GREAT RIVER ENERGY℠

APPLICATION TO THE MINNESOTA ENVIRONMENTAL QUALITY BOARD

FOR A

GENERATING PLANT SITE PERMIT

CAMBRIDGE STATION

EQB DOCKET NO. 05-92-PPS-GRE Cambridge Station

MARCH 11, 2005

PREPARED BY BARR ENGINEERING COMPANY

Application for a Generating Plant Site Permit
Cambridge Station Project

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Application Content Requirements Cross Reference

Project Permit Application Requirements (Minn. Rules 4400.1150, Subp. 1)	**Application Section**
A. a statement of proposed ownership of the facility as of the day of filing and after commercial operation;	1.2
B. the precise name of any person or organization to be initially named as permittee or permittees and the name of any other person to whom the permit may be transferred if transfer of the permit is contemplated;	1.2
C. at least two proposed sites for the proposed large electric power generating plant and identification of the applicant's preferred site and the reasons for preferring the site;	Not required under alternative process
D. a description of the proposed large electric power generating plant and all associated facilities, including the size and type of the facility;	2.1
E. the environmental information required under subpart 3;	See Environmental Information below
F. the names of the owners of the property for each proposed site;	2.1
G. the engineering and operational design for the large electric power generating plant at each of the proposed sites;	3.1
H. a cost analysis of the large electric power generating plant at each proposed site, including the costs of constructing and operating the facility that are dependent on design and site;	2.3
I. an engineering analysis of each of the proposed sites, including how each site could accommodate expansion of generating capacity in the future;	Section 4, 3.1, 2.4
J. identification of transportation, pipeline, and electrical transmission systems that will be required to construct, maintain, and operate the facility;	Section 3, 4.5.2
K. a listing and brief description of federal, state, and local permits that may be required for the project at each proposed site; and	1.4
L. a copy of the Certificate of Need for the project from the Public Utilities Commission or documentation that an application for a Certificate of Need has been submitted or is not required.	1.4.2
Environmental Information Requirements (Minn. Rules 4400.1150, Subp. 3)	**Application Section**
A. a description of the environmental setting for each site or route;	Section 4
B. a description of the effects of construction and operation of the facility on human settlement, including, but not limited to, public health and safety, displacement, noise, aesthetics, socioeconomic impacts, cultural values, recreation, and public services;	4.3, 4.4, 4.5
C. a description of the effects of the facility on land-based economies, including, but not limited to, agriculture, forestry, tourism, and mining;	4.4.3
D. a description of the effects of the facility on archaeological and historic resources;	4.5.3
E. a description of the effects of the facility on the natural environment, including effects on air and water quality resources and flora and fauna;	4.1, 4.2, 4.6
F. a description of the effects of the facility on rare and unique natural resources;	4.6.6

G. identification of human and natural environmental effects that cannot be avoided if the facility is approved at a specific site or route; and	Section 4
H. a description of measures that might be implemented to mitigate the potential human and environmental impacts identified in items A to G and the estimated costs of such mitigative measures.	Section 4, 3.1

1 Introduction

Great River Energy (GRE), hereby applies to the Minnesota Environmental Quality Board (EQB) for a Site Permit pursuant to the Minnesota Power Plant Siting Act (Minnesota Statutes 116C.51 through 116C.69) and Minnesota Rules Chapter 4400.

GRE proposes to construct a natural gas-fired simple cycle combustion turbine generator at its existing peaking plant site near Cambridge in Isanti County, Minnesota. The nominal 170-MW (summer capacity) plant is to be placed in service in the spring of 2007. The addition of this generating unit at the Cambridge Generating Station site falls within the definition of a Large Electric Power Generating Plant (LEPGP) in the Act and, thus, requires a Site Permit from the EQB prior to construction.

The proposed power plant and associated facilities (collectively the Project) are described in more detail throughout this Application. The Project location and the Project area are shown in Figures 1-1 and 1-2, respectively.

GRE informed the EQB by its February 8, 2005 letter that it is electing to make application and have its proposal reviewed using the procedures of Minnesota Rules 4400.2000 through 4400.2950, referred to as the Alternative Permitting Process. This Project to add generating capacity is eligible for the Alternative Permitting Process because the proposed unit will be fueled by natural gas (Minnesota Rules 4400.2000, Subp. 1, B).

GRE filed an application for a Certificate of Need (CON) with the Minnesota Public Utilities Commission (Commission) for the Project on February 28, 2005 in accordance with Minnesota Rules Chapter 7829 and 7849. Minnesota Rules 4410.7060 provide for the consolidation of environmental review procedures and Minnesota Statutes § 216B.243, Subd. 4 provides for joint hearing procedures for the Certificate of Need and Site and Route Permits when feasible. GRE respectfully requests the EQB and the Commission consider consolidating environmental review and hearings in this case.

1.1 Purpose

This Project is necessary to ensure that GRE has adequate generating capacity in 2007 and beyond to reliably meet customer demand for electricity. The need for the addition of peaking units at the

Cambridge Station is described in more detail in GRE's application for a CON before the Commission. The CON application has been posted on the GRE corporate Web site, http://www.greatriverenergy.com/projects/plants/cambridge_station.html.

1.2 Applicant Information

GRE is undertaking the Project, owns the Project as of the filing of this application, and intends to own the Project after commercial operation.

GRE is a not-for-profit wholesale electric cooperative—Minnesota's second largest electric utility based on generating capacity, serving 28 distribution cooperatives in Minnesota. Those member cooperatives supply electricity to more than 580,000 residential, commercial and industrial customers (a population of 1.5 million people) in Minnesota and Wisconsin. GRE member cooperatives provide service to 60 percent of Minnesota, geographically. The GRE system saw an annual energy growth of six percent in 2002, nearly three times the national average.

GRE intends to pursue construction financing and permanent financing from traditional sources including the Electric Program of the United States Department of Agriculture's (USDA) Rural Utilities Service (RUS).

The permittee for the site permit will be:

Great River Energy
17845 East Highway 10
P.O. Box 800
Elk River, MN 55330-0800

The contact person at GRE regarding this Project is:

Mark Strohfus, Environmental Project Leader
17845 East Highway 10
P.O. Box 800
Elk River, MN 55330-0800

1.3 Project Schedule

In order to meet the anticipated need for additional peaking duty generating capacity in the summer of 2007, construction of the Project must begin in the early spring 2006.

