. Steel.

While many details, including the exact location of wind turbines and associated facilities have yet to be determined, the area shown in the attached figure and outlined in the following table is the primary focus of our investigation.

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The information I am requesting will be used to help guide project development in a manner that avoids impacts to sensitive resources where practicable. If you require further information or have questions regarding this matter, please call me at (406) 248-9161.

Tetra Tech
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Thank you for your assistance.

Respectfully submitted,

Tetra Tech

Jeffrey R. Rice
Project Manager, Natural Resources

HMW(JRR)rr

cc: Rebecca Longley (TtEC, Boston)

Enclosure

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TETRA TECH

April 11, 2007

Mr. David Woodward
Cultural Resource Specialist
1854 Treaty Authority
4428 Haines Road
Duluth, MN 55811-1524

RE: Proposed Minntac Wind Farm, St. Louis County, Minnesota
Tetra Tech Project No. 7551197.100

Dear Mr. Woodward:

Tetra Tech, EC Inc. (Tetra Tech) is conducting an investigation of property in the City of Mountain Iron, St. Louis County as a potential location for a wind-powered energy facility. We are requesting assistance in identifying any cultural sites of significance within the proposed project boundary, described in the table below.

While the project is still in the planning and development stage, it is estimated that the facility will consist of no more than 20, 2.5 Megawatt (MW) wind turbines, an operations and maintenance building, and a 34.5 kV subtransmission line less than 700 feet long connecting to the existing 230 kV Minnesota Power Substation southwest of the proposed project. The wind facility will be owned and operated by Minnesota Power on property owned by U.S. Steel.

While many details, including the exact location of wind turbines and associated facilities have yet to be determined, the area shown in the attached figure and outlined in the following table is the primary focus of our investigation.

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The information I am requesting will be used to help guide project development in a manner that avoids impacts to sensitive resources where practicable. If you require further information or have questions regarding this matter, please call me at (406) 248-9161.

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618 South 25th Street, Billings, MT 59101
Tel 406.248.9161 Fax 406.248.9282 www.tetratech.com

Thank you for your assistance.

Respectfully submitted,

Tetra Tech

Jeffrey R. Rice
Project Manager, Natural Resources

HMW(JRR)rr

cc: Rebecca Longley (TtEC, Boston)

Enclosure

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TETRA TECH

April 11, 2007

Mayor Carolyn Luoma Gentilini
City of Virginia
327 1st Street South
Virginia MN 55792

RE: Proposed Minntac Wind Farm, St. Louis County, Minnesota
Tetra Tech Project No. 7551197.100

Dear Mayor Luoma Gentilini:

Tetra Tech, EC Inc. (Tetra Tech) is conducting an investigation of property in the City of Mountain Iron, St. Louis County as a potential location for a wind-powered energy facility on behalf of Minnesota Power. The wind facility will be owned and operated by Minnesota Power on property owned by U.S. Steel.

While the project is still in the planning and development stage, it is estimated that the facility will consist of no more than 20, 2.5 Megawatt (MW) wind turbines, an operations and maintenance building, and a 34.5 kV subtransmission line less than 700 feet long connecting to the existing 230 kV Minnesota Power Substation southwest of the proposed project. Many details, including the exact location of wind turbines and associated facilities have yet to be determined; however, the area shown in the attached figure and outlined in the following table is the primary focus of our investigation.

Township	Range	Section
59N	18W	23-27

Over the next several months, Tetra Tech will be conducting field inspections to identify cultural and environmental resources on-site. A Site Permit Application will be filed with the Minnesota Public Utilities Commission and wetlands applications with the US Army Corps of Engineers and State and local jurisdictions, if required. I am sending this letter to you as general information and to solicit any comments you may have about the project. Inquiry letters have been sent to other agencies including U.S. Fish and Wildlife Service and the Minnesota Department of Natural Resources If you require further information or have questions regarding this matter, please call me at (406) 248-9161.

Tetra Tech
P.O. Box 30615, Billings, MT 59107
618 South 25th Street, Billings, MT 59101
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Thank you for your assistance.

Respectfully submitted,

Tetra Tech

Jeffrey R. Rice
Project Manager, Natural Resources

HMW(JRR)rr

cc: Rebecca Longley (TtEC, Boston)

Enclosure

n:\pending\Mt Iron\Query Letters\Virginia Query Letter (HW4-11).doc

APPENDIX D

MNDNR LIST OF STATE THREATENED AND ENDANGERED SPECIES

MINNESOTA'S LIST OF ENDANGERED, THREATENED, AND SPECIAL CONCERN SPECIES

PURPOSE, SCOPE, AND RELATIONSHIP TO FEDERAL LAWS

Minnesota's Endangered Species Statute (Minnesota Statutes, Section 84.0895) requires the Minnesota Department of Natural Resources (DNR) to adopt rules designating species meeting the statutory definitions of endangered, threatened, or species of special concern. The resulting List of Endangered, Threatened, and Special Concern Species is codified as Minnesota Rules, Chapter 6134. The Endangered Species Statute also authorizes the DNR to adopt rules that regulate treatment of species designated as endangered and threatened. These regulations are codified as Minnesota Rules, Parts 6212.1800 to 6212.2300.

Minnesota's Endangered Species Statute and the associated Rules impose a variety of restrictions, a permit program, and several exemptions pertaining to species designated as endangered or threatened. A person may not take, import, transport, or sell any portion of an endangered or threatened species. However, these acts may be allowed by permit issued by the DNR; plants on certain agricultural lands and plants destroyed in consequence of certain agricultural practices are exempt; and the accidental, unknowing destruction of designated plants is exempt. Species of special concern are not protected by Minnesota's Endangered Species Statute or the associated Rules. Persons are advised to read the full text of the Statute and Rules in order to understand all regulations pertaining to species that are designated as endangered, threatened, or species of special concern.

Note that the Federal Endangered Species Act of 1973, as amended (16 USC 1531 - 1544) requires the U.S. Department of the Interior to identify species as endangered or threatened according to a separate set of definitions, and imposes a separate set of restrictions pertaining to those species. In the following list, the federal status of the eleven federally-listed species that occur in Minnesota is noted to the right of those species' names (E = Endangered; T = Threatened).

DEFINITIONS

A species is considered **endangered**, if the species is threatened with extinction throughout all or a significant portion of its range within Minnesota.

A species is considered **threatened**, if the species is likely to become endangered within the foreseeable future throughout all or a significant portion of its range within Minnesota.

A species is considered a **species of special concern**, if although the species is not endangered or threatened, is extremely uncommon in Minnesota, or has unique or highly specific habitat requirements and deserves careful monitoring of its status. Species on the periphery of their range that are not listed as threatened may be included in this category along with those species that were once threatened or endangered but now have increasing or protected, stable populations.

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FOR MORE INFORMATION, CONTACT:

Natural Heritage and Nongame Research Program
Section of Ecological Services, Minnesota Department of Natural Resources
500 Lafayette Rd., Box 25
St. Paul, MN 55155
Phone: 1-800-766-6000 (or 651-296-6157 in the metro area)
Fax: 651-296-1811

MAMMALS

Threatened

Spilogale putorius . . . . . eastern spotted skunk

Special Concern

Canis lupus . . . . . gray wolf (Fed. Status: T)
Cervus elaphus . . . . . elk
Cryptotis parva . . . . . least shrew
Felis concolor . . . . . mountain lion
Microtus ochrogaster . . . . . prairie vole
Microtus pinetorum . . . . . woodland vole
Mustela nivalis . . . . . least weasel
Myotis septentrionalis . . . . . northern myotis
Perognathus flavescens . . . . . plains pocket mouse
Phenacomys intermedius . . . . . heather vole
Pipistrellus subflavus . . . . . eastern pipistrelle
Sorex fumeus . . . . . smokey shrew
Synaptomys borealis . . . . . northern bog lemming
Thomomys talpoides . . . . . northern pocket gopher

