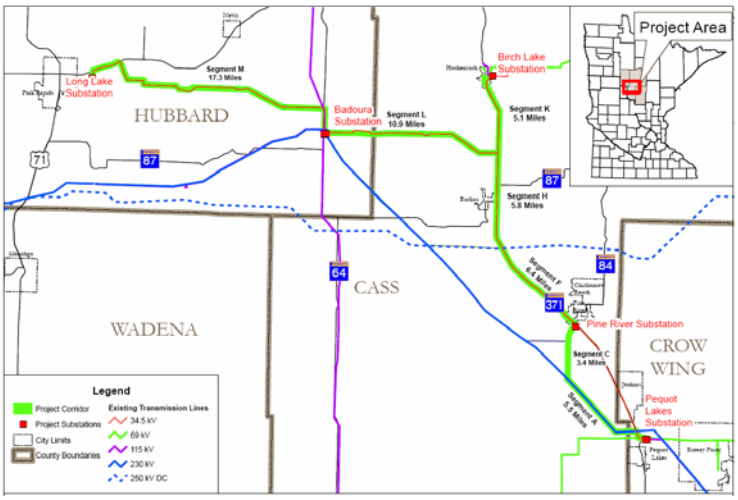
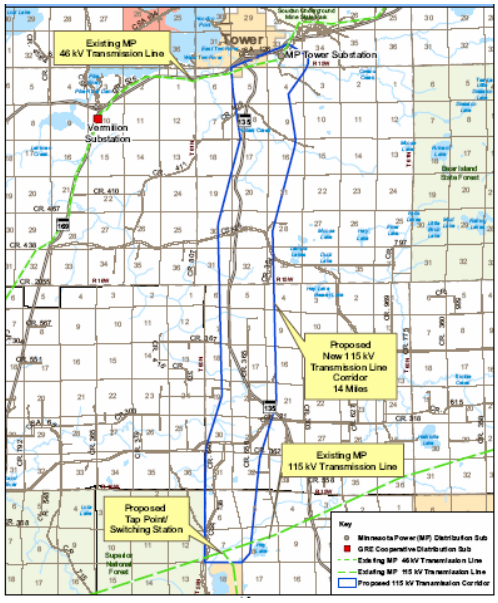
ENVIRONMENTAL REPORT

MINNESOTA POWER/GREAT RIVER ENERGY
BIENNIAL TRANSMISSION PROJECTS
CERTIFICATION OF HIGH VOLTAGE TRANSMISSION LINE PROJECTS
PUC DOCKET NO. E-015/TL-05-867





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OVERVIEW

The Project. Minnesota Power (MP) and Great River Energy (GRE) collectively known as "Applicants" have made a joint application to the Minnesota Public Utilities Commission (PUC) for Certification of two High-Voltage Transmission Line (HVTL) projects pursuant to the provisions of Minnesota Statutes 216B.2425 and Minnesota Rules, Chapter 7848, through the Biennial Transmission Projects Report proceeding. The two projects are referred to as "Tower" and "Badoura." The Badoura project would be approximately 56 miles of upgraded and new transmission lines interconnecting five existing substations located in Crow Wing, Cass and Hubbard counties to meet the needs of MP and GRE customers in northcentral Minnesota. The Tower project would be approximately 15 miles of new transmission lines, a new Embarrass switching station, and a new Tower substation located in Saint Louis County to meet the needs of MP and GRE customers in northeastern Minnesota.

Certificate of Need. The primary duties of the PUC regarding the regulation of energy are to conduct long-range planning of energy needs, resources and services, to ensure acceptable levels of system reliability, to set rates and regulate service quality for large electric and natural gas companies, to approve resource plans for large electric utilities, including consideration of environmental affects of energy use and to grant Certificates of Need (CON) for large energy facilities, including power plants and transmission lines. Before any route permit application is approved, the PUC must grant the utility a CON specifying details of how the required customer service can be provided in a cost-effective manner at reasonable rates. The Biennial Transmission Projects Report is a system upgrade needs-clustering mechanism whereby power companies can seek certification of their project needs in aggregate rather than as individual projects.

In 2004, the Applicants submitted two project reports to the PUC for certification of new 115 kV transmission line upgrades to satisfy an increased demand for electricity in northcentral and northeastern Minnesota. As part of the CON process, the Minnesota Department of Commerce (DOC) conducted detailed economic analysis of routes and system configurations proposed by GRE. If the PUC determines that there is a need for more power in the service territories described by the Applicants, then it will issue a CON for the new 115 kV lines designated in PUC Docket Number: ET2/TL-05-867. If the CON is granted, then the Applicants would have to apply for route permits within the specified corridors.

Historically the proposed routes submitted by the Applicants and ultimately approved by PUC are the least cost option that will satisfy system reliability requirements.

Permits. In addition to the Certification from the PUC, the applicants are required to obtain a Route Permit from the PUC for the specific route of the new transmission lines. Minn. Stat. 116C.57, subd. 2. The Route Permit establishes the specific route, and precise alignment in some cases, that the new transmission line will follow as opposed to the broad corridor concept outlined in the Biennial Report. Finally, the applicants may be required to obtain various permits from other State agencies relating to the construction and operation of the HVTL.

Environmental Report. As part of its review of a Biennial Transmission Report requesting certification of a HVTL, the PUC is required to prepare a document called an Environmental Report (ER). Minn. Rules 4410.7030. On behave of the PUC; the DOC Energy Facility Permitting Unit (EFP) prepared an ER based on its analyses of the information and data supplied in the two Biennial Projects Reports and several other relevant sources. In the Environmental Report the DOC evaluates the general potential impacts from construction, operation, and maintenance of the proposed HVTL along the broad corridor(s) proposed by the applicant and discusses ways to mitigate these potential impacts. The public is given an opportunity to participate in the development of the environmental report.

The ER will not consider the impacts or mitigative measures associated with specific routes and/or alignments within the proposed corridors. Site specific concerns (i.e., along specific alignments) will be addressed in the subsequent HVTL Route Permitting process.

This Environmental Report is divided into two, separate volumes, Volume 1 The Badoura Project and Volume 2 The Tower Project, bound into a single document. Since the two projects are geographically separate, this approach will aid readers that are solely interested in the proposed project in their locale.

Major Decisions. The decision that will be made in this proceeding is a decision by the PUC on whether there is a need for the additional transmission. If the PUC determines that there is a need for additional transmission, it will certify the projects within the Biennial Transmission Report.

If one or both of these projects is certified by the PUC the applicants can proceed onto the HVTL Route Permitting process, which is a separate filing.

Public Hearing. The PUC is required to hold a public hearing on the Biennial Transmission Report and the request for certification of the HVTL projects. Minn. Stat. 216B.243, subd. 4.

VOLUME 1

BADOURA PROJECT

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VOLUME 1 - BADOURA

1.0 INTRODUCTION

On November 11, 2005, Minnesota Power (MP) and Great River Energy (GRE) made a joint application to the Minnesota Public Utilities Commission (PUC) for Certification of two High-Voltage Transmission Line (HVTL) projects pursuant to the provisions of Minnesota Statutes 216B.2425 and Minnesota Rules, Chapter 7848 through the Biennial Transmission Projects Report proceeding. The two projects are referred to as "Tower" and "Badoura."

1.1 PROJECT DESCRIPTION

The Badoura project would be approximately 56 miles of upgraded and new 115 kV transmission lines interconnecting five existing substations located in Crow Wing, Cass and Hubbard counties to meet the needs of MP and GRE customers in northcentral Minnesota.

The substations include the Pequot Lakes Substation located northeast of Pequot Lakes, the Pine River Substation located southwest of Pine River, the Badoura Substation, the Long Lake Substation located east of Park Rapids, and the Birch Lake Substation located east of Hackensack in north central Minnesota (**Figure 1**). Substation improvements include new transformer additions at the Long Lake, Pine River and Birch Lake substations and conversion of the distribution service at the Pine River and Tripp Lake substations to 115 kV service.

1.2 PROJECT DESIGN

The 115 kV transmission line would use 636 ACSR (aluminum conductor steel reinforced) Rook conductor, which has an amp capacity of 914 amps at 100 degrees C. This will limit maximum continuous electric power capacity of the line to 182 megavolt amperes (MVA), provided there is not a more restrictive limit associated with the line's substation terminal equipment or transformation capacity. There would be three single conductors for the 115 kV circuit. The line will be shielded with either 3/8 inch H.S. (7-strand) steel or 64 mm 2/258 (24-fiber) overhead ground wires, dependent upon structure type.

The lines will have a maximum continuous power carrying capability of 182 megavolt amperes (MVA). The power flow is not expected to reach these levels under normal system operations.

The line will be designed to operate at a nominal voltage of 115,000 volts. During normal operations, voltage will deviate somewhat from nominal levels. Typical system intact voltage will be in the range of 95 to 105 percent of nominal and post contingency voltage will range between 90 and 110 percent of nominal.

The line will be a three-phase, 60 hertz (Hz) alternating current (AC) transmission line insulated to operate at a nominal voltage of 115,000 volts. The line will use 636 ACSR Rook conductors that have typical 60 Hz impedance of approximately 0.149 +J0.732 ohms per mile. The reactive

component will vary slightly with structure and conductor configuration. The thermal limit of conductors will be 182 MVA at 100 degrees Centigrade. Depending on transmission structure design, the line will carry an additional wire or two for lightning protection and communications.

Three structure types are being considered for the project: wood H-frame, wood single pole, and wood single pole with distribution underbuild. Dependent upon land use type, topography, right-of-way constraints and other design-dependent features, each of the three transmission line structure designs would be appropriate in certain areas within the proposed corridor. **Figure 2** shows the cross section views of typical 115 kV transmission line structures and distribution underbuild that could be incorporated onto the structures along portions of the line.

Wood H-frame

The two pole structure design is suited for areas with rugged topography and for areas requiring longer spans to avoid or minimize placement of structures in wetlands or waterways. The average span would be 600 to 900 feet, with 1,000-foot spans achievable with certain topography. The structure height would average 60 to 90 feet with taller structures required for the exceptionally long spans and in circumstances requiring additional vertical clearance (i.e., railroad tracks) exceeding the National Electric Safety Code (NESC) requirements.

Single Pole (no underbuild)

The single pole design is suited for areas where available right-of-way is limited, such as where corridors are shared along roads in developed areas. Average structure height would be 65 to 80 feet to achieve average span lengths of 400 to 600 feet. Specific structure heights and span lengths may exceed the average due to land use requirements and topography.

Single Pole (with underbuild)

This single pole design is used in areas where existing land use development restricts the placement of two separate power line circuits—a high voltage circuit and a lower voltage (distribution line) circuit. The advantage of this design is less right-of-way requirement; however, there are significant operating, maintenance, and cost factors to consider. The higher voltage circuit is “stacked” on top of the lower voltage circuit resulting in a taller pole, averaging 75 to 90 feet in height. Specific areas may require taller poles due to topography and/or vertical conductor clearance requirements. The conductor used for the lower voltage circuit and other limiting factors result in a shorter average span; averaging 250 to 350 feet. The shorter average spans would require more poles per mile than the other two structure design options.

1.3 RIGHT-OF-WAY REQUIREMENTS & ACQUISITION

The standard right-of-way width requirement for a 115 kV transmission project would be 100 feet for all three structure design types. However, the right-of-way width for a single pole design could be reduced in certain higher density, developed areas. The required right-of-way width may also be less in areas where the new transmission line follows an existing linear corridor such

as a road or trail. The Applicants would seek a permanent easement (i.e., land rights), providing the right to construct, operate and maintain the transmission line, for the full width and length of the right-of-way.

The Applicants selected preliminary corridors based on opportunities to:

- share right-of-way with existing transmission lines by double circuiting where practical or paralleling an existing line;
- minimize impacts to system reliability;
- parallel roads to help decrease the amount of right-of-way required;
- parallel field lines, property lines or railroads, where access is adequate and the transmission line would cause minimal conflicts; and
- minimize the length of the transmission line to reduce the impact area and costs for the Project.

If the PUC should certify the HVTL project, the Applicants would seek approval for a specific route within the project corridor through the HVTL Routing Permit process. Through this process specific routes will be identified that avoid, to the extent possible, areas where a high-voltage transmission line could create significant impacts. These areas include:

- high density residential areas;
- areas where clearances are limited because of trees or nearby structures; and
- environmentally sensitive sites, such as wetlands, archaeologically significant sites, areas with threatened, endangered and species of special concern, areas of significant biological or cultural significance, and state and federal lands.

1.4 CONSTRUCTION

The first phase of construction activities would involve surveying the centerline of the new transmission line, followed by removal of trees and other vegetation from the right-of-way. As a general practice, low-growing brush or tree species are allowable at the outer limits of the easement area. Taller tree species that endanger the safe and reliable operation of the transmission facility would be removed. In developed areas and to the extent practical, existing low growing vegetation that would not pose a threat to the transmission facility or impede construction would remain in the easement area.

The second phase of construction would involve staking the location of structures, followed by structure installation and stringing of conductor wire. Upon completion of construction activities, landowners would be contacted to determine whether or not construction damages have occurred. Areas that sustain construction damage would be restored to the pre-construction condition to the extent possible.

The proposed 115 kV transmission line would be constructed at existing grade elevations. Therefore, no pole locations would require grading, unless it is necessary to provide a level area for construction access and activities.

Typical structures will be wood, laminated wood or steel direct-embedded poles. Each structure will require a 10 to 15 feet deep hole that has a diameter of 3 to 4 feet. Any excess soil will be removed from the site unless requested by landowners or others. The poles may be backfilled with native soils, crushed rock or concrete depending on design conditions. In lowland areas, a galvanized steel culvert may also be inserted for pole stability due to poor soil capacity.

Large angle structures will typically be self-supporting steel poles that require a drilled pier foundation. The piers will typically have diameters of 4 to 8 feet. The hole may require a typical depth of 15 to 30 feet depending on design requirements. The piers will be filled with concrete delivered to the site via trucks from a local batch plant.

Once the structures have been erected, conductors are installed by establishing stringing setup areas within the right-of-way. These stringing setup areas are typically located every two miles along a project's route. The conductors are pulled with a rope lead that connects to every structure through a dolly attached at the insulator location. Temporary guard or clearance poles are installed at crossings to provide adequate clearance over other utilities, streets, roads, highways, railroads, or other obstructions after any necessary notifications are made or permit requirements met to mitigate any concerns with traffic flow or operations of other utilities.

During construction when temporary removal or relocation of fences may occur, installation of temporary or permanent gates may be required. The Applicants right-of-way agents will coordinate with affected landowners regarding replacement of fences and gates. The contractor will work around cultivated areas until harvest has occurred.

Rebuilding existing transmission lines would typically involve complete replacement of structures and conductors. Procedures would be similar to those discussed above for the project. Increased voltage or current requirements would result in increased phase spacing or larger cables. The transmission line would typically be rebuilt in the same right-of-way. However, if the voltage is increased, the right-of-way width needs to be evaluated for proper clearances. Compact designs can sometimes mitigate the need for additional right-of-way for voltage upgrades.

Substation capacity upgrades are typically required for obsolete equipment or equipment that has become undersized based on increased power flow through the facility. In most cases, the substation equipment can be replaced with a similar device that has more carrying capacity . In a few cases, the capacity needs may require many portions of the substation to be replaced. In this case it may be more cost-effective to establish a new site that will relieve the overloaded facility. Establishing a second facility would increase reliability and eliminate service concerns if the existing facility is out of service for a long time for rebuilding to a higher capacity. In many cases space considerations based on NESC (National Electric Safety Code) and land availability

at an existing site have to be considered when any significant substation work needs to be performed.

1.5 OPERATION & MAINTENANCE

MP and GRE would periodically use the right-of-way of the transmission line to perform inspections, maintenance, and repair of any damage. Regular maintenance and inspections would be performed over the life of the facility to ensure a reliable system. Annual inspections would be done by foot, snowmobile, all-terrain vehicles, pickup truck, or aerial means. These inspections would be limited to the acquired right-of-way and areas where obstructions or terrain require access off the easement. The Applicants would conduct an aerial inspection of each transmission line annually to ensure reliable operation.

The Applicants would conduct vegetation surveys and remove undesired vegetation that would interfere with the operation of the transmission line. Frequency of vegetation maintenance is on an approximate two-to-five year cycle. Right-of-way clearing practices include a combination of mechanical and hand clearing, along with an application of herbicides where allowed.

1.6 PERMITS

LOCAL APPROVALS

Road Crossing Permits

These permits may be required to cross or occupy county, township and city road right-of- way.

Lands Permits

These permits may be required to occupy county, township and city lands, such as park lands, watershed districts and other properties owned by these entities.

Building Permits

These permits may be required by the local jurisdictions for substation modifications and construction.

Over-width Loads Permits

These permits may be required to move over-width loads on county, township or city roads.

Driveway/Access Permits

These permits may be required to construct access roads or driveways from county, township or city roadways.

STATE APPROVALS

Route Permit (Alternative Process)

A HVTL cannot be constructed without a Route Permit approved by the PUC. Since the proposed HVTL is between 100 and 200 kilovolts (kV), the project would be eligible for the Alternative Review Process outlined in Minnesota Rules 4400.2000.

The Route Permit establishes the specific route (and in some cases, a precise alignment) that the new transmission line will follow as opposed to the broad corridor concept outlined in the Biennial Transmission Projects Report.

Utility Permit

A permit from the Mn/DOT is required for construction, placement or maintenance of utility lines to be placed adjacent or across the highway right-of-way. These permits would be acquired once the line design is completed and the route permit is granted.

License to Cross Public Waters/State Lands

The DNR Division of Lands and Minerals regulates utility crossings over, under or across any state land or Public Waters identified on the Public Waters and Wetlands maps. A license to cross Public Waters is required under Minnesota Statute § 84.415 and Minnesota Rules Chapter 6135. The Applicants will work closely with the DNR on these permits and will file for any required permits once the line design is complete and the route permit is granted.