1.4 Required Project Permits

This subsection identifies other major approvals and permits that are required for the Project.

1.4.1 RUS Finding of No Significant Impacts

GRE may obtain financing for the Project through the RUS, an agency within the USDA. The use of RUS funding triggers the requirement for environmental review for the plant site and the associated transmission line modifications under the National Environmental Policy Act (NEPA). Because the data requirements for a project under NEPA are similar to those required under the Minnesota Power Plant Siting Act and Minnesota Rule Chapter 7849, GRE will be addressing the two processes coincidentally when possible and practical. The expectation is that the RUS NEPA process will result in a Finding of No Significant Impacts (FONSI) for the Project.

1.4.2 Certificate of Need

GRE has filed an application for a Certificate of Need from the Minnesota Public Utilities Commission for the Project in accordance with Minnesota Rules Chapter 7849.

1.4.3 Other Project Permits

1.4.3.1 Air Quality Permit

GRE expects to submit an application to amend the Cambridge Station's air emission permit, Permit No. 05900014-001. The amendment will incorporate the Project into the existing facility air operating permit.

1.4.3.2 Water Appropriations Permits

GRE expects to install a new well at the Project site in 2006 to meet the water needs of the Project. GRE will submit an application to the Minnesota Department of Natural Resources (MDNR) for a groundwater appropriation permit immediately after the well construction is completed.

1.4.3.3 National Pollutant Discharge Elimination System Discharge Permit

GRE plans to dispose of Project storm water and process wastewater under a National Pollutant Discharge Elimination System (NPDES) discharge permit. Application for an NPDES permit is expected to be made to the Minnesota Pollution Control Agency (MPCA) in the second half of 2005.

1.4.3.4 NPDES Stormwater Program for Construction Activity

The Project will disturb more than one acre of land and therefore triggers the requirement to apply for coverage under the MPCA's NPDES Stormwater Permit Program for Construction Activities. GRE will require its contractor to apply for and comply with the construction storm water permit.

1.4.3.5 Transmission Line Permits

Transmission lines connecting the Project to four area substations will be upgraded with new conductors and new poles. The Cambridge-Princeton line is being upgraded independent of the Project to address reliability issues. The three other lines will require upgrades due to the CTG installation. No change in voltage of the existing 69-kilovolt (kV) lines is planned; therefore, no EQB High Voltage Transmission Line Route Permit is required. An MDNR License to Cross Public Waters will be obtained for public waters and wetlands crossed by the transmission lines. GRE will also obtain local building permits that may be required for the transmission line work.

1.4.3.6 Gas Pipeline Permits

GRE will obtain natural gas for the Project from Northern Natural Gas Company (NNG), an interstate pipeline company. NNG will construct and own a new lateral gas pipeline to the Project site from an existing interstate pipeline approximately ½ mile from the Project site. A town border station will be constructed on the Project site. Because the gas supply is being provided through an extension to an interstate pipeline, a gas pipeline routing permit in accordance with the requirements of Minnesota Statutes 116I.015 and Minnesota Rules 4415 is not required. NNG will apply for permits under the federal interstate pipeline permitting processes as required. NNG will also obtain other necessary permits for the gas pipeline construction, which may include:

- MPCA NPDES General Stormwater Permit for Construction Activity,
- MDNR License to Cross Public Lands and Waters,
- MDNR Wetland Replacement Plan Application,
- U.S. Army Corps of Engineers Section 404 Wetland Permit, and
- Road Crossing Permits (Mn/DOT, Minn. Rules Chpt. 8810).

1.4.3.7 Spill Prevention Control and Countermeasure (SPCC) Plan

GRE will update the existing station's SPCC Plan within six months of any site changes that may trigger revision of the plan.

1.4.3.8 Other Permits

The Project may require permits, approvals or notifications under the following programs:

- Exemption to allow burning of natural gas for power production (DOE, 10 CFR 503)
- Miscellaneous State Building and Construction Permits and Inspections
- Miscellaneous Local Building and Construction Permits and Inspections

2 Project Description

2.1 Overview

GRE's Cambridge 2007 Peaking Plant Project (Project) consists of adding one natural gas-fired simple-cycle combustion turbine generator to its existing Cambridge Station near Cambridge, Minnesota in Isanti County. The Project will have a nominal summer generating capacity of 170 MW and is expected to be operated during periods when GRE's member demand is the highest (e.g. the air conditioning season).

The Project site layout is shown in Figure 2-1. The Project Site will consist of two parcels currently owned by GRE. The larger portion of the Site is an approximate 11-acre parcel in Section 21, T36N, R23W. The Site will also include an approximate 2-acre parcel in Section 16, T36N, R23W that houses a service building across 349th Avenue NE, north of the larger parcel. The larger parcel has an existing fuel oil-fired 25-MW (nominal summer capacity) combustion turbine generator and associated substation, which will remain.

The Project will include upgrades to the existing site substation and three of the four 69-kV transmission lines originating from the substation. No change in the operating voltage and no significant realignment of the lines are required for the Project (see Section 3.2.1). A high pressure gas lateral pipeline approximately ½-mile long will also be constructed to provide a natural gas fuel supply for the Project (see Section 3.2.2)

2.2 Rejected Sites

GRE considered other existing peaking plant and substation sites for the Project. The current infrastructure at the existing plant site and the availability of transmission capacity result in an economical project with minimal environmental impacts. Greenfield sites and sites that would require major transmission system upgrades were not considered because of the long lead time necessary to site a new power plant and transmission line.

GRE completed a screening process that considered nine sites for the Project. The initial screening analysis considered issues related to transmission, natural gas supply, land use, water availability, wastewater disposal, transportation infrastructure, local support, economics and environmental

impacts. The screening process resulted in two candidate sites being considered most feasible. In addition to the Cambridge Generating Station site, the other leading candidate site was on the campus of GRE's headquarters in Elk River, Minnesota. The Cambridge site was chosen after detailed evaluation of the factors listed above, with the primary differentiating factor being lower overall costs.

2.3 Cost Analysis

Total construction costs for the addition of the Project are estimated to be about $80 million.

2.4 Future Expansion

Minnesota Rules 4400.1150, Subp. 1, I. and 4400.1150, Subp. 2, L. ask an applicant to describe the extent to which a proposed generating plant site can accommodate future expansion. In this case, the potential for land use and environmental impact is minimized because GRE has chosen a site that is currently used for electric generation.