BIRDS

Endangered

Ammodramus bairdii . . . . . Baird's sparrow
Ammodramus henslowii . . . . . Henslow's Sparrow
Anthus spragueii . . . . . Sprague's Pipit
Calcarius ornatus . . . . . chestnut-collared longspur
Charadrius melodus . . . . . piping plover (Fed. Status: T)
Rallus elegans . . . . . king rail
Speotyto cunicularia . . . . . burrowing owl

Threatened

Cygnus buccinator . . . . . trumpeter swan
Falco peregrinus . . . . . peregrine falcon (Fed. Status: E)
Lanius ludovicianus . . . . . loggerhead shrike
Phalaropus tricolor . . . . . Wilson's phalarope
Podiceps auritus . . . . . horned grebe
Sterna hirundo . . . . . common tern

Special Concern

Ammodramus nelsoni . . . . . Nelson's sharp-tailed sparrow
Asio flammeus . . . . . short-eared owl
Buteo lineatus . . . . . red-shouldered hawk
Coturnicops noveboracensis . . . . . yellow rail
Dendroica cerulea . . . . . cerulean warbler
Empidonax virescens . . . . . acadian flycatcher
Gallinula chloropus . . . . . common moorhen
Haliaeetus leucocephalus . . . . . bald eagle (Fed. Status: T)
Larus pipixcan . . . . . Franklin's gull
Limosa fedoa . . . . . marbled godwit
Pelecanus erythrorhynchos . . . . . American white pelican
Seiurus motacilla . . . . . Louisiana waterthrush
Sterna forsteri . . . . . Forster's tern
Tympanuchus cupido . . . . . greater prairie-chicken
Wilsonia citrina . . . . . hooded warbler

AMPHIBIANS AND REPTILES

Endangered

Acris crepitans . . . . . northern cricket frog
Sistrurus catenatus . . . . . massasauga

Threatened

Clemmys insculpta . . . . . wood turtle
Crotalus horridus . . . . . timber rattlesnake
Emydoidea blandingii . . . . . Blanding's turtle

Special Concern

Apalone mutica . . . . . smooth softshell
Chelydra serpentina . . . . . snapping turtle
Coluber constrictor . . . . . racer
Elaphe obsoleta . . . . . rat snake
Eumeces fasciatus . . . . . five-lined skink
Hemidactylium scutatum . . . . . four-toed salamander
Heterodon nasicus . . . . . western hognose snake
Pituophis catenifer . . . . . gopher snake
Tropidoclonion lineatum . . . . . lined snake

FISH

Threatened

Polyodon spathula . . . . . paddlefish

Special Concern

Acipenser fulvescens . . . . . lake sturgeon
Alosa chrysochloris . . . . . skipjack herring
Ammocrypta asprella . . . . . crystal darter
Aphredoderus sayanus . . . . . pirate perch
Coregonus kiyi . . . . . kiyi
Coregonus zenithicus . . . . . shortjaw cisco
Cycleptus elongatus . . . . . blue sucker
Erimystax x-punctata . . . . . gravel chub
Etheostoma microperca . . . . . least darter
Fundulus sciadicus . . . . . plains topminnow
Ichthyomyzon fossor . . . . . northern brook lamprey
Ichthyomyzon gagei . . . . . southern brook lamprey
Ictiobus niger . . . . . black buffalo
Morone mississippiensis . . . . . yellow bass
Notropis amnis . . . . . pallid shiner
Notropis anogenus . . . . . pugnose shiner
Notropis nubilus . . . . . Ozark minnow
Notropis topeka . . . . . Topeka shiner
Noturus exilis . . . . . slender madtom
Percina evides . . . . . gilt darter

MOLLUSKS

Endangered

Arcidens confragosus . . . . . rock pocketbook
Elliptio crassidens . . . . . elephant-ear
Fusconaia ebena . . . . . ebonyshell
Lampsilis higginsi . . . . . Higgins eye (Fed. Status: E)
Lampsilis teres . . . . . yellow sandshell
Novasuccinea n. sp. Minnesota B . . . . . Iowa pleistocene ambersnail
Plethobasus cyphyus . . . . . sheepnose
Quadrula fragosa . . . . . winged mapleleaf (Fed. Status: E)
Quadrula nodulata . . . . . wartyback
Vertigo hubrichti hubrichti . . . . . Midwest pleistocene vertigo

Threatened

Actinonaias ligamentina . . . . . mucket
Alasmidonta marginata . . . . . elktoe
Cumberlandia monodonta . . . . . spectaclecase
Cyclonaias tuberculata . . . . . purple wartyback
Ellipsaria lineolata . . . . . butterfly
Epioblasma triquetra . . . . . snuffbox
Megalonaias nervosa . . . . . washboard
Novasuccinea n. sp. Minnesota A . . . . . Minnesota pleistocene ambersnail
Pleurobema coccineum . . . . . round pigtoe
Quadrula metanevra . . . . . monkeyface
Simpsonaias ambigua . . . . . salamander mussel
Tritogonia verrucosa . . . . . pistolgrip
Venustaconcha ellipsiformis . . . . . ellipse
Vertigo hubrichti variabilis n. subsp. . . . . variable pleistocene vertigo
Vertigo meramecensis . . . . . bluff vertigo

Special Concern

Elliptio dilatata . . . . . spike
Lasmigona compressa . . . . . creek heelsplitter
Lasmigona costata . . . . . fluted-shell
Ligumia recta . . . . . black sandshell
Obovaria olivaria . . . . . hickorynut

JUMPING SPIDERS

Special Concern

Habronattus texanus . . . . . a species of jumping spider
Marpissa grata . . . . . a species of jumping spider
Metaphidippus arizonensis . . . . . a species of jumping spider
Paradamoetas fontana . . . . . a species of jumping spider
Phidippus apacheanus . . . . . a species of jumping spider
Phidippus pius . . . . . a species of jumping spider
Sassacus papenhoei . . . . . a species of jumping spider
Tutelina formicaria . . . . . a species of jumping spider

LEAFHOPPERS

Special Concern

Aflexia rubranura . . . . . red-tailed prairie leafhopper

DRAGONFLIES

Special Concern

Ophiogomphus anomalis . . . . . extra-striped snaketail
Ophiogomphus susbehcha . . . . . St. Croix snaketail

BUTTERFLIES AND MOTHS

Endangered

Erynnis persius . . . . . persius dusky wing
Hesperia comma assiniboia . . . . . assiniboia skipper
Hesperia uncas . . . . . uncas skipper
Lycaeides melissa samuelis . . . . . Karner blue (Fed. Status: E)
Oeneis uhleri varuna . . . . . Uhler's arctic

Threatened

Hesperia dacotae . . . . . dakota skipper
Hesperia ottoe . . . . . ottoe skipper
Oarisma garita . . . . . garita skipper

Special Concern

Atrytone arogos . . . . . arogos skipper
Erebia disa mancinus . . . . . disa alpine
Hesperia leonardus . . . . . leonardus skipper
Lycaeides idas nabokovi . . . . . Nabokov's blue
Oarisma powesheik . . . . . powesheik skipper
Pyrgus centaureae freija . . . . . grizzled skipper
Schinia indiana . . . . . phlox moth
Speyeria idalia . . . . . regal fritillary

CADDISFLIES

Endangered

Chilostigma itascae . . . . . headwaters chilostigman

Special Concern

Agapetus tomus . . . . . a species of caddisfly
Asynarchus rossi . . . . . a species of caddisfly
Ceraclea brevis . . . . . a species of caddisfly
Ceraclea vertreesi . . . . . a species of caddisfly
Hydroptila metoeca . . . . . a species of caddisfly
Hydroptila novicola . . . . . a species of caddisfly
Hydroptila tortosa . . . . . a species of caddisfly
Oxyethira ecornuta . . . . . a species of caddisfly
Oxyethira itascae . . . . . a species of caddisfly
Polycentropus milaca . . . . . a species of caddisfly
Protoptila talola . . . . . a species of caddisfly
Setodes guttatus . . . . . a species of caddisfly