NPDES Permit

An NPDES permit is required for stormwater discharges associated with construction activities disturbing a site equal-to or greater than one acre in area. A requirement of the permit is to develop and implement a Stormwater Pollution Prevention Plan, which includes Best Management Practices (BMPs) to minimize discharge of pollutants from the site. The Applicants will review the need for an NPDES permit for work at the Pine River Substation and other locations once the line design is complete and the route permit is granted.

FEDERAL APPROVALS

Section 404 Approval

A Section 404 approval is required from the United States Army Corp of Engineers (USACE) when filling of a wetland or water of the United States. Section 404 approvals are not expected to be required for the proposed project.

Section 401 Certification

A Section 401 Water Quality Certification is required when federal approval for a project is sought (i.e. Federal Energy Regulatory Commission {FERC} permits or a USACE Individual Permit).

Rural Electrical Utility

The RUS requires environmental approval of the proposed project before construction can begin.

1.7 PROPOSED CORRIDOR

The proposed corridor is comprised of seven segments that total approximately 56 miles: A, C, F, H, K, L and M as shown on **Figure 3**.

Segment A (5.5 miles)

The corridor begins at the Pequot Lakes Substation and exits to the north following the Riverton to Badoura 230 kV line, traveling cross-country in a northwesterly direction until it intersects with County Road 1, approximately three miles south of Pine River.

Segment C (3.4 miles)

New right-of-way would start at County Road 1 and then run north to the Pine River Substation.

Segment F (6.4 miles)

This segment follows the 34.5 kV line that exits the east side of the Pine River Substation and travels northwest along the west side of TH 371 next to the DNR Paul Bunyan Trail to a point north of Pine River. Here the 34.5 kV line crosses to the east side of TH 371 where it continues to parallel TH 371 until it intersects with the MP Direct Current transmission line (MP +/- 250 kV DC line) three miles south of Backus.

Segment H (5.8 miles)

This segment follows a 34.5 kV line that starts at the intersection with the MP DC line and continues to parallel TH 371 on the east side until the Birch Lake 34.5 kV Tap approximately two miles north of Backus.

Segment K (5.1 miles)

This segment follows a 34.5 kV line that starts at the Birch Lake 34.5 kV Tap (just north of Backus) and continues to parallel TH 371 on the east side until just south of Hackensack where it turns northeast and runs cross-country to Third Street before terminating at the Birch Lake Substation.

Segment L (10.9 miles)

This segment follows the Badoura to Birch Lake Tap 34.5 kV line that starts at the Birch Lake 34.5 kV Tap (approximately two miles north of Backus) and runs west cross country until it meets 16th Street in Cass County, which becomes 140th Street in Hubbard County. At this point it parallels the street to the north until just before County Road (CR) 64, where it crosses the road and enters the Badoura 115 kV Substation on the north side.

Segment M (17.3 miles)

The last segment follows the Badoura to Long Lake 34.5 kV line that exits the Badoura 115 kV Substation paralleling CR 64 northerly for approximately 2.5 miles. It then crosses CR 64 and travels westerly before meeting 174th Street. It parallels 174th Street on the south side until it turns south at Crown Point Road, where the line crosses the road and continues west cross-county. The line then intersects with CR 11 and turns north paralleling CR 11 until it intersects with 178th Street. The line turns west and parallels 178th Street until it intersects with CR 20, then follows CR 20 north until it intersects with TH 34. It then turns west and follows TH 34 around the north end of Long Lake until it intersects with 169th Avenue. The line turns south and follows 169th Avenue until it reaches the Long Lake Substation (just east of Park Rapids).

1.8 REGULATORY PROCESS & REQUIREMENTS

The authority for high voltage transmission line permits was transferred from the Minnesota Environmental Quality Board (EQB) to the Minnesota Public Utilities Commission by the Minnesota Legislature on July 1, 2005 (see S.F. 1368). EQB Energy Facility Permitting staff was transferred to the Department of Commerce, where they continue to coordinate the routing process through to the PUC final decision.

1.8.1 PUC CERTIFICATION REQUIREMENTS

Any biennial transmission projects report that seeks certification of a HVTL in the course of the biennial transmission report proceeding must comply with both the Minnesota Rules Chapter 7848 (Biennial Transmission Report) filing requirements and the filing requirements of Minnesota Rules Chapter 7849 (Certificate of Need).

1.8.2 DOC REQUIREMENTS

The DOC must conduct environmental review of large energy projects seeking PUC certification pursuant to Minnesota Statutes, §216B.243 and 216B.2425. Minnesota Rules, Parts 4410.7010 to 4410.7070, establish the process and requirements for conducting this review.

Under this process the DOC is required to hold a public meeting, prepare an environmental report (ER) and perform the associated administrative tasks.

On December 7, 2005, and December 8, 2005, staff from the DOC's Energy Facility Permitting Unit held public meetings in the Badoura and Tower areas, respectively. The purpose of the public meetings was to provide the public with information about the two projects, afford the public an opportunity to ask questions and present comments, and to solicit input on the content of the ER.

The comment period was held open until 5:00 pm January 10, 2006.

On January 11, 2006, after consideration of the public comments, the Commissioner of the DOC issued an Order outlining the content of the environmental report (**Appendix A**).

1.9 SOURCES OF INFORMATION

Much of the information used in this Environmental Report (ER) is derived from two source documents prepared by the Applicants and their consultants. These are, the "Biennial Transmission Projects Report: Certification of a High-Voltage Transmission Line, Badoura Project, November 2005, Minnesota Power and Great River Energy and the "Biennial Transmission Projects Report: Certification of a High-Voltage Transmission Line, Tower Project, November 2005, Minnesota Power and Great River Energy. The environmental review rules specifically recommend the incorporation by reference of information and data into the ER, as long as this material is briefly described and the referenced material is readily available to the public. These reports are both available at the PUC website:

http://energyfacilities.puc.state.mn.us/Docket.html?Id=17803

Additional sources of information are listed below:

- Minnesota Pollution Control Agency (http://www.pca.state.mn.us/)
- Minnesota Department of Natural Resources (http://www.dnr.state.mn.us/index.html)
- Minnesota Department of Health (http://www.health.state.mn.us/)
- U. S. Environmental Protection Agency (http://www.epa.gov/)
- Electric Power Research Institute (http://www.epri.com/default.asp)
- City of Shakopee (http://www.ci.shakopee.mn.us/)
- U. S. Department of Agriculture Natural Resources Conservation (http://soils.usda.gov/about/)
- Minnesota Geological Survey (http://www.geo.umn.edu/mgs/)
- Department of Administration, State Demographic Center (http://www.demography.state.mn.us/)
- Federal Emergency Management Agency (http://www.fema.gov/)
- U. S. Department of Energy, Energy Information Administration (http://eia.doe.gov/)

2.0 ALTERNATIVES TO THE PROJECT

Any biennial transmission projects report that seeks certification of a HVTL in the course of the proceeding must include a list and analysis of all feasible transmission and nontransmission alternatives to the line (Minn. Rules 7848.1400, subpart 2, item T).

2.1 NO-BUILD ALTERNATIVE

Under this alternative, the PUC would not approve the construction of the proposed HVTL and substation project.

Based on the analysis of load growth in the service area, preformed by the Applicants, doing nothing is not a viable alternative. Using only the existing transmission and substation system, as is, would not provide adequate power delivery capacity or reliable service by 2009. No action with respect to the improvement to the area's electric power delivery systems would place the area's residential and commercial customers and their business, safety, and welfare at risk of being without reliable electric service.

Currently, voltage support and line loading are only a concern a few hours a year when load on the 34.5 kV and 69 kV systems are at or above critical load levels. However, as load continues to grow, the number of hours the area will be at risk will increase. If this inadequacy is not eliminated, a single outage could result in localized voltage collapse. If this were to occur, it could take several hours to restore electric service to the customers served by the local transmission grid. Once load is restored, rotating blackouts may be required to insure voltage would not collapse again until the equipment that caused the outage is repaired and placed back in service. Loads in this area are a concern during both summer and winter, so loss of electric service to the area could result in property damage or life threatening conditions if it cannot be restored in a reasonable time.

2.2 CONSERVATION ALTERNATIVES

Minnesota Statute 216B.241 and Minnesota Rules 7690.0500 through 7690.0800 require that investor-owned utilities (IOUs) in Minnesota file a Biennial Conservation Improvement Plan (CIP) that details specific programs designed to save energy through conservation and energy efficiency activities. Investor-owned utilities are also required to determine the cost-effectiveness of these programs and to spend at least 1.5 percent of its annual gross revenue on approved CIP programs.

Minnesota Power's 2004 CIP Status Report (Docket No. E015/CIP-03-819.06) indicates that the company has exceeded the spending requirement of 1.5 percent and the projected demand side management (DSM) savings levels determined in the Integrated Resource Plan (IRP).

Minnesota Power's proposed 2006–2007 Biennial Plan (Docket No. E015/CIP-05-797) exceeds the CIP required spending levels and IRP determined energy savings levels.

Conservation measures employed in the project area have deferred, but cannot eliminate the need to install the proposed HVTL and substation improvements. Conservation programs will continue to be implemented in the area to maximize efficient use of electricity.

2.3 EXISTING LINE/SYSTEM IMPROVEMENTS

Reconductoring the existing 34.5 kV and 69 kV lines serving the area would reduce the voltage drop along the line and eliminate line overload issues. However, the voltage improvement would not be significant; therefore, reconductoring would only delay the need for a new source to serve the area by a few years at most. Simple reconductoring is not a reasonable solution.

The concern in this service area is the large amount of load served by a single radial 115 kV transmission line. Loss of this line puts a large amount of load on long radial 34.5 kV lines, such that voltage drop would always be a concern.

2.4 GENERATION ALTERNATIVES

Generation and distributed generation were considered as an alternative to the proposed new transmission. The generation could be located at one location, or distributed at two or more locations in the project area. Minnesota Statutes. §216B.169, subd. 1(c), defines distributed generation as high-efficiency, low-emissions, dispersed generation of no more than 10 MW of interconnected capacity. The most cost-effective method would be to connect generators to the electric grid in one place due to costs associated with interconnecting to the electric grid as well as communication and control issues.

Based on load flow steady state analysis, initially 20 MW of generation would be required in Park Rapids. In order to eliminate the transfer of load to other substations, the generation would need to be increased to levels that could support the entire load served out of the Long Lake substation or over 50 MW. In the Pequot Lakes area 30 MW of generation would be required initially. The generation sites could be spread across the area (e.g., 8 MW at Pine River, 8 MW at Nisswa, 6 MW at Emily and 8 MW at Birch Lake or Wabedo).

The Park Rapids area has natural gas, and generators could be sized to meet future load. However, if generators were distributed at sites away from the Park Rapids area, natural gas may not be readily available, and use of more costly fuels such as diesel or propane might be necessary.

This type of generation (i.e., back-up or emergency) would not be as reliable as transmission because of operating issues, and short outages that would likely occur as the generation is started, load transferred and the load is picked up. Additional generation would need to be added in future years to keep up with load growth. Lastly, generation would not eliminate the need for additional transmission; it would only delay the need.

2.5 ALTERNATIVE HVTL CORRIDOR

Minnesota Power provided an alternative corridor to its preferred option (**Figure 4**). The alternative corridor from Pequot Lakes to Park Rapids is comprised of nine segments totaling 61.3 miles: A, G, J (diagonal corridor), C, E, I, H, K and M. The segments are described below.

Segment A (5.5 miles)

The corridor alternative begins at the Pequot Lakes Substation and exits to the north following the Riverton to Badoura 230 kV line, traveling cross-country in a northwesterly direction until it intersects with CR 1, approximately three miles south of Pine River.

Segment C (3.4 miles)

New right-of-way would start at a new tap on the Riverton to Badoura 230 kV line and then run north to the Pine River Substation.

Segment E (2.5 miles)

New right-of-way would start southwest of the Pine River Substation and travel west to the Riverton to Badoura 230 kV line.

Segment G (8.2 miles)

This segment follows the Riverton to Badoura 230 kV line from the intersection with Segment E until it intersects with the MP DC line.

Segment H (5.8 miles)

This segment follows a 34.5 kV line that starts at the intersection point with the MP DC line and continues to parallel TH 371 on the east side until the Birch Lake 34.5 kV Tap (approximately two miles north of Backus).

Segment I (4.4 miles)

This segment follows the MP DC transmission line from its intersection with the Riverton to Badoura 230 kV line until its intersection with the 34.5 kV line that parallels TH 371 (approximately three miles south of Backus).

Segment J (9.1 miles)

This segment follows the Riverton to Badoura 230 kV line from the intersection with the Minnesota Power direct current line and runs cross-country until it terminates at the Badoura Substation.

Segment K (5.1 miles)

This segment follows a 34.5 kV line that starts at the Birch Lake 34.5 kV Tap (just north of Backus) and continues to parallel TH 371 on the east side until just south of Hackensack where it turns northeast and runs cross-country to Third Street before terminating at the Birch Lake Substation.

Segment M (17.3 miles)

The last segment follows the Badoura to Long Lake 34.5 kV line that exits the Badoura 115 kV Substation paralleling CR 64 northerly for approximately 2.5 miles. It then crosses CR 64 and travels westerly before meeting 174th Street. It parallels 174th Street on the south side until it turns south at Crown Point Road, where the line crosses the road and continues west cross-county. The line then intersects with CR 11 and turns north paralleling CR 11 until it intersects with 178th Street. The line turns west and parallels 178th Street until it intersects with CR 20, then follows CR 20 north until it intersects with TH 34. It then turns west and follows TH 34 around the north end of Long Lake until it intersects with 169th Avenue. The line turns south and follows 169th Avenue until it reaches the Long Lake Substation (just east of Park Rapids).

3.0 ASSESSMENT OF IMPACTS & MITIGRATION

Minnesota Rule part 4410.7035 outlines those areas which must be included in the environmental report; these include, but are not limited to, an analysis of the human and environmental impacts of the proposed project and an analysis of the mitigative measures that could be reasonably implemented to reduce or eliminate the identified impacts.

3.1 ENVIRONMENTAL SETTING

The proposed transmission corridor is located within the Northern Minnesota Drift and Lake Plains section of the Ecological Classification System.[1] The corridor falls within the Pine Moraines and Outwash Plains subsection. This subsection is characterized by end moraines, outwash plains, till plains and drumlin fields. Sands and sandy loam soils overlay bedrock and vary in depth between 200 and 600 feet below ground surface.

The corridor, which starts in Crow Wing County, traverses through Cass County and ends in Hubbard County, passes through only the Pine Moraines and Outwash Plains subsection. This area is characterized by morainic soils, excessively drained sands and numerous wetlands. The corridor is within three major watersheds: the Pine River, Leech Lake River and Crow Wing River. Kettle lakes and lakes greater than 160 acres are common throughout. Elevations generally range between 1,250 and 1,500 feet across the project area. The lowest elevation is 1,232 feet near Pine River, and the highest elevation is 1,565 feet located between the Badoura Substation and TH 371.

3.2 IMPACTS TO HUMAN SETTLEMENT

As stated in Section 1.3 of this document, if the PUC grants a certification to the proposed HVTL project, the Applicants would seek approval for a specific route within the project corridor through the HVTL Routing Permit process (Minnesota Rule Chapter 4400). In any route permit the PUC issues, the PUC will describe a specific route, and in some cases a specific alignment, within the applicant's conceptual HVTL corridor. Through this process specific routes will be identified that avoid, to the extent possible, areas where a HVTL could create significant impacts.

Crow Wing County

The eastern end of the proposed corridor begins near the city of Pequot Lakes (2000 population 947; 479 occupied homes); the city has several technology and manufacturing employers (US Link, Hunt Technology, Pequot Tool), a public school system, and several small businesses including banks, restaurants, retail and grocery stores.

[1] http://www.dnr.state.mn.us/ecs/index.html

According to the 2000 U.S. Census, the county had a total population of 55,099.[2] The 2004 Crow Wing County Comprehensive Plan shows that between 1990 and 2000, the population grew by 25 percent, and is continuing to grow at a similar pace.[3] Within the proposed corridor area, the TH 371 corridor is showing the greatest amount of growth. General demographics for Crow Wing County show a 49.2 percent male and 50.8 percent female distribution of the predominantly (97.6 percent) white population. Approximately 17.1 percent of residents are 65 years old or older. Median household income for the county ($37,589) is approximately 20 percent lower than the statewide average of $47,111. Unemployment in Crow Wing County was 5.5 percent, slightly higher than the statewide average (4.7 percent) for the year 2004.[4] The county's 755 farms (144,743 acres) produced a total market value of agricultural products of more than $13.7 million in the year 2002, including $5 million in crops and $8.7 million in livestock, poultry and related products.[5] The 2004 Comprehensive Plan shows that major employers in the county include retail centers, resorts, medical centers, government services and schools. Construction, real estate, finance, insurance, transportation and public utilities experienced the largest amount of growth from 1990 to 2000.

Cass County

The proposed corridor extends west from Pequot Lakes, intersecting the cities of Pine River (2000 population 928; 438 occupied homes) and Hackensack (2000 population 285; 132 occupied homes), and passing along the eastern edge of Backus (2000 population 311; 123 occupied homes). There are several small businesses (restaurants and retail) in Hackensack. Employers in Pine River include the public schools, the Whispering Pines Good Samaritan Nursing Home, and several smaller businesses, including car dealers, grocery stores and banks. Employers in Backus include the Backus Elementary School, several small manufacturing companies, and smaller businesses, such as grocery stores.