The Project site cannot accommodate future expansion without acquisition of additional property or removal of the existing 25-MW turbine. GRE currently has no plans, other than the proposed Project, for expanding generation capacity at the proposed site.

3 Engineering and Operational Design

This section describes the design of the proposed generating addition and its operation. The proposed plant additions will consist of a single simple cycle gas-fired combustion turbine generator (CTG) and associated equipment that will be operated primarily for peaking service.

The most fundamental Project design consideration is the selection of the generation technology. A simple cycle CTG is the most appropriate generation technology for the peaking service need the Project is intended to address. Overall power supply costs are minimized when a low capital cost resource like combustion turbines are used in peaking service. Peaking service also requires flexibility in operation, particularly rapid and frequent startups and short-duration runs. The selection of natural gas-fired simple cycle technology also results in several environmental benefits as discussed further in Section 4.

3.1 Design

3.1.1 Combustion Turbines and Balance of Plant Equipment

A simple cycle combustion turbine has three major components: (1) a compressor, (2) a combustion chamber, (3) and a turbine. Air is drawn into the compressor, compressed, and discharged to the combustion chamber, mixed with fuel and ignited. The resulting expanding hot gases are sent through the turbine blades, causing them to rotate. The rotating turbine blades turn a shaft connected to a generator that produces electricity. Exhaust gasses are emitted to the atmosphere through a stack that is expected to be about 90 feet tall. This process is shown schematically in Figure 3-1.

The combustion turbine generator for the Project will be “F” class technology, such as a Siemens Westinghouse Model V84. The Project will be one of the most efficient simple-cycle generation sources in the region due to this technology. The CTG will have a nominal summer capacity of about 170 MW.

In addition to the CTG, new plant equipment will include:

- a generator step-up transformer,

- less than 1,000 feet of transmission line from the transformers to the existing Cambridge Substation,
- a gas town-border-station and meter,
- an evaporative cooler, and
- an exhaust stack with silencer.

These items comprise the largest components of the CTG plant. The major systems that support the operation of the CTG are discussed below. The generating plant layout is shown in Figure 2-1.

3.1.2 Electrical Interconnection

One generator step-up transformer will be used to increase the voltage, supplied by the Project at a lower voltage (13.8 -16 kV), up to the substation voltage of 69 kV. Upgrades to the substation will be part of the Project. In addition, three of the four transmission lines that enter the Cambridge Substation will require upgrades as part of the Project. In total, approximately 47 miles of transmission line are expected to be upgraded (see Figure 3-2). These upgrades will consist of reconductoring or rebuilding to meet current state-of-the-art 69-kV design. Details of the interconnection will be finalized once the interconnection studies have been completed and a final interconnection recommendation is provided by the Midwest Independent System Operator (expected by mid-summer 2005).

3.1.3 Fuel Supply

Natural gas will be the only fuel used to generate electricity in the new plant. A ½-mile, 10-inch diameter lateral natural gas pipeline will be constructed off of Northern Natural Gas Pipeline's 16-inch trunk-line. A town border station will be constructed at the Project site. A gas metering and conditioning station will also be constructed on the Project site.

GRE anticipates purchasing Interruptible Transport (IT) service from NNG. If significant winter operation is anticipated, GRE may pursue purchasing firm transport capability on the secondary market. In addition, GRE will take advantage of some of NNG's tariffed balancing services to optimize operation of the Project while insuring an adequate supply of natural gas for variable operations.

At full load, the new CTG will burn 1,546 million cubic feet (MCf)/hour during summer operation and 1,771 MCf/hour during winter operation. Assuming a 10 percent capacity factor (operating for 876 hours per year), the Project will burn about 1.4 to 1.5 million MCf of natural gas annually.

3.1.4 Water Supply/Wastewater Management

Simple cycle combustion turbine technology can operate without water, except that required for fire protection. However, the Project will include the capability to use water to provide evaporative inlet air cooling and potentially wet compression power augmentation to sustain the cooler weather capacity of the CTG during the warmest days of the year. It is estimated that the proposed unit will operate without using any water more than 80 percent of the time. Evaporative cooling is anticipated to be used to cool the air entering the units up to about 20 percent of the time. Air is cooled through humidification by allowing water to flow over a fabric or cellular media at the inlet to the combustion turbine. The evaporative cooling process consumes a relatively small amount of water, but increases output by approximately 3 to 5 percent depending on the ambient relative humidity.

A water use diagram that summarizes water use and wastewater generation from the operation of the new CTG is shown in Figure 3-4. Total estimated annual groundwater appropriation for the Project is estimated to be 4.7 million gallons with an estimated groundwater withdrawal rate of 108 gallons per minute. The Cambridge site has an existing groundwater well on the north parcel for sanitary services, but the additional water needs for the Project will require installation of a new well on the south parcel (see Section 4.2.1).

Two water storage tanks will be provided on site. One 300,000-gallon tank will be used to store raw water, and one 200,000-gallon tank will store treated water. Treated water will be used for operation of the evaporative cooler during the summer months and potentially for wet compression power augmentation. Raw water will be used as supply for the water treatment system, for fire suppression, and other ancillary plant uses. A transportable demineralization unit will be used to treat the raw water. The demineralization beds will be recharged off site; therefore, no on-site wastewater discharge will occur from the demineralization system.

The only source of operations wastewater will be the evaporative cooler. When the evaporative cooler is in operation, approximately 15-75 gallons per minute of blow down wastewater will be generated. The actual blow down rate will be determined based on water quality data for the site,

which have not yet been obtained. This wastewater will be discharged to an on-site retention basin and will then be discharged off site along with site storm water in accordance with a new National Pollution Discharge Elimination System discharge permit (see Section 4.2).

An estimated 150,000 gallons of wastewater (compressor wash water) will be generated annually from maintenance of the CTG. This process wastewater will be stored in an on-site tank. The process wastewater will be off-loaded into tanker trucks and hauled to a municipal wastewater treatment plant for ultimate treatment and disposal.

3.1.5 Air Pollution Control

The Project will employ simple cycle combustion turbine technology using natural gas as the only fuel source. Natural gas combustion generates significantly less particulate matter than fuel oil, and very little sulfur dioxide or other trace air emissions. Uncontrolled natural gas combustion does produce nitrogen oxides (NO_x) and carbon monoxide (CO). The Project will use dry low NO_x technology to control NOx emissions. Dry low-NO_x burners minimize the air-to-fuel mix ratio, lower the peak flame temperature, and reduce the chemical reaction time available to form NO_X. NO_x emissions from the new unit will be limited by the Project air quality permit (see Section 4.1).