TIGER BEETLES

Endangered

Cicindela fulgida fulgida . . . . . a species of tiger beetle
Cicindela limbata nympha . . . . . a species of tiger beetle

Threatened

Cicindela denikei . . . . . a species of tiger beetle
Cicindela fulgida westbournei . . . . . a species of tiger beetle
Cicindela lepida . . . . . a species of tiger beetle

Special concern

Cicindela hirticollis rhodensis . . . . . a species of tiger beetle
Cicindela macra macra . . . . . a species of tiger beetle
Cicindela patruela patruela . . . . . a species of tiger beetle
Cicindela splendida cyanocephalata . . . . . a species of tiger beetle

VASCULAR PLANTS

Endangered

Agalinis auriculata . . . . . eared false foxglove
Agalinis gattingeri . . . . . round-stemmed false foxglove
Asclepias stenophylla . . . . . narrow-leaved milkweed
Astragalus alpinus . . . . . alpine milk-vetch
Bartonia virginica . . . . . Virginia bartonia
Botrychium gallicomontanum . . . . . frenchman's bluff moonwort
Botrychium oneidense . . . . . blunt-lobed grapefern
Botrychium pallidum . . . . . pale moonwort
Cacalia suaveolens . . . . . sweet-smelling Indian-plantain
Caltha natans . . . . . floating marsh-marigold
Carex formosa . . . . . handsome sedge
Carex pallescens . . . . . pale sedge
Carex plantaginea . . . . . plantain-leaved sedge
Castilleja septentrionalis . . . . . northern paintbrush
Cheilanthes lanosa . . . . . hairy lip-fern
Chrysosplenium iowense . . . . . Iowa golden saxifrage
Cristatella jamesii . . . . . James' polanisia
Dodecatheon meadia . . . . . prairie shooting star
Draba norvegica . . . . . Norwegian whitlow-grass
Eleocharis wolfii . . . . . Wolf's spike-rush
Empetrum eamesii . . . . . purple crowberry
Empetrum nigrum . . . . . black crowberry
Erythronium propullans . . . . . dwarf trout lily (Fed. Status: E)
Escobaria vivipara . . . . . ball cactus
Fimbristylis puberula var. *interior* . . . . . hairy fimbristylis
Glaux maritima . . . . . sea milkwort
Hydrastis canadensis . . . . . golden-seal
Iodanthus pinnatifidus . . . . . purple rocket
Isoetes melanopoda . . . . . blackfoot quillwort
Lechea tenuifolia . . . . . narrow-leaved pinweed
Lesquerella ludoviciana . . . . . bladder pod
Listera auriculata . . . . . auricled twayblade
Malaxis paludosa . . . . . bog adder's-mouth
Marsilea vestita . . . . . hairy water clover
Montia chamissoi . . . . . montia
Oryzopsis hymenoides . . . . . Indian ricegrass
Osmorhiza berteroi . . . . . Chilean sweet cicely
Oxytropis viscida . . . . . sticky locoweed
Paronychia fastigiata . . . . . forked chickweed
Parthenium integrifolium . . . . . wild quinine
Platanthera flava var. *herbiola* . . . . . tubercled rein-orchid
Platanthera praeclara . . . . . western prairie fringed orchid (Fed. Status: T)
Polemonium occidentale ssp. *lacustre* . . . . western Jacob's-ladder
Polygala cruciata . . . . . cross-leaved milkwort
Polystichum braunii . . . . . Braun's holly fern
Potamogeton bicupulatus . . . . . snailseed pondweed
Potamogeton diversifolius . . . . . diverse-leaved pondweed
Psoralidium tenuiflora . . . . . slender-leaved scurf pea
Sagina nodosa ssp. *borealis* . . . . . knotty pearlwort
Saxifraga cernua . . . . . nodding saxifrage
Scleria triglomerata . . . . . tall nut-rush
Sedum integrifolium ssp. *leedyi* . . . . . Leedy's roseroot (Fed. Status: T)
Selaginella selaginoides . . . . . northern spikemoss
Senecio canus . . . . . gray ragwort
Talinum rugospermum . . . . . rough-seeded fameflower
Tofieldia pusilla . . . . . small false asphodel
Xyris torta . . . . . twisted yellow-eyed grass

VASCULAR PLANTS

Threatened

Achillea sibirica . . . . . Siberian yarrow
Allium cernuum . . . . . nodding wild onion
Allium schoenoprasum var. *sibiricum* . . . . wild chives
Ammophila breviligulata . . . . . beachgrass
Arabis holboellii var. *retrofracta* . . . . . Holboell's rockcress
Arnica lonchophylla . . . . . long-leaved arnica
Arnoglossum plantagineum . . . . . tuberous Indian-plantain
Asclepias hirtella . . . . . prairie milkweed
Asclepias sullivantii . . . . . Sullivant's milkweed
Asplenium trichomanes . . . . . maidenhair spleenwort
Aster shortii . . . . . Short's aster
Aureolaria pedicularia . . . . . fernleaf false foxglove
Besseya bullii . . . . . kitten-tails
Botrychium lanceolatum . . . . . triangle moonwort
Botrychium lunaria . . . . . common moonwort
Botrychium rugulosum . . . . . St. Lawrence grapefern
Carex careyana . . . . . Carey's sedge
Carex conjuncta . . . . . jointed sedge
Carex davisii . . . . . Davis' sedge
Carex festucacea . . . . . fescue sedge
Carex garberi . . . . . Garber's sedge
Carex jamesii . . . . . James' sedge
Carex katahdinensis . . . . . Katahdin sedge
Carex laevivaginata . . . . . smooth-sheathed sedge
Carex laxiculmis . . . . . spreading sedge
Carex sterilis . . . . . sterile sedge
Crassula aquatica . . . . . pigmyweed
Crataegus douglasii . . . . . black hawthorn
Cyperus acuminatus . . . . . short-pointed umbrella-sedge
Cypripedium arietinum . . . . . ram's-head lady's-slipper
Diplazium pycnocarpon . . . . . narrow-leaved spleenwort
Dryopteris marginalis . . . . . marginal shield-fern
Eleocharis nitida . . . . . neat spike-rush
Eleocharis olivacea . . . . . olivaceous spike-rush
Eleocharis rostellata . . . . . beaked spike-rush
Eupatorium sessilifolium . . . . . upland boneset
Floerkea proserpinacoides . . . . . false mermaid
Heteranthera limosa . . . . . mud plantain
Huperzia porophila . . . . . rock clubmoss
Lespedeza leptostachya . . . . . prairie bush clover (Fed. Status: T)
Melica nitens . . . . . three-flowered melic
Moehringia macrophylla . . . . . large-leaved sandwort
Napaea dioica . . . . . glade mallow
Nymphaea leibergii . . . . . small white waterlily
Paronychia canadensis . . . . . Canadian forked chickweed
Phegopteris hexagonoptera . . . . . broad beech-fern
Plantago elongata . . . . . slender plantain
Poa paludigena . . . . . bog bluegrass
Polystichum acrostichoides . . . . . Christmas fern
Rhynchospora capillacea . . . . . hair-like beak-rush
Rotala ramosior . . . . . tooth-cup
Rubus chamaemorus . . . . . cloudberry
Salicornia rubra . . . . . red saltwort
Saxifraga paniculata . . . . . encrusted saxifrage
Scleria verticillata . . . . . whorled nut-rush
Scutellaria ovata . . . . . ovate-leaved skullcap
Shinnersoseris rostrata . . . . . annual skeletonweed
Silene nivea . . . . . snowy campion
Subularia aquatica . . . . . awlwort
Sullivantia sullivantii . . . . . reniform sullivantia
Vaccinium uliginosum . . . . . alpine bilberry
Valeriana edulis var. *ciliata* . . . . . valerian
Viola lanceolata . . . . . lance-leaved violet
Viola nuttallii . . . . . yellow prairie violet
Woodsia glabella . . . . . smooth woodsia
Woodsia scopulina . . . . . Rocky Mountain woodsia