The proposed corridor crosses Cass County in Wilson, Pine River, Powers and Birch Lake townships. According to the 2000 U.S. Census, the county had a total population of 27,150.[6] The 2002 Cass County Comprehensive Plan shows that between 1990 and 2000, the population grew by 25 percent and is continuing to grow at a similar pace.[7] General demographics for Cass County show a 50.5 percent male and 49.5 percent female distribution of the predominantly (86.5 percent) white population. Approximately 18 percent of residents are 65 years old or older. Median household income for the county ($34,332) is approximately 27 percent lower than the statewide average of $47,111. Unemployment in Cass County was 8.2 percent, higher than the statewide average (4.7 percent) for the year 2004.[8]

The county's 646 farms (197,153 acres) produced a total market value of agricultural products of more than $14.3 million in the year 2002, including $3.9 million in crops and $10.4 million in

[2] http://www.lmic.state.mn.us/datanetweb/php/census2000/2000Glance.php
[3] http://www.co.crow-wing.mn.us/Planning/2004_COMPREHENSIVE_PLAN.pdf
[4] http://www.ers.usda.gov/Data/
[5] http://www.nass.usda.gov/Census_of_Agriculture/index.asp
[6] http://www.lmic.state.mn.us/datanetweb/php/census2000/2000Glance.php
[7] http://www.co.cass.mn.us/
[8] http://www.ers.usda.gov/Data/Unemployment/RDList2.asp?ST=MN

livestock, poultry and related products.[9] Major employers in the county include government services, leisure and hospitality services and trade, transportation and public utilities.

Hubbard County

The western terminus of the proposed corridor is approximately two miles east of the city of Park Rapids (2000 population 3,276; 1,476 occupied homes). Employers in Park Rapids include the public schools, health services, county government, frozen food manufacturing, medical equipment manufacturing, and several smaller businesses, including grocery stores, retail stores and banks.

The proposed corridor lies within the southeast corner of Hubbard County. The county had a total population of 18,376 in 2000.[10] The 1990 U.S. Census Data show that between 1990 and 2000, the population grew by 23 percent, and is continuing to grow at a similar pace. General demographics for Hubbard County show a 50.0 percent male and 50.0 percent female distribution of the predominantly (96.3 percent) white population. Approximately 18 percent of residents are 65 years old or older. Median household income for the county ($35,321) is approximately 25 percent lower than the statewide average of $47,111. Unemployment in Hubbard County was 6.0 percent, slightly higher than the statewide average (4.7 percent) for the year 2004.[11]

The county's 535 farms (140,004 acres) produced a total market value of agricultural products of more than $22.9 million in the year 2002, including $17.3 million in crops and $5.6 million in livestock, poultry and related products.[12] Major employers in the county include government services, trade, transportation and public utilities, manufacturing, education and health services and leisure and hospitality services.

3.2.1 SOCIOECONOMIC

The direct socioeconomic impacts of construction will generally coincide with the construction period. These direct impacts include the effects on demographics, employment, income, and community services and facilities.

Impacts to social and economic resources would generally be of a short-term nature. Revenue would likely increase for some local businesses, such as hotels, restaurants, gas stations and grocery stores due to workers associated with construction of the project. Other local businesses, such as ready-mix concrete and gravel suppliers, hardware stores, welding and machine shops, packaging and postal services and heavy equipment repair and maintenance service providers would also likely benefit from the construction phase of the project. Significant impacts to social services would likely be minimal due to the short-term nature of construction activities. Construction crews would be approximately 20-30 personnel who would likely reside temporarily in the nearby towns (Park Rapids, Hackensack and Pine River).

[9] http://www.nass.usda.gov/Census_of_Agriculture/index.asp
[10] http://www.lmic.state.mn.us/datanetweb/php/census2000/2000Glance.php
[11] http://www.ers.usda.gov/
[12] http://www.nass.usda.gov/Census_of_Agriculture/index.asp

There would also be some long-term beneficial impacts from the new transmission lines and substation additions. These benefits include an increase to the counties' tax base resulting from the incremental increase in revenues from utility property taxes based on the value of the project. The availability of reliable power in the area would have a positive effect on local businesses and the quality of service provided to the general public.

3.2.2 DISPLACEMENT

This project will not displace any residential homes or businesses.

There are no direct impacts to human settlement anticipated as a result of this project. The transmission line would be located within or parallel to existing utility right-of-way. Any required expansion of right-of-way would not result in any loss of homes.

3.2.3 NOISE

Transmission conductors and transformers at substations produce noise under certain conditions. The level of noise or its loudness depends on conductor conditions, voltage level, and weather conditions. In foggy, damp, or rainy weather conditions, power lines can create a subtle crackling sound due to the small amount of the electricity ionizing the moist air near the wires. During heavy rain the general background noise level is usually greater than the noise from a transmission line. During light rain, dense fog, snow, and other times when there is moisture in the air, the proposed transmission lines will produce audible noise higher than rural background levels but similar to household background levels. During dry weather, audible noise from transmission lines is a nearly imperceptible, sporadic crackling sound.

The Minnesota Pollution Control Agency noise regulations (Minnesota Rule 7030.0050) list various activity categories by Noise Area Classification.[13] **Table 1** below identifies the established noise standards for daytime and nighttime by NAC. The standards are expressed as a range of dBA (decibel – A weighted) within a one hour period; L_{50} is the dBA that is exceeded 50 percent of the time within an hour, while L_{10} is the dBA that is exceeded ten percent of the time within the hour.

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

Table 1. MPCA Noise Standards (dBA – Decibel, A-weighted)

[13] http://www.pca.state.mn.us/programs/pubs/noise.pdf

The audible noise generated from the transmission line is not expected to exceed the Minnesota noise standards.

Table 2 below shows the noise levels for the various line geometries considered for this project. The table indicates that noise levels will be well below the MPCA's most restrictive standard (L_{10} nighttime in NAC1) at the edge of the right-of-way even during foul weather periods when the conductors are wet and the transmission line noise will be at it highest level. Also, note the data shown is for the more restrictive L5 noise level rather than the L50 or L10 levels; the L5 level is a level that is not exceeded more that 5 percent of the time. During fair weather conditions, the transmission line noise will seldom be noticed even if standing directly under the transmission line.

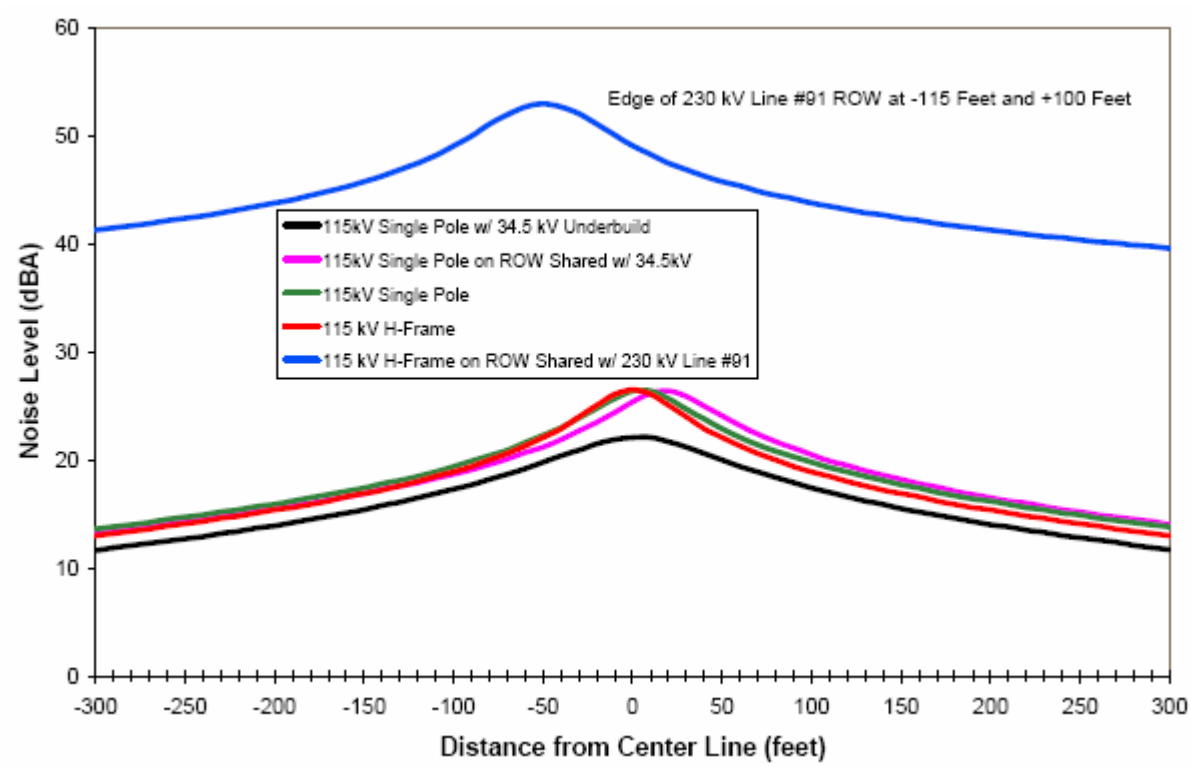

Table 2. Audible Noise – All Structures – L5 Wet Conductor

3.2.4 AESTHETICS

Although the transmission line and structures will be a contrast to surrounding land uses, the proposed corridor utilizes existing corridors and avoids homes to the greatest extent practicable.

The Applicants will work with landowners to identify concerns related to the transmission line and aesthetics to minimize the impacts as much as feasible. The majority of this work will be conducted during the HVTL Routing Permit process.

3.2.5 RADIO & TELEVISION INTERFENCE

"Radio Noise" is a term used to refer to any unwanted interference of an electromagnetic nature with any signal or communication channels throughout the radio frequency band of operation, 3 kilohertz (kHz) to 30,000 kHz. Corona-generated radio noise could cause interference with virtually any type of radio reception. However, in practice it has been found that the bands principally affected are the amplitude-modulated (AM) broadcast band, 535 to 1,605 kHz and in particular those stations broadcasting below approximately 1,000 kHz. Frequency-modulated (FM) stations are seldom impacted by electric transmission facilities. Cellular phones are unlikely to be affected due to the high frequencies used; in fact, utility personnel often use cellular phones within substations and transmission line rights-of-way.

The radio noise generated from transmission lines is a function of conductor size and geometry, conductor height above ground, phase spacing, and ground resistance. Because radio noise is due to corona discharges, it also depends on the line's operating voltage and weather conditions.

The Federal Communications Commission (FCC) considers transmission lines inadvertent emitters and therefore they are not covered directly by FCC regulations. However, in the past, the FCC and the State of Minnesota have suggested that transmission line radio noise should not result in interference within a licensed broadcast station's primary coverage area for non-mobile receivers outside the line's right of way. Based on the Applicants experience with operating other 115 kV transmission lines, the proposed HVTL is not expected to impact reception of commercial AM radio stations with non-mobile receivers within a station's primary coverage area.

Corona generated noise could cause interference with TV picture reception similarly as in the case with AM radio interference since the picture is broadcast as an AM signal. The level of interference depends on the TV signal strength for a particular channel. TV audio is an FM signal that it is typically not affected by transmission line radio frequency noise.

Due to the higher frequencies of the TV broadcast signal (54 megahertz and above), 115 kV transmission lines seldom result in reception problems within a station's primary coverage area. In the rare situation that the proposed transmission line would cause TV interference, MP and GRE would work with the affected party to correct the problem.

Usually any reception problem can be corrected with the addition of an outside antenna. TV picture reception interference can also be the result of a transmission structure blocking the signal to homes in close proximity to a structure. Because the structures proposed for this Project would be wood, this is unlikely to occur. However, measurements can be made to verify whether a structure is the cause of reception problems. Reception problems can usually be corrected with the addition of an outside antenna, an amplifier or both.

3.2.6 HUMAN HEALTH & SAFETY

The proposed HVTL will be designed in compliance with local, state, National Electric Safety Code (NESC), and Minnesota Power/Great River Energy standards regarding clearance to ground, clearance to crossing utilities, clearance to buildings, strength of materials, and right-of-way (ROW) widths. The Applicants and their construction crews and/or contract crews will comply with local, state, NESC, and MP/GRE standards regarding installation of facilities and standard construction practices. Established MP/GRE and industry safety procedures will be followed during and after installation of the transmission line. This will include clear signage during all construction activities.

The proposed transmission line will be equipped with protective devices to safeguard the public from the transmission line if an accident occurs, such as a structure or conductor falling to the ground. The protective devices are breakers and relays located where the line connects to the substation. The protective equipment will de-energize the line should an accident occur. In addition, the substation facility will be fenced and access limited to authorized personnel. Proper signage will be posted warning the public of the risk of coming into contact with the energized equipment.

ELECTRIC/MAGNETIC FIELDS

Electric and magnetic fields (EMF) arise from the flow of electricity and the voltage of a line. The intensity of the electric field is related to the voltage of the line and the intensity of the magnetic field is related to the current flow through the conductors.

Many years of research on the biological effects of electromagnetic fields have been conducted on animals and humans, and no association has been found between exposure to EMF and human disease. While the consensus is that EMF poses no risk to humans, the question of whether exposure to EMF can cause biological responses or even health effects continues to be the subject of medical research and public debate.

In 2002, Minnesota formed an Interagency Working Group to evaluate the body of research and develop policy recommendations to protect the public health from any potential problems resulting from HVTL EMF effects. The Working Group consisted of staff from the Department of Health, the Department of Commerce, the Public Utilities Commission, the Pollution Control Agency, and the Environmental Quality Board. The Department of Health coordinated the activities of the Working Group.

In September 2002, the Working Group published its findings in a White Paper on Electric and Magnetic Field (EMF) Policy and Mitigation Options (hereinafter "White Paper"). The Minnesota Department of Health made the following statement in the "White Paper:"

> "The Minnesota Department of Health 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 a health risk from EMF cannot be completely dismissed. The uncertainty surrounding EMF health effects presents a difficult context in which to make regulatory decisions. This approach suggests that one should avoid any activity or exposure about which there are questions of safety or health, at least to the extent that an activity can be avoided easily or cheaply."

Additional discussion of EMF can be found in the White Paper[14] and in other environmental reviews prepared by the Environmental Quality Board on proposed transmission lines. See for example, EQB Dockets 03-64-TR-Xcel (161 kV line in Jackson and Martin Counties), 03-73-TR-Xcel (345 kV line in southwest Minnesota) and 04-81-TR-Air Lake (a 115 kV line in Dakota County). These documents are all available on the PUC Energy Facilities website.

Minnesota does not have a standard for magnetic fields. The EQB has recognized in other transmission line proceedings that other states have established standards for magnetic fields, e.g., Florida (150 milligauss limit) and New York (200 milligauss limit).

The anticipated magnetic field was calculated for the structures being considered for the Badoura project by Minnesota Power. The data is presented in Appendix B of the Biennial Transmission Projects Report. The calculations were done at two different assumed current carrying capacities: (1) the flow at the conductors' thermal limit and (2) at the expected steady state system intact peak load current flow as determined from load flow modeling using the 2009 Peak Load model. In each case the more restrictive limit of 150 milligauss remained well within the expected ROW boundaries.

STRAY VOLTAGE

The electric field from a transmission line can induce an electric charge on other conducting objects in the vicinity of the line, such as vehicles and fences. If these objects are insulated or semi-insulated from the ground, and a person touched them, a small current would pass through the person's body to the ground. This might be accompanied by a spark discharge and mild shock, similar to what can occur when a person walks across a carpet and touches a grounded object or another person. Due to the relatively low operating voltage of the proposed line (115 kV), these discharges are unlikely to reach an annoyance level. To insure that any discharge does not reach unsafe levels, the NESC requires that any discharge be less than 5 milliamperes (ma).

The proposed HVTL will be designed such that the discharge from any large object such as a bus or truck parked under or adjacent to the line would be significantly less than 5 ma. The Applicants will assure that any fence or other large permanent conductive object in close proximity or parallel to the line would be grounded so that excessive discharges would not occur.

High intensity electric fields can have adverse impacts on the operation of pacemakers and implantable cardioverter/defibrillators (ICD). Interference to implanted cardiac devices can

[14] http://www.health.state.mn.us/divs/eh/radiation/emf/links.html

occur if the electric field intensity is high enough to induce sufficient body currents to cause interaction. Modern bipolar devices are much less susceptible to interactions with electric fields. Medtronic and Guidant, manufacturers of pacemakers and ICDs, have indicated that electric fields below 6 kV/meter are unlikely to cause interactions affecting operation of most of their devices.

Older unipolar designs are more susceptible to interference from electric fields. Research has indicated that the earliest evidence of interference was in electric fields ranging from 1.2 to 1.7 kV/meter.

Table 3 below shows that the e-field for all structure alternatives are well below levels at which modern bipolar devices are susceptible to interactions with electric fields. For older style unipolar designs, the electric field within the right-of-way from the "115 kV H-Frame on a shared right-of-way with the existing 230 kV line" does exceed levels which have been indicated may produce interference. However, recent research concludes that the risk of interference inhibition of unipolar cardiac pacemakers from high voltage power lines in everyday life is small.

In the unlikely event a pacemaker is impacted, the effect is typically a temporary asynchronous pacing (commonly referred to as reversion mode or fixed rate pacing). The pacemaker would return to its normal operation when the person moves away from the source of the interference.