3.2 Construction

Mobilization at the site will be the first construction activity, with GRE setting up field offices and the Contractor following with mobilization and setup of construction offices, security fencing and entrances.

Upon issuance of the necessary permits, construction will begin. The area where the new turbine will be located will be excavated approximately 2-4 feet to prepare the area for pouring of concrete footings and foundations. Preliminary geotechnical investigations indicate that pilings will not be required and that the surficial groundwater table is at great enough depth so that dewatering will not be necessary for construction of foundations. Underground services will be installed. At the same time, the foundations for the generator step-up transformer and miscellaneous equipment will be formed. Extensive concrete work for all foundations will follow. Rough-ins for cable and pipe will be installed in the various foundations.

Within two to three months of initial mobilization, deliveries will begin arriving at the site. These shipments will continue over a four to five month period. Shipments of the transformer, turbine and generator will likely be via rail, with other equipment likely being shipped by truck. The timing of these shipments will coincide with the completion and readiness of their respective foundations. Shipments at the rail siding in Cambridge and at the plant site will be coordinated by the Contractor's heavy haul subcontractor. This equipment will be lifted from the rail cars and loaded onto transport vehicles to be driven on site. A construction crane will be located on site to lift large equipment from transport vehicles onto foundations.

The combustion turbine, generator, and transformer for the new generating unit will be set first, followed by the remaining auxiliary equipment. Erection of the turbine's modular air inlet and the exhaust stack will take place next.

The greatest number of on-site workers will be present during the erection of the turbines, detailed wiring and piping, and while work is being performed in the Cambridge Substation.

Northern Natural Gas will be constructing the gas pipeline to the Project while the site work is being completed. The pipeline is planned to enter at the center of the site's south property line. The pipe will extend underground to a gas metering and regulating building. A contractor will take the pipeline from this point and run it underground to the turbines.

GRE will be constructing an overhead 69-kV line from the generator step-up transformers to the Cambridge Substation as plant work nears completion. Work will also be ongoing in the substation to install breakers, transformer and additional protection devices. During final stages of construction activities will include installation of the inlet air filter and bird screen, completion of equipment platforms, insulation and painting.

Pre-operational testing will take place for one to two months in preparation for start-up of the new unit currently targeted for May 2007. The initial turbine start-up requires a two-week schedule. The first days will fire gas in the unit and bring it up to full speed with no load on the turbine. Next, the turbine will be run and synchronized with the grid at a low load. Subsequently the unit's output will be slowly raised to its maximum capacity while testing the performance of various plant systems.

After the completion of testing, GRE and the Contractor will begin to demobilize the site. By early Fall 2007, trailers, construction equipment and temporary fencing are expected to be removed from the site.

3.3 Operation

The Project will operate as a peaking facility to provide electric energy during times of GRE's peak demand. The plant is expected to have a short start-up sequence for an "F Class" machine at 8 minutes, and the ramp rate is expected to be 12 MW per minute.

GRE expects the demand for the unit will result in an annual capacity factor of between 5 and 10 percent (438-876 hours) based on GRE's operating experience at Pleasant Valley Station and Lakefield Junction Station. The new unit will be effectively limited to a total of about 3,000 hours of operation per year (which would correspond to an annual capacity factor of about 30 percent) because of air quality permit pollutant emission limits (see Section 4.1). GRE anticipates the units will have at least a 30-year operating life. The new CTG energy efficiency is expected to be in the range of 35 to 37 percent, depending on operating conditions. Operational characteristics of the Project are summarized in Table 3-1.

Table 3-1 Project Operational Characteristics Summary

	Summer	Winter
General Project Description		
Unit Type	Simple Cycle Combustion Turbine	
Capability	170 MW	190 MW
Expected Annual Capacity Factor	5-10 percent	
Expected Heat Rate	10,200Btu/kWh (HHV)	9,720Btu/kWh (HHV)
Expected Efficiency	35 percent	37 percent
Fuel Use		
Fuel Type	Natural gas (only)	
Fuel Use Rate	1,546 MCf/hour	1,771 MCf/hour
Expected Annual Fuel Use	1.4-1.5 million MCf	
Water Use		
Expected Groundwater Withdrawal Rate	108 gpm	
Expected Annual Groundwater Appropriation	4.7 million gallons	
Expected Annual Wastewater/Stormwater Discharge	~ 4.8 million gallons	

3.4 Maintenance

Maintenance activities for the Plant's CTG and balance of plant equipment will be based on power industry practices and the equipment manufacturer's recommendations. GRE has extensive experience operating and maintaining combustion turbines, including General Electric (GE) Frame 5, Pratt & Whitney FT4, GE 7EA, Siemens V.843A, and Westinghouse 501D5A. GRE maintains those units using a combination of GRE staff and unit vendor staff through Long-Term Service Agreements. Service agreements typically include changing out of the generator core at prescribed points in the turbines service life. GRE is committed to providing its operations and maintenance staff with the very best in continuing education and training to insure a high level of reliability and availability of its generation assets. An existing warehouse will be utilized to house the critical parts tools and supplies needed for maintenance and reliable operations.

Table 3-2 lists the chemicals anticipated to be used on-site for operation and maintenance activities.

Table 3-2 List of Chemicals Anticipated to be Used On-Site*

Chemical	Use	Quantity Stored Onsite	Form/Type
Laboratory reagents	Various	Small amounts, generally less than 5 pounds each	Liquid and granular
Mineral insulating oil, C-10	Transformer systems	15,000 gallons	Insulating fluid
Sulfur hexafluoride, (SF_6)	Substation electrical insulating gas	33 pounds	Insulating gas
Lubrication oil	Rotating equipment	3,500 gallons	CTGs bearing lubricating oil
Diesel fuel	Fuel for diesel engine driven fire pump	300 - 500 gallons	Diesel fuel
Various detergents	Combustion turbine on/off line water wash skid	200 gallons stored	Liquid
Compressed gases			
Carbon dioxide (CO_2)	Fire Protection System	8 tons	Compressed gas
FM200	Fire Protection System	300 pounds	Compressed gas
Welding Gases	Maintenance	4-100-pound cylinders	Compressed gas

*All chemical types and quantities are preliminary estimates. The chemical types and quantities may change as the project design progresses.