VASCULAR PLANTS

Special Concern

Adoxa moschatellina . . . . . moschatel
Agrostis geminata . . . . . twin bentgrass
Androsace septentrionalis ssp. *puberulenta* northern androsace
Antennaria parvifolia . . . . . small-leaved pussytoes
Aristida purpurea var. *longiseta* . . . . . red three-awn
Aristida tuberculosa . . . . . sea-beach needlegrass
Asclepias amplexicaulis . . . . . clasping milkweed
Asplenium platyneuron . . . . . ebony spleenwort
Astragalus flexuosus . . . . . slender milk-vetch
Astragalus missouriensis . . . . . Missouri milk-vetch
Bacopa rotundifolia . . . . . water-hyssop
Baptisia alba . . . . . white wild indigo
Baptisia bracteata var. *leucophaea* . . . . . plains wild indigo
Botrychium campestre . . . . . prairie moonwort
Botrychium mormo . . . . . goblin fern
Botrychium minganense . . . . . Mingan moonwort
Botrychium simplex . . . . . least moonwort
Buchloe dactyloides . . . . . buffalo grass
Calamagrostis lacustris . . . . . marsh reedgrass
Calamagrostis montanensis . . . . . plains reedgrass
Calamagrostis purpurascens . . . . . purple reedgrass
Callitriche heterophylla . . . . . larger water-starwort
Carex annectens . . . . . yellow-fruited sedge
Carex crus-corvi . . . . . raven's foot sedge
Carex exilis . . . . . coastal sedge
Carex flava . . . . . yellow sedge
Carex hallii . . . . . Hall's sedge
Carex michauxiana . . . . . Michaux's sedge
Carex obtusata . . . . . blunt sedge
Carex praticola . . . . . prairie sedge
Carex scirpoidea . . . . . northern singlespike sedge
Carex supina var. *spaniocarpa* . . . . . weak arctic sedge
Carex typhina . . . . . cattail sedge
Carex woodii . . . . . Wood's sedge
Carex xerantica . . . . . dry sedge
Chamaesyce missurica . . . . . Missouri spurge
Cirsium hillii . . . . . Hill's thistle
Cladium mariscoides . . . . . twig-rush
Claytonia caroliniana . . . . . Carolina spring-beauty
Cymopterus acaulis . . . . . wild parsley
Cypripedium candidum . . . . . small white lady's-slipper
Dalea candida var. *oligophylla* . . . . . white prairie-clover
Decodon verticillatus . . . . . waterwillow
Deschampsia flexuosa . . . . . slender hairgrass
Desmanthus illinoensis . . . . . prairie mimosa
Desmodium cuspidatum var. *longifolium* . . big tick-trefoil
Desmodium nudiflorum . . . . . stemless tick-trefoil
Diarrhena obovata . . . . . American beakgrain
Dicentra canadensis . . . . . squirrel-corn
Draba arabisans . . . . . rock whitlow-grass
Drosera anglica . . . . . English sundew
Drosera linearis . . . . . linear-leaved sundew
Dryopteris goldiana . . . . . Goldie's fern
Eleocharis parvula . . . . . dwarf spike-rush
Eleocharis quinqueflora . . . . . few-flowered spike-rush
Eryngium yuccifolium . . . . . rattlesnake-master
Euphrasia hudsoniana . . . . . Hudson Bay eyebright
Fimbristylis autumnalis . . . . . autumn fimbristylis
Gaillardia aristata . . . . . blanket-flower
Gentiana affinis . . . . . northern gentian
Gentianella amarella ssp. *acuta* . . . . . felwort
Hamamelis virginiana . . . . . witch-hazel
Helianthus nuttallii ssp. *rydbergii* . . . . . Nuttall's sunflower
Helictotrichon hookeri . . . . . oat-grass
Hudsonia tomentosa . . . . . beach-heather
Hydrocotyle americana . . . . . American water-pennywort

VASCULAR PLANTS

Special Concern (continued)

Jeffersonia diphylla . . . . . twinleaf
Juglans cinerea . . . . . butternut
Juncus marginatus . . . . . marginated rush
Juncus stygius var. *americanus* . . . . . bog rush
Juniperus horizontalis . . . . . creeping juniper
Leersia lenticularis . . . . . catchfly grass
Limosella aquatica . . . . . mudwort
Listera convallarioides . . . . . broad-lipped twayblade
Littorella uniflora . . . . . American shore-plantain
Luzula parviflora ssp. *melanocarpa* . . . . . small-flowered woodrush
Lysimachia quadrifolia . . . . . whorled loosestrife
Machaeranthera pinnatifida . . . . . cutleaf ironplant
Malaxis monophyllos var. *brachypoda* . . . white adder's-mouth
Minuartia dawsonensis . . . . . rock sandwort
Muhlenbergia uniflora . . . . . one flowered muhly
Najas gracillima . . . . . slender naiad
Najas marina . . . . . sea naiad
Oenothera rhombipetala . . . . . rhombic-petaled evening primrose
Opuntia macrorhiza . . . . . plains prickly pear
Orobanche fasciculata . . . . . clustered broomrape
Orobanche ludoviciana . . . . . Louisiana broomrape
Orobanche uniflora . . . . . one-flowered broomrape
Osmorhiza depauperata . . . . . blunt-fruited sweet cicely
Panax quinquefolius . . . . . American ginseng
Pellaea atropurpurea . . . . . purple cliff-brake
Phacelia franklinii . . . . . Franklin's phacelia
Pinguicula vulgaris . . . . . butterwort
Platanthera clavellata . . . . . club-spur orchid
Poa wolfii . . . . . Wolf's bluegrass
Polygonum careyi . . . . . Carey's smartweed
Polygonum viviparum . . . . . alpine bistort
Polytaenia nuttallii . . . . . prairie-parsley
Potamogeton vaginatus . . . . . sheathed pondweed
Potamogeton vaseyi . . . . . Vasey's pondweed
Prenanthes crepidinea . . . . . nodding rattlesnake-root
Pyrola minor . . . . . small shinleaf
Ranunculus lapponicus . . . . . Lapland buttercup
Rhynchospora fusca . . . . . sooty-colored beak-rush
Rorippa sessiliflora . . . . . sessile-flowered cress
Rudbeckia triloba . . . . . three-leaved coneflower
Ruppia maritima . . . . . ditch-grass
Salix maccalliana . . . . . Maccall's willow
Salix pellita . . . . . satiny willow
Sanicula trifoliata . . . . . beaked snakeroot
Schedonnardus paniculatus . . . . . tumblegrass
Scirpus clintonii . . . . . Clinton's bulrush
Senecio indecorus . . . . . elegant grounsel
Silene drummondii . . . . . Drummond's campion
Solidago mollis . . . . . soft goldenrod
Solidago sciaphila . . . . . cliff goldenrod
Sparganium glomeratum . . . . . clustered bur-reed
Stellaria longipes . . . . . long-stalked chickweed
Symphoricarpos orbiculatus . . . . . coralberry
Tephrosia virginiana . . . . . goat's-rue
Torreyochloa pallida . . . . . Torrey's manna-grass
Trillium nivale . . . . . snow trillium
Trimorpha acris var. *asteroides* . . . . . bitter fleabane
Trimorpha lonchophylla . . . . . shortray fleabane
Triplasis purpurea . . . . . purple sand-grass
Tsuga canadensis . . . . . eastern hemlock
Utricularia purpurea . . . . . purple-flowered bladderwort
Utricularia resupinata . . . . . lavender bladderwort
Verbena simplex . . . . . narrow-leaved vervain
Vitis aestivalis . . . . . silverleaf grape
Waldsteinia fragarioides . . . . . barren strawberry
Woodsia alpina . . . . . alpine woodsia
Xyris montana . . . . . montane yellow-eyed grass