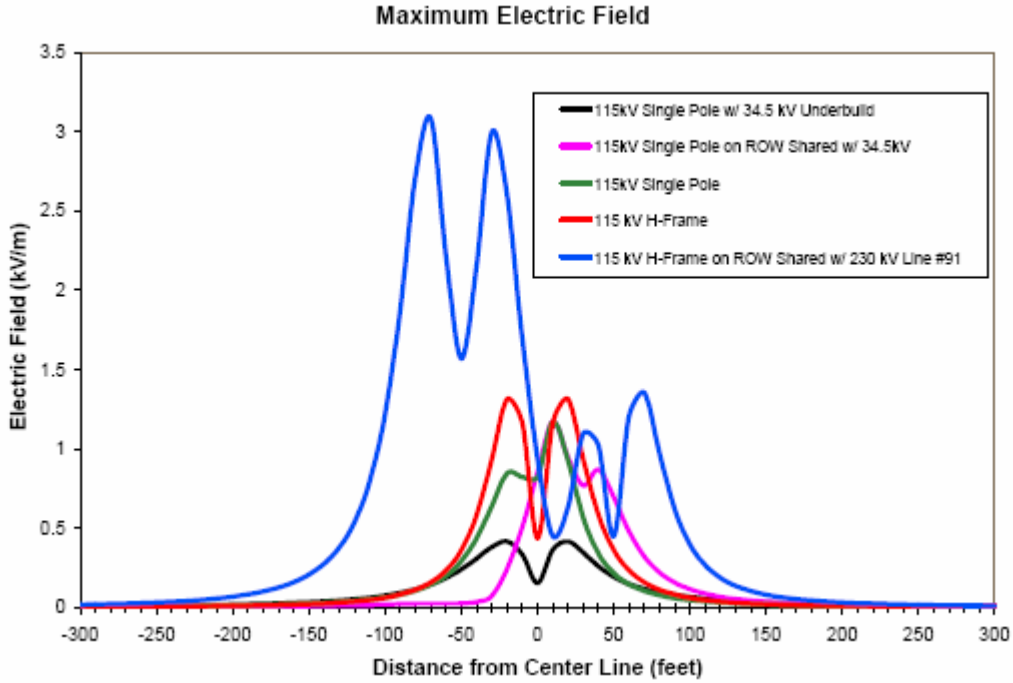

Table 3 Maximum Electric Fields for the Proposed Project

There is no state or federal standard for transmission line electric fields. However, in previous transmission line permits, the EQB has imposed a maximum electric field limit of eight kV/meter measured one meter above the ground. The restriction was designed to prevent serious

hazard from shocks when touching large objects like a bus or combine parked under high voltage transmission lines.

3.3 IMPACTS ON LAND-BASED ECONOMICS

The proposed corridor covers a variety of land use patterns in a general rural environment.

Segments A and C (**Figure 3**) consist of northern forest state lands, cottages and residential properties. Segments F, H, and K consist of a mix of woodlots, commercial, residential and agricultural property along TH 371. Mn/DOT is presently expanding the section of TH 371 within the proposed corridor from two to four lanes. In addition, the Paul Bunyan Trail parallels TH 371 on the west side from Pequot Lakes to the Pine River. Segment L consists of northern forest state lands for the eastern half and a mix of residential, woodlots and irrigated agriculture in the western half. Segment M consists predominantly of irrigated agriculture with a mix of residential properties, cottages and woodlots.

3.3.1 RECREATION

Recreational opportunities in the general area of the proposed corridor include hiking, horse-back riding, mountain biking, boating, fishing, snowmobiling and cross-country skiing. There are numerous recreational sites located in this area and they include the Paul Bunyan State Trail, the Heartland State Trail, Itasca State Park, the Mississippi River Canoe & Boating Route, the Crow Wing River Canoe & Boating Route, Smokey Hills State Forest, Two Inlets State Forest, Foot Hills State Forest, Hunterville State Forest, Paul Bunyan State Forest, Welsh Lake State Forest., Lake Bemidji State Park, Crow Wing State Park, Mississippi Headwaters State Forest, Pillsbury State Forest, and the Pine River Canoe & Boating Route.[15]

The portion of the Paul Bunyan Trail which parallels TH 371 along its west side, from Pequot Lakes to the Pine River, lies closest to the proposed HVTL corridor. When completed, the Paul Bunyan State Trail will be a 110 mile long multiple use trail between Brainerd/Baxter and Bemidji. Primarily located on a former Burlington Northern Railroad grade, the trail is generally level and is wheelchair accessible. Currently, 74.5 miles of the trail is paved: 69.5 miles from Baxter to Walker, and 5 miles from Lake Bemidji State Park to Co. Rd. 20 across the Mississippi River trestle to 5th and Gould. The remaining 35.5 mile section is undeveloped with variable surface material ranging from the original railroad ballast to sand. When completed, the Paul Bunyan State Trail will also connect with the Blue Ox Trail forming one of the longest rails to trail conversions in North America - 210 miles.[16]

The Heartland State Trail was one of the first rail-to-trail projects in the country. It is a 49 mile multiple use trail between Park Rapids and Cass Lake. The trail is located entirely on a level abandoned railroad grade except for a four mile segment north of Walker, on sharply rolling terrain. The 27 mile segment between Park Rapids and Walker has a paved surface. This segment also has a second grassy treadway for horseback riding and mountain biking. The 22

[15] http://www.dnr.state.mn.us/state_trails/list.html
[16] http://www.dnr.state.mn.us/state_trails/paul_bunyan/index.html

mile segment from Walker to Cass Lake is primarily compacted gravel and railroad ballast with occasional sandy areas.[17]

Views of lakes, rivers and streams from the various roadways and trails of this area are numerous, and many are accessible to the general public. The construction and operation of the proposed HVTL will not directly impact these resources. In some places the new transmission line structures will contrast with the surrounding landscape, however, there will be no direct impacts to the recreational uses in the area. To the extent practicable, the Applicants will select specific routes and alignments that are located near existing transmission line corridors and/or other corridors such as county and township road and railroad ROWs. This will minimize the visual impact to the surrounding areas.

3.3.2 PRIME FARMLAND

Preliminary information indicates that the proposed HVTL may encounter agricultural lands in the Hubbard County portion of the proposed corridor. In those areas where there is potential to cross agricultural lands, transmission line structures will be placed on section lines and field breaks where possible, to minimize interference with agricultural operations.

3.3.3 TRANSPORTATION

The proposed HVTL will parallel existing road ROWs for the majority of the lines distance. However, the transmission line will not affect transportation systems except for minor impacts during the construction period.

The Pine River Municipal Airport is within half a mile of the proposed HVTL corridor in Section 36 of Pine River Township, passing through areas within Airspace Obstruction Zoning and Land Use Safety Zoning. The Backus Municipal Airport is also within the proposed HVTL corridor in Section 29 of Powers Township; the corridor is within the Safety Zones of the airport.

The Applicants may need to secure a flight hazard determination from the Federal Aviation Administration (FAA). This process involves providing the FAA with the general configuration of the structures along with elevations and height.[18]

3.3.4 MINING & FORESTRY

The project will not impact any active mining or forestry operations

3.3.5 ECONOMIC DEVELOPMENT

Continuing economic growth in the Park Rapids area has caused a considerable increase in electrical use in the region. The addition of new electrical services and the increase in demand from existing services are creating electricity delivery concerns in this area. The existing

[17] http://www.dnr.state.mn.us/state_trails/heartland/index.html
[18] Title 14 of the Code of Federal Regulations CFR Part 77 (http://www1.faa.gov/ats/ata/ata400/oeaaa.html)

electrical system, consisting of transmission lines and substations, is approaching its physical limit.

Loss of a HVTL facility may result in potential long-term outages, and with the anticipated continued growth in this area, the number of critical hours during the year will increase.

The proposed HVTL project will encourage economic development along the corridor, enhance overall power system reliability and provide greater flexibility in terms of power availability.

3.3.6 ARCHEOLOGICAL, CULTURAL & HISTORIC RESOURCES

Within the one-mile study area of the proposed corridors, 40 archaeological sites and 88 historic architectural structures were identified (**Appendix B**). Of these known resources, three archaeological sites are listed on the National Register of Historic Places (NRHP) and four archaeological sites are considered eligible for listing in the NRHP. There are also two architectural structures listed on the NRHP and five that the Minnesota State Historical Preservation Office (SHPO) has determined eligible. Most of the historic structures are within the corporate limits of the towns in the area, most notably, Pine River and Park Rapids.

Historic structures must be at least 50 years old to be significant. The sites listed here demonstrate the variety of uses the land has seen over time. The archaeological sites listed range from the Archaic Period (6,000 - 800 years B.C.) to the Historic Period, with most falling within the Woodland Period (1000 B.C – 1700 A.D).

Most of the listed sites have not been evaluated as to their historical significance and there may be other resources within the alternative corridors that have not yet been identified.

Sites were included if they occurred in the same section as the proposed corridor.

Cass County

- six recorded archaeological sites (artifact scatters, cemeteries, earthworks)
- One unconfirmed cemetery
- two unconfirmed artifact scatters
- 16 architectural structures (one considered eligible for NRHP in Pine River)

Crow Wing County

There are no recorded sites or historic architectural structures within the Project sections.

Hubbard County

- three recorded sites (lithic scatters/artifact scatters, earthworks/cemeteries, structural ruins)
- seven architectural structures

According to the SHPO database, township sections crossed in whole or partly by Segments A, C, F, H, K, L, and M contain recorded historic structures and/or archaeological sites (**Table 4**).

Construction of new HVTL structures in the proposed corridors could impact previously identified and currently unknown cultural resources.

Archaeological sites may be disturbed during construction of transmission structures, maintenance structures, staging areas or access roads. Historic buildings or other sites may be impacted as construction of modern transmission structures may compromise the integrity of a historic viewshed from or to above ground cultural resources. The realized potential impacts would be determined once routes are selected within these proposed corridors.

Prior to submittal of a HVTL Route Permit application, areas that are deemed to have a high potential for cultural resources and that lie within the proposed HVTL route will be surveyed. The surveys would be coordinated with the appropriate landowners or land management agency. A product of the survey would be a cultural resources report recording findings and suggesting mitigation measures. The findings would be reviewed with the SHPO and specific mitigation measures necessary for each site or resource would be determined.

Mitigation may include relocation of access routes, structure sites and other disturbed areas to avoid cultural sites.

3.4 IMPACTS ON THE NATURAL ENVIRONMENT

3.4.1 AIR QUALITY

During project construction, there will be emissions from vehicles and construction equipment and fugitive dust from right-of-way clearing. Temporary air quality impacts caused by the proposed construction-related emissions are expected to occur. Fugitive dust may result from any ROW clearing required. The magnitude of these emissions is influenced heavily by weather conditions and the specific construction activity taking place. Exhaust emissions from diesel equipment will vary during construction, but will be minimal and temporary.

The only potential air emissions from a 115 kV transmission line result from corona and are limited. Corona can produce ozone and oxides of nitrogen in the air surrounding the conductor, especially in humid conditions. Corona consists of the ionization of air within a few centimeters immediately surrounding conductors. Ozone is a very reactive form of oxygen and combines readily with other elements and compounds in the atmosphere. Because of its reactivity, it is relatively short-lived.

Segment	Historic/Architecture	Archaeology
A	1 property CA-WLS-001	1 site 21CA067
C	4 properties (CA-PRC-001, CA-PRC-006, CA-PRC-052, CA-WLS-001)	1 site (21CA214)
F	11 properties (CA-PRC-001, CA-PRC-003, CA-PRC-004, CA-PRC-005, CA-PRC-006, CA-PRC-007, CA-PRC-008, CA-PRC-009, CA-PRC044, CA-PRC-052, CA-PRT-001)	3 sites (21CA214, 21CAbv, 21CAbx)
H	0 properties	2 sites (21CA170, 21CA178)
K	3 properties (CA-HSC-001, CA-HSC-002, CA-HSC-003)	0 sites
L	0 properties	3 sites (21CAbb, 21HB0002, 21HB0058)
M	7 properties (HB-WOT-001, HB-WOT-002, HB-WOT-003, HB-NVT-001, HB-HEN-005, HB-HEN-006, HB-HEN-007)	3 sites (21HB002, 21HB0020, 21HB0058)

Table 4. Recorded Structures &/or Archaeological Site

3.4.2 WATER QUALITY

The corridor lies within the Pine River and Crow Wing River watersheds of the Upper Mississippi River Basin. Within the portion of the corridor in Hubbard County, surface water flows generally toward the Crow Wing River; within Cass and Crow Wing counties the water generally flows toward the Pine River.

Hydrologic features, such as wetlands, lakes, rivers and floodplains perform several important functions within a landscape, including flood attenuation, ground water recharge, water quality protection and wildlife habitat production. Hydrologic resources are regulated by several different agencies in Minnesota, including the USACE, the Minnesota Board of Water and Soil Resources (BWSR), the DNR and the MPCA.

Wetlands are defined by the USACE as "Waters of the United States" and are subject to jurisdiction under Section 404 of the Clean Water Act (1972). Waters of the United States include both wetlands and non-wetlands that meet USACE criteria. In Minnesota, all wetlands are regulated under the Wetland Conservation Act of 1991 (Minnesota Statute 103G.222-.2373 requiring coordination with BWSR) and Section 404 of the Clean Water Act by the USACE.

Public Waters are water basins and watercourses of significant recreational or natural resource value in Minnesota as defined in Minnesota Statute 103G.005. The DNR has regulatory jurisdiction over these waters.

The Clean Water Act requires states to publish, every two years, a list of streams and lakes that are not meeting their designated uses because of excess pollutants (impaired waters). The list, known as the 303(d) list, is based on violations of water quality standards. In Minnesota, the MPCA determines which water bodies are considered impaired.

SURFACE and GROUNDWATER

The proposed corridor crosses 14 DNR Public Waters Inventory (PWI) lakes (11 in Cass County and three in Hubbard County), four PWI wetlands (one in Cass County and three in Hubbard County) and six PWI creeks and rivers (four in Cass County and two in Hubbard County). **Table 5** shows the PWI resources within the corridor.

The general DNR public waters located in the area of the proposed corridor are illustrated on **Figure 5**.

The MPCA lists four impaired waters within the proposed corridor on its 2004 Impaired Waters List: Boot Lake in Cass County and Long Lake, Tamarack Lake and the Crow Wing River in Hubbard County. All of these water bodies are impaired for mercury and fecal coliform.

The portions of Hubbard, Cass and Crow Wing counties within the proposed corridor have not been mapped by the Federal Emergency Management Agency (FEMA) for floodplains. It is possible that the corridor crosses the 100-year floodplains associated with the Crow Wing River, Pine River, and/or Hay Creek, as well as any floodplains associated with the lakes in the vicinity.

During construction there is the possibility of sediment reaching surface waters as the ground is disturbed by excavation, grading, and construction traffic. The surface water resources that could be affected by the construction of the transmission line are Hodapp Marsh (76W) and Eagle Lake (60P), which are DNR Public Waters and Public Water Wetlands.

Minnesota Power will follow standard erosion control measures identified in the Minnesota Pollution Control Agency's Stormwater Best Management Practices Manual, such as using silt fencing to prevent impacts to adjacent water resources. Once the project is complete it will have no impact on surface water quality.

County	Name	Type	Location
CASS	Boot (343 P)	Lake	T138N, R30W, Sections 16, 21 and 22
	Paquet (381 P)	Lake	T140N, R30W, Sections 20 and 29
	North Haynes (449 P)	Lake	T139N, R31W, Sections 5 and 6
	Unnamed (448 P)	Lake	T139N, R31W, Sections 3 and 10
	South Haynes (450 P)	Lake	T139N, R31W, Sections 7 and 8
	Unnamed (833 P)	Lake	T139N, R31W, Section 7
	Unnamed (834 P)	Lake	T139N, R31W, Section 8
	First Trestle (837 P)	Lake	T139N, R31W, Section 2
	Unnamed (838 P)	Lake	T139N, R31W, Sections 2 and 11
	Unnamed (839 P)	Lake	T139N, R31W, Sections 2 and 3
	Pine River (3 crossings)	River/stream	Between Beuber and Island lakes
			Between Pine Mountain and Bowen lakes
			South of the City of Pine River
	Unnamed Tributary to Island Lake	River/stream	North of Island Lake
HUBBARD	Fifth Crow Wing (92 P)	Lake	T140N, R33W, Sections 29 and 30
	Long (161 P)	Lake	T140N, R34W; Section 20
	Peysenske (169 P)	Lake	T140N, R34W; Sections 21, 22, 27 and 28
	Kettle (1 W)	Wetland	T139N, R32W, Section 4
	Tamarack (94 W)	Wetland	T140 N, R33W; Section 25
	Mud (168 W)	Wetland	T140N, R34W; Sections 20 and 21
	Crow Wing River	River/stream	South of Fifth Crow Wing Lake
	Wallingford Creek	River/stream	South of Tamarack Lake

Table 5. DNR Public Water Inventory

Wetlands

There are 499 National Wetland Inventory (NWI) wetlands totaling 1,862 acres within the proposed corridor. Palustrine scrub/shrub and palustrine emergent make up the majority of the area. **Table 6** shows the wetland resources for each segment in the corridor.

The general NWI wetlands located in the area of the proposed corridor are illustrated on **Figure 6**.

It is anticipated that the proposed HVTL project will be able to avoid most wetland areas and surface water features, such as rivers and streams, by spanning the transmission line over the water bodies. There are several PWI and NWI basins that are wider than 1,000 feet within the corridor and may not be able to be spanned completely. However, rebuilding in-place or paralleling the 34.5 kV transmission lines that currently skirt the majority of the hydrologic features would minimize any new impacts to wetlands and water bodies.

In practice, utility companies attempt to avoid placing poles in wetlands. If placement of poles in wetlands is necessary, the Applicants will minimize impacts by using special construction mats to limit disturbance and compaction. If areas of the wetland are disturbed, the Applicants will restore the area to preconstruction contours and will allow the existing seed bank to re-vegetate the area. Any soil removed from the wetlands will not be placed back into the wetland.