4 Environmental Information

The Project's proposed generation addition will be made with a natural gas-fired combustion turbine at a site that has previously been developed for power production, and as a result, will not have significant adverse environmental impacts. The effects of the Project on air, water, noise, land use, socio-economic resources, and the natural environment are described below. Agency correspondence regarding environmental resources is provided in Appendix A.

4.1 Air Impacts

The Project is a new combustion source and will emit products of combustion to the air; however, these emissions will have no significant impact on area air quality. The new combustion turbine will use clean-burning natural gas combustion technology, dry low-NO_X emissions control technology, and will have limits on the total amount of emissions.

Air quality in the Cambridge area is similar to that of the Twin Cities in general. The air quality meets or is better than National Ambient Air Quality Standards and Minnesota Air Quality Standards for all pollutants that have promulgated standards, including sulfur dioxide, nitrogen oxide, carbon monoxide, ozone, and particulate matter. The Twin Cities is under a maintenance plan for carbon monoxide and sulfur dioxide, and the U.S. Environmental Protection Agency (EPA) recently agreed with the MPCA that the entire state, including the Twin Cities and Cambridge area, should be classified as meeting the new 8-hour ozone standard.

GRE plans to submit an application for an amendment to the existing Cambridge Generating Plant air emission permit, Permit No. 05900014-001, to the Minnesota Pollution Control Agency in late spring 2005 in keeping with the Project timeline. The permit application requests that emissions from the plant after Project construction be limited to less than 250 tons per year (tpy) of NOx, CO, SO_2, or PM_{10}. This will effectively limit operation of the Project to about 3,000 hours per year. The actual hours of operation will depend on the equipment manufacturer chosen, the time of year that the unit is operated, and the actual generating rate at which the unit is operated. The estimated actual air emissions from the new units, based on expected operating hours for the Project are presented in Table 4-1. These emission estimates are based on the new unit operating for 876 hours a year (a 10 percent capacity factor), which is about a third of the operating hours that the anticipated air permit

conditions would allow. If the Project should operate more frequently than anticipated, actual emissions could be up to about three times those presented in Table 4-1.

Table 4-1 Estimated Project Air Emissions

General		
Pollutant	**Emission Factor**[1] at Rated Project Capacity (average ambient conditions, base load) (lbs/hour per CTG)	**Emissions**[2] (tons/year)
SO_2	2.9	1.4
NO_X	148	66
PM_{10}	12.9	5.8
CO	32	14.4
VOCs	8.2	3.6

Hazardous Air Pollutants (HAPS) (selected list from EPA's AP-42 emission factor database)			
Pollutant	**Emissions**[2] (tons/year)	**Pollutant**	**Emissions**[2] (tons/year)
Formaldehyde	0.6	Benzene	0.008
Toluene	0.1	Acrolein	0.004
Xylene	0.04	PAH	0.0016
Acetaldehyde	0.04	Naphthalene	0.0008
Ethyl Benzene	0.02	1,3-Butadiene	0.0004
Propylene Oxide	0.02		

[1]Emission factors for the general pollutants from manufacturer data.
[2]Based on 876 operating hours
[4] PAH is polycyclic aromatic hydrocarbon.

The potential impact to ambient air quality was modeled using ISC3-Prime. The results of the modeling, presented in Table 4-2, show that the Project will have a minimal impact on area air quality for all pollutants modeled. The modeled concentrations are well below National Ambient Air Quality Standards and Minnesota Air Quality Standards for all pollutants.

The Project is not required to complete an Air Emissions Risk Analysis (AERA) because the CTG will be fired solely by natural gas. The MPCA's AERA Guidance; Version 1.0 (March 2004) excludes gas-fired emission sources from the AERA process.

Another potential source of air emissions is fugitive dust from site preparation and construction activities. However, these fugitive emissions will be short-term and will be controlled by watering or

applying dust suppressants to exposed soil surfaces as necessary to reduce the impact on area residents.

Table 4-2 Potential Impacts to Ambient Air Quality - Preliminary Modeling, February 2005

Pollutant	Averaging Period	Maximum Modeled Concentration (ug/m^3)	Monitored Background Concentration (ug/m^3)	Modeling Significant Impact Level (ug/m^3)	Ambient Air Quality Standard (ug/m^3)
Formaldehyde	Annual	0.000031	1.5	NA	NA
Nitrogen Dioxide	Annual	0.0045	20	1	100
Sulfur Dioxide	Annual	0.00015	0.9	1	80
	24-hour	0.0075		5	365
	3-Hour	0.051		25	1300
	1-Hour	0.14		NA	1300

Pollutant	Averaging Period	Maximum Modeled Concentration As Percent of Background Concentration
Formaldehyde	Annual	0.002%
Nitrogen Dioxide	Annual	0.022%
Sulfur Dioxide	Annual	0.017%

4.2 Water Use and Wastewater Generation

4.2.1 Water

The Plant's current water well is designed for domestic-type use and is not suitable to meet the Project water needs. GRE plans to construct a new well on the Project site south of 349th Avenue NE. This well will provide water for evaporative cooling and other minor uses such as equipment washing. GRE will apply for a water appropriations permit from the MDNR after the new well is constructed and tested. The appropriation permit amendment will request total authorized annual appropriation somewhat above the 4.7 million gallons expected water requirement annually with a

maximum withdrawal rate of around 150 gpm, somewhat higher than the expected typical pumping rate of 108 gpm.

The well will likely withdraw water from the Prairie du-Chien/Jordan bedrock aquifers. The estimated annual groundwater appropriation for the Project is relatively small and is not expected to result in any adverse impacts on the aquifer and regional water supplies. Prairie du-Chien/Jordan aquifer wells are generally highly productive and it is not uncommon for them to produce in excess of 1500 gpm. The City of Cambridge does not obtain its municipal water supply from the Prairie du-Chien/Jordan bedrock aquifer. The city obtains its water from the deeper Mount Simon aquifer. Therefore, it is not anticipated that the proposed 150-gpm appropriation rate will have an adverse impact on any existing wells in the area.

4.2.2 Wastewater

GRE plans to dispose of Project storm water and process wastewater under a new NPDES discharge permit. Storm water drainage patterns from the service building area north of 349th Avenue NE will be unchanged by the Project. Storm water from the portion of the site south of 349th Avenue NE will be routed to a new water retention basin constructed near the south end of the site. Process wastewater, consisting primarily of evaporative cooler blow down water, will also be routed to the same retention pond.