LICHENS

Endangered

Buellia nigra . . . . . a species of lichen
Caloplaca parvula . . . . . a species of lichen
Dermatocarpon moulinsii . . . . . a species of lichen
Leptogium apalachense . . . . . a species of lichen
Lobaria scrobiculata . . . . . a species of lichen
Parmelia stictica . . . . . a species of lichen
Pseudocyphellaria crocata . . . . . a species of lichen
Umbilicaria torrefacta . . . . . a species of lichen

Threatened

Cetraria oakesiana . . . . . a species of lichen
Coccocarpia palmicola . . . . . a species of lichen
Parmelia stuppea . . . . . a species of lichen

Special concern

Anaptychia setifera . . . . . a species of lichen
Cetraria aurescens . . . . . a species of lichen
Cladonia pseudorangiformis . . . . . a species of lichen
Lobaria quercizans . . . . . a species of lichen
Peltigera venosa . . . . . a species of lichen
Sticta fuliginosa . . . . . a species of lichen

MOSSES

Endangered

Schistostegia pennata . . . . . luminous moss

Special Concern

Bryoxiphium norvegicum . . . . . sword moss
Tomenthypnum falcifolium . . . . . a species of moss

FUNGI

Endangered

Fuscoboletinus weaverae . . . . . a species of fungus
Psathyrella cystidiosa . . . . . a species of fungus
Psathyrella rhodospora . . . . . a species of fungus

Special concern

Laccaria trullisata . . . . . a species of fungus
Lactarius fuliginellus . . . . . a species of fungus
Lysurus cruciatus . . . . . a species of fungus

Alphabetical Index by Scientific Name

STATUS CODES: E = Endangered; T = Threatened; SC = Special Concern

SCIENTIFIC NAME	COMMON NAME	STATUS	TAXONOMIC GROUP
Achillea sibirica	Siberian yarrow	T	vascular plant
Acipenser fulvescens	lake sturgeon	SC	fish
Acris crepitans	northern cricket frog	E	amphibian/reptile
Actinonaias ligamentina	mucket	T	mollusk
Adoxa moschatellina	moschatel	SC	vascular plant
Aflexia rubranura	red-tailed prairie leafhopper	SC	leafhopper
Agalinis auriculata	eared false foxglove	E	vascular plant
Agalinis gattingeri	round-stemmed false foxglove	E	vascular plant
Agapetus tomus	a species of caddisfly	SC	caddisfly
Agrostis geminata	twin bentgrass	SC	vascular plant
Alasmidonta marginata	elktoe	T	mollusk
Allium cernuum	nodding wild onion	T	vascular plant
Allium schoenoprasum var. *sibiricum*	wild chives	T	vascular plant
Alosa chrysochloris	skipjack herring	SC	fish
Ammocrypta asprella	crystal darter	SC	fish
Ammodramus bairdii	Baird's sparrow	E	bird
Ammodramus henslowii	Henslow's Sparrow	E	bird
Ammodramus nelsoni	Nelson's sharp-tailed sparrow	SC	bird
Ammophila breviligulata	beachgrass	T	vascular plant
Anaptychia setifera	a species of lichen	SC	lichen
Androsace septentrionalis ssp. *puberulenta*	northern androsace	SC	vascular plant
Antennaria parvifolia	small-leaved pussytoes	SC	vascular plant
Anthus spragueii	Sprague's Pipit	E	bird
Apalone mutica	smooth softshell	SC	amphibian/reptile
Aphredoderus sayanus	pirate perch	SC	fish
Arabis holboellii var. *retrofracta*	Holboell's rockcress	T	vascular plant
Arcidens confragosus	rock pocketbook	E	mollusk
Aristida purpurea var. *longiseta*	red three-awn	SC	vascular plant
Aristida tuberculosa	sea-beach needlegrass	SC	vascular plant
Arnica lonchophylla	long-leaved arnica	T	vascular plant
Arnoglossum plantagineum	tuberous Indian-plantain	T	vascular plant
Asclepias amplexicaulis	clasping milkweed	SC	vascular plant
Asclepias hirtella	prairie milkweed	T	vascular plant
Asclepias stenophylla	narrow-leaved milkweed	E	vascular plant
Asclepias sullivantii	Sullivant's milkweed	T	vascular plant
Asio flammeus	short-eared owl	SC	bird
Asplenium platyneuron	ebony spleenwort	SC	vascular plant
Asplenium trichomanes	maidenhair spleenwort	T	vascular plant
Aster shortii	Short's aster	T	vascular plant
Astragalus alpinus	alpine milk-vetch	E	vascular plant
Astragalus flexuosus	slender milk-vetch	SC	vascular plant
Astragalus missouriensis	Missouri milk-vetch	SC	vascular plant
Asynarchus rossi	a species of caddisfly	SC	caddisfly
Atrytone arogos	arogos skipper	SC	butterfly/moth
Aureolaria pedicularia	fernleaf false foxglove	T	vascular plant
Bacopa rotundifolia	water-hyssop	SC	vascular plant
Baptisia alba	white wild indigo	SC	vascular plant
Baptisia bracteata var. *leucophaea*	plains wild indigo	SC	vascular plant
Bartonia virginica	Virginia bartonia	E	vascular plant
Besseya bullii	kitten-tails	T	vascular plant
Botrychium campestre	prairie moonwort	SC	vascular plant
Botrychium gallicomontanum	frenchman's bluff moonwort	E	vascular plant
Botrychium lanceolatum	triangle moonwort	T	vascular plant
Botrychium lunaria	common moonwort	T	vascular plant
Botrychium minganense	Mingan moonwort	SC	vascular plant
Botrychium mormo	goblin fern	SC	vascular plant
Botrychium oneidense	blunt-lobed grapefern	E	vascular plant
Botrychium pallidum	pale moonwort	E	vascular plant
Botrychium rugulosum	St. Lawrence grapefern	T	vascular plant
Botrychium simplex	least moonwort	SC	vascular plant
Bryoxiphium norvegicum	sword moss	SC	moss
Buchloe dactyloides	buffalo grass	SC	vascular plant
Buellia nigra	a species of lichen	E	lichen
Buteo lineatus	red-shouldered hawk	SC	bird
Cacalia suaveolens	sweet-smelling Indian-plantain	E	vascular plant
Calamagrostis lacustris	marsh reedgrass	SC	vascular plant
Calamagrostis montanensis	plains reedgrass	SC	vascular plant
Calamagrostis purpurascens	purple reedgrass	SC	vascular plant
Calcarius ornatus	chestnut-collared longspur	E	bird
Callitriche heterophylla	larger water-starwort	SC	vascular plant
Caloplaca parvula	a species of lichen	E	lichen
Caltha natans	floating marsh-marigold	E	vascular plant
Canis lupus	gray wolf (Fed. Status: T)	SC	mammal
Carex annectens	yellow-fruited sedge	SC	vascular plant