Segment	Wetland Type	No. of Basins	Area (Acres)	% of Wetlands in Segment
A	Lacustrine	0	0	0
	Palustrine	-	-	-
	Emergent	46	114	46.7
	Forested	2	2	0.7
	Scrub/shrub	17	117	47.8
	Unconsolidated bottom	6	12	4.8
	Riverine	0	0	0
	Total	**71**	**245**	
Segment	Wetland Type	No. of Basins	Area (Acres)	% of Wetlands in Segment
C	Lacustrine	0	0	0
	Palustrine	-	-	-
	Emergent	8	128	54
	Forested	1	1	.4
	Scrub/shrub	22	101	42.7
	Unconsolidated bottom	3	2	0.7
	Riverine	1	5	2.3
	Total	**35**	**237**	
Segment	Wetland Type	No. of Basins	Area (Acres)	% of Wetlands in Segment
F	Lacustrine	1	24	33.4
	Palustrine	-	-	-
	Emergent	19	18	25.6
	Forested	0	0	0
	Scrub/shrub	6	26	37
	Unconsolidated bottom	1	0.2	0.2
	Riverine	1	3	4.1
	Total	28	71	
Segment	Wetland Type	No. of Basins	Area (Acres)	% of Wetlands in Segment
H	Lacustrine	0	0	0
	Palustrine	-	-	-
	Emergent	39	113	16.7
	Forested	15	127	18.7
	Scrub/shrub	57	419	61.7
	Unconsolidated bottom	19	20	2.9
	Riverine	0	0	0
	Total	**467**	**1,458**	

Table 6. NWI Wetlands by Corridor Segment

Segment	Wetland Type	No. of Basins	Area (Acres)	% of Wetlands in Segment
K	Lacustrine	1	3	1.7
	Palustrine	-	-	-
	Emergent	8	38	22.9
	Forested	2	31	18.4
	Scrub/shrub	21	95	56.7
	Unconsolidated bottom	0	0	0
	Riverine	1	0.6	0.4
	Total	**33**	**167**	
Segment	**Wetland Type**	**No. of Basins**	**Area (Acres)**	**% of Wetlands in Segment**
L	Lacustrine	7	82	17.8
	Palustrine	-	-	-
	Emergent	61	80	17.4
	Forested	10	174	38.0
	Scrub/shrub	59	78	17.1
	Unconsolidated bottom	37	45	9.7
	Riverine	0	0	0
	Total	**174**	**459**	
Segment	**Wetland Type**	**No. of Basins**	**Area (Acres)**	**% of Wetlands in Segment**
M	Lacustrine	7	15	2.7
	Palustrine	-	-	-
	Emergent	32	238	43.6
	Forested	9	51	9.4
	Scrub/shrub	23	38	7.0
	Unconsolidated bottom	10	203	37.3
	Riverine	0	0	0
	Total	**81**	**545**	

Table 6. NWI Wetlands by Corridor Segment (Continued)

3.4.3 SOILS & GEOLOGY

Minimal surficial disturbances, outside of the direct impact of the HVTL structures, are anticipated. Soil erosion control measures will be followed to minimize loss of top soil; areas disturbed will be return to their pre-construction condition.

No permanent impacts to the subsoil or geology along the proposed corridor are anticipated.

3.4.4 FLORA & FAUNA

The proposed corridor is dominated by mature conifer and northern hardwood forests and interspersed with lake and wetland plant communities. Minnesota Landsat[19] land cover data shows that approximately 44 percent of the corridor is woodland (including mature coniferous

[19] http://www.lmic.state.mn.us/chouse/land_use_recent.html

and deciduous forests), and 21 percent of the corridor is grassland. A summary of the land cover types within the corridor is shown in **Table 7**.

Impacts to vegetation may occur due to the placement of structures. The area around the structure may also be temporarily disturbed due to construction activities. Because much of the corridor follows an existing 34.5 kV line, construction in previously undisturbed communities will be minimized. Some vegetation clearing would be necessary due to expanded right-of-way needs associated with the upgraded facility.

LAND COVER TYPE	AREA (ACRES)	PERCENT OF CORRIDOR
Coniferous Forest	2,410	18.1%
Deciduous Forest	3,490	26.2%
Grassland/Shrubby Grassland	2,755	20.7%
Wetlands	700	5.3%
Open Water	225	1.7%
Cultivated Land/Rural Farmstead	3,474	26.1%
Urban/Industrial (cities & towns)	255	1.9%

Table 7. Minnesota LandSat Data

Wildlife in the vicinity of the proposed corridor consists of birds, mammals, fish, reptiles, amphibians and insects, both resident and migratory, which use the area habitat for forage, shelter, breeding habitat and/or stopover during migration. Species likely to be found are those associated with forested and/or grassland habitats, including small mammals, such as voles, shrews, mice and rabbits, larger mammals, such as beaver, bobcat, coyote, gray wolf, river otter, fox, white tailed deer, black bear, waterfowl and songbirds (both forest and grassland species). Fish, reptiles and amphibians, such as snakes, turtles, toads and frogs would likely be found near the wetlands and open water within the corridor.

The potential for the permanent displacement of wildlife and loss of habitat from construction of the proposed project is minimal. Wildlife that inhabits natural areas, such as those near water bodies and state forests, could be impacted in the short-term within the immediate area of construction. The distance that animals will be displaced will depend on the species. Impacts to wildlife are anticipated to be short-term because the route primarily will be constructed along an existing transmission right-of-way.

Raptors, waterfowl and other bird species may also be affected by the construction and placement of the transmission lines. Avian collisions are a possibility after the completion of the transmission line. Waterfowl are typically more susceptible to transmission line collision, especially if the line is placed between agricultural fields that serve as feeding areas or between wetlands and open water, which serve as resting areas.

Additionally, electrocution of large birds, such as raptors, is a concern related to distribution lines. Electrocution occurs when birds with large wingspans come in contact with either two conductors or a conductor and a grounding device. Minnesota Power will use design standards that provide adequate spacing to eliminate the risk of raptor electrocution.

4.0 Acronyms, Abbreviations and Definitions

AC	Alternating current
ACEEE	American Council for an Energy Efficient Economy
ACSR	Aluminum conductor steel reinforced
AM	Amplitude-modulated
ATC	Available transmission capacity
BMPs	Best Management Practices
BWSR	Minnesota Board of Water and Soil Resources
CAP	Community Action Program
CFL	Compact fluorescent lights
C/I-A	Commercial/Industrial-Agriculture
Commission	Minnesota Public Utilities Commission
CIP	Conservation Improvement Program
CH	County Highway
dBA	Decibel (A weighted)
DC	Direct current
DNR	Minnesota Department of Natural Resources
DOC	Minnesota Department of Commerce
DSM	Demand Side Management
EMF	Electromagnetic fields
EMS	Energy Management System
ETS	Electric thermal storage
EQB	Minnesota Environmental Quality Board
ERO	Electric Reliability Organization
FAA	Federal Aviation Administration
FCC	Federal Communications Commission
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
FM	Frequency-modulated
GRE	Great River Energy
GSHP	Ground source heat pump
HVAC	Heating, ventilation and air conditioning
HVTL	High voltage transmission line
Hz	Hertz
ICD	Implantable cardioverter/defibrillator
IEE&C	Integrated Energy Education and Communications
IOUs	Investor-Owned Utilities
IRP	Integrated Resource Plan
kHz	kilohertz
kV	Kilovolt
kVA	Kilovolt-ampere
kV/m	Kilovolts per meter
kW	Kilowatt
kWh	Kilowatt hour

LCP	Lake Country Power
LGU	Local governmental unit
LRLF	Long-Range Load Forecast
ma	milliamperes
MAPP	Mid-Continent Area Power Pool
MBS	Modeling Building Subcommittee
mG	milliGauss
MHz	Megahertz
MISO	Midwest Independent Transmission System Operator
Mn/DOT	Minnesota Department of Transportation
MPCA	Minnesota Pollution Control Agency
MP	Minnesota Power
MRO	Midwest Reliability Organization
MVA	Megavolt ampere
MW	Megawatt
MWh	Megawatt hour
NAC	Noise area classifications
NERC	North American Electric Reliability Council
NESC	National Electric Safety Code
NIEHS	National Institute of Environmental Health Sciences
NPDES	National Pollutant Discharge Elimination System
NRHP	National Register of Historic Places
NWI	National Wetland Inventory
PWI	Public Waters Inventory
R & D	Research and Development
ROW	Right-of-way
RUS	Rural Utilities Service
SHPO	State Historic Preservation Office
TH	Trunk Highway
UPA	United Power Association
USACE	United States Army Corps of Engineers
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service

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FIGURES

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APPENDICES A

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APPENDICES B

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VOLUME 2

TOWER PROJECT

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VOLUME 2 - TOWER

1.0 INTRODUCTION

On November 11, 2005, Minnesota Power (MP) and Great River Energy (GRE) made a joint application to the Minnesota Public Utilities Commission (PUC) for Certification of two High-Voltage Transmission Line (HVTL) projects pursuant to the provisions of Minnesota Statutes 216B.2425 and Minnesota Rules, Chapter 7848 through the Biennial Transmission Projects Report proceeding. The two projects are referred to as "Tower" and "Badoura."

1.1 PROJECT DESCRIPTION

The Tower project consists of a 115 kilovolt (kV) electric transmission line, approximately 15 miles in length, between a new Tower Substation and a new Embarrass Switching Station in St. Louis County, Minnesota (**Figure 1**). The MP and GRE additions to the power delivery system would allow both utilities to maintain the necessary voltage and reliability requirements in the area. The transmission line and substation improvements are necessary to allow MP and GRE to continue serving their present and future electric customers and their growing electric energy requirements.

1.2 PROJECT DESIGN

The proposed endpoints of the transmission project would be a new substation near the City of Tower and a new 115 kV switching station at the junction of MP's existing (115 kV) 34 Line and 34 Line Tap (located in White Township, Section 7, Township 59N, Range 15W). A 115 kV transmission line between the two endpoints would be located within a north-south, 6000-foot wide corridor. The transmission alignment would be determined during the route permitting process and would consider existing corridors, public input, and environmental impacts.

Line Length

A 115 kV transmission line constructed within the proposed corridor would be approximately 15 miles in length. There are no existing transmission lines in the project corridor. The entire project would be located in St. Louis County, Minnesota.

Conductors

The proposed 115 kV transmission line would use 636 aluminum conductor-steel reinforced (ACSR) conductors. There would be three single conductors for the 115 Kv circuit. Depending on structure type, there would also be one or two shield wires (3/8" high strength 7-strand steel) to protect the conductors from lightning. It is likely that this shield wire would consist of an optical shield wire (64mm2/258 OPGW 24 fiber) so it could be used for communications.

Two structure types are being considered for the Project: wood H-frame and wood single pole. Dependent upon land use type, topography, right-of-way constraints and other design-dependent features, each of these transmission line structure designs would be appropriate in certain areas within the proposed corridor. **Figure 2** shows cross section views of typical 115 kV transmission line structures being considered for this project.

Wood H-frame

The two pole structure design is suited for areas with rugged topography and for areas requiring longer spans to avoid or minimize placement of structures in wetlands or waterways. The average span would be 600–900 feet, with 1,000-foot spans achievable with certain topography. The structure height would average 60–80 feet with taller structures required for the exceptionally long spans and in circumstances requiring additional vertical clearance (i.e., railroad tracks) exceeding the National Electric Safety Code (NESC) requirements.

Single Pole (no under build)

The single pole design is suited for areas where available ROW is limited, such as where corridors are shared along roads in developed areas. Average structure height would be 65–90 feet to achieve average span lengths of 400–600 feet. Specific structure heights and span lengths may exceed the average due to land use requirements and topography.

In addition to the two main structures under consideration for the Project, there may be limited use of a single pole structure with low voltage single phase or three phase distribution under build that directly supplies area electric customers. This single pole design is used in areas where existing land use development restricts the placement of two separate power line circuits, a high voltage circuit and a lower voltage (distribution line) circuit. The advantage of this design is less ROW requirement; however, there are significant operating, maintenance, and cost factors to consider. The higher voltage circuit is “stacked” on top of the lower voltage distribution circuit, resulting in a taller pole (averaging 75-90 feet in height) and shorter spans (250 - 350 feet). Another alternative would be to underground the distribution in specific areas.

The 115 kV transmission line would use 636 ACSR Rook conductors, which have an amp-capacity of 914 amps at 100 degrees C. This will limit maximum continuous electric power capacity of the line to 182 megavolt amperes (MVA), provided there is not a more restrictive limit associated with the substation terminal equipment or transformation capacity.

The line would be designed to operate at a nominal voltage of 115,000 volts. During normal operations, voltage would deviate somewhat from nominal levels. Typical system intact voltage would be in the range of 95% to 105% of nominal and post contingency voltage would range between 90% and 105% of nominal. The line would be a 3-phase, 60 hertz (Hz) alternating current (AC) transmission line insulated to operate at a nominal voltage of 115,000 volts. The line would use 636 ACSR Rook conductors that have typical 60 Hz impedance of approximately 0.149 +J0.732 ohms per mile (the reactive component will vary slightly with structure and

conductor configuration). The thermal limit of conductors would be 182 MVA at 100 degrees Centigrade.

1.3 RIGHT-OF-WAY REQUIREMENTS & ACQUISITION

The right-of-way width requirement for a 115 kV transmission project would be 100 feet for the two structure design types, understanding that the right-of-way width for the single pole designs could be reduced in certain higher density, developed areas. The required right-of-way width may also be less in areas where the new transmission line follows an existing linear corridor such as a road or trail. The Applicants would seek a permanent easement (i.e., land rights), providing the right to construct, operate and maintain the transmission line, for the full width and length of the right-of-way.

The Applicants selected preliminary corridors based on opportunities to:

- share right-of-way with existing transmission lines by double circuiting where practical or paralleling an existing line;
- minimize impacts to system reliability;
- parallel roads to help decrease the amount of right-of-way required;
- parallel field lines, property lines or railroads, where access is adequate and the transmission line would cause minimal conflicts; and
- minimize the length of the transmission line to reduce the impact area and costs for the Project.

If the PUC should certify the HVTL project, the Applicants would seek approval for a specific route within the project corridor through the HVTL Routing Permit process. Through this process specific routes will be identified that avoid, to the extent possible, areas where a high-voltage transmission line could create significant impacts. These areas include:

- high density residential areas;
- areas where clearances are limited because of trees or nearby structures; and
- environmentally sensitive sites, such as wetlands, archaeologically significant sites, areas with threatened, endangered and species of special concern, areas of significant biological or cultural significance, and state and federal lands.

1.4 CONSTRUCTION

The first phase of construction activities would involve surveying the centerline of the new transmission line, followed by removal of trees and other vegetation from the right-of-way. As a general practice, low-growing brush or tree species are allowable at the outer limits of the easement area. Taller tree species that endanger the safe and reliable operation of the transmission facility would be removed. In developed areas and to the extent practical, existing low growing vegetation that would not pose a threat to the transmission facility or impede construction would remain in the easement area.

The second phase of construction would involve staking the location of structures, followed by structure installation and stringing of conductor wire. Upon completion of construction activities, landowners would be contacted to determine whether or not construction damages have occurred. Areas that sustain construction damage would be restored to the pre-construction condition to the extent possible.

The proposed 115 kV transmission line would be constructed at existing grade elevations. Therefore, no pole locations would require grading, unless it is necessary to provide a level area for construction access and activities.

Typical structures will be wood, laminated wood or steel direct-embedded poles. Each structure will require a 10 to 15 feet deep hole that has a diameter of 3 to 4 feet. Any excess soil will be removed from the site unless requested by landowners or others. The poles may be backfilled with native soils, crushed rock or concrete depending on design conditions. In lowland areas, a galvanized steel culvert may be also inserted for pole stability due to poor soil capacity.

Large angle structures will typically be self-supporting steel poles that require a drilled pier foundation. The piers will typically have diameters of 4 to 8 feet. The hole may require a typical depth of 15 to 30 feet depending on design requirements. The piers will be filled with concrete delivered to the site via trucks from a local batch plant.

Once the structures have been erected, conductors are installed by establishing stringing setup areas within the right-of-way. These stringing setup areas are typically located every two miles along a project's route. The conductors are pulled with a rope lead that connects to every structure through a dolly attached at the insulator location. Temporary guard or clearance poles are installed at crossings to provide adequate clearance over other utilities, streets, roads, highways, railroads, or other obstructions after any necessary notifications are made or permit requirements met to mitigate any concerns with traffic flow or operations of other utilities.

During construction when temporary removal or relocation of fences may occur, installation of temporary or permanent gates may be required. The Applicants right-of-way agents will coordinate with affected landowners regarding replacement of fences and gates. The contractor will work around cultivated areas until harvest has occurred.

A 35 MVA 115/46 kV transformer would be installed in the proposed Tower Substation; a 60 MVA 115/69 kV transformer would be installed in the proposed Tower Substation in the future.

1.5 OPERATION & MAINTENANCE

MP and GRE would periodically use the right-of-way of the transmission line to perform inspections, maintenance, and repair of any damage. Regular maintenance and inspections would be performed over the life of the facility to ensure a reliable system. Annual inspections would be done by foot, snowmobile, all-terrain vehicles, pickup truck, or aerial means. These inspections would be limited to the acquired right-of-way and areas where obstructions or terrain

require access off the easement. The Applicants would conduct an aerial inspection of each transmission line annually to ensure reliable operation.

The Applicants would conduct vegetation surveys and remove undesired vegetation that would interfere with the operation of the transmission line. Frequency of vegetation maintenance is on an approximate two-to-five year cycle. Right-of-way clearing practices include a combination of mechanical and hand clearing, along with an application of herbicides where allowed.

1.6 PERMITS

LOCAL APPROVALS

Road Crossing Permits

These permits may be required to cross or occupy county, township and city road right-of- way.

Lands Permits

These permits may be required to occupy county, township and city lands, such as park lands, watershed districts and other properties owned by these entities.

Building Permits

These permits may be required by the local jurisdictions for substation modifications and construction.

Over-width Loads Permits

These permits may be required to move over-width loads on county, township or city roads.

Driveway/Access Permits

These permits may be required to construct access roads or driveways from county, township or city roadways.