The retention pond will have a controlled outlet that will discharge water to a drainage swale from the south edge of the Project site to a wetland located about 300 feet south of the site. GRE will obtain a drainage easement from the adjacent property owner to allow for the discharge through the drainage swale. The wetland discharges to the southwest through an unnamed creek that intersects Beckins Creek about one mile southwest of the site. Beckins Creek discharges to the Rum River about another 1.5 miles downstream.

The expected annual discharge volume from the retention basin is on the order of 4.8 million gallons, approximately 1.8 million gallons from evaporative cooler blow down and 3 million gallons from storm water runoff.

The wastewater discharged from this facility will consist of multi-cycle cooling water. It is anticipated that the required cooling water will be obtained from a groundwater source and will

contain minimal additives. Expected chemical and thermal characteristics of the wastewater discharged are anticipated to be similar to that of wastewater discharged from other similar GRE facilities, such as their Pleasant Valley and Lakefield Junction facilities. The wastewater effluent characteristics of these facilities were reviewed and indicate that there no anticipated chemical and thermal issues with the wastewater from the proposed facility.

It is proposed that the wastewater will be discharged to a nearby wetland and drain to nearby Beckins Creek and ultimately the Rum River. The Rum River, ultimate receiving water, is a designated component of the Minnesota wild, scenic, and recreational rivers system (MN Rules 6105.1400). The reach of the Rum River where Project wastewater will ultimately discharge is classified as recreational (see Section 4.6.2).

4.3 Noise

Operation of the new generation unit will result in an increase in frequency of operational noises, but not a significant increase in maximum noise levels at nearby residences. The Project will not result in any violation of Minnesota Noise Standards at the residences located near the facility.

Noise will be generated during the construction and operation of the Project. Construction noise will be predominantly intermittent sources originating from diesel engine-driven construction equipment. Potential noise impacts will be mitigated by proper muffling equipment fitted to construction equipment and restricting activities conducted during nighttime hours.

Noise from the operation of the new CTG is expected to be predominantly low frequency noise, as is noise from traffic. Noise from Project operation will not significantly impact the acoustical environment given the high background noise levels (particularly in low frequencies) from nearby Minnesota Highway 65 and 349th Avenue NE, the distance of the Project from adjacent properties and the noise control technology that will be employed by the new generating unit.

Noise from combustion turbine operation is a result of air flow through the combustion air intake and from the exhaust gases discharging from the stack. The Project air inlet will be appropriately sized and fitted with diffusers to minimize velocity and therefore the noise of air moving into the inlets. The stack will be fitted with silencers to reduce the noise of exhaust gases leaving the plant.

The locations of the two residences closest to the proposed CTG location are highlighted on Figure 1-2. Preliminary noise calculations indicate that the Minnesota L_{50} nighttime standard of 50 decibels would not be exceeded during CTG operation at distances greater than 600 feet from the new CTG. The nearest residence is approximately 1,300 feet southwest of the proposed CTG location.

GRE contracted HDR Engineering, Inc. to conduct noise level monitoring at the fence line around the site and south-southwest of the site near the intersection of Main Street and Township Road 75. Measurements were taken during daytime hours to determine background levels and levels from the existing Frame 5 combustion turbine at the site.

Background noise around the site appears to be predominantly associated with traffic on Highway 65 and Main Street. Background L50 noise levels (the 50th percentile level for the period of time measured) at the fence line ranged between 49 and 52 dBA. The background L50 level south-southwest of the site was 52 dBA.

With the existing Frame 5 combustion turbine in operation, L50 levels at the fence ranged between 56 and 63 dBA. At the south-southwest monitoring location, the L50 level was 56 dBA. The proposed project is estimated to add an additional one or two decibels to the existing noise levels at the south-southwest monitoring location if both combustion turbines were operated at the same time. The MPCA's, "A Guide to Noise Control in Minnesota"[1] describes a one decibel change in noise levels as being "not perceptible" and a three decibel noise change as being at the "threshold of perception". Considering the high background noise levels and the negligible increase in noise levels from the proposed Project, the change in noise levels is not expected to be noticeable at the nearest receptors.

4.4 Land Use Impacts

The Project location takes advantage of existing infrastructure. The new generating units will be located within the footprint of an existing plant in an industrial-zoned area and will not change the land use of the area.

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[1] http://www.pca.state.mn.us/programs/noise.html

4.4.1 Zoning and Displacement

The area surrounding the Cambridge Station is zoned by Isanti County as Agricultural District (A). A zoning map of the Project area is included as Figure 4-1.

The Project will not require the displacement of any occupied residences or businesses. Work on the Project will not displace any other existing or planned land use, including residential land uses. The proposed site for the new generating unit is located within a parcel currently owned by GRE and used for power generation (see Figure 2-1). The nearest residence is located approximately 1,300 feet southwest of the proposed CTG location.

4.4.2 Aesthetics

Area aesthetics will not be significantly changed by the Project. The proposed plant site is already developed and includes the existing Cambridge Station and its 25-MW fuel oil-fired CTG. The new gas-fired plant will be larger than the existing fuel oil-fired plant, and two new water tanks will constructed. The Project will result in a similar industrial look as the existing plant.

The project will also include upgrading approximately 47 miles of 69-kV transmission line in Isanti, Chisago and Kanabec counties to improve the overall operation and reliability of the Cambridge area transmission system.. The transmission line rebuilds will involve changing to taller poles (from approximately 40-55 feet to 60-65 feet above ground), upgrading wire size, and adding lightning protection. The transmission lines will not appear significantly different than the existing transmission line configurations.

4.4.3 Impacts to Industries

Area industries will not be adversely impacted by the Project.

No agricultural land will be used for the Project. No forestry-related industry will be adversely impacted by the Project. Area tourism and recreation areas (see Figure 4-2) will not be adversely impacted by the Project.

4.5 Social, Cultural and Economic Impacts

4.5.1 Public Health and Safety

Typical health and safety concerns associated with generation of electricity are related to air emissions, noise, security, and emergency preparedness. Air and noise impacts from the Project are addressed in Sections 4.1 and 4.3, respectively. Plant security and emergency preparedness are discussed below.

4.5.1.1 Plant Security and Emergency Preparedness

The Project site will be surrounded by an 8-foot high, chain-link fence. Access into the Project will be controlled by an automatic gate with the option for manual operations from the Project's Control Room and GRE's 24-hour System Operations Center in Elk River, Minnesota. The Project site will be monitored through closed circuit television linked to the Project's Control Room and the System Operations Center. GRE will work with local law enforcement agencies to provide reliable security.