Alphabetical Index by Scientific Name

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SCIENTIFIC NAME	COMMON NAME	STATUS	TAXONOMIC GROUP
Carex careyana	Carey's sedge	T	vascular plant
Carex conjuncta	jointed sedge	T	vascular plant
Carex crus-corvi	raven's foot sedge	SC	vascular plant
Carex davisii	Davis' sedge	T	vascular plant
Carex exilis	coastal sedge	SC	vascular plant
Carex festucacea	fescue sedge	T	vascular plant
Carex flava	yellow sedge	SC	vascular plant
Carex formosa	handsome sedge	E	vascular plant
Carex garberi	Garber's sedge	T	vascular plant
Carex hallii	Hall's sedge	SC	vascular plant
Carex jamesii	James' sedge	T	vascular plant
Carex katahdinensis	Katahdin sedge	T	vascular plant
Carex laevivaginata	smooth-sheathed sedge	T	vascular plant
Carex laxiculmis	spreading sedge	T	vascular plant
Carex michauxiana	Michaux's sedge	SC	vascular plant
Carex obtusata	blunt sedge	SC	vascular plant
Carex pallescens	pale sedge	E	vascular plant
Carex plantaginea	plantain-leaved sedge	E	vascular plant
Carex praticola	prairie sedge	SC	vascular plant
Carex scirpoidea	northern singlespike sedge	SC	vascular plant
Carex sterilis	sterile sedge	T	vascular plant
Carex supina var. *spaniocarpa*	weak arctic sedge	SC	vascular plant
Carex typhina	cattail sedge	SC	vascular plant
Carex woodii	Wood's sedge	SC	vascular plant
Carex xerantica	dry sedge	SC	vascular plant
Castilleja septentrionalis	northern paintbrush	E	vascular plant
Ceraclea brevis	a species of caddisfly	SC	caddisfly
Ceraclea vertreesi	a species of caddisfly	SC	caddisfly
Cervus elaphus	elk	SC	mammal
Cetraria aurescens	a species of lichen	SC	lichen
Cetraria oakesiana	a species of lichen	T	lichen
Chamaesyce missurica	Missouri spurge	SC	vascular plant
Charadrius melodus	piping plover (Fed. Status: T)	E	bird
Cheilanthes lanosa	hairy lip-fern	E	vascular plant
Chelydra serpentina	snapping turtle	SC	amphibian/reptile
Chilostigma itascae	headwaters chilostigman	E	caddisfly
Chrysosplenium iowense	Iowa golden saxifrage	E	vascular plant
Cicindela denikei	a species of tiger beetle	T	tiger beetle
Cicindela fulgida westbournei	a species of tiger beetle	T	tiger beetle
Cicindela fulgida fulgida	a species of tiger beetle	E	tiger beetle
Cicindela hirticollis rhodensis	a species of tiger beetle	SC	tiger beetle
Cicindela lepida	a species of tiger beetle	T	tiger beetle
Cicindela limbata nympha	a species of tiger beetle	E	tiger beetle
Cicindela macra macra	a species of tiger beetle	SC	tiger beetle
Cicindela patruela patruela	a species of tiger beetle	SC	tiger beetle
Cicindela splendida cyanocephalata	a species of tiger beetle	SC	tiger beetle
Cirsium hillii	Hill's thistle	SC	vascular plant
Cladium mariscoides	twig-rush	SC	vascular plant
Cladonia pseudorangiformis	a species of lichen	SC	lichen
Claytonia caroliniana	Carolina spring-beauty	SC	vascular plant
Clemmys insculpta	wood turtle	T	amphibian/reptile
Coccocarpia palmicola	a species of lichen	T	lichen
Coluber constrictor	racer	SC	amphibian/reptile
Coregonus kiyi	kiyi	SC	fish
Coregonus zenithicus	shortjaw cisco	SC	fish
Coturnicops noveboracensis	yellow rail	SC	bird
Crassula aquatica	pigmyweed	T	vascular plant
Crataegus douglasii	black hawthorn	T	vascular plant
Cristatella jamesii	James' polanisia	E	vascular plant
Crotalus horridus	timber rattlesnake	T	amphibian/reptile
Cryptotis parva	least shrew	SC	mammal
Cumberlandia monodonta	spectaclecase	T	mollusk
Cycleptus elongatus	blue sucker	SC	fish
Cyclonaias tuberculata	purple wartyback	T	mollusk
Cygnus buccinator	trumpeter swan	T	bird
Cymopterus acaulis	wild parsley	SC	vascular plant
Cyperus acuminatus	short-pointed umbrella-sedge	T	vascular plant
Cypripedium arietinum	ram's-head lady's-slipper	T	vascular plant
Cypripedium candidum	small white lady's-slipper	SC	vascular plant
Dalea candida var. *oligophylla*	white prairie-clover	SC	vascular plant
Decodon verticillatus	waterwillow	SC	vascular plant
Dendroica cerulea	cerulean warbler	SC	bird
Dermatocarpon moulinsii	a species of lichen	E	lichen
Deschampsia flexuosa	slender hairgrass	SC	vascular plant

Alphabetical Index by Scientific Name

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SCIENTIFIC NAME	COMMON NAME	STATUS	TAXONOMIC GROUP
Desmanthus illinoensis	prairie mimosa	SC	vascular plant
Desmodium cuspidatum var. *longifolium*	big tick-trefoil	SC	vascular plant
Desmodium nudiflorum	stemless tick-trefoil	SC	vascular plant
Diarrhena obovata	American beakgrain	SC	vascular plant
Dicentra canadensis	squirrel-corn	SC	vascular plant
Diplazium pycnocarpon	narrow-leaved spleenwort	T	vascular plant
Dodecatheon meadia	prairie shooting star	E	vascular plant
Draba arabisans	rock whitlow-grass	SC	vascular plant
Draba norvegica	Norwegian whitlow-grass	E	vascular plant
Drosera anglica	English sundew	SC	vascular plant
Drosera linearis	linear-leaved sundew	SC	vascular plant
Dryopteris goldiana	Goldie's fern	SC	vascular plant
Dryopteris marginalis	marginal shield-fern	T	vascular plant
Elaphe obsoleta	rat snake	SC	amphibian/reptile
Eleocharis nitida	neat spike-rush	T	vascular plant
Eleocharis olivacea	olivaceous spike-rush	T	vascular plant
Eleocharis parvula	dwarf spike-rush	SC	vascular plant
Eleocharis quinqueflora	few-flowered spike-rush	SC	vascular plant
Eleocharis rostellata	beaked spike-rush	T	vascular plant
Eleocharis wolfii	Wolf's spike-rush	E	vascular plant
Ellipsaria lineolata	butterfly	T	mollusk
Elliptio crassidens	elephant-ear	E	mollusk
Elliptio dilatata	spike	SC	mollusk
Empetrum eamesii	purple crowberry	E	vascular plant
Empetrum nigrum	black crowberry	E	vascular plant
Empidonax virescens	acadian flycatcher	SC	bird
Emydoidea blandingii	Blanding's turtle	T	amphibian/reptile
Epioblasma triquetra	snuffbox	T	mollusk
Erebia disa mancinus	disa alpine	SC	butterfly/moth
Erimystax x-punctata	gravel chub	SC	fish
Eryngium yuccifolium	rattlesnake-master	SC	vascular plant
Erynnis persius	persius dusky wing	E	butterfly/moth
Erythronium propullans	dwarf trout lily (Fed. Status: E)	E	vascular plant
Escobaria vivipara	ball cactus	E	vascular plant
Etheostoma microperca	least darter	SC	fish
Eumeces fasciatus	five-lined skink	SC	amphibian/reptile
Eupatorium sessilifolium	upland boneset	T	vascular plant
Euphrasia hudsoniana	Hudson Bay eyebright	SC	vascular plant
Falco peregrinus	peregrine falcon (Fed. Status: E)	T	bird
Felis concolor	mountain lion	SC	mammal
Fimbristylis autumnalis	autumn fimbristylis	SC	vascular plant
Fimbristylis puberula var. *interior*	hairy fimbristylis	E	vascular plant
Floerkea proserpinacoides	false mermaid	T	vascular plant
Fundulus sciadicus	plains topminnow	SC	fish
Fuscoboletinus weaverae	a species of fungus	E	fungus
Fusconaia ebena	ebonyshell	E	mollusk
Gaillardia aristata	blanket-flower	SC	vascular plant
Gallinula chloropus	common moorhen	SC	bird
Gentiana affinis	northern gentian	SC	vascular plant
Gentianella amarella ssp. *acuta*	felwort	SC	vascular plant
Glaux maritima	sea milkwort	E	vascular plant
Habronattus texanus	a species of jumping spider	SC	jumping spider
Haliaeetus leucocephalus	bald eagle (Fed. Status: T)	SC	bird
Hamamelis virginiana	witch-hazel	SC	vascular plant
Helianthus nuttallii ssp. *rydbergii*	Nuttall's sunflower	SC	vascular plant
Helictotrichon hookeri	oat-grass	SC	vascular plant
Hemidactylium scutatum	four-toed salamander	SC	amphibian/reptile
Hesperia comma assiniboia	assiniboia skipper	E	butterfly/moth
Hesperia dacotae	dakota skipper	T	butterfly/moth
Hesperia leonardus	leonardus skipper	SC	butterfly/moth
Hesperia ottoe	ottoe skipper	T	butterfly/moth
Hesperia uncas	uncas skipper	E	butterfly/moth
Heteranthera limosa	mud plantain	T	vascular plant
Heterodon nasicus	western hognose snake	SC	amphibian/reptile
Hudsonia tomentosa	beach-heather	SC	vascular plant
Huperzia porophila	rock clubmoss	T	vascular plant
Hydrastis canadensis	golden-seal	E	vascular plant
Hydrocotyle americana	American water-pennywort	SC	vascular plant
Hydroptila metoeca	a species of caddisfly	SC	caddisfly
Hydroptila novicola	a species of caddisfly	SC	caddisfly
Hydroptila tortosa	a species of caddisfly	SC	caddisfly
Ichthyomyzon fossor	northern brook lamprey	SC	fish
Ichthyomyzon gagei	southern brook lamprey	SC	fish
Ictiobus niger	black buffalo	SC	fish