STATE APPROVALS

Route Permit (Alternative Process)

A HVTL cannot be constructed without a Route Permit approved by the PUC. A route permit under the Alternative Permitting Process requires the Applicants to be eligible as outlined in Minnesota Rules 4400.2000.

Since the proposed HVTL is between 100 and 200 kilovolts (kV), the project would be eligible for the Alternative Review Process outlined in Minnesota Rules 4400.2000.

The Route Permit establishes the specific route (and in some cases, a precise alignment) that the new transmission line will follow as opposed to the broad corridor concept outlined in the Biennial Transmission Projects Report.

Utility Permit

A permit from the Mn/DOT is required for construction, placement or maintenance of utility lines to be placed adjacent or across the highway right-of-way. These permits would be acquired once the line design is completed and the route permit is granted.

License to Cross Public Waters/State Lands

The DNR Division of Lands and Minerals regulates utility crossings over, under or across any state land or Public Waters identified on the Public Waters and Wetlands maps. A license to cross Public Waters is required under Minnesota Statute § 84.415 and Minnesota Rules Chapter 6135. The Applicants will work closely with the DNR on these permits and will file for any required permits once the line design is complete and the route permit is granted.

NPDES Permit

An NPDES permit is required for stormwater discharges associated with construction activities disturbing a site equal-to or greater than one acre in area. A requirement of the permit is to develop and implement a Stormwater Pollution Prevention Plan, which includes Best Management Practices (BMPs) to minimize discharge of pollutants from the site. The Applicants will review the need for an NPDES permit for work at the Pine River Substation and other locations once the line design is complete and the route permit is granted.

FEDERAL APPROVALS

Section 404 Approval

A Section 404 approval is required from the United States Army Corp of Engineers (USACE) when filling of a wetland or water of the United States. Section 404 approvals are not expected to be required for the proposed project.

Section 401 Certification

A Section 401 Water Quality Certification is required when federal approval for a project is sought (i.e. Federal Energy Regulatory Commission {FERC} permits or a USACE Individual Permit).

Rural Electrical Utility

The Rural Utility Service (RUS) requires environmental approval of the proposed project before construction can begin.

1.7 PROPOSED CORRIDOR

The proposed corridor is approximately 6,000 feet wide and extends on a north-south configuration from the City of Tower to the Giants Ridge Recreation Area in St. Louis County (**Figure 1**). The north terminus (site of proposed new 115 kV substation) is located approximately one mile east of Tower near the intersection of Junction Road and Tower Road. The southern terminus would be a new 115 kV switching station located at the junction of MP's existing (115 kV) 34 Line and 34 Line Tap (White Township, Section 7, Township 59N, Range 15W).

1.8 REGULATORY PROCESS & REQUIREMENTS

The authority for high voltage transmission line permits was transferred from the Minnesota Environmental Quality Board (EQB) to the Minnesota Public Utilities Commission by the Minnesota Legislature on July 1, 2005 (see S.F. 1368). EQB Energy Facility Permitting staff was transferred to the Department of Commerce, where they continue to coordinate the routing process through to the PUC final decision.

1.8.1 PUC CERTIFICATION REQUIREMENTS

Any biennial transmission projects report that seeks certification of a HVTL in the course of the biennial transmission report proceeding must comply with both the Minnesota Rules Chapter 7848 (Biennial Transmission Report) filing requirements and the filing requirements of Minnesota Rules Chapter 7849 (Certificate of Need).

1.8.2 DOC REQUIREMENTS

The DOC must conduct environmental review of large energy projects seeking PUC certification pursuant to Minnesota Statutes, 216B.243 and 216B.2425. Minnesota Rules 4410.7010 to 4410.7070 establish the process and requirements for conducting this review.

Under this process the DOC is required to hold a public meeting, prepare an environmental report (ER) and perform the associated administrative tasks.

On December 7, 2005, and December 8, 2005, staff from the DOC's Routing and Siting Unit held public meetings in the Badoura and Tower areas, respectively. The purpose of the public meetings was to provide the public with information about the two projects, afford the public an opportunity to ask questions and present comments, and to solicit input on the content of the ER.

The comment period was held open until 5:00 pm January 10, 2006.

On January 11, 2006, after consideration of the public comments, the Commissioner of the DOC issued an Order outlining the content of the environmental report (**Appendix A**).

1.9 SOURCES OF INFORMATION

Much of the information used in this Environmental Report (ER) is derived from two source documents prepared by the Applicants and their consultants. These are, the "Biennial Transmission Projects Report: Certification of a High-Voltage Transmission Line, Badoura Project, November 2005, Minnesota Power and Great River Energy and the "Biennial Transmission Projects Report: Certification of a High-Voltage Transmission Line, Tower Project, November 2005, Minnesota Power and Great River Energy. The environmental review rules specifically recommend the incorporation by reference of information and data into the ER, as long as this material is briefly described and the referenced material is readily available to the public. These reports are both available at the DOC website:

http://energyfacilities.puc.state.mn.us/Docket.html?Id=17803

Additional sources of information are listed below:

- Minnesota Pollution Control Agency (http://www.pca.state.mn.us/)
- Minnesota Department of Natural Resources (http://www.dnr.state.mn.us/index.html)
- Minnesota Department of Health (http://www.health.state.mn.us/)
- U. S. Environmental Protection Agency (http://www.epa.gov/)
- Electric Power Research Institute (http://www.epri.com/default.asp)
- City of Shakopee (http://www.ci.shakopee.mn.us/)
- U. S. Department of Agriculture Natural Resources Conservation (http://soils.usda.gov/about/)
- Minnesota Geological Survey (http://www.geo.umn.edu/mgs/)
- Department of Administration, State Demographic Center (http://www.demography.state.mn.us/)
- Federal Emergency Management Agency (http://www.fema.gov/)
- U. S. Department of Energy, Energy Information Administration (http://eia.doe.gov/)

2.0 ALTERNATIVES TO THE PROJECT

Any biennial transmission projects report that seeks certification of a HVTL in the course of the proceeding must include a list and analysis of all feasible transmission and non-transmission alternatives to the line (Minn. Rules 7848.1400, subpart 2, item T).

2.1 NO-BUILD ALTERNATIVE

Under this alternative, the PUC would not approve the construction of the proposed HVTL and substation project.

The voltage support and line loading, as it stands, is a concern for a few hours a year when the load on the 46 kV loop is at or above approximately 28 MW. As load continues to grow, the number of hours the area will be at risk will increase. A single outage could result in localized voltage collapse and may take several hours to restore electric service to the customers served by the Virginia-Ely-Babbitt loop.

Based on the analysis of load growth in the service area, preformed by the Applicants, doing nothing is not a viable alternative. The existing transmission and substation system, as is, will not provide adequate power delivery capacity or reliable service into 2009. No action with respect to the improvement to the area's electric power delivery systems would place the area's residential and commercial customers and their business, safety, and welfare at risk of being without reliable electric service.

2.2 CONSERVATION ALTERNATIVES

Minnesota Statute 216B.241 and Minnesota Rules 7690.0500 through 7690.0800, require that investor-owned utilities (IOUs) in Minnesota file a Biennial Conservation Improvement Plan (CIP) that details specific programs designed to save energy through conservation and energy efficiency activities. Investor-owned utilities are also required to determine the cost-effectiveness of these programs and to spend at least 1.5 percent of its annual gross revenue on approved CIP programs.

The Applicants have been actively involved in energy conservation and load management programs across all customer classes—residential, commercial-industrial, agriculture, and large power. Through the biennial Conservation Improvement Program (CIP) and a variety of load management programs, MP and GRE have worked with their customers get the most out of their energy dollar.

GRE and its 28 member cooperatives have pursued load management and energy conservation for over 22 years. In 2001, combined spending on load management and energy conservation by GRE and its member cooperatives totaled over $12.6 million. This represents 1.98 percent of the retail revenue of the 29 member cooperatives. Since 2001, spending has increased each year.

Spending in 2002 was $14,558,439 which was over 2.27 percent of the retail revenue, and spending in 2003 was $14,929,776 which was 2.08 percent of the retail revenue. In 2004, CIP spending was budgeted to increase to almost $16.0 million, 2.09 percent of retail revenue. In 2005 spending is budgeted at more than $17.3 million, 2.16 percent of retail revenue. In 2006 spending is budgeted at more than $17.5 million, 2.12 percent of projected retail revenue.

These programs have resulted in significant operational benefits for GRE. During high demand periods during the summer of 2001, GRE estimates that it was able to reduce its summer peak demand by 250 megawatts or 10 percent of estimated uncontrolled peak levels. In 2002 and 2003 approximately 271 MW and 285 MW was reduced during key summer peaks due to CIP load management (LM) programs. Demand side management (DSM) and LM reduced the 2004 GRE summer peak by over 300 MW. In 2005 and 2006, the peak is projected to be reduced by 318 MW and 336 MW, respectively.

Conservation measures employed in the project area have deferred but cannot eliminate the need to install a new transmission line and two substations. Conservation programs will continue to be implemented in the area to maximize efficient use of electricity.

2.3 EXISTING LINE/SYSTEM IMPROVEMENTS

Reconductoring

The voltage drop and overload issues associated with the the existing 46 kV lines serving the area could benefit from reconductoring. However, the voltage improvement would not be significant; reconductoring would only delay the need for a new source to serve the area by a few years. This option would include removal and rebuilding of 46 kV Line #31 (Winton to Babbitt) and Line #32 (Virginia to Winton) because the present structures are not capable of supporting the heavier replacement conductor.

Additional right-of-way for construction space would be required to complete the reconductoring because the present lines cannot be removed from service for an extended period of time. The total cost for permitting, right-of-way acquisition and reconductoring construction is estimated to be $22,660,000.

Upgrading/Rebuilding Existing Facilities

Upgrading/rebuilding existing transmission lines typically involves a complete replacement of structures and conductors. Increased voltage or current requirements would result in increased phase spacing or larger conductors. Transmission lines are typically rebuilt in the same right-of way provided the circuit being rebuilt can be removed from service for an extended period.

If the voltage is increased, right-of-way widths need to be evaluated for proper clearances. Compact designs can sometimes mitigate the need for additional right-of-way for voltage upgrades.

The option of upgrading the voltage of the 46 kV # 31Line between Babbitt and Winton and the 46 kV #32 Line between Virginia and Tower to115 kV was considered by the Applicants. A voltage upgrade would reduce the current flow necessary to supply the area loads and thereby reduce the voltage drop and increase the thermal limit of the existing lines.

Portions of the #31 Line were constructed with 115 kV structures and phase spacing; however, the line would need to be reinsulated to 115 kV levels. In addition to the line upgrades, the 46 kV Winton Substation line would need to be upgraded to 115 kV.

The existing #32 Line structures are not capable of being upgraded to 115 kV operation. This line would need to be dismantled and rebuilt as a 115 kV line. Because #32 Line would need to remain in service while it was being rebuilt, the right-of-way would need to be widened.

Additionally, the GRE Vermilion and MP Tower substations would need to be converted to 115 kV. The total permitting, right-of-way acquisition, and transmission line and substation construction cost was estimated to be $ 25,276,000.

Double Circuiting

The proposed line could be routed from Virginia to Tower and either share rights-of-way with the existing 46 kV # 32 Line or the # 32 Line could be rebuilt as a 46/115 kV double circuit line. The # 32 Line would need to remain in service during construction, so for either option (parallel or double-circuit construction), the right-of-way would need to be widened. The increased distance (approximately 27 miles vs.15 miles for the proposed Embarrass-Tower line), would result in an increase in project costs of approximately $17,933,000.

This option would not provide a significant improvement in reliability or security to the area, since each circuit (46 kV and 115 kV) of the double circuit line would serve the same function. A common failure (loss of a double circuit structure, for example) would mean the area would need to be supplied by the only remaining source, the Babbitt source.

There would be similar reliability and security concerns if the proposed 115 kV line shared right-of-way with the # 32 line. There would be no geographic separation between the two lines serving the same function (sources to the project area). Because the lines would be located on the same right-of-way, a single storm could result in loss of both lines, such as can occur with straight line winds or a tornado. This is much less likely to occur if the two lines are geographically separated, as is the case with the proposed project.

2.4 GENERATION ALTERNATIVES

The Applicants considered distributed generation (DG) as an alternative to new transmission into the Tower area. Minnesota Statutes. §216B.169, subd. 1(c), defines distributed generation as high-efficiency, low-emissions, dispersed generation of no more than 10 MW of interconnected capacity.

Based on load flow steady state analysis performed by the Applicants, 6 MW of generation would be required to be located between Tower and Winton. This distributed local generation could be located at one location, which would be the most cost effective method due to the equipment required to connect the generators to the electric grid, or dispersed at several locations between Winton and Tower.

Since natural gas is not readily available in the area, the generators would most likely be fueled by diesel, gasoline or propane. Typically generators such as this would be diesel fueled and in the 1.5 to 2 MW size range, therefore several units would be required. Diesel fueled generators may not meet the State of Minnesota's definition of a distributed resource.

Additionally, due to the high cost of this type of fuel, it is unlikely that these generators would be on-line doing an outage event. The generators would then need to be started, synchronized and the load picked up. This would require 10 to 30 or more minutes, provided automatic switches are installed to allow load to be picked up in sections. Depending on the length of time required to get loads back on line, there is a possibility of loss of load diversity. This could result in a significant increase in electric load immediately after restoration, and a possibility that more than 6 MW of generation would be required. Since the generation may not be on-line during a contingency, area load would likely be lost due to under voltage load shedding (depending on load levels).

If generation were used in place of the proposed project, generation would also need to be added along the 69 kV loop to address the Shannon-Virginia 69 kV inadequacy. The best location for this generation would be in the Cook area. GRE has estimated that 6 MW of generation would be required to eliminate post contingency voltage issues. above.

3.0 ASSESSMENT OF IMPACTS & MITIGRATION

Minnesota Rule 4410.7035 outlines those areas which must be included in the environmental report; these include, but are not limited to, an analysis of the human and environmental impacts of the proposed project and an analysis of the mitigative measures that could be reasonably implemented to reduce or eliminate the identified impacts.

3.1 ENVIRONMENTAL SETTING

The Quaternary glacial geology of the region has influenced the topography of the project area.[20] A relatively thin layer (<40 feet) of glacial till is overlain on Precambrian bedrock, portions of which are exposed at the surface.[21] The Vermilion Range formation dominates the northern end of the project area near the City of Tower and provides more elevation relief in that immediate area. South of Tower, the topography is lower with small gently rolling hills and flat large wetland basins (peat deposits).

Soils are comprised of peat, muck, and clay-based hydric soils in the wetlands and a relatively thin layer of glacial till over bedrock in the uplands.

Lakes are absent within the proposed corridor study area. Lake Vermilion, a large lake, is located outside of the proposed corridor to the north. Additional lakes are found several miles east and north of the proposed corridor. Fullers Creek, the Pike River, and the Embarrass River transect the proposed corridor on an east-west axis

3.2 IMPACTS TO HUMAN SETTLEMENT

As stated previously, if the PUC grants a certification to the proposed HVTL project, the Applicants would seek approval for a specific route within the project corridor through the HVTL Routing Permit process (Minnesota Rule Chapter 4400). In any route permit the PUC issues, the PUC will describe a specific route, and in some cases a specific alignment, within the applicant's conceptual HVTL corridor. Through this process specific routes will be identified that avoid, to the extent possible, areas where a HVTL could create significant impacts.

The City of Tower has historically been a mining town and has more recently become a municipality that supports tourism and development related to Lake Vermilion. The density of residential developments is highest within the City of Tower and around Lake Vermilion to the north and west. The Township of Embarrass has the next highest density of settlement within the area of the proposed HVTL corridor. Settlement throughout this area is concentrated near roads and likely influenced by land uses including timber production.

The population of the City of Tower in 2000 was 479 with a 5.71% decrease in population from 1990 to 2000. St. Louis County had a population of 200,528 in 2000 with a 1.17% increase in

[20] http://www.geo.umn.edu/mgs/surfexpl.html
[21] http://www.geo.umn.edu/mgs/bdrkexpl.html

population from 1990 to 2000.[22] The housing occupancy rate in 2000 included 48.64% owner-occupied in Tower and 41.20% owner-occupied in St. Louis County.

The minority population of St. Louis County includes individuals who are members of the following population groups: American Indian or Alaskan Native; Asian or Pacific Islander; Black, not of Hispanic origin; or Hispanic (Presidential Executive Order 12898). In the 2000 data, the City of Tower had 95.74% in the White population group, 1.49% in the American Indian group, 1.92% in the Hispanic group, and 0.85% classified as other race. In 2000, 48.43% of the population was male and 51.57% was female. The age group composition in 2000 was 78.5% for the 19 and over age group and 21.5% for the under 19 age group.

In the 2000 data, the St. Louis County population had 94.86% in the White population group, 0.85% in the Black (not of Hispanic origin) group, 2.03% in the American Indian Group, 0.69% in the Asian group, 0.80% in the Hispanic group, 0.22% percent categorized as other race, and 1.35% in more than one race group. Males comprised 49.18% and females 50.82% of the County population in 2000. The age group composition was 73.73% for the 19 and over group and 26.27% for the under 19 age group.[23]

Historically, timber production and mining were the economic mainstays of the area. While timber production remains, mining has declined as a primary employer. Many residents commute, sometimes great distances, to employment opportunities located outside of the area. Some local industries and employment are available, and the expanding recreational home industry, gaming facilities, and other tourism-based economies have increased and provided opportunities for area residents. Seasonal residents are relatively few within the proposed project area compared to neighboring areas where lake shore parcels are present.

Business patterns for the City of Tower and St. Louis County are based upon the most recent information available.[24] In the 2000 data, the City of Tower had a work force of approximately 242 employees with a median household income of $26,429. No specific industries were identified in the data. St. Louis County had a work force of approximately 100,974 employees with an average median household income of $36,306.[25]

3.2.1 SOCIOECONOMIC

The direct socioeconomic impacts of the proposed HVTL project will generally coincide with the construction period. These direct impacts include the effects on demographics, employment, income, and community services and facilities.