4.5.2 Public Services and Infrastructure

The Project will not require extraordinary public services nor strain the public infrastructure. Construction and operating simplicity associated with simple cycle technology result in minimal burden on roadways and public services.

The Project will be supplied by East Central Cooperative, the local distribution cooperative.

Cambridge Station does not currently have natural gas utility service. The Project natural gas fuel supply will be furnished through a new natural gas pipeline that will be constructed in association with the Project. The natural gas pipeline is described in Section 3.1.2.

The major traffic routes in the area are Minnesota Highway 65, which runs north and south west of the Cambridge Station, and Minnesota Highway 95, which runs east and west approximately two miles south of the plant site (see Figure 4-3).

The Burlington Northern Santa Fe Railway track passes directly adjacent to the west portion of the site (Figure 4-3). Construction of the plant and transmission line upgrades will not impact area airports (see MDOT correspondence in Appendix A).

Additional traffic generated by the Project is limited to the truck traffic associated with construction in the short-term and GRE operation and maintenance staff in the long-term. The additional traffic will not significantly affect area transportation services.

4.5.3 Archaeological and Historical Resources

The Project will be located on an existing industrial site, thus there will be no direct impacts to any buildings, including historic structures.

The project will also include upgrading approximately 47 miles of 69-kV transmission line in Isanti, Chisago and Kanabec counties to improve the overall operation and reliability of the Cambridge area transmission system. The Minnesota State Historic Preservation Office (SHPO) has been asked to review their records to determine whether there are any reported historic or archaeological resources in the vicinity of the project site. Their review response and the listing of recorded archaeological sites and historical resources within a one mile distance of the project site and transmission lines is included in Appendix A. The results of the Minnesota Historical Society (MHS) database search request indicated that 15 recorded archaeological sites and five national register properties are located within one mile of the project site and transmission lines. A letter was sent to the MHS requesting an assessment of the Project's potential to impact these sites or properties. That letter and the MHS response, where the MHS concluded no properties eligible for or listed on the National Register of Historic Places are within the Project's area of effect, are included in Appendix A.

4.5.4 Economic Benefits

The local community will benefit from the Project construction. Construction of the Project will require an estimated 100 skilled craft workers over the 12-month construction period. These high-skill, high paying positions, including pipe fitters, iron workers, millwrights, boilermakers, carpenters, electricians, and other trades, are estimated to have a payroll of about $10 million over the course of the Project. Day-to-day operation of Cambridge Station will require two to three full-time employees after construction.

The Project will contribute approximately $350,000 in property taxes for Isanti County and the Cambridge and Braham School Districts. The state and Isanti County will also benefit from income

and sales taxes paid as a result of the construction of the Project. The operating staff associated with the Project will continue to pay payroll taxes.

4.6 Effects on the Natural Environment

4.6.1 Geology and Soils

The geology and soils at the Project site are structurally suitable for construction of the Project CTG and other facilities. The geology and soils do not present any special concerns related to water or wastewater management for the Project.

The site is located within the Anoka Sand Plain region and is underlain by approximately 100 feet of unconsolidated sediments, according to regional well logs[2]. Pleistocene-aged lake sediments associated with the Grantsburg sublobe of the Des Moines lobe are directly beneath the site. These lake sediments consist primarily of very fine to medium sand with minor amounts of silt. Till deposits associated with the Grantsburg sublobe and recent alluvium and organic deposits occur elsewhere in the region. The unconsolidated sediments at the Site are underlain by Cambrian-aged sedimentary rocks[3]. See Figure 4-5 for a visual representation of the surficial geology of the site.

The Soil Survey of Isanti County, Minnesota (1958) indicates soils found on the site are Anoka and Lino loamy fine sands. The Lino and Anoka series are nearly level to gently sloping and formed in outwash sands. Soils can be poorly drained due to the profile of loamy sand over fine sands. Figure 4-5 provides an overview of the soils for the project site and the surrounding area. The Project site has been in an industrial land use and thus the soils have been altered due to prior construction activities.

The Natural Resources Conservation Service (NRCS) has been asked to review the Project to determine if there will be impacts to prime farmland.

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[2] Meyer, G.N., C.J. Patterson, H.C. Hobbs, and J.D. Lehr, 1993. "Surficial Geology" in "Anoka Sand Plain Regional Hydrogeologic Assessment." Minnesota DNR Regional Assessment Series, RHA-1, Plate 1.

[3] Ericson, D.W., G.F. Lindholm, and J.O. Helgesen, 1974. “Water Resources of the Rum River Watershed, East-Central Minnesota.” Minnesota Department of Natural Resources Hydrologic Investigations Atlas HA-509.

4.6.2 Rivers, Streams and Lakes

The Project will not significantly impact area water bodies. The Project site is located within the Rum River watershed. The nearest named stream is Beckins Creek, branches of which are approximately 1,300 feet north, 1,000 feet south, and 2,200 feet west of the Project site. The Rum River is approximately one mile west of the plant site. The nearest lake, Rum Lake (71-48P) is approximately 3,700 feet east of the Project site (see Figure 4-7).

Surface water runoff from the south portion of the Project site will be routed to an on-site retention basin, while discharge from other portions of the site will follow existing drainage patterns. Process wastewater, primarily evaporative cooler blow down wastewater, will also be discharged to the retention basin. Combined storm water and process wastewater will be discharged from the retention basin to a wetland south of the site. The wetland drains to the southwest, eventually into Beckins Creek and ultimately to the Rum River. The disposition of the retention basin discharge is discussed further in Section 4.2.2.

The existing transmission lines to be upgraded cross a number of public waters and wetlands, but most are spanned and in other locations any disturbance for the rebuilds will be minimal and limited to pole placement. The MDNR identified three locations of special concern related to water resources. The Cambridge to East Bethel transmission line passes through Cedar Creek Natural History Area, which contains wet meadow, alder swamp, white cedar swamp, tamarack swamp, mixed hardwood swamp, rich fen, and cattail marsh native plant communities. The Cambridge to Grasston transmission line crosses the Snake River in Grasston (T38N R23W Section 13) and passes through a "Site of Moderate Biodiversity Significance" (T37N, R23W, Section 2). GRE will comply with the recommendations made by the MDNR to mitigate and minimize impacts from the Project in these sensitive areas.