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SCIENTIFIC NAME	COMMON NAME	STATUS	TAXONOMIC GROUP
Iodanthus pinnatifidus	purple rocket	E	vascular plant
Isoetes melanopoda	blackfoot quillwort	E	vascular plant
Jeffersonia diphylla	twinleaf	SC	vascular plant
Juglans cinerea	butternut	SC	vascular plant
Juncus marginatus	marginated rush	SC	vascular plant
Juncus stygius var. *americanus*	bog rush	SC	vascular plant
Juniperus horizontalis	creeping juniper	SC	vascular plant
Laccaria trullisata	a species of fungus	SC	fungus
Lactarius fuliginellus	a species of fungus	SC	fungus
Lampsilis higginsi	Higgins eye (Fed. Status: E)	E	mollusk
Lampsilis teres	yellow sandshell	E	mollusk
Lanius ludovicianus	loggerhead shrike	T	bird
Larus pipixcan	Franklin's gull	SC	bird
Lasmigona compressa	creek heelsplitter	SC	mollusk
Lasmigona costata	fluted-shell	SC	mollusk
Lechea tenuifolia	narrow-leaved pinweed	E	vascular plant
Leersia lenticularis	catchfly grass	SC	vascular plant
Leptogium apalachense	a species of lichen	E	lichen
Lespedeza leptostachya	prairie bush clover (Fed. Status: T)	T	vascular plant
Lesquerella ludoviciana	bladder pod	E	vascular plant
Ligumia recta	black sandshell	SC	mollusk
Limosa fedoa	marbled godwit	SC	bird
Limosella aquatica	mudwort	SC	vascular plant
Listera auriculata	auricled twayblade	E	vascular plant
Listera convallarioides	broad-lipped twayblade	SC	vascular plant
Littorella uniflora	American shore-plantain	SC	vascular plant
Lobaria quercizans	a species of lichen	SC	lichen
Lobaria scrobiculata	a species of lichen	E	lichen
Luzula parviflora ssp. *melanocarpa*	small-flowered woodrush	SC	vascular plant
Lycaeides idas nabokovi	Nabokov's blue	SC	butterfly/moth
Lycaeides melissa samuelis	Karner blue (Fed. Status: E)	E	butterfly/moth
Lysimachia quadrifolia	whorled loosestrife	SC	vascular plant
Lysurus cruciatus	a species of fungus	SC	fungus
Machaeranthera pinnatifida	cutleaf ironplant	SC	vascular plant
Malaxis monophyllos var. *brachypoda*	white adder's-mouth	SC	vascular plant
Malaxis paludosa	bog adder's-mouth	E	vascular plant
Marpissa grata	a species of jumping spider	SC	jumping spider
Marsilea vestita	hairy water clover	E	vascular plant
Megalonaias nervosa	washboard	T	mollusk
Melica nitens	three-flowered melic	T	vascular plant
Metaphidippus arizonensis	a species of jumping spider	SC	jumping spider
Microtus ochrogaster	prairie vole	SC	mammal
Microtus pinetorum	woodland vole	SC	mammal
Minuartia dawsonensis	rock sandwort	SC	vascular plant
Moehringia macrophylla	large-leaved sandwort	T	vascular plant
Montia chamissoi	montia	E	vascular plant
Morone mississippiensis	yellow bass	SC	fish
Muhlenbergia uniflora	one flowered muhly	SC	vascular plant
Mustela nivalis	least weasel	SC	mammal
Myotis septentrionalis	northern myotis	SC	mammal
Najas gracillima	slender naiad	SC	vascular plant
Najas marina	sea naiad	SC	vascular plant
Napaea dioica	glade mallow	T	vascular plant
Notropis amnis	pallid shiner	SC	fish
Notropis anogenus	pugnose shiner	SC	fish
Notropis nubilus	Ozark minnow	SC	fish
Notropis topeka	Topeka shiner	SC	fish
Noturus exilis	slender madtom	SC	fish
Novasuccinea n. sp. Minnesota B	Iowa pleistocene ambersnail	E	mollusk
Novasuccinea n. sp. Minnesota A	Minnesota pleistocene ambersnail	T	mollusk
Nymphaea leibergii	small white waterlily	T	vascular plant
Oarisma garita	garita skipper	T	butterfly/moth
Oarisma powesheik	powesheik skipper	SC	butterfly/moth
Obovaria olivaria	hickorynut	SC	mollusk
Oeneis uhleri varuna	Uhler's arctic	E	butterfly/moth
Oenothera rhombipetala	rhombic-petaled evening primrose	SC	vascular plant
Ophiogomphus anomalis	extra-striped snaketail	SC	dragonfly
Ophiogomphus susbehcha	St. Croix snaketail	SC	dragonfly
Opuntia macrorhiza	plains prickly pear	SC	vascular plant
Orobanche fasciculata	clustered broomrape	SC	vascular plant
Orobanche ludoviciana	Louisiana broomrape	SC	vascular plant
Orobanche uniflora	one-flowered broomrape	SC	vascular plant
Oryzopsis hymenoides	Indian ricegrass	E	vascular plant
Osmorhiza berteroi	Chilean sweet cicely	E	vascular plant