Impacts to social and economic resources would generally be of a short-term nature. Revenue would likely increase for some local businesses, such as hotels, restaurants, gas stations and grocery stores due to workers associated with construction of the project. Other local businesses,

[22] http://www.lmic.state.mn.us/datanetweb/php/census2000/2000Glance.php
[23] http://www.lmic.state.mn.us/datanetweb/php/census2000/2000Glance.php
[24] http://www.lmic.state.mn.us/datanetweb/php/census2000/c2000.html
[25] http://www.ers.usda.gov/StateFacts/MN.HTM

such as ready-mix concrete and gravel suppliers, hardware stores, welding and machine shops, packaging and postal services and heavy equipment repair and maintenance service providers would also likely benefit from the construction phase of the project. Significant impacts to social services would likely be minimal due to the short-term nature of construction activities.

There would also be some long-term beneficial impacts from the new transmission lines and substation addition. These benefits include an increase to the counties' tax base resulting from the incremental increase in revenues from utility property taxes based on the value of the project. The availability of reliable power in the area would have a positive effect on local businesses and the quality of service provided to the general public.

3.2.2 DISPLACEMENT

This project will not displace any residential homes or businesses.

There are no direct impacts to human settlement anticipated as a result of this project. The transmission line would be located within or parallel to existing utility right-of-way, where possible. Any required expansion of existing right-of-way or creation of new ROW would not result in any loss of homes.

3.2.3 NOISE

Transmission conductors and transformers at substations produce noise under certain conditions. The level of noise or its loudness depends on conductor conditions, voltage level, and weather conditions. In foggy, damp, or rainy weather conditions, power lines can create a subtle crackling sound due to the small amount of the electricity ionizing the moist air near the wires. During heavy rain the general background noise level is usually greater than the noise from a transmission line. During light rain, dense fog, snow, and other times when there is moisture in the air, the proposed transmission lines will produce audible noise higher than rural background levels but similar to household background levels. During dry weather, audible noise from transmission lines is a nearly imperceptible, sporadic crackling sound.

The Minnesota Pollution Control Agency noise regulations (Minnesota Rule 7030.0050) list various activity categories by Noise Area Classification.[26] **Table 1** below identifies the established noise standards for daytime and nighttime by NAC. The standards are expressed as a range of dBA (decibel – A-weighted) within a one hour period; L_{50} is the dBA that is exceeded 50 percent of the time within an hour, while L_{10} is the dBA that is exceeded ten percent of the time within the hour.

The audible noise generated from the transmission line is not expected to exceed the Minnesota noise standards.

[26] http://www.pca.state.mn.us/programs/pubs/noise.pdf

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

Table 1. MPCA Noise Standards (dBA – Decibel, A-weighted)

Table 2 below shows the noise levels for the various line geometries considered for this project. The table indicates that noise levels will be well below the MPCA's most restrictive standard (L_{10} nighttime in NAC1) at the edge of the right-of-way even during foul weather periods when the conductors are wet and the transmission line noise will be at it highest level. Also, note the data shown is for the more restrictive L5 noise level rather than the L50 or L10 levels; the L5 level is a level that is not exceeded more that 5 percent of the time. During fair weather conditions, the transmission line noise will seldom be noticed even if standing directly under the transmission line.

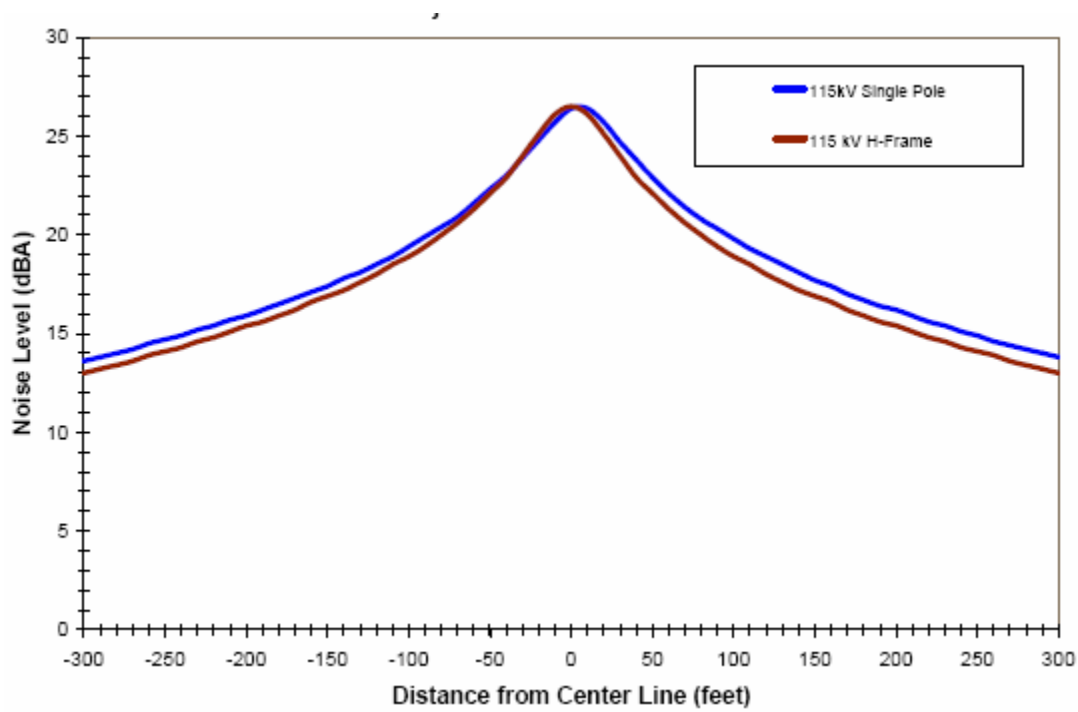

Table 2. Audible Noise – All Structures – L5 Wet Conductor

3.2.4 AESTHETICS

Although the transmission line and structures will be a contrast to surrounding land uses, the proposed corridor does provide opportunity to utilize existing road ROWs and section/property lines in an effort to minimize these impacts.

The Applicants will work with landowners to identify concerns related to the transmission line and aesthetics to minimize the impacts as much as feasible. The majority of this work will be conducted during the HVTL Routing Permit process.

3.2.5 RADIO & TELEVISION INTERFENCE

"Radio Noise" is a term used to refer to any unwanted interference of an electromagnetic nature with any signal or communication channels throughout the radio frequency band of operation, 3 kilohertz (kHz) to 30,000 kHz. Corona-generated radio noise could cause interference with virtually any type of radio reception. However, in practice it has been found that the bands principally affected are the amplitude-modulated (AM) broadcast band, 535 to 1,605 kHz and in particular those stations broadcasting below approximately 1,000 kHz. Frequency-modulated (FM) stations are seldom impacted by electric transmission facilities. Cellular phones are unlikely to be affected due to the high frequencies used; in fact, utility personnel often use cellular phones within substations and transmission line rights-of-way.

The radio noise generated from transmission lines is a function of conductor size and geometry, conductor height above ground, phase spacing, and ground resistance. Because radio noise is due to corona discharges, it also depends on the line's operating voltage and weather conditions.

The Federal Communications Commission (FCC) considers transmission lines inadvertent emitters and therefore they are not covered directly by FCC regulations. However, in the past, the FCC and the State of Minnesota have suggested that transmission line radio noise should not result in interference within a licensed broadcast station's primary coverage area for non-mobile receivers outside the line's right of way. Based on the Applicants experience with operating other 115 kV transmission lines, the proposed HVTL is not expected to impact reception of commercial AM radio stations with non-mobile receivers within a station's primary coverage area.

Corona generated noise could cause interference with TV picture reception similarly as in the case with AM radio interference since the picture is broadcast as an AM signal. The level of interference depends on the TV signal strength for a particular channel. TV audio is an FM signal that it is typically not affected by transmission line radio frequency noise.

Due to the higher frequencies of the TV broadcast signal (54 megahertz and above), 115 kV transmission lines seldom result in reception problems within a station's primary coverage area. In the rare situation that the proposed transmission line would cause TV interference, MP and GRE would work with the affected party to correct the problem.

Usually any reception problem can be corrected with the addition of an outside antenna. TV picture reception interference can also be the result of a transmission structure blocking the signal to homes in close proximity to a structure. Because the structures proposed for this Project would be wood, this is unlikely to occur. However, measurements can be made to verify whether a structure is the cause of reception problems. Reception problems can usually be corrected with the addition of an outside antenna, an amplifier or both.

3.2.6 HUMAN HEALTH & SAFETY

The proposed HVTL will be designed in compliance with local, state, NESC, and Minnesota Power/Great River Energy standards regarding clearance to ground, clearance to crossing utilities, clearance to buildings, strength of materials, and right-of-way (ROW) widths. The Applicants and their construction crews and/or contract crews will comply with local, state, NESC, and MP/GRE standards regarding installation of facilities and standard construction practices. Established MP/GRE and industry safety procedures will be followed during and after installation of the transmission line. This will include clear signage during all construction activities.

The proposed transmission line will be equipped with protective devices to safeguard the public from the transmission line if, such as a structure or conductor falling to the ground. The protective devices are breakers and relays located where the line connects to the substation. The protective equipment will de-energize the line should such an accident occur. In addition, the substation facility will be fenced and access limited to authorized personnel. Proper signage will be posted warning the public of the risk of coming into contact with the energized equipment.

ELECTRIC/MAGNETIC FIELDS

Electric and magnetic fields (EMF) arise from the flow of electricity and the voltage of a line. The intensity of the electric field is related to the voltage of the line and the intensity of the magnetic field is related to the current flow through the conductors.

Many years of research on the biological effects of electromagnetic fields have been conducted on animals and humans, and no association has been found between exposure to EMF and human disease. While the consensus is that EMF poses no risk to humans, the question of whether exposure to EMF can cause biological responses or even health effects continues to be the subject of medical research and public debate.

In 2002, Minnesota formed an Interagency Working Group to evaluate the body of research and develop policy recommendations to protect the public health from any potential problems resulting from HVTL EMF effects. The Working Group consisted of staff from the Department of Health, the Department of Commerce, the Public Utilities Commission, the Pollution Control Agency, and the Environmental Quality Board. The Department of Health coordinated the activities of the Working Group.

In September 2002, the Working Group published its findings in a White Paper on Electric and Magnetic Field (EMF) Policy and Mitigation Options (hereinafter "White Paper"). The Minnesota Department of Health made the following statement in the "White Paper:"

> "The Minnesota Department of Health 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 a health risk from EMF cannot be completely dismissed. The uncertainty surrounding EMF health effects presents a difficult context in which to make regulatory decisions. This approach suggests that one should avoid any activity or exposure about which there are questions of safety or health, at least to the extent that an activity can be avoided easily or cheaply."

Additional discussion of EMF can be found in the White Paper[27] and in other environmental reviews prepared by the Environmental Quality Board on proposed transmission lines. See for example, EQB Dockets 03-64-TR-Xcel (161 kV line in Jackson and Martin Counties), 03-73-TR-Xcel (345 kV line in southwest Minnesota) and 04-81-TR-Air Lake (a 115 kV line in Dakota County). These documents are all available on the PUC Energy Facilities website.

Minnesota does not have a standard for magnetic fields. The EQB has recognized in other transmission line proceedings that other states have established standards for magnetic fields, e.g., Florida (150 milligauss limit) and New York (200 milligauss limit).

The anticipated magnetic field was calculated for the structures being considered for the Badoura project by Minnesota Power. The data is presented in Appendix B of the Biennial Transmission Projects Report. The calculations were done at two different assumed current carrying capacities: (1) the flow at the conductors' thermal limit and (2) at the expected steady state system intact peak load current flow as determined from load flow modeling using the 2009 Peak Load model. In each case the more restrictive limit of 150 milligauss remained well within the expected ROW boundaries.

STRAY VOLTAGE

The electric field from a transmission line can induce an electric charge on other conducting objects in the vicinity of the line, such as vehicles and fences. If these objects are insulated or semi-insulated from the ground, and a person touched them, a small current would pass through the person's body to the ground. This might be accompanied by a spark discharge and mild shock, similar to what can occur when a person walks across a carpet and touches a grounded object or another person. Due to the relatively low operating voltage of the proposed line (115 kV), these discharges are unlikely to reach an annoyance level. To insure that any discharge does not reach unsafe levels, the NESC requires that any discharge be less than 5 milliamperes (ma).

[27] http://www.health.state.mn.us/divs/eh/radiation/emf/links.html

The proposed HVTL will be designed such that the discharge from any large object such as a bus or truck parked under or adjacent to the line would be significantly less than 5 ma. The Applicants will assure that any fence or other large permanent conductive object in close proximity or parallel to the line would be grounded so that excessive discharges would not occur.

High intensity electric fields can have adverse impacts on the operation of pacemakers and implantable cardioverter/defibrillators (ICD). Interference to implanted cardiac devices can occur if the electric field intensity is high enough to induce sufficient body currents to cause interaction. Modern bipolar devices are much less susceptible to interactions with electric fields. Medtronic and Guidant, manufacturers of pacemakers and ICDs, have indicated that electric fields below 6 kV/meter are unlikely to cause interactions affecting operation of most of their devices.

Older unipolar designs are more susceptible to interference from electric fields. Research has indicated that the earliest evidence of interference was in electric fields ranging from 1.2 to 1.7 kV/meter.

Table 3 below shows that the electric field for all structure alternatives are well below levels at which modern bipolar devices are susceptible to interactions with electric fields.

In the unlikely event a pacemaker is impacted, the effect is typically a temporary asynchronous pacing (commonly referred to as reversion mode or fixed rate pacing). The pacemaker would return to its normal operation when the person moves away from the source of the interference.

There is no state or federal standard for transmission line electric fields. However, in previous transmission line permits, the EQB has imposed a maximum electric field limit of eight kV/meter measured one meter above the ground. The restriction was designed to prevent serious hazard from shocks when touching large objects like a bus or combine parked under high voltage transmission lines.

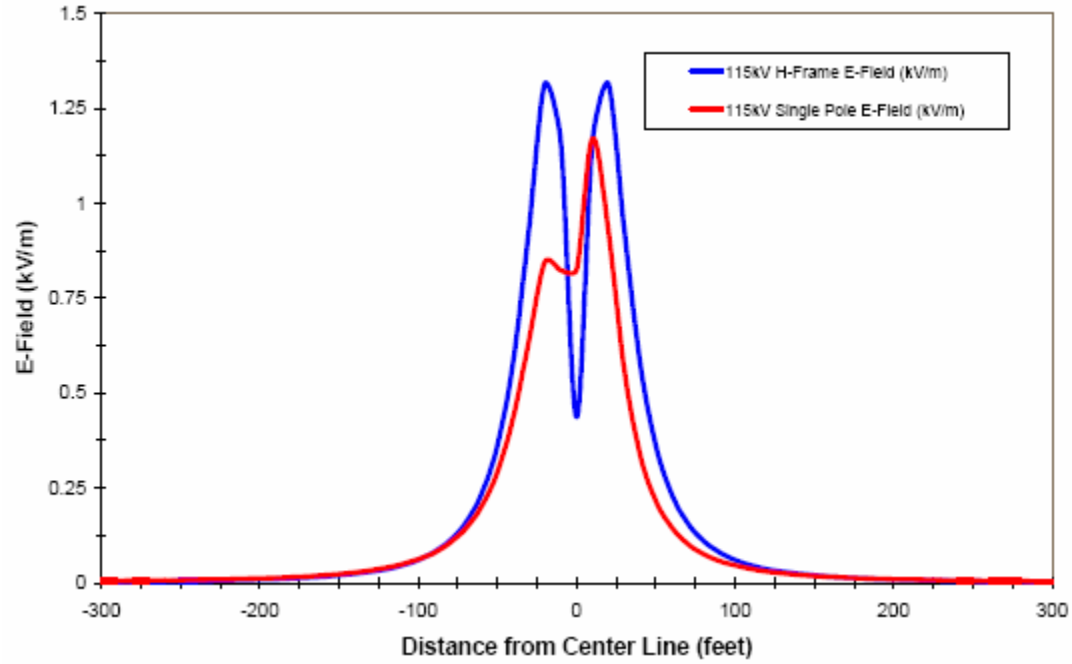

Table 3 Maximum Electric Fields for the Proposed Project

3.3 IMPACTS ON LAND-BASED ECONOMICS

The area contains a variety of land use patterns in a general rural environment; land uses in the proposed corridor are predominantly forest, rural residential, and wetlands.

The northern portion of the proposed corridor is relatively rural with scattered houses and extensive timber production tracts. Wetlands are widespread in this area and bog habitat is common within many wetlands. The scattered agricultural parcels present are mostly pastures and hay production fields. Timber production tracts and wetlands are the most abundant land use.

The portion of the proposed corridor that encompasses the Town of Embarrass has the highest residential development density in the entire corridor, but still retains some semi-rural character. South from the Town of Embarrass and the CH 21 alignment, the proposed corridor's low-density residential and forested character resumes and continues to the south terminus.

The proposed HVTL project is expected to have minimal effects on or changes to land uses, especially in portions of the proposed corridor that will be co-located with existing roads, utility rights-of-way, or similar linear corridors.

New HVTL right-of-way would result in permanent conversion of forested land uses (including forested and shrub- dominated wetlands) to a linear cleared and maintained right-of-way. New project right-of-way construction would cause temporary impacts with no land use conversions

to herbaceous wetlands, pastures and hay fields, unforested fields, and other land that does not require tree or shrub removal.

There is little farmland in the project area.