Review request letters have been sent to the MDNR and the U.S. Army Corps of Engineers requesting information on potential impacts of the Project on area water resources.

4.6.3 Vegetation

The Project site is located on the Anoka Sandplain landform, with pre-settlement vegetation being primarily composed of oak openings and barrens (savanna) on the upland areas and river bottom forest adjacent to the Rum River at lower elevations. Most of the native vegetation has been removed to allow the land to be converted to agricultural uses. There are some remnants of pre-

settlement vegetation indicated by the Minnesota County Biological Survey (MCBS) to the west across the railroad tracks and Highway 65 known as the North Cambridge Swamp (Figure 4-7). The MCBS data identifies minerotrophic tamarack swamp (*Larix larcina*) and mixed hardwood swamp as native plants communities west and northwest of the site (~1000 feet). These tree and shrub species are listed in Table 4-2. MCBS survey data also identify a small area of mesic oak forest adjacent to the swamps on the upland areas. Because of their location on the opposite side of the railroad and Highway 65, these remnants will not be negatively impacted by the Project.

Table 4-3 Plant Species (Trees and Shrubs) Found in Native Vegetation Remnants

Minerotrophic Tamarack Swamp (1989 site data)
Acer rubrum (Red maple)
Betula alleghaniensis (Yellow birch)
Betula papyrifera (Paper birch)
*Cornus stolonifera (*Red osier dogwood)
Larix lacina (Tamarack)
Picea mariana (Black spruce)
Rhamnus frangula (Glossy buckthorn)
*Rhus vernix (*Poison sumac)
Ulmus rubra (Slippery elm)
Diverse groundlayer noted in MNH database summary
Mixed Hardwood Swamp (1989 and1990 site data)
Acer rubrum (Red maple)
Betula papyrifera (Paper birch)
Fraxinus nigra (Black ash)
Juglans cinerea (Butternut)
Larix lacina (Tamarack)
Diverse groundlayer noted in MNH database summary

The existing transmission lines to be upgraded cross or are immediately adjacent to a number of sites identified by the MDNR. Ninety-four occurrences were listed in the MDNR Natural Heritage Inventory System (NHIS) database within a one-mile radius of the transmission lines and Project site. Six locations of special concern were identified by the DNR.

A site of outstanding biodiversity significance is located just east of the transmission line north of East Bethel (T34NR23W Sections 16 and 21). This particular site is the Cedar Creek Natural History Area, contains wet meadow, alder swamp, white cedar swamp, oak forest, white pine forest, tamarack swamp, mixed hardwood swamp, rich fen, and cattail marsh native plant communities, and provides habitat for several rare plant and

animal species. Several sites of biodiversity significance are located adjacent to the Cambridge to Rush City transmission line in T37N R22W Sections 26 & 36 and T37N R21W Section 30. The Cambridge to Grasston transmission line passes through a site of moderate biodiversity significance west of Braham (T37N R23W Section 2). This site contains Tamarack Swamp and Poor Fen native plant communities. GRE will comply with the recommendations made by the MDNR to mitigate and minimize impacts from the Project in these sensitive areas.

In all other locations any disturbance to vegetation due to the transmission line rebuilds will be minimal and limited to pole placement.

4.6.4 Fauna

The Project is not expected to adversely impact area wildlife. The MDNR Natural Heritage Program was contacted to review their NHIS database. Results of the database search, included in Appendix A, identified Blanding's turtle as being present in the vicinity of the Project site, but not on the site. Construction activities should not adversely impact any Blanding's turtle habitat given the agriculture land use that abuts the Project site. A project review request letter has also been sent to the U.S. Fish and Wildlife Service to determine if the Project will affect any threatened or endangered species and a response has not yet been received.

Blanding's Turtles (*Emydoidea blandingii*), a state-listed threatened species, have been reported in the vicinity of all three transmission lines by the Minnesota DNR. They have provided recommendations to prevent harm to turtles during construction work that will be followed during the upgrade construction activities. The Cambridge to Grasston transmission line crosses the Snake River immediately south of Grasston (T38N R23W Section 13). Several rare freshwater mussel species including Mucket, Purple Wartyback, and Round Pigtoe Mussels (threatened species) and Spike, Black Sandshell, Fluted-Shell, Creek Heelsplitter, and Hickorynut Mussels (special concern species) have been documented in the Snake River in this vicinity. Erosion and sediment control practices implemented and maintained during any line rebuilding will prevent impacts to mussel populations.

4.6.5 Wetlands

The Project will not significantly impact area wetlands. No wetlands are located within the Project Site. However, several wetlands are found in the area surrounding the plant site, the nearest of which

is a saturated forested wetland approximately 250 feet west of the plant site. The Project will discharge combined storm water and process wastewater from an on-site retention basin to a wetland located about 300 feet south of the site (see Section 4.2.2). There are two additional wetlands located with 1,000 feet of the Project, neither of which will be impacted by the project. Figure 4-8 shows the wetlands in the vicinity of the Project site and Table 4-4 lists the Cowardin classification for all wetlands within approximately 2,000 feet of the Project site.

Table 4-4 Wetlands Summary

Distance and Direction from Project Site	Cowardin Classification	Plant Community Type
300 ft S	PSS1/EMBd/ PEMFd/PUBGx	Scrub-shrub/ Semi-permanently flooded emergent marsh (partially drained) (71-49W)
250 feet W	PFO2/1B	Tamarack and mixed hardwood swamp
400 feet ENE	PEMAd	Temporarily flooded emergent marsh (drained and farmed)
650 ft N	PEMB	Emergent marsh

Information has been requested from the MDNR on the possible effects of the proposed project on wetland resources that occur in the project area and along transmission routes. The existing transmission lines cross some wetlands, but most are spanned and in other locations disturbance for the rebuilds will be minimal and limited to pole placement.

4.6.6 Rare and Unique Natural Resources

The Project will not adversely impact threatened or endangered species. The Natural Heritage Program of the MDNR was contacted and asked to review its database to determine if any rare plant or animal species or other significant natural features are known to occur within the Project site. No plants or animals of concern were identified that would be adversely impacted by the Project.

Ninety-four occurrences were listed in the MDNR NHIS database within a one-mile radius of the transmission lines and project site. The six locations of special concern were identified by the MDNR are discussed in detail in Sections 4.6.3 and 4.6.4.