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Osmorhiza depauperata	blunt-fruited sweet cicely	SC	vascular plant
Oxyethira ecornuta	a species of caddisfly	SC	caddisfly
Oxyethira itascae	a species of caddisfly	SC	caddisfly
Oxytropis viscida	sticky locoweed	E	vascular plant
Panax quinquefolius	American ginseng	SC	vascular plant
Paradamoetas fontana	a species of jumping spider	SC	jumping spider
Parmelia stictica	a species of lichen	E	lichen
Parmelia stuppea	a species of lichen	T	lichen
Paronychia canadensis	Canadian forked chickweed	T	vascular plant
Paronychia fastigiata	forked chickweed	E	vascular plant
Parthenium integrifolium	wild quinine	E	vascular plant
Pelecanus erythrorhynchos	American white pelican	SC	bird
Pellaea atropurpurea	purple cliff-brake	SC	vascular plant
Peltigera venosa	a species of lichen	SC	lichen
Percina evides	gilt darter	SC	fish
Perognathus flavescens	plains pocket mouse	SC	mammal
Phacelia franklinii	Franklin's phacelia	SC	vascular plant
Phalaropus tricolor	Wilson's phalarope	T	bird
Phegopteris hexagonoptera	broad beech-fern	T	vascular plant
Phenacomys intermedius	heather vole	SC	mammal
Phidippus apacheanus	a species of jumping spider	SC	jumping spider
Phidippus pius	a species of jumping spider	SC	jumping spider
Pinguicula vulgaris	butterwort	SC	vascular plant
Pipistrellus subflavus	eastern pipistrelle	SC	mammal
Pituophis catenifer	gopher snake	SC	amphibian/reptile
Plantago elongata	slender plantain	T	vascular plant
Platanthera clavellata	club-spur orchid	SC	vascular plant
Platanthera flava var. *herbiola*	tubercled rein-orchid	E	vascular plant
Platanthera praeclara	western prairie fringed orchid (Fed. Status: T)	E	vascular plant
Plethobasus cyphyus	sheepnose	E	mollusk
Pleurobema coccineum	round pigtoe	T	mollusk
Poa paludigena	bog bluegrass	T	vascular plant
Poa wolfii	Wolf's bluegrass	SC	vascular plant
Podiceps auritus	horned grebe	T	bird
Polemonium occidentale ssp. *lacustre*	western Jacob's-ladder	E	vascular plant
Polycentropus milaca	a species of caddisfly	SC	caddisfly
Polygala cruciata	cross-leaved milkwort	E	vascular plant
Polygonum careyi	Carey's smartweed	SC	vascular plant
Polygonum viviparum	alpine bistort	SC	vascular plant
Polyodon spathula	paddlefish	T	fish
Polystichum acrostichoides	Christmas fern	T	vascular plant
Polystichum braunii	Braun's holly fern	E	vascular plant
Polytaenia nuttallii	prairie-parsley	SC	vascular plant
Potamogeton bicupulatus	snailseed pondweed	E	vascular plant
Potamogeton diversifolius	diverse-leaved pondweed	E	vascular plant
Potamogeton vaginatus	sheathed pondweed	SC	vascular plant
Potamogeton vaseyi	Vasey's pondweed	SC	vascular plant
Prenanthes crepidinea	nodding rattlesnake-root	SC	vascular plant
Protoptila talola	a species of caddisfly	SC	caddisfly
Psathyrella cystidiosa	a species of fungus	E	fungus
Psathyrella rhodospora	a species of fungus	E	fungus
Pseudocyphellaria crocata	a species of lichen	E	lichen
Psoralidium tenuiflora	slender-leaved scurf pea	E	vascular plant
Pyrgus centaureae freija	grizzled skipper	SC	butterfly/moth
Pyrola minor	small shinleaf	SC	vascular plant
Quadrula fragosa	winged mapleleaf (Fed. Status: E)	E	mollusk
Quadrula metanevra	monkeyface	T	mollusk
Quadrula nodulata	wartyback	E	mollusk
Rallus elegans	king rail	E	bird
Ranunculus lapponicus	Lapland buttercup	SC	vascular plant
Rhynchospora capillacea	hair-like beak-rush	T	vascular plant
Rhynchospora fusca	sooty-colored beak-rush	SC	vascular plant
Rorippa sessiliflora	sessile-flowered cress	SC	vascular plant
Rotala ramosior	tooth-cup	T	vascular plant
Rubus chamaemorus	cloudberry	T	vascular plant
Rudbeckia triloba	three-leaved coneflower	SC	vascular plant
Ruppia maritima	ditch-grass	SC	vascular plant
Sagina nodosa ssp. *borealis*	knotty pearlwort	E	vascular plant
Salicornia rubra	red saltwort	T	vascular plant
Salix maccalliana	Maccall's willow	SC	vascular plant
Salix pellita	satiny willow	SC	vascular plant
Sanicula trifoliata	beaked snakeroot	SC	vascular plant
Sassacus papenhoei	a species of jumping spider	SC	jumping spider
Saxifraga cernua	nodding saxifrage	E	vascular plant

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Saxifraga paniculata	encrusted saxifrage	T	vascular plant
Schedonnardus paniculatus	tumblegrass	SC	vascular plant
Schinia indiana	phlox moth	SC	butterfly/moth
Schistostegia pennata	luminous moss	E	moss
Scirpus clintonii	Clinton's bulrush	SC	vascular plant
Scleria triglomerata	tall nut-rush	E	vascular plant
Scleria verticillata	whorled nut-rush	T	vascular plant
Scutellaria ovata	ovate-leaved skullcap	T	vascular plant
Sedum integrifolium ssp. *leedyi*	Leedy's roseroot (Fed. Status: T)	E	vascular plant
Seiurus motacilla	Louisiana waterthrush	SC	bird
Selaginella selaginoides	northern spikemoss	E	vascular plant
Senecio canus	gray ragwort	E	vascular plant
Senecio indecorus	elegant grounsel	SC	vascular plant
Setodes guttatus	a species of caddisfly	SC	caddisfly
Shinnersoseris rostrata	annual skeletonweed	T	vascular plant
Silene drummondii	Drummond's campion	SC	vascular plant
Silene nivea	snowy campion	T	vascular plant
Simpsonaias ambigua	salamander mussel	T	mollusk
Sistrurus catenatus	massasauga	E	amphibian/reptile
Solidago mollis	soft goldenrod	SC	vascular plant
Solidago sciaphila	cliff goldenrod	SC	vascular plant
Sorex fumeus	smokey shrew	SC	mammal
Sparganium glomeratum	clustered bur-reed	SC	vascular plant
Speotyto cunicularia	burrowing owl	E	bird
Speyeria idalia	regal fritillary	SC	butterfly/moth
Spilogale putorius	eastern spotted skunk	T	mammal
Stellaria longipes	long-stalked chickweed	SC	vascular plant
Sterna forsteri	Forster's tern	SC	bird
Sterna hirundo	common tern	T	bird
Sticta fuliginosa	a species of lichen	SC	lichen
Subularia aquatica	awlwort	T	vascular plant
Sullivantia sullivantii	reniform sullivantia	T	vascular plant
Symphoricarpos orbiculatus	coralberry	SC	vascular plant
Synaptomys borealis	northern bog lemming	SC	mammal
Talinum rugospermum	rough-seeded fameflower	E	vascular plant
Tephrosia virginiana	goat's-rue	SC	vascular plant
Thomomys talpoides	northern pocket gopher	SC	mammal
Tofieldia pusilla	small false asphodel	E	vascular plant
Tomenthypnum falcifolium	a species of moss	SC	moss
Torreyochloa pallida	Torrey's manna-grass	SC	vascular plant
Trillium nivale	snow trillium	SC	vascular plant
Trimorpha acris var. *asteroides*	bitter fleabane	SC	vascular plant
Trimorpha lonchophylla	shortray fleabane	SC	vascular plant
Triplasis purpurea	purple sand-grass	SC	vascular plant
Tritogonia verrucosa	pistolgrip	T	mollusk
Tropidoclonion lineatum	lined snake	SC	amphibian/reptile
Tsuga canadensis	eastern hemlock	SC	vascular plant
Tutelina formicaria	a species of jumping spider	SC	jumping spider
Tympanuchus cupido	greater prairie-chicken	SC	bird
Umbilicaria torrefacta	a species of lichen	E	lichen
Utricularia purpurea	purple-flowered bladderwort	SC	vascular plant
Utricularia resupinata	lavender bladderwort	SC	vascular plant
Vaccinium uliginosum	alpine bilberry	T	vascular plant
Valeriana edulis var. *ciliata*	valerian	T	vascular plant
Venustaconcha ellipsiformis	ellipse	T	mollusk
Verbena simplex	narrow-leaved vervain	SC	vascular plant
Vertigo hubrichti variabilis n. subsp.	variable pleistocene vertigo	T	mollusk
Vertigo hubrichti hubrichti	Midwest pleistocene vertigo	E	mollusk
Vertigo meramecensis	bluff vertigo	T	mollusk
Viola lanceolata	lance-leaved violet	T	vascular plant
Viola nuttallii	yellow prairie violet	T	vascular plant
Vitis aestivalis	silverleaf grape	SC	vascular plant
Waldsteinia fragarioides	barren strawberry	SC	vascular plant
Wilsonia citrina	hooded warbler	SC	bird
Woodsia alpina	alpine woodsia	SC	vascular plant
Woodsia glabella	smooth woodsia	T	vascular plant
Woodsia scopulina	Rocky Mountain woodsia	T	vascular plant
Xyris montana	montane yellow-eyed grass	SC	vascular plant
Xyris torta	twisted yellow-eyed grass	E	vascular plant