3.3.1 RECREATION

Recreational opportunities in the general area of the proposed corridor include hiking, horse-back riding, mountain biking, boating, fishing, snowmobiling and cross-country skiing. There are numerous recreational sites located in this area and they include Lake Vermillion, Soudan Underground Mine and State Park, Sisu Heritage Pioneer Homestead, the Taconite State Trail, and the Arrowhead State Trail[28]

The Taconite State Trail stretches 165 miles from Grand Rapids to Ely and intersects with the Arrowhead State Trail just west of Lake Vermillion. The first 6 miles from Grand Rapids are paved for biking and in-line skating. The remainder of the natural surface trail is used primarily for snowmobiling in the winter. The trail goes through a few areas that have standing water in the summer, however portions of the trail are suitable for horseback riding, hiking, and mountain biking.

The Taconite Trail winds through forests of birch and aspen intertwined with pine, leading the visitor by many isolated lakes and streams. From Grand Rapids heading north, you see the impact of the taconite and iron mining industry. The northern portion of the trail terrain is rolling and tree covered as it winds through state and national forest land. Eight trail waysides and picnic facilities offer scenic vistas of the hills, lakes and rivers of this area. The trail also links three state parks: Bear Head Lake, Soudan Underground Mine, and McCarthy Beach. The landscape in and around Bear Head Lake State Park is very rolling and rocky.

The construction and operation of the proposed HVTL will not directly impact these resources. In some places the new transmission line structures will contrast with the surrounding landscape, however, there will be no direct impacts to the recreational uses in the area. To the extent practicable, the Applicants will select specific routes and alignments that are located near existing transmission line corridors and/or other corridors such as county and township road and railroad ROWs. This will minimize the visual impact to the surrounding areas.

3.3.2 PRIME FARMLAND

There is little farmland in the project area. In those areas where there is potential to cross agricultural lands, transmission line structures will be placed on section lines and field breaks where possible, to minimize interference with agricultural operations.

[28] http://www.dnr.state.mn.us/state_trails/list.html

3.3.3 TRANSPORTATION

The proposed HVTL will parallel existing road ROWs for the majority of the lines distance. However, the transmission line will not affect transportation systems except for minor impacts during the construction period.

There is a private 2,100 foot air-strip located within the proposed corridor, along State Highway 135 approximately one half mile south of Wahlsten, Minnesota (**Figure 3**).

The Minnesota Department of Transportation (Mn/DOT) has three different types of airport licenses depending on the type of use. A public airport license is issued to owners of airports that meet the minimum safety standards required for the airport to be open to the public. A private airport license allows for the airport owner and others with the prior permission of the owner to use the airport. Personal airport licenses are issued to individuals who intend the airport only for personal use by the airport owner. Airport licenses are issued to airports, heliports and seaplane bases. Each type of airport use and air vehicle has different licensing requirements. For specific requirements see the Mn/DOT Aeronautics Rules Chapter 8800. Personal airports that are more than 5 miles form the nearest public airport are not required to obtain a license from Mn/DOT.[29] Federal Aviation Administration (FAA) and local government requirements may still apply.[30]

The Applicants, within the subsequent HVTL Route Permitting process, will need to identify the ownership of this air-strip and any protections that may be afforded to it under Mn/DOT and/or FAA regulations.

3.3.4 MINING & FORESTRY

The project will not impact any active mining or forestry operations

3.3.5 ECONOMIC DEVELOPMENT

Continuing economic growth in the area has caused a considerable increase in electrical use in the region. The addition of new electrical services and the increase in demand from existing services are creating electricity delivery concerns in this area. The existing electrical system, consisting of transmission lines and substations, is approaching its physical limit.

The proposed HVTL project will encourage economic development along the corridor, enhance overall power system reliability and provide greater flexibility in terms of power availability.

3.3.6 ARCHEOLOGICAL, CULTURAL & HISTORIC RESOURCES

Within the one-mile study area of the proposed corridors, five archaeological sites and 46 historic architectural structures were identified (**Appendix B**). Of these known resources,

[29] http://www.dot.state.mn.us/aero/avoffice/licensing.html
[30] Title 14 of the Code of Federal Regulations CFR Part 77 (http://www1.faa.gov/ats/ata/ata400/oeaaa.html)

there is one archaeological site listed on the National Register of Historic Places (NRHP) and none that were considered eligible for listing in the NRHP. Nearly all of the historic structures are located in close proximity to the Town of Embarrass.

Historic structures must be at least 50 years old to be significant. The sites listed here demonstrate the variety of uses the land has seen over time. Most of the listed sites have not been evaluated as to their historical significance and that there may be other resources within the alternative corridors that have not yet been identified. Sites were included if they occurred in the same section as the proposed corridor.

Breitung Township

One archaeological site (Old Indian Cemetery) recorded.

Embarrass Township

Forty-one architectural structures (one listed on the NRHP) recorded.

Kugler Township

Two recorded archaeological sites (trails) and five architectural structures recorded.

White Township

Two recorded archaeological sites.

Construction of new transmission line structures in the proposed corridor could impact previously identified and currently unknown cultural resources.

Archaeological sites may be disturbed during construction of transmission structures, staging areas or access roads. Historic buildings or other sites may be impacted as construction of modern transmission structures may compromise the integrity of a historic view shed from or to above ground cultural resources. Potential impacts would be determined once routes are selected within the corridor. Prior to construction, areas that are deemed high potential for cultural resources would be surveyed. The surveys would be coordinated with the appropriate landowners or land management agency. A product of the survey would be a cultural resources report recording findings and suggesting mitigation measures. The findings would be reviewed with the Minnesota State Historical Preservation Office (SHPO) and specific mitigation measures necessary for each site or resource would be determined.

Mitigation may include relocation of access routes, structure sites and other disturbed areas to avoid cultural sites.

3.4 IMPACTS ON THE NATURAL ENVIRONMENT

3.4.1 AIR QUALITY

During project construction, there will be emissions from vehicles and construction equipment and fugitive dust from right-of-way clearing. Temporary air quality impacts caused by the proposed construction-related emissions are expected to occur. Fugitive dust may result from any ROW clearing required. The magnitude of these emissions is influenced heavily by weather conditions and the specific construction activity taking place. Exhaust emissions from diesel equipment will vary during construction, but will be minimal and temporary.

The only potential air emissions from a 115 kV transmission line result from corona and are limited. Corona can produce ozone and oxides of nitrogen in the air surrounding the conductor, especially in humid conditions. Corona consists of the ionization of air within a few centimeters immediately surrounding conductors. Ozone is a very reactive form of oxygen and combines readily with other elements and compounds in the atmosphere. Because of its reactivity, it is relatively short-lived.

3.4.2 WATER QUALITY

SURFACE and GROUNDWATER

The north end of the proposed corridor, near the City of Tower, is within the watershed of a small creek system comprised of the West Two Rivers Creek and the Fullers Creek. These creeks merge and flow north into Lake Vermilion. The middle section of the proposed corridor encompasses the upper reaches and watershed of the Pike River, which flows west. The main channel and two branches of the Embarrass River are located within the south end of proposed corridor. The Embarrass River flows in a southwesterly direction (**Figure 4**).

According to the designated floodplain maps of the Federal Emergency Management Agency (FEMA), 100-year floodplains are present along the channels of all three of the above-mentioned rivers including the Fullers Creek/West Two Rivers Creek system, the Pike River and its upper tributaries, and the Embarrass River.

Possible site specific potential impacts would be determined once routes are selected within the corridor (HVTL Routing Process). If a proposed route would result in permanent encroachments to the cross section of a designated floodplain, a floodplain assessment would be completed. The assessment quantifies the scale of the impact so that a design solution to mitigate the impacts (through minimization and facilitation of continued floodplain function) can be developed.

Little, if any, floodplain fill or disturbance is anticipated and the effects of the installment of any poles within the floodplain are expected to be negligible.

WETLANDS

The wetlands within the proposed corridor are mapped on the National Wetland Inventory (NWI) (USFWS 1979, 1983) and were confirmed by the Applicants representatives in a 2005 field survey. The wetlands of the proposed corridor are shown in **Figure 5, Figure 6 and Figure 7**.

The wetlands within the proposed corridor are typically large, influenced and defined by topography, and often are interconnected. The larger wetlands trend on an east-west axis and are highly convoluted in shape. Small, isolated depressions are also present but less common. These small isolated basins typically occur within forest settings or former forested areas.

Impacts to hydrologic resources could occur by directly filling wetlands or DNR Public Waters due to construction activities, or by otherwise negatively altering their functions and values. During the HVTL Route Permitting process the Applicants will perform a wetland delineation of any selected routes. Depending upon the results of the delineation, project components may be moved to avoid affecting wetlands along the route.

It is anticipated that the proposed HVTL will avoid many wetland areas and surface water features, such as rivers and streams, by spanning the transmission line over these water bodies.

Best Management Practices (BMPs) will be followed during construction activities to protect hydrologic features from sedimentation and erosion. In practice, the Applicants will attempt to avoid placing poles in wetlands. If placement of poles in wetlands is necessary, measures will be taken to minimize impacts by using special construction mats to limit disturbance and compaction. If areas of the wetland are disturbed, the affected areas will be restored to preconstruction contours and will allow the existing seed bank to re-vegetate the area. Any soil removed from the wetlands will not be placed back into the wetland.

If impacts to hydrologic features are unavoidable, the Applicants would work with the jurisdictional agencies (USACE, DNR and/or Minnesota Board of Water and Soil Resources (BWSR)) to determine the best ways to minimize the impacts and create appropriate mitigation measures.

To minimize contamination of water due to accidental spilling of fuels or other hazardous substances, all construction equipment would be equipped with spill cleanup kits.

3.4.3 SOILS & GEOLOGY

Minimal surficial disturbances, outside of the direct impact of the HVTL structures, are anticipated. Soil erosion control measures will be followed to minimize loss of top soil; areas disturbed will be return to their pre-construction condition.

No permanent impacts to the subsoil or geology along the proposed corridor are anticipated.

3.4.4 FLORA & FAUNA

As part of an analysis of the flora and fauna in the area of the proposed corridor, the Applicants submitted a request to DNR for sensitive features identified in the Natural Heritage Information System (NHIS) database (**Appendix B**). Several NHIS database occurrences are present within the area.

Representatives of the Applicants conducted a habitat field reconnaissance survey of the area in the early summer of 2005.

The NHIS data were reviewed to implement avoidance of potential effects on Rare, Threatened or Endangered species or sensitive natural resources. Generally speaking, species protected under the federal Endangered Species Act require complete avoidance, no project effects, or extensive consultation with the USFWS if there is a potential for impacts.

Potential effects on NHIS occurrences, including flora and fauna protected under the Minnesota Endangered Species Act require additional coordination with the DNR, a possible requirement for a takings permit, and/or may require mitigation. Mitigation could vary and include salvage and relocation for plants, the purchase and management of habitat, or some other measure unique to the species impacted that would satisfactorily compensate for the impact. The extent to which mitigation is required for NHIS occurrences depends on the nature of and protection status of the affected occurrences. State-listed Species of Special Concern have no or different mitigation requirements than species that are designated as Threatened or Endangered.[31]

The wetlands located in the northern portion of the proposed corridor are of relatively high quality. Nuisance vegetation is absent and disturbance is minimal. No listed species were observed. A mature upland conifer forest with mixed pine and spruce is located on a hillside on the south side of the Iron Trail as the trail approaches Sherman Road from the north. This area could be potential habitat for the listed fern species identified by the DNR NHIS and is also suitable for goshawk nesting. A goshawk vocalization was heard within this forest parcel. This forest is mature, contiguous and shows no evidence of recent timber activities. The area is also traversed by the City of Tower Cross Country Ski Trails. Avoidance of this habitat is possible by co-locating on or adjacent to the Iron Trail or through alignment shifts northwards away from the habitat area.

A DNR NHIS occurrence (#14832) is present within the first wetland complex located south of Sherman Road. The occurrence is a plant species and is located approximately 600 feet east of the Iron Trail snowmobile right-of-way. Habitat for this species is present in close proximity to the trail.

Most of the upland habitats in this area have been recently subjected to forest harvesting activities. Some smaller patches of mature mixed pine-spruce forest are present on the upland islands imbedded within the wetlands, but there are also indications of disturbances within these

[31] http://www.dnr.state.mn.us/ets/index.html

areas as well. The probability for suitable goshawk nesting habitats is low and suitable habitats for the listed fern species are lacking or in poor quality.

South of Wahlsten Road, the wetland habitats are in a good to excellent qualitative state. Large amounts of bog habitats are present and could potentially harbor listed plant species. The upland habitats located in the central area of the corridor are mostly comprised of young second growth mixed conifer-hardwood forest with evidence of recent timber activities. Goshawk nesting habitat is poor quality as is the potential habitats for the listed fern species.

Two vocalizing American bitterns (*Botaurus lentiginosus*) were documented in a wetland located on the east side of Bergstedt Road at the north terminus for the road. The vocalizations and time of year are indications that breeding activity may be occurring. The American bittern is a secretive and uncommon bird in Minnesota, although it is not state or federally listed. Like all native birds, the American bittern and its nests are protected under the federal Migratory Bird Treaty Act.

From the north end of Bergstedt Road to East Taylor Road the wetlands are in excellent quality and undisturbed. A mature pine-spruce forest that has been selectively cut and managed is present south of the first wetland. This area is large, contiguous and could be potential nesting habitat for goshawks and habitat for the listed fern species. Colocation along TH 135 is a possible option if avoidance of this area becomes necessary, as this habitat extends to the east for four or more miles.

From East Taylor Road to CH 21 most of the wetland habitats have been disturbed and lack the habitat for the listed species. Most of the upland habitats have been converted to land uses associated with the houses and development in the Town of Embarrass and are not suitable for the threatened and endangered species of interest.

From CH 21 to the southern edge of the proposed corridor the wetland habitats are in good condition and undisturbed. Two NHIS occurrences (#22985, #22997) are present within the wetland habitats in this area. The upland habitats are mostly comprised of mixed mature conifer-pine-hardwood forests. These are contiguous, extensive and sporadically subjected to timber activities. The habitat also extends into the Superior National Forest boundary. Northern goshawk vocalizations were documented during the habitat field reconnaissance surveys, mostly within the southern half of the segment and east of the road.

Impacts to vegetation may occur due to the placement of structures. The area around the structure may also be temporarily disturbed due to construction activities. Some vegetation clearing would be necessary along the HVTL ROW.

Wildlife in the vicinity of the proposed corridor consists of birds, mammals, fish, reptiles, amphibians and insects, both resident and migratory, which use the area habitat for forage, shelter, breeding habitat and/or stopover during migration. Species likely to be found are those associated with forested and/or wetland habitats, including small mammals, such as voles, shrews, mice and rabbits, larger mammals, such as beaver, bobcat, coyote, gray wolf, river otter,

fox, white tailed deer, black bear, reptiles and amphibians, such as snakes, turtles, toads and frogs, waterfowl and songbirds (both forest and grassland species).

The potential for the permanent displacement of wildlife and loss of habitat from construction of the proposed project is minimal. Wildlife that inhabits natural areas, such as those near water bodies and state forests, could be impacted in the short-term within the immediate area of construction. The distance that animals will be displaced will depend on the species. Impacts to wildlife are anticipated to be short-term.

4.0 Acronyms, Abbreviations and Definitions

AC	Alternating current
ACEEE	American Council for an Energy Efficient Economy
ACSR	Aluminum conductor steel reinforced
AM	Amplitude-modulated
ATC	Available transmission capacity
BMPs	Best Management Practices
BWSR	Minnesota Board of Water and Soil Resources
CAP	Community Action Program
CFL	Compact fluorescent lights
C/I-A	Commercial/Industrial-Agriculture
Commission	Minnesota Public Utilities Commission
CIP	Conservation Improvement Program
CH	County Highway
dBA	Decibel (A weighted)
DC	Direct current
DNR	Minnesota Department of Natural Resources
DOC	Minnesota Department of Commerce
DSM	Demand Side Management
EMF	Electromagnetic fields
EMS	Energy Management System
ETS	Electric thermal storage
EQB	Minnesota Environmental Quality Board
ERO	Electric Reliability Organization
FAA	Federal Aviation Administration
FCC	Federal Communications Commission
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
FM	Frequency-modulated
GRE	Great River Energy
GSHP	Ground source heat pump
HVAC	Heating, ventilation and air conditioning
HVTL	High voltage transmission line
Hz	Hertz
ICD	Implantable cardioverter/defibrillator
IEE&C	Integrated Energy Education and Communications
IOUs	Investor-Owned Utilities
IRP	Integrated Resource Plan
kHz	kilohertz
kV	Kilovolt
kVA	Kilovolt-ampere
kV/m	Kilovolts per meter
kW	Kilowatt

kWh	Kilowatt hour
LCP	Lake Country Power
LGU	Local governmental unit
LRLF	Long-Range Load Forecast
ma	milliamperes
MAPP	Mid-Continent Area Power Pool
MBS	Modeling Building Subcommittee
mG	milliGauss
MHz	Megahertz
MISO	Midwest Independent Transmission System Operator
Mn/DOT	Minnesota Department of Transportation
MPCA	Minnesota Pollution Control Agency
MP	Minnesota Power
MRO	Midwest Reliability Organization
MVA	Megavolt ampere
MW	Megawatt
MWh	Megawatt hour
NAC	Noise area classifications
NERC	North American Electric Reliability Council
NESC	National Electric Safety Code
NIEHS	National Institute of Environmental Health Sciences
NPDES	National Pollutant Discharge Elimination System
NRHP	National Register of Historic Places
NWI	National Wetland Inventory
PWI	Public Waters Inventory
R & D	Research and Development
ROW	Right-of-way
RUS	Rural Utilities Service
SHPO	State Historic Preservation Office
TH	Trunk Highway
UPA	United Power Association
USACE	United States Army Corps of Engineers
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service

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FIGURES

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APPENDIX A

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APPENDIX B